PHASE II ENVIRONMENTAL SITE ASSESSMENT

Former Coaldale Junction Truck Stop
Esmeralda, Nevada

Southwest Corner of U.S. Highway 95 and U.S. Highway 6 Intersection

Esmeralda County Assessor Parcel Number:
006-161-09

Prepared For:
Nye County
2100 East Walt Williams Drive, Suite 100
Pahrump, Nevada 89048

On Behalf of:
Rural Desert Southwest Brownfields Coalition

Prepared By:
BEC Environmental, Inc.
7660 West Sahara Avenue, Suite 150
Las Vegas, Nevada 89117

Project No. 804.11.Task 2E
September 2013

BEC Environmental, Inc.

7660 West Sahara Avenue
Suite 150
Las Vegas, Nevada 89117
702.304.9830

PO Box 11083
Reno, Nevada 89510
775.345.5261

www.becnv.com

bec environmental, inc.
Environmental Services

Table of Contents

List of Tables

List of Appendices

ACRONYMS

ACBM .....Asbestos Containing Building Material
AHERA .....Asbestos Hazard Emergency Response Act
APN.....Assessor Parcel Number
AST .....Aboveground Storage Tank
ASTM.....American Society for Testing and Materials
CEM .....Certified Environmental Manager
CFR .....Code of Federal Regulations
EPA .....Environmental Protection Agency
ESA .....Environmental Site Assessment
HUD .....Department of Housing and Urban Development
MS .....Matrix Spike
MSD .....Matrix Spike Duplication
NDEP.....Nevada Division of Environmental Protection
NESHAP.....National Emissions Standard for Hazardous Air Pollutants (Federal Clean Air Act)
OSHA .....Occupational Safety and Health Administration
PACM.....Presumed Asbestos Containing Materials
PID .....Photo-Ionization Detector
RACM .....Regulated Asbestos Containing Materials
RCRA .....Resource Conservation and Recovery Act
RDSBC.....Rural Desert Southwest Brownfields Coalition
REC .....Recognized Environmental Condition
TPH .....Total Petroleum Hydrocarbons
UEPA.....Utility Environmental Protection Act
UST .....Underground Storage Tank
VOC .....Volatile Organic Compound
XRF .....X-Ray Fluorescence

Units of measure

sq ft or ft^2 .....square feet
mg/kg.....milligrams per kilogram
mg/l.....milligrams per liter
ug/l.....micrograms per liter
ppb.....parts per billion
ppm .....parts per million

1 EXECUTIVE SUMMARY

BEC Environmental, Inc. (BEC) was authorized by Nye County, Nevada, on behalf of the Rural Desert Southwest Brownfields Coalition (RDSBC), to perform a Phase II Environmental Site Assessment (ESA) of the former Coaldale Junction Truck Stop. This Phase II ESA was conducted to investigate suspected contamination of the site associated with Recognized Environmental Conditions (RECs) identified in the December 2012 Phase I ESA completed by BEC under the RDSBC program. The Phase II ESA was conducted in accordance with the following documents:

- American Society for Testing and Materials (ASTM) E1903-11 Standard Practice for Environmental Site Assessments: Phase II Environmental Site Assessment Process
- Sampling and Analysis Plan (Revised): Phase II Subsurface Investigation & Asbestos/Lead-Based Paint Assessment, Coaldale Junction Truck Stop

The former Coaldale Junction Truck Stop (currently abandoned), located in Esmeralda County, Nevada, lies in the northwest corner of a 40-acre parcel (assessor parcel number [APN] 006-161-09). The parcel is located on the southwest corner of the intersection of U.S. Highway 95 and U.S. Highway 6. The parcel is located in a remote, unpopulated area of Esmeralda County with the nearest town (Tonopah) approximately 40 miles away. The majority of the 40-acre parcel is undeveloped. The former Coaldale Junction Truck Stop occupies approximately 10 acres of the 40-acre parcel. Adjoining properties are undeveloped and do not show signs of previous development.

The Phase I ESA identified several RECs that warranted further investigation. These included:

- Suspected asbestos-containing building materials (ACBMs) and lead-based paint in and around buildings
- An in-ground hydraulic vehicle lift in the former service garage building
- Two large burn pits used to burn trash, tires and other solid waste generated at the truck stop
- Suspected soil and groundwater contamination from previous operation of underground storage tanks (USTs) and above-ground storage tanks (ASTs) for diesel and gasoline

Areas of investigation were selected based on the results of the December 2012 Phase I ESA. The Phase II sampling activity included advancing 11 borings using hollow-stem auger and air rotary drilling methods, four hand auger borings, and a biased grab sample. Surface and subsurface soil samples and three groundwater grab samples were collected during the investigation and analyzed, as practicable, for total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), and metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver).

Soil and groundwater analytical data collected during this assessment indicated petroleum hydrocarbon contamination consistent with reported releases of gasoline and diesel fuel from on-site fuel dispensing activities. Additionally, TPH concentrations above the Nevada Division of Environmental Protection (NDEP) regulatory action levels were also identified in the northern solid waste burn pit located southeast of the former truck stop within the 10-acre assessed area. Finally, both asbestos and lead-based paint concentrations in excess of NDEP regulatory action levels were detected in samples collected from several former truck stop structures.

BEC recommends additional assessment during cleanup activities to identify the specific area and quantity of soil and other constituents of concern which should be removed. In the interim, signage should be posted on the former truck stop to inform travelers that the property is private and of on-site hazards. Removal of on-site buildings and debris would be preferable to signage; however, abatement and demolition activities pose a significant cost which could be better leveraged through the development

and implementation of a risk-based cleanup and reuse plan for the former truck stop. Public safety is of immediate concern and needs to be addressed, at a minimum, through signage.

2 INTRODUCTION

2.1 Purpose

BEC was authorized by Nye County, Nevada, on behalf of the RDSBC to perform a Phase II ESA of the former Coaldale Junction Truck Stop. This Phase II ESA was conducted to investigate suspected contamination of the site associated with RECs identified in the December 2012 Phase I ESA. The former Coaldale Junction Truck Stop, located in Esmeralda County, Nevada (APN 006-161-09) lies on 10 acres within a 40-acre parcel located on the southwest corner of the intersection of U.S. Highways 95 and 6 (hereinafter referenced as the site, subject site, or subject property). The approximate location of the parcel and former truck stop is shown in Figure 1 and Figure 2 (**Appendix A).**

The purpose of this investigation was to assess for the presence of petroleum hydrocarbon, VOC, and Resource Conservation and Recovery Act 8 (RCRA 8) metal contamination in the subsurface (soil and groundwater) beneath the former truck stop. This contamination may have resulted from historic use of the former truck stop and from on-site refuse disposal practices that included two on-site burn pits on the southeast portion of the site. This assessment also surveyed for the presence of asbestos containing building materials and lead-based paints within building materials of the on-site structures. The intent of the assessment was to provide sufficient data to determine if additional investigation activities were warranted.

2.2 Scope of Services

The Phase II ESA was conducted in accordance with "ASTM E1903-11 Standard Practice for Environmental Site Assessments: Phase II Environmental Site Assessment Process" and the approved Sampling and Analysis Plan (Revised). The ASTM Standard establishes the industry-accepted approach and process for the execution and development of a Phase II ESA.

The scope of services for the Phase II ESA included:

- Review of background information
- Site sampling and procedures
- Evaluation of information
- Interpretation of results and recommendations

Prior to conducting Phase II ESA activities, BEC prepared a Sampling and Analysis Plan (Revised) to outline the project objectives and degree of uncertainty as well as the appropriate scope of work to satisfy those objectives. Subsequently, BEC conducted asbestos, lead-based paint, soil and groundwater field investigations to screen the site for the presence and extent of contamination potentially related to the site being utilized as a former truck stop with retail gasoline and diesel operations. The results of the Phase II ESA are presented in this report.

2.3 Limitations and Expectations of Assessments

The environmental services described in this report have been conducted in general accordance with current regulatory guidelines and the standard of care exercised by environmental consultants performing similar work in the project area. This study was not intended to be a definitive investigation of the nature and extent of contamination at the former truck stop, and the recommendations provided are not necessarily inclusive of all the possible conditions. The assessment did not include a survey for wetlands, endangered species or naturally occurring radioactive materials. No other warranty, expressed or implied, is made regarding the professional opinions presented in this report. This document is intended to be

used in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Nye County or BEC should be contacted if the reader requires any additional information or has questions regarding the content, interpretations presented, or completeness of this document.

The conclusions presented in this report are professional opinions based solely upon indicated data described in this report. BEC does not assume any liability for information that has been misrepresented to us by others or for items not visible, accessible, or present on the subject property during the time of the investigation. The conclusions and recommendations are intended exclusively for the purpose outlined herein and for the site location and project indicated. This Phase II ESA report has been prepared for use by Nye County and the RDSBC. This report shall not be relied upon by or transferred to any additional parties, or used for any other purpose, without the express written authorization of Nye County.

2.4 Limiting Conditions and Methodologies Used

The findings, opinions, and conclusions are based on analytical results from soil, groundwater, building material, and paint samples collected at the former truck stop and burn pits. The conditions of a site can change with time as a result of natural processes or the activities of man at or within the vicinity of the parcel. Additionally, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which neither Nye County nor BEC has any control. Neither Nye County nor BEC can warrant or guarantee that not finding indicators of any particular hazardous material means that this particular hazardous material or any other hazardous materials do not exist on the parcel. Additional research, including invasive testing, can reduce the uncertainty, but no techniques now commonly employed can eliminate the uncertainty altogether.

3 BACKGROUND

3.1 Site Description and Features

The former truck stop accounts for approximately 10 acres of the 40-acre partially-developed, commercial parcel. The former truck stop lies in the northwest corner of the 40 acre parcel and consisted of a vehicle service garage, café, shower facility, two fuel dispenser islands, two small utility buildings, and six motel structures. Two former burn pits were also observed to the south of the former truck stop. None of the structures described are operable or habitable and are in a state of disrepair. An additional structure was burned down with only the building pad remaining. Please refer to **Appendix B** for photographs of the buildings and their current state of disrepair.

3.2 Physical Setting

The parcel is located near the southwest corner of U.S. Highway 95 and U.S. Highway 6 in Coaldale, Nevada. The parcel slopes from southeast to northwest at approximately a 1.6 to 1.7 percent grade. The legal description of the parcel is Section 17 within the NW ¼ of the SE ¼ of Township 2N, Range 37E M.D.M in Esmeralda County, Nevada. Currently, Coaldale, Nevada does not maintain a population base and is located approximately 40 miles from Tonopah, Nevada and is more than 200 miles from the nearest urban centers (Las Vegas and Reno). The elevation of the parcel is approximately 4,663 feet above mean sea level. The parcel is mainly undeveloped desert, with a 10-acre portion that comprises the former truck stop (see Figure 3, **Appendix A**) and burn pits.

3.3 Site History and Land Use

According to aerial photography, the subject site was partially developed sometime after 1954 and before 1965. It is unclear if the present level of development was completed at the site from the time of initial development or if some development occurred progressively. Aerial photography also indicates adjacent

property remained vacant, undisturbed land, except for U.S. Highway 95 to the east and U.S. Highway 6 located north of the parcel. Other than the former truck stop, no other known site usage has been documented by either Esmeralda County or the State of Nevada.

Records indicate the former truck stop ceased operations and was subsequently abandoned in the mid-1990s. The former truck stop has been under a Corrective Actions order for a suspected petroleum release since 1994, according to the NDEP. According to the NDEP documentation, the former truck stop operated USTs and ASTs for diesel and gasoline. The exact number of USTs and ASTs operated at any given time is unknown and appeared to vary over time based on the available documentation provided by the NDEP case file. An NDEP site inspection report, dated August 11, 1994, stated four (4) ASTs were observed on-site and contained diesel fuel. The report stated product from the ASTs was transferred to the USTs. The NDEP inspection also noted the ASTs had no emergency shutoff or overfill protection or secondary containment. During a subsequent site visit on September 4, 1996, NDEP collected a single water sample from the former truck stop well. The laboratory analytical results associated with that sample showed 12 parts per billion (ppb) of benzene. According to the site owner representative, the USTs and ASTs had been removed. No evidence of USTs or ASTs was observed during this assessment. However, the pump islands (minus dispensers) and ancillary piping were observed on-site during the assessment. According to the NDEP file, documentation demonstrating the proper removal and sampling of the UST system had not yet been provided.

3.4 Summary of Previous Assessments

In December 2012, BEC completed a Phase I ESA on behalf of Nye County for the RDSBC at the former truck stop. During Phase I ESA activities, BEC observed several RECs associated with suspect ACBMs, LBP, and on-site use of petroleum hydrocarbons. Based on the RECs identified in connection with the former truck stop, BEC recommended a limited asbestos and lead-based paint survey be conducted to assess the extent of ACBMs and LBPs in the motel and commercial buildings. A Phase II ESA was recommended to test for petroleum hydrocarbons, VOCs, and RCRA 8 metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) in the subsurface soil/groundwater in connection with a hydraulic lift in the former service garage and in the vicinity of the former UST/AST system including the dispenser islands and ancillary piping. Additionally, surface and subsurface sampling was recommended in the area of the former burn pits. The December 2012 Phase I ESA provides additional information regarding the parcel's description and features, its physical setting, site and land use history, adjacent property land use, and the assessment's findings.

3.5 Subsurface Conditions

3.5.1 Geologic Setting

The area is located within the Great Basin Province, which typically consists of linear, roughly parallel, north–south mountain ranges separated by valleys, most of which are closed drainage basins. Coaldale itself is located just west of the pass separating the Monte Cristo range to the north and the Silver Peak range to the south.

Physiographically, the parcel is located on a flat valley bottom, characteristic of valleys in the Basin and Range province. The Columbus Salt Marsh is also located in the valley bottom, just east of the subject site, and is an alkali flat and local sink for surface water draining from the surrounding upland areas. There are a number of outcrops of coal occurring in the area, several of which were mined in the early 1900s. The presence of coal under the subject site or any potential effect on groundwater at the site is unknown.

3.5.2 Hydrogeologic Conditions

The pattern of precipitation in the Coaldale area is fairly evenly distributed throughout the year, with the average monthly precipitation lowest in June (0.28 inches) and highest in March (0.57 inches). The total average annual precipitation is just 5.26 inches, typical of the arid Mojave Desert (weather.com).

Historic groundwater table measurement data obtained for the area through the NDEP and the Nevada Division of Water Resources indicated the groundwater table was expected to be at depths ranging between 60 and 80 feet below ground surface. However, initial drilling activities performed between April 15 and 17, 2013, using a hollow-stem auger drilling rig did not reach the water table at at the maximum recommended drilling depth for that equipment (approximately 100 feet below land surface). Thus, no groundwater was encountered and groundwater samples were not collected during the April 2013, sampling activities.

An air rotary drilling rig was scheduled for subsequent site assessment activities conducted between June 25 through June 28, 2013. This technology allowed access to the groundwater table at depths greater than 100 feet below ground surface but did not allow for incremental sampling of the soil column from surface to the groundwater table. Thus, the sole purpose for soil borings SB-8, SB-9, SB-10, and SB-11 was groundwater sample collection. The location of these borings is shown in Figure 4, **Appendix A**.

Groundwater (first strike) was encountered in borings SB-8, SB-9, SB-10, and SB-11 at depths between 100 and 120 feet below ground surface, based upon driller's estimate. Subsequent groundwater measurements collected from the open borehole for SB-8 and SB-9 were measured using a water level sounder at 63.0 and 60.5 feet below ground surface, respectively. Boreholes SB-8 and SB-9 were allowed 15 hours and 17 hours, respectively, for groundwater recovery within the borehole prior to groundwater level measurement and subsequent sample collection. Soil boring SB-10 had insufficient water in the borehole to permit either groundwater table measurement or sample collection. Groundwater in boring SB-11 was measured at 55 feet below ground surface by dropping the sounder through the air rotary pipe, as the borehole initially drilled in that location collapsed before groundwater measurements could be collected and had to be re-drilled. After re-drilling soil boring SB-11, only one-half hour was allowed for groundwater recovery prior to groundwater measurement and sample collection activities to allow sufficient time for sample delivery to the laboratory for groundwater analysis.

The depth to groundwater in boring SB-8 and SB-9 (thought to be most representative of the groundwater table elevation measurements expected for the area) suggests water flows from the southeast toward the northwest, consistent with the expected groundwater flow direction beneath the site based on surface topography.

4 PHASE II ACTIVITIES

4.1 Scope of Assessment

Areas of investigation were selected based on the results of the Phase I ESA. RECs identified in the Phase I ESA included RCRA 8 metals, TPH, ACBMs, and lead-based paints from numerous potential sources including two burn pits, a former UST/AST system including the dispenser islands and ancillary piping, and building materials. Sample collection was completed within the 10-acre boundary of the former truck stop and burn pits (shown in Figure 2, **Appendix A)**. Sampling was limited to soil, groundwater, and building materials. A total of seven borings were drilled between April 15-17, 2013, and an additional four borings between June 24 -28, 2013.

4.1.1 Sampling and Analysis Plan

BEC prepared a Sampling and Analysis Plan dated April 2013, in advance of Phase II ESA activities at the subject site. In a letter dated March 14, 2013, Gail E. Morrison, Environmental Protection Agency (EPA) Region IX, approved the Sampling and Analysis Plan, upon completing revisions per Morrison's comments. Please refer to **Appendix C** for the Sampling and Analysis Plan approval letter.

4.1.2 Deviations from Sampling and Analysis Plan

BEC does not believe deviations from the Sampling and Analysis Plan (Revised), detailed below, affect the overall recommendations for future site activity, consistent with the intent of the Phase II ESA. Deviations from the Sampling and Analysis Plan (Revised) include the following:

- Soil samples from borings SB-1 through SB-7 were not analyzed for TPH Gas Range Organics (GRO) due to the subject site's remote location and inability to have samples shipped within the 48-hour hold time.
- Building materials and paint samples collected for asbestos and lead-based paint analysis were held by the Nevada Certified Environmental Manager (CEM) initially assigned to complete Phase II activities, for submission with samples collect during the second site visit; however, due to rescheduling of the second site visit based on drill rig availability, the samples were retained approximately three months prior to submittal. The CEM initially assigned to complete the Phase II activities is no longer employed with BEC.
- Building materials and paint samples were submitted to Fiberquant Analytical Services (Fiberquant) and Silver State Analytical Laboratories (Silver State) for asbestos and lead-based paint analysis, respectively. Each lab's statement of qualifications, quality assurance program or procedures, and accreditation has been included in **Appendix D**.
- The hollow stem auger drilling rig used during the April 2013 site visit had a maximum drilling depth of 100 feet. SB-1 was drilled to 100 feet to verify the depth to groundwater; however, at 100 feet no groundwater had been reached. As water was not reached during the boring of SB-1 only soil samples for borings SB-2, SB-3, and SB-4 were collected, of which, none were drilled more than 20 feet below ground surface. Samples were collected at 5-foot intervals for SB-5 and analyzed using a photo-ionization detector (PID). PID readings were in excess of 50 units above background at multiple depths below ground surface. As a result, samples were collected up to 100 feet below ground surface. No groundwater was encountered during the boring of SB-5. Borings SB-6 and SB-7 were drilled until no contamination was evident based upon PID readings; neither was drilled to more than 25 feet below ground surface. As groundwater was not encountered, no water samples were collected for the seven boring completed during the April 2013 site visit.
- Boring SB-4 was drilled in the location suspected to have had a UST; however, no contamination appeared to be present, based on PID readings. Sampling concluded at 15 feet below ground surface.
- The X-Ray Fluorescence (XRF) equipment malfunctioned and was inoperable for the duration of the lead-based paint assessment activities. Thus, bulk paint chip samples were collected for laboratory analysis in lieu of the XRF assessment.
- A total of three borings were drilled during the June 2013 site visit, to obtain the depth to groundwater and groundwater samples. Samples were labeled and were referenced in **Appendix G** as SB-1, SB-2, and SB-3; however, to avoid confusion with borings completed during the April 2013 site visit, which used the same naming convention, those borings conducted during the June 2013 site visit, for the purpose of this report, have been renamed as shown in **Table 1** (page 10).

Table 1 - Groundwater Samples Naming Convention

June 2013 Field Sampling Name	APPENDIX G – Groundwater Laboratory Analytical Results	Coaldale Phase II ESA
SB-1	SB-1	SB-11
SB-2	SB-2	SB-8
SB-3	SB-3	SB-9

- The June 2013 field activities were conducted exclusively for the purpose of collecting groundwater data and samples. A total of three borings were planned and four boring were drilled of which SB-8, SB-9, and SB-11 yielded water for data collection and sampling. A total of four attempts to retrieve water from SB-10 were conducted, but no groundwater was retrieved due to suspected boring collapse.
- Borings SB-8, SB-9, and SB-11 were allowed to recharge for a minimum of 10 hours (overnight). Water retrieved from borings SB-8, SB-9, and SB-11 was prioritized for multi-meter use and VOC sampling as minimal water was retrieved per bailer drop. Sampling for VOCs was further complicated as a result of the free floating drilling foam. The initial borehole for SB-11 collapsed and had to be re-drilled to 110 feet below ground surface. The drill pipe was left in place to maintain access to groundwater in SB-11 and water was allowed to recharge for 30 minutes before sampling.
- Boring locations SB-10 and SB-11 were selected based on the limited length of the air rotary hose and to allow sufficient safe distance from overhead power lines.
- During groundwater sampling activities, insufficient water was collected to perform all of the analytical methods proposed in the Sampling and Analysis Plan (initial groundwater analysis included TPH, RCRA 8 metals, and VOCs). Previous analysis of groundwater at the site indicated the main constituent of concern was benzene. As such, water retrieved was prioritized for VOC analysis.
- A sample was not collected beneath the hydraulic lift located in the former service garage bay due to unsafe building conditions that made heavy equipment access inside the building unadvisable.

4.2 Field Explorations and Methods

Drilling and sampling was performed in accordance with current applicable ASTM Standard E1903-11 for site investigations. Field activities were performed as prescribed in the site specific Health & Safety Plan prepared by BEC and reviewed and approved by the RDSBC. BEC maintained records of site access and daily tailgate safety meetings. Site workers were monitored during field activities by buddy system coworker observation.

4.2.1 Borings

Prior to conducting subsurface exploration, proposed boring locations were marked in the field and the locations assessed for possible conflicts with underground and aboveground utilities prior to drilling.

A total of 11 borings, seven in April 2013 and four in June 2013, were drilled as part of the Coaldale Phase II ESA (see Figures 4 and 5, **Appendix A).** The April 2013 borings were drilled using a truck-mounted hollow stem auger drilling rig. The June 2013 borings were drilled using a truck-mounted air rotary drilling rig.

The April 2013 borings were drilled for the purposes of collecting soil and water samples; however, groundwater was not encountered during the April 2013 field visit. Soil samples were collected using a split-barrel/spoon sampler through the hollow stem auger at approximate 5-foot intervals. Soil cuttings were discarded in 55 gallon drums and appropriately labeled for disposal. Field boring logs for borings SB-1 through SB-7 are available in **Appendix E.**

The additional four borings drilled in June 2013 were for the purpose of collecting groundwater samples. Soil cuttings from the air rotary drilling were directly blown into on-site roll-off bins. Borings SB-8 through SB-11 were drilled until groundwater was encountered. As no soil samples were taken, boring logs were not used. Groundwater samples were collected using plastic disposable bailers. Groundwater collection logs are available in **Appendix J**.

Upon completion of sample collection activities, all borings were backfilled with bentonite chips and hydrated to form an impermeable plug, in accordance with Nevada Division of Water Resources requirements.

4.2.2 Soil Sampling

A limited subsurface investigation of the subject site was performed using a truck-mounted hollow stem auger drill rig. Between April 15 and 17, 2013, seven soil borings SB-1 through SB-7 were drilled to determine the presences and extent of hazardous materials on the Coaldale site.

Samples were placed in sealed jars (or brass sleeves) and labeled showing the boring number, sample number and depth. The soils were logged and information was recorded on the boring log for each boring. A field activity log was maintained to document the activities conducted during the day, and photos of the activities were taken (see **Appendix B**). GPS coordinates were also collected for each boring location and logged in the field notebook. Sampling equipment was decontaminated between samples to reduce the risk of cross-contamination.

BEC conducted field screening activities on selected soil samples. Field screening for organic vapors was conducted using a PID, specifically the Phocheck 1000+ made by Ion Science. Each day the PID was used, it was calibrated according to the manufacturer's directions using ambient air and isobutylene gas. PID calibration and field screening were conducted upwind of heavy equipment operating within the sampling area to prevent diesel exhaust from interfering with readings. A biased grab sample of soil was collected and placed in a sealable, air-tight plastic bag, allowing the soil gases to volatilize and accumulate in the headspace of the plastic bag for a minimum of ten minutes. Upon completion of the volatilization period, the PID was used to obtain field screening concentration readings.

Soil samples were submitted to Advanced Technology Laboratories, Inc. (ATL), a laboratory certified by the State of Nevada, for the specified analysis. BEC followed industry standard chain-of-custody protocol to maintain sample integrity during transmittal to the laboratory.

4.2.3 Groundwater Sampling

A limited subsurface investigation of the subject site was performed using a truck-mounted air rotary drill rig. Between June 24 and 28, 2013, four (4) soil borings were drilled in the vicinity of the former truck stop to determine the depth to groundwater, and the presences and extent of, hazardous materials in the groundwater on the subject site.

Samples were collected using disposable plastic bailers, placed in sealed 40 ml vials. Sample bottles were labeled with a boring number, date, time of collection, and project name. Groundwater samples were packed in an ice chilled cooler and transported under chain-of-custody to ATL on June 28,

2013. The multi-meter results were logged and information was recorded on a log for each boring. Water samples for SB-8, SB-9, and SB-11 were analyzed for concentrations of volatile organic chemicals. Refer to Figure 4 in **Appendix A** which shows the locations of soil borings SB-8 through SB-11.

4.2.4 Asbestos Sampling

On April 17, 2013, Brian Loffman, an EPA accredited and State of Nevada licensed (I-1561) asbestos consultant from BEC, conducted an asbestos assessment at the subject site. The assessment was conducted to identify the presence of any materials containing asbestos pursuant to the requirements of:

- Occupational Safety and Health Act (OSHA) – Nevada Administrative Code (NAC) 618.960
- Occupational Safety and Health Act "Criteria to rebut the designation of installed material as PACM (Presumed Asbestos Containing Material)", 1926.1101(k)(5)
- Utility Environmental Protection Act (UEPA): 40 CFR Part 61, National Emission Standard for Hazardous Air Pollutants (NESHAP).

These regulations outline inspection and abatement requirements for materials containing asbestos.

Prior to sampling, a complete visual observation of interior/exterior areas was conducted to identify building materials that may contain asbestos. During the visual observation an assessment was made as to the relative condition of building materials to determine if the material was friable. According to Asbestos Hazard Emergency Response Act (AHERA), a "friable" material can be reduced to dust or powder with hand pressure. Review of historical documents, including aerial photography, suggest site development occurred between the early 1950s and ceased in the late 1960s. Interior/exterior building materials were in poor condition at the time of the survey. Damaged and/or friable building materials were observed during the visual assessment or sampling activities.

The sampling strategy complied with the sampling protocol established under AHERA (40 CFR 763.86) with primary emphasis on following the "3-5-7" rule, meaning three samples from a less than 1,000 square foot area, five samples from a 1,000 to 5,000 square foot area, and seven samples from a greater than 5,000 square foot area. However, if any homogenous area of non-friable suspect ACBM is not assumed to be ACBM, then the accredited inspector shall collect, in a manner sufficient to determine if the material is ACBM or not ACBM, bulk samples from the homogenous area of non-friable ACBM that is not assumed to be ACBM. Therefore, fewer samples than the above stated AHERA criteria may be collected during this survey, depending on visual observations made by the accredited inspector. Samples were handled with accepted procedures for the collection, packaging, chain-of-custody documentation and transport of bulk samples to the laboratory for analysis. Once the homogenous areas were identified for each like material, the required amount of samples of each type of suspect ACBM was collected for analysis. Bulk samples of suspect ACBM were collected by spraying the suspect material with amended water, where appropriate, removing a small portion of the material, and placing it into a laboratory-provided or generic zip-lock plastic bag. All suspect materials sampled were identified on a building floor plan diagram with an identifying sample number presented in Figure 6, **Appendix A**. A chain-of-custody record was prepared to accompany bulk samples to the laboratory.

All samples were submitted to Fiberquant. Fiberquant is certified under the EPA's National Voluntary Laboratory Accreditation Program. The suspect ACBM samples were analyzed for asbestos fibers utilizing Polarized Light Microscopy. Bulk sample analysis was conducted in accordance with the EPA's "Test Method for the Determination of Asbestos in Bulk Building Materials, " EPA/600/R-93/116, 1993. A total of 37 bulk samples of the following observed suspect

ACBMs were collected and submitted to Fiberquant. A copy of the Fiberquant asbestos analytical laboratory report and chain-of-custody can be found in **Appendix H**.

Typical suspect ACBM samples collected and submitted for laboratory analysis included ceiling tile, composite roofing material and mastic, gypsum wallboard/joint compound and surface texture and cove base/mastic. Please refer to Figure 6 in **Appendix A** for approximate sample locations and Photographs 12 and 17 in **Appendix B**, which show typical sample material encountered during site activities.

4.2.5 Lead-Based Paint Sampling

On April 17, 2013, an EPA-certified inspector conducted a lead-based paint assessment of painted surface coatings at the subject site to identify the presence and content level of lead for compliance with the OSHA and EPA regulatory requirements pertaining to worker protection and waste disposal.

Per the sampling and analysis plan, XRF was intended to be used to conduct the lead-based paint survey. However, the XRF equipment malfunctioned and was inoperable for the assessment. Thus, bulk paint chip samples were collected in lieu of the XRF assessment. Prior to sample collection, an initial walk through of the building was conducted to identify homogenous suspect materials that may contain lead based paint. During the visual observation an assessment was made as to the relative condition of paint materials to determine if the materials were friable. Interior/exterior paint materials were in poor condition at the time of the survey. Damaged and/or friable paint materials were observed during the visual assessment and sampling activities. Once identified, paint chip samples were collected, sealed in their own zipper locked plastic containers and labeled with a unique identification number. Proper decontamination techniques described within the Sampling and Analysis Plan (Revised) were utilized after each sample was collected. Each sample was recorded on the chain-of-custody form which accompanied all samples to the analytical laboratory. The confirmatory samples were analyzed for lead in accordance with the EPA's Method SW846-7420. Approximate sample locations and sample designations are provided in Figure 7, **Appendix A**.

4.3 Analytical Testing

Analytical testing was performed for soil, groundwater, asbestos, and lead-based paint samples. ATL was used for soil and groundwater analysis, Fiberquant for asbestos analysis, and Silver State Laboratories, Inc. (Silver State) for lead-based paint analysis.

4.3.1 Quality Assurance Review

The statement of qualifications, standard operating procedure or QAQC manual, accreditations, and certifications for each laboratory are available in **Appendix D**.

BEC utilized ATL to perform the soil and groundwater laboratory analysis for this project. Analytical testing and sample handling, including container types and preservation methods, were conducted in accordance with ATL's Quality Assurance Program Plan as shown in the approved Coaldale Sampling and Analysis Plan (Revised) Appendix A-1. ATL is a State of Nevada certified analytical laboratory. Sample containers and preservation methods for each proposed soil and groundwater analysis at the site have been summarized from ATL's Quality Assurance Plan and are provided in the approved Coaldale Sampling and Analysis Plan (Revised).

Asbestos analysis was conducted by Fiberquant. Fiberquant is certified under the EPA's National Voluntary Laboratory Accreditation Program. Additional information relevant to the Operating Procedures, Statement of Qualifications and Quality Assurance Program for Figerquant is provided in **Appendix D**.

Silver State performed the lead analysis on paint chip samples. Silver State is certified for metals analysis in the State of Nevada. Additional information relevant to the Operating Procedures, Statement of Qualifications and Quality Assurance Program for Silver State is provided in **Appendix D**.

As specified in the criteria, the laboratory detection limit was 1.0 mg/kg for both total arsenic and total lead. In the laboratory reports, the detection limit is called the practical quantitation limit. Some of the laboratory reports note results for the matrix spike (MS) and matrix spike duplicate (MSD) fall outside the acceptable criteria range possibly due to matrix interference, i.e., the laboratory spike aliquot cannot be recovered from the soil matrix of the sample within the expected efficiency. However, the associated Laboratory Control Sample results were acceptable for each batch analyzed. This result indicated: 1) the variable results of the MSs and MSDs were due strictly to the characteristics of the soil matrix; 2) the laboratory methods for extracting the metals from the soil were acceptable; and 3) the total arsenic and total lead results from the environmental screening samples were acceptable.

4.3.2 Soil

ATL was provided samples from borings SB-1 through SB-7; burn pits BP1 and BP2; and a biased grab sample for TPH and RCRA 8 metals (total metals) analysis. A total of 48 soil samples on were provided to ATL on April 19, 2013. ATL provided the analytical results to BEC on April 26 and 29, 2013. Table 2 provides a summary of soil analytical results, and the laboratory reports for these analyses are provided in **Appendix F**.

Table 2 - Summary of Soil Analytical Results

Sample Location	Sample ID	Sample Date	TPH (mg/kg)				VOCs (ug/kg)	RCRA 8 Totals (mg/kg)							
			DRO	GRO	ORO	Total		As	Ba	Cd	Cr	Hg	Pb	Se	Ag
NDEP Approved Target Clean-up Levels			-	-	-	*100*	*NA*	*0.39*	*1,600*	*8*	*38*	*6.7*	*400*	*5*	*34*
BGS	BGS	04/17/13	NA	NA	NA	NA	NA	**9.5**	130	ND	9.4	ND	6	ND	ND
BP1	BP1-N	04/17/13	260	NA	330	**590**	NA	**7.1**	94	ND	8	ND	8.5	ND	ND
BP1	BP1-S	04/17/13	ND	NA	ND	NA	NA	**11**	96	1.5	17	ND	140	2.2	ND
BP2	BP2-N	04/17/13	15	NA	31	46	NA	**9.4**	85	ND	13	ND	22	ND	ND
BP2	BP2-S	04/17/13	ND	NA	16	16	NA	**8.9**	200	ND	16	ND	18	3.1	ND
SB1	SB1-5	04/15/13	ND	NA	ND	NA	NA	**10**	65	ND	5.7	ND	5.7	ND	ND
SB1	SB1-15	04/15/13	ND	NA	ND	NA	NA	**33**	120	ND	9.9	ND	4.3	ND	ND
SB1	SB1-25	04/15/13	ND	NA	ND	NA	NA	**14**	230	ND	11	ND	3.6	ND	ND
SB1	SB1-35	04/15/13	ND	NA	ND	NA	NA	**11**	16	ND	12	ND	3.8	ND	ND
SB1	SB1-40	04/15/13	ND	NA	ND	NA	NA	**30**	880	ND	9.3	ND	5.3	ND	ND
SB1	SB1-45	04/15/13	ND	NA	ND	NA	NA	**54**	73	ND	3.4	ND	8.9	ND	ND
SB1	SB1-50	04/15/13	32	NA	41	73	NA	**20**	74	ND	5.2	ND	20	ND	ND
SB1	SB1-55	04/15/13	11	NA	11	22	NA	**2.3**	58	ND	2.5	ND	8.1	ND	ND
SB1	SB1-60	04/15/13	ND	NA	10	10	NA	**2.8**	48	ND	4.6	ND	7.5	ND	ND
SB1	SB1-65	04/15/13	ND	NA	ND	NA	NA	**5.9**	57	ND	1.8	ND	12	ND	ND
SB2	SB2-10	04/15/13	ND	NA	ND	NA	NA	**18**	79	ND	8.3	ND	5.6	ND	ND
SB2	SB2-15	04/15/13	ND	NA	ND	NA	NA	**13**	200	ND	7	ND	4.3	ND	ND
SB2	SB2-20	04/15/13	71	NA	77	**148**	NA	**7.1**	540	ND	3.4	ND	44	ND	ND
SB3	SB3-2	04/15/13	1500	NA	650	**2150**	NA	**9.6**	200	ND	12	ND	5.3	ND	ND
SB3	SB3-5	04/15/13	1300	NA	780	**2080**	NA	**13**	69	ND	8.8	ND	5.7	ND	ND
SB3	SB3-10	04/15/13	ND	NA	ND	NA	NA	**8.7**	79	ND	8.4	ND	4	ND	ND
SB3	SB3-15	04/15/13	ND	NA	ND	NA	NA	**16**	110	ND	8.1	ND	4	ND	ND
SB3	SB3-20	04/15/13	ND	NA	ND	NA	NA	**11**	220	ND	13	ND	7.8	ND	ND
SB4	SB4-5	04/15/13	170	NA	150	**320**	NA	**11**	110	ND	7.5	ND	4.4	ND	ND
SB4	SB4-10	04/15/13	ND	NA	ND	NA	NA	**15**	67	ND	10	ND	6.5	ND	ND
SB4	SB4-15	04/15/13	ND	NA	ND	NA	NA	**35**	110	ND	8.2	ND	6.5	ND	ND

Table 2 - Summary of Soil Analytical Results

Sample Location	Sample ID	Sample Date	TPH (mg/kg)				VOCs (ug/kg)	RCRA 8 Totals (mg/kg)							
			DRO	GRO	ORO	Total		As	Ba	Cd	Cr	Hg	Pb	Se	Ag
SB5	SB5-5	04/16/13	3500	NA	1500	**5000**	NA	**8.1**	84	ND	8.9	ND	3.9	ND	ND
SB5	SB5-10	04/16/13	6000	NA	2400	**8400**	NA	**9**	76	ND	6.1	ND	3.1	ND	ND
SB5	SB5-15	04/16/13	3200	NA	1300	**4500**	NA	**2.6**	86	ND	14	ND	6.6	ND	ND
SB5	SB5-20	04/16/13	2400	NA	970	**3370**	NA	**2.2**	63	ND	14	ND	7.4	ND	ND
SB5	SB5-25	04/16/13	260	NA	120	**380**	NA	**2.4**	130	ND	12	ND	8.9	ND	ND
SB5	SB5-30	04/16/13	220	NA	100	**320**	NA	**2.9**	34	ND	11	ND	11	ND	ND
SB5	SB5-35	04/16/13	ND	NA	ND	NA	NA	**3.8**	110	ND	8.7	ND	9.6	ND	ND
SB5	SB5-40	04/16/13	11	NA	ND	11	NA	**2.8**	34	ND	10	ND	8.9	ND	ND
SB5	SB5-45	04/16/13	3700	NA	1400	**5100**	NA	**11**	220	ND	12	ND	7.4	ND	ND
SB5	SB5-50	04/16/13	ND	NA	ND	NA	NA	**9.7**	31	ND	11	ND	12	ND	ND
SB5	SB5-55	04/16/13	860	NA	330	**1190**	NA	**3.1**	38	ND	8.3	ND	10	ND	ND
SB5	SB5-60	04/16/13	260	NA	100	**360**	NA	**12**	78	ND	2.7	ND	16	ND	ND
SB5	SB5-70	04/16/13	24	NA	13	37	NA	**27**	33	ND	9.6	ND	12	ND	ND
SB5	SB5-80	04/16/13	560	NA	190	**750**	NA	**2.8**	29	ND	7.5	ND	11	ND	ND
SB5	SB5-100	04/16/13	ND	NA	ND	NA	NA	**3.4**	23	ND	6.2	ND	7.3	ND	ND
SB6	SB6-5	04/16/13	ND	NA	ND	NA	NA	**8.2**	82	ND	11	ND	3.4	ND	ND
SB6	SB6-10	04/16/13	ND	NA	ND	NA	NA	**14**	61	ND	6.6	ND	3.7	ND	ND
SB6	SB6-15	04/16/13	ND	NA	ND	NA	NA	**19**	120	ND	8	ND	4.1	ND	ND
SB6	SB6-20	04/16/13	ND	NA	ND	NA	NA	**11**	290	ND	7.6	ND	1.9	ND	ND
SB7	SB7-15	04/16/13	ND	NA	ND	NA	NA	**11**	210	ND	7.2	ND	9.7	ND	ND
SB7	SB7-20	04/16/13	ND	NA	ND	NA	NA	**6.5**	410	ND	7.4	ND	7.3	ND	ND
SB7	SB7-25	04/16/13	ND	NA	ND	NA	NA	**9.1**	160	ND	8.2	ND	11	ND	ND

BGS = Biased Grab Sample
BP = Burn Pit
NA = Not Analyzed
ND = Non Detect at the laboratory detection limit for that particular analyte as shown in the lab report.
SB = Soil Boring

4.3.3 Groundwater

ATL was provided samples from borings SB-8, SB-9, and SB- 11 for analysis of VOCs. A total of three groundwater samples on were provided to ATL on June 28, 2013. ATL provided the analytical results to BEC on July 10, 2013. Refer to Table 3 for a summary of the groundwater analytical results. Laboratory reports for groundwater analyses are provided in **Appendix G**.

Table 3 - Summary of Groundwater Analytical Results

	EPA 8260B (ug/L)		
Sample ID	*SB-11*	*SB-8*	*SB-9*
Sample Date	6/28/2013	06/25/13	06/26/13
1,1,1,2-Tetrachloroethane	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND
1,1-Dichloropropene	ND	ND	ND
1,2,3-Trichlorobenzene	ND	ND	ND
1,2,3-Trichloropropane	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	ND
1,2,4-Trimethylbenzene	ND	ND	ND
1,2-Dibromo-3-chloropropane	ND	ND	ND
1,2-Dibromoethane	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND
1,3,5-Trimethylbenzene	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND
1,3-Dichloropropane	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND
2,2-Dichloropropane	ND	ND	ND
2-Chlorotoluene	ND	ND	ND
4-Chlorotoluene	ND	ND	ND
4-Isopropyltoluene	ND	ND	ND
Benzene	ND	ND	**18**
Bromobenzene	ND	ND	ND
Bromodichloromethane	ND	ND	ND
Bromoform	ND	ND	ND
Bromomethane	ND	ND	ND
Carbon tetrachloride	ND	ND	ND
Chlorobenzene	ND	ND	ND
Chloroethane	ND	ND	ND
Chloroform	ND	ND	ND

Table 3 - Summary of Groundwater Analytical Results

	EPA 8260B (ug/L)		
Sample ID	*SB-11*	*SB-8*	*SB-9*
Sample Date	6/28/2013	06/25/13	06/26/13
Chloromethane	ND	ND	ND
cis-1,2-Dichloroethene	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND
Dibromochloromethane	ND	ND	ND
Dibromomethane	ND	ND	ND
Dichlorodifluoromethane	ND	ND	ND
Ethylbenzene	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND
Isopropylbenzene	ND	ND	ND
m,p-Xylene	ND	ND	ND
Methylene chloride	ND	ND	ND
MTBE	ND	ND	14
n-Butylbenzene	ND	ND	ND
n-Propylbenzene	ND	ND	ND
Naphthalene	ND	ND	85
o-Xylene	ND	ND	ND
sec-Butylbenzene	ND	ND	ND
Styrene	ND	ND	ND
tert-Butylbenzene	ND	ND	ND
Tetrachloroethene	ND	ND	ND
Toluene	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND
Trichloroethene	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND
Vinyl Chloride	ND	ND	ND
GRO (by **EPA 8015B (mg/L)**)	ND	ND	0.31

NA = Not Analyzed
ND = Non Detect at the laboratory detection limit for that particular analytic as shown in the lab report

4.3.4 Asbestos

Fiberquant was provided samples from buildings 5, 6, 7, 8, 9, and 10 suspected to contain ACBM. A total of 37 samples were submitted to Fiberquant on July 23, 2013, and BEC was provided the analytical results on July 26, 2013.A summary of the building material samples collected, sample name and location, and asbestos content are summarized in Table 4 below. Asbestos Laboratory Analytical Results are available in **Appendix H**.

Table 4 - Summary of Asbestos Analytical Results

Sample ID	Sample Location	Layer Type	Layer	Lab Result
Bldg 5-TSI	Building 5	insulation wrap	Layer 1	ND
		insulation	Layer 2	5-10% amosite (grunerite) asbestos 5-10% chrysotile asbestos
Bldg 5-TE	Building 5	paint	Layer 1	ND
		cem/asb board	Layer 2	5-10% chrysotile asbestos
Bldg 5-RS	Building 5	roofing roll/shingle	Layer 1	ND
		roof ply	Layer 2	ND
Bldg 5-I W	Building 5	paint	Layer 1	ND
		paper/cardboard	Layer 2	ND
		drywall core	Layer 3	ND
Bldg 6-5 VT	Building 6	floor tile	Layer 1	10-20% chrysotile asbestos
		mastic	Layer 2	ND
Bldg 6-4 VT	Building 6	powder	Layer 1	ND
		floor tile	Layer 2	>1-2% chrysotile asbestos
		mastic	Layer 3	ND
Bldg 6-5 IW	Building 6	paint	Layer 1	ND
		paper/cardboard	Layer 2	ND
		drywall core	Layer 3	ND
Bldg 6-6 EW	Building 6	paint	Layer 1	ND
		bitumen-paper	Layer 2	ND
		paper/cardboard	Layer 3	ND
		drywall core	Layer 4	ND
Bldg 6-3	Building 6	surface	Layer 1	ND
		paint	Layer 2	ND
		bitumen-paper	Layer 3	ND
Bldg 6-RS	Building 6	bitumen	Layer 1	ND
		roof ply/bitumen	Layer 2	ND
Bldg 6-2 ES	Building 6	paint	Layer 1	ND
		bitumen-paper	Layer 2	ND
Bldg 6-1 ES	Building 6	bitumen-paper	Layer 1	ND
Bldg 6-3 IW	Building 6	paint	Layer 1	ND
		paper/cardboard	Layer 2	ND
		drywall core	Layer 3	ND

Table 4 - Summary of Asbestos Analytical Results

Sample ID	Sample Location	Layer Type	Layer	Lab Result
Bldg 7 IW	Building 7	paint	Layer 1	ND
		texture/joint compound	Layer 2	ND
		paper/cardboard	Layer 3	ND
		texture/joint compound	Layer 4	ND
		paper/cardboard	Layer 5	ND
		drywall core	Layer 6	ND
Bldg 7 EW	Building 7	paint	Layer 1	ND
		plaster	Layer 2	ND
Bldg 7 RS	Building 7	roofing roll/shingle	Layer 1	ND
		roofing roll/shingle	Layer 2	ND
Bldg 8 VT1	Building 8	floor tile	Layer 1	>1-2% chrysotile asbestos
		mastic	Layer 2	ND
Bldg 8 VT2	Building 8	sheet flooring surface	Layer 1	ND
		sheet flooring backing	Layer 2	ND
Bldg 8 VT3	Building 8	floor tile	Layer 1	>1-2% chrysotile asbestos
		mastic	Layer 2	ND
Bldg 8 MISC	Building 8	surface	Layer 1	ND
		bitumen-paper	Layer 2	ND
		mastic	Layer 3	ND
Bldg 9 VT	Building 9	floor tile	Layer 1	ND
		mastic	Layer 2	ND
Bldg 9 RS	Building 9	bitumen	Layer 1	ND
		roof ply	Layer 2	ND
		roof ply	Layer 3	ND
		roof ply	Layer 4	ND
Bldg 9 IW	Building 9	paper/cardboard	Layer 1	ND
		drywall core	Layer 2	ND
Bldg 10 ESM	Building 10	surface	Layer 1	ND
		bitumen-paper	Layer 2	ND
		backing	Layer 3	ND
Bldg 10 RS	Building 10	roofing roll/shingle	Layer 1	ND
Bldg 10 IW	Building 10	texture/joint compound	Layer 1	ND
		paper/cardboard	Layer 2	ND
		drywall core	Layer 3	ND
Bldg 10 EW	Building 10	paint	Layer 1	ND

Table 4 - Summary of Asbestos Analytical Results

Sample ID	Sample Location	Layer Type	Layer	Lab Result
		cem/asb board	Layer 2	5-10% chrysotile asbestos
Bldg 10 VT	Building 10	floor tile	Layer 1	ND
		mastic	Layer 2	ND
ND = Non Detect at the laboratory detection limit for that particular analytic as shown in the lab report				

4.3.5 Lead-Based Paint

Silver State was provided paint samples from buildings 1, 2, 3, 5, 6, 7, 8, 9, and 10. A total of 23 samples were submitted to Silver State on July 19, 2013, and BEC was provided the analytical results on July 29, 2013. Analytical results are presented below in Table 5 and laboratory results are provided in detail in **Appendix I**.

Table 5 - Summary of Bulk Paint Chip Analytical Results

Sample Location	Sample ID	Sample Date	Lab Result (mg/kg)
Building 1	1A Bldg 1	4/17/2013	66.7
Building 1	1B Bldg 1	4/17/2013	24.3
Building 1	1C Bldg 1	4/17/2013	21.4
Building 1	1D Bldg 1	4/17/2013	44.5
Building 2	2A Bldg 2	4/17/2013	30.9
Building 2	2B Bldg 2	4/17/2013	223
Building 2	2C Bldg 2	4/17/2013	36
Building 3	3A Bldg 3	4/17/2013	229
Building 3	3C Bldg 3	4/17/2013	35.8
Building 5	5A Bldg 5	4/17/2013	**2,530**
Building 6	6A Int Bldg 6	4/17/2013	**32,100**
Building 6	6B Bldg 6	4/17/2013	50.4
Building 6	6C Bldg 6	4/17/2013	**58,400**
Building 6	6A Ext Bldg 6	4/17/2013	15.1
Building 6	6D Bldg 6	4/17/2013	31.9
Building 7	7A Int Bldg 7	4/17/2013	23.1
Building 7	7A Ext Bldg 7	4/17/2013	47.2
Building 8	8A Int Bldg 8	4/17/2013	13.8
Building 8	8B Ext Bldg 8	4/17/2013	23.6
Building 9	9B Bldg 9	4/17/2013	15.1
Building 9	9C Bldg 9	4/17/2013	44.1
Building 10	10A Int Bldg 10	4/17/2013	**2,490**
Building 10	10C Ext Bldg 10	4/17/2013	52.6

5 DISCUSSION OF FINDINGS AND CONCLUSIONS

5.1 Recognized Environmental Conditions

5.1.1 Soil

Soil analytical data collected during this assessment indicated petroleum hydrocarbon contamination consistent with reported releases of gasoline and diesel fuel from on-site fuel dispensing activities. Subsurface soil samples from soil boring SB-5 (located adjacent to the former diesel fuel dispensers) showed TPH concentrations in excess of the NDEP regulatory action level of 100 mg/kg from 5 to 80 feet below ground surface. Laboratory analysis of soil borings SB-2, SB-3 and SB-4 also showed TPH concentrations in excess of the NDEP action level in several locations ranging from 2 to 20 feet below ground surface.

Similarly, soil sample BP1-N, collected from the northern burn pit area, exhibited TPH concentration of 590 mg/kg. However, the amount and nature of the debris in the pit indicates there may be additional contamination beneath the solid waste remaining in the pit.

Total metal concentrations, aside from arsenic, were within NDEP action levels. Although arsenic concentrations were in excess of the NDEP action limit of 0.39 mg/kg, the comments in NDEP's Draft Guidelines for Discovery Events (Soil RCs) for arsenic state, "A facility owner/operator is not required to make notification if metal concentrations are within an appropriately determined background, irrespective of their discovery above the Reportable Concentration." Based on the background sample concentration of 9.5 mg/kg at ground surface, and the relatively consistent, high range of arsenic concentration throughout the site (ranging from a low of 2.2 mg/kg in sample SB-5 at 20 feet below ground surface to a high of 54 mg/kg in sample SB-1 at 45 feet below ground surface), high arsenic concentrations appear to be naturally occurring in the vicinity of the subject site.

5.1.2 Groundwater

Groundwater analytical data collected during this assessment indicated petroleum hydrocarbon contamination consistent with reported releases of gasoline and diesel fuel from on-site fuel dispensing activities. Laboratory analysis of the groundwater grab sample collected from boring SB-9 (adjacent to soil boring SB-5) indicated a benzene concentration of 18 µg/L, above the NDEP action level of 5 µg/L. However, no other concentrations above NDEP action levels were evident in the groundwater at the site, based on the results from samples collected.

5.1.3 Asbestos

In accordance with OSHA 29 CFR 1926.1101 and NESHAPS 40 CFR 61.141 the definition of an asbestos containing material is "any material which contains more than one percent asbestos by weight".

Analytical results indicated that seven of the 37 bulk samples collected during this inspection were positive for containing asbestos in excess of one percent. Table 4 summarizes positive materials identified, sample locations and asbestos content. The remaining samples that were collected during this investigation were "none detected" for containing asbestos. Buildings 5, 6, 8, and 10 contained materials with asbestos in excess of one percent by weight.

5.1.4 Lead

The Nevada Division of Industrial Relations and the EPA defines lead-based paint as paint containing 0.5 percent (5,000 mg/kg) or greater, lead by weight. Reference Table 5 for a summary of the lead-based paint results and those above the Department of Housing and Urban Development (HUD)

action level of 5,000 mg/kg. The only structure containing building materials with concentrations in excess of the HUD action level, based on materials collected during field sampling activities, was Building 6.

6 WASTE DISPOSAL

Contaminated soil and investigation-derived wastes generated during site investigation activities were containerized in 55-gallon drums or in roll-off bins and stored on-site in appropriately labeled and secured containers. Laboratory analytical results from soil samples were used to characterize the material and identify an appropriate disposal method in compliance with local, State, and Federal regulations. A waste profile form was completed for the materials temporarily stored on-site and used to obtain authorization for disposal at the US Ecology waste facility located in Beatty, Nevada. However, there was a significant delay (approximately 50 days) prior to disposal of the waste materials due to challenges associated with contacting the site property owner to obtain his signature for the waste profile form and authorization for subsequent disposal of the material. Waste tickets and associated non-hazardous waste manifests are provided in **Appendix K**.

7 RECOMMENDATIONS

BEC recommends removal and proper disposal of surface structures and burn pit debris, and subsequent confirmation sampling beneath these areas, specifically under the hydraulic lift in the former service garage, and beneath the solid waste materials in the northern and southern burn pits located at the southeast corner of the subject site. Additionally, visible staining at ground surface, around former fuel piping, and near the former UST and AST systems should be removed and the base of excavations tested to verify removal of petroleum hydrocarbon contamination to concentrations below NDEP action levels. Soil and groundwater contamination in excess of NDEP action levels at depths five feet or more beneath ground surface should be considered for future remedial action.

BEC recommends installation of one groundwater monitoring well in the vicinity of SB-9 to allow additional groundwater assessment, and potentially to perform groundwater remediation activities to reduce benzene concentrations to below NDEP action levels. Monitoring of up to two additional groundwater wells (either for groundwater monitoring or site development activities) is recommended to allow triangulation of the local groundwater flow direction and additional remediation activities.

Laboratory analysis of several samples collected from the buildings at the subject property exhibited greater than one percent asbestos in these samples. EPA and Nevada Department of Industrial Relations regulations require the removal of all regulated asbestos containing materials (RACM) prior to any renovation or demolition that could impact or disturb RACM. Therefore, prior to the disturbance of these materials, it is recommended that the following procedures are followed in order to maintain EPA, State of Nevada OSHA and federal OSHA regulatory compliance, and reduce liability and health concerns:

- All materials which were identified as containing greater than one percent asbestos should be removed from the building prior to any renovation projects commencing which would disturb these materials.
- A certified asbestos abatement consultant licensed in the State of Nevada should be contracted to develop abatement specifications based on this investigation and any other additional findings.
- A certified asbestos abatement contractor licensed in the State of Nevada should be contracted to perform all activities involving the removal or disturbance of materials which contain greater than one percent asbestos. All abatement work should be done in strict accordance with applicable Federal, State and local regulations.
- Notification to the EPA and State of Nevada OSHA, which regulate the removal of asbestos, should be performed by an asbestos abatement contractor (if required).

- A certified asbestos consultant licensed in the State of Nevada should be contracted to conduct perimeter air monitoring and project oversight during the removal of all ACBM, and final clearance air sampling assessments after the asbestos abatement is complete.

Although some of the floor tile material and exterior transite siding found to contain asbestos greater than one percent is non-friable, it will need to be handled as a RACM if there is a high probability the material will become pulverized or reduced to a friable state by forces expected to act on the material in the course of renovation. Therefore, it is recommended that removal of all ACBM occurs in the manner described above whenever feasible.

Based on information obtained from conducting the lead-based paint assessment, results indicated that multiple locations contained lead in paint at levels above 5,000 mg/kg. These locations are found both within the buildings and on the exterior of the buildings.

Federal EPA and OSHA regulations require the implementation of worker protection if there is a potential that paint containing lead will be disturbed during renovation activities. In accordance with these regulations, the following is recommended:

- A certified lead consultant should be contracted to develop a project specification based on this investigation and any other additional findings.
- A lead abatement contractor licensed in the State of Nevada should be contracted to stabilize and/or remove all regulated lead-painted materials.
- A certified lead consultant should be contracted to monitor the removal activities and to provide final clearance inspection reports.

Prior to renovation or demolition activities, it is recommended the hazards be removed by abatement of all lead-based paint in compliance with EPA's 40 CFR Part 745.

Cleanup activities may require additional assessment to identify the specific area and quantity of soil which should be removed. Signage should be posted on sight to inform travelers that the property is private and of any on-site hazards. Removal of on-site buildings and debris would be preferable to signage; however, abatement and demolition activities pose a significant cost which could be better leveraged through the development and implementation of a cleanup plan consistent with a risk-based approach based on proposed reuse plans for the site.

8 PHASE II STATEMENT AND NEVADA ENVIRONMENTAL MANAGER CERTIFICATION

We have performed a Phase II environmental site assessment at the property formerly known as the Coaldale Junction Truck Stop, located on the southwest corner of U.S. Highway 95 and U.S. Highway 6 Intersection, in Esmeralda County, Nevada, (APN 006-161-09), in conformance with the scope and limitations of ASTM Practice E 1903-11 and for the following objectives: to assess for the presence of contaminants that may be present in the surface and subsurface soils, groundwater, and remaining structures at the site, consistent with the EPA-approved Sampling and Analysis Plan for the subject site.

I declare that, to the best of my professional knowledge and belief, I meet the definition of Environmental Professional as defined in §312.10 of 40 CFR 312.

I, Belva Eileen Christensen, hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession and to the best of my knowledge comply with all applicable federal, state, and local statutes, regulations, and ordinances.

Belva Eileen Christensen, C.E.M.
Certified Environmental Manager
No. 1694
Expires: October 7, 2015

9/30/13
Date

9 REFERENCES

American Society for Testing and Materials International, Standard Practice for Environmental Site Assessments: Phase II Environmental Site Assessment Process. (Designation: E 1903-11).

American Society for Testing and Materials International, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process. (Designation: E 1527-05).

BEC Environmental Inc., 2012, Phase I Environmental Site Assessment, Coaldale Junction, Coaldale, Nevada, December.

BEC Environmental Inc., 2013, Sampling and Analysis Plan, Coaldale Junction, Coaldale, Nevada, March.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 ("CERCLA" or "Superfund"), as amended by Superfund Amendments and Reauthorization Act of 1986 ("SARA") and Small Business Liability Relief and Brownfields Revitalization Act of 2002 ("Brownfield Amendments"), 42 U.S.C. §§9601, et. seq.

Resource Conservation and Recovery Act, as amended ("RCRA"), 42 U.S.C. §6901, et. seq.

Appendix A

Figures

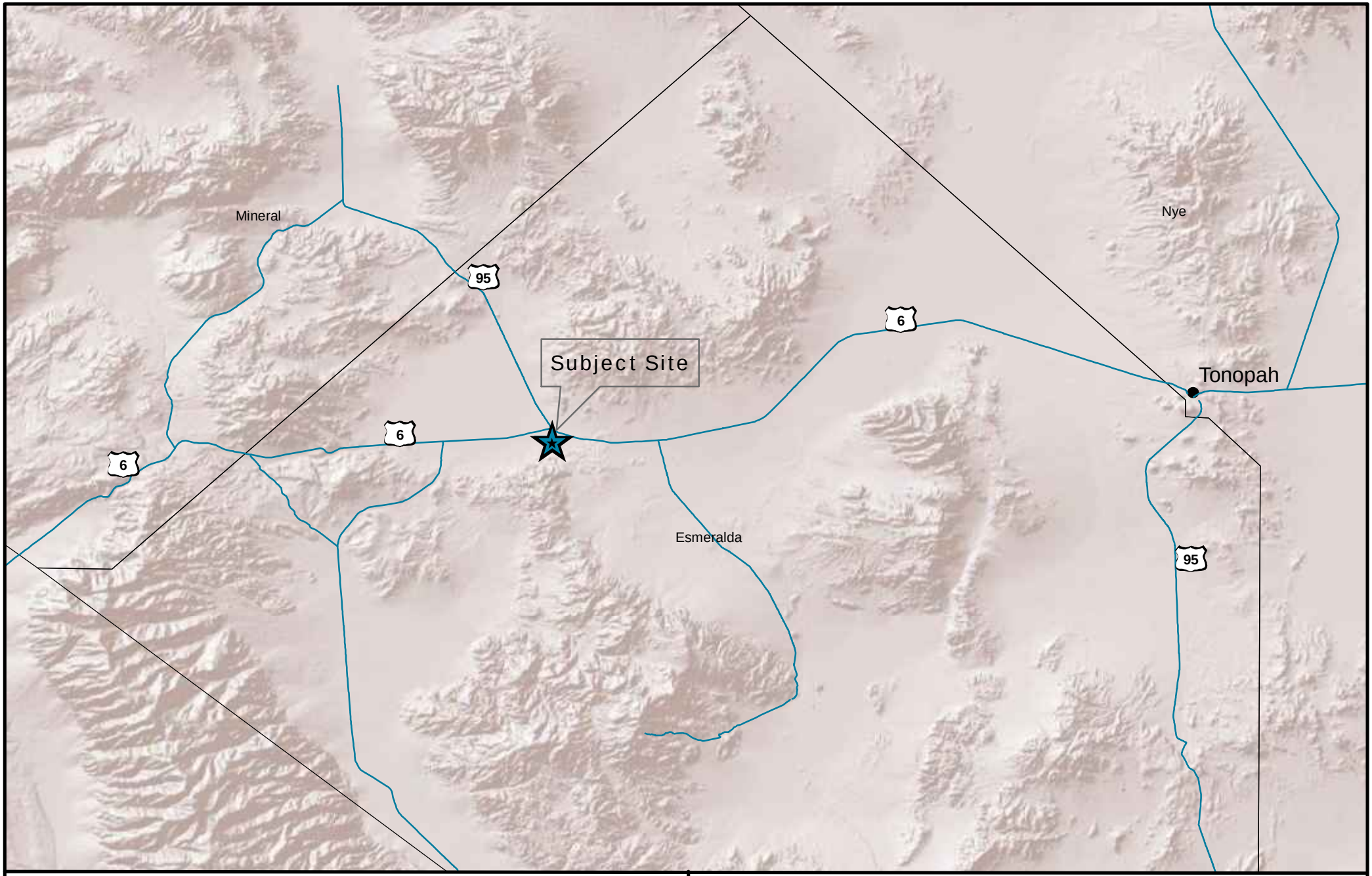


Figure 1 - Vicinity Map

Former Coaldale Junction Truck Stop
Coaldale Junction, Esmeralda County, Nevada

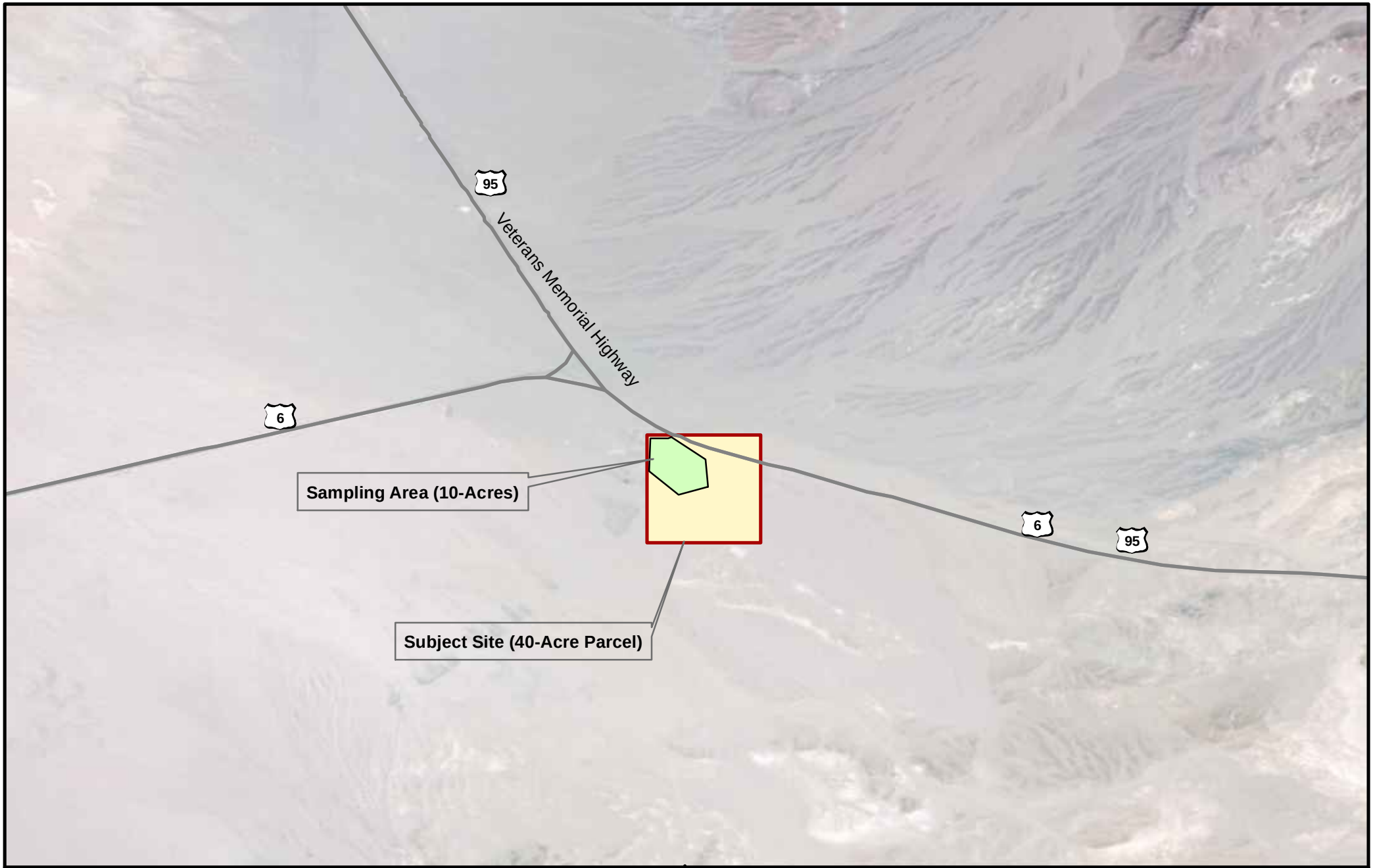


Figure 2 - Site Location Map

Former Coaldale Junction Truck Stop
Coaldale Junction, Esmeralda County, Nevada

0 0.25 0.5 0.75 1 Miles

N

bec environmental, inc.

1 inch = 0.5 miles

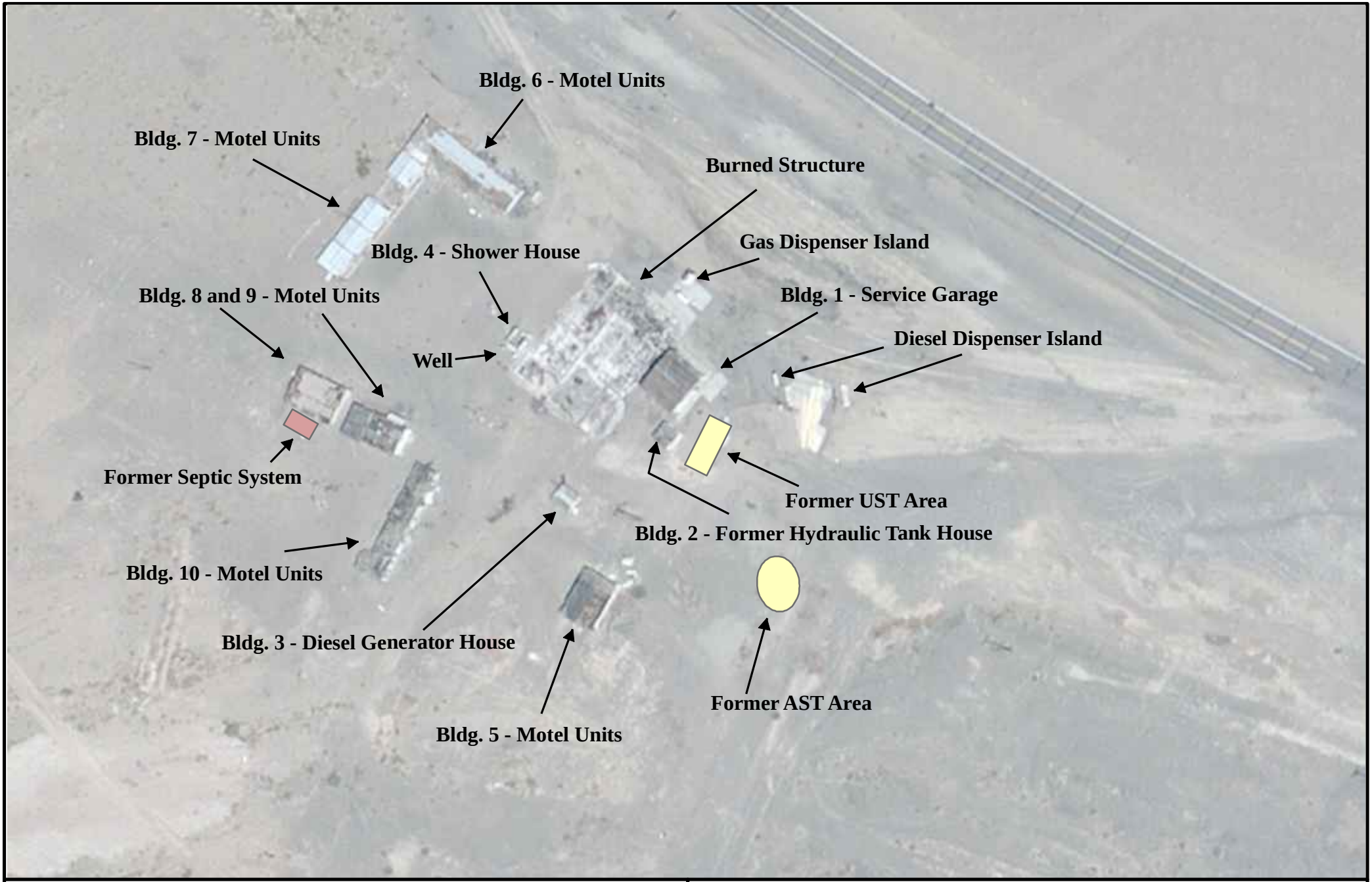


Figure 3 - Site Reconnaissance Map

Former Coaldale Junction Truck Stop
Coaldale Junction, Esmeralda County, Nevada

0 100 200 400 Feet

N

bec environmental, inc.

1 inch = 125 feet

Figure 4 - North Soil Boring & Sample Location Map
Former Coaldale Junction Truck Stop
Coaldale Junction, Esmeralda County, Nevada

0 125 250 500 Feet

N

bec environmental, inc.

1 inch = 150 feet

Figure 5 - South Soil Boring & Sample Location Map

Former Coaldale JunctionTruck Stop

Coaldale Junction, Esmeralda County, Nevada

0 87.5 175 350 Feet

N

bec environmental, inc.

1 inch = 100 feet

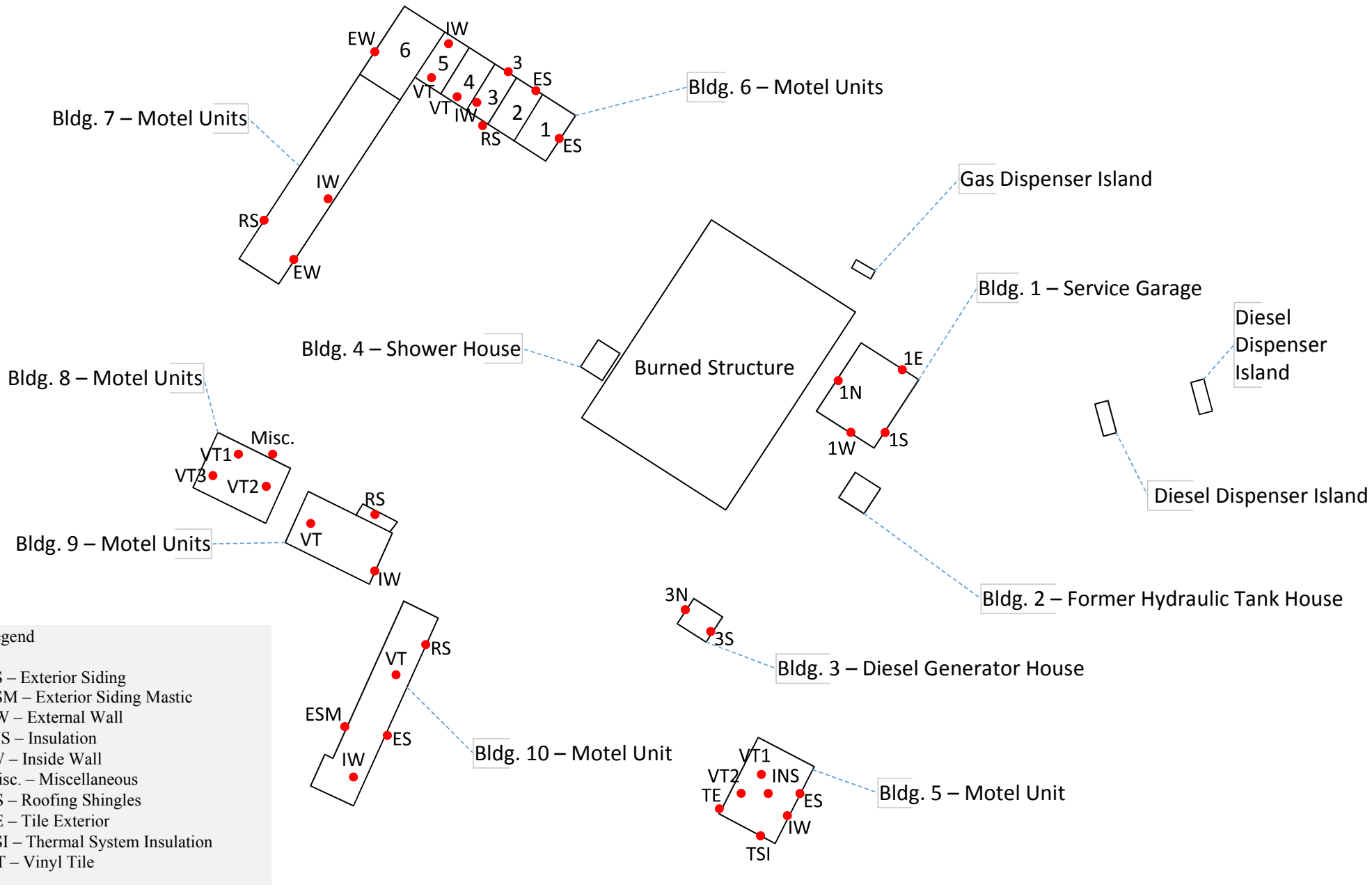


Figure 6 – Asbestos Sampling Location Map
Former Coaldale Junction Truck Stop
Coaldale Junction, Esmeralda County, Nevada

Not to Scale

bec environmental, inc.

N

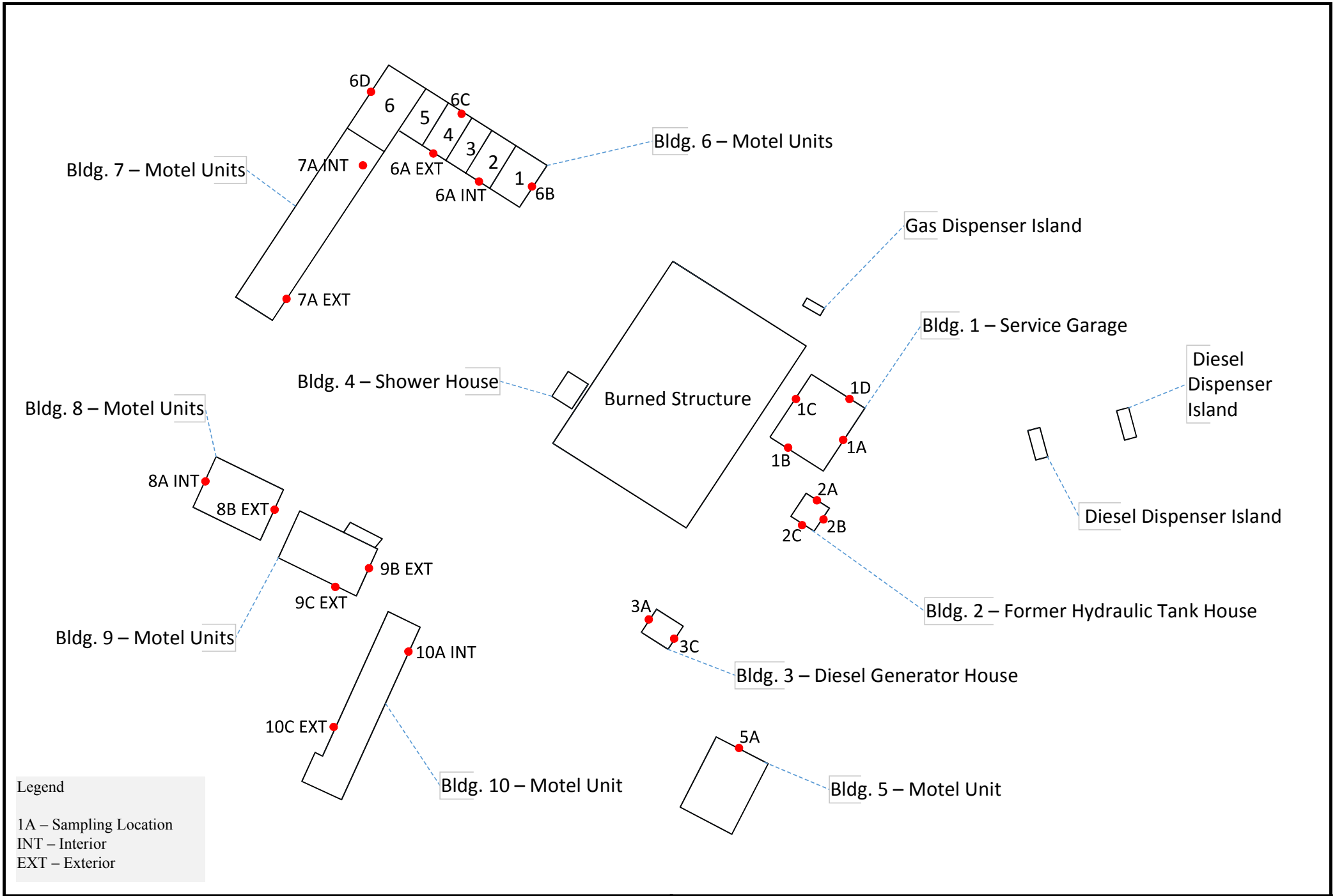


Figure 7 – Lead-Based Paint Sampling Location Map
Former Coaldale Junction Truck Stop
Coaldale Junction, Esmeralda County, Nevada

Not to Scale

bec environmental, inc.

N

Appendix B

Site Photographs

Photograph 1: Exterior view of Building 1, former Service Garage (looking north).

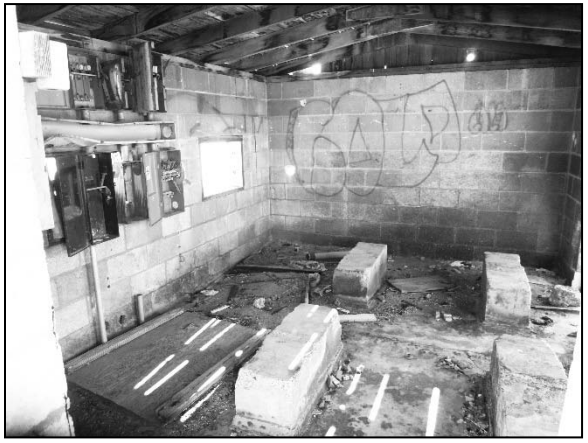
Photograph 2: Interior view of Building 1, former Service Garage (looking west).

Photograph 3: Hydraulic Lift in Building 1, Former Service Garage (looking east).

Photograph 4: Exterior view of Building 2, Former Hydraulic Tank House (looking southwest).

Photograph 5: Interior view of Building 2, Former Hydraulic Tank House (looking south).

Photograph 6: Exterior view of Building 3, Diesel Generator House (looking southwest).

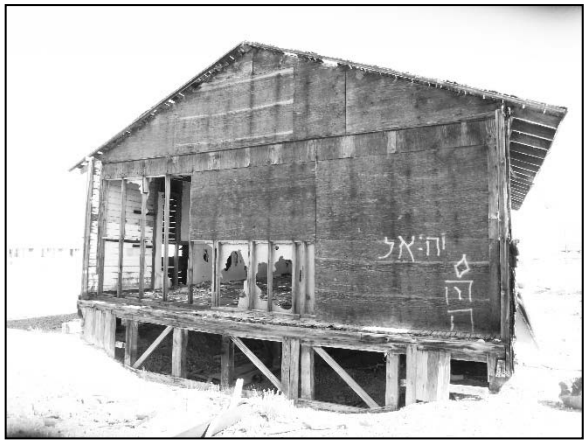


Photograph 7: Interior view of Building 3, Diesel Generator House (looking east).

Photograph 8: Exterior view of Building 4, Shower House (looking west)

Photograph 9: Interior view of Building 4, Shower House (looking southwest).

Photograph 10: Exterior view of Building 5, Motel Unit (looking southwest)



Photograph 11: Exterior view of Building 5, Motel Unit (looking north)

Photograph 12: Thermal system insulation below Building 5, Motel Unit (looking north).

Photograph 13: Exterior view of Building 6, Motel Units (looking north).

Photograph 14: Interior view of motel unit in Building 6, Motel Units (looking northeast).

Photograph 15: Exterior view of Building 7, Motel Units (looking west).

Photograph 16: Interior view of motel unit in Building 7, Motel Units (looking northwest).

Photograph 17: Suspected transite pipe on the along northwest exterior of Building 7, Motel Units.

Photograph 18: Exterior view of Building 8, Motel Units (looking southwest).

Photograph 19: Interior view of Building 8, Motel Units (looking southeast).

Photograph 20: Exterior of Building 9, Motel Units (looking southwest).

Photograph 21: Interior view of Building 9, Motel Units (looking north).

Photograph 22: Exterior view of Building 10, Motel Units (looking southwest).

Photograph 23: Interior view of motel unit in Building 10, Motel Units (looking southwest)

Photograph 24: View of Burned Structure (looking southwest).

Photograph 25: View of Gas Dispenser Island (looking southwest).

Photograph 26: View of the west Diesel Dispenser Island (looking west).

Photograph 27: Boring SB-1 (looking northwest).

Photograph 28: Boring SB-3 (looking north).

Photograph 29: Suspected former fuel pump and UST location adjacent to SB-3.

Photograph 30: Boring SB-5 (looking north).

Photograph 31: North Burn Pit BP1 (looking east).

Photograph 32: South Burn Pit BP2 (looking southeast).

Appendix C

EPA Sampling and Analysis Plan Approval Letter

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

March 14, 2013

MEMORANDUM

SUBJECT: Sampling and Analysis Plan, Phase II Subsurface Investigation & Asbestos/Lead-Based Paint Assessment, Coaldale Junction Truck Stop, SWC of US Highway 95 & US Highway 6, Coaldale, Nevada (EPA QA Office Document Control Number [DCN] BNFD0624SV2)

FROM: Gail E. Morison, Environmental Scientist
Quality Assurance Office, MTS-3

THROUGH: Eugenia McNaughton, Ph.D., Manager
Quality Assurance Office, MTS-3

TO: Noemi Emeric-Ford, Project Manager
Brownfields and Site Assessment, SFD-6-1

A Response to Comments (RTC) memorandum and revised Sampling and Analysis Plan (SA) for the Coaldale Junction Truck Stop in Coaldale, Nevada, prepared by BEC Environmental, Inc., and dated March 2013, have been reviewed. The reviews were based on information provided in the "Sampling and Analysis Plan Guidance and Template, Version 3, Brownfields Projects" (R9QA/008.1, September 2009) and a Quality Assurance (QA) Office memorandum dated February 11, 2013.

The plan is conditionally approved. The RTC has been attached for reference. Several additional comments were noted and should be addressed. If you have any questions or need any further information, please feel free to contact me at 415-972-3807.

Comments

1a. [Section 3.3.1, Precision and Accuracy] Under the heading "Soil & Groundwater," it is stated: "Accuracy and precision are determined through QC parameters such as surrogate recoveries, matrix spikes, QC check samples and blind field duplicates. A blind field duplicate sample will be analyzed as a QC sample for verification of precision and accuracy." Typically, surrogates and matrix spikes measure accuracy, while field duplicates (and matrix spike/ matrix spike duplicate pairs) measure precision. Discussing precision and accuracy together, as is done in Section 3.3.1, is confusing. For clarity, it is recommended that precision and accuracy be discussed separately.

1b. The discussion in Section 3.3.1 pertaining to data review and validation should be moved to Section 3.4.

For Your Consideration

1. [General] References to Tables 4-2 and 6-1 could not be found in the text.

Appendix D

Laboratory Documentation

Advanced Technology Laboratories, Inc.

Statement of Qualifications

3151 W. Post Road
Las Vegas, NV 89118
Phone: 702-307-2659 Fax: (702) 307-2691
www.atl-labs.com

Table of Contents

Overview

Advanced Technology Laboratories Inc. (ATL Inc) was established as a corporation in 2009 as a spin off environmental testing laboratory in Las Vegas, Nevada. ATL Inc has been accredited by NELAP, CA ELAP and NDEP since 2007. ATL Inc. offers a wide variety of chemical and physical analyses, including organics and inorganics in water, wastewater, soil and hazardous waste.

On December 2005, ATL Signal Hill opened a Service Center in Las Vegas to enhance service to Nevada customers. Since the opening of the Service Center, ATL's client base grew enough to warrant the establishment of a physical presence in Las Vegas and was then incorporated as a separate entity in June of 2009. *ATL Inc is a small disadvantaged woman owned business enterprise (WBE/UDBE/SBE).*

ATL is accredited to perform environmental analytical services by the following regulatory agencies:

- *State of California Department of Health Services (ELAP)*
- *State of Nevada Division of Environmental Protection (NDEP)*
- *National Environmental Laboratory Accreditation Program (NELAP)*

Other Certifications Relating to Business Structure and Ownership

- *Small Business Certification*
- *California CUCP Certificate (Underutilized Disadvantaged Woman Owned Business Enterprise)*
- *Nevada DOT Disadvantage Business Enterprise*
- *Soill Permit by the US Dept of Agriculture*

Copies of these certificates are included as part of the Appendices. ATL Inc is in the process of applying for DOD ELAP Certification.

ATL has developed a superior quality system to both fully comply with the specific requirements of the above agencies as well as ensure accurate and consistent results for each of our clients. Each staff member is fully committed to quality and client responsiveness.

ATL Inc. is a full-service environmental testing laboratory. Our business is providing analytical services to meet the needs of client's projects. ATL Inc has a team of experienced professionals to successfully achieve the client's goal. With state-of-the-art equipment, instrument redundancy and a computerized Laboratory Information Management System (LIMS), ATL Inc provides timely analytical results to its clients.

We maintain versatility in meeting client needs and are able to perform and develop specialized testing in compliance with routine and non-routine investigations. US Environmental Protection Agency (EPA) Methods, Standard Methods and SW846 Methods are utilized to perform analysis, and our strict quality assurance program validates analytical results.

Our Mission Statement is:

Advanced Technology Laboratories Inc. places its primary emphasis on customer satisfaction and promotion of exceptional quality analytical services, while keeping our environment and employees safe.

Environmental Testing Services

Advanced Technology Laboratories Inc. provides a full range of environmental testing services, with 24-hour to 7-day turnaround times. The following represent these services:

Water and Wastewater

- Inorganic Chemistry
- Organic Chemistry
- Wastewater Analysis
- Sampling/monitoring of water/wastewater

Hazardous Waste

- Hazardous material characterization
- Waste contamination

NPDES Priority Pollutants

- Chlorinated Hydrocarbons
- Oxygenates
- 1,4-Dioxane
- Alcohols
- Pesticides and PCBs
- Phenols
- Volatile Aromatics
- TOC

Underground Storage Tank Investigations

- Petroleum Hydrocarbons
- Metals
- Oxygenates
- Purgeable Aromatics

Electronic Deliverables

Advanced Technology Laboratories Inc. maintains a Laboratory Information Management System (LIMS) that is capable of acquiring direct instrumentation data and generating analytical reports. Electronic data deliverables (EDD) can be customized based on regulatory or client requirements, such as Geotracker EDF, COELT, Caltrans Storm Water EDD, AFCEE EPRIMS, Tetratech's specific client EDD and EQUIS EDF. Reports can be delivered in portable document format (PDF), MS Excel, ASCII or MS Access format.

Instrumentation

Analytical chemistry procedures employed by Advanced Technology Laboratories Inc. are in compliance with Standard Methods, EPA and SW846 methodologies using the following technologies:

- Gas Chromatography – FID,PID, ECD, NPD
- Gas Chromatography/Mass Spectroscopy (GC/MS)
- Atomic Absorption Spectroscopy – Cold Vapor
- Inductively Coupled Plasma Spectroscopy
- Inductively Coupled Plasma Spectroscopy/Mass Spectroscopy
- Ion Chromatography
- Wet Chemistry – UV/VIS, Ion-Specific Electrode
- Gravimetry

Our state-of-the-art facilities are equipped with redundant instrumentation that enables timely delivery of results to clients. Below is our equipment list:

Volatile Organics (Soil and Water) EPA Method 8260/624 VOC by GC MS, EPA Method 8015 Gasoline Range Organics by GC FID, and EPA Method 8021 BTEX plus MTBE by GC PID			
7	Gas Chromatograph	Hewlett Packard	6890 /5890
4	GC Mass Spectrometer	Hewlett Packard	5973 MSD Quadrupole
4	Purge & Trap Concentrator	Tekmar	LSC 3100
4	Purge & Trap Concentrator	Archon	5100
11	Data System	Agilent	Enviroquant
8	Computers	Dell	Dimension 3100
5	Printers	Hewlett Packard	
2	Analytical Balance	Mettler	

Semi-Volatile Organics (Soil and Water) EPA 8270/8270SIM/625 by GCMS			
2	Gas Chromatograph	Agilent	6890
2	GC Mass Spectrometer	Agilent	5973
2	Liquid Auto Sampler	Agilent	7673
2	Data System	Agilent	Enviroquant
2	Printer	Hewlett Packard	Laser Jet 4
1	Automated Solvent Extractor	Dionex	ASE 200
2	Hoods	Genie Scientific	4 ft/4 ft
1	Refrigerator	GE	

Semi-Volatile Organics (Soil and Water) EPA 8081/8082, EPA Method 8015 Diesel Range Organics and Motor Oil by GC FID			
2	Gas Chromatograph	Agilent	6890 ECD
2	Gas Chromatograph	Agilent	5890 Series II FID
4	Liquid Auto Sampler	Agilent	7673
2	Data System	Agilent	Enviroquant
2	Printer	Hewlett Packard	Laser Jet 4
1	Automated Solvent Extractor	Dionex	ASE 200
1	Hoods	Genie Scientific	10ft
1	Refrigerator	GE	

Metals (Soil and Water) EPA Method 6010/200.7 by Inductively Coupled Plasma – Atomic Emission Spectrometry (ICP-AES)			
2	Inductively Coupled Plasma	Perkin Elmer	Optima 4200 DV and 7300DV
2	Inductively Coupled Plasma Mass Spectrometer	Agilent/Perkin Elmer	7700x/ELAN DRC Plus
4	Auto Sampler	Perkin Elmer/CETAC	AS93plus/ASX 500
4	Chiller	Polyscience	
4	Computer	Dell/HP	Optiplex/Destop
3	Printer	Hewlett Packard	Laser Jet 4250/3100LJ

Mercury (Soil and Water) EPA Method 7470/7471A/245.1			
1	Mercury cold Vapor Analyzer	CETAC	M6000
1	Hood	Prescott	Custom
1	Auto Sampler		
1	Data System	CETAC	
1	Computer	Dell	GX100
1	Printer	Hewlett Packard	Laser Jet 4250

Inorganics (Soil and Water) EPA Method 300.0 by Ion Chromatography, EPA 218.6/7199 Hexavalent Chromium by Ion Chromatography, and Wet Chemistry methods such as Gravimetric and Titrimetric			
5	Ion Chromatograph	Dionex	ICS-1500, ICS-2000, ICS-5000, DX500
2	Ion Chromatograph	Dionex	DX-100
7	Autosampler	Dionex	AS 40
7	Data System	Dionex	Integrated with Instrument
1	TOC Analyzer	GE	Sievers 900
4	Computer	Dell	OptiplexGX1/GX270 /Dimension 2400
2	Analytical Balance	Sartorius	BA 100S
4	Printer	Hewlett Packard	Laser Jet 2300/4L

Classsical Wet Chemistry			
1	Analytica Balance	Sartorius	SP180
1	Convection Oven	Scientific Products	DK-3
1	pH Meter	VWR	Symphony
1	Turbidimeter	Le Motter	2008
1	Computer	Dell	Optiplex GX1
1	Printer	Hewlett Packard	Laser Jet 4
1	Conductivity Meter	VWR	
2	Hoods	Genie Scientific	
1	UV/VIS Spectrophotometer	Thermo	Helios Gamma
1	Distillation Aparratus for NH3/TKN	Buchi	332 Distillation Unit/342 Control Unit
1	Digestion block for TKN	Buchi	342
1	Digestion Vessel/Reaction/Vesselfor NH#/TKN	Buchi	342

Sample Preparation Chemistry			
2	Hot Block Digestor	Environmental Express	Optima 4200 DV
5	Fume Hoods	Genie/Custom	
3	Sonicators	Tekmar	Various
3	Hot Plate	Corning/Linberg/Thermolyne	
2	Top Loading Balance	Mettler	DB202
2	TCLP Rotator	Environmental Express	
2	Turbo Vap Concentrator	Zymark/Caliper	Turbo Vap II
12	ZHE Vessels		

Sample Control			
1	Top Loading Balance	Sartorius	B3103
1	Hood	Custom	Custom
10	Refrigerators	VWE/Walk In/Various	4deg Coolers
2	Printer/Copier/Fax	Konica/Brother	352C/7820N
2	Computer	Dell Work Stations	Optiplex
1	Barcode Printer	WASP 606	Z4000
2	Barcode Scanner	Metrologic	MS6720
100	Sample Coolers	Miscellaneous	Various Sizes

Document Contol/Client Services			
3	Computers	Dell Work Stations	Optiplex
2	Caopier/Scanner/Printer/Fax	Konica Minolta	601/550C
2	Printer	Hewlett Packard	Laser Jet 2300/4L

Laboratory Information Management System (LIMS)			
3	SQL-SVR/LIMS/MAll	Dell	Power Edge (LIMS Data)
14	Computers	Dell	Dimension/Optiplex /Vostro
1	LIMS Software	Khemia/Custom	

Health and Safety			
3	First Aid Kits	Lab Safety Products	Various
8	Fire Extinguishers	Underwriter Laboratories	
14	Half Face Masks	3M	With Organic Vapor Cartridges
2	Plumbed Portable Eyewash	Various	
1	Spill Containment Kit	Labconco	
1	Spill Kit	Labconco	

Field/Courier Services			
1	Field Truck	Ford	Escape
1	pH Meter	VWR	2000/3000 Series
2	Field/Utility Vehicle	Ford/Chevy	F150/Silverado

Document Contol/Client Services			
3	Computers	Dell Work Stations	Optiplex
3	Copier/Scanner/Printer/Fax	Konica Minolta	601/550C, 701
2	Printer	Hewlett Packard	Laser Jet 2300/4L

Key Personnel

Puri Romualdo
President

Puri Romualdo holds a B.S. in Chemical Engineering (Magna cum Laude). She has over 25 years of experience in all aspects of classical and instrumental analytical chemistry, as well as research and development experience in the environmental, oil field, pharmaceutical and detergent chemistry.

In addition to her being a skilled scientist, Ms. Romualdo is an accomplished businessperson, consistently achieving annual sales growth of 100%. She supervised the acquisition and assimilation of several laboratories including the acquisition of Jacobs Laboratories and Sterling Laboratories by CRL Environmental which was eventually acquired by Enseco. She was also responsible in spinning off Air Technology Laboratories in California and Advanced Technology Laboratories, Inc in Nevada which is now solely owned by Ms. Romualdo

Ms. Romualdo has managed client service and project management departments. The combination of her project management skills, technical knowledge and business experience ensures clients of a reliable source and advocate.

Jose Tenorio Jr.
Laboratory Director

Jose Tenorio Jr. holds a B.S. degree in Chemical Engineering. He has over 10 years experience in all aspects of classical and instrumental analytical chemistry, sampling, as well as research and development in an environmental laboratory setting. He is well versed with the operation and maintenance of Gas Chromatographs such as FIDs, PIDs, ECDs, NPDs, TCDs and Mass Spectrometers. He has expertise in the operation and maintenance of ICPs, ICP-MS, AAS-Flame, AAS-Furnace, FIMS, and other Hot-Vapor AAS techniques. He is experienced in Ion Chromatrography techniques such as anions, cations, perchlorate and hexavalent chromium including instrumentation and maintenance. He has extensive knowledge in the wet chemistry analyses, sample preparation techniques, sampling techniques and sample control.

His goals are to provide clients with data of known and documented quality and to take an active part in the partnership of the laboratory and its clients. Combining his expertise with key personnel of ATL Inc. Laboratory, you can rest assure that the ATL Inc can provide all its clients quality service regardless of the complexity of the project.

Key Personnel

Glen Gesmundo QA Manager	Glen Gesmundo has a M.S. in Agricultural Chemistry and a BS in Chemical Engineering. She is responsible for implementing and monitoring the laboratory's quality assurance program. She maintains laboratory certifications in various states and is the liaison with various agencies regarding certifications and regulatory compliance. She is an experienced analyst which makes her an excellent QA Manager. Her technical specialties include Level IV data validation, LIMS implementation and maintenance and EDD generation in different formats such as AFCEE/EPRIMS, EQUIS, Geotracker and client specific EDDs.
Marlon Cartin Sample Control/Project Coordinator	Marlon Cartin has a B.S. in Chemistry. He has over seven years of experience in an environmental laboratory as a bench chemist and presently working at ATL Inc as the sample control and project coordinator. He has successfully managed big projects such as coordinating a 75 samples a day project for 2 months with the
Quennie Manimtim Supervising Analyst	Quennie Manimtim has a B.S. in Chemistry and holds a M.S. degree in Agricultural Chemistry minor in Environmental Science. She has an extensive experience in both pharmaceutical and environmental laboratory testing. Her expertise includes the use of Gas Chromatography such as FIDs, PIDs, MSDs.. She is well trained in the operation and maintenance of Ion Chromatographs for Anions and Hexavalent Chromium. She also has extensive experience in inorganic analyses, organic preparations, metals digestion, sample preparations such as EPA 3060, TKN digestion. She now acts the supervising chemist for both organics and inorganics department.
Nancy Sibucao Analyst	Nancy Sibucao holds a B.S. in Chemical Engineering. She has trained with Perkin Elmer regarding the operation of the AAS, FIMS, ICP and ICP-MS instruments. She was the former supervisor for the inorganic department of ATL-Signal Hill. She also has experience in GC-FIDs. Currently, she does organic and inorganic analyses. She has extensive experience in the organic and inorganic chemistry, as well as her expertise in the organic extraction, metals digestion and other sample preparations.

Project Experience

Advanced Technology Laboratories has proven that it can handle high volume projects with rigorous QA/QC requirements as demonstrated by the following examples. The handling of high volume work is evidenced by the continuous flow of Caltrans work. ATL is also diversified in its experience, such as groundwater monitoring, landfill monitoring, underground storage tanks, and wet and organic chemistry.

Client Type:	Major Environmental Consulting & Engineering Firm
Project Name:	Phase II Investigations and Remediations
Contaminants:	RCRA 8, PCBs, DRO, Motor Oil, GRO, 8260 (VOC's and MTBE)
Matrix:	Soil and Groundwater
Dates Work Performed:	Ongoing
QA/QC Level:	NDEP Routine QA/QC

Pertinent Information:

Advanced Technology Laboratories provides service to a major consulting firm based in Las Vegas. ATL provides results on an expedited turn around time (same day TAT or 24 hr TAT).

Client Type:	Electrical Utility
Project Name:	Quarterly Monitoring
Contaminants:	Metals, Anions, GRO, DRO and Motor Oil, Inorganics
Matrix:	groundwater, pond samples
Dates Work Performed:	Ongoing
QA/QC Level:	NDEP Routine QA/QC, Level 4 Data Package

Pertinent Information:

Advanced Technology Laboratories has a contract with a major power generating facility in Las Vegas to perform quarterly monitoring analysis on about 60 groundwater monitoring wells and ponds. ATL is a high volume laboratory that can process large number of samples and meet scheduled turn around time. This is achieved by redundancy in equipment, latest state of the art equipment and dedicated and motivated professional staff. This project also requires Level IV raw data packages and client specific electronic deliverables. .

Client:	Major Consulting Firm
Project Name:	Various
Methods:	Anions, general chemistry, metals and volatile organics
Matrix:	Quarterly Groundwater Monitoring
Dates Work Performed:	Ongoing
QA/QC Level:	Level IV

Pertinent Information:

After an audit by the project scientist and project chemist ATL was selected based on capabilities and ability to produce volume and Level IV QA/QC. This is a high profile project with rigorous QA/QC requirements. The project involves more than 200 groundwater samples per quarter.

Client:	Major Consulting Firm
Project Name:	Utility Company
Methods:	8260, 8270 SIM, 6010 Metals, 8082, 8081, 8015GRO/ DRO
Matrix:	Soil
Dates Work Performed:	Ongoing
QA/QC Level:	Level IV

Pertinent Information:

Project started in 2008 with the laboratory receiving 40 – 70 samples on a daily basis with the above parameters with Level IV QA/QC to gather background information on site. ATL Inc has successfully completed the project that went into remediation in 2010 where the laboratory became the primary laboratory for two major consulting firms. Screening samples were done on a daily basis and confirmation samples based on the screening were also analyzed.

This exemplifies the ability of ATL Inc that it can handle large volume as well as Level IV data packages.

Appendix A: Target Analytes

Typical EPA 8260 Target Analytes *

1,1,1,2-Tetrachloroethane
1,1,1-Trichloroethane
1,1,2,2-Tetrachloroethane
1,1,2-Trichloroethane
1,1-Dichloroethane
1,1-Dichloroethene
1,1-Dichloropropene
1,2,3-Trichlorobenzene
1,2,3-Trichloropropane
1,2,4-Trichlorobenzene
1,2,4-Trimethylbenzene
1,2-Dibromo-3-chloropropane
1,2-Dibromoethane
1,2-Dichlorobenzene
1,2-Dichloroethane
1,2-Dichloropropane
1,3,5-Trimethylbenzene
1,3-Dichlorobenzene
1,3-Dichloropropane
1,4-Dichlorobenzene
2,2-Dichloropropane
2-Chlorotoluene
4-Chlorotoluene
4-Isopropyltoluene
Benzene
Bromobenzene
Bromodichloromethane
Bromoform
Bromomethane
Carbon tetrachloride
Chlorobenzene
Chloroethane
Chloroform
Chloromethane
cis-1,2-Dichloroethene
cis-1,3-Dichloropropene
Dibromochloromethane
Dibromomethane
Dichlorodifluoromethane
Ethylbenzene
Hexachlorobutadiene
Isopropylbenzene
m,p-Xylene
Methylene chloride
n-Butylbenzene
n-Propylbenzene
Naphthalene
o-Xylene
sec-Butylbenzene
Styrene
tert-Butylbenzene
Tetrachloroethene
Toluene
trans-1,2-Dichloroethene
Trichloroethene
Trichlorofluoromethane
Vinyl chloride

Oxygenates

Di-isopropyl ether (DIPE)
Ethyl tert-butyl ether (ETBE)
Methyl tert-butyl ether (MTBE)
Tert-amyl methyl ether (TAME)
Tert-butanol (TBA)

* Special compounds may be analyzed upon request

Typical EPA 8270 Target Analytes *

1,2,4-Trichlorobenzene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2,4-Dichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2,4-Dinitrotoluene
2,6-Dinitrotoluene
2-Chloronaphthalene
2-Chlorophenol
2-Methylnaphthalene
2-Methylphenol
2-Nitroaniline
2-Nitrophenol
3,3´-Dichlorobenzidine
3-Nitroaniline
4,6-Dinitro-2-methylphenol
4-Bromophenyl-phenylether
4-Chloro-3-methylphenol
4-Chloroaniline
4-Chlorophenyl-phenylether
4-Methylphenol
4-Nitroaniline
4-Nitrophenol
Acenaphthene
Acenaphthylene
Anthracene
Benzidine (M)
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(g,h,i)perylene
Benzo(k)fluoranthene
Benzoic acid
Benzyl alcohol
Bis(2-chloroethoxy)methane
Bis(2-chloroethyl)ether
Bis(2-chloroisopropyl)ether
Bis(2-ethylhexyl)phthalate
Butylbenzylphthalate
Chrysene
Di-n-butylphthalate
Di-n-octylphthalate
Dibenz(a,h)anthracene
Dibenzofuran
Diethylphthalate
Dimethylphthalate
Fluoranthene
Fluorene
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane
Indeno(1,2,3-cd)pyrene
Isophorone
N-Nitrosodi-n-propylamine
N-Nitrosodiphenylamine
Naphthalene
Nitrobenzene
Pentachlorophenol
Phenanthrene
Phenol
Pyrene

* Special compounds may be analyzed upon request

RCRA 8

EPA 6010 Analytes

Arsenic
Barium
Cadmium
Chromium
Lead
Selenium
Silver

EPA 7470/7471 Analyte

Mercury

* Special compounds may be analyzed upon request.

Most Common Inorganics Analyses

Biochemical Oxygen Demand
Chemical Oxygen Demand
Nitrogen, Ammonia
Oil & Grease
Perchlorate
pH
Solids, Total Dissolved
Solids, Total Suspended
Specific Conductance
MBAS, Surfactants
Total Organic Carbon (TOC)
Total Organic Halogens (TOX)
Turbidity

Typical EPA 300 Target Anions

Chloride
Fluoride
Nitrate
Nitrite
Orthophosphate
Sulfate

Typical EPA 8081/8082 Target Analytes *

4,4´-DDD
4,4´-DDE
4,4´-DDT
Aldrin
alpha-BHC
alpha-Chlordane
beta-BHC
Chlordane
delta-BHC
Dieldrin
Endosulfan I
Endosulfan II
Endosulfan sulfate
Endrin
Endrin aldehyde
Endrin ketone
gamma-BHC
gamma-Chlordane
Heptachlor
Heptachlor epoxide
Methoxychlor
Toxaphene

Aroclor 1016
Aroclor 1221
Aroclor 1232
Aroclor 1242
Aroclor 1248
Aroclor 1254
Aroclor 1260

* Special compounds may be analyzed upon request

Appendix B: Sampling Quick Reference

Volatile Organics in Water

Parameter	Method	Holding Time	Min. Vol. (mL)	Container Type	Preservation
GRO	8015B	14 days*	40	3 x 40 mL vials with Teflon lined septum caps	HCL, pH < 2, add 1000 mg ascorbic acid/L if residual chlorine present, 4 °C
TPH(g)/BTEX/MTBE	8015B (GRO), 8021B (BTEX/MTBE)	14 days*	40	3 x 40 mL vials with Teflon lined septum caps	HCL, pH < 2, add 1000 mg ascorbic acid/L if residual chlorine present, 4 °C
Purgeable Halocarbons/ Aromatics	8260B (8021B list)	14 days*	40	3 x 40 mL vials with Teflon lined septum caps	HCL, pH < 2, add 1000 mg ascorbic acid/L if residual chlorine present, 4 °C
VOCs (Volatile Organic Compounds)	8260B/624	14 days*	40	3 x 40 mL vials with Teflon lined septum caps	HCL, pH < 2, add 1000 mg ascorbic acid/L if residual chlorine present, 4 °C

Note: * 7 days without HCl

Volatile Organics in Soil

Parameter	Method	Holding Time	Min. Vol. (g)	Container Type	Preservation
GRO	8015B	14 days	5	4 oz glass jar w/Teflon lid	4°C
GRO(EnCore)	5035/8015B	48 hours	(3) 5g/sample	(3) 5g EnCORE sampler	4°C
GRO (NaHSO4 preserved)	5035/8015B	14 days	(3) 5g/sample	2 pre-weighed NaHSO4 preserved VOA + 1 pre-weighed MeOH preserved VOA	4°C, NaHSO4, MeOH
Purgeable Halocarbons/Aromatics	8260(8021B list)	14 days	5	4 oz glass jar w/Teflon lid	4°C
GRO/BTEX/MTBE	8015B/8021B	14 days	5	4 oz glass jar w/Teflon lid	4°C
TPH(g) (EnCORE)	5035/8015B (M)	48 hours	(3) 5g/sample	(3) 5g EnCORE sampler	4°C
TPH(g) (NaHSO4 & MeOH preserved)	5035/8015B (M)	14 days	(3) 5g/sample	2 pre-weighed NaHSO4 preserved VOA + 1 pre-weighed MeOH preserved VOA	4°C, NaHSO4, MeOH
VOCs	8260B	14 days	5	4 oz glass jar w/Teflon lid	4°C
VOCs (EnCORE)	5035/8260B	48 hours	(3) 5g/sample	(3) 5g EnCORE sampler	4°C
VOCs (NaHSO4 & MeOH preserved)	5035/8260B	14 days	(3) 5g/sample	2 pre-weighed NaHSO4 preserved VOA + 1 pre-weighed MeOH preserved VOA	4°C, NaHSO4, MeOH

Semivolatile Organics in Water

Parameter	Method	Holding Time	Min. Vol. (mL)	Container Type	Preservation
DRO	8015B	7*	1000	1 L amber glass	4 °C**
Pesticides, Organochlorine	8081A/608	7*	1000	1 L amber glass	4 °C**
PCBs	8082/608	7*	1000	1 L amber glass	4 °C**
SVOCs (BNAs)	625/8270C	7*	1000	1 L amber glass	4 °C**
1,4-Dioxane	8270C Isotope Dilution	7*	1000	1 L amber glass	4 °C**
TPH (d)	8015B (M)	7*	1000	1 L amber glass	4 °C**
TPH-CC (C8-C40)	8015B (M)	7*	1000	1 L amber glass	4 °C**

Note: * 7 days for extraction, 40 days after extraction for analysis. ** If sampling from location where residual chlorine is present, samples have to be treated with sodium thiosulfate ($Na_2S_2O_3$)

Semivolatile Organics in Soil

Parameter	Method	Holding Time	Min. Vol. (g)	Container Type	Preservation
DRO	EPA 8015B	14*	30	4 oz glass jar w/Teflon lid	4°C
PCBs	EPA 8082	14*	30	4 oz glass jar w/Teflon lid	4°C
Pesticides, Organochlorine	EPA 8081A	14*	30	4 oz glass jar w/Teflon lid	4°C
SVOCs (BNAs)	EPA 8270C	14*	30	4 oz glass jar w/Teflon lid	4°C
TPH(d)	EPA 8015B(M)	14*	15	4 oz glass jar w/Teflon lid	4°C
TPH-CC (C8-C40)	EPA 8015B(M)	14*	15	4 oz glass jar w/Teflon lid	4°C

Note: * 14 days for extraction, 40 days for analysis

General Chemistry Water

Parameter	Method	Holding Time	Minimum Volume (mL)	Sample Volume & Container Type	Preservation
Acidity	SM 2310B	14 days	100	125 mL, 4oz plastic or glass	Cool, 4 °C
Alkalinity	SM 2320B	14 days	100	125 mL, 4oz plastic or glass	Cool, 4 °C
Ammonia	SM 4500-NH3C	28 days	100	500 mL, plastic or glass	Cool, 4 °C, H2SO4 to pH < 2
Biochemical Oxygen Demand	SM5210B	48 hours	300	1 L, plastic or glass	Cool, 4 °C
Bromide	300.0	28 days	50	125 mL, 4oz plastic	Cool, 4 °C
cBOD	SM5210B	48 hours	300	1 L, 32oz plastic	Cool, 4 °C
Chemical Oxygen Demand	410.4	28 days	50	125 mL, 4oz plastic	Cool, 4 °C, H2SO4 to pH < 2
Chloride	SM 4500-Cl- C, 300.0	28 days	50	125 mL, 4oz plastic	Cool, 4 °C
Chlorine, Free	SM4500CLG	15 mins	100	500 mL, plastic or glass	Cool, 4 °C

Parameter	Method	Holding Time	Minimum Volume (mL)	Sample Volume & Container Type	Preservation
Chlorine, Total Residual	SM4500CLG	15 mins	100	500 mL, plastic or glass	Cool, 4 °C
Color	110.2	48 hours	100	250 mL, 8oz plastic or glass	Cool, 4 °C
Cyanide, Amenable	SM 4500-CN G	14	250	250 mL, 8oz plastic	Cool, 4 °C; if oxidizing agents present add 0.6 g of ascorbic acid per L; adjust pH > 12 with 10N NaOH.
Cyanide, Total	SM 4500-CN G 9014	14 days	250	250 mL, 8oz plastic	Cool, 4 °C; if oxidizing agents present add 0.6 g of ascorbic acid per L; adjust pH > 12 with 10N NaOH.
Flashpoint	1010	14 days	100	250 mL, 8oz plastic	None
Fluoride	SM 4500-F C, 300.0	28 days	50	250 mL, 8oz plastic	None
Hardness	SM2340 C SM2340B	6 months	100	125 mL, 4oz plastic or glass	HNO_3 , pH < 2
Nitrate	300.0, SM 4500-NO3 E	48 Hours	50	125 mL, 4oz plastic or glass	Cool, 4 °C
Nitrate-Nitrite	SM 4500-NO3 E	28 days	50	125 mL, 4oz plastic or glass	Cool, 4 °C, H2SO4 to pH < 2
Nitrite	300.0; SM 4500-NO2 B	48 hours	50	125 mL, 4oz plastic or glass	Cool, 4 °C
Oil and Grease - HEM	1664	28 days	1000	32oz, glass	Cool, 4 °C, H2SO4 to pH < 2
Oxygen, Dissolved	360.1, SM4500-O G	15 mins	50	250 mL, glass or BOD bottle	None
Perchlorate	314.0	28	50	125 ml HDPE	Sterile Filtered, 4°C,
pH	SM 4500-H+ B	15 mins	50	125 mL, 4oz plastic or glass	None required
Phenolics	420.1	28 days	100	500 mL amber	Cool, 4 °C, H2SO4 to pH < 2
Phosphate,Ortho	300.0; 365.3; SM 4500-P E	48 hours	50	125 mL, 4oz plastic	Cool, 4 °C
Phosphorus, Total	365.3; SM4500-PE	28 days	100	125 mL, 4oz plastic	Cool, 4 °C, H2SO4 to pH < 2
Solids, Total (TS)	SM 2540 B	7 days	200	250 mL, 8oz plastic	Cool, 4 °C
Solids, Total Dissolved (TDS)	SM 2540 C	7 days	200	250 mL, 8oz plastic	Cool, 4 °C
Solids, Total Suspended (TSS)	SM 2540 D	7 days	200	250 mL, 8oz plastic	Cool, 4 °C
Solids, Settleable (SS)	SM 2540 F	48 hours	1000	1 L , 32oz plastic	Cool, 4 °C
Solids, Volatile (VS)	160.4	7 days	200	250 mL, 8oz plastic	Cool, 4 °C
Specific Conductance	120.1	48 hours	50	125 mL, 4oz plastic or glass	Cool, 4 °C
Sulfate	300.0	28 days	50	125 mL, 4oz plastic or glass	Cool, 4 °C
Sulfide, Dissolved	SM 4500-S-2 D	7 days	100	125 mL, Plastic	NaOH + AlCl3, flocculate + settle. Transfer liquid, preserve w/ zinc acetate, pH > 9. Cool, 4 °C
Sulfide, Total	SM 4500-S-2 D	7 days	100	500 mL, Plastic or Glass	Cool, 4 °C, add zinc acetate, pH > 9
Surfactants (MBAS)	SM 5540 C	48 hours	200	250 mL,	Cool, 4 °C

				8oz plastic	
Parameter	**Method**	**Holding Time**	**Minimum Volume (mL)**	**Sample Volume & Container Type**	**Preservation**
Total Organic Carbon (TOC)	SM 5310B	28 days	40	40 mL VOA	Cool, 4 °C, H2SO4 to pH < 2
Total Organic Halides (TOX)	9020	14 days	200	500 mL, amber glass	Cool, 4 °C, H2SO4 to pH < 2
TRPH	1664	28 days	1000	1 L, glass	Cool, 4 °C, H2SO4 to pH < 2
Turbidity	180.1	48 Hours	50	125 mL, plastic or glass	Cool, 4 °C

General Chemistry Soil

Parameter	Method	Holding Time	Minimum Volume (g)	Sample Volume & Container Type	Preservation
Alkalinity	310.1(M)	14 days	20	4 oz glass jar w/Teflon lid	4°C
Bromide	300.0(M)	28 days	10	4 oz glass jar w/Teflon lid	4°C
Chemical Oxygen Demand (COD)	410.4(M)	28 days	10	4 oz glass jar w/Teflon lid	4°C
Chloride	300.0(M)	28 days	10	4 oz glass jar w/Teflon lid	4°C
Chromium IV (Hexavalent Chromium)	7196A	21 days	10	4 oz glass jar w/Teflon lid	4°C
Cyanide, Amenable	9010B/9014	14 days	20	4 oz glass jar w/Teflon lid	4°C
Cyanide, Reactive	SW 846 Ch.7	14 days	10	4 oz glass jar w/Teflon lid	4°C
Cyanide, Total	9010B/9014	14 days	10	4 oz glass jar w/Teflon lid	4°C
Ignitability (Flashpoint)	1010	14 days	20	4 oz glass jar w/Teflon lid	4°C
Moisture Content	ASTM D2216	ASAP	10	4 oz glass jar w/Teflon lid	4°C
Nitrogen, Nitrate	300.0(M)	48 hours	10	4 oz glass jar w/Teflon lid	4°C
Nitrogen, Nitrite	300.0(M)	48 hours	10	4 oz glass jar w/Teflon lid	4°C
Oil and Grease (HEM)	1664(M)	28 days	30	4 oz glass jar w/Teflon lid	4°C
Perchlorate	314.0 (M)	28	50	125 ml HDPE	4°C
pH	9045C / 9040B	ASAP	10	4 oz glass jar w/Teflon lid	4°C
Phenolics, Total	420.1 (M)	28 days	20	4 oz glass jar w/Teflon lid	4°C
Phosphate, Ortho	300.0(M)	48 hours	10	4 oz glass jar w/Teflon lid	4°C
Phosphate, Total	365.3(M)	28 days	20	4 oz glass jar w/Teflon lid	4°C
Phosphorus, Total	365.3(M)	28 days	20	4 oz glass jar w/Teflon lid	4°C
Sulfate	300.0(M)	28 days	20	4 oz glass jar w/Teflon lid	4°C
Sulfide, Reactive	SW 846 Ch.7	7 days	20	4 oz glass jar w/Teflon lid	4°C
Sulfide, Total	9030B/EPA 376.2(M)	7 days	20	4 oz glass jar w/Teflon lid	4°C
Total Organic Carbon (TOC)	9060	28 days	2	4 oz glass jar w/Teflon lid	4°C
TRPH	1664SGT/ HEM (M)	28 days	30	4 oz glass jar w/Teflon lid	4°C

Note: (M) indicates modification of the method

Metals in Water

Parameter	Method	Holding Time	Minimum Volume (mL)	Sample Volume & Container Type	Preservation
Mercury	7470A/245.1	28 days	50	Minimum 250mL or 16oz plastic	HNO3, pH < 2
ICP Metals, except Chromium VI & Mercury	6010B,200.7	6 months	50	250 mL, 16oz plastic	HNO3, pH < 2
ICPMS Metals	6020/200.8	6 months	50	250 mL, 16oz plastic	HNO3, pH < 2
Sodium	7770/SM 3111B	6 months	50	250 mL, 16oz plastic	HNO3, pH < 2
Potassium	7610/ SM 3111B	6 months	50	250 mL, 16oz plastic	HNO3, pH < 2
Hexavalent Chromium	7196A , 218.6/ 7199	24 hours	50	250 mL, 8oz plastic	Cool, 4 °C
Hexavalent Chromium	218.6	28 days	50	250 mL, 8oz plastic	Cool to 4°C, field filtered and adjusted to pH 9.0-9.5 with ammonium buffer solution

Note: Dissolved Metals must be filtered prior to preservation.

Metals in Soil

Parameter	Method	Holding Time	Minimum Volume (g)	Sample Volume & Container Type	Preservation
Mercury	EPA 7471A	28 days	5	4 oz glass jar w/Teflon lid	4°C
ICP Metals	EPA 6010B	6 months	5	4 oz glass jar w/Teflon lid	4°C
ICP/MS Metals	EPA 6020	6 months	5	4 oz glass jar w/Teflon lid	4°C
Sodium	EPA 7770	6 months	5	4 oz glass jar w/Teflon lid	4°C
Pottasium	EPA 7610	6 months	5	4 oz glass jar w/Teflon lid	4°C
Mercury	EPA 7471A	28 days	5	4 oz glass jar w/Teflon lid	4°C

TCLP

A. Parameter	From: Field Collection To: TCLP Extraction	From: TCLP Extraction To: Preparative Extraction	From: Preparative Extraction To: Determinative Analysis	Sample Volume & Container Type	Total Elapsed Time	Preservation
Volatiles	14 days	NA	14 days	40mL VOA	28 days	None
Semivolatiles	14 days	7 days	40 days	32oz amber	61 days	None
Mercury	28 days	NA	28 days	16oz plastic	56 days	HNO3, pH < 2
Metals, except Mercury	180 days	NA	180 days	16oz plastic	360 days	HNO3, pH < 2

ADVANCED TECHNOLOGY LABORATORIES, INC.

QUALITY ASSURANCE MANUAL
Revision 6.0

3151-3153 W. Post Road
Las Vegas, NV 89118
PHONE: (702) 307-3248
FAX: (702) 307-2691

Effective Date: September 16, 2013

Quality Assurance Manual
APPROVAL SIGNATURES

Date: 09/16/13

Puri Romualdo
President

Date: 9/16/13

Jose Tenorio Jr.
Laboratory Director

Date: 9/16/13

Glen Gesmundo
QA Officer

SECTION 2.0 TABLE OF CONTENTS

LIST OF REFERENCED LABORATORY SOPs

SOP No.	Title
GE-JOBS-01	ATL-LV Job Description
GE-DCONTROL-02	SOPs, Logbooks Generation, Maintenance and Storage
GE-PROCUREMENT-01	Procurement of Supplies, Material, and Services
GE-AUDITS-01	External Audits and Internal Audits
GE-CLIENTS-01	Client Complaints
GE-NONCONFORM-01	Non Conformance and Corrective Action
GE-TRAININGPROGRAM-01	Employee Training Program
GE-ETHICS-01	Ethics and Data Integrity
GE-SOP-01	Standard Operating Procedures (SOPs)
GE-MDLS-01	Method Detection Limits and Instrument Detection Limits
GE-UNCERTAINTY-01	Procedures for Estimating Uncertainty
GE-MINTEGRATION-01	Manual Integrations
GE-BALANCES-01	Calibration of Analytical Balances and Top-loading Balances
GE-THERMOMETER-01	Thermometers
GE-ICODE-01	Inorganic Standard Codes
GE-STDCODE-01	Organic Standard Codes
GE-SUBSAMP-01	Subsampling
GE-LOGIN-01	Sample Receipt, Control and Login
GE-DISPOSAL-01	Sample Disposal
GE-PT-01	Proficiency Testing Program
GE-CCHARTS-01	Control Charts and Control Limits

LIST OF TABLES

LIST OF APPENDICES

SECTION 3.0 INTRODUCTION, SCOPE AND APPLICABILITY

3.1 Introduction

ADVANCED TECHNOLOGY LABORATORIES, INC. (ATLInc) is a full service analytical laboratory, which provides technical and laboratory support for commercial and regulatory agencies. Clientele include consulting, engineering firms, city/local, various state agencies, and others clients requiring analytical services.

It is the purpose of this document to describe ATLInc's program to assure that analytical data generated by ATLInc are of known and documented quality. The policies and procedures in this document have been developed to meet US Department of Defense, Quality Systems Manual for Environmental Laboratories Version 4.2, dated 2010, The NELAC Institute (TNI) Standard, dated 2009 Volume 1 Modules 2 and 4 and/or California Environmental Laboratory Accreditation Program (ELAP) requirements as well as project specific requirements. This manual is in compliance with various laboratory accreditations and certifications listed in Appendix L.

3.1.1 Company Vision

ATLInc's Vision is to grow through client directed partnering and the acquisition or placement of strategically located Laboratories and Service Centers worldwide.

3.1.2 Mission Statement

ATLInc's Mission is *Customer Satisfaction,* which is achieved by providing the best possible laboratory services in a timely manner with emphasis on Quality, Cost Effective results, Safety and a regard for the environment.

3.1.3 Company Goals

ATLInc management and its employees are doing every effort to achieve the following company goals:

- Excellence
- Continuous Accessibility for clients
- Mutually beneficial cost effective pricing for Client and ATLInc
- Unexcelled attention to details
- Highly-trained staff
- Technical sophistication of employees and equipment
- Diverse Technical Services
- Training and education for ambitious, self-motivated and co-operative individuals
- Clean and safe working environment
- Staff and equipment redundancy

3.2 Terms and Definitions

A Quality Assurance Program is a planned system of activities designed to ensure that analytical data generated by the laboratory are of known and documented quality.

Refer to Appendix A for the Glossary/Acronyms

3.3 Scope

The laboratory analyzes environmental and industrial samples which vary from wastewater, drinking water, groundwater, soil, sediments and air matrices. The Quality Assurance Manual contains the specific procedures and methods to conduct analyses of these samples. It also contains guidelines for documenting the analytical processes from the start of a project until the results are delivered to clients. These processes includes reviewing of requests & contracts, servicing clients, sample receiving, tracking of samples received in the laboratory, analyzing samples, reviewing and reporting results.

This document aims to define the minimum level of quality assurance and quality control necessary to meet the requirements of US DoD, NELAC and/or ELAP.

3.4 Management of the QA Manual

This Quality Assurance Manual is reviewed annually to assure that it remains current and in compliance with applicable regulations and client specifications. The Quality Assurance Officer is responsible for the review and the revision if necessary. The QA Officer can make changes in the normal course of business and all changes are integrated into the revised manual. All updates and changes are done following Document Control (see Section 6.0).

SECTION 4.0 ORGANIZATION

Appendix B shows the organizational structure of the analytical services within Advanced Technology Laboratories, Inc. and a table of Key Personnel along with their assignments, responsibilities, education, and years of applicable experience.

Deputies and/or designees are appointed by the management in the absence of the key personnel in the laboratory.

4.1 Roles and Responsibilities

Quality system is the responsibility of every employee of the laboratory. All employees have access to this manual, are trained to this manual, and conduct their everyday tasks in accordance with the procedures in this manual and laboratory's SOPs.

Specific roles and responsibilities of ATLInc's management and staff related to production of quality data are presented in ATL SOP GE-JOBS-01, ATL-LV Job Description and are summarized as follows:

4.1.1 President

The President has the overall responsibility for the general operations of ATLInc, including but not limited to Administration, Business Office, Regulatory Affairs, and Technical Operations.

The President is responsible for:

- Supervising and administrating the quality assurance program
- Ensuring that all general and client-specific quality assurance requirements are strictly followed.
- Resolving the approval/rejection of deliverable client sample data package and/or reports.

4.1.2 Laboratory Director

The Laboratory Director is directly involved in the day-to-day operation such as scheduling, staff training, QAPP implementation, and technical peer reviews. The Laboratory Director directly reports to the President.

Specific responsibilities include, but are not limited to:

- Researches, analyzes and modifies, as needed, test methods and procedures. Reviews and approves new and revised Standard Operating Procedures (SOPs) and other laboratory documents. Complies with and implement current SOPs, Good Laboratory Practices (GLPs), Chemical Hygiene and Health & Safety requirements.

- Reviewing and approving, together with the QA Officer, project proposals from marketing including project's QAPP, in accordance with the established procedure for the review of new contracts. This is to ensure identification of capabilities and limitations of the laboratory. Discrepancies are resolved before the contract is signed and project is initiated.

- He/She reviews schedules of laboratory workloads to ensure timely completion of projects.

- Overseeing and supports staff training to assure that documentation is complete and accurate and that new employees are properly trained.

- Monitoring validity of analyses performed and data generated in the laboratory. Reviews analytical results to assure data quality & defensibility. Also reviews critical technical data and investigations.

- Recommending process improvements and corrective actions.

- Enforcing current Company policies and procedures, QA/QC procedures including safety rules and regulations from ELAP, NELAP, Nevada and all pertinent accreditation and regulatory requirements within the laboratory.

- Ensuring that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory. Oversees, participates and approves the interviewing, recommends hiring, of departmental employees.

- Creating, planning and implementing goals, objectives and practices for effective, efficient and cost effective management of allocated resources.

- Maintaining an environment that emphasizes an intelligent and responsible approach to producing high data quality and accuracy based on the SOPs carried out.

- Coordinates audit responses with the QA Officer.

- Performing annual management review together with the QA Officer to evaluate suitability and effectiveness of quality system and make necessary changes or improvements

4.1.3 Quality Assurance Officer (QA Officer)

The QA Officer reports directly to the President and is responsible for all matters on laboratory quality assurance.

Specific roles include but not limited to:

- Serves as the focal point for QA/QC in the laboratory
- Having functions independent from the laboratory operations for which he/she has quality assurance oversight.
- Having documented training and/or experience in QA/QC procedures and be knowledgeable in the quality system.
- Responsible for implementation and monitoring of the laboratory quality assurance program. Training and advising all laboratory staff on QA/QC procedures to their daily tasks. Provides training to employees on ethics and data integrity.
- Ensuring that all data generated is scientifically sound, legally defensible, and of known precision and accuracy.
- Developing and implementing new QA procedures within ATLInc to improve data quality.
- Conducting internal audits and inspections of all departments on a periodic basis at least annually; reporting the results of the audits to the Laboratory Director, and Department Supervisors/Group Leaders; and implementation of corrective actions to ensure compliance with the QA plan.
- Monitoring and evaluating laboratory certifications; scheduling proficiency testing samples.
- Coordinating the analysis of performance evaluation (PE) samples for all analytical departments on a periodic basis.
- Evaluating the results; reporting the results to the President, Laboratory Director, and appropriate Supervisors; and applying corrective actions as needed.
- Establishing and maintaining statistical and data records that accurately reflect the quality assurance performance of all analytical departments.
- Maintaining and overseeing the master sources of all SOPs, training logs, and completed/full laboratory notebooks.
- Responsible for filing and reviewing training records of employees.
- Serving as the in-house client representative on all projects inquiries involving data quality issues.
- Maintaining and updating the QA Manual on an annual basis (minimum).

4.1.4 Laboratory Supervisor(s)/Group Leader(s)

The Laboratory Supervisors are directly involved in the day-to-day such as scheduling, supervision of laboratory procedures and reporting of results, staff training, etc. of their respective departments. He/She reports to the Laboratory Director. The Laboratory Supervisors/Group Leaders are responsible for:

- Enforcing the QA/QC procedures and requirements within their respective activities and areas of specialization.
- Monitoring validity of the analyses performed and data generated in the laboratory to assure reliable data.
- Supervising the staff training in the procedures described in the standard operating procedures (SOPs) as they apply to the assigned responsibilities of the staff.
- Recommending process improvements and corrective actions

4.1.5 Project Coordinators (PC)

The Project Coordinator has the overall responsibility for the technical completeness, subcontracting, invoicing, cost control, and adherence to schedules. He/She has to perform the roles of a Document Control Officer. He/She reports to the Laboratory Director.

Specific responsibilities include but not limited to:

- Implementing the appropriate quality procedures for project activities in support of the QAPP.
- Communicating with the Laboratory Director and/or QA Officer relating to QA/QC activities
- Communicating with client on their queries, clarifications or requests, and coordinating it back to the Laboratory Director and/or designee for approval
- Communicating with client on all inquries involving project-specific issues.
- Responsible for the filing, offsite archival, retrieval and storage of all documents

4.1.6 Sample Control Officer

The Sample Control Officer has the primary responsibility of managing the day to day activities of the sample control section.

Specific responsibilities include but not limited to:

- Overseeing sample log-in and its proper documentation
- Sample tracking, sample storage, sample disposal/return
- Bottle preparation and packaging
- Subcontracting of analysis
- Coordination and scheduling of sampling programs
- Client contact for verifications, non-conformances and TAT requests
- Assists with contract administration

4.1.7 Staff (Chemists, Analysts, Technicians and Support Personnel)

Every ATLInc laboratory personnel are responsible for the quality of work that is consistent with the requirements established by the ATLInc management. The laboratory personnel play an active role in the ATLInc Laboratory quality program and whenever possible, make recommendations regarding the process improvements and corrective actions. Specific job descriptions are available in the Human Resource File. He/She reports to Department Supervisor/Group Leaders.

ATLInc personnel responsibilities include but not limited to:

- Performs environmental sample analyses in accordance to approved laboratory SOPs, instrument/equipment maintenance and prepares data packages.
- Providing the management and the QA Officer with the immediate notifications of the quality problems by submitting Non-Conformance forms.
- Identifying and carrying out the approved corrective actions within their respective activities and specialization.
- Participating in the training program (including reading SOPs and QA Manual, MDL determinations and Accuracy and Precision data).
- Following QA/QC criteria for all program requirements.
- Correct reporting of sample results and QC samples.

4.2 Deputies

The following table defines who temporarily assumes the duties and responsibilities of key personnel in their absence:

Table 4-2. Key personnel Deputies

Key Personnel	Deputy
President	Laboratory Director
Laboratory Director	QA Officer
Quality Officer	Laboratory Director
Supervisor/Group Leader	Laboratory Director
Project Coordinator	QA Officer
Sample Control Officer	Project Coordinator

In the case of absence of both Laboratory Director and QA Officer, the Department Supervisors/Group Leaders and/or designee will perform the duties and responsibilities of the job.

SECTION 5.0 QUALITY SYTEM

5.1 Quality Policy Statement and Objectives

ATLInc is committed to provide the client with analytical data of known and documented quality to meet its data quality objectives in a reasonable time frame and at a fair cost. The reliability of the data generated by ATLInc is measured by the close adherence to quality control, qualifications and experience of personnel, and the organization's commitment in maintaining data integrity, validity, and usability.

The following statements describe the quality of the data required to be usable for the client.

5.1.1 Data Quality Objectives (DQOs)

Data quality objectives are used to assess the minimum data quality to ensure that the amount, type, and quality of data obtained during analytical processes are adequate to support and draw valid conclusions with a known level of confidence. DQOs also support specific decisions, and planning relative to remedial and regulatory actions.

The data quality objectives process facilitates the determination of the following:

- Information and data requirements for the specified project.
- Where, when, and how to collect samples to allow the most precise measurements as possible.
- Laboratory Quality Assurance/Quality Control required to defend data quality.
- Required number of observations.

DQOs are usually expressed in terms of:

5.1.1.1 Precision

The agreement among a set of replicate measurements without assumption of knowledge of the true value. Precision is estimated by means of duplicate/replicate analyses. These samples should contain concentrations of analyte above the MDL, and may involve the use of matrix spikes. The most commonly used estimates of precision are the relative standard deviation (RSD) or the coefficient of variation (CV) (SW 846, Chapter One),

$$RSD = CV = \frac{100S}{X}$$

where:

x = the arithmetic mean of the x_i measurements,
S = Variance

The relative percent difference (RPD) when only two samples are available is calculated as.

$$RPD = 100\left[\frac{(X1 - X2)}{\left\{\frac{X1 + X2}{2}\right\}}\right]$$

5.1.1.2 Accuracy

The closeness of agreement between an observed value and an accepted reference value. When applied to a set of observed values, accuracy will be a combination of a random component and of a common systematic error (or bias) component (SW 846, Chapter One).

5.1.1.3 Representativeness

It is the degree to which data accurately represent a particular characteristic of a population or environmental parameter. It is a qualitative parameter that is most concerned with the proper design of the sampling program.

5.1.1.4 Comparability

It measures the confidence in comparing results in one experiment with the results of the same experiment on different samples. It is also demonstrated through the participation in round-robin performance evaluation studies and the use of standard reference materials that are traceable to the National Institutes of Science and Technology (NIST) and EPA.

5.1.2 Preventive Maintenance and Quality Assessment

ATLInc's QA/QC protocol ensures that analytical measurement systems are maintained within acceptable limits and reproducibility. Specific sections of this QA/QC plan address various QA/QC procedures that are followed to generate valid and defensible data. Some elements of the QA/QC procedure include:

5.1.2.1 Preventive Maintenance

All analytical instruments and equipment are checked and calibrated by the analyst each time the instrument or equipment is used. In addition, the instrument or equipment is rechecked and recalibrated depending on the usage either on a time basis or sample basis according to the Standard Operating Procedures (SOPs). Besides daily checks, a schedule of preventive maintenance is kept to reduce the likelihood of total failures. Instrument calibration and precision statistical data are kept for record and reference.

5.1.2.2 Quality Assessment Procedures

ATLInc. employs quality assessment procedures to detect problems through data assessment and establish corrective action procedures that keep the analytical process reliable. Data validation is accomplished at all levels. Data reporting procedures start at the laboratory bench level. Supervisors/Group Leaders, QA Officer, and Laboratory Director and/or his designated signatory personnel perform the review of the final data package report.

5.1.3 Data Integrity, Confidentiality and Quality of Data

Performance levels, Data Integrity and Confidentiality are of utmost importance for the maintenance of ATLInc's required quality of data and all personnel are required to attend training and sign an "Ethics and Data Integrity Agreement". Data integrity procedures provide assurance of laboratory's dedication in providing data of known and documented quality to ATLInc's clients. Client confidentiality policy assures that the reports and associated documentation will only be released to the original client.

ATLInc has "zero tolerance" for falsification of data – any deliberate or negligent manipulation of data resulting in false reporting of results, time worked, documentation, will cause immediate termination.

5.2 Quality System Documentation

ATLInc's laboratory Quality System is communicated through the ff documents:

- Quality Assurance Manual (QAM)

- Work Instructions – procedural steps, tasks or forms associated with operation of management system (e.g . checklists, forms, logbooks)
- Laboratory SOPs – General and Technical

5.2.1 Order of Precedence

In the event of conflict or discrepancy between policies or procedures, the order of precedence is as follows:

1. Quality Assurance Manual
2. Laboratory SOPs
3. Other Work Instructions (memos, flow charts)

Note: Client's Quality Assurance Project Plan (QAPP) will take precedence over the above items for the client's specific project only.

SECTION 6.0 DOCUMENT CONTROL

6.1 General

A document control program is established to ensure that all documents issued or generated at ATLInc are accountable, traceable and up-to-date and out-of-date or obsolete documents are archived or destroyed. All documents distributed within the laboratory are controlled documents. Uncontrolled documents are those documents given to clients, auditors, etc. Controlled documents are also uploaded on the laboratory intranet. Printed copies from the intranet are considered uncontrolled. Documents issued in the laboratory includes logbooks, notebooks, SOPs, and control limits.

The QA officer is responsible for control and distribution of SOPs and other quality related documents in the laboratory. The QA officer maintains a database for documents issued in the laboratory.

The QA Officer also maintains access to reference methods (Standard Method, EPA) and regulatory documents (TNI 2009, DoD QSM) for employee reference.

The laboratory also maintains records of audit reports and responses, Proficiency Testing Studies, certifications, non-conformance and corrective action reports, MDL studies, LOD/PQL verification results, and training files. The laboratory also maintains raw analytical documents such as instrument printouts, standard preparation & sample preparation logbooks, electronic data and final reports.

6.2 Document Approval and Issue

Documents generated and issued by the laboratory are uniquely identified with laboratory's name, document title and number, revision number, effective date, page numbering, total number of pages and the issuing authority. The QA Officer is responsible for the maintenance of the document control program of the laboratory.

Controlled documents are authorized by the QA Officer. The development of a new document starts with the chemist when he/she submits an electronic draft to the laboratory director for review. The Laboratory director will review and make necessary corrections to the document before submission to the QA Officer for final approval. The QA Officer will verify the document and retains the document as the final version. This final version is then given unique identification, distributed to applicable department of the laboratory and uploaded in the intranet.

All current SOPs for internal laboratory use are controlled and uploaded to the laboratory's intranet. The QA Officer maintains a list of the final versions of controlled documents.

The Quality Assurance Manual and SOPs will be reviewed annually for accuracy and content. The Laboratory Director and QA Officer signs and approves SOPs and together with the President signs and approves the QAM.

All current SOPs and the QAM are uploaded on the laboratory intranet (ATL Help Desk) by the QA Officer and are considered controlled copies. No paper copies are issued in the laboratory. Any printed copies on work desks are considered uncontrolled. Access to the intranet is based on user name and password. Each employee is issued a user name and password for access. The QA Officer maintains a database for documents uploaded in the intranet.

Uncontrolled copies must not be used with in the laboratory.

6.3 Document Changes

For the changes to the QAM, SOPs, and Logbooks refer to ATL SOP GE-DCONTROL-02, SOPs, Logbooks Generation, Maintenance and Storage. Changes to any documents shall be reviewed and approved by the same key personnel who performed the original review.

For minor changes in the SOP, the chemist can make minor changes without having to revise the entire SOP. Minor changes include changing initial temperature, changing the head pressure, changing a standard in the calibration curve, etc. The changes can be made by crossing out the old entry, adding the new entry, date and then initial. All changes must be conveyed to the QA Officer as soon as possible. For major changes such as changing the make of autosampler, changing extraction procedure or applying changes in the reference method, the chemist will make the changes and submits to the laboratory director for review and approval. The chemist will wait for the approval of the laboratory director before any procedure is changed. Once the laboratory director approves the changes, all changes must be conveyed to the QA Officer as soon as possible.

Every year after the approval date, SOPs are reviewed for accuracy and content by the QA Officer. Minor and major changes are integrated in the final revision. A newly revised document

will be re-issued as soon as practicable. Upon released of the revised SOPs in the laboratory, they are also uploaded in the intranet.

For changes in logbooks and notebooks, all mistakes are corrected at the time the error is discovered. Cross out with a single line so as to remain legible. **Do not** erase, write over, or use correction material. Each cross out is initialed and dated. If the reason for the change is not obvious, then the reason must be stated. If there is insufficient space for all or part of the correction information, enter a footnote call out near the incorrect data and enter the required information as a comment elsewhere on the data sheet, notebook page, etc.

6.4 Obsolete Documents

All invalid or obsolete documents are removed from where they were issued, or otherwise prevented from unintended use.

SECTION 7.0 REVIEW OF REQUESTS, TENDERS AND CONTRACTS

When large or new projects are scheduled to arrive at the laboratory, the project coordinator or client service person should request all pertinent sample information from the client. This includes methods to be used, number of sample(s), matrix types, QC requirements like MDL, PQL and control limits, turn-around-time, data package requirements and expected sample delivery schedule. The project coordinator or client service person should always request the project's Quality Assurance Project Plan (QAPP).

A meeting of all key personnel is called to distribute the sample information for the project. The current accreditation status of the laboratory must be reviewed against requested analyses. Allocation of personnel, laboratory resources and materials are distributed for the type of work and the expected turn-around-time. The laboratory must inform the client thru the project coordinators the results of this review in case there is any potential conflict, deficiency, lack of appropriate accreditation status, or inability on the laboratory's part to complete or meet client's requirements. Any work that needs to be subcontracted will also be communicated to the clients. The client will also be informed of any deviation from the contract. For major changes, a documented approval (i.e. correspondence log, email, phone logs) from client will be kept for reference.

Any differences between the request or tender and the contract shall be resolved before any work commences. Each contract shall be acceptable both to the laboratory and the client. If a contract needs to be amended after work has commenced, the same contract review shall be repeated and any amendments shall be communicated to all affected personnel.

Records of reviews as well as pertinent communication/discussion with clients shall be maintained by means of e-mails or phone logs.

The President maintains copies of all signed contracts. Copies are distributed to Project Coordinator and QA Officer. All pertinent information in the contract is disseminated in the laboratory through project QAPP SOP and/or scheduled project meetings.

SECTION 8.0 SUBCONTRACTING OF ENVIRONMENTAL TESTS

Samples can be subcontracted to another laboratory if ATLInc is not approved to perform a particular test or if the lab is not able to complete analysis of required tests because of unforeseen reasons (e.g., workload, need for further expertise or temporary incapacity). Previously arranged projects/contracts where clients were notified of intention to subcontract analysis in form of bids or client communication through e-mail is sufficient form of notification. In other case, the client will be advised in writing by the Project Coordinators of its intention to sub-contract any portion of the testing to another party. If the laboratory subcontracts any part of the testing covered under NELAP, this work will be placed with a laboratory accredited under NELAP for the tests to be performed or with a laboratory that meets applicable statutory and regulatory requirements for performing the tests. The laboratory performing the subcontracted work shall be indicated in the final report and non-NELAP accredited work shall be clearly identified. Subcontracted laboratories must be accredited by US DoD and meet the requirements of the US DoD QSM if client or project requires US DoD certification.

All data from subcontract laboratories must meet all project requirements. Samples must be re-analyzed if specified project requirements are not met. The final report is reviewed for typographical and technical errors. The laboratory is responsible to the client for the subcontractor's work, except in the case where the client specifies which subcontractor is to be used.

The QA Officer maintains a list of subcontractors that the laboratory uses for environmental tests and their certifications/accreditations.

SECTION 9.0 PURCHASING SERVICES AND SUPPLIES

ATLinc has procedure for purchasing supplies, reception and storage of reagents and laboratory consumable materials relevant to environmental testing. This is to guarantee that the quality of supplies used for various laboratory analyses are complying with standard specifications or requirements. Refer to ATL SOP GE-Procurement-01, Procurement of Supplies, Material, and Services for more details.

The procurement of supplies is important to guarantee proper delivery of requested supplies. When supplies require special paperwork or extra equipment, they must be stated on the Purchase Order to provide the vendor with the laboratory's requirements. Proper ordering of supplies ensures the laboratory high quality chemicals and standards, calibration certificates for calibration items, and safety materials sheets for chemicals.

9.1 Glasswares

All glasswares used for volumetric measurements and dispensing must be Class A (Pyrex or equivalent) or checked for accuracy on a quarterly basis according to laboratory procedures.

9.2 Materials, Reagents, Standards & Supplies

Materials, reagents, standards, solvent, and gases are carefully selected to meet specifications defined in the analyses methods. Each new supply of these items is verified for their performance capabilities, freedom from impurities that interfere with the analysis, and background levels measured to check the degree of contamination.

Reagents and standards have specific grade of reagent in the laboratory SOPs. It is the responsibility of the chemist to check the suitable grade of reagent in the laboratory SOPs before use. Reagents and standards are checked and concentrations verified before use whenever possible. The reagents and standards are checked for signs of deterioration (e.g., formation of precipitates and discoloration) and verified through analysis as blank (i.e. instrument blank) to check for interferences and as spike standards to check for concentrations and specifications.

Chemicals must not be used past the manufacturer's expiration date and must not be used past the expiration time noted in the laboratory SOPs after preparation. The expiration date is generally determined from the manufacturer's expiration date. If not stated, the laboratory will assume 3 years from date opened for solids and 2 years from date opened for liquids.

Blank or clean water for volatile and semi-volatile organics is purchased from a commercial water distributor. Deionized or nanopure water for inorganic analyses are obtained from a commercial water demineralizer. The laboratory conducts daily checks of the reagent water by monitoring conductivity. The conductivity must be equal to or less than 1 μmho/cm.

Services such as electricity, air, gas, and vacuum are checked for proper specifications for efficient and reliable performance of the instruments.

Compressed gases in use should be monitored daily. The pressure in the gas cylinders must not be below 500 psi or the cylinders must be replaced.

Purchased pre-cleaned sample containers must be accompanied with certificate of analysis.

9.2.1 Purchasing

The chemist or analyst in charge will be the requisitioner. He/She will identify items for purchase and creates a purchase order on MAS 200. Items must be specified by description, concentration, packaging, catalog number, manufacturer and quantity needed. The purchase order will be submitted to the Laboratory Director for approval. Once approved, items can now be ordered.

9.2.2 Receiving

Materials are dated upon receipt to establish their order of use, "as first in, first out basis," and to minimize the possibility of exceeding their shelf life. Pertinent information such as name of supplier, lot or serial number, expiration date, concentration, date opened, date received, and date expired are logged/recorded into the chemical inventory logbook.

Chemicals are labeled with sticker containing information such as chemical inventory code, receipt date, open date, and expiration date.

Purchased supplies and reagents and consumable materials that may affect the quality of environmental tests should not be used until they have been inspected or otherwise verified as complying with standard specifications or requirements defined in the methods for environmental tests concerned. For the following type of supplies, the accompanying paperwork is required for the items ordered. The requisitioner is required to check for the said items when supplies were received. If missing, this must be immediately communicated to the vendor.

Table 9-2 . Materials Document Requirements

Type of supply	Requirements
Standards	Certificate of Analysis
Chemicals	MSDS
Acids	Trace Grade Quality
Solvents	Pesticide Grade
Equipment	Specific items needed for the purchase of the equipment
Thermometers (Calibration Type Only)	Certificate of Calibration
Weights (Class A Only)	Certificate of Calibration
Class A glassware including glass micro liter syringes	Certificate of Calibration

9.2.3 Storage

Acids and bases are segregated in terms of storage. Various types of solvents are stored in flammable storage cabinets. Dry chemicals used for inorganic and organic analyses are stored in the chemical storage cabinet. Incompatible chemicals should not be stored together for safety reasons. Primary standards and working standards prepared for organic analysis are stored in the standard refrigerator/freezer.

All chemicals must be stored properly following directions of storage procedures in containers to prevent degradation and contamination. Light sensitive reagents must be stored in amber bottles.

9.3 Equipment/Instrument/Software

Information on the actual performance of the equipment is obtained before request to purchase equipment is made. The availability of the supplier's service to install and test it against specifications as part of purchase price is also considered. The chemist or analyst will make a request for new equipment to the Laboratory Director. The Laboratory Director and/or designee will make the list of the necessary specifications needed for the new equipment to be purchased.

Upon receipt of new equipment, unique identification name or number is given and also added on the equipment list. When first installed, an internal calibration of the instrument is performed using the manufacturer's manual. Analytical reference standards are analyzed for qualitative and quantitative checks on the instrument performance during the sample run. Routine preventive maintenance of the instruments/or equipment is done on a regular scheduled basis.

9.4 Services

ATL is using outside services for maintenance of the equipment for instrumentation work such as ICP and ICP-MS. ATL has a contract for instrument maintenance services from instrument's manufacturer. All other instruments are currently maintained/serviced by in-house technician.

SECTION 10.0 SERVICE TO CLIENT

10.1 Client Confidentiality and Support

The laboratory shall afford clients or their representatives' cooperation to clarify the client's request and to monitor laboratory's performance in relation to the work performed, provided that the laboratory ensures confidentiality to other clients.

The laboratory has procedures established for the review of requests and contracts (Section 7.0). The laboratory performs the thorough review of the technical and QC requirements in every requests and contracts to ensure the success of every project.

The clients or their representatives can be granted by the laboratory special services like reasonable access to the relevant areas of the laboratory for witnessing tests performed for the client and assisting client-specified third party data validators.

10.2 Client Communication and Feedback

The laboratory maintains and documents timely communication with the client for the purposes of seeking feedback, both positive and negative, and clarifying customer requests. Feedbacks are used and analyzed to improve the laboratory quality system, testing activities, and service to client.

Negative customer feedback is documented as customer complaint as discussed in Section 11.0

The Project Coordinator or client service person is the main communication link to the clients. He/She will inform the clients if there are any non-conformances in sample receipt and sample analysis. Also, he/she will notify the clients of any delay in project completion.

The QA Officer and/or Laboratory Director is available to discuss any technical questions or concerns of the clients.

SECTION 11.0 CLIENT COMPLAINTS

11.1 General

Client complaints can range from issues with reported results, technical problems or other incident stemming from all facets of the laboratory business, which may affect quality of the product and/ or service. The person who receives the complaint or discovers the incident is responsible for initiating the process. Investigation of root cause and identifying the corrective action for the issue are all documented on the client complaint form.

The ATL SOP GE-CLIENTS-01, Client Complaints discusses the details for initiating, documenting, reviewing and reporting complaints/incidents.

When a client has a question on the report, have the department supervisor re-check all calculations and identifications. When a client has a technical question, the Laboratory Director must spearhead the investigation. Any other problems affecting quality of product and services to the client not addressed above must be directed to Laboratory Director. Any issues involving legal or business decisions must be directed to the Laboratory Director and Senior Management.

Appendix C shows an example of a Client Complaint/Incident Form

11.2 Monitoring of Client Complaints

The person who ultimately receives the complaint or discovers the incident is responsible for initiating the client complaint form. The client complaint form is available at QA department. The QA Officer will be responsible for filling up the general information and description of complaint of the form. The form is then forwarded to the concerned department supervisor/group leader for investigation of the nature of complaints. The department supervisor/group leader recommends corrective action and forwards the form to the Laboratory Director for approval. The QA Officer will review the actions taken if acceptable or not acceptable. QA will be responsible to determine if the laboratory is in error or not in error on the complaint reported.

If the corrective action was insufficient upon review by the QA Officer, the form and other documentation will be returned to the department supervisor/group leader and Laboratory Director until the corrective action is satisfactory.

All client complaint forms are assigned with a sequential control number by the QA Officer. A copy of the complaint form and other documentation related to the issue will be given to Project Coordinator for filing if the complaint is related to a particular project folder, with subsequent notification to salesperson. Otherwise, the original copy is filed at QA office. In the future, it is ATL's plan to create a database for tracking client complaints.

11.3 Reporting

The laboratory shall inform the initiator of the complaint of the results of the investigation and the corrective action taken, if there is any.

The Project Coordinator is responsible for reporting the result of investigation for issues requiring client notification. At the end of each year, the QA Officer is responsible for summarizing the client complaints and includes it as part of QA report to management.

SECTION 12.0 CONTROL OF NON CONFORMING WORK

12.1 General

When nonconforming work or departures from the laboratory's policies and procedures in the quality system or technical operations have been identified, corrective action is taken immediately. The laboratory evaluates the significance of the non-conforming work and initiates corrective action based on the result of evaluation. If the non-conforming work is isolated case, the laboratory can opt to add a qualifier to the final results and/or document the non-conformance in the case narrative. If the non-conforming work is systematic or involved improper practices, the corrective action should include in depth investigation and a possible suspension of analytical method. Non-conformances should be documented following the laboratory's corrective action system (Section 13.0).

An example of a Nonconformance Form is shown in Appendix D.

12.2 Responsibilities and Authorities

Any non-conformance can be immediately brought to the attention of the department supervisor/group leader, the Laboratory Director and/or QA Officer. These personnel must assess whether a problem or departure has any effect on laboratory's QA/QC policy. The analyst, department supervisor/group leader, QA Officer, Sample Control personnel or Project Coordinator(s) personnel, can initiate the Non-Conformance form. The previously mentioned groups can also recommend possible corrective actions to problems. For exceptionally permitting departures from documented policies and procedures or standard specifications, all must be clearly stated in the case narrative of the report.

Any issues involving violations to the laboratory's Ethics and Data Integrity procedures must be reported immediately to the Laboratory Director, QA Officer and/or President.

The Laboratory Director, QA Officer and President have the authority to halt work, withhold reports and suspend analysis as well as authorize the resumption of work.

12.3 Analysis Suspension/Stop Work

When a result in a performance audit is unacceptable or when a system audit reveals an unacceptable performance, the laboratory identifies the problems and implement corrective actions immediately. Also, the authorized personnel may suspend the analytical work until corrective action has been implemented and performance has been proven to be acceptable.

In cases when suspension/restriction of analysis is necessary, the laboratory will hold all reports to client pending review. No faxing, mailing or distributing through electronic means may occur. Client will NOT generally be notified and analysis may still proceed in some instances depending on the nonconformance.

Within 24 hrs, the QA Manager will determine if the compliance is met and reports can be released, or together with the Laboratory Director, Department Supervisor/Group Leader and President (if needed) will determine the plan of action to bring work into compliance, and release work. Clients will then be notified if the suspension of work will affect the laboratory's capability to accept work.

SECTION 13.0 CORRECTIVE ACTION

13.1 General

The need for corrective action comes from several sources: equipment malfunction; failure of internal QA/QC checks; failure of performance of system audits; non-compliance with QA requirements, calculation and reporting errors, deviations from established laboratory procedures, failure of Proficiency Testing Studies, client complaints and staff observation. The Non-Conformance event is documented on a Non-Conformance/Corrective Action form. The details of how the Non-Conformance/Corrective Action form is completed and routed are in the ATL SOP GE-NONCONFORM-01, Non Conformance and Corrective Action.

13.2 Cause of Analysis

Once the non-conformance has been identified, a non-conformance form must be filled out by any ATLInc employee or the first person to observe the non-conformance and submitted to the department supervisor/group leader, QA Officer, Sample Control Officer or Project Coordinator and Laboratory Director.

The non-conformance forms contain incident description, samples affected, possible cause, corrective action, and proof of conformance.

The procedure for corrective action shall start with an investigation to determine the root cause(s) of the problem.

13.2.1 Root Cause Analysis

A system of problem solving methods aimed at identifying the underlying or basic factors of problems or incidents (A2LA Complaints, Feedback, Root Cause Analysis, and Corrective Action June 2011)

In order to identify the root cause of a problem, several tools and techniques can be used such as flow charts, records, interviews, five whys and fish bone diagram. The flow chart presents linkages and connections from beginning to end of task for easier understanding of work flow. Interviewing staffs helps explain the problem, documents and actions for better understanding of the situation. Asking the five whys is helpful in tracing the chain of events because the problem on hand might have come from overlooked detail before, perceived to be a small problem at that time.

13.2.2 Selection and Implementation of Corrective Actions

Where corrective action is needed, the laboratory shall identify potential corrective actions. It shall select and implement the action(s) most likely to eliminate the problem and to prevent recurrence.

Corrective actions shall be to a degree appropriate to the magnitude and the risk of the problem.

The laboratory shall document and implement any required changes resulting from the corrective action investigations.

13.3 Monitoring of Corrective Actions

After department supervisor/group leader had signed the Non-Conformance it is submitted to QA Officer for review and filed at QA department. The Laboratory Director and QA Officer will monitor the results to ensure that the corrective action(s) taken is/are effective.

At the end of each year, the QA Officer is responsible for summarizing the non-conformance reports and includes it as part of QA report to management.

13.4 Additional Audits

Where the identification of nonconformances or departures casts doubts on the laboratory's compliance with its own policies and procedures or on its compliance with state and federal requirements, the laboratory shall ensure that the appropriate areas of activity are audited in accordance with Section 16.2.

13.5 Technical Corrective Action

If quality control measurements are found to be unacceptable, the analyst must follow corrective actions on Appendix E. Some unacceptable results may require re-analysis or re-preparation. If the re-analysis is within acceptable criteria, then the analyst does not submit a Non-Conformance form. If the re-analysis is not within acceptance criteria, then a Non-Conformance form must be submitted to document the possible matrix effects. And if the failed QC does not affect the use of results, data will be reported with an appropriate data qualifier and/or documented properly in the report's case narrative.

SECTION 14.0 PREVENTIVE ACTION / IMPROVEMENT

Preventive action is a pro active process to identify opportunities for improvement rather than a reaction to the identification of problems or complaints. It can be initiated through feedbacks from clients, employees and business affiliates.

Opportunities for preventive actions may be discovered during data analysis and data review processing, evaluation of internal or external audits, results and evaluation of Proficiency Testing Studies, client complaints, staff observation and management review.

The QA Department has the overall responsibility to ensure that preventive action processes is implemented and documented. Documents are presented in the QA annual report and discussed in the Management Review.

SECTION 15.0 CONTROL OF RECORDS

The laboratory maintains a records management system that complies with regulatory and client requirements. The lab shall retain all original observations, calculations and derived data, calibration records and a copy of the test report for a minimum of **five years**.

15.1 General

The laboratory has established procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality technical and administrative records. Records can be as hard copy or electronic copy or at times, records are in both formats. Table 15-1 presents the different types and examples of records and their corresponding retention times. The QA Officer maintains the quality records and technical records.

All record entries must be legible. Printed is preferable, but written is acceptable for all characters, including notes. All record entries must be made using indelible ink pens, preferably blue or black. All records are stored and retained in secure and easily retrievable facility that prevents damage or deterioration and loss.

The laboratory has procedures to protect and back up records stored electronically and to prevent unauthorized access to or amendments of these records. Electronic copies of the ATL

QAM and SOPs are located on a secured laboratory server accessible only to the QA officer. The computer is virus checked at all times to deter virus data corruption. The network is backed-up on a weekly basis followed by an incremental, daily back up.

Table 15-1 Record Types & Retention Times

	Record Types	**Retention Time**
Quality Records	ATL QAM SOPs Regulatory Certifications Internal & external audits/responses Corrective/Prevention Action reports Client Complaint forms Management Reviews Method & software validation data PT results MDLs/LOQ/PQLS/DOCs Training Records	5 yrs
Technical Records	Raw Data (instrument/noted observations) Logbooks Analytical records Lab reports	5 yrs
Project Records	Project QAPP Contracts COC & SRCs Correspondence (email & telephone logs) Lab Reports Project Folders*	5 yrs
Administrative	Company Policy Employee Handbook Personnel files Safety Manual	5 yrs

*project folder is generated by Project Coordinators that contains all pertinent paperwork of a project (COC, SRC, correspondence, sample results, calibration, calibration verifications, QA/QC data, data verification checklists, preliminary and/or final reports)

The laboratory record system allows historical reconstruction of all laboratory activities that produced the analytical data. This includes readily understood documentation of sample from receipt to report generation. The ATL SOP GE-DCONTROL-01, Document Control (Project Folders) provides the detailed pathway of how project documents are routed and archived in the laboratory.

- The records include identity of personnel involved in sampling, sample receipt, preparation and analysis. The laboratory's copy of COCs is kept together with sample receipt documentations and correspondence in project folders. In all analytical work in the laboratory, the originator(s) of all record entries are identified by initial(s) or

signature(s). In most cases, there are specific places on logbooks and data sheet for initials to identify the originator of entries or groups of entries. In logbooks, all analysts making entries are required to print their names with corresponding initials and signatures in the second page.

- All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification are documented.

- The record keeping system facilitates retrieval of all working files and archived records for inspection and verification purposes. Instrument data are stored sequentially by date of analyses for each instrument. Run logs are maintained and stored for each instrument and a copy is included in the data package. This is essential for the reconstructing of an analytical sequence. If no instrument was used for an analysis, documentations are recorded in bound logbooks. Standards and reagents preparations are recorded in bound logbooks and entered into the chemical inventory in LIMS.

- All changes to records must follow procedure in Section 6.3. All changes to electronic copies, in LIMS and instrument data are reflected in audit trails. The reason for the signature or initials shall be clearly indicated in the records such as “sampled by”, “prepared by”, or “reviewed by”.

15.2 Technical Records

The laboratory retains records of original observations, derived data and sufficient information to establish audit trail, calibration records, staff records and a copy of each test report issued for a minimum of five years. The records for each environmental test shall contain sufficient information to facilitate identification of factors affecting the uncertainty and to enable the environmental test to be repeated under conditions as close as possible to the original. The records shall include the identity of the personnel responsible for sampling, performance of each environmental test and checking of results.

The essential information to be associated with analysis, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run log, include:

- Laboratory sample ID code
- Date of analysis and time of analysis is required if the holding time is 72 hours or less or when time critical steps are included in the analysis. For DoD projects, date and time of preparation and analysis shall be included in the laboratory report. If the time of sample collection is not provided, the laboratory must assume the most conservative time of day. For the purpose of batch processing, the start and stop dates and times shall be recorded.
- Instrumentation identification and instrument operating conditions/parameters
- Analysis type
- All manual integrations including manual integrations
- Analyst’s or operator’s initials/signature

- Sample preparation including clean up, separation protocols, volumes, weights, instrument printouts, meter readings, calculations, reagents
- Sample analysis
- Standard and reagent origin, receipt, preparation and use
- Calibration criteria, frequency and acceptance criteria
- Data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions
- Quality control protocols and assessment
- Electronic data security, software documentation and verification, software & hardware audits, backups and records of any changes to automated data entries
- Method performance criteria including expected quality control requirements.

Observations, data and calculations shall be recorded at the time they are made and shall be identifiable to the specific task.

All changes to records must follow procedure in Section 6.3. All changes to electronic copies, in LIMS and instrument data are reflected in audit trails

15.3 Laboratory Support Activities

In addition to documenting all the above mentioned essential information, the following shall be retained:

- All original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analyst's work sheets and data output records (chromatograms, strip charts, and other instrument response readout records)
- A written description or reference to the specific test method used which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value
- Copies of final reports
- Archived SOPs
- Correspondence relating to laboratory activities for a specific project
- All corrective action reports, audits and audits responses
- Proficiency test results and raw data
- Results of data review, verification and crosschecking procedures

15.4 Sample Handling Records

A record of all procedures to which a sample is subjected while in the possession of the laboratory shall be maintained. These shall include but are not limited to all records pertaining to:

- Sample preservation, receipt, acceptance or rejection and log-in
- Sample storage and tracking including shipping receipts, sample transmittal forms (chain of custody form)

- Documented procedures for the receipt and retention of samples, including all provisions necessary to protect the integrity of samples.

15.5 Administrative Records

The laboratory maintains personnel qualifications, experience and training records, and a log of names, initials and signatures for all individuals who are responsible for signing or initiating any laboratory record.

15.6 Records Management and Storage

15.6.1 Quality and Technical Records

All laboratory records are kept and retained for a maximum of 5 years unless otherwise specified by client or regulatory bodies.

Analyst's notebooks, instrument maintenance logbooks, standard preparation and extraction logbooks, instrument run logbooks, laboratory equipment and maintenance logbooks are submitted to the QA Officer once they are already full and are archived by the QA Officer for 5 years. An Access database has been developed to record the name of the logbook, notebook code identification, department, and type of logbook, log number, date of issue, archival date and number of box where the logbook was kept. This will allow easy retrieval of logbooks when needed.

All records in the project folders are retained for 5 years from the generation of the last entry in records. For clients that require archival of records longer than 5 years, a formal request latter must be submitted prior to the start of retrieval.

The original hard copy of the client complaint and non-conformance forms will be filed and retained at the QA Office for a minimum of five years.

15.6.2 Electronic Records

Records that are stored or generated by computers or personal computers shall have hard protected backups.

All electronic data generated by instruments are backed up at a minimum of every 4 weeks. All data is copied from the instrument computers to specific directories on the network. Only the primary user and the department supervisor have access to these directories. The network is backed-up on a weekly basis followed by an incremental, daily tape back up. These files are then copied to a recordable CD for permanent storage.

Electronic copies of the SOPs are located on a secured laboratory server accessible only to the QA Officer. The computer is virus checked at all times to deter virus data corruption. The network is backed-up on a weekly basis followed by an incremental, daily back up.

Electronic reports generated for the client are saved directly to a specified directory on the network. Amended reports are retrieved from and saved to the network directory. The network is backed-up on a weekly basis followed by an incremental, daily tape back up.

15.6.3 Archive Access

Access to archived information shall be documented with an access log. These records shall be protected against fire, theft, loss, environmental deterioration , vermin and, in the case of electronic records, electronic or magnetic sources.

If the project folder needs to be retrieved from the folder storage location, the project folder must be retrieved by the Document Control Officer. An access log must be filled to document person borrowing the project folder and when it was returned. Using Sample Tracker in LIMS, the Document Control Officer is able to track where the folder was transferred to and when it was returned. For workorders done in the last three months, folders are still at ATLInc on-site storage. However for old folders, the document control officer will have to request the file for retrieval from the private file storage facility. The laboratory has to pay for folder retrievals and expedited folder retrieval request can be accomplished at an extra cost.

15.6.4 Transfer of Ownership

In the event that the laboratory transfers ownership, all records and data will be kept for a minimum of five years. All applicable client notifications will be sent for their information. In the unlikely event that the laboratory goes out of business, laboratory data will be turned over to applicable client for their record retention.

15.7 Records Disposal

Records are removed from archive and destroyed after 5 years or as per client/regulatory requirement. For project specific records, the clients are notified prior to destruction. Electronic copies of records must also be destroyed.

SECTION 16.0 AUDITS

ATLInc participates in external audits from engineering companies, other laboratories, and government agencies. External audits assure that the laboratory is operating under proper specifications as well as meeting their requirements. Another source of audits for the laboratory is the internal audit conducted by the QA Officer. Audits are conducted and documented as described in ATL SOP GE-AUDITS-01, External Audits and Internal Audits.

16.1 External Audits

16.1.1 Agency Audits

ATL retains the laboratory certification from National Environmental Laboratory Accreditation Program (NELAP) through the California Department of Health Services, California Environmental Laboratory Accreditation Program (CA-ELAP) and Nevada Division of Environmental Protection (NDEP). (See Appendix G for ATL's Certification). NELAP/ELAP performs inspections of the laboratory every 2 years. Any recorded deficiencies are corrected and a response letter is submitted to accrediting agency.

16.1.2 Client Audits

Clients can audit or inspect the laboratory for conformance to EPA methods and/or specific project requirements. After the audit, a formal letter describing any findings is submitted to the laboratory. All findings will require corrective actions and evidence or proof of conformance for the response letter.

16.2 Internal Audits

Internal audits are performed at least annually but may be performed more frequently if the QA Officer determines a need for more frequent audits. An internal audit encompasses Sample Control, Organics, and Inorganics. Items checked for include, but are not limited to the following:

- Runlog are checked for completeness, verification of calculations, and for standard traceability.
- Balances, oven temperatures, refrigerator temperatures are being recorded.
- Standard logbooks are checked for completeness and for traceability.

The internal audits are documented on checklists during the actual audit. A report is generated based on the findings, and is then distributed to the President, Laboratory Director, and the Department Supervisors/Group Leaders.

All deficiencies found during an internal audit are written into a report. The report is then given to the President, Laboratory Director, and the department supervisor/ group leader. All corrections must be completed within 10 working days. A follow-up inspection is performed on the outstanding deficiencies. Deficiencies that are not completed are documented in the report to the Laboratory Director and/or President.

If findings during the internal audit cast a doubt on the effectiveness of the operations or on the correctness or validity of the data, immediate investigation and performance of corrective action is implemented by the QA Officer, Department Supervisor/Group Leader, Laboratory Director and/or the President (if necessary). Clients will be notified in writing within 24 hrs, if investigation shows that the laboratory results may have been affected.

Section 17.0 MANAGEMENT REVIEWS

17.1 Annual QA Report

Data from formal performance audits of the laboratory's activities are reviewed directly by the QA Officer, Laboratory Director, and the department supervisors.

All quality assurance or quality control issues are discussed among the QA Officer, Laboratory Director, and department supervisors. The report can be used as a focal point for discussion involving corrective action. Any corrective action taken is decided with the concurrence of the unit department supervisors, the QA Officer, and/or Project Coordinator, and the Laboratory Director.

The QA Officer provides a management report at least annually to the President. The report describes any significant quality assurance problem and/or solution, results of performance and system audits, assessment of accuracy and precision data, and health and safety issues. An overall QA report will be compiled that will outline problems (short-term and long-term), solutions, areas to improve, and long-term goals for the upcoming year. The supervisors and Laboratory Director can also make comments and/or suggestions to the report.

17.2 Annual Management Review

Management review of the quality system and laboratory operations is being done at a minimum on an annual basis. The Laboratory Director and QA officer reports the review and findings to management in a form or e-mail or formal report. The review takes into account reports from the analysts, the outcome of recent internal audits, assessments by external bodies, the results of interlaboratory comparisons or proficiency test, any changes in the volume and type of work undertaken, feedback from clients, corrective actions and other relevant factors.

Findings from the management reviews and the action that arise from them should be recorded. The management shall ensure that those actions are carried out within an appropriate and agreed timescale.

SECTION 18.0 TECHNICAL REQUIREMENTS

18.1 PERSONNEL

18.1.1 Education and Experience Requirements for Technical Personnel

ATL SOP GE-JOBS-01, ATL-LV Job Description details the minimum educational attainment and experience requirement for each position in the laboratory. A master's degree in chemistry or related field may substitute one year laboratory experience and two years' experience for doctorate degree. Laboratory experience may also substitute the minimum education credential requirement. For example, 8 years analytical laboratory experience may substitute BS degree requirement.

18.1.2 Training

It is ATLInc's intention to provide all new, experienced or inexperienced, employees with structured and documented training. The training provided by ATLInc will enable new members to integrate quickly and more predictably. Depending on experience and education a new member may start at a support level such as sample preparation or a sophisticated level such as instrumental analyses (GC, GC/MS, ICP, AA). This apprenticeship program is an excellent vehicle for chemists inexperienced in environmental analyses and new graduates to assimilate considerable skills and experience in a short period of time.

ATLInc's training program is designed to ensure that all personnel are qualified and properly trained to perform all required tasks. The training program also provides that all pertinent health and safety issues, ethics and data integrity policy are covered before the commencement of work. Periodic evaluation of each staff member's skills by performance evaluation samples is also part of the training procedure. ATL SOP GE-Training Program-01, Employee Training Program presents the details of the ATLInc's training program.

Initial training includes reading and understanding the quality manual, method, Standard Operating Procedure (SOP) comprehension, standards preparation, method set-up, accurate reporting, correct and accurate QA/QC and routine instrument maintenance. Trainees are given supervised training by the department supervisor or by designated chemist(s) who already completed the initial proficiency. Once the initial training is complete, the chemist's initial proficiency demonstration can be determined from accuracy and precision data, testing of the SOPs, and demonstration through performance evaluation (PE) samples. All results are documented into the personnel training folder by the QA Officer to reflect current training qualifications.

As part of the chemist's training, each chemist and technician must read the QA Manual whenever there is a revision to the manual. Each chemist must answer some questions and sign the questionnaire as documentation to reading the QA Manual. The questionnaire also allows the chemist to ask questions and give updates for the next revision.
If laboratory will use temporary or contractual employees, the employee will undergo the same training as the regular employee. The procedure for initial demonstration of capability, ethics and data integrity training, proficiency testing and other method related trainings would also be applied to temporary or contractual employees.

The oversight of the training program is performed by the QA Officer, the department supervisors/group leaders, and the Laboratory Director.

18.1.2.1 Initial Demonstration of Capability

Demonstration of capability (DOC) must be made prior to institution of new methods, when there is change in personnel and there is major change in instrumentation.

As part of the training procedure, the analysts must provide a documented demonstration of capability for the test methods being performed. This is achieved by providing "Accuracy and Precision" data. The accuracy and precision data is calculated from 4 Laboratory Control Samples (LCS) that are spiked with a secondary source

standard. The results are evaluated for accuracy (average recovery) and precision (standard deviation of the recovery). The results are evaluated against method or in-house limits. If there are no method criteria, the average recovery of 80 – 120% (Inorganics) and 70-130% (Organics) and 20% for the standard deviation will be used as acceptance criteria. If the data does not meet the criteria, then a corrective action is initiated. Once the problem is corrected, a new precision and accuracy data set is collected and evaluated.

A certification statement signed by the Laboratory Director and QA Officer is issued to analysts who have completed their demonstration of capability. The certification and raw data generated are filed electronically in employees' training folder.

18.1.2.2 Ethics and Data Integrity Training and Policy

Data integrity training is an integral part in new employee orientation and is conducted at least annually thereafter. Topics covered shall be documented in writing and provided to all trainees. Key topics covered during training must include organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting, how and when to report data integrity issues, and record keeping. Training shall include discussion regarding all data integrity procedures, data integrity training documentation, in-depth data monitoring and data integrity procedure documentation. Employees are required to understand that any infractions of the laboratory data integrity procedures will result in a detailed investigation that could lead to very serious consequences including immediate termination, debarment or civil/criminal prosecution.

The initial data integrity training and the annual refresher training shall have a signature attendance sheet or other form of documentation that demonstrates all staff has participated and understands their obligations related to data integrity.

The data integrity procedures also include written ethics agreements, examples of improper practices, examples of improper chromatographic manipulations, requirements for external ethics program training, and any external resources available to employees. All documentation of training and agreement are filed on employees' training folder.

According to ATLInc's Employee Handbook, under section "Personal Conduct", disciplinary action, which may include discharge, will be taken for offenses such as: falsifying data and/or company records, violation of safety rules, breach of security and/or confidentiality, commitment of financial or legal resources without authorization of company officer." When a new employee begins work at ATL, they are required to read the Employee Handbook and an "Ethics and Data Integrity Agreement". Each document requires the employee to sign an acknowledgement memo stating that they have read and understood each item that was submitted to them.

The ATL SOP GE-ETHICS-01, Ethics and Data Integrity describes the following activities unacceptable under any circumstances:

- Knowingly record inaccurate data.

- Fabricate data without performing the work needed to generate the information or also called “dry labbing”. This also includes creating any type of fictitious data or documentation.

- Time travel or adjusting clocks on software systems to make it appear that data was analyzed within holding times.

- Manipulations of data for the purpose of passing system performance checks or quality control criteria (e.g., surrogate standards, internal standards, calibration standards, method blanks, laboratory control standards, matrix spike samples, instrument tuning, pesticide degradation check,

- Manipulations of samples, software, or analytical conditions (e.g. unjustified dilution of samples, manipulating GC/MS tuning data to produce an ion abundance result that appears to meet specific QC criteria, changing instrument conditions for sample analysis from the conditions used for standard analysis, forcing calibration or QC data to meet criteria, removing computer operational codes such as the “m” flag, inappropriately subtracting background, or improperly manipulating he chromatographic baseline, turning off, or otherwise disabling, electronic instrument audit/tracking functions)

- Misrepresenting or misreporting QC samples (e.g., representing spiked samples as being digested or extracted when this was not performed, substituting previously generated runs for a non-compliant calibration or QC run to make it appear that an acceptable run was performed, failing to prepare or analyze method blanks and the laboratory control sample (LCS) in the same manner that samples were prepared or analyzed, tampering with QC samples and results, including special treatments for QC samples, performing multiple calibrations or QC runs until one meets criteria, rather than taking needed corrective action, and not documenting or retaining data for the other unacceptable data, deleting or failing to record non-compliant QC data to conceal the fact that calibration on other QC analyses were non-compliant

- Improper calibrations (e.g. discarding mid-level points in the initial calibration to meet calibration criteria, discarding points from a Limit of Detection (LOD) study to force the calculated LOD to be lower than the actual value, using an initial calibration that does not correspond to the actual run sequence to make continuing calibration data look acceptable when in fact it was no)

- Improper manual integrations, including peak shaving, peak enhancing, or baseline manipulation to meet QC criteria or to avoid corrective action

- Concealing a known analytical or sample problem

- Concealing a known improper or unethical behavior or action

- Failing to report the occurrence of a prohibited practice or known improper or unethical act to the appropriate laboratory or contract representative, or to an appropriate government official

- Any employee aware of misrepresentation of facts regarding analytical results is required to notify his/her immediate supervisor or, if this is not feasible, another representative of the management of the company immediately.

- Any employee who has a concern regarding misrepresentation of facts should speak with his/her immediate supervisor.

- If at this stage, they both feel that the issue has been adequately addressed the matter is closed. If the matter remains unresolved, the employee is to bring it to the attention of the next level of management. This process is to continue until either that matter has been resolved to the satisfaction of the employee, or until the laboratory director has become involved.

- If the laboratory director cannot address the issue to the satisfaction of the employee, a three-way discussion between the employee, the laboratory director and QA officer is to be held to resolve the matter.

- Employees are encouraged to follow the above steps. However, if an employee feels that it would be in his/her best interest to contact any member of the management directly, the employee can take advantage of laboratory's open door policy.

- An employee who complies with the provisions of this policy will be protected from any retaliatory action. However, if the employee has engaged in wrongdoing, disclosure of this will not relieve him/her from accepting responsibilities for his/her acts.

- If an employee reports a potential wrongdoing pursuant to this policy, the most senior manager involved in the resolution of the matter must document, in writing, the episode to the President.

18.1.2.3 Initial Performance Evaluation Samples

After completing the training period, a performance evaluation sample will be given to the analyst to evaluate his/her performance of method. The performance evaluation sample(s) can either be single or double blind samples for the analyst to analyze. The analyst will report all target compounds identified. If there are "unacceptable" results, the analyst must investigate the cause of the problem, correct the issue and perform another performance evaluation sample.

Record of Performance Evaluation samples is kept by the QA Officer and included in the

analyst-training file. Non-conformance and corrective action forms (if there are any) are also filed by the QA Officer.

Internal performance evaluation samples are performed as needed.

18.1.2.4 Continuing Training and Proficiency.

Continuing (supplemental) training includes development of SOPs, learning the importance of documentation, the understanding of meeting QA/QC criteria and quality. Supplemental training can be obtained from reading different procedures, instrument manuals and related literature. Knowledge regarding methods and instrumentation can also be obtained from external training by agencies and manufacturers. Copies of completion certifications are kept in the chemist's training file.

Continuing proficiency of analysts is demonstrated by analysis of another precision and accuracy data as described in initial demonstration of capability or analysis of proficiency testing sample on annual basis. All records supporting analyst's continuing proficiency must be filed on employees' training folder. A certification statement signed by the Laboratory Director and QA Officer to demonstrate continued proficiency are also issued to analyst and filed on their training folder.

ATL employees will receive ethics and data integrity training on a minimum frequency of once per year. Copy of training materials will be provided to the employees for reference. Attendance sheet will be required to acknowledge receipt of training.

SECTION 19.0 ACCOMODATION AND ENVIRONMENTAL CONDITIONS

19.1 Laboratory Layout

The laboratory is strategically situated in a commercial business complex and occupies five suites combined together. ATL Inc's official address is 3151 W. Post Road, Las Vegas, Nevada, 89118. See Appendix F for Laboratory Layout.

19.2 Building Security

The laboratory suites are kept secure during and after office hours with building keys, alarm and door codes.

All visitors, guests, and other non-laboratory personnel are required to sign the guest registry. Allvisitors are escorted within the facility.

19.3 Work Areas

The laboratory is separated into specific areas for sample receiving, sample preparation,

organic analysis, inorganic analysis, and administrative functions. They are only accessible to authorized personnel.

Measures have been taken to prevent cross-contamination. There's an effective separation between neighboring areas in which there are incompatible activities like volatile organic area from semi volatile preparation and sample receiving area. Samples suspected of containing high analyte concentrations are stored separately from other samples.

Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality.

Section 20.0 ENVIRONMENTAL METHODS AND METHOD VALIDATION

20.1 General

ATLInc uses appropriate methods and procedures to meet regulatory and client requirements and within the scope and laboratory's capabilities. These include sampling, handling, transport, storage and preparation of samples, and, where appropriate, an estimation of the measurement uncertainty as well as statistical techniques for analysis of environmental test data.

The laboratory has instructions on the use and operation of all relevant equipment, and on the handling and preparation of samples where the absence of such instructions could jeopardize the results of environmental tests. All instructions, standards, manuals and reference data relevant to the work of the laboratory are available in the laboratory to all analysts. Deviation, if there is any, from the environmental test methods has been documented, technically justified, authorized, and accepted by the client.

20.1.1 Standard Operating Procedures (SOPs)

Analytical procedures used for various laboratory analyses are in accordance with the EPA approved methods. Any variances in the methods have been documented for equivalency based on accuracy and precision data. All variances in the analytical methods are noted in all corresponding SOPs. Controlled SOPs are available to the all analysts. New methods and/or SOPs are distributed throughout the laboratory by issuing controlled copies. Old methods/SOPs are collected before the new documents are given to the analysts. They are also available in the laboratory intranet.

- All SOPs contains a revision number, effective date and approval signatures.
- Procedures in developing and writing a SOP are described in ATL SOP GE-SOP-01, Standard Operating Procedures (SOPs)
- SOPs are reviewed for accuracy and adequacy annually and revised when necessary.
- Administrative SOPs are reviewed and revised every two years or when necessary.

20.1.2 Laboratory Method Manuals

ATLInc maintains in-house method manuals for each accredited analyte or test method.

These method manuals refer to test methods or SOPs that have been written by the laboratory. Each test method includes the following (where applicable):

1) identification of the test method;
2) applicable matrix or matrices;
3) detection limit;
4) scope and application, including components to be analyzed;
5) summary of the test method;
6) definitions;
7) interferences;
8) safety;
9) equipment and supplies;
10) reagents and standards;
11) sample collection, preservation, shipment and storage;
12) quality control;
13) calibration and standardization;
14) procedure;
15) data analysis and calculations;
16) method performance;
17) pollution prevention;
18) data assessment and acceptance criteria for quality control measures;
19) corrective actions for out of control data;
20) contingencies for handling out-of-control or unacceptable data;
21) waste management;
22) revisions
23) references; and
24) any tables, diagrams, flowcharts and validation data.
25) equipment/instrument maintenance;
26) computer hardware/software
27) troubleshooting

20.2 Selection of Methods

The laboratory analyzes those target analytes identified by the client on a project-specific basis. The Project Coordinator is responsible in making sure that proper methods are applied to samples that arrived in the laboratory. ATLInc employs analytical procedures according to the laboratory certification granted by regulatory agencies.

20.2.1 Sources of Methods

Some common sources of methods include Standard Methods for the Analysis of Water and Wastewater, SW-846 Test Methods for Evaluating Solid Waste and Methods for Chemical Analysis of Water and Wastes. The laboratory uses the latest methods as approved by the California Environmental Laboratory Accreditation Program (ELAP), Nevada Division of Environmental Protection and California National Environmental Laboratory Accreditation Program (NELAP).

The laboratory shall inform the client when the method proposed by the client is considered to be inappropriate or out of date. The communication will be documented especially when the client decided to proceed contrary to the laboratory's recommendation.

20.2.2 Demonstration of Capabilities

Prior to acceptance and institution of new methods, satisfactory demonstration of capability is required. The demonstration of capability is done on a clean quality system matrix free of target analytes or interferences. Thereafter, continuing demonstration of method performance is required any time there is a significant change in instrumentation, personnel and methodology. The following steps shall be performed:

a. A quality control sample shall be prepared using stock standards that are prepared independently from those used in instrument calibration. The Laboratory Control Sample (LCS) is used as a quality control sample.

b. Four LCSs shall be prepared and analyzed according to the test method either concurrently or over a period of days.

c. Using all of the results, calculate the Average Recovery in the appropriate reporting units and the standard deviations.

d. Compare the Average Recovery and Standard Deviations to the corresponding criteria for accuracy and precision in the test method if there is any or to the laboratory in-house limit. The default limit is 70-130% for Average Recovery and 20% for Standard Deviations.

When one or more of the tested parameters did not meet the acceptance criteria, the analyst must perform the following:

a. Locate and correct the source of the problem and repeat by analyzing 4 LCSs again for all parameters of interest.

b. Repeat the analysis for all the parameters that failed to meet criteria by analyzing 4 LCSs. Repeated failure confirms a general problem with the measurement system and if this occurs, locate and correct the source of the problem and repeat the analysis of 4 LCSs for all compounds of interest.

A certification statement signed by the Laboratory Director and QA Officer is issued to analysts who have completed their demonstration of capability.

20.3 Laboratory Developed Methods and Non-Standard Methods

The laboratory can develop new method but must be fully define in an SOP, approved and validated by the Laboratory Director and QA Officer. When it's necessary to use methods not covered by standard methods, these shall subject to agreement with the client and shall include a clear specification of the client's requirements and the purpose of the environmental tests.

20.4 Validation of Methods

A method is validated and ready for use if the calibration procedure has been completed, MDL study has been performed, procedure for demonstration of capability was conducted and proficiency testing was performed if applicable.

It is important to differentiate DL, LOD and LOQ in order to get a better understanding of these limits and relate it to its equivalent laboratory terminologies. The following provides the definition of these limits at how it is used in the laboratory:

Detection Limit (DL) – The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value (NELAC). Method Detection Limit (MDL) is one way to establish a detection limit.

Limit of Detection (LOD) – An estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte and matrix specific and maybe laboratory dependent (NELAC). LOD is not equivalent to MDL.

Limit of Quantitation (LOQ) – The minimum levels, concentrations, or quantities of a target variable (e.g. target analyte) that can be reported with a specified degree of confidence (NELAC). For US Department of Defense (US DoD) projects, it is defined as the lowest concentration that produces a quantitative result within specified limits of precision and bias. LOQ shall be set at or above the concentration of the lowest initial calibration standard. At the laboratory, this is also equivalent to practical quantitation limit (PQL).

ATL SOP GE-MDLS-01, Method Detection Limits and Instrument Detection Limits describe the overall procedure on how they are generated and used within the laboratory.

20.4.1 Method Detection Limit (MDL) Study

ATL's methods for which the MDL are developed have been based on the EPA methods 40 CFR 136 - Definition and Procedure for the Determination of the Method Detection Limit.

The calculation for MDL is defined as follows for all measurements:

$$MDL = t_{(n-1,1-\alpha=0.99)} \, x \, S$$

Where:

MDL = the method detection limit
S = the standard deviation of the replicate analyses
$t_{(n - 1, 1 - \alpha = 0.99)}$ = the Students' t-value appropriate to a 99% confidence level and a standard deviation estimate with n-1 degrees of freedom.

Method Detection Limits (MDL) are conducted by the laboratory on initial setup of the method or if there is a major modification of the method. MDLs are performed on a more frequent basis if conditions are changed from the previous MDL study. Examples of such conditions are a new instrument, new or refurbished detector or detector components, or different purge and trap device. The MDL is defined as the minimum concentration of a substance that can be measured and reported with a 99% confidence level that the analyte concentration is greater than zero. This procedure consists of analyzing seven (7) aliquots of a standard at 3 to 5 times the estimated MDL, which is taken through all the sample processing steps of the analytical method. MDLs are matrix dependent. The MDL is defined as the student T-factor times the standard deviation from the seven replicates.

Once the MDL is generated, the department supervisor/group leader, the Laboratory Director, and the QA Officer reviews and approves the MDL study as being valid. The QA Officer then collects and maintains all MDL studies.

Each MDL is compared to the current reporting limits. The analyte reporting limit must be greater than or equal to the established MDL value. The spiking concentration must not exceed 10 times the MDL value. If the MDL fails to meet these criteria, a new sample will be extracted/analyzed and added to the MDL study. In calculating MDL, a new T –factor must be used corresponding to the number of samples analyzed.

MDL is not required for any component for which spiking solutions or quality control samples are not available such as temperature, pH or when test results are not reported outside the calibration range.

20.4.2 Limit of Detection (LOD) Determination and Verification

MDL data shall be used to determine LOD for each analyte and matrix as well as for all preparatory and cleanup methods. After each detection limit determination, LOD must be immediately established by spiking quality system matrix at approximately 2-3X MDL for single analyte standard and 1-4X MDL for a multi-analyte standard. This spike concentration establishes LOD. It is specific to each combination of analyte, matrix, method (including sample preparation), and instrument configuration. The analytes must be qualitatively identified. The LOD must be verified quarterly. The following requirements apply to the initial detection limit/LOD determinations and to the quarterly LOD verifications:

- The apparent signal to noise ratio at the LOD must be at least three and the results must meet all method requirements for analyte identification (e.g., ion abundance, second-column confirmation, or pattern recognition.) For data systems that do not provide a measure of noise, the signal produced by the verification sample must produce a result that is at least three standard deviations greater than the mean method blank concentrations.

- If a laboratory uses multiple instruments for a given method the LOD must be verified on each.

- If the LOD verification fails, then the laboratory must repeat the detection limit determination and LOD verification at a higher concentration or perform and pass two consecutive LOD verifications at a higher concentration and set the LOD at the higher concentration.

- The laboratory shall maintain documentation for all detection limit determinations and LOD verifications.

LOD must be determined each time there is a change in the test method that affects how the test is performed, or when a change in instrumentation occurs that affects the sensitivity of the analysis. LOD should be less than PQL. LOD is not required for a test method which spiking solutions or quality control samples are not available such as temperature, or, when test results are not reported outside of the calibration range. When an LOD study is not performed, the laboratory may not report a value below the PQL.

20.4.3 Practical Quantitation Limit (PQL) Establishment and Verification

PQL is the lowest concentration that can be measured with the consideration for practical limitations such as sample size, matrix interferences and dilutions. PQL must be set within the calibration range (this includes the low calibration point) prior to sample analysis.

The validity of PQL shall be confirmed by successful analysis of a QC sample containing the analytes of concern at 1-2X the claimed PQL. A successful analysis is one where the recovery of each analyte is within the established test method acceptance criteria or client data quality objectives accuracy. PQL verification is conducted quarterly per test method per matrix. Normally, MDL study is performed at PQL concentration or less. The data obtained from MDL study can be used to determine precision and bias at PQL.

PQL verification is not required for any component or property for which spiking solutions or quality control samples are not commercially available like pH, temperature, etc.

20.5 Estimation of Uncertainty

Uncertainty is defined by ISO as the parameter, associated with the result of measurement that characterizes the dispersion of the values that could reasonably be attributed to the measurement.

The ultimate use of uncertainty estimates is to be able to state the goodness of a test result and to allow client or end user to properly interpret data in the report.
Measurement uncertainty in the laboratory can be attributed to different sources like the reference standards and reference materials, methods and equipment and other environmental conditions including the analyst. Qualitative tests or categorical tests do not require measurement of uncertainty. Methods that specify reporting requirements are also not subject to measurement of uncertainty. For all test methods that do not specify reporting requirements and method uncertainty, control charting of Laboratory Control Samples (LCS) results will be the simplest, most direct way of estimating measurement uncertainty. Using control chart, it can be immediately seen that the action limits provide an estimate of

measurement uncertainty at approximately the 99.7% level of confidence (3 sigma) and that warning limits will provide estimates of uncertainty at approximately the 95% level of confidence (2 sigma) (G-104-A2LA Guide for Estimation of Measurement Uncertainty in Testing, July 2002).

ATL SOP GE-UNCERTAINTY-01, Procedures for Estimating Uncertainty provides a guideline for estimating uncertainty of measurements in the laboratory.

20.6 Control of Data

The laboratory has procedures to ensure that reported data are free from transcription and calculation errors.

20.6.1 Electronic Data

ATLInc utilizes LIMS, a customized database that meets the laboratory needs. LIMS integrity is assured by internal user controls. Personnel are issued with unique user name by the IT department upon completion of training and approval from the Laboratory Director. Each personnel are required to create a unique password.

Instrument data output are directly uploaded to the LIMS to prevent error.

Spreadsheets that are used for calculation are verified through hand calculations prior to use and are lock protected.

20.6.2 Logbook Entries

All logbooks/notebooks are controlled by the QA Officer. The cover of each logbooks/notebooks is identified with subject identification (instrument, method, procedure, etc). All analysts making entries in the book are required to print their names with corresponding initials and signatures in the second page of each logbook. All documentation entered must be clear, legible and detailed. Each entry must be dated by month, day and year in which the data were recorded and signed by the person performing the work or entering the data. Corrections should follow procedures outlined in 6.3

All blanks with no data must contain a diagonal line or "Z" out and initialed and dated.

The use of abbreviations is kept to a minimum. Only nationally accepted abbreviations (e.g., mg/Kg, mL, µg/Kg) and chemical formula abbreviations (e.g., NaOH, HCl) may be used without further clarification. Other abbreviations can be used providing the abbreviation can be traced to the corresponding abbreviation explanation.

20.6.3 Data Review/Validation

The data review and validation starts with the analyst who makes sure that all integrations and peak identifications are correct. The analyst must also verify that all LIMSDATA (raw data) is being imported into ELIMS properly. Calculation of results and % recovery must be verified against expected results. The second step of the data validation pathway is the

department supervisors. The Inorganic and Organic supervisors must check and verify all data leaving their department. The third step of data validation is by the Project Managers. They have to make sure that all project requirements have been met. The final step is the Laboratory Director, designated signatory person, or the QA Officer who will oversee that all data reports are correct before going to the client.

Data Review and Validation procedures are outlined in Section 25.3

20.6.4 Significant Figures

For analyses with instrument output records that are compatible with the LIMS system are calculated with all the digits produced by the instrument. Results are reported at 2 significant figures.

For those analyses without instrument printout or instrument output that are not compatible with the LIMS system, raw values are manually entered by analysts including dilution factors using at least 2 significant figures. The LIMS will calculate and results are reported at 2 significant figures.

20.7 Manual Integration

Manual integration should only be performed on sample data when substantial matrix interferences result in quantification errors when automated procedures are used. In the event that manual integration is necessary on any analytical standard, strict documentation requirements are to be followed (the chromatograms obtained before and after the manual integration must be retained to permit reconstruction of results).

Manual integrations are necessary when the software identifies the wrong peak, does not integrate the peak or the integration takes positive or negative area from the peak. The chemist must then re-integrate the peak. After the quantitation report is printed, the analyst must put the reason for doing manual integrations and initial and date.

If manual integration is performed, it must follow a pattern and be consistent so that (a) automatic and manual integrations are consistent, (b) continuing calibration verification standards are integrated the same as initial calibration standards, and (c) target analytes surrogates, and matrix spiked analytes in samples are similarly processed.

The ATL SOP GE-MINTEGRATION-01, Manual Integrations describes standard practices for performing and documenting integration of chromatographic peaks and provides guidelines to analyst in making ethical judgment regarding manual peak integration.

Section 21.0 EQUIPMENT and CALIBRATION REQUIREMENTS

Appendix G lists the various instrumentation and equipment currently available in the laboratory.

Equipment shall be operated by authorized personnel only. Up-to-date instructions on the use and maintenance of equipment (including any relevant manuals provided by the manufacturer of the equipment) shall be readily available for the use by the appropriate laboratory personnel.

21.1 Preventive Maintenance Activities and Schedules

Instruments are maintained according to the SOPs using the manufacturer documentation. Repairs are conducted as needed, either by manufacturer representatives or by in-house personnel. Routine maintenance (lamp replacement, etc.) is conducted as needed to maintain instrument integrity.

Critical equipment and instrumentation are maintained on a scheduled basis to minimize analytical downtime. Hard bound maintenance logbooks are kept for each equipment. The analysts also records routine and unscheduled maintenance. Each entry must contain at the minimum: date, event/problem, corrective action, proof of conformance, and initials.

Equipment that has been subjected to overloading or mishandling, gives suspect results, or has been shown to be defective or outside specified limits should be taken out of service. It must be clearly labeled or marked “Out of Service”, until it has been repaired and known by calibration or test to perform correctly. All corrective action done on the instrument must be recorded on the maintenance logbook as proof of conformance.

21.2 Support Equipment

This section applies to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, temperature measuring devices, thermal/pressure sample preparation devices and volumetric dispensing devices if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume.

21.2.1 Weights and Balances

Each analytical and top-loading balance in the laboratory is calibrated daily using two traceable weights that bracket the expected weights to be measured. These calibration weights used for daily check are calibrated against Class “1” weights on annual basis. This calibration is recorded in the calibration notebook of each balance. The reading must be within the specified acceptance limits: Top-loading balance: ±2% or ±0.02g, whichever is greater; Analytical balance: ±0.1% or ±0.05 mg, whichever is greater. If the reading falls outside the acceptance limit, a non-conformance form must be submitted and the problem addressed.

The Class “1” weights are sent for outside calibration every five years.

ATL SOP GE-BALANCES-01, Calibration of Analytical Balances and Top-loading Balances, describes the procedures on how to calibrate an analytical or top-loading balance.

21.2.2 Thermometers

Thermometers throughout the laboratory are calibrated before first use and annually against a NIST traceable thermometer. IR guns are calibrated before first use and checked against

in-house calibrated thermometer daily. The NIST traceable thermometer is sent for outside calibration on annual basis. Each thermometer in the laboratory is labeled with an identifier code and the positive or negative correction factor. The positive or negative correction factor must be applied to all temperature readings from that particular thermometer. The reading must be within the specified limits for the type of thermometer. If the temperature reading falls outside the acceptance limit, a non-conformance form must be submitted and the problem addressed.

ATL SOP GE-THERMOMETER-01, Thermometers describes the calibration of all thermometers according to purpose.

21.2.3 Pipettes, Burettes and Syringes

Pipettes are calibrated by measuring the weight of a volume of water. Calibration checks of the pipettes are performed daily. The reading must be within the specified acceptance limits (See Pipette SOP for details of acceptance limits). If the reading falls outside the acceptance limit, a non-conformance form must be submitted and the problem addressed.

Eppendorf pipettes are calibrated at a minimum of 1 week. See ATL SOP GE-EPPENDORF-01, Calibration of Eppendorf Pipettes for details of calibration and acceptance limits.

Mechanical volumetric dispensing devices (except Class A and glass microliter syringes) are calibrated by lot before first use and quarterly.

Glass microliter syringes are considered as Class A glassware but must come with a certificate attesting to established accuracy or the accuracy must be initially demonstrated and documented by the laboratory.

21.2.4 Ovens, Refrigerators/Freezers, Incubators, Water Baths

The temperature of refrigerators and freezers must be monitored each working day. Refrigerators and freezers used for sample storage must be monitored daily (7 days per week).

Ovens and water baths are checked in the expected use range prior to each use. Temperature ranges/settings are specified in specific SOPs. For drying ovens, temperatures must be within ±5% of set temperature.

21.3 Instrument Calibration

Calibration refers to the relationship of concentrations of known analyte standards versus the instrument response to the analyte. It is a reproducible reference point to which all sample measurements can be correlated.

ATL has established procedures for the calibration of each laboratory instrument and equipment. Procedures for calibration are discussed in detail in method SOPs. The instruments are calibrated following the requirements of the specific methods of analysis. If

there is no method specific calibration procedure, manufacturer's recommended procedure is used. All calibrations and acceptance criteria are checked for conformance to the specific method requirements. The data resulting from the instrument calibration and the associated QC procedures used determine the frequency of the calibration process.

Sufficient raw data records must be retained to permit reconstruction of the initial instrument calibration, e.g. calibration date, test method, instrument, analysis date, each analyte name, analyst's initials or signature; concentration and response, calibration curve or response factor, or unique equation or coefficient used to reduce instrument responses to concentration.

Sample results must be quantitated from the initial instrument calibration and may not be quantitated from any continuing instrument calibration verification, unless otherwise required by regulation, method or program.

Criteria for the acceptance of an initial instrument calibration must be established, e.g., correlation coefficient or relative percent difference. The criteria must be appropriate to the calibration technique employed.

If the initial instrument calibration results are outside established acceptance criteria, corrective actions must be performed and all associated samples reanalyzed. If reanalysis of the samples is not possible, data associated with an unacceptable initial instrument calibration shall be reported with appropriate data qualifiers.

21.3.1 Calibration Standards

Calibration standards are prepared following procedures in the laboratory SOPs. If a reference or mandated method does not specify the number of calibration standards, the minimum number is five for organic analytes and three for inorganic analytes (one which must be at Limit of Quantitation), not including blanks or a zero standard except for ICP or ICP/MS.

The lowest calibration standard shall be at or below the Practical Quantitation Limit (PQL) but above the Limit of Detection.

Measured concentrations outside the working range shall be reported using defined qualifiers or flags or explained in the case narrative with the exception of ICP methods and methods that doesn't specify use of two or more standards.

All reported target analytes and surrogates (if applicable) shall be included in the initial calibration.

21.3.2 Initial Calibration Verification (ICV)

The initial calibration must be verified by analyzing a second source standard. ICV standard can be a standard from a different manufacturer or different lot number used for initial calibration. The concentration of the second source shall be near the midpoint of the calibration range. Acceptance criteria are based on the reference methods or from project specific requirements. Initial calibration verification shall be successfully completed prior to

analyzing any sample.

If ICV fails, check standard and standard preparation and analyze new set. If ICV passed the criteria, the initial calibration is verified and ready for sample analysis. ICV still fails, check instrument and prepare new calibration.

21.3.3 Continuing Calibration Verification (CCV)

Instrument calibration verification applies to both external and internal standard calibration as well as to linear and non-linear calibration. CCV standard should be the same as the source for the initial calibration standards. The concentration of the CCV standard shall be between the low calibration standard and the midpoint of the calibration range.

Instrument calibration verification must be performed at the beginning and end of each analytical batch except if an internal standard is used like GC/MS on which only one verification needs to be performed at the beginning of 12-hr analytical shift. The 12-hr analytical shift begins with the injection of the calibration verification (or the MS tuning standard in MS methods) and ends after the completion of the analysis of the last sample or standard that can be injected within 12 hours of the beginning of the shift. Some methods have more frequent CCV requirements (see specific SOPs). Inorganic methods require the CCV to be analyzed after every 10 samples and at the end of the sequence.

CCV standard must be within established limit. If CCV fails and immediate reanalysis still fails, corrective actions must be performed. Once corrective actions have been completed and documented, the laboratory has to demonstrate acceptable performance with two consecutive CCVs or a new calibration must be performed.

The laboratory shall reanalyze CCVs and all samples analyzed since the last successful calibration verification. If reanalysis is not possible, data reported with appropriate qualifiers and explained in the report's case narrative. Data associated with unacceptable calibration verification may be fully useable under the following special conditions:

- When the acceptance criteria for the continuing calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise the samples affected by the unacceptable calibration verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

- When the acceptance criteria for the continuing calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise the samples affected by the unacceptable verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

Data reported by the conditions above will be flagged with appropriate qualifier.

DoD requires that if the laboratory routinely analyzes two CCVs, then both CCv's must be evaluated. If either CCV fails, perform corrective action and reanalyze all samples since last acceptable calibration verification.

SECTION 22.0 MEASUREMENT TRACEABILITY

22.1 Reference Materials

Reference materials can be used in the laboratory to verify results against a certified value. These reference materials are purchased from NIST certified vendors or the PT provider. ATL utilizes certified reference materials to validate methods, verify instrument performance, preparation procedures, standard preparation and calibrations.

22.2 Documentation and Labeling of Standards, Reagents, and Reference Materials

As chemicals and solvents are received in the laboratory, each individual type of chemical must be documented according to the date received, opened, and expired (ROE). The laboratory records the inventory code, chemical name, formula, location of storage, vendor, lot number, grade/purity, date received, date of expiration, status, CAS number, Catalog number and comments into the LIMS. (This information is temporarily being recorded in the manual system.) Certificate of Analysis are retained as well.

Standard solutions are properly labeled as to name of solution, concentration, solvent, date of preparation, date of expiration and initial of who prepared. Standard preparation is documented in the standard preparation logbook. The standards are stored in places where these are protected from degradation and contamination.

Refer to Organic & Inorganic Standard Code SOPs for procedures in creating standard codes.

SECTION 23.0 SAMPLING

23.1 Sample Collection

Sampling is done by outside contractors mostly by clients, i.e., environmental engineering consultants, and government contractors.

23.2 Holding Time and Preservation

The laboratory conforms to all regulations for holding times and preservations. See Appendix H for tables of holding times and preservations (Referenced from EPA SW-846, Standard Methods, 40 CFR Part 136). Sample holding time, preparation, and analyses follow the specified method requested for analysis.

The laboratory can also provide containers with chemical preservation for clients requesting containers ahead of time.

23.3 Sample Containers Preparation

To ensure sample integrity, steps are taken to minimize contamination from the containers by lot analyses verification of cleanliness. If the analyte(s) to be determined is organic in nature, the preferred container is made of glass. If the analyte(s) is inorganic, then the container is plastic. Sample containers supplied to the clients are either commercially obtained as pre-cleaned containers or verified clean by ATLInc lab analyses. Purchased pre-cleaned containers must be accompanied with certificate of analysis.

ATLInc prepares all sample containers, including trip or transport blanks, according to the requirements stated in 40CFR, Part 136, Guidelines Establishing Test Procedures for the Analysis of Pollutants and SW 846.

23.4 Subsampling

Taking out a portion of material from a laboratory sample bottle for weighing and analysis is a sample mass reduction step and should be performed with correct subsampling practices in order to get a representative sample of the parent sample it is derived. The ATL SOP GE-SUBSAMP-01, Subsampling describes the laboratory protocol when a single container sample is requested for multiple analyses, taking samples if dissolved analysis is requested, taking aliquot samples form brass tubes/sleeves and glass jars, and subsampling heterogeneous sample.

23.5 Handling of Samples

23.5.1 Chain of Custody (COC)

Chain-of-custody procedures are used and implemented in the laboratory. The purpose of COC is to establish a detailed documentation of all transactions in which the samples are transferred from the custody of one individual to another. These procedures are used from the point at which the samples are collected to the opening of the samples in the laboratory, and the subsequent disposition of unused samples. A COC form documents sampling efforts and sample transfer from the field to a testing facility or between testing facilities. An example of an ATLInc chain-of-custody form is shown in Appendix I. A sample is considered in the possession of the laboratory upon receipt of ATLInc courier.

If samples need to be subcontract, a new ATLInc COC form, that cross references the original COC, is generated to accompany samples delivered outside the laboratory.

23.5.2 Sample Receiving Procedure

Samples received at ATLInc are considered as physical evidence and are handled according to the procedural safeguards established by EPA.

The ATL SOP GE-LOGIN-01, Sample Receipt, Control and Login describes in detail how

samples are received, the step-by-step sample log-in process, how samples are tracked from receipt to completion, and the overall responsibilities of the Sample Control Officer.

23.5.2.1 Sample Acceptance Policy

ATLInc has established a sample acceptance policy procedure to better serve its clients. Analytical results from samples that do not satisfy the laboratory sample acceptance policy will be noted on the case narrative.

- Proper, full and complete documentation of the chain-of-custody form that includes sample identification and location, date and time of collection (time is required especially for samples with holding time of less than 48 hrs), collector's name, sample matrix, preservation and test required on samples. See Appendix I for ATLInc's COC.

- Sample labels that are intact and Sample IDs legibly written to identify sample. Use of indelible or water resistant ink is advised.

- Samples have unique identification or sample IDs.

- Samples have proper container and preservative as required by the method. See Appendix H for container type and preservative for each test.

- Samples received in the laboratory within method holding time. For a list of holding time for each test, see Appendix H. When samples are received for field tests with short holding time like pH and residual chlorine, the laboratory will analyze the samples as soon as possible or within 24 hrs. Data from samples that are analyzed out of holding time are flagged with H qualifier.

- Adequate sample volume provided for test requested. For a list of required sample volume, see Appendix H.

- Sample received at required temperature of ≤ 6°C or there is evidence of chilling like received on cooler with ice for samples collected and received on the same day.

- Sample does not show sign of damage or contamination like loosely cap lid.

- Water samples for volatiles analysis should have minimum headspace. The size of any bubble if there is any should not exceed 5 - 6 mm.

Document all discrepancy in the sample receipt checklist. Client must be informed by e-mail or telephone for any sample that does not meet the above requirements. The communication can be either by e-mail or telephone and must be documented on the client correspondence log. Any instruction from client should be noted in the correspondence log. If the laboratory does not receive response from client and there is holding time issue, the laboratory will proceed with analysis.

23.5.2.2 Sample Verification

A sample custodian receives a sample shipment or delivery. An alternate person is designated to receive samples if the Sample Control Officer is not available. The following procedures are taken during the process.

- Coolers should be opened under a fume hood, wearing the appropriate personal protection equipment.
- The cooler temperature is taken through the use of one or more temperature blank(s) for each transport container. If temperature blank is not available, the laboratory uses an IR gun to monitor the surface temperature of sample containers. The cooler temperature is recorded on the project folder. The acceptance criterion for the cooler temperature is ≤ 6 degrees Celsius.
- Presence or absence of custody seals or tape on the shipping containers and the condition of the seals (i.e. intact, broken, etc.) are noted on the chain of custody.
- If the COC is not available with the samples, a Sample Control Personnel or Client Service person must call the client to request the COC.
- The COC accompanying the samples is signed and dated. A copy of the COC is kept in the project folder.
- The Sample Control Personnel must check agreement between client's sample labels, ATL's labels and COC. If there are any discrepancies, then client must be notified immediately of any problems.

23.5.2.3 Sample Login

Login begins with assigning an ATLInc Laboratory workorder number from ELIMS (Environmental Laboratory Information Management System). This is a seven digit sequential number that identifies the samples by batch.

- Within each workorder, the samples are assigned an individual number starting at 001A. A sample is defined as having a unique client ID. A workorder with 10 samples will be labeled as N002500-001A / 010A.
- Those samples that have the same client ID but have different bottle/preservation must have individual fraction assigned to each bottle. A sample with 3 fractions will be labeled as N002500-001A / 001C.

- For VOA vials, the ELIMS will assign multiple containers with 1 of 2, 2 of 2, etc. VOAs with headspace will be assigned the higher number. Analyst will analyze first the 1 vial.

Turnaround time for samples received after 3:00 pm starts at 8:00 am the following day. Samples are login for the test requested using in-house specific testcodes.

Other login information including information for specific sample handling, QA/QC, detection limits are documented in the "Comments" section of the sample login of ELIMS.

A sample-receiving checklist is filled out on the ELIMS. The checklist documents the carrier name, cooler temperature, shipment/sample condition questions and Sample Control personnel initials. A printout of the checklist is placed into the project folder.

An electronic project folder is created for each WorkOrder. A WorkOrder COC generated by ELIMS is pdf printed and placed into the electronic folder. All sample receiving documentation that includes COC, sample receipt checklist and client communication is placed to its corresponding project folder for supervisor's review.

23.5.2.4 Sample Labeling

After the samples have been logged into the ELIMS, a sample label is printed containing the client ID, ATL laboratory number, date received and the barcode. When affixing label to the container, sample control personnel must compare client sample ID written on the laboratory's label versus client's sample label. If the labels do not match, sample login and chain of custody must be reviewed for errors and corrected as needed.

23.5.2.5 Sample Preservation Check

The preservation of all aqueous samples for Metals, Sulfide, and Cyanide must be verified in Sample Control. A small aliquot is transferred to a plastic container and the pH tested using a pH strip. The result is recorded in the pH/preservative logbook and the corresponding test.

For samples received that are not preserved, sample control will preserve the sample to meet the test requirement.

- Sulfide - add zinc acetate and NaOH to adjust the pH to >9.

- Cyanide - oxidizing agents such as chlorine decompose most of the cyanides. Test a drop of the sample with potassium iodide-starch test paper; a blue color indicates the need for treatment. Add Ascorbic acid, a few crystals at a time, until a drop of sample produces no color on the indicator paper. Then add 0.06 grams of ascorbic acid for each liter of sample. Adjust pH to >12 with 10N NaOH.

- Metals (Total Recoverable) - adjust the pH with HNO_3 to pH <2. Following

acidification, the sample should be mixed, held for 24 hours, and then verified to be pH <2 just prior to withdrawing an aliquot for processing or "direct analysis". If for some reason such as high alkalinity the sample pH is verified to be > 2, more acid must be added and the sample held for 24 hours until verified to be pH < 2.

- Oil and Grease (EPA 1664) – Samples received for Oil and Grease or TRPH that are not marked preserved are treated by adding hydrochloric acid (HCl). Sample pH is checked following EPA 1664 SOP for pH verification.

23.6 Sample Storage

23.6.1 Samples

Sample control department is responsible for the proper sample storage.

- Samples received by the laboratory are placed into refrigeration units, which are restricted to authorized laboratory personnel. Samples for volatile analysis are kept in a separate refrigerator. The temperature of the refrigerators is monitored for the acceptable temperature range.

- Acceptable refrigerator temperature range is ≤ 6^{o} C.

- Temperature of the sample storage refrigerators is monitored daily for acceptable working temperature range using an NIST traceable thermometer. See Section 5.4.2 for thermometer and refrigerator/freezer calibrations.

- Corrective actions are taken if the refrigerators malfunction or the temperature is out of acceptable range. A Non-Conformance Form is submitted to the QA Officer following the corrective action.

- If a client submits samples to the laboratory, which could or/will, go to litigation, the laboratory can make provisions to store the samples into a separate walk-in refrigerator. The refrigerator can be locked and secured until a written notice is received from the client. The client must approve transferring or disposal of samples. A written authorization must be faxed to the laboratory confirming status of samples. All documentation must be placed into the project folder.

23.6.2 Extracts, Digestates and Leachates

The department that performs the extraction and digestion is responsible for the storage of extracts, leachates and digestates. Once the sample has been processed, the extract, digestate or leachate must be stored according to method specified conditions. The digestates for metals are stored at room temperature until sample analysis. Organic extracts can be stored up to 40 days at ≤ 6° C. The extracts must be stored in a separate refrigerator from that housing the analytical standards. The leachates (from tests such as TCLP) can be stored prior to the preparation stage or the analytical stage. Each has a holding time and/or preservation requirements. See method SOPs for details.

23.6.3 Refrigerator Blank

Samples or extracts designated for volatile organics analysis must be segregated from other samples and extracts. Samples suspected of containing high concentrations of volatile organics shall be further isolated from other volatile organic samples.

Storage or refrigerator blanks are used to determine if cross contamination occurred. A refrigerator blank also known as holding blank is made by placing a preserved filled VOA with water or a VOA with blank soil inside the refrigerator for seven days to monitor storage contaminants. After seven days, the VOA is log to be analyzed for EPA 8260. The results are checked by the QA Officer and filed by the Sample Control Officer.

23.7 Sample Traceability in the Laboratory

Traceability of the samples that are transferred to or from the laboratory is tracked by the use of the ATLInc laboratory number (batch) and client sample identification. These are monitored from the point of acquisition by the laboratory through the sample preparation, analysis, data reduction, data validation, final report generation, and sample disposal.

Sample traceability throughout the laboratory is achieved by using the ELIMS Sample Tracker.

- When the samples are given to the chemist, ELIMS records the date, time, samples, the name of the chemist the samples were transferred to and the Sample Control personnel initials.

- When the samples are returned to Sample Control, the date, time, samples and the location of the walk-in refrigerator are recorded.

- When samples are transferred to Sample Disposal, ELIMS records the date, time, samples, transfer location and the Sample Control personnel initials.

- Samples that are consumed, broken, disposed or returned to the client are recorded by ELIMS with the date and time of transaction.

In the Sample Preparation Areas, sample traceability is documented on the organic extraction and metal digestion logbooks. After the samples have been prepared, the extractor or digestor gives the extracts and an extraction printout from ELIMS to the analyst.

Sample traceability continues through the analysis, data reduction, data validation, final report generation, and sample disposal by the use of the ATLInc laboratory number. All result templates, folders, invoices, and final reports document the ATLInc laboratory number for all samples.

23.8 Sample Disposal

Unused and remaining portions of the samples received in the laboratory are kept for at least 45 days upon receipt (or as stated by the project requirements). A sample disposal fee is charged if client prefers the laboratory to dispose them. Laboratory sample disposal is in accordance with the local, state, and federal regulations.

Laboratory waste is segregated according to hazard class. Non-hazardous waste is disposed of in one of two ways: non-hazardous aqueous waste is neutralized and disposed with excess water. Non-hazardous soil samples are disposed of in the regular trash.

Hazardous wastes are segregated by organic and inorganic type material. This material is packaged in steel drums. Oil samples are also segregated into steel drums for recycling. Waste solvents and solvent-based extracts are stored in steel drums for recycling. A licensed disposal company performs all handling of hazardous waste.

ATL SOP GE-DISPOSAL-01, Sample Disposal provides a detailed pathway how to handle and dispose environmental sample disposals.

SECTION 24.0 QUALITY ASSURANCE for ENVIRONMENTAL TESTING

24.1 Proficiency Testing Program

ATL participates in performance evaluation sample analyses as a requirement of NELAP (National Level), ELAP (State Level) and NDEP (Nevada). The laboratory joins the proficiency testing (PT) program provided by a third party on a semi-annual basis. Proficiency testing is performed for wastewater, drinking water and hazardous waste program. Results from these are reported to the regulatory agencies for compliance with certification requirements. Analyst's training records are also updated with the result of the proficiency testing and data are used for continuing demonstration of capability.

If there is "unacceptable" result on proficiency testing, the analyst must investigate the root cause of the problem, correct the issue and perform a corrective action PT. A corrective action letter is submitted to the State Agency for all analytes that did not pass acceptance criteria. Another proficiency sample may be submitted for evaluation.

The QA Officer is responsible for assigning, ordering and reporting PT samples from an accredited PT provider. The QA Officer is responsible for record keeping of PT results and entering result of the study into an Access database.

ATL SOP GE-PT-01, Proficiency Testing Program indicates procedure to treat PT samples as regular samples, i.e., managed, analyzed and reported in the same manner as real environmental samples utilizing same staff, methods as used for routine analysis of that analyte, procedures, equipment, facilities, and frequency of analysis.

24.2 Quality Control Parameters

Data generated at ATL are assessed for data quality in terms of accuracy, bias and precision. QC results are reported together with the final sample results. When the project or client requests QC data, a blank, duplicate, spike, and a standard reference material are analyzed for each set of samples for precision and accuracy data. The exact quality and quantity of the QC samples are determined by the project or client.

Method QA/QCs are those measures taken to evaluate the method protocols and provide assurance that the values being obtained are correct. These are run at a frequency of one (1) per batch (batch QC sample frequencies and batch size are defined by the method series requirement and/or project requirements). A batch is defined as a group of samples, which are analyzed together with the same method sequence and with the manipulations common to each sample within the same time period or in continuous sequential time periods. Samples in each batch must be of similar composition.

Samples are analyzed in the laboratory per batch. A typical batch usually consist 20 samples, Method Blank (MB), Laboratory Control Sample (LCS), Matrix Spike (MS) and Matrix Spike Duplicate (MSD) or as required by method or client requirements. A duplicate sample can also be analyzed per client request or method requirement. A batch cannot have more than 20 samples.

24.2.1 Negative Control

24.2.1.1 Method Blank

Method Blank is an analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank should be carried through the complete sample preparation and analytical procedure. It is used to assess contamination resulting from the analytical process.

A minimum of one method blank must be included with each set of 20 or fewer samples.

Target analytes present in the method blank should be below the reporting limit or less than 1/10 of sample concentration or 1/10 the regulatory limit (whichever is greater). For DoD projects, the method blank should be below ½ the reporting limit or less than 1/10 of sample concentration or 1/10 the regulatory limit (whichever is greater)

If the method blank is contaminated, then the laboratory shall reprocess affected samples in a subsequent preparation batch, except when sample results are below the PQL. If insufficient sample volume remains for reprocessing, the results shall be reported with appropriate data qualifiers.

The following are also Negative Controls:

- Calibration Blank – reagent water containing no analytes of interest, prepared and analyzed together with the calibration standards. Used to determine the zero ppoint of the calibration curve for all initial and continuing calibrations

- Instrument Blank – a clean sample or reagent water prepared and processed during the analytical sequence used to determine instrument contamination.

- Trip Blank – is submitted by the client with each shipment of water and soil samples for volatile analyses or as specified in the project QAPP. Used to assess contamination during handling and shipment.

- Equipment Blank – created in the field, usually prepared by blank water rinsed sampling equipment to assess effectiveness of decontamination

- Refrigerator Blank – also referred as holding blank, used to monitor contamination in sample storage of VOC samples.

For Trip, Equipment and Storage Blanks, if contaminant analyte is at or above the reporting limit and is greater than 1/10 of the amount measured in any sample, the results are considered suspect and are reported as estimated. For DoD projects, no analyte should be greater than ½ the reporting limit.

24.2.2 Positive Controls

24.2.2.1 Laboratory Control Sample (LCS)

LCS is an aliquot of laboratory reagent blanks to which known quantities of the method analytes are added in the laboratory. All analyte concentrations shall be within the calibration range of the methods or at project-specific concentration of concern. If this is not specified, it shall be at or below the midpoint of the calibration curve. The components to be spiked shall be as specified by the mandated test method or other regulatory requirement or as requested by the client. In the absence of specified spiking components the laboratory shall spike per the following:

- For those components that interfere with an accurate assessment such as spiking simultaneously with technical chlordane, toxaphene and PCBs, the spike should be chosen that represents the chemistries and elution patterns of the components to be reported.
- For methods that have extremely long lists of analytes, a representative number may be chosen: 1-10 target analytes, spike all components; 11-20, spike at least 10 or 80%, whichever is greater; >20 target analytes, spike at least 16 components. However, all target analytes should be included in the spike mixture over a 2-year period.

The LCS is analyzed exactly like a sample, and is used to evaluate ongoing laboratory performance and analyte recovery in a clean matrix.

A minimum of one LCS must be included with each set of 20 or fewer samples. Exceptions would be for those analytes for which no spiking.

LCS is recovery is calculated as:

$$\%\,Recovery = \frac{Concentration\,Found}{True\,Concentration} x\,100$$

For example, if the LCS True Concentration is 50 ug/L and the Concentration Found during the analysis is 46 ug/L, then (46/50)*100 = 92% recovery.

LCS recovery should be within control limit. Control limit maybe based on laboratory generated in-house limit, method default limit or client specific limit.

If the LCS recovery is outside control limit, samples analyzed along with the LCS shall be reprocessed and re-analyzed or the data reported with appropriate data qualifying codes. If LCS recovery is biased high and samples were none detect (ND), it is not necessary to reanalyze LCS and samples.

24.2.3 Sample Specific Controls

24.2.3.1 Matrix Spike (MS)

MS is aliquot of environmental sample to which a known quantity of the method analyte is added in the laboratory. The spiking occurs prior to sample preparation and analysis. The MS is analyzed exactly like a sample, and is used to determine whether the sample matrix contributes bias to the analytical results. A minimum of one MS must be included with each set of 20 or fewer samples.

The background concentration of the analyte in the sample matrix must be determined in a separate aliquot and the measured value in the Matrix Spike corrected for background concentration.

Matrix spike recovery is calculated as follows:

$$\%\,Recovery = \frac{Spike\,Sample\,Result - Original\,Sample\,Result}{Spike\,Concentration} x\,100$$

For example, if the Spike Concentration is 50 ug/L, the Spiked Sample Result is 54 ug/L, and the original Sample Result is 6 ug/L, then (54-6)/50*100 = 96%.

Matrix spike recovery should be within control limit. Control limit maybe based on laboratory generated in-house limit, method default limit or client specific limit.

For matrix spike results outside established criteria, corrective action shall be documented or the data reported with appropriate data qualifying codes.

24.2.3.2 Matrix Spike Duplicate (MSD)

MSD is a duplicate of the Matrix Spike used to determine the precision and bias of a method in a given sample matrix. A minimum of one MSD must be included with each set of 20 or fewer samples.

MSD recovery is calculated the same as the matrix spike. Relative Percent Difference (RPD) of MS and MSD concentration is calculated as follows:

$$Duplicate\ \%RPD = \frac{MS_{result} - MSD_{result}}{\left(\frac{MS_{result} + MSD_{result}}{2}\right)} x\,100$$

For example, if the original result is 250 mg/L and the duplicate result is 200 mg/L, then [(250-200)/(250+200)/2] *100 = 22

MSD recovery and %RPD should be within control limit. Control limit maybe based on laboratory generated in-house limit, method default limit or client specific limit.

For matrix spike duplicate results outside established criteria, corrective action shall be documented or the data reported with appropriate data qualifying codes.

24.2.3.3 Sample Duplicates

Sample duplicates are replicate aliquots of same sample taken through the entire analytical procedure to determine the precision of analytical results in a given matrix. Duplicate analysis is performed only as required in test method or per client request. At a minimum, duplicate is analyzed each set of 20 or fewer samples or as specified by the mandated test method or per client request.

%RPD of sample duplicates is calculated and should be within control limit. Control limit maybe based on laboratory generated in-house limit, method default limit or client specific limit.

For sample duplicate results outside established criteria, corrective action shall be documented or the data reported with appropriate data qualifying codes.

24.2.3.4 Surrogates

Most organic analyses make use of surrogates. Surrogate is an organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples (SW-846, Chapter One). Surrogates are added to samples and QCs prior to sample preparation/extraction and recovery are compared against method default limit or based on in-house laboratory limit.

Surrogate recovery is calculated using the formula below:

$$\%Recovery = \frac{Concentration\ Found}{True\ Concentration} x\ 100$$

For example, if the Surrogate True Concentration is 0.5 ug /L and the Concentration Found during the analysis is 0.4 ug/L, then (0.4/0.5)*100 = 80% recovery.

If the surrogate recovery is outside control limit, samples must be reprocessed and re-analyzed or the data reported with appropriate data qualifying codes. If surrogate recovery is biased high and analyte(s) is none detect (ND), it is not necessary to reanalyze samples.

24.3 Quality Control (QC) Limit

The analysis of QC samples for organics, metals, and general chemistry demonstrate that adequate recoveries have been obtained in spiked (fortified) samples, check for matrix interference in samples, confirm that reagents used for analyses have no impurities that interfere with the analysis of the analyte, identify if cross-contamination between samples has occurred during workup, check laboratory performance against reference materials, and verify the precision and accuracy of methods. The results from the QC samples such as matrix spike (MS), matrix spike duplicate (MSD), laboratory control sample (LCS), and surrogates (if applicable) are compiled and graphed on control charts. The primary functions of the control charts are to define control limits for the individual methods and as a performance monitoring tool.

The laboratory follows at least the minimum quality control requirements specified by each method (if and only if all parameters are the same). In general, these method specific quality control requirements will be used as a guideline to determine approximate limits until in-house limits can be generated. The laboratory will follow whichever limits are the most stringent.

If the method does not specify limits or guidelines for quality control requirements, the laboratory will default to recovery limits such as 80 – 120% and RPD of 20% (for inorganic methods such as wet chemistry and metals) or recovery limits of 70 – 130% and RPD of 30% (for methods such as purgeable and extractable organics) until in-house limits can be generated.

If the method only has guidelines for the quality control requirement, then the laboratory will use them strictly as guidelines and set default limits as stated above until in-house limits can be generated. For tests where in-house control limits are used, these are updated on annual basis.

The acceptability of LCS/MS/MSD results within any preparatory batch shall be based on project-specified limits if available. In the absence of project specified limits, the laboratory will use its in-house limits for batch acceptance. The laboratory in-house limits are calculated from the laboratory's historical LCS/MS/MSD data in accordance with its SOP. ATLInc SOP GE-CCHARTS-01. Control Charts and Control Limits describes the process for establishing and maintaining LCS limits and the use of control charts. In summary, in-house limits are generated using a minimum of 20 points generated under the same analytical process. No point is excluded from the calculation unless there is a documented and scientifically valid reason. Average (Ave) and standard deviation (SD) were calculated and in-house limits are generated using Ave $\pm$ 3SD.

See Appendix J for current in-house control limits.

24.4 Marginal Exceedance

If a large number of analytes are in the LCS, it becomes statistically likely that a few will be outside control limits. This may not indicate that the system is out of control; therefore corrective action may not be necessary. Upper and lower marginal exceedance (ME) limits can be established to determine when corrective action is necessary. A ME limit is four (4) standard deviations around the mean.

The number of allowable marginal exceedances is based on the number of analytes in the LCS. This ME approach is relevant only for methods with long lists of analytes and do not apply to methods with fewer than 11 target analytes. The number of allowable ME is as follows:

- >90 analytes in LCS, 5 analytes allowed in ME of the LCS control limit
- 71-90 analytes in LCS, 4 analytes allowed in ME of the LCS control limit
- 51-70 analytes in LCS, 3 analytes allowed in ME of the LCS control limit
- 31-50 analytes in LCS, 2 analytes allowed in ME of the LCS control limit
- 11-30 analytes in LCS, 1 analytes allowed in ME of the LCS control limit

If one analyte exceeds the ME limits, the LCS fails and corrective action is necessary. Marginal exceedances must be random. If the same analyte exceeds the LCS control limit repeatedly, it is an indication of a systemic problem. The source of the error must be located and corrective action taken.

SECTION 25.0 REPORTING OF RESULTS

25.1 General

The results of each test and analyses carried out by the laboratory are reported accurately, clearly, unambiguously and objectively, and in accordance with State and Federal requirements as well as client specific requirements

Upon completion of all required analyses, the results are submitted for final report generation. At all stages of Data Handling (Data Collection, Validation, and Reporting), the laboratory staff and management review all data before the final deliverable package is released. The following steps detail the internal laboratory procedure that ensures the final report is complete and concise format. All final reports must be signed by the Laboratory Director or designee before they are released to the client.

25.2 Data Collection and Review

Computers are used to collect and quantify data from the GCMS, GC, AA, ICP and ICP-MS and other instruments. Instrument output can be imported into the ELIMS for calculations and reporting. General chemistry results are manually typed into the ELIMS for reporting.

Data are spot-checked for accuracy. Concentration of the analytes found in the analysis for organics, metals, and general chemistry will be expressed according to required units depending on the sample matrix, i.e., µg/L or µg/Kg.

Data collection and review include the following:

- Review of sample documents for completeness by the analyst(s) at each step of the analysis scheme.

- Daily review of quality control indicators such as blanks, surrogate recoveries, duplicate analyses, matrix spikes analyses, etc. The quality control indicators must be evaluated using specific criteria described in Section 24.2. If any indicator is outside the acceptance criteria, then the analyst must follow the SOP for Non-Conformance, Corrective Actions.

- All analyses must have data qualifiers for such items as:

    - All results must be flagged if the method blank contains hits above the reporting limit.
    - All results must be flagged for samples analyzed past holding time.

    - All manual integrations must be dated and initialed by the analyst and must follow the manual integration policy.

    - The analyst prints a “preliminary” report from the ELIMS program. The analyst reviews all raw data and the “preliminary” report prior to submittal for:

        - Correct sample identification on raw data
        - Correct analytical method
        - Correct analyte list to report
        - Matrix type and Units
        - Dilution Factors
        - Calculations
        - MDL, PQL
        - Correct and complete QA/QC
        - Complete technical check

    - The analyst submits a “First Level Data Review” sheet for each ATL batch number.

    - All data must be reported in a consistent unit to allow comparability of data among organization. The standard units used to report data are listed below.

- Units of mass/volume, volume/volume, mass/mass are reported as parts per unit. The common units are:

  - Parts per Million or ppm: mg/L or uL/mL or mg/Kg
  - Parts per Billion or ppb: ug/L or nL/mL or μg/Kg

  Physical parameters are reported using common units as:

  - pH (pH units)
  - Hardness (mg $CaCO_3$/L)
  - Alkalinity (mg $CaCO_3$/L)
  - Temperature (°C or °F)
  - Dissolved Oxygen (mg/L)
  - Flow Rate (mL/min)

- Data is usually reported on an "as received" basis. Solid samples results are reported in wet basis but if requested can be reported in dry basis. Other reporting units are allowed, based upon client request. Refer to appropriate project descriptions for special reporting of units.

25.3 Data Validation

Once the preliminary report has been generated, the department supervisor/group leader reviews the report for technical errors against the raw data submitted by the analyst(s).

Results must be checked for correlation between test results from different tests. Some tests are grouped together by type (i.e. demand, general minerals, etc.). The results from each grouping should correlate through ratios, percentages, etc. If the ratios do not meet the criteria, then check for reporting and calculation errors. If all reporting and calculations are correct, then re-analyze one or more of the tests (as necessary) and re-evaluate.

The following steps are taken during the data validation process:

- All final data are visually checked for consistency and reasonableness. Series of grossly high or grossly low results are also checked. Unusually high or unexpectedly low results are verified using a different method, where possible.

- All reported data must be within the working linear range of the instrument.

- LCS and spike recovery must be within the specified control limits, or within the laboratory generated limits, when applicable. Any out-of-control data are properly qualified with an appropriate explanation (e.g., matrix interference).

- All analytical problems encountered during sample analysis must be properly addressed to provide explanations for data reviewers.

- Checks on calculations are as follows
  - Calculations from new analyst(s) are reviewed at 100%
  - A calculation from a trained analyst(s) is subject to a minimum of a 50% review.

- Department Supervisor/Group Leader must review the raw data and report for:
  - All assigned samples are properly analyzed
  - Correct matrix and units
  - Correct and complete QA/QC
  - Correct calculations (including sample preparation factor and sample dilutions)
  - Special instruction met

- The department supervisor/group leader approves the "Second Level Review Section" on the bottom of the "First Level Review" sheet. If there are any problems or questions, the department supervisor/group leader sends the entire data package back to the analyst for review.

25.4 Final Report

25.4.1 Final Reports

After the department supervisor/group leader reviews and approves the preliminary report, the data package is submitted to the Project Coordinator(s). The Project Coordinator(s) reviews the entire package and then fill-out a "Project Coordinator" checklist which documents typographical errors, holding time issues, project specific requirements, etc. The Project Coordinator prints the final report, which includes sample results and applicable QA/QC. Preliminary results can be faxed to the client with a disclaimer that the results are preliminary. In order to avoid miss-communication of results, no verbal results are given to the client.

Validated results can be faxed, e-mailed or transferred to diskette at the client's request. For an example of fax cover page, see Appendix K. If there are amendments to the results, a new hardcopy report must be generated. A new electronic copy will be submitted to the client.

25.4.1.1 Test Report

Each test report shall include at least the following information, unless the laboratory has valid reasons for not doing so:

- a report title (e.g. Analytical Results)
- cover page which includes name, address and telephone number of the laboratory

- unique identification of the report (such as the Work Order number), and on each page an identification in order that the page is recognized as a part of the test report, and clear identification of the test report.

Note: Page numbers are represented as page # of ## or total number of pages is listed in the table of contents.

- The name and address of the client and project name/number
- Identification of the method used
- A description of, the condition of, and unambiguous identification of the sample(s), including client identification code
- The date of receipt of the sample(s), date and time of sample collection, date(s) of performance of environmental test, time of sample preparation and/or analysis
- Date reported
- Practical Quantitation Limit
- Method Detection Limit (if requested)
- Definition of data qualifiers and reporting acronyms
- Sample results with appropriate unit of measurements
- QC results including Method blank, LCS, MS/MSD recoveries and limits
- COC and other sample receiving items (such as client correspondence, shipping documents)
- A statement to the effect that the results relate only to the samples
- The name, title and signature of person(s) authorizing the test report
- Where applicable, a narrative of the report that explains the issue(s) and corrective actions taken.
- Appropriate laboratory certification number for the state of origin of the sample, if applicable

25.4.1.2 Electronic Data and Deliverables (EDD)

Some clients may request an electronic Data Deliverable (EDD). The default format is ATL. However, the EDD format may be customized to fit the client's needs. If a different format is required, a copy of the EDD specification must be submitted prior to the report's due date to the ELIMS Implementation Team. Also, please note that the price for EDDs is dependent on the format.

25.4.1.3 Supplemental Information for Test Reports

In addition to Section 25.4.1.1 requirements, test reports include unacceptable quality controls, inclusion or exclusions to the test method and information on specific test conditions that may have affected the quality of the results. This is typically in the form of a footnote or a qualifier and/or a narrative explaining the discrepancy.

25.4.2 Final Review

All hardcopy final reports are then sent to the Laboratory Director or the designated signatory person for final review. Copies of the final report are kept in the project/batch folder, and are then archived.

If the final report is found to be incomplete or additional errors are found, it is then documented and returned to the department supervisors for correction.

QA Officer reviews at least 10% of the data generated. If the final report is found to be incomplete or errors found, it is then returned to the department supervisors for correction. An amended report is generated and sent to the Laboratory Director or designee for final review.

25.5 Amendments

Procedures for amendments and/or additions to documentation are:

- Typographical errors (client initiated) are documented by e-mail from the client or by documenting the conversation on the client correspondence log.
- Re-analysis of a test parameter may be necessary if the data is questionable to the analyst/supervisor.
- When completed, the supervisor reviews and validates all data for precision, accuracy, completeness, and comparability.
- If any result is changed, the report is amended and is e-mailed and mailed to the client.
- All data is archived into the project folder.

SECTION 26.0 REFERENCES

26.1 Federal Register, 40CFR Part 136, March 12, 2007, "Guidelines Establishing Test Procedures for Analysis of Pollutants the Clean Water Act.

26.2 Taylor, John K., Quality Assurance of Chemical Measurements, Lewis Publishing, 1987.

26.3 USEPA, Handbook for Analytical Quality Control in Water and Wastewater Laboratories. EPA-600/4-79-019, Environmental Monitoring and Support Laboratory, Cincinnati, OH, 1979.

26.4 USEPA, Methods for Chemical Analysis of Water and Wastes. EPA-600/4-79-020, Environmental Monitoring and Support Laboratory, Cincinnati, OH, 1979.

26.5 USEPA, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. SW-846, Office of Soil Waste and Emergency Response, Washington, D.C., 1987.

26.6 USEPA, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. SW-846, Office of Soil Waste and Emergency Response, Washington, D.C., 1992.

26.7 USEPA, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. SW-846, Office of Soil Waste and Emergency Response, Washington, D.C., 1996.

26.8 USEPA, Testing Methods: Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater. EPA-600/4-82-057, Environmental Monitoring and Support Laboratory, Cincinnati, OH, 1982.

26.9 The NELAC Institute Standard 2009 Modules 2 & 4

26.10 US Department of Defense, Quality Systems Manual for Environmental Laboratories Version 4.2, 2010

26.11 Greenberg, Arnold E., Clesceri, Lenore S., Eaton, Andrew D., Standard Method for the Examination of Water and Wastewater, 18th ed., American Public Health Association, 1992.

26.12 Standard Methods Online Edition.

APPENDIX A

GLOSSARY/ACRONYMS

ACCEPTANCE CRITERIA Specified limits placed on characteristics of an item, process, or service defined in a requirement document

ACCURACY is the nearness of a result or the mean of a set of results to the true or accepted value.

B is a laboratory flag when target analyte is detected in method blank at or above the method reporting limit or PQL.

BATCH is a group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit using the same lot of solvents/reagents/spikes. A batch is group of 20 samples or fewer processed together in one analytical run.

CALIBRATION refers to a plot of concentrations of known analyte standards versus the instrument response to the analyte. It is a reproducible reference point to which all sample measurements can be correlated. The appropriate linear or nonlinear coefficient for standard concentration to instrument response should $\geq$ 0.995.

CALIBRATION STANDARDS are series of known standard solutions used by the analyst for calibration of the instrument. These are prepared by diluting a stock standard solution to produce working standards, which cover the working range of the instrument. One calibration standard should be at or below the reporting limit for the method.

CAL DOHS is an acronym for **California Department of Health Services**. CAL DOHS is the lead agency for the ELAP program and for setting environmental standards in the state.

CARBON RANGE refers to the amount of petroleum hydrocarbons in a specific section of a chromatogram based on the retention time of pure alkanes such as hexane, heptane, octane etc., i.e. c6-c7, c7-c8, c8-c9 etc. Pure straight chain hydrocarbons (alkanes) have retention times that increase regularly with the number of carbon atoms. These retention times are used to divide a chromatogram into carbon ranges: C8-C10 indicates that we are talking about the part of the chromatogram between the retention time of Octane (eight carbon atoms) and Decane (ten carbon atoms).
The TPH of a Carbon Range is defined as the area of a range of the sample compared to the area of the same range of the reference standard. The carbon ranges of some typical products:

C5-C12	Gasoline
C8-C17	Jet A
C8-C17	JP5
C8-C18	Kerosene
C10-C28	Diesel
C18-C36	Motor Oil
C20-C38	Hydraulic Oil
C10-C40	Fuel Oil#6 (Bunker Oil)

CCV is an acronym for **Continuing Calibration Verification**. CCV is a standard that periodically confirms that instrument response has not changed significantly from the initial calibration. This is prepared from the same stock solution that was used to prepare the calibration standards. Its concentration should be at or near the mid-range levels of the

calibration curve. It is analyzed at the beginning and end of a sample run, or periodically during a run for example every after every 10th sample depending on the method requirements. Each method has its own set of acceptance criteria.

CHAIN OF CUSTODY FORM Record that documents the possession of the samples from time of collection to receipt in the laboratory.

CHLORINATED HYDROCARBONS refer to the list of Volatile Organic Compounds contained in EPA 8010 and EPA 601. This list can also be referred to as Chlorinated Solvents or Purgeable Halocarbons.

CHLORINATED SOLVENTS refer to the list of Volatile Organic Compounds contained in EPA 8010 and EPA 601. This list can also be referred to as Chlorinated Hydrocarbons or Purgeable Halocarbons.

CONTAMINATION is a component of a sample or an extract that is not representative of the environment source of the sample. Contamination may stem from other samples, sampling equipment, while in transit, from laboratory reagents, laboratory environment, or analytical instruments.

CONTINUING CALIBRATION is the analysis of analytical standard at concentration within the calibration range to verify initial calibration of the system at a specified time frame.

CORRECTIVE ACTIONS are steps that are taken to remove the causes of an existing nonconformity or to make quality improvements. Corrective actions address actual problems. In general, the corrective action process can be thought of as a problem solving process.

DETECTION LIMIT (DL) is the lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value (NELAC). Method Detection Limit (MDL) is one way to establish a detection limit.

DEMONSTRATION OF CAPABILITY (DOC). A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision. (TNI)

DUP or DUPLICATE is a client assigned or randomly selected routine sample that is analyzed twice. Sample duplicate is processed independently through entire sample preparation and analytical process. A minimum of one duplicate must be included for each matrix type with each set of 20 or fewer samples.

E is a laboratory flag when analyte exceeded the calibration range.

ELAP is an acronym for **Environmental Laboratory Accreditation Program**. ELAP is responsible for the certification of environmental laboratories in the state of California.

EPA 8260 is the methodology for the identification of a specified list of Volatile Organic Compounds utilizing GC/MS (Gas Chromatography/Mass Spectrometry).

EPA 8270 is the methodology for the identification of a specified list of Semi-Volatile Organic Compounds utilizing GC/MS (Gas Chromatography/Mass Spectrometry).

GAS CHROMATOGRAPH is the instrument used to separate analytes on a stationary phase

within a chromatographic column.

GC/MS is an acronym for **Gas Chromatography/Mass Spectrometry**. It refers to methodology for the identification of compounds which utilizes Gas Chromatography to separate compounds and a Mass Spectrometer as detector.

H is a laboratory flag when analyte was analyzed beyond holding time.

Holding Time. The maximum time that samples may be held prior to analyses and still be considered valid or not compromised.

IC is an acronym for **Ion Chromatography**, a method which can be used for the detection of Phosphate (PO_4), Sulfate (SO_4), Chloride (Cl), Fluoride (F), Bromide (Br), Nitrite (NO_2), and Nitrate (NO_3).

ICB is an acronym for Initial Calibration Blank. ICB is a volume of reagent water or solvent treated in the same manner as the calibration standards. It is used to verify blank standard, and to check carry-overs and contamination.

ICP is an acronym for **Inductively Coupled Plasma.** Inductively Coupled Plasma Spectrometer is one technique for analyzing metal samples. An induction coil is wrapped around a quartz tube in which a stream of charge argon particles and sample solute is flowing. The sample must be in solution and is normally introduced through a nebulizer. The interaction between the induced magnetic field from the coil and the argon plasma create an extremely high temperature. The primary goal of ICP is to get elements to emit characteristic wavelength specific light which can then be meausured.

ICP/MS is an acronym for **Inductively Coupled Plasma/Mass Spectrometry**. It refers to methodology for the detection of metals which utilizes an ICP as ion source and a mass spectrometer as detector. It may also be referred to as EPA Method 6020.

ICV is an acronym for **Initial Calibration Verification** Standard. It is a standard used to confirm the accuracy of the instrument calibration. This is prepared from a different stock solution (i.e. different vendor or lot number) than was used to prepare the calibration standards. It is run after the initial calibration and each method has its own set of acceptance criteria.

IDL is an acronym for **Instrument Detection Limit.** IDL is the concentration equivalent to a signal, due to the analyte of interest, which is the smallest signal that can be distinguished from background noise by a particular instrument. The IDL should always be below the method detection limit, and is not used for compliance data reporting, but may be used for statistical data analysis and comparing the attributes of different instruments. IDL is determined on a clean matrix and analyzed without going through the preparatory step.

INITIAL CALIBRATION is the analysis of analytical standards for a series of different specified concentrations; used to define the linearity and dynamic range of the response of the detector to the target compounds.

INTERNAL STANDARD CALIBRATION is a calibration that involves the comparison of instrument responses from the target compounds in the sample to the responses of specific

standards added to the sample or sample extract prior to injection. The ratio of the peak area (or height) of the target compound in the sample or sample extract to the peak area (or height) of the internal standard in the sample or sample extract is compared to a similar ratio derived for each calibration standard. The ratio is termed the response factor (RF), and may also be known as a relative response factor in other methods.

IS is an acronym for **INTERNAL STANDARD.** The internal standard is a compound that matches as closely, but not completely, the chemical species of interest in the samples.

LOD is an acronyl for **Limit of Detection**. It is an estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte and matrix specific and maybe laboratory dependent (NELAC). LOD is not equivalent to MDL.

LOQ is an acronym for **Limit of Quantitation**. It is the minimum levels, concentrations, or quantities of a target variable (e.g. target analyte) that can be reported with a specified degree of confidence (NELAC). This is also equivalent to practical quantitation limit (PQL).

LCS is an acronym for **Laboratory Control Sample.** It is an aliquot of laboratory reagent blanks to which known quantities of the method analytes are added in the laboratory. The LCS is analyzed exactly like a sample, and is used to evaluate ongoing laboratory performance and analyte recovery in a clean matrix. A minimum of one LCS must be included with each set of 20 or fewer samples.

MDL is an acronym for **Method Detection Limit.** Minimum concentrations of a substance that can be measured and reported with 99% confidence that the value is above zero. The sample is carried through the entire method under ideal conditions. This is performed on an annual basis by the laboratory.

$$MDL = t_{(n-1,\ 1-\alpha\alpha=0.99)} \times S$$

Where: S = standard deviation of the replicate analyses

$t_{(n-1,\ 1-\alpha\alpha=0.99)}$ = the Student's t-value appropriate to a 99% confidence level and a standard deviation estimate with n-1 degrees of freedom.

METHOD BLANK or MB is an analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank should be carried through the complete sample preparation and analytical procedure. It is used to assess contamination resulting from the analytical process. A minimum of one method blank must be included with each set of 20 or fewer samples.

mg/kg is an acronym for **milligrams per kilogram**. It is a unit of measure used in analytical results which expresses the concentration of the constituent of concern, i.e. 500 mg/kg diesel. It is normally used in conjunction with solid or soil samples.

mg/L is an acronym for **milligrams per liter**. It is a unit of measure used in analytical results which expresses the concentration of the constituent of concern, i.e. 5 mg/L lead. It is normally used in conjunction with extracted samples involved in STLC or TCLP analysis which show the quantities of the constituent which are leachable.

MS is an acronym for **Matrix Spike**. It is an aliquot of environmental sample to which a known quantity of the method analyte is added in the laboratory. The spiking occurs prior to sample

preparation and analysis. Spiking volume should be limited to 5% or less of sample volume. The MS is analyzed exactly like a sample, and is used to determine whether the sample matrix contributes bias to the analytical results. A minimum of one MS must be included with each set of 20 or fewer samples. The background concentration of the analyte in the sample matrix must be determined in a separate aliquot and the measured value in the Matrix Spike corrected for background concentration.

MSD is an acronym for Matrix Spike Duplicate. MSD A duplicate of the Matrix Spike used to determine the precision and bias of a method in a given sample matrix.

ND is an acronym for none detected. nd is reported when an analyte was not found at detection limit.

NIST is an acronym for National Institute of Standards and Technology. A federal agency under the United States Commerce's Technology Administration that is designed as the United States national metrology institute (NMI).

NELAC is an acronym for national environmental laboratory accreditation conference. nelac is a standards adoption body that solicits, adopts and publishes a consensus performance standard on which nelap is based.

NELAP is an acronym for national environmental laboratory accreditation program. nelap is the program that implements the nelac standards. state and federal agencies serve as accrediting authorities with coordination facilitated by EPA to assure uniformity.

NON-CONFORMANCE is a departure of a quality characteristic from its intended level of state that occurs with severity sufficient to cause an associated product or service not to meet specified criterion.

PERCENT RECOVERY or %R is the numerical ratio of the amount of analyte measured by the laboratory method divided by the known amount of analyte added to the matrix to be analyzed.

PERCENT DIFFERENCE OR %D is the comparison of two values. the percent difference indicates both the direction and magnitude of the comparison, i.e, the percent difference may be either negative, positive, or zero.

ppb is an acronym for **parts per billion**. It is a unit of measure used in analytical results which expresses the concentration of the constituent of concern, i.e. 5 ppb diesel. It is normally used in conjunction with aqueous samples.

ppm is an acronym for **parts per million**. It is a unit of measure used in analytical results which expresses the concentration of the constituent of concern, i.e. 500 ppm diesel. It is normally used in conjunction with solid or soil samples.

ppt is an acronym for **parts per trillion**. It is a unit of measure used in analytical results which expresses the concentration of the constituent of concern, i.e. 5 ppt gasoline. It is normally used in conjunction with air samples.

PQL is an acronym for **Practical Quantitation Limits.** PQL is the lowest concentration that can be measured with the consideration for practical limitations such as sample size, matrix interferences and dilutions. PQL is normally 3-10 times the MDL.

PRECISION is a measure of the reproducibility of a set of replicate results among themselves or the agreement among repeat observations made under the same conditions.

Preservation Any conditions under which is a sample must be kept in order to maintain chemical and/or biological integrity prior to analysis (TNI)

Proficiency Testing. A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (TNI)

Proficiency Test Sample (PT) A sample, the composition of which is unknown to the laboratory and is provided to test whether the laboratory can produce analytical results within the specified acceptance criteria.

RPD is an acronym for **Relative Percent Difference.** It is the ratio of the difference of two readings over its average. This is a means of determining the precision between two numbers.

$$RPD = 100\left[\frac{(X1 - X2)}{\left\{\frac{X1 + X2}{2}\right\}}\right]$$

Where:

X_1 = the larget of the two observed values
X_2 = the smaller of the two observed values

QA is an acronym for **Quality Assurance**. QA is a planned system of activities (program) whose purpose is to provide assurance of the reliability and defensibility of the data.

QC is an acronym for **Quality Control**. QC is a routine application of procedure for controlling the monitoring process. QC is the responsibility of all those performing the hands-on operations in the laboratory.

Reference Material. Material or substance one or more properties of which are sufficiently homogenous and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (TNI)

Reference Standard. Standard used for the calibration of working measurement standards in a given organization or a given location. (TNI)

RESOLUTION is the separation between peaks on a chromatogram.

S is a laboratory flag when surrogates or spikes are outside control limits due to matrix interference.

SERIAL DILUTION is the dilution of a sample by a known factor. When corrected by the dilution factor, the diluted sample must agree with the original undiluted sample within specified limits. Serial dilution may reflect the influence of interferents.

SEMIVOLATILE COMPOUNDS are compounds amenable to analysis by extraction with an organic solvent. Used synonymously with base neutral acid or extractable compounds.

SIM is an acronym for **Selected Ion Monitoring**. SIM sets the mass selective detector to repeatedly scan a few selected ions rather than a full spectrum. In the acquisition method (GC/MS SIM or Gas Chromatography/Mass Spectrometry using Selected Ion Monitoring), the selected ions can be changed to reflect the desired compound to be detected. The detector scans for a primary, secondary and tertiary ion set unique to the compound of interest in a particular retention time window. It is an invaluable tool for positive identification of a compound resulting in considerable reduction in false positives and exceptionally low detection limits.

SOLUBLE is a term used for the characterization of metals as hazardous waste. It is often used interchangeably with "WET" or "STLC" when referring to the amount of a metal that is leachable, i.e. soluble lead. The extraction process takes 48 hours.

STANDARD ADDITION or Method of Standard Addition (MSA) is the addition of three increments of a standard solution (spikes) to sample aliquots of the same size. Measurements are made on the original and after each addition. The slope, x-intercept and y-intercept are determined by least-squares analysis. The analyte concentration is determine by the absolute value of the x-intercept. Ideally, the spike volume is low relative to the sample volume. Standard addition may counteract matrix effects; it will not counteract spectral effects.

STANDARD DEVIATION is the square root of the variance of a set of values.

$$S = \frac{(Y_i - Y)^2}{n - 1}$$

where S = Standard Deviation
Y_i = measured value of replicate
Y = mean of replicate measurements
n = number of replicates

SURROGATE is an organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples.

SVOCs is an acronym for **Semi-Volatile Organic Compound**. It is also commonly referred to as BNAs (Base Neutral Acid) or EPA 8270.

TCLP is an acronym for **Toxicity Characteristic Leachate Procedure** and is used to characterize the mobility of both organic and inorganic analytes present in liquid and solid wastes. It is an extraction method prescribed by CFR (Code of Federal Regulations.) The extraction process takes 18 hours.

TPH is an acronym for **Total Petroleum Hydrocarbons**. It is a measure of the total amount of fuel present in the sample, i.e., TPH-gasoline or TPH-diesel. TPH results can be quantified or calculated as:

- Totals as specific fuels types, i.e. TPH as diesel, crude or gasoline
- Totals in specific carbon ranges, i.e. 500 ppm C10-C25

Traceability. The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project. (TNI)

µg/L is an acronym for **micrograms per liter**. It is a unit measure for concentration used in analytical results which expresses the concentration of the constituent of concern, i.e. 5 µg/L diesel. It is normally used in conjunction with aqueous samples.

US DoD is an acronym for **United States Department of Defense.**

VOLATILE COMPOUNDS are compounds amendable to analysis by the purge and trap techniques. used synonymously with purgeable compounds.

VOAs is an acronym for **Volatile Organic Analysis or Analytes**. VOA is often used when speaking about the analysis of volatile organics. The acronym is rarely used and has been replaced by VOC's. VOA vials refer to the 40 ml containers used for aqueous sampling of volatile compounds.

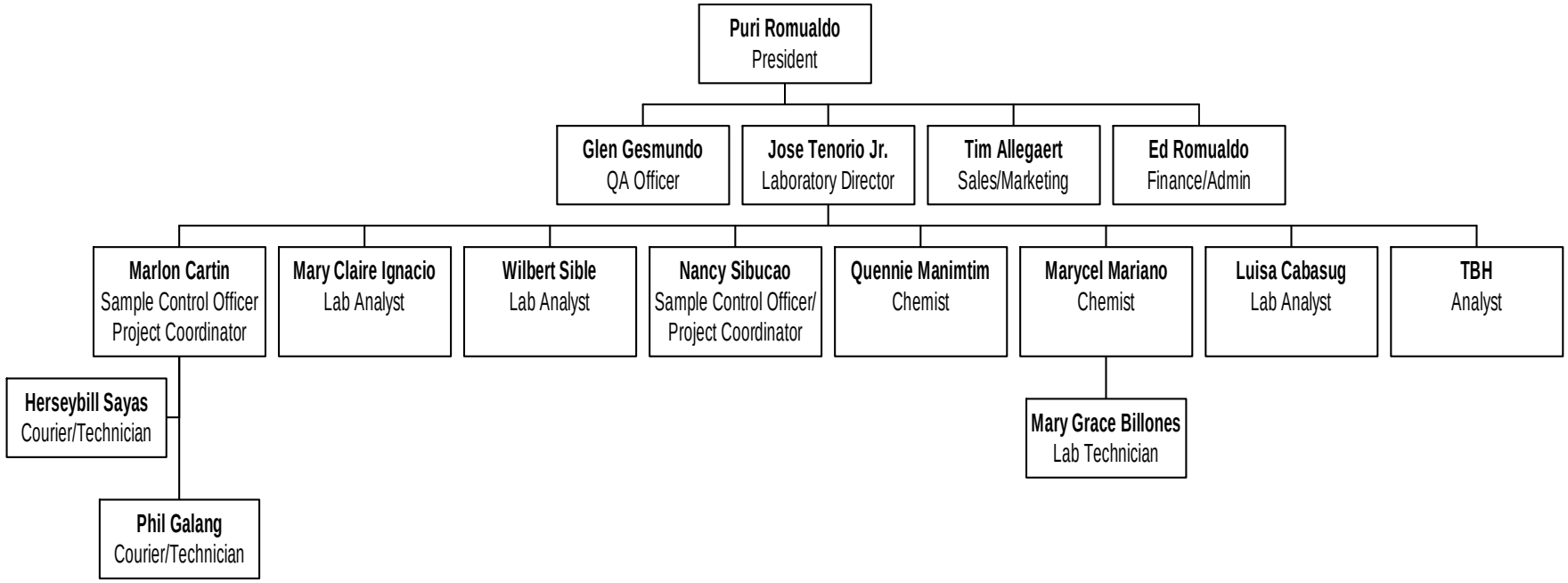
VOCs is an acronym for **Volatile Organic Compounds**. The term VOCs commonly refers to the list of compounds contained in EPA Method 8240 or the longer list of EPA Method 8260.

APPENDIX B

ORGANIZATIONAL CHART and
LIST OF KEY PERSONNEL AND RESPONSIBILITIES

3151 W. Post Rd Las Vegas,NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

Advanced Technology Laboratories, Inc.
Organizational Chart
Effective April 15, 2013



Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

Advanced Technology Laboratories
Key Personnel

Name	Title	Responsibilities	Years of Experience	Education
Puri Romualdo	President/General Manager	· Supervising and administrating the quality assurance program. · Ensuring that all general and client-specific quality assurance requirements are strictly followed. · Resolving the approval/rejection of deliverable client sample data package and/or reports.	**39 Years**; 7 year as President; 8 years as Vice-President of ATL ; 10 years as Vice-President of CRL; 4 years as Vice-President of ET&T; 10 years as Chemist.	B.S., Chemical Engineering
Jose Tenorio Jr.	Laboratory Director	· Ensuring that sufficient numbers of qualified personnel are employed to supervise and perfom the work of the laboratory. · Enforcing the QA/QC procedures and requirements within their respective activities and areas of specialization. · Recommending process improvements and corrective actions · Supervising the staff training in the procedures described in the standard operating procedures (SOPs) as they apply to the assigned responsibilities of the staff. · Maintaining an environment that emphasizes an intelligent and responsible approach to producing high data quality and accuracy based on the SOPs carried out.	**15 Years:** 6 year Laboratory Supervisor; 3 years R&D Chemist; 6 years Laboratory Chemist	B.S., Chemical Engineering
Glen Gesmundo	QA Manager	· Responsible for implementation and monitoring of the laboratory quality assurance program · Ensuring that all data generated is scientifically sound, legally defensible, and of known precision and accuracy. · Monitoring the QA plan on a periodic basis to ensure compliance with the QA objectives of the laboratory. · Developing and implementing new QA procedures within ATL to improve data quality. · Conducting audits and inspections of all division sections on a periodic basis. · Coordinating the analysis of performance evaluation (PE) samples for all analytical divisions on a periodic basis. · Evaluating the results; reporting the results to the General Manager and appropriate Group Leaders; and applying corrective action as needed. · Establishing and maintaining statistical and data records that accurately reflect the quality assurance performance of all analytical divisions. · Maintaining and overseeing the master sources of all SOPs, training logs and completed/full laboratory notebooks. · Serving as the in-house client representative on all projects inquires involving data quality issues. · Overseeing ATL's data validation process and Electronic Data Deliverables	**13 Years;** 10 years as QA Officer 3 years Organic Chemist;	M.S., Agricultural Chemistry minor in Environmental Science BS Chemical Engineering

Name	Title	Responsibilities	Years of Experience	Education
Quennie Manimtim	Senior Chemist	• Performs routine tasks and non-routine tasks. • Performs non-routine instrument repairs. • Develops and evaluates new methodologies. • Provides the management and the QAO with immediate notifications of the quality problems by submitting Non-Conformance forms. • Identifies and carries out the approved corrective actions within their respective activities and specialization. • Participates in the training program (including reading SOPs and QA Manual, MDL determinations and Accuracy and Precision data). • Follows QA/QC criteria for all program requirements. • Correct reporting of sample results and QC samples. • Supervising the staff training in the procedures described in the standard operating procedures (SOPs) as they apply to the assigned responsibilities of the staff. • Reports to laboratory director.	**7 Years;** Inorganic and Organic Chemist	M.S., Agricultural Chemistry minor in Environmental Science BS Chemical Engineering
Marlon Cartin	Sample Control Officer/Project Coordinator	· Responsible for overseeing sample log-in, proper documentation, sample tracking, sample storage, sample disposal/return, and coordination and scheduling of sampling programs.	**7 Years;** Sample Control Officer/Project Coordinator	B.S. Chemistry

APPENDIX C

CLIENT COMPLAINT/INCIDENT FORM

CLIENT COMPLAINT/INCIDENT REPORT FORM

Control No.: _____

Section I. General Information

Submitted by: _____ Date Initiated: _____ Complaint/Incident Date: _____

Complaint/Incident address to: Organics Inorganics Sales Client Services QA Others _____

Client Name: _____ Samples Affected: _____

Section 2. Description of Complaint/Incident

Section 3. Investigation of Root Cause

Date	Action(s)	Responsible Person

Section 4. Corrective Action

Date	Action(s)	Responsible Person

Section 5. Analyst, Supervisor, Laboratory Director Approval

Employee: _____ Date: _____
Supervisor: _____ Date: _____
Laboratory Director: _____ Date: _____

Section 6. QA Evaluation of complaint/incident

Corrective Action: Acceptable Not Acceptable
Is claim valid: Yes No Not Applicable
QA Manager: _____ Date: _____

Section 7. QA Follow-up/Corrective Action Verification

Follow-up necessary: Yes No
Schedule date of follow-up: _____ Date Followed up: _____ Signature: _____
Corrective Action: Effective Not Effective
QA Comments/Actions: _____

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

APPENDIX D

NON-CONFORMANCE FORM

Non-Conformance Form

Submitted by:_____ Date:_____

Section: ☐ Organics ☐ Sample Control ☐ QA Office
☐ Inorganics ☐ Client Services ☐ Administration

[1] A. SAMPLE INFORMATION

Test / Method No.:_____ **Instrument ID**:_____

Batch No.: _____

B. SAMPLES AFFECTED

☐ Soil ☐ Water ☐ Liquid ☐ Other _____

LAB SAMPLE ID

_____
_____
_____

[2] SAMPLE ANALYSIS

☐ 1.1 MS/MSD exceeded allowable limit: ☐ 1.1.1 low bias ☐ 1.1.2 high bias
Analyte(s):_____
_____

☐ 1.2 RPD exceeded allowable limit: ☐ 1.2.1 low bias ☐ 1.2.2 high bias
Analyte(s):_____
_____

☐ 1.3 LCS exceeded allowable limit: ☐ 1.3.1 low bias ☐ 1.3.2 high bias
Analyte(s):_____
_____

☐ 1.4 Surrogate exceeded allowable limit: ☐ 1.4.1 low bias ☐ 1.4.2 high bias

☐ 1.5 IS exceeded allowable limit: ☐ 1.5.1 low bias ☐ 1.5.2 high bias

[3] SAMPLE/STANDARDS INTEGRITY

☐ 1.7 Sample container broken
- ☐ 1.7.1 In transit
- ☐ 1.7.2 Within Laboratory

☐ 1.8 Ref temp exceeded range (2-6°C): ☐ 1.8.1 low bias ☐ 1.8.2 high bias
Refrigerator ID:_____

☐ 1.9 Missed sample holding times

[4] QUALITY ASSURANCE

☐ 1.10 WS / WP / ERA / HW / PE( )results were not acceptable
Analyte(s):_____

☐ 1.11 Internal audit deficiencies (attach copy of audit)
Department:_____

REVIEWED / APPROVED BY:_____
Signature & Date

[5] MISCELLANEOUS

☐ 1.99 Other:_____
_____
_____
_____

[6] POSSIBLE CAUSE(S) or REASON(S)

_____
_____
_____
_____
_____

☐ Matrix interferences / matrix effects

[7] CORRECTIVE ACTION

_____
_____
_____
_____
_____

☐ Sample/Extract analyzed twice.

[8] PROOF OF CONFORMANCE (Attach applicable documentation.)

(i.e. spl analyzed twice, tune-ok, CCV-ok,etc.)

_____
_____
_____
_____

☐ Same Results (still outside criteria)
☐ Re-run within criteria

[9] QA FOLLOW-UP/CORRECTIVE ACTION VERIFICATION

Follow-up necessary: ☐ Yes ☐ No

Schedule date of follow-up: _____Date Followed up: _____

Corrective Action: ☐ Effective ☐ Not Effective

QA Comments/Actions:

_____
_____

_____
QA Signature & Date

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

APPENDIX E

TABLES OF INSTRUMENTATION CALIBRATION,
LABORATORY QC PROCEDURES AND CORRECTIVE ACTIONS

Summary of Instrument Calibration, Laboratory QC Procedures and Corrective Actions

GCMS Methods (Methods 8260 and 8270)					
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**	**Flagging Criteria**	**Comments**
Demonstrate acceptable analytical capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, test method, or sample matrix.	Method-specific criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria.	NA.	This is a demonstration of analytical ability to generate acceptable precision and bias. No analysis shall be allowed by analyst until successful demonstration of capability is complete.
Tuning	Prior to ICAL and at the beginning of each 12-hour period.	Refer to method for specific ion criteria.	Retune instrument and verify. Rerun affected samples.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be accepted without a valid tune.
Breakdown check (DDT Method 8270 only)	Correct problem then repeat breakdown check.	Degradation ≤ 20% for DDT. Benzidine and pentachlorophenol shall be present at their normal responses, and shall not exceed a tailing factor of 2.	At the beginning of each 12-hour period, prior to analysis of samples.	Flagging criteria are not appropriate.	No samples shall be run until degradation ≤ 20%.
Second source calibration verification (ICV)	Once after each ICAL.	1. Average RF for SPCCs: VOCs ≥ 0.30 for chlorobenzene and 1,1,2,2-tetrachlorolethane; ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. SVOCs ≥ 0.050. 2. %Difference/Drift for all target compounds and surrogates: VOCs and SVOCs ≤ 30%D.	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.
Retention time window position establishment for each analyte and surrogate	Once per ICAL.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	NA.	NA.	

GCMS Methods (Methods 8260 and 8270) (continued)					
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**	**Flagging Criteria**	**Comments**
Evaluation of relative retention times (RRT)	With each sample.	RRT of each target analyte within ± 0.06 RRT units.	Correct problem, then rerun ICAL.	Flagging criteria are not appropriate.	Laboratories may update the retention times based on the CCV to account for minor performance fluctuations or after routine system maintenance (such as column clipping). With each sample, the RRT shall be compared with the most recently updated RRT. If the RRT has changed by more than ±0.06 RRT units since the last update, this indicates a significant change in system performance and the laboratory must take appropriate corrective actions as required by the method and rerun the ICAL to reestablish the retention times.
Continuing calibration verification (CCV)	Daily before sample analysis and every 12 hours of analysis time.	1. Average RF for SPCCs: VOCs ≥ 0.30 for chlorobenzene and 1,1,2,2-tetrachlorolethane; ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. SVOCs ≥ 0.050. 2. %Difference/Drift for all target compounds and surrogates: VOCs and SVOCs ≤ 20%D (Note: D = difference when using RFs or drift when using least squares regression or non-linear calibration).	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL.	CCV failure must be explained in the case narrative.	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.

GCMS Methods (Methods 8260 and 8270) (continued)					
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**	**Flagging Criteria**	**Comments**
Internal standards verification	Every field sample, standard, and QC sample.	Retention time ± 30 seconds from retention time of the CCV; EICP area within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory.	If corrective action fails in field samples, explain in case narrative.	Sample results are not acceptable without a valid IS verification.
Method blank	One per preparatory batch.	No analytes detected > RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results.	Correct problem. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
LCS/LCSD containing all analytes to be reported, including surrogates	One per preparatory batch.	Use method default or in-house control limits. In-house control limits may not be greater than ± 3 times the standard deviation of the mean LCS recovery.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Matrix spike (MS)	One per preparatory batch per matrix .	Use method default or in-house control limits.	Evaluate results to determine the source of difference and to determine if there is a matrix effect or analytical error.	Data must be qualified and explained in the case narrative.	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.

GCMS Methods (Methods 8260 and 8270) (continued)					
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**	**Flagging Criteria**	**Comments**
Matrix spike duplicate (MSD) or sample duplicate	One per preparatory batch per matrix.	Use method default or in-house control limits. MSD or sample duplicate: RPD ≤ 30% (between MS and MSD or sample and sample duplicate).	Evaluate results to determine the source of difference and to determine if there is a matrix effect or analytical error.	Data must be qualified and explained in the case narrative.	The data shall be evaluated to determine the source of difference.
Surrogate spike	All field and QC samples.	Use method default or in-house control limits.	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.	Apply Q-flag to all associated analytes if acceptance criteria are not met.	Alternative surrogates are recommended when there is obvious chromatographic interference.
Results reported between MDL and PQL.	NA.	NA.	NA.	Apply J-flag to all results between MDL and PQL.	
MDL study	One per instrument per year.	For all analytes MDL should be <PQL and MDL X10 should be greater than amount spike.	Check instrument. Re-do MDL.		

Summary of Instrument Calibration, Laboratory QC Procedures and Corrective Actions

GC Methods (Methods 8015, 8081, and 8082)					
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**	**Flagging Criteria**	**Comments**
Demonstrate acceptable analytical capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, test method, or sample matrix.	Method-specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria	Not Applicable (NA).	This is a demonstration of analytical ability to generate acceptable precision and bias. No analysis shall be allowed by analyst until successful demonstration of capability is complete.
(RT) window width calculated for each analyte and surrogate	At method set-up and after major maintenance (e.g., column change).	RT width is ± 3 times standard deviation for each analyte RT from a 72-hour study.	NA.	NA.	
Breakdown check (Endrin / DDT Method 8081 only)	At the beginning of each 12-hour period, prior to analysis of samples.	Degradation ≤ 15% for both DDT and Endrin.	Correct problem then repeat breakdown check.	Flagging criteria are not appropriate.	No samples shall be run until degradation ≤ 15% for both DDT and Endrin.
Minimum five-point initial calibration (ICAL) for all analytes	ICAL prior to sample analysis.	One of the options below: Option 1: RSD for each analyte ≤ 20%; Option 2: linear least squares regression: r ≥ 0.995; Option 3: non-linear regression: coefficient of determination (COD) r_2 ≥ 0.99 (6 points shall be used for second order, 7 points shall be used for third order).	Correct problem then repeat ICAL.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed. Calibration may not be forced through the origin. Quantitation for multicomponent analytes such as chlordane, toxaphene, and Aroclors must be performed using a 5-point calibration. Results may not be quantitated using a single point.

GC Methods (Methods 8015, 8081, and 8082) (continued)					
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**	**Flagging Criteria**	**Comments**
Retention time window position establishment for each analyte and surrogate	Once per ICAL and at the beginning of the analytical shift.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	NA.	NA.	
Second source calibration verification (ICV)	Immediately following ICAL.	All analytes within established retention time windows. GC methods: All analytes within ± 15% of expected value from the ICAL;	Correct problem, rerun ICV. If that fails, repeat ICAL.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.
Continuing calibration verification (CCV)	Prior to sample analysis, after every 12 hrs, and at the end of the analysis sequence.	All analytes within established retention time windows. GC methods: All analytes within ± 15% of expected value from the ICAL;	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed. Retention time windows are updated per the method.
Method blank	One per preparatory batch.	No analytes detected > RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results.	Correct problem.If required, reprep and reanalyze method blank and all samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
MDL study	One per instrument per year.	For all analytes MDL should be <PQL and MDL X10 should be greater than amount spike.	Check instrument. Re-do MDL.		

GC Methods (Methods 8015, 8081, and 8082) (continued)					
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**	**Flagging Criteria**	**Comments**
Laboratory control sample (LCS)/ Laboratory control sample duplicate (LCSD) containing all analytes to be reported, including surrogates	One per preparatory batch.	Use method default or in-house control limits. In-house control limits may not be greater than ± 3 times the standard deviation of the mean LCS recovery..	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available	If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Matrix spike (MS)	One per preparatory batch per matrix .	Use method default or in-house control limits.	Evaluate results to determine the source of difference and to determine if there is a matrix effect or analytical error.	Data must be qualified and explained in the case narrative.	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.
Matrix spike duplicate (MSD) or sample duplicate	One per preparatory batch per matrix.	Use method default or in-house control limits. MSD or sample duplicate: RPD ≤ 30% (between MS and MSD or sample and sample duplicate).	Evaluate results to determine the source of difference and to determine if there is a matrix effect or analytical error.	Data must be qualified and explained in the case narrative.	The data shall be evaluated to determine the source of difference.
Surrogate spike	All field and QC samples.	Use method default or in-house control limits.	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.	Data must be qualified and explained in the case narrative.	Alternative surrogates are recommended when there is obvious chromatographic interference.

GC Methods (Methods 8015, 8081, and 8082) (continued)					
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**	**Flagging Criteria**	**Comments**
Confirmation of positive results (second column or second detector)	All positive results must be confirmed (with the exception of Method 8015).	Calibration and QC criteria same as for initial or primary column analysis. Results between primary and second column RPD ≤ 40%.	NA.	Discuss in the case narrative if RPD > 40%.	Report the result from the primary column if RPD ≤ 40%. Otherwise, report higher result. .
Results reported between MDL and PQL.	NA.	NA.	NA.	Apply J-flag to all results between MDL and PQL.	

Summary of Instrument Calibration, Laboratory QC Procedures and Corrective Actions

Method EPA 6010B (Metals by ICP)			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Initial Calibration	Initial calibration prior to sample analysis	r>0.995	Evaluate system. Repeat calibration.
Initial calibration verification (second source) ICV	With each initial calibration	Within 10 % of expected value.	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.
Initial Calibration Blank (ICB)/ Continuing Calibration Blank (CCB)	After initial calibration, every 10 samples, and at the end of analytical sequence.	All analytes < PQL.	Investigate source of contamination. Clean instrument if necessary and rerun blank
Interference Check Standards A / AB (ICSA / ICSAB)	At the start and end of each analytical sequence or twice during an 8-hour period, whichever is more frequent.	For ICSA, Al, Ca, Fe, Mg, Cr, Mo, Ti within 20% of expected value; Others, below PQL. For ICSAB, all analytes within 20% of expected value	a.Investigate source of interference. Correct instrument if necessary and rerun ICSAB. b. Adjust interelement correction factors. Recalibrate the instrument.
Continuing calibration verification (CCV)	After every ten samples and at the end of the analytical sequence.	Recoveries within ± 10% of expected value.	Correct problem, rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification. If analyte concentration is high bias and the sample is ND, no need to re-analyze samples.
Method Blank	One per batch of 20 samples	All analytes < PQL.	Investigate source of contamination. Clean instrument if necessary and rerun blank.
Laboratory Control Sample and Laboratory Control Sample Duplicate (LCSD)	Minimum of one LCS per batch of 20 samples.	85-115% for water 80-120% for soil	a.Check calculations. Check standards preparation. Check for instrument malfunction. Rerun the LCS. b. If out the second time, reprepare the entire batch. c. If LCS is high bias and sample is ND, no need to re-prepare/reanalyze the batch.
Matrix spike/matrix spike duplicate (MS/MSD)	One MS/MSD per batch of 20 samples. Same spiking analytes as LCS.	In-house established limits.	Check for standards preparation. Check for interferences. Review against LCS recoveries to look for trends. If poor recovery is indicative of laboratory problems, re-prepare and re-analyze batch. Otherwise, if LCS passed QC criteria batch is validated by the LCS.

Summary of Instrument Calibration, Laboratory QC Procedures and Corrective Actions

Method EPA 6010B (Metals by ICP) (continued)			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Internal Standard	Added to every sample including standards and blanks prior to analysis.	65-125%	a.Check for instrument malfunction. Check for sample interference. Rerun the sample. b. Recalibrate the instrument.
MDL study	One per instrument per year.	For all analytes MDL should be <PQL and MDL X 10 should be greater than amount spike..	Check instrument. Re-do MDL.
Dilution Test	One per preparatory batch.	Five-fold dilution must agree within ± 10% of the original measurement.	Perform post-digestion spike (PDS) addition.
Post-digestion spike (PDS) addition	When dilution test fails.	Recovery within 75-125%.	Run all associated samples in the preparatory batch by method of standard additions (MSA).

Summary of Instrument Calibration, Laboratory QC Procedures and Corrective Actions

Method EPA 6020 (Metals by ICPMS).			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Initial Calibration	Initial calibration prior to sample analysis	r>0.995	Evaluate system. Repeat calibration.
Initial calibration verification (second source) ICV	With each initial calibration	Within 10% of expected value.	Correct problem, then repeat initial calibration
Initial Calibration Blank (ICB)/ Continuing Calibration Blank (CCB)	After initial calibration, every 10 samples, and at the end of analytical sequence.	All analytes < PQL.	Investigate source of contamination. Clean instrument if necessary and rerun blank
Interference Check Standard A / AB (ICSA/ICSAB)	At the beginning of an analytical run or once every 12 hour, whichever is more frequent.	For ICSA, Al, Ca, Fe, Mg, Na, K, Mo, Ti within 20% of expected value; Others, below PQL. For ICSAB, all analytes within 20% of expected value	a.Investigate source of interference. Rerun ICSA / ICSAB. b. Recalibrate the instrument.
Continuing calibration verification (CCV)	After every ten samples and at the end of the analytical sequence.	Recoveries within ± 15% of expected value.	a. Evaluate system. Rerun standard. b. Reprep standard and recalibrate. Rerun affected samples.
Method Blank	One per batch of 20 samples	All analytes < PQL.	Investigate source of contamination. Clean instrument if necessary and rerun blank.
Laboratory Control Sample (LCS)	Minimum of one LCS per batch of 20 samples.	85-115% for water/soil	a.Check calculations. Check standards preparation. Check for instrument malfunction. Rerun the LCS. b. If out the second time, reprepare the entire batch.
Matrix spike/matrix spike duplicate (MS/MSD)	One MS/MSD per batch of 20 samples. Same spiking analytes as LCS.	75-125% for water/soil	Check for standards preparation. Check for interferences. Review against LCS recoveries to look for trends. If poor recovery is indicative of laboratory problems, re-prepare and re-analyze batch. Otherwise, if LCS passed QC criteria batch is validated by the LCS.
Internal Standard	Added to every sample including standards and blanks prior to analysis.	30-120% of ICB's IS intensity	a.Check for instrument malfunction. Check for sample interference. Rerun the sample. b. Recalibrate the instrument.
MDL study	One per instrument per matrix per year.	For all analytes MDL should be <PQL.	Check instrument. Re-do MDL.

Summary of Instrument Calibration, Laboratory QC Procedures and Corrective Actions

EPA 7470A /7471A/245.1					
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**	**Flagging Criteria**	**Comments**
Minimum 5 standards and a calibration blank	Daily ICAL prior to sample analysis.	If more than one calibration standard is used, r ≥ 0.995.	Correct problem, then repeat ICAL.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed
Second source calibration verification (ICV)	Once after each ICAL, prior to beginning a sample run.	Value of second source for all analyte(s) within ± 10% of true value.	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.
Continuing calibration verification (CCV)	After every 10 field samples and at the end of the analysis sequence.	± 10% of true value.	Correct problem, rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Method blank	One per preparatory batch.	No analytes detected > PQL and greater than 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Correct problem. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Calibration blank	Before beginning a sample run, after every 10 samples, and at end of the analysis sequence.	No analytes detected > PQL.	Correct problem. Re-prep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed.	Apply B-flag to all results for specific analyte(s) in all samples associated with the blank.	

EPA 7470A /7471A/245.1 (continued)					
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**	**Flagging Criteria**	**Comments**
LCS containing all analytes to be reported	One per preparatory batch.	85-115%	Investigate and correct problem. If poor recovery is indicative of laboratory problems, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Matrix spike (MS)	One per 10 samples.	70-130%	Check for standards preparation. Check for interferences. Review against LCS recoveries to look for trends. If poor recovery is indicative of laboratory problems, re-prepare and re-analyze batch. Otherwise, if LCS passed QC criteriabatch is validated by the LCS.	Apply S-flag if acceptance criteria are not met.	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.
Matrix spike duplicate (MSD) or sample duplicate	One per preparatory batch per matrix	MSD Recovery: 70-130% MSD or sample duplicate: RPD ≤ 20% (between MS and MSD or sample and sample duplicate).	Check for standards preparation. Check for interferences. Review against LCS recoveries to look for trends. If poor recovery is indicative of laboratory problems, re-prepare and re-analyze batch. Otherwise, if LCS passed QC criteria batch is validated by the LCS.	Apply S-flag if acceptance criteria are not met.	The data shall be evaluated to determine the source of difference.
Results reported between DL and LOQ	NA.	NA.	NA.	Apply J-flag to all results between MDL and PQL.	

Summary of Instrument Calibration, Laboratory QC Procedures and Corrective Actions

EPA 300.0 (Inorganic Anions by IC)			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Initial Calibration (minimum of 3 standards and a calibration blank)	Initial calibration prior to sample analysis	r > 0.995	Evaluate system. Repeat calibration.
Initial calibration verification (second source) ICV	With each initial calibration	Within 10% of expected value.	Correct problem, then repeat initial calibration
Initial Calibration Blank (ICB)	After initial calibration, every 10 samples, and at the end of analytical sequence.	All analytes < RL.	Investigate source of contamination. Clean instrument if necessary and rerun blank
Continuing calibration verification (CCV)	After every ten samples and at the end of the analytical sequence.	Recoveries within ± 10% of expected value.	a. Evaluate system. Rerun standard. b. Reprep standard and recalibrate. Rerun affected samples.
Method Blank	One per batch of 20 samples	All analytes < RL.	Investigate source of contamination. Clean instrument if necessary and rerun blank.
Laboratory Control Sample (LCS)	Minimum of one LCS per batch of 20 samples.	80-120%	a.Check calculations. Check standards preparation. Check for instrument malfunction. Rerun the LCS. b. If out the second time, reprepare the entire batch.
Matrix spike/matrix spike duplicate (MS/MSD)	One MS/MSD per batch of 20 samples. Same spiking analytes as LCS.	80-120%	Check for standards preparation. Check for interferences. Review against LCS recoveries to look for trends. If poor recovery is indicative of laboratory problems, re-prepare and re-analyze batch. Otherwise, if LCS passed QC criteria batch is validated by the LCS.
MDL study	Twice a year per instrument .	For all analytes MDL should be < PQL.	Check instrument. Re-do MDL.

Summary of Instrument Calibration, Laboratory QC Procedures and Corrective Actions

Spectrophotometer Tests			
Calibration QC Check	**Frequency**	**Acceptance Criteria**	**Corrective Action**
Initial Calibration	Initial calibration prior to sample analysis	r > 0.995	Evaluate system. Repeat calibration.
Initial calibration verification (second source) ICV	With each initial calibration	Within 10% of expected value.	Correct problem, then repeat initial calibration
Continuing Calibration	Every 20 samples	± 10%	a. Evaluate system. Rerun standard. b. Reprep standard and recalibrate. Rerun affected samples.
Method Blank	Every 20 samples	< PQL	Investigate source of contamination. Clean instrument if necessary and rerun blank.
Laboratory Control Sample (LCS)	Every 20 samples	80 – 120%	a.Check calculations. Check standards preparation. Check for instrument malfunction. Rerun the LCS. b. If out the second time, reprepare the entire batch.
Matrix spike/matrix spike duplicate (MS/MSD)	Every 20 samples	80-120%	Check for standards preparation. Check for interferences. Review against LCS recoveries to look for trends. If poor recovery is indicative of laboratory problems, re-prepare and re-analyze batch. Otherwise, if LCS passed QC criteria batch is validated by the LCS.
MDL study	One for each test per year.	For all analytes MDL should be < PQL.	Check instrument. Re-do MDL.

Summary of Instrument Calibration, Laboratory QC Procedures and Corrective Actions

Titration Tests			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Titrant standardization	Every 20 samples	Within 5% of expected concentration	Check calculations and standard preparation. Reanalyze.
Method Blank	Every 20 samples	< PQL	Investigate source of contamination. Reanalyze.
Laboratory Control Sample (LCS)	Every 20 samples	80 – 120%	a.Check calculations. Check standards preparation. Rerun the LCS. b. All samples (including QC samples) must be reanalyze if LCS fails.
Matrix spike/matrix spike duplicate (MS/MSD)	Every 20 samples	80-120%	Check for standards preparation. Check for interferences. Review against LCS recoveries to look for trends. If poor recovery is indicative of laboratory problems, re-prepare and re-analyze batch. Otherwise, if LCS passed QC criteria batch is validated by the LCS.

Summary of Instrument Calibration, Laboratory QC Procedures and Corrective Actions

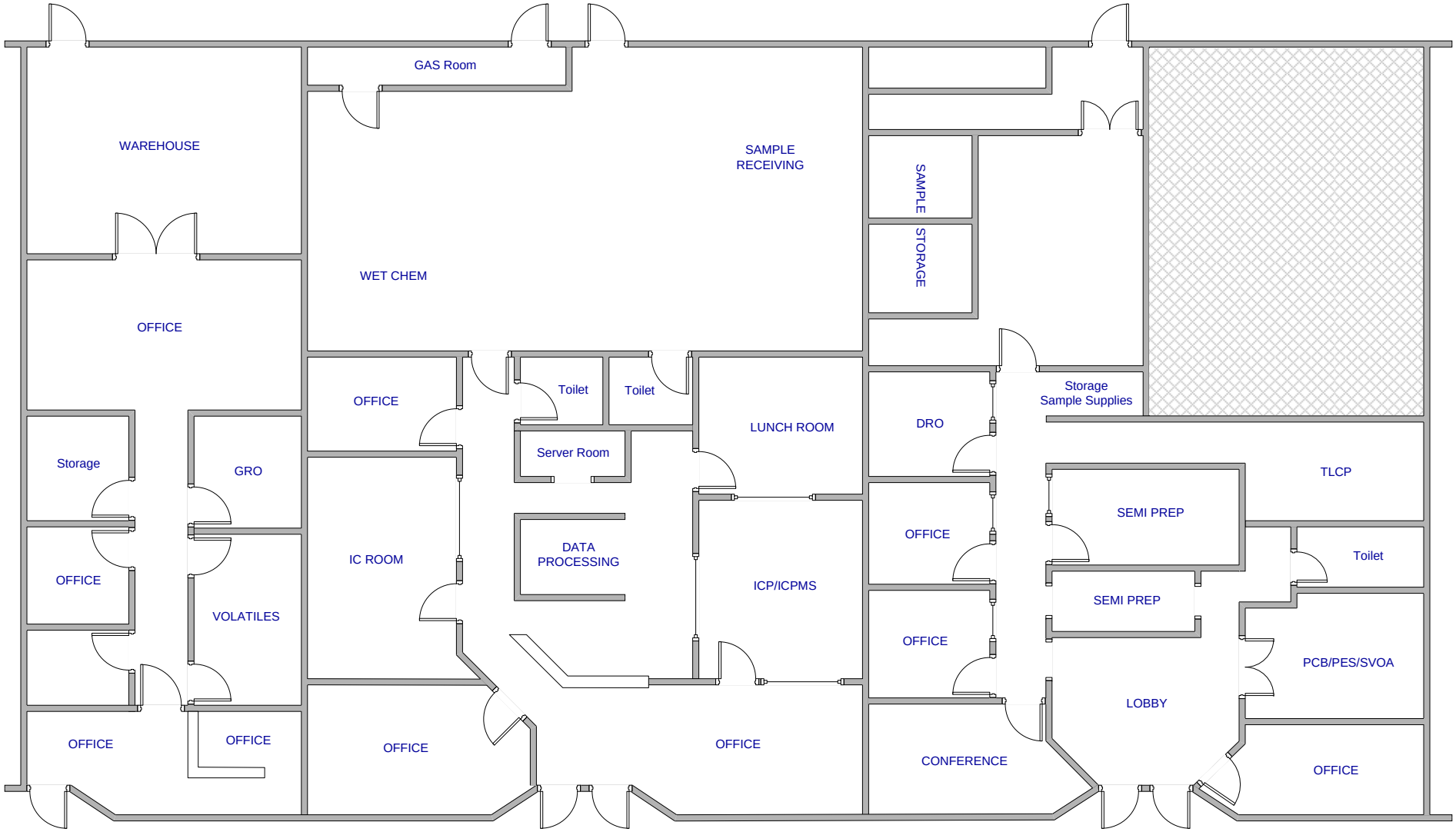
pH			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Three Buffers	Beginning of use / new chemist	Within 0.1 unit of true value	Recalibrate instrument.
Buffer Check	Every 10 samples and at the end of the sample batch.	Within 0.1 unit of true value	Recalibrate instrument.
Duplicate	Every 10 samples	% RPD must be < current control limits	Reanalyze original sample and sample duplicate.
Gravimetric Tests			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Balance Check	Beginning of use.	Within current control limits.	Recalibrate instrument.
Method Blank	Every 20 samples	< PQL	Investigate source of contamination. Reanalyze.
Laboratory Control Sample (LCS)	Every 20 samples	80 – 120%	a.Check calculations. Check standards preparation. Rerun the LCS. b. All samples (including QC samples) must be reanalyze if LCS fails.
Matrix spike/matrix spike duplicate (MS/MSD)	Every 20 samples	80-120%	Check for standards preparation. Check for interferences. Review against LCS recoveries to look for trends. If poor recovery is indicative of laboratory problems, re-prepare and re-analyze batch. Otherwise, if LCS passed QC criteria batch is validated by the LCS.
Sample Duplicate	Every 20 samples	RPD: 20%	Reanalyze original sample and sample duplicate.

Summary of Instrument Calibration, Laboratory QC Procedures and Corrective Actions

Distillation Tests +Spectrophotometer Tests			
QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Initial Calibration	Initial calibration prior to sample analysis	r > 0.995	Evaluate system. Repeat calibration.
Continuing Calibration	Every 20 samples	± 10%	a. Evaluate system. Rerun standard. b. Reprep standard and recalibrate. Rerun affected samples.
Method Blank	Every 20 samples	< PQL	Investigate source of contamination. Reanalyze.
Laboratory Control Sample (LCS)	Every 20 samples	80 – 120%	a.Check calculations. Check standards preparation. Rerun the LCS. b. All samples (including QC samples) must be reanalyze if LCS fails.
Matrix Spike / Matrix Spike Duplicate (MS/MSD)	Every 20 samples	80 – 120%	Check for standards preparation. Check for interferences. Review against LCS recoveries to look for trends. If poor recovery is indicative of laboratory problems, re-prepare and re-analyze batch. Otherwise, if LCS passed QC criteria batch is validated by the LCS
MDL study	One for each test per year.	For all analytes MDL should be < PQL.	Check instrument. Re-do MDL.

APPENDIX F

LABORATORY LAYOUT



TITLE	**3145 - 3151 W. POST ROAD**	**REVISION No.: 03**	**Date:** 15 May 2012
		DOCUMENT	
SECTION	**OFFICE FLOOR PLAN** **NOT TO SCALE**	AUTHORIZATION	**Page 01 of 01**

APPENDIX G

LIST OF INSTRUMENTATION AND EQUIPMENT

EQUIPMENT LIST

(updated 05/16/13)

Volatile Organics- EPA Method 8015B GRO and 8260B			
Qty	**Equipment**	**Make**	**Model**
4	Gas Chromatograph	Agilent	5890/6890 N
2	GC Mass Spectrometer	Agilent	5973 and 5975 MSD
4	Purge & Trap Concentrator	Tekmar	LSC 3100, Atom X
4	Auto Sampler	Archon	5100, Atom X
4	Data System	Agilent	Enviroquant
1	Analytical Balance	Mettler	
4	Computers	Dell	Dimension 3100
2	Printers	HP	
Semi-volatile Organics- EPA Method 8015B DRO			
Qty	**Equipment**	**Make**	**Model**
2	Gas Chromatograph	Agilent	5890 Series II w/2 FID
3	Liquid Auto Sampler	Agilent	7673
2	Data System	Agilent	Enviroquant
2	Computer	Dell	Dimension 3100
1	Printer	HP	Laser Jet
1	Refrigerator	GE	
3	Hood	Genie Scientific/Custom	
Semi-volatile Organics- EPA Method 8081/8082			
Qty	**Equipment**	**Make**	**Model**
2	Gas Chromatograph	Agilent	5890 w/ dual ECD and 6890 w/ dual ECD
2	Liquid Auto Sampler	Agilent	7673
2	Data System	Agilent	Enviroquant
2	Computer	Dell	Dimension 3100
1	Printer	HP	Laser Jet
Semi-volatile Organics- EPA Method 8270C			
Qty	**Equipment**	**Make**	**Model**
2	Gas Chromatograph	Agilent	(2) 6890
2	GC Mass Spectrometer	Agilent	(2)5973 MSD
2	Liquid Auto Sampler	Agilent	7673
2	Data System	Agilent	Enviroquant
2	Computer	Dell	Dimension 3100
1	Printer	HP	Laser Jet
Metals- EPA Method 6000/200.7/200.8 Series			
Qty	**Equipment**	**Make**	**Model**
2	Inductively Coupled Plasma	Perkin Elmer	Optima 4200DV and 7300DV

2	Inductively Coupled Plasma_Mass Spectrophotometer	Perkin Elmer/Agilent	ELAN DRC Plus/7700X
4	Auto Sampler	Perkin Elmer/CETAC	AS93 plus/ASX 500
4	Chiller	Polyscience	
4	Computer	Dell/HP	Optiplex/Desktop
3	Printer	HP	HP Laser Jet 250/4350
Metals- EPA Method 7470/7471A/245.1			
Qty	**Equipment**	**Make**	**Model**
1	Mercury Cold Vapor Analyzer	CETAC Mercury Analyzer	M 6000
1	Hood	Prescott	Custom
1	Data System	CETAC	
1	Computer	Dell	GX100
1	Printer	HP	HP Laser Jet 250
Classical Wet Chemistry			
Qty	**Equipment**	**Make**	**Model**
1	Analytical Balance	Sartorius	SP 180
1	Convection Oven	Scientific Products	DK-3
1	pH Meter	VWR	Symphony
1	Turbidimeter	Le Motte	2008
1	Computer	Dell	Optiplex GX1
1	Printer	Agilent	
2	Hood	Genie Scientific	
1	Conductivity meter	VWR	
1	UV/VIS Spectrophotometer	Thermo	Helios Gamma
1	Distillation Apparatus for Ammonia and TKN	Buchi	Buchi 322 Distillation Unit and Buchi 342 Control Unit
1	Digestion Block for TKN	Buchi	Buchi 342
1	Digestion Vessel/Reaction Vessel for Ammonia and TKN	Buchi	
Inorganics- EPA Method 300/218.6/7199/TOC			
Qty	**Equipment**	**Make**	**Model**
5	Ion Chromatograph	Dionex	ICS-5000, ICS-2000, ICS 1500, DX 500
2	Ion Chromatograph	Dionex	DX-100
5	Data System	Dionex	Integrated w/instrument
1	TOC Analyzer	GE	Sievers 900
5	Auto Sampler	Dionex	AS40, AS DV
6	Computer	Dell	Optiplex GX1,GX270, Dimension 2400
1	Analytical Balance	Sartorius	BA100S
2	Printer	Agilent	Laser Jet 2300, 4L

Sample Preparation Chemistry			
Qty	**Equipment**	**Make**	**Model**
2	Hot Block Digester	Env.Express	-----
1	Computer	Dell	Optiplex GX100,
5	Fume Hood	Genie Scientific/Custom	Custom
3	Sonicator	Tekmar	Various
1	Hot Plate	Corning/Linberg/Thermolyne	
1	Top Loading Balance	Mettler	DB202
2	TCLP Rotator	Environmental Express	-----
3	Top Loading Balance	Mettler	Various
2	TurboVap Concentrator	Zymark/Caliper	TurboVap II
1	Refrigerator		
Sample Control			
Qty	**Equipment**	**Make**	**Model**
1	Top Loading Balance	Sartorius	B3103
50	Sample Coolers	Miscellaneous	Various sizes
10	Refrigerator	VWR	4°C coolers
2	Computer	Dell	Dimension 3100
2	Printer/Copier/Fax	Brother/Konica Minolta	7820 N
1	Barcode Printer	Zebra	WASP 606
2	Barcode Scanner	Metrologic	MS 6720
1	Fume Hood	Custom	Custom
Document Control/Client Services			
Qty	**Equipment**	**Make**	**Model**
3	Computer	Dell	Optiflex
2	Copier/Scanner /Printer	Konica Minolta	601,550C
Laboratory Information Management System (LIMS)/Data Storage System			
1	SQL-SVR	Dell	Power Edge (LIMS Data)
3	Servers	Dell	Power Edge (Storage/E-mail)
4	Computer	Dell	Dimension/Optiplex,Vostro
Health and Safety			
Qty	**Equipment**	**Make**	**Model**
3	First Aid Kits	Lab Safety Products	Various
4	Fire Extinguishers	Underwriter Laboratories	First Alert
2	Portable Eye Wash/Plumbed	Various	
1	Spill Containment Set-up	Labconco	-----
1	Spill Kit	Labconco	-----
Field/Courier Services			
3	Field Truck	Ford/Chevy	Escape /F150/Silverado
1	pH meter	VWR	2000/3000 series

APPENDIX H

TABLES OF HOLDING TIMES AND PRESERVATIONS

Tables of Holding Time and Preservation

Please see our website for method references at www.atl-labs.com

Volatile Organics in Water

Parameter	Method	Holding Time	Min. Vol. (mL)	Container Type	Preservation
GRO	8015B	14 days*	40	3 x 40 mL vials with Teflon lined septum caps	HCL, pH < 2, add 1000 mg ascorbic acid/L if residual chlorine present, 4 °C
TPH(g)/BTEX/MTBE	8015B (GRO), 8021B (BTEX/MTBE)	14 days*	40	3 x 40 mL vials with Teflon lined septum caps	HCL, pH < 2, add 1000 mg ascorbic acid/L if residual chlorine present, 4 °C
Purgeable Halocarbons/ Aromatics	8260B (8021B list)	14 days*	40	3 x 40 mL vials with Teflon lined septum caps	HCL, pH < 2, add 1000 mg ascorbic acid/L if residual chlorine present, 4 °C
VOCs (Volatile Organic Compounds)	8260B/624	14 days*	40	3 x 40 mL vials with Teflon lined septum caps	HCL, pH < 2, add 1000 mg ascorbic acid/L if residual chlorine present, 4 °C

Note: * 7 days without HCl

Volatile Organics in Soil

Parameter	Method	Holding Time	Min. Vol. (g)	Container Type	Preservation
GRO	8015B	14 days	5	4 oz glass jar w/Teflon lid	4°C
GRO(EnCore)	5035/8015B	48 hours	(3) 5g/sample	(3) 5g EnCORE sampler	4°C
GRO (NaHSO4 preserved)	5035/8015B	14 days	(3) 5g/sample	2 pre-weighed NaHSO4 preserved VOA + 1 pre-weighed MeOH preserved VOA	4°C, NaHSO4, MeOH
Purgeable Halocarbons/Aromatics	8260(8021B list)	14 days	5	4 oz glass jar w/Teflon lid	4°C
GRO/BTEX/MTBE	8015B/8021B	14 days	5	4 oz glass jar w/Teflon lid	4°C
TPH(g) (EnCORE)	5035/8015B (M)	48 hours	(3) 5g/sample	(3) 5g EnCORE sampler	4°C
TPH(g) (NaHSO4 & MeOH preserved)	5035/8015B (M)	14 days	(3) 5g/sample	2 pre-weighed NaHSO4 preserved VOA + 1 pre-weighed MeOH preserved VOA	4°C, NaHSO4, MeOH
VOCs	8260B	14 days	5	4 oz glass jar w/Teflon lid	4°C
VOCs (EnCORE)	5035/8260B	48 hours	(3) 5g/sample	(3) 5g EnCORE sampler	4°C
VOCs (NaHSO4 & MeOH preserved)	5035/8260B	14 days	(3) 5g/sample	2 pre-weighed NaHSO4 preserved VOA + 1 pre-weighed MeOH preserved VOA	4°C, NaHSO4, MeOH

Semivolatile Organics in Water

Parameter	Method	Holding Time	Min. Vol. (mL)	Container Type	Preservation
DRO	8015B	7*	1000	1 L amber glass	4 °C**
Pesticides, Organochlorine	8081A/608	7*	1000	1 L amber glass	4 °C**
PCBs	8082/608	7*	1000	1 L amber glass	4 °C**
SVOCs (BNAs)	625/8270C	7*	1000	1 L amber glass	4 °C**
1,4-Dioxane	8270C Isotope Dilution	7*	1000	1 L amber glass	4 °C**
TPH (d)	8015B (M)	7*	1000	1 L amber glass	4 °C**
TPH-CC (C8-C40)	8015B (M)	7*	1000	1 L amber glass	4 °C**

Note: * 7 days for extraction, 40 days after extraction for analysis. ** If sampling from location where residual chlorine is present, samples have to be treated with sodium thiosulfate ($Na_2S_2O_3$)

Semivolatile Organics in Soil

Parameter	Method	Holding Time	Min. Vol. (g)	Container Type	Preservation
DRO	EPA 8015B	14*	30	4 oz glass jar w/Teflon lid	4°C
PCBs	EPA 8082	14*	30	4 oz glass jar w/Teflon lid	4°C
Pesticides, Organochlorine	EPA 8081A	14*	30	4 oz glass jar w/Teflon lid	4°C
SVOCs (BNAs)	EPA 8270C	14*	30	4 oz glass jar w/Teflon lid	4°C
TPH(d)	EPA 8015B(M)	14*	15	4 oz glass jar w/Teflon lid	4°C
TPH-CC (C8-C40)	EPA 8015B(M)	14*	15	4 oz glass jar w/Teflon lid	4°C

Note: * 14 days for extraction, 40 days for analysis

General Chemistry Water

Parameter	Method	Holding Time	Minimum Volume (mL)	Sample Volume & Container Type	Preservation
Acidity	SM 2310B	14 days	100	125 mL, 4oz plastic or glass	Cool, 4 °C
Alkalinity	SM 2320B	14 days	100	125 mL, 4oz plastic or glass	Cool, 4 °C
Ammonia	SM 4500-NH3C	28 days	100	500 mL, plastic or glass	Cool, 4 °C, H2SO4 to pH < 2
Biochemical Oxygen Demand	SM5210B	48 hours	300	1 L, plastic or glass	Cool, 4 °C
Bromide	300.0	28 days	50	125 mL, 4oz plastic	Cool, 4 °C
cBOD	SM5210B	48 hours	300	1 L, 32oz plastic	Cool, 4 °C
Chemical Oxygen Demand	410.4	28 days	50	125 mL, 4oz plastic	Cool, 4 °C, H2SO4 to pH < 2
Chloride	SM 4500-Cl- C, 300.0	28 days	50	125 mL, 4oz plastic	Cool, 4 °C
Chlorine, Free	SM4500CLG	15 mins	100	500 mL, plastic or glass	Cool, 4 °C
Chlorine, Total Residual	SM4500CLG	15 mins	100	500 mL, plastic or glass	Cool, 4 °C
Color	SM2120B	48 hours	100	250 mL, 8oz plastic or glass	Cool, 4 °C
Cyanide, Amenable	SM 4500-CN G	14 days	250	250 mL, 8oz plastic	Cool, 4 °C; if oxidizing agents present add 0.6 g of ascorbic acid per L; adjust pH > 12 with 10N NaOH.
Cyanide, Total	SM 4500-CN G 9014	14 days	250	250 mL, 8oz plastic	Cool, 4 °C; if oxidizing agents present add 0.6 g of ascorbic acid per L; adjust pH > 12 with 10N NaOH.
Flashpoint	1010	14 days	100	250 mL, 8oz plastic	None
Fluoride	SM 4500-F C, 300.0	28 days	50	250 mL, 8oz plastic	None
Hardness	SM2340 C SM2340B	6 months	100	125 mL, 4oz plastic or glass	HNO_3 , pH < 2
Nitrate	300.0, SM 4500 NO3 E	48 Hours	50	125 mL, 4oz plastic or glass	Cool, 4 °C
Nitrate-Nitrite	SM 4500-NO3 E	28 days	50	125 mL, 4oz plastic or glass	Cool, 4 °C, H2SO4 to pH < 2
Nitrite	300.0; SM 4500-NO2 B	48 hours	50	125 mL, 4oz plastic or glass	Cool, 4 °C
Oil and Grease - HEM	1664	28 days	1000	32oz, glass	Cool, 4 °C, H2SO4 to pH < 2
Oxygen, Dissolved	360.1, SM4500-O G	15 mins	50	250 mL, glass or BOD bottle	None

Perchlorate	314.0	28	50	125 ml HDPE	4°C
pH	SM 4500-H+ B	15 mins	50	125 mL, 4oz plastic or glass	None required
Phenolics	420.1	28 days	100	500 mL amber	Cool, 4 °C, H2SO4 to pH < 2
Phosphate,Ortho	300.0; 365.3; SM 4500-P E	48 hours	50	125 mL, 4oz plastic	Cool, 4 °C
Phosphorus, Total	365.3; SM4500-PE	28 days	100	125 mL, 4oz plastic	Cool, 4 °C, H2SO4 to pH < 2
Solids, Total (TS)	SM 2540 B	7 days	200	250 mL, 8oz plastic	Cool, 4 °C
Solids, Total Dissolved (TDS)	SM 2540 C	7 days	200	250 mL, 8oz plastic	Cool, 4 °C
Solids, Total Suspended (TSS)	SM 2540 D	7 days	200	250 mL, 8oz plastic	Cool, 4 °C
Solids, Settleable (SS)	SM 2540 F	48 hours	1000	1 L , 32oz plastic	Cool, 4 °C
Solids, Volatile (VS)	160.4	7 days	200	250 mL, 8oz plastic	Cool, 4 °C
Specific Conductance	120.1	24 hours	50	125 mL, 4oz plastic or glass	Cool, 4 °C
Sulfate	300.0	28 days	50	125 mL, 4oz plastic or glass	Cool, 4 °C
Sulfide, Dissolved	SM 4500-S-2 D	7 days	100	125 mL, Plastic	NaOH + AlCl3, flocculate + settle. Transfer liquid, preserve w/ zinc acetate, pH > 9. Cool, 4 °C
Sulfide, Total	SM 4500-S-2 D	7 days	100	500 mL, Plastic or Glass	Cool, 4 °C, add zinc acetate, pH > 9
Surfactants (MBAS)	SM 5540 C	48 hours	200	250 mL, 8oz plastic	Cool, 4 °C
Total Organic Carbon (TOC)	SM 5310B	28 days	40	40 mL VOA	Cool, 4 °C, H2SO4 to pH < 2
Total Organic Halides (TOX)	9020	28 days	200	500 mL, amber glass	Cool, 4 °C, H2SO4 to pH < 2
TRPH	1664	28 days	1000	1 L, glass	Cool, 4 °C, H2SO4 to pH < 2
Turbidity	180.1	48 Hours	50	125 mL, plastic or glass	Cool, 4 °C

General Chemistry Soil

Parameter	Method	Holding Time	Minimum Volume (g)	Sample Volume & Container Type	Preservation
Alkalinity	310.1(M)	14 days	20	4 oz glass jar w/Teflon lid	4°C
Bromide	300.0(M)	28 days	10	4 oz glass jar w/Teflon lid	4°C
Chemical Oxygen Demand (COD)	410.4(M)	28 days	10	4 oz glass jar w/Teflon lid	4°C
Chloride	300.0(M)	28 days	10	4 oz glass jar w/Teflon lid	4°C
Chromium IV (Hexavalent Chromium)	7196A	21 days	10	4 oz glass jar w/Teflon lid	4°C
Cyanide, Amenable	9010B/9014	14 days	20	4 oz glass jar w/Teflon lid	4°C
Cyanide, Reactive	SW 846 Ch.7	14 days	10	4 oz glass jar w/Teflon lid	4°C
Cyanide, Total	9010B/9014	14 days	10	4 oz glass jar w/Teflon lid	4°C
Ignitability (Flashpoint)	1010	14 days	20	4 oz glass jar w/Teflon lid	4°C
Moisture Content	ASTM D2216	ASAP	10	4 oz glass jar w/Teflon lid	4°C
Nitrogen, Nitrate	300.0(M)	48 hours	10	4 oz glass jar w/Teflon lid	4°C
Nitrogen, Nitrite	300.0(M)	48 hours	10	4 oz glass jar w/Teflon lid	4°C
Oil and Grease (HEM)	1664(M)	28 days	30	4 oz glass jar w/Teflon lid	4°C
Perchlorate	314.0 (M)	28	50	125 ml HDPE	4°C
pH	9045C / 9040B	ASAP	10	4 oz glass jar w/Teflon lid	4°C
Phenolics, Total	420.1 (M)	28 days	20	4 oz glass jar w/Teflon lid	4°C
Phosphate, Ortho	300.0(M)	48 hours	10	4 oz glass jar w/Teflon lid	4°C
Phosphate, Total	365.3(M)	28 days	20	4 oz glass jar w/Teflon lid	4°C
Phosphorus, Total	365.3(M)	28 days	20	4 oz glass jar w/Teflon lid	4°C
Sulfate	300.0(M)	28 days	20	4 oz glass jar w/Teflon lid	4°C
Sulfide, Reactive	SW 846 Ch.7	7 days	20	4 oz glass jar w/Teflon lid	4°C
Sulfide, Total	9030B/EPA 376.2(M)	7 days	20	4 oz glass jar w/Teflon lid	4°C
Total Organic Carbon (TOC)	9060	28 days	2	4 oz glass jar w/Teflon lid	4°C
TRPH	1664SGT/ HEM (M)	28 days	30	4 oz glass jar w/Teflon lid	4°C

Note: (M) indicates modification of the method

Metals in Water

Parameter	Method	Holding Time	Minimum Volume (mL)	Sample Volume & Container Type	Preservation
Mercury	7470A/245.1	28 days	50	Minimum 250mL or 16oz plastic	HNO3, pH < 2
ICP Metals, except Chromium VI & Mercury	6010B,200.7	6 months	50	250 mL, 16oz plastic	HNO3, pH < 2
ICPMS Metals	6020/200.8	6 months	50	250 mL, 16oz plastic	HNO3, pH < 2
Sodium	7770/SM 3111B	6 months	50	250 mL, 16oz plastic	HNO3, pH < 2
Potassium	7610/ SM 3111B	6 months	50	250 mL, 16oz plastic	HNO3, pH < 2
Hexavalent Chromium	7196A , 218.6/ 7199	24 hours	50	250 mL, 8oz plastic	Cool, 4 °C
Hexavalent Chromium	218.6	28 days	50	250 mL, 8oz plastic	Cool to 4^{o}C, field filtered and adjusted to pH 9.3-9.7 with ammonium buffer solution

Note: Dissolved Metals must be filtered prior to preservation.

Metals in Soil

Parameter	Method	Holding Time	Minimum Volume (g)	Sample Volume & Container Type	Preservation
Mercury	EPA 7471A	28 days	5	4 oz glass jar w/Teflon lid	4°C
ICP Metals	EPA 6010B	6 months	5	4 oz glass jar w/Teflon lid	4°C
ICP/MS Metals	EPA 6020	6 months	5	4 oz glass jar w/Teflon lid	4°C
Sodium	EPA 7770	6 months	5	4 oz glass jar w/Teflon lid	4°C
Potassium	EPA 7610	6 months	5	4 oz glass jar w/Teflon lid	4°C
Mercury	EPA 7471A	28 days	5	4 oz glass jar w/Teflon lid	4°C

TCLP

Parameter	From: Field Collection To: TCLP Extraction	From: TCLP Extraction To: Preparative Extraction	From: Preparative Extraction To: Determinative Analysis	Sample Volume & Container Type	Total Elapsed Time	Preservation
Volatiles	14 days	NA	14 days	40mL VOA	28 days	None
Semivolatiles	14 days	7 days	40 days	32oz amber	61 days	None
Mercury	28 days	NA	28 days	16oz plastic	56 days	HNO3, pH < 2
Metals, except Mercury	180 days	NA	180 days	16oz plastic	360 days	HNO3, pH < 2

APPENDIX I

CHAIN OF CUSTODY FORM

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories INC.
3151-3153 W. Post Rd.
Las Vegas, NV 89118
Tel: (702) 307-2659 ● Fax: (702) 307-2691

FOR LABORATORY USE ONLY

P.O. #: _____

Logged By: _____ Date: _____

Method of Transport
Client ☐
ATL ☐
CA OverN ☐
FedEx ☐
Other: _____

Sample Condition Upon Receipt
1. CHILLED Y ☐ N ☐ 4. SEALED Y ☐ N ☐
2. HEADSPACE (VOA) Y ☐ N ☐ 5. # OF SPLS MATCH COC Y ☐ N ☐
3. CONTAINER INTACT Y ☐ N ☐ 6. PRESERVED Y ☐ N ☐

Client: Address: Tel:
Attention: City: State: Zip Code: Fax:

Project Name: Project #: Sampler: *I attest to the validity and authenticity of this sample. I am aware that tampering with or intentionally mislabeling the sample location, date or time of collection is considered fraud and may be grounds for legal action.* (Printed Name) (Signature)

Relinquished by: (Signature and Printed Name) Date: Time: Received by: (Signature and Printed Name) Date: Time:

Relinquished by: (Signature and Printed Name) Date: Time: Received by: (Signature and Printed Name) Date: Time:

Relinquished by: (Signature and Printed Name) Date: Time: Received by: (Signature and Printed Name) Date: Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter:
Print Name Date
Signature

Send Report To:
Attn:
Co:
Addr:
City: State: Zip:

Bill To:
Attn:
Co:
Addr:
City: State: Zip:

Special Instructions/Comments:

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample :$2.00 / sample /mo (after 45 days)
- Records: $1 /ATL workorder /mo (after 1 year)

Circle or Add Analysis(es) Requested

SPECIFY APPROPRIATE MATRIX

PRESERVATION

Q A / Q C
RTNE ☐
CT ☐
SWRCB ☐
Logcode_____
OTHER _____

ITEM	LAB USE ONLY: Lab No.	Sample Description: Sample ID / Location	Date	Time	8260B (Volatiles)	8015M - GRO	8015B - DRO/ORO	SOIL	WATER	GROUND WATER	WASTEWATER	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
															H	

■ TAT starts 8AM the following day if samples received after 3 PM

TAT: ☐ A = Overnight ≤ 24 hrs ☐ B = Emergency Next Workday ☐ C = Critical 2 Workdays ☐ D = Urgent 3 Workdays ☐ E = Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives:
H=HCl N=HNO_3 S=H_2SO_4 C=4ºC
Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

APPENDIX J

CONTROL LIMITS

HEXAVALENT CHROMIUM BY IC

Matrix: **WATER**

EPA 218.6

	MS		RPD	LCS	
Analyte	Lower Limit	Upper Limit	Limit	Lower Limit	Upper Limit
Cr6+	90	110	20	90	110

EPA 218.6 LOW LEVEL

	MS		RPD	LCS	
Analyte	Lower Limit	Upper Limit	Limit	Lower Limit	Upper Limit
Cr6+	90	110	20	90	110

EPA 218.7

	MS		RPD	LCS	
Analyte	Lower Limit	Upper Limit	Limit	Lower Limit	Upper Limit
Cr6+	90	110	20	90	110

EPA 218.7 LOW LEVEL

	MS		RPD	LCS	
Analyte	Lower Limit	Upper Limit	Limit	Lower Limit	Upper Limit
Cr6+	90	110	20		

EPA 7199

	MS		RPD	LCS	
Analyte	Lower Limit	Upper Limit	Limit	Lower Limit	Upper Limit
Cr6+	85	115	20	85	115

Matrix: **SOIL**

EPA 7199

	MS		RPD	LCS	
Analyte	Lower Limit	Upper Limit	Limit	Lower Limit	Upper Limit
Cr6+	75	125	20	80	120

Effective Date: February 2013

6010B/200.7 _ ICP Metals

Matrix: **WATER**

	MS			RPD *		LCS	
Analyte	Lower Limit	Upper Limit		Limit		Lower Limit	Upper Limit
Antimony	75	125		20		85	115
Arsenic	75	125		20		85	115
Barium	75	125		20		85	115
Beryllium	75	125		20		85	115
Cadmium	75	125		20		85	115
Chromium	75	125		20		85	115
Cobalt	75	125		20		85	115
Copper	75	125		20		85	115
Lead	75	125		20		85	115
Molybdenum	75	125		20		85	115
Nickel	75	125		20		85	115
Selenium	75	125		20		85	115
Silver	75	125		20		85	115
Thallium	75	125		20		85	115
Vanadium	75	125		20		85	115
Zinc	75	125		20		85	115

Matrix: **SOIL**

	MS			RPD *		LCS	
Analyte	Lower Limit	Upper Limit		Limit		Lower Limit	Upper Limit
Antimony	75	125		20		80	120
Arsenic	75	125		20		80	120
Barium	75	125		20		80	120
Beryllium	75	125		20		80	120
Cadmium	75	125		20		80	120
Chromium	75	125		20		80	120
Cobalt	75	125		20		80	120
Copper	75	125		20		80	120
Lead	75	125		20		80	120
Molybdenum	75	125		20		80	120
Nickel	75	125		20		80	120
Selenium	75	125		20		80	120
Silver	75	125		20		80	120
Thallium	75	125		20		80	120
Vanadium	75	125		20		80	120
Zinc	75	125		20		80	120

6010B/200.7 _ ICP Metals

Matrix: **WATER**

	MS			RPD		LCS	
Analyte	Lower Limit	Upper Limit		Limit		Lower Limit	Upper Limit
Aluminum	75	125		20		85	115
Calcium	75	125		20		85	115
Iron	75	125		20		85	115
Magnesium	75	125		20		85	115
Manganese	75	125		20		85	115
Boron	75	125		20		85	115
Silicon	75	125		20		85	115
Silicon (SiO2)	75	125		20		85	115
Potassium	75	125		20		85	115
Sodium	75	125		20		85	115
Titanium	75	125		20		85	115
Strontium	75	125		20		85	115

Matrix: **SOIL**

	MS			RPD		LCS	
Analyte	Lower Limit	Upper Limit		Limit		Lower Limit	Upper Limit
Aluminum	75	125		20		80	120
Calcium	75	125		20		80	120
Iron	75	125		20		80	120
Magnesium	75	125		20		80	120
Manganese	75	125		20		80	120
Boron	75	125		20		80	120
Silicon	75	125		20		80	120
Potassium	75	125		20		80	120
Sodium	75	125		20		80	120

6020/200.8 _ ICPMS Metals

Matrix: **WATER**

	MS			RPD *		LCS	
Analyte	Lower Limit	Upper Limit		Limit		Lower Limit	Upper Limit
Antimony	75	125		20		85	115
Arsenic	75	125		20		85	115
Barium	75	125		20		85	115
Beryllium	75	125		20		85	115
Cadmium	75	125		20		85	115
Chromium	75	125		20		85	115
Cobalt	75	125		20		85	115
Copper	75	125		20		85	115
Lead	75	125		20		85	115
Molybdenum	75	125		20		85	115
Nickel	75	125		20		85	115
Selenium	75	125		20		85	115
Silver	75	125		20		85	115
Thallium	75	125		20		85	115
Vanadium	75	125		20		85	115
Zinc	75	125		20		85	115

Matrix: **SOIL**

	MS			RPD *		LCS	
Analyte	Lower Limit	Upper Limit		Limit		Lower Limit	Upper Limit
Antimony	75	125		20		85	115
Arsenic	75	125		20		85	115
Barium	75	125		20		85	115
Beryllium	75	125		20		85	115
Cadmium	75	125		20		85	115
Chromium	75	125		20		85	115
Cobalt	75	125		20		85	115
Copper	75	125		20		85	115
Lead	75	125		20		85	115
Molybdenum	75	125		20		85	115
Nickel	75	125		20		85	115
Selenium	75	125		20		85	115
Silver	75	125		20		85	115
Thallium	75	125		20		85	115
Vanadium	75	125		20		85	115
Zinc	75	125		20		85	115

Matrix: **FILTER**

	MS			RPD *		LCS	
Analyte	Lower Limit	Upper Limit		Limit		Lower Limit	Upper Limit
Arsenic				20		85	115
Lead				20		85	115

Effective Date: February 2013

6020/200.8 _ ICPMS Metals

Matrix: **WATER**

	MS			RPD		LCS	
Analyte	Lower Limit	Upper Limit		Limit		Lower Limit	Upper Limit
Aluminum	75	125		20		85	115
Calcium	75	125		20		85	115
Iron	75	125		20		85	115
Magnesium	75	125		20		85	115
Manganese	75	125		20		85	115
Boron	75	125		20		85	115
Silicon	75	125		20		85	115
Potassium	75	125		20		85	115
Sodium	75	125		20		85	115

Matrix: **SOIL**

	MS			RPD		LCS	
Analyte	Lower Limit	Upper Limit		Limit		Lower Limit	Upper Limit
Aluminum	75	125		20		85	115
Calcium	75	125		20		85	115
Iron	75	125		20		85	115
Magnesium	75	125		20		85	115
Manganese	75	125		20		85	115
Boron	75	125		20		85	115
Silicon	75	125		20		85	115
Potassium	75	125		20		85	115
Sodium	75	125		20		85	115

MERCURY BY COLD VAPOR TECHNIQUE

Matrix: **WATER**

EPA 245.1

	MS		RPD	LCS	
Analyte	Lower Limit	Upper Limit	Limit	Lower Limit	Upper Limit
Mercury	75	125	20	85	115

EPA 245.1 LL

	MS		RPD	LCS	
Analyte	Lower Limit	Upper Limit	Limit	Lower Limit	Upper Limit
Mercury	75	125	20	85	115

EPA 7470

	MS		RPD	LCS	
Analyte	Lower Limit	Upper Limit	Limit	Lower Limit	Upper Limit
Mercury	75	125	20	85	115

Matrix: **SOIL**

EPA 7471A

	MS		RPD	LCS	
Analyte	Lower Limit	Upper Limit	Limit	Lower Limit	Upper Limit
Mercury	75	125	20	80	120

Effective Date: February 2013

ANIONS BY IC

Matrix: **WATER**

EPA 300.0

	MS			RPD		LCS	
Analyte	Lower Limit	Upper Limit		Limit		Lower Limit	Upper Limit
Bromide	80	120		20		90	110
Chloride	80	120		20		90	110
Fluoride	80	120		20		90	110
Nitrogen, Nitrate (As N)	80	120		20		90	110
Nitrogen, Nitrite	80	120		20		90	110
Phosphate	80	120		20		90	110
Sulfate	80	120		20		90	110

Matrix: **WATER LOW LEVEL**

EPA 300.0

	MS			RPD		LCS	
Analyte	Lower Limit	Upper Limit		Limit		Lower Limit	Upper Limit
Nitrate as N_PGE	80	120		20		90	110
Nitrogen, Nitrite	80	120				90	110

Matrix: **SOIL**

EPA 300.0

	MS			RPD		LCS	
Analyte	Lower Limit	Upper Limit		Limit		Lower Limit	Upper Limit
Bromide	80	120		20		90	110
Chloride	80	120		20		90	110
Fluoride	80	120		20		90	110
Nitrogen, Nitrate (As N)	80	120		20		90	110
Nitrogen, Nitrite	80	120		20		90	110
Phosphate	80	120		20		90	110
Sulfate	80	120		20		90	110

Effective Date: February 2013

EPA 8081

Matrix: **SOIL**

	LCS/LCSD		RPD
Analyte	Lower Limit	Upper Limit	Limit
4,4´-DDD	57	143	30
4,4´-DDE	54	137	30
4,4´-DDT	57	148	30
Aldrin	44	115	30
alpha-BHC	40	130	30
alpha-Chlordane	49	142	30
beta-BHC	44	127	30
delta-BHC	50	144	30
Dieldrin	59	135	30
Endosulfan I	53	121	30
Endosulfan II	60	137	30
Endosulfan sulfate	72	145	30
Endrin	53	148	30
Endrin aldehyde	53	131	30
Endrin ketone	55	139	30
gamma-BHC	37	134	30
gamma-Chlordane	51	131	30
Heptachlor	36	138	30
Heptachlor epoxide	50	127	30
Methoxychlor	56	144	30

	MS/MSD		RPD
Analyte	Lower Limit	Upper Limit	Limit
4,4´-DDD	31	162	30
4,4´-DDE	33	165	30
4,4´-DDT	17	180	30
Aldrin	36	141	30
alpha-BHC	23	149	30
alpha-Chlordane	24	175	30
beta-BHC	38	145	30
delta-BHC	36	166	30
Dieldrin	24	172	30
Endosulfan I	36	138	30
Endosulfan II	27	166	30
Endosulfan sulfate	49	157	30
Endrin	25	180	30
Endrin aldehyde	29	146	30
Endrin ketone	30	155	30
gamma-BHC	32	143	30
gamma-Chlordane	40	172	30
Heptachlor	33	145	30
Heptachlor epoxide	40	153	30
Methoxychlor	23	164	30

	Surrogate	
Analyte	Lower Limit	Upper Limit
Decachlorobiphenyl	28	120
Tetrachloro-m-xylene	28	161

Effective Date: April 4, 2013

EPA 8081

Matrix: **WATER**

	LCS/LCSD/MS/MSD		RPD
Analyte	Lower Limit	Upper Limit	Limit
4,4´-DDD	61	127	20
4,4´-DDE	54	128	20
4,4´-DDT	63	132	20
Aldrin	46	117	20
alpha-BHC	51	147	20
alpha-Chlordane	46	123	20
beta-BHC	62	117	20
delta-BHC	41	94	20
Dieldrin	53	135	20
Endosulfan I	50	129	20
Endosulfan II	59	127	20
Endosulfan sulfate	54	134	20
Endrin	51	160	20
Endrin aldehyde	51	124	20
Endrin ketone	44	128	20
gamma-BHC	48	125	20
gamma-Chlordane	49	127	20
Heptachlor	44	126	20
Heptachlor epoxide	48	127	20
Methoxychlor	63	142	20

	Surrogate	
Analyte	Lower Limit	Upper Limit
Decachlorobiphenyl	35	126
Tetrachloro-m-xylene	36	121

Effective Date: April 4, 2013

EPA 8082

Matrix: **WATER**

	LCS/MS/MSD		RPD
Analyte	Lower Limit	Upper Limit	Limit
Aroclor 1016	49	141	20
Aroclor 1260	48	132	20

	Surrogate	
Analyte	Lower Limit	Upper Limit
Decachlorobiphenyl	38	131
Tetrachloro-m-xylene	28	124

Matrix: **SOIL**

	LCS		RPD
Analyte	Lower Limit	Upper Limit	Limit
Aroclor 1016	56	121	
Aroclor 1260	62	121	

	MS/MSD		RPD
Analyte	Lower Limit	Upper Limit	Limit
Aroclor 1016	43	142	20
Aroclor 1260	34	146	20

	Surrogate	
Analyte	Lower Limit	Upper Limit
Decachlorobiphenyl	40	146
Tetrachloro-m-xylene	32	109

Matrix: **OIL**

	LCS		RPD
Analyte	Lower Limit	Upper Limit	Limit
Aroclor 1016	69	142	
Aroclor 1260	71	135	

	MS/MSD		RPD
Analyte	Lower Limit	Upper Limit	Limit
Aroclor 1016	50	153	20
Aroclor 1260	45	157	20

	Surrogate	
Analyte	Lower Limit	Upper Limit
Decachlorobiphenyl	65	148
Tetrachloro-m-xylene	49	128

Effective Date: April 4, 2013

3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

8015B _ DIESEL

Matrix: **WATER HIGH LEVEL**

	LCS/MS/MSD		RPD
Analyte	Lower Limit	Upper Limit	Limit
Diesel	38	121	20

	Surrogate	
Analyte	Lower Limit	Upper Limit
p_Terphenyl	54	146

Matrix: **WATER LOW LEVEL**

	LCS/MS/MSD		RPD
Analyte	Lower Limit	Upper Limit	Limit
Diesel	32	133	20

	Surrogate	
Analyte	Lower Limit	Upper Limit
p_Terphenyl	52	135

Matrix: **SOIL HIGH LEVEL**

	LCS		RPD
Analyte	Lower Limit	Upper Limit	Limit
Diesel	65	119	

	MS/MSD		RPD
Analyte	Lower Limit	Upper Limit	Limit
Diesel	32	171	20

	Surrogate	
Analyte	Lower Limit	Upper Limit
p_Terphenyl	52	175

Matrix: **SOIL LOW LEVEL**

	LCS		RPD
Analyte	Lower Limit	Upper Limit	Limit
Diesel	52	126	

	MS/MSD		RPD
Analyte	Lower Limit	Upper Limit	Limit
Diesel	13	129	20

	Surrogate	
Analyte	Lower Limit	Upper Limit
p_Terphenyl	59	127

Effective Date: April 11, 2013

8015B _ GAS

Matrix: **WATER**

	LCS		RPD
Analyte	Lower Limit	Upper Limit	Limit
Gasoline	70	130	

	MS/MSD		RPD
Analyte	Lower Limit	Upper Limit	Limit
Gasoline	39	153	

	Surrogate	
Analyte	Lower Limit	Upper Limit
Chlorobenzene-d5	74	126

Matrix: **SOIL**

	LCS		RPD
Analyte	Lower Limit	Upper Limit	Limit
Gasoline	77	122	

	MS/MSD		RPD
Analyte	Lower Limit	Upper Limit	Limit
Gasoline	41	132	30

	Surrogate	
Analyte	Lower Limit	Upper Limit
Chlorobenzene-d5	51	136

Effective Date: April 4, 2013

8260B _ VOC

Matrix: **SOIL**

LCS/LCSD

Analyte	Lower	Upper	RPD
1,1,1,2-Tetrachloroethane	80	123	20
1,1,1-Trichloroethane	71	127	20
1,1,2,2-Tetrachloroethane	80	120	20
1,1,2-Trichloroethane	80	120	20
1,1-Dichloroethane	80	120	20
1,1-Dichloroethene	80	121	20
1,1-Dichloropropene	74	131	20
1,2,3-Trichlorobenzene	64	137	20
1,2,3-Trichloropropane	75	120	20
1,2,4-Trichlorobenzene	75	128	20
1,2,4-Trimethylbenzene	73	128	20
1,2-Dibromo-3-chloropropane	53	143	20
1,2-Dibromoethane	74	124	20
1,2-Dichlorobenzene	80	120	20
1,2-Dichloroethane	70	139	20
1,2-Dichloropropane	80	120	20
1,3,5-Trimethylbenzene	76	126	20
1,3-Dichlorobenzene	80	120	20
1,3-Dichloropropane	80	120	20
1,4-Dichlorobenzene	80	120	20
2,2-Dichloropropane	72	135	20
2-Butanone	80	121	20
2-Chlorotoluene	79	120	20
2-Hexanone	80	123	20
4-Chlorotoluene	80	120	20
4-Isopropyltoluene	76	126	20
4-Methyl-2-pentanone	80	120	20
Acetone	80	143	20
Acrolein	71	120	20
Acrylonitrile	80	120	20
Benzene	80	120	20
Bromobenzene	80	120	20
Bromochloromethane	80	122	20
Bromodichloromethane	79	131	20
Bromoform	80	120	20
Bromomethane	43	179	20
Carbon disulfide	64	144	20
Carbon tetrachloride	80	125	20
Chlorobenzene	80	120	20
Chloroethane	32	181	20
Chloroform	77	129	20
Chloromethane	80	120	20
cis-1,2-Dichloroethene	80	120	20
cis-1,3-Dichloropropene	80	120	20
Cyclohexanone	80	130	20
Dibromochloromethane	80	122	20
Dibromomethane	80	120	20
Dichlorodifluoromethane	64	135	20

LCS/LCSD

Analyte	Lower	Upper	RPD
Di-isopropyl ether	80	120	20
Ethyl Acetate	80	120	20
Ethyl Ether	77	148	20
Ethyl Tert-butyl ether	78	121	20
Ethylbenzene	80	120	20
Freon-113	80	129	20
Hexachlorobutadiene	69	132	20
Iodomethane	80	120	20
Isopropylbenzene	79	121	20
m,p-Xylene	80	121	20
Methylene chloride	74	123	20
MTBE	56	140	20
Naphthalene	69	126	20
n-Butylbenzene	72	131	20
n-Propylbenzene	79	122	20
o-Xylene	80	120	20
sec-Butylbenzene	74	127	20
Styrene	80	120	20
Tert-amyl methyl ether	80	120	20
Tert-Butanol	48	142	20
tert-Butylbenzene	75	125	20
Tetrachloroethene	80	120	20
Toluene	80	120	20
trans-1,2-Dichloroethene	80	125	20
trans-1,3-Dichloropropene	80	120	20
Trichloroethene	80	120	20
Trichlorofluoromethane	67	152	20
Vinyl acetate	78	127	20
Vinyl chloride	69	135	20

Surrogate

Analyte	Lower Limit	Upper Limit
1,2-Dichloroethane-d4	63	139
Dibromofluoromethane	70	133
Toluene-d8	80	123
4-Bromofluorobenzene	75	124

8260B _ VOC

Matrix: **SOIL**

MS/MSD

Analyte	Lower	Upper	RPD
1,1,1,2-Tetrachloroethane	58	149	20
1,1,1-Trichloroethane	67	126	20
1,1,2,2-Tetrachloroethane	18	193	20
1,1,2-Trichloroethane	70	136	20
1,1-Dichloroethane	65	134	20
1,1-Dichloroethene	61	135	20
1,1-Dichloropropene	68	125	20
1,2,3-Trichlorobenzene	40	134	20
1,2,3-Trichloropropane	38	167	20
1,2,4-Trichlorobenzene	40	132	20
1,2,4-Trimethylbenzene	58	123	20
1,2-Dibromo-3-chloropropane	30	181	20
1,2-Dibromoethane	67	139	20
1,2-Dichlorobenzene	65	122	20
1,2-Dichloroethane	63	149	20
1,2-Dichloropropane	69	127	20
1,3,5-Trimethylbenzene	58	122	20
1,3-Dichlorobenzene	64	120	20
1,3-Dichloropropane	64	141	20
1,4-Dichlorobenzene	62	122	20
2,2-Dichloropropane	62	138	20
2-Butanone	46	210	20
2-Chlorotoluene	59	124	20
2-Hexanone	53	197	20
4-Chlorotoluene	60	123	20
4-Isopropyltoluene	50	124	20
4-Methyl-2-pentanone	47	178	20
Acetone	9	275	20
Acrolein	19	162	20
Acrylonitrile	70	150	20
Benzene	72	122	20
Bromobenzene	64	129	20
Bromochloromethane	76	133	20
Bromodichloromethane	67	142	20
Bromoform	35	192	20
Bromomethane	62	150	20
Carbon disulfide	54	144	20
Carbon tetrachloride	56	142	20
Chlorobenzene	71	120	20
Chloroethane	55	149	20
Chloroform	70	135	20
Chloromethane	37	151	20
cis-1,2-Dichloroethene	69	131	20
cis-1,3-Dichloropropene	71	129	20
Cyclohexanone	67	152	20
Dibromochloromethane	53	161	20
Dibromomethane	66	145	20
Dichlorodifluoromethane	52	135	20

Analyte	Lower	Upper	RPD
Di-isopropyl ether	60	138	20
Ethyl Acetate	12	191	20
Ethyl Ether	65	168	20
Ethyl Tert-butyl ether	64	144	20
Ethylbenzene	65	120	20
Freon-113	53	149	20
Hexachlorobutadiene	22	135	20
Iodomethane	41	147	20
Isopropylbenzene	60	121	20
m,p-Xylene	65	120	20
Methylene chloride	55	138	20
MTBE	64	149	20
Naphthalene	48	139	20
n-Butylbenzene	43	126	20
n-Propylbenzene	56	122	20
o-Xylene	67	118	20
sec-Butylbenzene	50	123	20
Styrene	57	129	20
Tert-amyl methyl ether	70	130	20
Tert-Butanol	34	177	20
tert-Butylbenzene	54	121	20
Tetrachloroethene	35	149	20
Toluene	68	120	20
trans-1,2-Dichloroethene	62	139	20
trans-1,3-Dichloropropene	69	139	20
Trichloroethene	63	134	20
Trichlorofluoromethane	34	179	20
Vinyl acetate	0	191	20
Vinyl chloride	57	136	20

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

8260B _ VOC

Matrix: **WATER**

LCS/LCSD

Analyte	Lower	Upper	RPD
1,1,1,2-Tetrachloroethane	77	127	20
1,1,1-Trichloroethane	74	122	20
1,1,2,2-Tetrachloroethane	70	128	20
1,1,2-Trichloroethane	73	120	20
1,1-Dichloroethane	72	120	20
1,1-Dichloroethene	69	125	20
1,1-Dichloropropene	80	120	20
1,2,3-Trichlorobenzene	80	126	20
1,2,3-Trichloropropane	68	126	20
1,2,4-Trichlorobenzene	80	125	20
1,2,4-Trimethylbenzene	80	124	20
1,2-Dibromo-3-chloropropane	66	129	20
1,2-Dibromoethane	78	120	20
1,2-Dichlorobenzene	80	120	20
1,2-Dichloroethane	79	120	20
1,2-Dichloropropane	75	120	20
1,3,5-Trimethylbenzene	80	122	20
1,3-Dichlorobenzene	80	120	20
1,3-Dichloropropane	80	120	20
1,4-Dichlorobenzene	80	120	20
2,2-Dichloropropane	61	151	20
2-Butanone	19	169	20
2-Chlorotoluene	80	120	20
2-Hexanone	29	172	20
4-Chlorotoluene	80	120	20
4-Isopropyltoluene	80	122	20
4-Methyl-2-pentanone	55	142	20
Acetone	0	199	20
Acrolein	16	175	20
Acrylonitrile	65	129	20
Benzene	80	120	20
Bromobenzene	80	120	20
Bromochloromethane	74	120	20
Bromodichloromethane	79	123	20
Bromoform	65	141	20
Bromomethane	13	175	20
Carbon disulfide	67	131	20
Carbon tetrachloride	71	136	20
Chlorobenzene	80	120	20
Chloroform	71	120	20
Chloroethane	63	137	20
Chloromethane	35	145	20
cis-1,2-Dichloroethene	74	120	20
cis-1,3-Dichloropropene	80	120	20
Cyclohexanone	75	130	20
Dibromochloromethane	74	127	20
Dibromomethane	80	120	20
Dichlorodifluoromethane	67	123	20
Di-isopropyl ether	65	126	20

LCS/LCSD

Analyte	Lower	Upper	RPD
Ethyl Acetate	60	131	20
Ethyl Ether	67	138	20
Ethyl tert-butyl ether	69	129	20
Ethylbenzene	80	120	20
Freon-113	69	133	20
Hexachlorobutadiene	80	120	20
Iodomethane	15	143	20
Isopropylbenzene	80	120	20
m,p-Xylene	80	120	20
Methylene chloride	63	126	20
MTBE	68	119	20
Naphthalene	74	131	20
n-Butylbenzene	80	121	20
n-Propylbenzene	80	120	20
o-Xylene	80	120	20
sec-Butylbenzene	80	120	20
Styrene	80	120	20
Tert-amyl methyl ether	77	120	20
Tert-Butanol	20	160	20
tert-Butylbenzene	80	120	20
Tetrachloroethene	80	120	20
Toluene	80	120	20
trans-1,2-Dichloroethene	74	120	20
trans-1,3-Dichloropropene	74	132	20
Trichloroethene	80	120	20
Trichlorofluoromethane	67	135	20
Vinyl acetate	50	174	20
Vinyl chloride	72	120	20

Surrogate

Analyte	Lower Limit	Upper Limit
1,2-Dichloroethane-d4	70	127
Dibromofluoromethane	73	128
Toluene-d8	80	120
4-Bromofluorobenzene	80	120

8260B _ VOC

Matrix: **WATER**

Analyte	MS/MSD Lower	MS/MSD Upper	MS/MSD RPD
1,1,1,2-Tetrachloroethane	67	135	20
1,1,1-Trichloroethane	67	131	20
1,1,2,2-Tetrachloroethane	67	131	20
1,1,2-Trichloroethane	73	120	20
1,1-Dichloroethane	69	124	20
1,1-Dichloroethene	65	128	20
1,1-Dichloropropene	79	120	20
1,2,3-Trichlorobenzene	79	124	20
1,2,3-Trichloropropane	64	123	20
1,2,4-Trichlorobenzene	79	124	20
1,2,4-Trimethylbenzene	61	135	20
1,2-Dibromo-3-chloropropane	52	140	20
1,2-Dibromoethane	70	122	20
1,2-Dichlorobenzene	80	120	20
1,2-Dichloroethane	75	122	20
1,2-Dichloropropane	73	120	20
1,3,5-Trimethylbenzene	74	124	20
1,3-Dichlorobenzene	80	120	20
1,3-Dichloropropane	78	120	20
1,4-Dichlorobenzene	80	120	20
2,2-Dichloropropane	51	154	20
2-Butanone	16	120	20
2-Chlorotoluene	79	120	20
2-Hexanone	23	130	20
4-Chlorotoluene	80	120	20
4-Isopropyltoluene	80	120	20
4-Methyl-2-pentanone	56	134	20
Acetone	0	120	20
Acrolein	10	160	20
Acrylonitrile	42	149	20
Benzene	72	122	20
Bromobenzene	80	120	20
Bromochloromethane	71	121	20
Bromodichloromethane	72	130	20
Bromoform	49	155	20
Bromomethane	11	165	20
Carbon disulfide	65	132	20
Carbon tetrachloride	60	145	20
Chlorobenzene	80	120	20
Chloroethane	53	145	20
Chloroform	66	130	20
Chloromethane	40	137	20
cis-1,2-Dichloroethene	73	120	20
cis-1,3-Dichloropropene	75	121	20
Cyclohexanone	71	133	20
Dibromochloromethane	60	137	20
Dibromomethane	78	120	20
Dichlorodifluoromethane	57	128	20
Di-isopropyl ether	60	130	20

Analyte	MS/MSD Lower	MS/MSD Upper	MS/MSD RPD
Ethyl Acetate	53	135	20
Ethyl Ether	54	150	20
Ethyl tert-butyl ether	61	135	20
Ethylbenzene	80	120	20
Freon-113	62	138	20
Hexachlorobutadiene	74	120	20
Iodomethane	0	155	20
Isopropylbenzene	80	120	20
m,p-Xylene	80	120	20
Methylene chloride	59	125	20
MTBE	62	125	20
Naphthalene	65	130	20
n-Butylbenzene	80	122	20
n-Propylbenzene	79	120	20
o-Xylene	80	120	20
sec-Butylbenzene	80	120	20
Styrene	50	138	20
Tert-amyl methyl ether	69	120	20
Tert-Butanol	26	148	20
tert-Butylbenzene	80	120	20
Tetrachloroethene	76	120	20
Toluene	78	120	20
trans-1,2-Dichloroethene	72	122	20
trans-1,3-Dichloropropene	61	140	20
Trichloroethene	76	120	20
Trichlorofluoromethane	53	148	20
Vinyl acetate	41	180	20
Vinyl chloride	67	120	20

Effective Date: April 16, 2013

8270SIM

Matrix: **SOIL**

LCS/LCSD/MS/MSD

Analyte	Lower	Upper	**RPD**
1-Methylnaphthalene	46	120	20
2-Methylnaphthalene	44	127	20
Acenaphthene	50	125	20
Acenaphthylene	52	125	20
Anthracene	46	133	20
Benzo(a)anthracene	63	141	20
Benzo(a)pyrene	63	139	20
Benzo(b)fluoranthene	63	151	20
Benzo(g,h,i)perylene	59	148	20
Benzo(k)fluoranthene	61	151	20
Chrysene	68	139	20
Dibenz(a,h)anthracene	59	146	20
Fluoranthene	67	135	20
Fluorene	50	131	20
Indeno(1,2,3-cd)pyrene	59	142	20
Naphthalene	45	125	20
Phenanthrene	54	125	20
Pyrene	66	132	20

Surrogate

Analyte	Lower Limit	Upper Limit
1,2-Dichlorobenzene-d4	14	120
2-Fluorobiphenyl	28	130
4-Terphenyl-d14	19	165
Nitrobenzene-d5	23	150

Effective Date: April 4, 2013

8270SIM

Matrix: **WATER**

LCS/LCSD/MS/MSD

Analyte	Lower	Upper	**RPD**
1-Methylnaphthalene	30	124	20
2-Methylnaphthalene	45	129	20
Acenaphthene	44	127	20
Acenaphthylene	47	128	20
Anthracene	41	129	20
Benzo(a)anthracene	61	132	20
Benzo(a)pyrene	54	134	20
Benzo(b)fluoranthene	55	149	20
Benzo(g,h,i)perylene	49	142	20
Benzo(k)fluoranthene	57	140	20
Chrysene	62	130	20
Dibenz(a,h)anthracene	54	140	20
Fluoranthene	63	128	20
Fluorene	47	131	20
Indeno(1,2,3-cd)pyrene	53	136	20
Naphthalene	42	124	20
Phenanthrene	48	124	20
Pyrene	60	124	20

Surrogate

Analyte	Lower Limit	Upper Limit
1,2-Dichlorobenzene-d4	25	120
2-Fluorobiphenyl	30	125
4-Terphenyl-d14	50	122
Nitrobenzene-d5	30	138

Effective Date: April 4, 2013

8270C _ SVOC

Matrix: **SOIL**

LCS/MS/MSD

Analyte	Lower	Upper	RPD
1,2,4-Trichlorobenzene	36	120	20
1,2-Dichlorobenzene	32	120	20
1,2-Diphenylhydrazine	51	120	20
1,3-Dichlorobenzene	31	120	20
1,4-Dichlorobenzene	32	120	20
1-Methylnaphthalene	46	120	20
2,4,5-Trichlorophenol	53	120	20
2,4,6-Trichlorophenol	47	120	20
2,4-Dichlorophenol	43	120	20
2,4-Dimethylphenol	41	120	20
2,4-Dinitrophenol	30	138	20
2,4-Dinitrotoluene	56	120	20
2,6-Dinitrotoluene	54	120	20
2-Chloronaphthalene	41	120	20
2-Chlorophenol	37	120	20
2-Methylnaphthalene	34	121	20
2-Methylphenol	37	120	20
2-Nitroaniline	58	122	20
2-Nitrophenol	39	120	20
3,3´-Dichlorobenzidine	43	120	20
3/4-Methylphenol	43	120	20
3-Nitroaniline	59	120	20
4,6-Dinitro-2-methylphenol	55	126	20
4-Bromophenyl-phenylether	57	120	20
4-Chloro-3-methylphenol	50	120	20
4-Chloroaniline	35	120	20
4-Chlorophenyl-phenylether	49	120	20
4-Methylphenol	43	120	20
4-Nitroaniline	52	121	20
4-Nitrophenol	45	121	20
Acenaphthene	47	120	20
Acenaphthylene	48	121	20
Aniline	35	120	20
Anthracene	52	126	20
Benzidine (M)	3	143	20
Benzo(a)anthracene	63	132	20
Benzo(a)pyrene	34	132	20
Benzo(b)fluoranthene	61	141	20
Benzo(g,h,i)perylene	61	139	20
Benzo(k)fluoranthene	58	141	20
Benzoic acid	23	120	20
Benzyl alcohol	37	120	20
Bis(2-chloroethoxy)methane	45	120	20
Bis(2-chloroethyl)ether	36	120	20
Bis(2-chloroisopropyl)ether	30	120	20
Bis(2-ethylhexyl)phthalate	65	135	20
Butylbenzylphthalate	37	137	20
Carbazole	62	120	20
Chrysene	58	145	20

LCS/MS/MSD

Analyte	Lower	Upper	RPD
Dibenz(a,h)anthracene	63	139	20
Dibenzofuran	48	120	20
Diethylphthalate	50	131	20
Dimethylphthalate	54	120	20
Di-n-butylphthalate	56	129	20
Di-n-octylphthalate	58	146	20
Fluoranthene	57	133	20
Fluorene	50	123	20
Hexachlorobenzene	56	120	20
Hexachlorobutadiene	36	120	20
Hexachlorocyclopentadiene	29	120	20
Hexachloroethane	32	120	20
Indeno(1,2,3-cd)pyrene	64	136	20
Isophorone	49	120	20
Naphthalene	40	120	20
Nitrobenzene	38	120	20
N-Nitrosodimethylamine	34	120	20
N-Nitrosodi-n-propylamine	43	120	20
N-Nitrosodiphenylamine	62	120	20
Pentachlorophenol	46	120	20
Phenanthrene	57	120	20
Phenol	40	120	20
Pyrene	57	130	20
Pyridine	13	140	20

Surrogate

Analyte	Lower Limit	Upper Limit
1,2-Dichlorobenzene-d4	23	120
2,4,6-Tribromophenol	24	134
2-Chlorophenol-d4	28	120
2-Fluorobiphenyl	32	120
2-Fluorophenol	29	120
4-Terphenyl-d14	51	128
Nitrobenzene-d5	29	120
Phenol-d5	28	120

Effective Date: April 11, 2013

8270C _ SVOC

Matrix: **WATER**

LCS/LCSD/MS/MSD

Analyte	Lower	Upper	RPD
1,2,4-Trichlorobenzene	29	120	20
1,2-Dichlorobenzene	28	120	20
1,2-Diphenylhydrazine	50	120	20
1,3-Dichlorobenzene	26	120	20
1,4-Dichlorobenzene	27	120	20
2,4,5-Trichlorophenol	46	120	20
2,4,6-Trichlorophenol	39	120	20
2,4-Dichlorophenol	34	120	20
2,4-Dimethylphenol	33	120	20
2,4-Dinitrophenol	9	156	20
2,4-Dinitrotoluene	56	120	20
2,6-Dinitrotoluene	51	120	20
2-Chloronaphthalene	34	120	20
2-Chlorophenol	30	120	20
2-Methylnaphthalene	33	120	20
2-Methylphenol	31	120	20
2-Nitroaniline	56	123	20
2-Nitrophenol	31	120	20
3,3´-Dichlorobenzidine	44	120	20
3/4-Methylphenol	35	120	20
3-Nitroaniline	54	120	20
4,6-Dinitro-2-methylphenol	38	138	20
4-Bromophenyl-phenylether	52	120	20
4-Chloro-3-methylphenol	45	120	20
4-Chloroaniline	35	120	20
4-Chlorophenyl-phenylether	45	120	20
4-Methylphenol	35	120	20
4-Nitroaniline	54	120	20
4-Nitrophenol	34	120	20
Acenaphthene	42	120	20
Acenaphthylene	42	120	20
Aniline	28	120	20
Anthracene	53	120	20
Benzidine (M)	0	172	20
Benzo(a)anthracene	64	120	20
Benzo(a)pyrene	65	120	20
Benzo(b)fluoranthene	66	120	20
Benzo(g,h,i)perylene	58	127	20
Benzo(k)fluoranthene	63	120	20
Benzoic acid	2	120	20
Benzyl alcohol	25	120	20
Bis(2-chloroethoxy)methane	36	120	20
Bis(2-chloroethyl)ether	30	120	20
Bis(2-chloroisopropyl)ether	34	120	20
Bis(2-ethylhexyl)phthalate	61	130	20
Butylbenzylphthalate	61	133	20
Carbazole	60	120	20
Chrysene	44	144	20

LCS/LCSD/MS/MSD

Analyte	Lower	Upper	RPD
Dibenz(a,h)anthracene	62	131	20
Dibenzofuran	44	120	20
Diethylphthalate	35	147	20
Dimethylphthalate	53	120	20
Di-n-butylphthalate	57	124	20
Di-n-octylphthalate	60	130	20
Fluoranthene	57	120	20
Fluorene	50	120	20
Hexachlorobenzene	49	120	20
Hexachlorobutadiene	29	120	20
Hexachlorocyclopentadiene	18	120	20
Hexachloroethane	27	120	20
Indeno(1,2,3-cd)pyrene	61	131	20
Isophorone	42	120	20
Naphthalene	35	120	20
Nitrobenzene	32	120	20
N-Nitrosodimethylamine	25	120	20
N-Nitrosodi-n-propylamine	37	120	20
N-Nitrosodiphenylamine	55	120	20
Pentachlorophenol	43	120	20
Phenanthrene	56	120	20
Phenol	22	120	20
Pyrene	57	120	20
Pyridine	10	124	20

Surrogate

Analyte	Lower Limit	Upper Limit
1,2-Dichlorobenzene-d4	13	120
2,4,6-Tribromophenol	38	122
2-Chlorophenol-d4	19	120
2-Fluorobiphenyl	19	120
2-Fluorophenol	13	120
4-Terphenyl-d14	44	134
Nitrobenzene-d5	18	120
Phenol-d5	7	120

Effective Date: April 4, 2013

WET CHEMISTRY

Matrix: **WATER**

	METHOD	MS		RPD	LCS	
Analyte		Lower Limit	Upper Limit	Limit	Lower Limit	Upper Limit
Hexavalent Chromium	EPA 7196A	85	115	20	85	115
Total Phosphorus	EPA 365.3	80	120	20	80	120
Ammonia	SM4500NH3C	80	120	20	80	120
TKN	SM4500NH3C	70	130	20	80	120
Alkalinity	SM2320B	80	120	20	80	120
pH	SM4500-H+B			10		
TDS	SM2540C			5	80	120
Oil and Grease	EPA 1664	76	104	18	76	104
TRPH	EPA 1664	76	104	18	76	104

Matrix: **SOIL**

	METHOD	MS		RPD	LCS	
Analyte		Lower Limit	Upper Limit	Limit	Lower Limit	Upper Limit
Hexavalent Chromium	EPA 7196A	70	130	30	80	120
Total Phosphorus	EPA 365.3	70	130	30	80	120
Ammonia	SM4500NH3C	70	130	30	80	120
TKN	SM4500NH3C	70	130	30	80	120
pH	EPA 9045C			20		
Oil and Grease	EPA 1664	70	130	30	80	120
TRPH	EPA 1664	70	130	30	80	120

APPENDIX K

FAX COVER PAGE

Advanced Technology Laboratories, Inc.

3151 W. Post Rd.
Las Vegas, NV 89118
(702) 307-2659 Phone
(702) 307-2691 Fax

Fax Transmittal Sheet

To:

From:

RE:

Message:

APPENDIX L

LABORATORY CERTIFICATIONS

CALIFORNIA ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

(ELAP)

Advanced Technology Laboratories, Inc.

3151 W. Post Rd Las Vegas,NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CDPH
California Department of
PublicHealth

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF ENVIRONMENTAL LABORATORY ACCREDITATION

Is hereby granted to

Advanced Technology Laboratories, Inc.

3151-3153 West Post Road

Las Vegas, NV 89118

Scope of the certificate is limited to the
"Fields of Testing"
which accompany this Certificate.

Continued accredited status depends on successful completion of on-site, proficiency testing studies, and payment of applicable fees.

This Certificate is granted in accordance with provisions of Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **2676**

Expiration Date: **06/30/2015**

Effective Date: **07/01/2013**

Richmond, California
subject to forfeiture or revocation

Fred Shaffer for
David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

State of California—Health and Human Services Agency
California Department of Public Health

RON CHAPMAN, MD, MPH
Director & State Health Officer

EDMUND G. BROWN JR.
Governor

February 6, 2012

Jose Tenorio Jr.
Advanced Technology Laboratories, Inc.
3151 West Post Road
Las Vegas, NV 89118

Dear Jose Tenorio Jr.:

Certificate No. 2676

Enclosed is an amended copy of your certificate.

If you have any questions, please contact our office at (510) 620-3155.

Sincerely,

Fred Chosh for

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

Enclosure

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM
Accredited Fields of Testing

Advanced Technology Laboratories, Inc.
3151 West Post Road
Las Vegas, NV 89118
Phone: (702) 307-3248

Certificate No.: 2676
Renew Date: 6/30/2013

Field of Testing: 102 - Inorganic Chemistry of Drinking Water

102.030	001	Bromide	EPA 300.0
102.030	003	Chloride	EPA 300.0
102.030	005	Fluoride	EPA 300.0
102.030	006	Nitrate	EPA 300.0
102.030	007	Nitrite	EPA 300.0
102.030	008	Phosphate, Ortho	EPA 300.0
102.030	010	Sulfate	EPA 300.0
102.045	001	Perchlorate	EPA 314.0
102.120	001	Hardness	SM2340B
102.140	001	Total Dissolved Solids	SM2540C
102.150	001	Chloride	SM4110B
102.150	002	Fluoride	SM4110B
102.150	003	Nitrate	SM4110B
102.150	004	Nitrite	SM4110B
102.150	005	Phosphate, Ortho	SM4110B
102.150	006	Sulfate	SM4110B
102.520	001	Calcium	EPA 200.7
102.520	002	Magnesium	EPA 200.7
102.520	003	Potassium	EPA 200.7
102.520	004	Silica	EPA 200.7
102.520	005	Sodium	EPA 200.7
102.520	006	Hardness (calc.)	EPA 200.7

Field of Testing: 103 - Toxic Chemical Elements of Drinking Water

103.060	009	Iron	SM3120B
103.140	001	Aluminum	EPA 200.8
103.140	002	Antimony	EPA 200.8
103.140	003	Arsenic	EPA 200.8
103.140	004	Barium	EPA 200.8
103.140	005	Beryllium	EPA 200.8
103.140	006	Cadmium	EPA 200.8
103.140	007	Chromium	EPA 200.8
103.140	008	Copper	EPA 200.8
103.140	009	Lead	EPA 200.8
103.140	010	Manganese	EPA 200.8
103.140	012	Nickel	EPA 200.8

As of 3/30/2012 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

103.140	013	Selenium	EPA 200.8
103.140	014	Silver	EPA 200.8
103.140	015	Thallium	EPA 200.8
103.140	016	Zinc	EPA 200.8
103.140	017	Boron	EPA 200.8
103.140	018	Vanadium	EPA 200.8
103.160	001	Mercury	EPA 245.1
103.310	001	Chromium (VI)	EPA 218.6

Field of Testing: 108 - Inorganic Chemistry of Wastewater

108.020	001	Conductivity	EPA 120.1
108.090	001	Residue, Volatile	EPA 160.4
108.110	001	Turbidity	EPA 180.1
108.112	001	Boron	EPA 200.7
108.112	002	Calcium	EPA 200.7
108.112	003	Hardness (calc.)	EPA 200.7
108.112	004	Magnesium	EPA 200.7
108.112	005	Potassium	EPA 200.7
108.112	006	Silica	EPA 200.7
108.112	007	Sodium	EPA 200.7
108.113	001	Boron	EPA 200.8
108.113	002	Calcium	EPA 200.8
108.113	003	Magnesium	EPA 200.8
108.113	004	Potassium	EPA 200.8
108.113	005	Silica	EPA 200.8
108.113	006	Sodium	EPA 200.8
108.120	001	Bromide	EPA 300.0
108.120	002	Chloride	EPA 300.0
108.120	003	Fluoride	EPA 300.0
108.120	004	Nitrate	EPA 300.0
108.120	005	Nitrite	EPA 300.0
108.120	006	Nitrate-nitrite	EPA 300.0
108.120	007	Phosphate, Ortho	EPA 300.0
108.120	008	Sulfate	EPA 300.0
108.264	001	Phosphate, Ortho	EPA 365.3
108.265	001	Phosphorus, Total	EPA 365.3
108.381	001	Oil and Grease	EPA 1664A
108.390	001	Turbidity	SM2130B
108.410	001	Alkalinity	SM2320B
108.420	001	Hardness (calc.)	SM2340B
108.430	001	Conductivity	SM2510B
108.440	001	Residue, Total	SM2540B
108.441	001	Residue, Filterable	SM2540C
108.442	001	Residue, Non-filterable	SM2540D

108.443	001	Residue, Settleable	SM2540F
108.447	001	Boron	SM3120B
108.447	002	Calcium	SM3120B
108.447	003	Hardness (calc.)	SM3120B
108.447	004	Magnesium	SM3120B
108.447	005	Potassium	SM3120B
108.447	006	Silica	SM3120B
108.447	007	Sodium	SM3120B
108.448	001	Bromide	SM4110B
108.448	002	Chloride	SM4110B
108.448	003	Fluoride	SM4110B
108.448	004	Nitrate	SM4110B
108.448	005	Nitrite	SM4110B
108.448	006	Nitrate-nitrite	SM4110B
108.448	007	Phosphate, Ortho	SM4110B
108.448	008	Sulfate	SM4110B
108.490	001	pH	SM4500-H+ B
108.491	001	Ammonia	SM4500-NH3 C (18th)
108.491	002	Kjeldahl Nitrogen	SM4500-NH3 C (18th)
108.540	001	Phosphate, Ortho	SM4500-P E
108.541	001	Phosphorus, Total	SM4500-P E
108.611	001	Total Organic Carbon	SM5310C

Field of Testing: 109 - Toxic Chemical Elements of Wastewater

109.010	001	Aluminum	EPA 200.7
109.010	002	Antimony	EPA 200.7
109.010	003	Arsenic	EPA 200.7
109.010	004	Barium	EPA 200.7
109.010	005	Beryllium	EPA 200.7
109.010	007	Cadmium	EPA 200.7
109.010	009	Chromium	EPA 200.7
109.010	010	Cobalt	EPA 200.7
109.010	011	Copper	EPA 200.7
109.010	012	Iron	EPA 200.7
109.010	013	Lead	EPA 200.7
109.010	015	Manganese	EPA 200.7
109.010	016	Molybdenum	EPA 200.7
109.010	017	Nickel	EPA 200.7
109.010	019	Selenium	EPA 200.7
109.010	021	Silver	EPA 200.7
109.010	023	Thallium	EPA 200.7
109.010	024	Tin	EPA 200.7
109.010	026	Vanadium	EPA 200.7
109.010	027	Zinc	EPA 200.7

109.020	001	Aluminum	EPA 200.8
109.020	002	Antimony	EPA 200.8
109.020	003	Arsenic	EPA 200.8
109.020	004	Barium	EPA 200.8
109.020	005	Beryllium	EPA 200.8
109.020	006	Cadmium	EPA 200.8
109.020	007	Chromium	EPA 200.8
109.020	008	Cobalt	EPA 200.8
109.020	009	Copper	EPA 200.8
109.020	010	Lead	EPA 200.8
109.020	011	Manganese	EPA 200.8
109.020	012	Molybdenum	EPA 200.8
109.020	013	Nickel	EPA 200.8
109.020	014	Selenium	EPA 200.8
109.020	015	Silver	EPA 200.8
109.020	016	Thallium	EPA 200.8
109.020	017	Vanadium	EPA 200.8
109.020	018	Zinc	EPA 200.8
109.020	021	Iron	EPA 200.8
109.020	022	Tin	EPA 200.8
109.020	023	Titanium	EPA 200.8
109.104	001	Chromium (VI)	EPA 218.6
109.190	001	Mercury	EPA 245.1
109.400	001	Mercury	SM3112B
109.430	001	Aluminum	SM3120B
109.430	002	Antimony	SM3120B
109.430	003	Arsenic	SM3120B
109.430	004	Barium	SM3120B
109.430	005	Beryllium	SM3120B
109.430	007	Cadmium	SM3120B
109.430	009	Chromium	SM3120B
109.430	010	Cobalt	SM3120B
109.430	011	Copper	SM3120B
109.430	012	Iron	SM3120B
109.430	013	Lead	SM3120B
109.430	015	Manganese	SM3120B
109.430	016	Molybdenum	SM3120B
109.430	017	Nickel	SM3120B
109.430	019	Selenium	SM3120B
109.430	021	Silver	SM3120B
109.430	023	Thallium	SM3120B
109.430	024	Vanadium	SM3120B
109.430	025	Zinc	SM3120B

109.809	002	Chromium (VI)	SM3500-Cr B (20th)

Field of Testing: 114 - Inorganic Chemistry of Hazardous Waste

114.010	001	Antimony	EPA 6010B
114.010	002	Arsenic	EPA 6010B
114.010	003	Barium	EPA 6010B
114.010	004	Beryllium	EPA 6010B
114.010	005	Cadmium	EPA 6010B
114.010	006	Chromium	EPA 6010B
114.010	007	Cobalt	EPA 6010B
114.010	008	Copper	EPA 6010B
114.010	009	Lead	EPA 6010B
114.010	010	Molybdenum	EPA 6010B
114.010	011	Nickel	EPA 6010B
114.010	012	Selenium	EPA 6010B
114.010	013	Silver	EPA 6010B
114.010	014	Thallium	EPA 6010B
114.010	015	Vanadium	EPA 6010B
114.010	016	Zinc	EPA 6010B
114.020	001	Antimony	EPA 6020
114.020	002	Arsenic	EPA 6020
114.020	003	Barium	EPA 6020
114.020	004	Beryllium	EPA 6020
114.020	005	Cadmium	EPA 6020
114.020	006	Chromium	EPA 6020
114.020	007	Cobalt	EPA 6020
114.020	008	Copper	EPA 6020
114.020	009	Lead	EPA 6020
114.020	010	Molybdenum	EPA 6020
114.020	011	Nickel	EPA 6020
114.020	012	Selenium	EPA 6020
114.020	013	Silver	EPA 6020
114.020	014	Thallium	EPA 6020
114.020	015	Vanadium	EPA 6020
114.020	016	Zinc	EPA 6020
114.103	001	Chromium (VI)	EPA 7196A
114.106	001	Chromium (VI)	EPA 7199
114.140	001	Mercury	EPA 7470A
114.141	001	Mercury	EPA 7471A
114.240	001	Corrosivity - pH Determination	EPA 9040B
114.241	001	Corrosivity - pH Determination	EPA 9045C

Field of Testing: 115 - Extraction Test of Hazardous Waste

115.020	001	Toxicity Characteristic Leaching Procedure (TCLP)	EPA 1311
115.030	001	Waste Extraction Test (WET)	CCR Chapter11, Article 5, Appendix II

115.040	001	Synthetic Precipitation Leaching Procedure (SPLP)	EPA 1312
Field of Testing: 116 - Volatile Organic Chemistry of Hazardous Waste			
116.030	001	Gasoline-range Organics	EPA 8015B
116.080	000	Volatile Organic Compounds	EPA 8260B
116.080	120	Oxygenates	EPA 8260B
116.110	001	Total Petroleum Hydrocarbons - Gasoline	LUFT
Field of Testing: 117 - Semi-volatile Organic Chemistry of Hazardous Waste			
117.010	001	Diesel-range Total Petroleum Hydrocarbons	EPA 8015B
117.016	001	Diesel-range Total Petroleum Hydrocarbons	LUFT
117.110	000	Extractable Organics	EPA 8270C
117.210	000	Organochlorine Pesticides	EPA 8081A
117.220	000	PCBs	EPA 8082
Field of Testing: 120 - Physical Properties of Hazardous Waste			
120.020	001	Ignitability	EPA 1020A
120.070	001	Corrosivity - pH Determination	EPA 9040B
120.080	001	Corrosivity - pH Determination	EPA 9045C

NATIONAL ENVIRONMENTAL ACCREDITATION PROGRAM

(NELAP)

NELAP - RECOGNIZED

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF NELAP ACCREDITATION

Is hereby granted to

Advanced Technology Laboratories, Inc.

3151 West Post Road

Las Vegas, NV 89118

Scope of the Certificate is limited to the
"NELAP Fields of Accreditation"
which accompany this Certificate.

Continued accredited status depends on successful
ongoing participation in the program.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **08262CA**

Expiration Date: **3/31/2014**

Effective Date: **4/1/2013**

Richmond, California
subject to forfeiture or revocation

Fred Chosbe for
David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

NELAP RECOGNIZED

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

NELAP Fields of Accreditation

Advanced Technology Laboratories, Inc.
3151 West Post Road
Las Vegas, NV 89118
Phone: (702) 307-3248

Certificate No. 08262CA
Renew Date: 3/31/2014

114 - Inorganic Chemistry of Hazardous Waste

114.010	001	EPA 6010B	Antimony
114.010	002	EPA 6010B	Arsenic
114.010	003	EPA 6010B	Barium
114.010	004	EPA 6010B	Beryllium
114.010	005	EPA 6010B	Cadmium
114.010	006	EPA 6010B	Chromium
114.010	007	EPA 6010B	Cobalt
114.010	008	EPA 6010B	Copper
114.010	009	EPA 6010B	Lead
114.010	010	EPA 6010B	Molybdenum
114.010	011	EPA 6010B	Nickel
114.010	012	EPA 6010B	Selenium
114.010	013	EPA 6010B	Silver
114.010	014	EPA 6010B	Thallium
114.010	015	EPA 6010B	Vanadium
114.010	016	EPA 6010B	Zinc
114.020	001	EPA 6020	Antimony
114.020	002	EPA 6020	Arsenic
114.020	003	EPA 6020	Barium
114.020	004	EPA 6020	Beryllium
114.020	005	EPA 6020	Cadmium
114.020	006	EPA 6020	Chromium
114.020	007	EPA 6020	Cobalt
114.020	008	EPA 6020	Copper
114.020	009	EPA 6020	Lead
114.020	010	EPA 6020	Molybdenum
114.020	011	EPA 6020	Nickel
114.020	012	EPA 6020	Selenium
114.020	013	EPA 6020	Silver
114.020	014	EPA 6020	Thallium
114.020	015	EPA 6020	Vanadium
114.020	016	EPA 6020	Zinc

As of 4/22/2013 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

114.103	001	EPA 7196A	Chromium (VI)
114.106	001	EPA 7199	Chromium (VI)
114.140	001	EPA 7470A	Mercury
114.141	001	EPA 7471A	Mercury

116 - Volatile Organic Chemistry of Hazardous Waste

116.030	001	EPA 8015B	Gasoline-range Organics
116.080	001	EPA 8260B	Acetone
116.080	003	EPA 8260B	Acrolein
116.080	004	EPA 8260B	Acrylonitrile
116.080	007	EPA 8260B	Benzene
116.080	010	EPA 8260B	Bromochloromethane
116.080	011	EPA 8260B	Bromodichloromethane
116.080	012	EPA 8260B	Bromoform
116.080	013	EPA 8260B	Bromomethane
116.080	015	EPA 8260B	Carbon Disulfide
116.080	016	EPA 8260B	Carbon Tetrachloride
116.080	018	EPA 8260B	Chlorobenzene
116.080	019	EPA 8260B	Chloroethane
116.080	020	EPA 8260B	2-Chloroethyl Vinyl Ether
116.080	021	EPA 8260B	Chloroform
116.080	022	EPA 8260B	Chloromethane
116.080	026	EPA 8260B	Dibromochloromethane
116.080	027	EPA 8260B	Dibromochloropropane
116.080	028	EPA 8260B	1,2-Dibromoethane
116.080	029	EPA 8260B	Dibromofluoromethane
116.080	030	EPA 8260B	Dibromomethane
116.080	031	EPA 8260B	1,2-Dichlorobenzene
116.080	032	EPA 8260B	1,3-Dichlorobenzene
116.080	033	EPA 8260B	1,4-Dichlorobenzene
116.080	036	EPA 8260B	Dichlorodifluoromethane
116.080	037	EPA 8260B	1,1-Dichloroethane
116.080	038	EPA 8260B	1,2-Dichloroethane
116.080	039	EPA 8260B	1,1-Dichloroethene
116.080	040	EPA 8260B	trans-1,2-Dichloroethene
116.080	041	EPA 8260B	cis-1,2-Dichloroethene
116.080	042	EPA 8260B	1,2-Dichloropropane
116.080	043	EPA 8260B	1,3-Dichloropropane
116.080	044	EPA 8260B	2,2-Dichloropropane
116.080	045	EPA 8260B	1,1-Dichloropropene
116.080	046	EPA 8260B	cis-1,3-Dichloropropene

116.080	047	EPA 8260B	trans-1,3-Dichloropropene
116.080	052	EPA 8260B	Ethyl Acetate
116.080	053	EPA 8260B	Ethylbenzene
116.080	056	EPA 8260B	Hexachlorobutadiene
116.080	058	EPA 8260B	2-Hexanone (MBK)
116.080	059	EPA 8260B	Iodomethane
116.080	064	EPA 8260B	Methyl tert-butyl Ether (MTBE)
116.080	065	EPA 8260B	Methylene Chloride
116.080	066	EPA 8260B	Methyl Ethyl Ketone
116.080	068	EPA 8260B	4-Methyl-2-pentanone (MIBK)
116.080	069	EPA 8260B	Naphthalene
116.080	081	EPA 8260B	1,1,1,2-Tetrachloroethane
116.080	082	EPA 8260B	1,1,2,2-Tetrachloroethane
116.080	083	EPA 8260B	Tetrachloroethene
116.080	084	EPA 8260B	Toluene
116.080	086	EPA 8260B	1,2,3-Trichlorobenzene
116.080	087	EPA 8260B	1,2,4-Trichlorobenzene
116.080	088	EPA 8260B	1,1,1-Trichloroethane
116.080	089	EPA 8260B	1,1,2-Trichloroethane
116.080	090	EPA 8260B	Trichloroethene
116.080	091	EPA 8260B	Trichlorofluoromethane
116.080	092	EPA 8260B	1,2,3-Trichloropropane
116.080	093	EPA 8260B	Vinyl Acetate
116.080	094	EPA 8260B	Vinyl Chloride
116.080	095	EPA 8260B	Xylenes, Total
116.080	096	EPA 8260B	tert-Amyl Methyl Ether (TAME)
116.080	097	EPA 8260B	tert-Butyl Alcohol (TBA)
116.080	098	EPA 8260B	Ethyl tert-butyl Ether (ETBE)
116.080	099	EPA 8260B	Bromobenzene
116.080	100	EPA 8260B	n-Butylbenzene
116.080	101	EPA 8260B	sec-Butylbenzene
116.080	102	EPA 8260B	tert-Butylbenzene
116.080	103	EPA 8260B	2-Chlorotoluene
116.080	104	EPA 8260B	4-Chlorotoluene
116.080	105	EPA 8260B	Isopropylbenzene
116.080	106	EPA 8260B	N-propylbenzene
116.080	107	EPA 8260B	Styrene
116.080	108	EPA 8260B	1,2,4-Trimethylbenzene
116.080	109	EPA 8260B	1,3,5-Trimethylbenzene
116.080	120	EPA 8260B	Oxygenates

116.110	001	LUFT	Total Petroleum Hydrocarbons - Gasoline

117 - Semi-volatile Organic Chemistry of Hazardous Waste

117.010	001	EPA 8015B	Diesel-range Total Petroleum Hydrocarbons
117.016	001	LUFT	Diesel-range Total Petroleum Hydrocarbons
117.110	000	EPA 8270C	Extractable Organics
117.110	001	EPA 8270C	Acenaphthene
117.110	002	EPA 8270C	Acenaphthylene
117.110	007	EPA 8270C	Aniline
117.110	008	EPA 8270C	Anthracene
117.110	010	EPA 8270C	Benzidine
117.110	011	EPA 8270C	Benz(a)anthracene
117.110	012	EPA 8270C	Benzo(b)fluoranthene
117.110	013	EPA 8270C	Benzo(k)fluoranthene
117.110	014	EPA 8270C	Benzo(g,h,i)perylene
117.110	015	EPA 8270C	Benzo(a)pyrene
117.110	016	EPA 8270C	Benzoic Acid
117.110	018	EPA 8270C	Benzyl Alcohol
117.110	019	EPA 8270C	Benzyl Butyl Phthalate
117.110	020	EPA 8270C	bis(2-chloroethoxy)methane
117.110	021	EPA 8270C	bis(2-chloroethyl) Ether
117.110	022	EPA 8270C	Bis(2-chloroisopropyl) Ether
117.110	023	EPA 8270C	Di(2-ethylhexyl) Phthalate
117.110	024	EPA 8270C	4-Bromophenyl Phenyl Ether
117.110	026	EPA 8270C	4-Chloroaniline
117.110	027	EPA 8270C	4-Chloro-3-methylphenol
117.110	029	EPA 8270C	2-Chloronaphthalene
117.110	030	EPA 8270C	2-Chlorophenol
117.110	031	EPA 8270C	4-Chlorophenyl Phenyl Ether
117.110	032	EPA 8270C	Chrysene
117.110	036	EPA 8270C	Dibenz(a,h)anthracene
117.110	037	EPA 8270C	Dibenzofuran
117.110	038	EPA 8270C	Dibenzo(a,e)pyrene
117.110	039	EPA 8270C	1,2-Dichlorobenzene
117.110	040	EPA 8270C	1,3-Dichlorobenzene
117.110	041	EPA 8270C	1,4-Dichlorobenzene
117.110	042	EPA 8270C	3,3'-Dichlorobenzidine
117.110	043	EPA 8270C	2,4-Dichlorophenol
117.110	045	EPA 8270C	Diethyl Phthalate
117.110	053	EPA 8270C	2,4-Dimethylphenol
117.110	054	EPA 8270C	Dimethyl Phthalate

117.110	055	EPA 8270C	Di-n-butyl phthalate
117.110	056	EPA 8270C	Di-n-octyl phthalate
117.110	060	EPA 8270C	2,4-Dinitrophenol
117.110	061	EPA 8270C	2,4-Dinitrotoluene
117.110	062	EPA 8270C	2,6-Dinitrotoluene
117.110	064	EPA 8270C	1,2-Diphenylhydrazine
117.110	067	EPA 8270C	Fluoranthene
117.110	068	EPA 8270C	Fluorene
117.110	069	EPA 8270C	Hexachlorobenzene
117.110	070	EPA 8270C	Hexachlorobutadiene
117.110	071	EPA 8270C	Hexachlorocyclopentadiene
117.110	072	EPA 8270C	Hexachloroethane
117.110	073	EPA 8270C	Hexachlorophene
117.110	075	EPA 8270C	Indeno(1,2,3-c,d)pyrene
117.110	076	EPA 8270C	Isophorone
117.110	080	EPA 8270C	2-Methyl-4,6-dinitrophenol
117.110	083	EPA 8270C	2-Methylnaphthalene
117.110	084	EPA 8270C	2-Methylphenol
117.110	086	EPA 8270C	4-Methylphenol
117.110	092	EPA 8270C	2-Nitroaniline
117.110	093	EPA 8270C	3-Nitroaniline
117.110	094	EPA 8270C	4-Nitroaniline
117.110	095	EPA 8270C	Nitrobenzene
117.110	096	EPA 8270C	2-Nitrophenol
117.110	097	EPA 8270C	4-Nitrophenol
117.110	100	EPA 8270C	N-nitrosodimethylamine
117.110	101	EPA 8270C	N-nitroso-di-n-propylamine
117.110	102	EPA 8270C	N-nitrosodiphenylamine
117.110	110	EPA 8270C	Pentachlorophenol
117.110	112	EPA 8270C	Phenanthrene
117.110	113	EPA 8270C	Phenol
117.110	119	EPA 8270C	Pyrene
117.110	120	EPA 8270C	Pyridine
117.110	129	EPA 8270C	1,2,4-Trichlorobenzene
117.110	130	EPA 8270C	2,4,5-Trichlorophenol
117.110	131	EPA 8270C	2,4,6-Trichlorophenol
117.210	000	EPA 8081A	Organochlorine Pesticides
117.210	001	EPA 8081A	Aldrin
117.210	002	EPA 8081A	a-BHC
117.210	003	EPA 8081A	b-BHC

117.210	004	EPA 8081A	d-BHC
117.210	005	EPA 8081A	g-BHC (Lindane)
117.210	007	EPA 8081A	a-Chlordane
117.210	008	EPA 8081A	g-Chlordane
117.210	009	EPA 8081A	Chlordane (tech.)
117.210	013	EPA 8081A	4,4'-DDD
117.210	014	EPA 8081A	4,4'-DDE
117.210	015	EPA 8081A	4,4'-DDT
117.210	020	EPA 8081A	Dieldrin
117.210	021	EPA 8081A	Endosulfan I
117.210	022	EPA 8081A	Endosulfan II
117.210	023	EPA 8081A	Endosulfan Sulfate
117.210	024	EPA 8081A	Endrin
117.210	025	EPA 8081A	Endrin Aldehyde
117.210	026	EPA 8081A	Endrin Ketone
117.210	027	EPA 8081A	Heptachlor
117.210	028	EPA 8081A	Heptachlor Epoxide
117.210	033	EPA 8081A	Methoxychlor
117.220	000	EPA 8082	PCBs
117.220	001	EPA 8082	PCB-1016
117.220	002	EPA 8082	PCB-1221
117.220	003	EPA 8082	PCB-1232
117.220	004	EPA 8082	PCB-1242
117.220	005	EPA 8082	PCB-1248
117.220	006	EPA 8082	PCB-1254
117.220	007	EPA 8082	PCB-1260

STATE OF NEVADA

(NDEP)

Advanced Technology Laboratories, Inc.

3151 W. Post Rd Las Vegas,NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

STATE OF NEVADA
Department of Conservation & Natural Resources
DIVISION OF ENVIRONMENTAL PROTECTION
Brian Sandoval, Governor
Leo M. Drozdoff, P.E., Director
Colleen Cripps, Ph.D., Administrator

July 26, 2013

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd
Las Vegas, NV 89118-

RE: Nevada Environmental Laboratory Certification 1 Year Extension.

Dear Sir or Madam:

Your laboratory's 2012-2013 Nevada scope has been extended until July 31, 2014 or until you receive the updated 2013-2014 scope.

This will serve as official notice to you and your clients.

Be advised this letter is only valid as long as your laboratory maintains compliance with State of Nevada regulation NAC 445A.0552 to .067, NAC 445A.542 to .54296 and/or NAC 459.96902 to .9699.

Failure to do so will result in invalidation of any data submitted to the Nevada Department of Environmental Protection.

If you or your clients have any questions, please contact Donald LaFara at 775-687-9491.

Sincerely,

Don LaFara

Donald LaFara, Laboratory Certification Officer
Program Manager, Laboratory Certification Program
State of Nevada Division of Environmental Protection

State of Nevada

Department of Conservation and Natural Resources
Division of Environmental Protection

Certifies that

Advanced Technology Laboratory, Inc. - Las Vegas

3151-3153 W. Post Rd Las Vegas, NV 89118-

Having met the requirements of the
Nevada Administrative Code: NAC 445A

is hereby approved to perform the analyses as indicated on the most recently issued parameter list which must accompany this certificate to be valid. It is the certified laboratory's responsibility to provide their client the most current certified parameter list. Contact LCP to verify certification status.

Expiration Date: 7/31/2013

Certificate Number: NV009222013-1

Donald LaFara, Program Manager
Laboratory Certification Program

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***CWA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
Discipline Chemistry				
EPA 120.1	Conductivity	8/1/2012	7/31/2013	Certified
EPA 1664A	n-Hexane Extractable Material (O&G)	8/1/2012	7/31/2013	Certified
EPA 1664A (SGT-HEM)	n-Hexane Extractable Material (O&G)	8/1/2012	7/31/2013	Certified
EPA 200.7	Aluminum	8/1/2012	7/31/2013	Certified
EPA 200.7	Antimony	8/1/2012	7/31/2013	Certified
EPA 200.7	Arsenic	8/1/2012	7/31/2013	Certified
EPA 200.7	Barium	8/1/2012	7/31/2013	Certified
EPA 200.7	Beryllium	8/1/2012	7/31/2013	Certified
EPA 200.7	Boron	8/1/2012	7/31/2013	Certified
EPA 200.7	Cadmium	8/1/2012	7/31/2013	Certified
EPA 200.7	Calcium	8/1/2012	7/31/2013	Certified
EPA 200.7	Calcium hardness as CaCO3	8/1/2012	7/31/2013	Certified
EPA 200.7	Chromium	8/1/2012	7/31/2013	Certified
EPA 200.7	Cobalt	8/1/2012	7/31/2013	Certified
EPA 200.7	Copper	8/1/2012	7/31/2013	Certified
EPA 200.7	Hardness by calculation	8/1/2012	7/31/2013	Certified
EPA 200.7	Iron	8/1/2012	7/31/2013	Certified
EPA 200.7	Lead	8/1/2012	7/31/2013	Certified
EPA 200.7	Magnesium	8/1/2012	7/31/2013	Certified
EPA 200.7	Manganese	8/1/2012	7/31/2013	Certified
EPA 200.7	Molybdenum	8/1/2012	7/31/2013	Certified
EPA 200.7	Nickel	8/1/2012	7/31/2013	Certified
EPA 200.7	Potassium	8/1/2012	7/31/2013	Certified
EPA 200.7	Selenium	8/1/2012	7/31/2013	Certified
EPA 200.7	Silica as SiO2	8/1/2012	7/31/2013	Certified
EPA 200.7	Silicon by calculation	8/1/2012	7/31/2013	Certified
EPA 200.7	Silver	8/1/2012	7/31/2013	Certified
EPA 200.7	Sodium	8/1/2012	7/31/2013	Certified
EPA 200.7	Strontium	8/1/2012	7/31/2013	Certified

Disclaimer: A laboratory that is certified or approved has established that they have the ability to implement a quality control program in accordance with the appropriate Federal or State regulations or statutes. It is the certified laboratory's responsibility to provide their client the most current certified parameter list. Contact LCP to verify certification status.

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***CWA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 200.7	Thallium	8/1/2012	7/31/2013	Certified
EPA 200.7	Tin	8/1/2012	7/31/2013	Certified
EPA 200.7	Total hardness as CaCO3	8/1/2012	7/31/2013	Certified
EPA 200.7	Vanadium	8/1/2012	7/31/2013	Certified
EPA 200.7	Zinc	8/1/2012	7/31/2013	Certified
EPA 200.8	Aluminum	8/1/2012	7/31/2013	Certified
EPA 200.8	Antimony	8/1/2012	7/31/2013	Certified
EPA 200.8	Arsenic	8/1/2012	7/31/2013	Certified
EPA 200.8	Barium	8/1/2012	7/31/2013	Certified
EPA 200.8	Beryllium	8/1/2012	7/31/2013	Certified
EPA 200.8	Cadmium	8/1/2012	7/31/2013	Certified
EPA 200.8	Calcium	8/1/2012	7/31/2013	Certified
EPA 200.8	Chromium	8/1/2012	7/31/2013	Certified
EPA 200.8	Cobalt	8/1/2012	7/31/2013	Certified
EPA 200.8	Copper	8/1/2012	7/31/2013	Certified
EPA 200.8	Iron	8/1/2012	7/31/2013	Certified
EPA 200.8	Lead	8/1/2012	7/31/2013	Certified
EPA 200.8	Manganese	8/1/2012	7/31/2013	Certified
EPA 200.8	Molybdenum	8/1/2012	7/31/2013	Certified
EPA 200.8	Nickel	8/1/2012	7/31/2013	Certified
EPA 200.8	Selenium	8/1/2012	7/31/2013	Certified
EPA 200.8	Silver	8/1/2012	7/31/2013	Certified
EPA 200.8	Strontium	8/1/2012	7/31/2013	Certified
EPA 200.8	Thallium	8/1/2012	7/31/2013	Certified
EPA 200.8	Vanadium	8/1/2012	7/31/2013	Certified
EPA 200.8	Zinc	8/1/2012	7/31/2013	Certified
EPA 218.6	Chromium VI	8/1/2012	7/31/2013	Certified
EPA 245.1	Mercury	8/1/2012	7/31/2013	Certified
EPA 300.0	Bromide	8/1/2012	7/31/2013	Certified
EPA 300.0	Chloride	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***CWA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 300.0	Nitrate as N	8/1/2012	7/31/2013	Certified
EPA 300.0	Nitrate-nitrite	8/1/2012	7/31/2013	Certified
EPA 300.0	Nitrite as N	8/1/2012	7/31/2013	Certified
EPA 300.0	Orthophosphate as P	8/1/2012	7/31/2013	Certified
EPA 300.0	Sulfate	8/1/2012	7/31/2013	Certified
EPA 314.0	Perchlorate	8/1/2012	7/31/2013	Certified
EPA 365.3	Orthophosphate as P	8/1/2012	7/31/2013	Certified
EPA 365.3	Phosphorus, total	8/1/2012	7/31/2013	Certified
EPA 608	4,4'-DDD	8/1/2012	7/31/2013	Certified
EPA 608	4,4'-DDE	8/1/2012	7/31/2013	Certified
EPA 608	4,4'-DDT	8/1/2012	7/31/2013	Certified
EPA 608	Aldrin	8/1/2012	7/31/2013	Certified
EPA 608	alpha-BHC (alpha-Hexachlorocyclohexane)	8/1/2012	7/31/2013	Certified
EPA 608	alpha-Chlordane	8/1/2012	7/31/2013	Certified
EPA 608	Aroclor-1016 (PCB-1016)	8/1/2012	7/31/2013	Certified
EPA 608	Aroclor-1221 (PCB-1221)	8/1/2012	7/31/2013	Certified
EPA 608	Aroclor-1232 (PCB-1232)	8/1/2012	7/31/2013	Certified
EPA 608	Aroclor-1242 (PCB-1242)	8/1/2012	7/31/2013	Certified
EPA 608	Aroclor-1248 (PCB-1248)	8/1/2012	7/31/2013	Certified
EPA 608	Aroclor-1254 (PCB-1254)	8/1/2012	7/31/2013	Certified
EPA 608	Aroclor-1260 (PCB-1260)	8/1/2012	7/31/2013	Certified
EPA 608	beta-BHC (beta-Hexachlorocyclohexane)	8/1/2012	7/31/2013	Certified
EPA 608	Chlordane (tech.)	8/1/2012	7/31/2013	Certified
EPA 608	Chlordane, total	8/1/2012	7/31/2013	Certified
EPA 608	delta-BHC	8/1/2012	7/31/2013	Certified
EPA 608	Dieldrin	8/1/2012	7/31/2013	Certified
EPA 608	Endosulfan I	8/1/2012	7/31/2013	Certified
EPA 608	Endosulfan II	8/1/2012	7/31/2013	Certified
EPA 608	Endosulfan sulfate	8/1/2012	7/31/2013	Certified
EPA 608	Endrin	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***CWA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 608	Endrin aldehyde	8/1/2012	7/31/2013	Certified
EPA 608	Endrin ketone	8/1/2012	7/31/2013	Certified
EPA 608	gamma-BHC (Lindane)	8/1/2012	7/31/2013	Certified
EPA 608	gamma-Chlordane	8/1/2012	7/31/2013	Certified
EPA 608	Heptachlor	8/1/2012	7/31/2013	Certified
EPA 608	Heptachlor epoxide	8/1/2012	7/31/2013	Certified
EPA 608	Methoxychlor	8/1/2012	7/31/2013	Certified
EPA 608	Toxaphene (Chlorinated camphene)	8/1/2012	7/31/2013	Certified
EPA 624	1,1,1,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 624	1,1,1-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 624	1,1,2,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 624	1,1,2-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 624	1,1-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 624	1,1-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 624	1,2,3-Trichloropropane	8/1/2012	7/31/2013	Certified
EPA 624	1,2,4-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 624	1,2,4-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 624	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	8/1/2012	7/31/2013	Certified
EPA 624	1,2-Dibromoethane (EDB, Ethylene dibromide)	8/1/2012	7/31/2013	Certified
EPA 624	1,2-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 624	1,2-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 624	1,2-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 624	1,3,5-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 624	1,3-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 624	1,4-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 624	2-Butanone (Methyl ethyl ketone, MEK)	8/1/2012	7/31/2013	Certified
EPA 624	2-Chloroethyl vinyl ether	8/1/2012	7/31/2013	Certified
EPA 624	2-Hexanone	8/1/2012	7/31/2013	Certified
EPA 624	4-Methyl-2-pentanone (MIBK)	8/1/2012	7/31/2013	Certified
EPA 624	Acetone	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***CWA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 624	Acrolein (Propenal)	8/1/2012	7/31/2013	Certified
EPA 624	Acrylonitrile	8/1/2012	7/31/2013	Certified
EPA 624	Benzene	8/1/2012	7/31/2013	Certified
EPA 624	Bromodichloromethane	8/1/2012	7/31/2013	Certified
EPA 624	Bromoform	8/1/2012	7/31/2013	Certified
EPA 624	Carbon disulfide	8/1/2012	7/31/2013	Certified
EPA 624	Carbon tetrachloride	8/1/2012	7/31/2013	Certified
EPA 624	Chlorobenzene	8/1/2012	7/31/2013	Certified
EPA 624	Chlorodibromomethane (Dibromochloromethane)	8/1/2012	7/31/2013	Certified
EPA 624	Chloroethane (Ethyl chloride)	8/1/2012	7/31/2013	Certified
EPA 624	Chloroform	8/1/2012	7/31/2013	Certified
EPA 624	cis & trans-1,2-Dichloroethene	8/1/2012	7/31/2013	Certified
EPA 624	cis-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 624	cis-1,3-Dichloropropene (cis-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 624	Dibromomethane (Methylene bromide)	8/1/2012	7/31/2013	Certified
EPA 624	Dichlorodifluoromethane (Freon-12)	8/1/2012	7/31/2013	Certified
EPA 624	Di-isopropylether (DIPE)	8/1/2012	7/31/2013	Certified
EPA 624	Ethylbenzene	8/1/2012	7/31/2013	Certified
EPA 624	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)	8/1/2012	7/31/2013	Certified
EPA 624	Hexachlorobutadiene	8/1/2012	7/31/2013	Certified
EPA 624	m+p-xylene	8/1/2012	7/31/2013	Certified
EPA 624	Methyl bromide (Bromomethane)	8/1/2012	7/31/2013	Certified
EPA 624	Methyl chloride (Chloromethane)	8/1/2012	7/31/2013	Certified
EPA 624	Methyl tert-butyl ether (MTBE)	8/1/2012	7/31/2013	Certified
EPA 624	Methylene chloride (Dichloromethane)	8/1/2012	7/31/2013	Certified
EPA 624	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 624	n-Propylbenzene	8/1/2012	7/31/2013	Certified
EPA 624	o-Xylene	8/1/2012	7/31/2013	Certified
EPA 624	Styrene	8/1/2012	7/31/2013	Certified
EPA 624	T-amylmethylether (TAME)	8/1/2012	7/31/2013	Certified

EPA Number: ***NV00922*** **Attachment to Certificate Number:** **NV009222013-1** **Expiration Date:** **7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***CWA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 624	tert-Butyl alcohol (TBA)	8/1/2012	7/31/2013	Certified
EPA 624	Tetrachloroethylene (Perchloroethylene)	8/1/2012	7/31/2013	Certified
EPA 624	Toluene	8/1/2012	7/31/2013	Certified
EPA 624	trans-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 624	trans-1,3-Dichloropropene (trans-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 624	Trichloroethene (Trichloroethylene)	8/1/2012	7/31/2013	Certified
EPA 624	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	8/1/2012	7/31/2013	Certified
EPA 624	Vinyl acetate	8/1/2012	7/31/2013	Certified
EPA 624	Vinyl chloride	8/1/2012	7/31/2013	Certified
EPA 624	Xylene (total)	8/1/2012	7/31/2013	Certified
EPA 625	1,2,4-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 625	1,2-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 625	1,3-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 625	1,4-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 625	2,4,5-Trichlorophenol	8/1/2012	7/31/2013	Certified
EPA 625	2,4,6-Trichlorophenol	8/1/2012	7/31/2013	Certified
EPA 625	2,4-Dichlorophenol	8/1/2012	7/31/2013	Certified
EPA 625	2,4-Dimethylphenol	8/1/2012	7/31/2013	Certified
EPA 625	2,4-Dinitrophenol	8/1/2012	7/31/2013	Certified
EPA 625	2,4-Dinitrotoluene (2,4-DNT)	8/1/2012	7/31/2013	Certified
EPA 625	2,6-Dinitrotoluene (2,6-DNT)	8/1/2012	7/31/2013	Certified
EPA 625	2-Chloronaphthalene	8/1/2012	7/31/2013	Certified
EPA 625	2-Chlorophenol	8/1/2012	7/31/2013	Certified
EPA 625	2-Methylnaphthalene	8/1/2012	7/31/2013	Certified
EPA 625	2-Methylphenol (o-Cresol)	8/1/2012	7/31/2013	Certified
EPA 625	2-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 625	2-Nitrophenol	8/1/2012	7/31/2013	Certified
EPA 625	3 & 4-Methylphenol (m & p-Cresol)	8/1/2012	7/31/2013	Certified
EPA 625	3,3'-Dichlorobenzidine	8/1/2012	7/31/2013	Certified
EPA 625	3-Nitroaniline	8/1/2012	7/31/2013	Certified

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***CWA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 625	4-Bromophenyl phenyl ether	8/1/2012	7/31/2013	Certified
EPA 625	4-Chloro-3-methylphenol	8/1/2012	7/31/2013	Certified
EPA 625	4-Chloroaniline	8/1/2012	7/31/2013	Certified
EPA 625	4-Chlorophenyl phenylether	8/1/2012	7/31/2013	Certified
EPA 625	4-Methylphenol (p-Cresol)	8/1/2012	7/31/2013	Certified
EPA 625	4-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 625	4-Nitrophenol	8/1/2012	7/31/2013	Certified
EPA 625	Acenaphthene	8/1/2012	7/31/2013	Certified
EPA 625	Acenaphthylene	8/1/2012	7/31/2013	Certified
EPA 625	Aniline	8/1/2012	7/31/2013	Certified
EPA 625	Anthracene	8/1/2012	7/31/2013	Certified
EPA 625	Benzidine	8/1/2012	7/31/2013	Certified
EPA 625	Benzo(a)anthracene	8/1/2012	7/31/2013	Certified
EPA 625	Benzo(a)pyrene	8/1/2012	7/31/2013	Certified
EPA 625	Benzo(b)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 625	Benzo(g,h,i)perylene	8/1/2012	7/31/2013	Certified
EPA 625	Benzo(k)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 625	Benzoic acid	8/1/2012	7/31/2013	Certified
EPA 625	Benzyl alcohol	8/1/2012	7/31/2013	Certified
EPA 625	bis(2-Chloroethoxy)methane	8/1/2012	7/31/2013	Certified
EPA 625	bis(2-Chloroethyl) ether	8/1/2012	7/31/2013	Certified
EPA 625	bis(2-Chloroisopropyl) ether	8/1/2012	7/31/2013	Certified
EPA 625	bis(2-Ethylhexyl)phthalate,(DEHP, Di(2-ethylhexyl) phthalate)	8/1/2012	7/31/2013	Certified
EPA 625	Butyl benzyl phthalate	8/1/2012	7/31/2013	Certified
EPA 625	Carbazole	8/1/2012	7/31/2013	Certified
EPA 625	Chrysene	8/1/2012	7/31/2013	Certified
EPA 625	Dibenz(a,h) anthracene	8/1/2012	7/31/2013	Certified
EPA 625	Dibenzofuran	8/1/2012	7/31/2013	Certified
EPA 625	Diethyl phthalate	8/1/2012	7/31/2013	Certified
EPA 625	Dimethyl phthalate	8/1/2012	7/31/2013	Certified

EPA Number: ***NV00922*** **Attachment to Certificate Number:** **NV009222013-1** **Expiration Date:** **7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***CWA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 625	Di-n-butyl phthalate	8/1/2012	7/31/2013	Certified
EPA 625	Di-n-octyl phthalate	8/1/2012	7/31/2013	Certified
EPA 625	Fluoranthene	8/1/2012	7/31/2013	Certified
EPA 625	Fluorene	8/1/2012	7/31/2013	Certified
EPA 625	Hexachlorobenzene	8/1/2012	7/31/2013	Certified
EPA 625	Hexachlorobutadiene	8/1/2012	7/31/2013	Certified
EPA 625	Hexachlorocyclopentadiene	8/1/2012	7/31/2013	Certified
EPA 625	Hexachloroethane	8/1/2012	7/31/2013	Certified
EPA 625	Indeno(1,2,3-cd) pyrene	8/1/2012	7/31/2013	Certified
EPA 625	Isophorone	8/1/2012	7/31/2013	Certified
EPA 625	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 625	Nitrobenzene	8/1/2012	7/31/2013	Certified
EPA 625	n-Nitrosodimethylamine	8/1/2012	7/31/2013	Certified
EPA 625	n-Nitrosodi-n-propylamine	8/1/2012	7/31/2013	Certified
EPA 625	n-Nitrosodiphenylamine	8/1/2012	7/31/2013	Certified
EPA 625	Pentachlorophenol	8/1/2012	7/31/2013	Certified
EPA 625	Phenanthrene	8/1/2012	7/31/2013	Certified
EPA 625	Phenol	8/1/2012	7/31/2013	Certified
EPA 625	Pyrene	8/1/2012	7/31/2013	Certified
EPA 625	Pyridine	8/1/2012	7/31/2013	Certified
SM 2130 B [21st]	Turbidity	8/1/2012	7/31/2013	Certified
SM 2320 B [21st]	Alkalinity as CaCO3	8/1/2012	7/31/2013	Certified
SM 2340 B	Calcium hardness as CaCO3	8/1/2012	7/31/2013	Certified
SM 2340 B [21st]	Hardness by calculation	8/1/2012	7/31/2013	Certified
SM 2510 B [21st]	Conductivity	8/1/2012	7/31/2013	Certified
SM 2540 B-1997	Residue-total	8/1/2012	7/31/2013	Certified
SM 2540 C [21st]	Residue-filterable (TDS)	8/1/2012	7/31/2013	Certified
SM 2540 D [21st]	Residue-nonfilterable (TSS)	8/1/2012	7/31/2013	Certified
SM 2540 F [21st]	Residue-settleable	8/1/2012	7/31/2013	Certified
SM 3500-Cr B [20th]	Chromium VI	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***CWA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
SM 4500 NH3 C [18th]	Ammonia as N	8/1/2012	7/31/2013	Certified
SM 4500-H+ B [21st]	pH	8/1/2012	7/31/2013	Certified
SM 4500-NH3 C [18th]	Kjeldahl nitrogen - total	8/1/2012	7/31/2013	Certified
SM 4500-NH3 C [18th]	Kjeldahl nitrogen - total	8/1/2011	7/31/2013	Certified
SM 4500-Norg C	Kjeldahl nitrogen - total	8/1/2012	7/31/2013	Certified
SM 4500-P E	Orthophosphate as P	8/1/2012	7/31/2013	Certified
SM 4500-P E [21st]	Phosphorus, total	8/1/2012	7/31/2013	Certified
SM 4500-$S2^-$ D-00	Sulfide	8/1/2012	7/31/2013	Certified
SM 5310 C [21st]	Total organic carbon	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
Discipline Chemistry				
EPA 1311-Metals	TCLP extracted Metals	8/1/2012	7/31/2013	Certified
EPA 1311-SOCs	TCLP extracted SOCs	8/1/2012	7/31/2013	Certified
EPA 1311-VOCs	TCLP extracted VOCs	8/1/2012	7/31/2013	Certified
EPA 1312-Metals	SPLP extracted Metals	8/1/2012	7/31/2013	Certified
EPA 1312-SOCs	SPLP extracted SOCs	8/1/2012	7/31/2013	Certified
EPA 1312-VOCs	SPLP extracted VOCs	8/1/2012	7/31/2013	Certified
EPA 314.0	Perchlorate	8/1/2012	7/31/2013	Certified
EPA 6010B	Aluminum	8/1/2012	7/31/2013	Certified
EPA 6010B	Antimony	8/1/2012	7/31/2013	Certified
EPA 6010B	Arsenic	8/1/2012	7/31/2013	Certified
EPA 6010B	Barium	8/1/2012	7/31/2013	Certified
EPA 6010B	Beryllium	8/1/2012	7/31/2013	Certified
EPA 6010B	Boron	8/1/2012	7/31/2013	Certified
EPA 6010B	Cadmium	8/1/2012	7/31/2013	Certified
EPA 6010B	Calcium	8/1/2012	7/31/2013	Certified
EPA 6010B	Chromium	8/1/2012	7/31/2013	Certified
EPA 6010B	Cobalt	8/1/2012	7/31/2013	Certified
EPA 6010B	Copper	8/1/2012	7/31/2013	Certified
EPA 6010B	Iron	8/1/2012	7/31/2013	Certified
EPA 6010B	Lead	8/1/2012	7/31/2013	Certified
EPA 6010B	Magnesium	8/1/2012	7/31/2013	Certified
EPA 6010B	Manganese	8/1/2012	7/31/2013	Certified
EPA 6010B	Molybdenum	8/1/2012	7/31/2013	Certified
EPA 6010B	Nickel	8/1/2012	7/31/2013	Certified
EPA 6010B	Potassium	8/1/2012	7/31/2013	Certified
EPA 6010B	Selenium	8/1/2012	7/31/2013	Certified
EPA 6010B	Silica as SiO2	8/1/2012	7/31/2013	Certified
EPA 6010B	Silicon by calculation	8/1/2012	7/31/2013	Certified
EPA 6010B	Silver	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 6010B	Sodium	8/1/2012	7/31/2013	Certified
EPA 6010B	Strontium	8/1/2012	7/31/2013	Certified
EPA 6010B	Thallium	8/1/2012	7/31/2013	Certified
EPA 6010B	Tin	8/1/2012	7/31/2013	Certified
EPA 6010B	Titanium	8/1/2012	7/31/2013	Certified
EPA 6010B	Vanadium	8/1/2012	7/31/2013	Certified
EPA 6010B	Zinc	8/1/2012	7/31/2013	Certified
EPA 6010C	Aluminum	8/1/2012	7/31/2013	Certified
EPA 6010C	Antimony	8/1/2012	7/31/2013	Certified
EPA 6010C	Arsenic	8/1/2012	7/31/2013	Certified
EPA 6010C	Barium	8/1/2012	7/31/2013	Certified
EPA 6010C	Beryllium	8/1/2012	7/31/2013	Certified
EPA 6010C	Boron	8/1/2012	7/31/2013	Certified
EPA 6010C	Cadmium	8/1/2012	7/31/2013	Certified
EPA 6010C	Calcium	8/1/2012	7/31/2013	Certified
EPA 6010C	Chromium	8/1/2012	7/31/2013	Certified
EPA 6010C	Cobalt	8/1/2012	7/31/2013	Certified
EPA 6010C	Copper	8/1/2012	7/31/2013	Certified
EPA 6010C	Iron	8/1/2012	7/31/2013	Certified
EPA 6010C	Lead	8/1/2012	7/31/2013	Certified
EPA 6010C	Magnesium	8/1/2012	7/31/2013	Certified
EPA 6010C	Manganese	8/1/2012	7/31/2013	Certified
EPA 6010C	Molybdenum	8/1/2012	7/31/2013	Certified
EPA 6010C	Nickel	8/1/2012	7/31/2013	Certified
EPA 6010C	Potassium	8/1/2012	7/31/2013	Certified
EPA 6010C	Selenium	8/1/2012	7/31/2013	Certified
EPA 6010C	Silica as SiO2	8/1/2012	7/31/2013	Certified
EPA 6010C	Silicon by calculation	8/1/2012	7/31/2013	Certified
EPA 6010C	Silver	8/1/2012	7/31/2013	Certified
EPA 6010C	Sodium	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 6010C	Strontium	8/1/2012	7/31/2013	Certified
EPA 6010C	Thallium	8/1/2012	7/31/2013	Certified
EPA 6010C	Tin	8/1/2012	7/31/2013	Certified
EPA 6010C	Titanium	8/1/2012	7/31/2013	Certified
EPA 6010C	Vanadium	8/1/2012	7/31/2013	Certified
EPA 6010C	Zinc	8/1/2012	7/31/2013	Certified
EPA 6020	Aluminum	8/1/2012	7/31/2013	Certified
EPA 6020	Antimony	8/1/2012	7/31/2013	Certified
EPA 6020	Arsenic	8/1/2012	7/31/2013	Certified
EPA 6020	Barium	8/1/2012	7/31/2013	Certified
EPA 6020	Beryllium	8/1/2012	7/31/2013	Certified
EPA 6020	Boron	8/1/2012	7/31/2013	Certified
EPA 6020	Cadmium	8/1/2012	7/31/2013	Certified
EPA 6020	Calcium	8/1/2012	7/31/2013	Certified
EPA 6020	Chromium	8/1/2012	7/31/2013	Certified
EPA 6020	Cobalt	8/1/2012	7/31/2013	Certified
EPA 6020	Copper	8/1/2012	7/31/2013	Certified
EPA 6020	Iron	8/1/2012	7/31/2013	Certified
EPA 6020	Lead	8/1/2012	7/31/2013	Certified
EPA 6020	Magnesium	8/1/2012	7/31/2013	Certified
EPA 6020	Manganese	8/1/2012	7/31/2013	Certified
EPA 6020	Molybdenum	8/1/2012	7/31/2013	Certified
EPA 6020	Nickel	8/1/2012	7/31/2013	Certified
EPA 6020	Potassium	8/1/2012	7/31/2013	Certified
EPA 6020	Selenium	8/1/2012	7/31/2013	Certified
EPA 6020	Silica as SiO2	8/1/2012	7/31/2013	Certified
EPA 6020	Silver	8/1/2012	7/31/2013	Certified
EPA 6020	Sodium	8/1/2012	7/31/2013	Certified
EPA 6020	Strontium	8/1/2012	7/31/2013	Certified
EPA 6020	Thallium	8/1/2012	7/31/2013	Certified

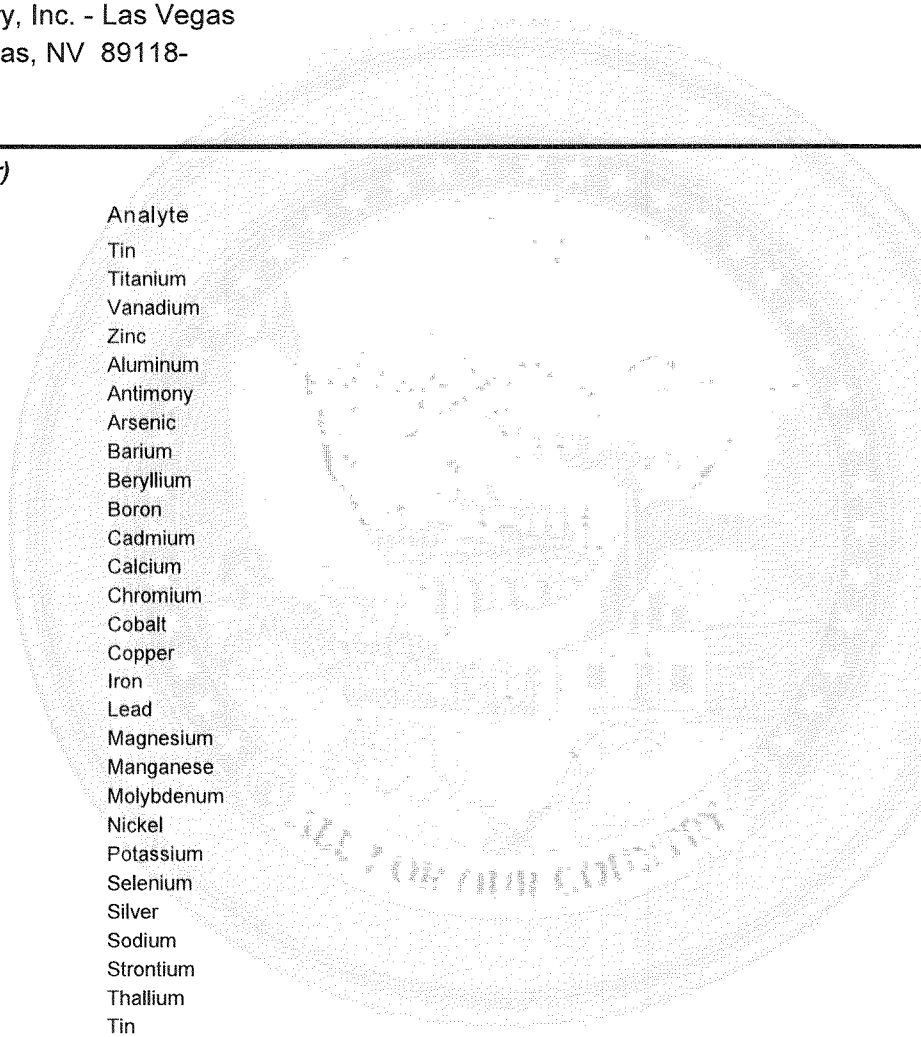
State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 6020	Tin	8/1/2012	7/31/2013	Certified
EPA 6020	Titanium	8/1/2012	7/31/2013	Certified
EPA 6020	Vanadium	8/1/2012	7/31/2013	Certified
EPA 6020	Zinc	8/1/2012	7/31/2013	Certified
EPA 6020A	Aluminum	8/1/2012	7/31/2013	Certified
EPA 6020A	Antimony	8/1/2012	7/31/2013	Certified
EPA 6020A	Arsenic	8/1/2012	7/31/2013	Certified
EPA 6020A	Barium	8/1/2012	7/31/2013	Certified
EPA 6020A	Beryllium	8/1/2012	7/31/2013	Certified
EPA 6020A	Boron	8/1/2012	7/31/2013	Certified
EPA 6020A	Cadmium	8/1/2012	7/31/2013	Certified
EPA 6020A	Calcium	8/1/2012	7/31/2013	Certified
EPA 6020A	Chromium	8/1/2012	7/31/2013	Certified
EPA 6020A	Cobalt	8/1/2012	7/31/2013	Certified
EPA 6020A	Copper	8/1/2012	7/31/2013	Certified
EPA 6020A	Iron	8/1/2012	7/31/2013	Certified
EPA 6020A	Lead	8/1/2012	7/31/2013	Certified
EPA 6020A	Magnesium	8/1/2012	7/31/2013	Certified
EPA 6020A	Manganese	8/1/2012	7/31/2013	Certified
EPA 6020A	Molybdenum	8/1/2012	7/31/2013	Certified
EPA 6020A	Nickel	8/1/2012	7/31/2013	Certified
EPA 6020A	Potassium	8/1/2012	7/31/2013	Certified
EPA 6020A	Selenium	8/1/2012	7/31/2013	Certified
EPA 6020A	Silver	8/1/2012	7/31/2013	Certified
EPA 6020A	Sodium	8/1/2012	7/31/2013	Certified
EPA 6020A	Strontium	8/1/2012	7/31/2013	Certified
EPA 6020A	Thallium	8/1/2012	7/31/2013	Certified
EPA 6020A	Tin	8/1/2012	7/31/2013	Certified
EPA 6020A	Titanium	8/1/2012	7/31/2013	Certified
EPA 6020A	Vanadium	8/1/2012	7/31/2013	Certified



Disclaimer: A laboratory that is certified or approved has established that they have the ability to implement a quality control program in accordance with the appropriate Federal or State regulations or statutes. It is the certified laboratory's responsibility to provide their client the most current certified parameter list. Contact LCP to verify certification status.

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 6020A	Zinc	8/1/2012	7/31/2013	Certified
EPA 7196A	Chromium VI	8/1/2012	7/31/2013	Certified
EPA 7199	Chromium VI	8/1/2012	7/31/2013	Certified
EPA 7470A	Mercury	8/1/2012	7/31/2013	Certified
EPA 8015B	Diesel range organics (DRO)	8/1/2012	7/31/2013	Certified
EPA 8015B	Gasoline range organics (GRO)	8/1/2012	7/31/2013	Certified
EPA 8015B	Residual Range Organics (RRO) - Oil Range Organics	8/1/2012	7/31/2013	Certified
EPA 8015C	Diesel range organics (DRO)	8/1/2012	7/31/2013	Certified
EPA 8015C	Gasoline range organics (GRO)	8/1/2012	7/31/2013	Certified
EPA 8015C	Residual Range Organics (RRO) - Oil Range Organics	8/1/2012	7/31/2013	Certified
EPA 8015M	Gasoline range organics (GRO)	8/1/2012	7/31/2013	Certified
EPA 8081A	4,4'-DDD	8/1/2012	7/31/2013	Certified
EPA 8081A	4,4'-DDE	8/1/2012	7/31/2013	Certified
EPA 8081A	4,4'-DDT	8/1/2012	7/31/2013	Certified
EPA 8081A	Aldrin	8/1/2012	7/31/2013	Certified
EPA 8081A	alpha-BHC (alpha-Hexachlorocyclohexane)	8/1/2012	7/31/2013	Certified
EPA 8081A	alpha-Chlordane	8/1/2012	7/31/2013	Certified
EPA 8081A	beta-BHC (beta-Hexachlorocyclohexane)	8/1/2012	7/31/2013	Certified
EPA 8081A	Chlordane (tech.)	8/1/2012	7/31/2013	Certified
EPA 8081A	Chlordane, total	8/1/2012	7/31/2013	Certified
EPA 8081A	delta-BHC	8/1/2012	7/31/2013	Certified
EPA 8081A	Dieldrin	8/1/2012	7/31/2013	Certified
EPA 8081A	Endosulfan I	8/1/2012	7/31/2013	Certified
EPA 8081A	Endosulfan II	8/1/2012	7/31/2013	Certified
EPA 8081A	Endosulfan sulfate	8/1/2012	7/31/2013	Certified
EPA 8081A	Endrin	8/1/2012	7/31/2013	Certified
EPA 8081A	Endrin aldehyde	8/1/2012	7/31/2013	Certified
EPA 8081A	Endrin ketone	8/1/2012	7/31/2013	Certified
EPA 8081A	gamma-BHC (Lindane)	8/1/2012	7/31/2013	Certified
EPA 8081A	gamma-Chlordane	8/1/2012	7/31/2013	Certified

EPA Number: ***NV00922*** **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8081A	Heptachlor	8/1/2012	7/31/2013	Certified
EPA 8081A	Heptachlor epoxide	8/1/2012	7/31/2013	Certified
EPA 8081A	Methoxychlor	8/1/2012	7/31/2013	Certified
EPA 8081A	Toxaphene (Chlorinated camphene)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1016 (PCB-1016)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1016 in Oil (PCB-1016 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1221 (PCB-1221)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1221 in Oil (PCB-1221 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1232 (PCB-1232)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1232 in Oil (PCB-1232 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1242 (PCB-1242)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1242 in Oil (PCB-1242 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1248 (PCB-1248)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1248 in Oil (PCB-1248 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1254 (PCB-1254)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1254 in Oil (PCB-1254 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1260 (PCB-1260)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1260 in Oil (PCB-1260 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1016 (PCB-1016)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1221 (PCB-1221)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1232 (PCB-1232)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1242 (PCB-1242)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1248 (PCB-1248)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1254 (PCB-1254)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1260 (PCB-1260)	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,1,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,1-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,2,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,2-Trichloroethane	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260B	1,1-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1-Dichloropropene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2,3-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2,3-Trichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2,4-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2,4-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dibromoethane (EDB, Ethylene dibromide)	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,3,5-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,3-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,3-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,4-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,4-Dioxane (1,4- Diethyleneoxide)	8/1/2012	7/31/2013	Certified
EPA 8260B	2,2-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260B	2-Butanone (Methyl ethyl ketone, MEK)	8/1/2012	7/31/2013	Certified
EPA 8260B	2-Chloroethyl vinyl ether	8/1/2012	7/31/2013	Certified
EPA 8260B	2-Chlorotoluene	8/1/2012	7/31/2013	Certified
EPA 8260B	2-Hexanone	8/1/2012	7/31/2013	Certified
EPA 8260B	4-Chlorotoluene	8/1/2012	7/31/2013	Certified
EPA 8260B	4-Isopropyltoluene (p-Cymene)	8/1/2012	7/31/2013	Certified
EPA 8260B	4-Methyl-2-pentanone (MIBK)	8/1/2012	7/31/2013	Certified
EPA 8260B	Acetone	8/1/2012	7/31/2013	Certified
EPA 8260B	Acetonitrile	8/1/2012	7/31/2013	Certified
EPA 8260B	Acrolein (Propenal)	8/1/2012	7/31/2013	Certified
EPA 8260B	Acrylonitrile	8/1/2012	7/31/2013	Certified
EPA 8260B	Allyl chloride (3-Chloropropene)	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260B	Benzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Bromobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Bromochloromethane	8/1/2012	7/31/2013	Certified
EPA 8260B	Bromodichloromethane	8/1/2012	7/31/2013	Certified
EPA 8260B	Bromoform	8/1/2012	7/31/2013	Certified
EPA 8260B	Carbon disulfide	8/1/2012	7/31/2013	Certified
EPA 8260B	Carbon tetrachloride	8/1/2012	7/31/2013	Certified
EPA 8260B	Chlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Chlorodibromomethane (Dibromochloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Chloroethane (Ethyl chloride)	8/1/2012	7/31/2013	Certified
EPA 8260B	Chloroform	8/1/2012	7/31/2013	Certified
EPA 8260B	cis & trans-1,2-Dichloroethene	8/1/2012	7/31/2013	Certified
EPA 8260B	cis-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260B	cis-1,3-Dichloropropene (cis-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	cis-1,4-Dichloro-2-butene	8/1/2012	7/31/2013	Certified
EPA 8260B	Dibromomethane (Methylene bromide)	8/1/2012	7/31/2013	Certified
EPA 8260B	Dichlorodifluoromethane (Freon-12)	8/1/2012	7/31/2013	Certified
EPA 8260B	Di-isopropylether (DIPE)	8/1/2012	7/31/2013	Certified
EPA 8260B	Ethyl acetate	8/1/2012	7/31/2013	Certified
EPA 8260B	Ethyl methacrylate	8/1/2012	7/31/2013	Certified
EPA 8260B	Ethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Hexachlorobutadiene	8/1/2012	7/31/2013	Certified
EPA 8260B	Iodomethane (Methyl iodide)	8/1/2012	7/31/2013	Certified
EPA 8260B	Isobutyl alcohol (2-Methyl-1-propanol, Isobutanol)	8/1/2012	7/31/2013	Certified
EPA 8260B	Isopropylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	m+p-xylene	8/1/2012	7/31/2013	Certified
EPA 8260B	Methacrylonitrile	8/1/2012	7/31/2013	Certified
EPA 8260B	Methyl bromide (Bromomethane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Methyl chloride (Chloromethane)	8/1/2012	7/31/2013	Certified

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260B	Methyl methacrylate	8/1/2012	7/31/2013	Certified
EPA 8260B	Methyl tert-butyl ether (MTBE)	8/1/2012	7/31/2013	Certified
EPA 8260B	Methylene chloride (Dichloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 8260B	n-Butylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	n-Propylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	o-Xylene	8/1/2012	7/31/2013	Certified
EPA 8260B	Propionitrile (Ethyl cyanide)	8/1/2012	7/31/2013	Certified
EPA 8260B	sec-Butylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Styrene	8/1/2012	7/31/2013	Certified
EPA 8260B	T-amylmethylether (TAME)	8/1/2012	7/31/2013	Certified
EPA 8260B	tert-Butyl alcohol (TBA)	8/1/2012	7/31/2013	Certified
EPA 8260B	tert-Butylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Tetrachloroethylene (Perchloroethylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	Toluene	8/1/2012	7/31/2013	Certified
EPA 8260B	trans-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260B	trans-1,3-Dichloropropene (trans-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	trans-1,4-Dichloro-2-butene	8/1/2012	7/31/2013	Certified
EPA 8260B	Trichloroethene (Trichloroethylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	8/1/2012	7/31/2013	Certified
EPA 8260B	Vinyl acetate	8/1/2012	7/31/2013	Certified
EPA 8260B	Vinyl chloride	8/1/2012	7/31/2013	Certified
EPA 8260B	Xylene (total)	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1,1,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1,1-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1,2,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1,2-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1-Dichloroethylene	8/1/2012	7/31/2013	Certified

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260C	1,1-Dichloropropene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2,3-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2,3-Trichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2,4-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2,4-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2-Dibromoethane (EDB, Ethylene dibromide)	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,3,5-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,3-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,3-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,4-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,4-Dioxane (1,4- Diethyleneoxide)	8/1/2012	7/31/2013	Certified
EPA 8260C	2,2-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260C	2-Butanone (Methyl ethyl ketone, MEK)	8/1/2012	7/31/2013	Certified
EPA 8260C	2-Chloroethyl vinyl ether	8/1/2012	7/31/2013	Certified
EPA 8260C	2-Chlorotoluene	8/1/2012	7/31/2013	Certified
EPA 8260C	4-Chlorotoluene	8/1/2012	7/31/2013	Certified
EPA 8260C	4-Isopropyltoluene (p-Cymene)	8/1/2012	7/31/2013	Certified
EPA 8260C	4-Methyl-2-pentanone (MIBK)	8/1/2012	7/31/2013	Certified
EPA 8260C	Acetone	8/1/2012	7/31/2013	Certified
EPA 8260C	Acetonitrile	8/1/2012	7/31/2013	Certified
EPA 8260C	Acrolein (Propenal)	8/1/2012	7/31/2013	Certified
EPA 8260C	Acrylonitrile	8/1/2012	7/31/2013	Certified
EPA 8260C	Allyl chloride (3-Chloropropene)	8/1/2012	7/31/2013	Certified
EPA 8260C	Benzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Bromobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Bromochloromethane	8/1/2012	7/31/2013	Certified

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260C	Bromodichloromethane	8/1/2012	7/31/2013	Certified
EPA 8260C	Bromoform	8/1/2012	7/31/2013	Certified
EPA 8260C	Carbon disulfide	8/1/2012	7/31/2013	Certified
EPA 8260C	Carbon tetrachloride	8/1/2012	7/31/2013	Certified
EPA 8260C	Chlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Chlorodibromomethane (Dibromochloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260C	Chloroethane (Ethyl chloride)	8/1/2012	7/31/2013	Certified
EPA 8260C	Chloroform	8/1/2012	7/31/2013	Certified
EPA 8260C	cis & trans-1,2-Dichloroethene	8/1/2012	7/31/2013	Certified
EPA 8260C	cis-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260C	cis-1,3-Dichloropropene (cis-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 8260C	cis-1,4-Dichloro-2-butene	8/1/2012	7/31/2013	Certified
EPA 8260C	Dibromomethane (Methylene bromide)	8/1/2012	7/31/2013	Certified
EPA 8260C	Dichlorodifluoromethane (Freon-12)	8/1/2012	7/31/2013	Certified
EPA 8260C	Di-isopropylether (DIPE)	8/1/2012	7/31/2013	Certified
EPA 8260C	Ethyl acetate	8/1/2012	7/31/2013	Certified
EPA 8260C	Ethyl methacrylate	8/1/2012	7/31/2013	Certified
EPA 8260C	Ethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)	8/1/2012	7/31/2013	Certified
EPA 8260C	Hexachlorobutadiene	8/1/2012	7/31/2013	Certified
EPA 8260C	Iodomethane (Methyl iodide)	8/1/2012	7/31/2013	Certified
EPA 8260C	Isobutyl alcohol (2-Methyl-1-propanol, Isobutanol)	8/1/2012	7/31/2013	Certified
EPA 8260C	Isopropylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	m+p-xylene	8/1/2012	7/31/2013	Certified
EPA 8260C	Methacrylonitrile	8/1/2012	7/31/2013	Certified
EPA 8260C	Methyl bromide (Bromomethane)	8/1/2012	7/31/2013	Certified
EPA 8260C	Methyl chloride (Chloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260C	Methyl methacrylate	8/1/2012	7/31/2013	Certified
EPA 8260C	Methyl tert-butyl ether (MTBE)	8/1/2012	7/31/2013	Certified
EPA 8260C	Methylene chloride (Dichloromethane)	8/1/2012	7/31/2013	Certified

EPA Number: ***NV00922*** **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260C	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 8260C	n-Butylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	n-Propylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	o-Xylene	8/1/2012	7/31/2013	Certified
EPA 8260C	Propionitrile (Ethyl cyanide)	8/1/2012	7/31/2013	Certified
EPA 8260C	sec-Butylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Styrene	8/1/2012	7/31/2013	Certified
EPA 8260C	T-amylmethylether (TAME)	8/1/2012	7/31/2013	Certified
EPA 8260C	tert-Butyl alcohol (TBA)	8/1/2012	7/31/2013	Certified
EPA 8260C	tert-Butylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Tetrachloroethylene (Perchloroethylene)	8/1/2012	7/31/2013	Certified
EPA 8260C	Toluene	8/1/2012	7/31/2013	Certified
EPA 8260C	trans-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260C	trans-1,3-Dichloropropene (trans-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 8260C	trans-1,4-Dichloro-2-butene	8/1/2012	7/31/2013	Certified
EPA 8260C	Trichloroethene (Trichloroethylene)	8/1/2012	7/31/2013	Certified
EPA 8260C	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	8/1/2012	7/31/2013	Certified
EPA 8260C	Vinyl acetate	8/1/2012	7/31/2013	Certified
EPA 8260C	Vinyl chloride	8/1/2012	7/31/2013	Certified
EPA 8260C	Xylene (total)	8/1/2012	7/31/2013	Certified
EPA 8270C	1,1'-Biphenyl (BZ-0)	8/1/2012	7/31/2013	Certified
EPA 8270C	1,2,4,5-Tetrachlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270C	1,2,4-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270C	1,2-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270C	1,2-Diphenylhydrazine	8/1/2012	7/31/2013	Certified
EPA 8270C	1,3-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270C	1,4-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270C	2,3,4,6-Tetrachlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2,4,5-Trichlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2,4,6-Trichlorophenol	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270C	2,4-Dichlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2,4-Dimethylphenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2,4-Dinitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2,4-Dinitrotoluene (2,4-DNT)	8/1/2012	7/31/2013	Certified
EPA 8270C	2,6-Dinitrotoluene (2,6-DNT)	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Chloronaphthalene	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Chlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Methylnaphthalene	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Methylphenol (o-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Nitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	3 & 4-Methylphenol (m & p-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270C	3,3'-Dichlorobenzidine	8/1/2012	7/31/2013	Certified
EPA 8270C	3-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Bromophenyl phenyl ether	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Chloro-3-methylphenol	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Chloroaniline	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Chlorophenyl phenylether	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Methylphenol (p-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Nitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	Acenaphthene	8/1/2012	7/31/2013	Certified
EPA 8270C	Acenaphthylene	8/1/2012	7/31/2013	Certified
EPA 8270C	Acetophenone	8/1/2012	7/31/2013	Certified
EPA 8270C	Aniline	8/1/2012	7/31/2013	Certified
EPA 8270C	Anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C	Atrazine	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzaldehyde	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzidine	8/1/2012	7/31/2013	Certified

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270C	Benzo(a)anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzo(a)pyrene	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzo(b)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzo(g,h,i)perylene	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzo(k)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzoic acid	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzyl alcohol	8/1/2012	7/31/2013	Certified
EPA 8270C	bis(2-Chloroethoxy)methane	8/1/2012	7/31/2013	Certified
EPA 8270C	bis(2-Chloroethyl) ether	8/1/2012	7/31/2013	Certified
EPA 8270C	bis(2-Chloroisopropyl) ether	8/1/2012	7/31/2013	Certified
EPA 8270C	bis(2-Ethylhexyl)phthalate,(DEHP, Di(2-ethylhexyl) phthalate)	8/1/2012	7/31/2013	Certified
EPA 8270C	Butyl benzyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270C	Caprolactam	8/1/2012	7/31/2013	Certified
EPA 8270C	Carbazole	8/1/2012	7/31/2013	Certified
EPA 8270C	Chrysene	8/1/2012	7/31/2013	Certified
EPA 8270C	Dibenz(a,h) anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C	Dibenzofuran	8/1/2012	7/31/2013	Certified
EPA 8270C	Diethyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270C	Dimethyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270C	Di-n-butyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270C	Di-n-octyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270C	Fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C	Fluorene	8/1/2012	7/31/2013	Certified
EPA 8270C	Hexachlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270C	Hexachlorobutadiene	8/1/2012	7/31/2013	Certified
EPA 8270C	Hexachlorocyclopentadiene	8/1/2012	7/31/2013	Certified
EPA 8270C	Hexachloroethane	8/1/2012	7/31/2013	Certified
EPA 8270C	Indeno(1,2,3-cd) pyrene	8/1/2012	7/31/2013	Certified
EPA 8270C	Isophorone	8/1/2012	7/31/2013	Certified
EPA 8270C	Naphthalene	8/1/2012	7/31/2013	Certified

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270C	Nitrobenzene	8/1/2012	7/31/2013	Certified
EPA 8270C	n-Nitrosodimethylamine	8/1/2012	7/31/2013	Certified
EPA 8270C	n-Nitrosodi-n-propylamine	8/1/2012	7/31/2013	Certified
EPA 8270C	n-Nitrosodiphenylamine	8/1/2012	7/31/2013	Certified
EPA 8270C	Pentachlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	Phenanthrene	8/1/2012	7/31/2013	Certified
EPA 8270C	Phenol	8/1/2012	7/31/2013	Certified
EPA 8270C	Pyrene	8/1/2012	7/31/2013	Certified
EPA 8270C	Pyridine	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Acenaphthene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Acenaphthylene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Benzo(a)anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Benzo(a)pyrene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Benzo(b)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Benzo(g,h,i)perylene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Benzo(k)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Chrysene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Dibenz(a,h) anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Fluorene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Indeno(1,2,3-cd) pyrene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Phenanthrene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Pyrene	8/1/2012	7/31/2013	Certified
EPA 8270D	1,1'-Biphenyl (BZ-0)	8/1/2012	7/31/2013	Certified
EPA 8270D	1,2,4,5-Tetrachlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	1,2,4-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	1,2-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	1,2-Diphenylhydrazine	8/1/2012	7/31/2013	Certified

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270D	1,3-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	1,4-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	2,3,4,6-Tetrachlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2,4,5-Trichlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2,4,6-Trichlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2,4-Dichlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2,4-Dimethylphenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2,4-Dinitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2,4-Dinitrotoluene (2,4-DNT)	8/1/2012	7/31/2013	Certified
EPA 8270D	2,6-Dinitrotoluene (2,6-DNT)	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Chloronaphthalene	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Chlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Methylnaphthalene	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Methylphenol (o-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Nitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	3 & 4-Methylphenol (m & p-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270D	3,3'-Dichlorobenzidine	8/1/2012	7/31/2013	Certified
EPA 8270D	3-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Bromophenyl phenyl ether	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Chloro-3-methylphenol	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Chloroaniline	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Chlorophenyl phenylether	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Methylphenol (p-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Nitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	Acenaphthene	8/1/2012	7/31/2013	Certified
EPA 8270D	Acenaphthylene	8/1/2012	7/31/2013	Certified
EPA 8270D	Acetophenone	8/1/2012	7/31/2013	Certified

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270D	Aniline	8/1/2012	7/31/2013	Certified
EPA 8270D	Anthracene	8/1/2012	7/31/2013	Certified
EPA 8270D	Atrazine	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzaldehyde	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzidine	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzo(a)anthracene	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzo(a)pyrene	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzo(b)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzo(g,h,i)perylene	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzo(k)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzoic acid	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzyl alcohol	8/1/2012	7/31/2013	Certified
EPA 8270D	bis(2-Chloroethoxy)methane	8/1/2012	7/31/2013	Certified
EPA 8270D	bis(2-Chloroethyl) ether	8/1/2012	7/31/2013	Certified
EPA 8270D	bis(2-Chloroisopropyl) ether	8/1/2012	7/31/2013	Certified
EPA 8270D	bis(2-Ethylhexyl)phthalate,(DEHP, Di(2-ethylhexyl) phthalate)	8/1/2012	7/31/2013	Certified
EPA 8270D	Butyl benzyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270D	Caprolactam	8/1/2012	7/31/2013	Certified
EPA 8270D	Carbazole	8/1/2012	7/31/2013	Certified
EPA 8270D	Chrysene	8/1/2012	7/31/2013	Certified
EPA 8270D	Dibenz(a,h) anthracene	8/1/2012	7/31/2013	Certified
EPA 8270D	Dibenzofuran	8/1/2012	7/31/2013	Certified
EPA 8270D	Diethyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270D	Dimethyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270D	Di-n-butyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270D	Di-n-octyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270D	Fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270D	Fluorene	8/1/2012	7/31/2013	Certified
EPA 8270D	Hexachlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	Hexachlorobutadiene	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00922*** **Attachment to Certificate Number:** **NV009222013-1** **Expiration Date:** **7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270D	Hexachlorocyclopentadiene	8/1/2012	7/31/2013	Certified
EPA 8270D	Hexachloroethane	8/1/2012	7/31/2013	Certified
EPA 8270D	Indeno(1,2,3-cd) pyrene	8/1/2012	7/31/2013	Certified
EPA 8270D	Isophorone	8/1/2012	7/31/2013	Certified
EPA 8270D	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 8270D	Nitrobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	n-Nitrosodimethylamine	8/1/2012	7/31/2013	Certified
EPA 8270D	n-Nitrosodi-n-propylamine	8/1/2012	7/31/2013	Certified
EPA 8270D	n-Nitrosodiphenylamine	8/1/2012	7/31/2013	Certified
EPA 8270D	Pentachlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	Phenanthrene	8/1/2012	7/31/2013	Certified
EPA 8270D	Phenol	8/1/2012	7/31/2013	Certified
EPA 8270D	Pyrene	8/1/2012	7/31/2013	Certified
EPA 8270D	Pyridine	8/1/2012	7/31/2013	Certified
EPA 9040B	pH	8/1/2012	7/31/2013	Certified
EPA 9040C	Corrosivity	8/1/2012	7/31/2013	Certified
EPA 9040C	pH	8/1/2012	7/31/2013	Certified
EPA 9050A	Conductivity	8/1/2012	7/31/2013	Certified
EPA 9060A	Total organic carbon	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
Discipline Chemistry				
EPA 1020A	Ignitability	8/1/2012	7/31/2013	Certified
EPA 1311-Metals	TCLP extracted Metals	8/1/2012	7/31/2013	Certified
EPA 1311-Pest	TCLP extracted Pesticides	8/1/2012	7/31/2013	Certified
EPA 1311-SOCs	TCLP extracted SOCs	8/1/2012	7/31/2013	Certified
EPA 1311-VOCs	TCLP extracted VOCs	8/1/2012	7/31/2013	Certified
EPA 1312-Metals	SPLP extracted Metals	8/1/2012	7/31/2013	Certified
EPA 1312-SOCs	SPLP extracted SOCs	8/1/2012	7/31/2013	Certified
EPA 1312-VOCs	SPLP extracted VOCs	8/1/2012	7/31/2013	Certified
EPA 6010B	Aluminum	8/1/2012	7/31/2013	Certified
EPA 6010B	Antimony	8/1/2012	7/31/2013	Certified
EPA 6010B	Arsenic	8/1/2012	7/31/2013	Certified
EPA 6010B	Barium	8/1/2012	7/31/2013	Certified
EPA 6010B	Beryllium	8/1/2012	7/31/2013	Certified
EPA 6010B	Boron	8/1/2012	7/31/2013	Certified
EPA 6010B	Cadmium	8/1/2012	7/31/2013	Certified
EPA 6010B	Calcium	8/1/2012	7/31/2013	Certified
EPA 6010B	Chromium	8/1/2012	7/31/2013	Certified
EPA 6010B	Cobalt	8/1/2012	7/31/2013	Certified
EPA 6010B	Copper	8/1/2012	7/31/2013	Certified
EPA 6010B	Iron	8/1/2012	7/31/2013	Certified
EPA 6010B	Lead	8/1/2012	7/31/2013	Certified
EPA 6010B	Magnesium	8/1/2012	7/31/2013	Certified
EPA 6010B	Manganese	8/1/2012	7/31/2013	Certified
EPA 6010B	Molybdenum	8/1/2012	7/31/2013	Certified
EPA 6010B	Nickel	8/1/2012	7/31/2013	Certified
EPA 6010B	Potassium	8/1/2012	7/31/2013	Certified
EPA 6010B	Selenium	8/1/2012	7/31/2013	Certified
EPA 6010B	Silver	8/1/2012	7/31/2013	Certified
EPA 6010B	Sodium	8/1/2012	7/31/2013	Certified

Disclaimer: A laboratory that is certified or approved has established that they have the ability to implement a quality control program in accordance with the appropriate Federal or State regulations or statutes. It is the certified laboratory's responsibility to provide their client the most current certified parameter list. Contact LCP to verify certification status.

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 6010B	Strontium	8/1/2012	7/31/2013	Certified
EPA 6010B	Thallium	8/1/2012	7/31/2013	Certified
EPA 6010B	Tin	8/1/2012	7/31/2013	Certified
EPA 6010B	Titanium	8/1/2012	7/31/2013	Certified
EPA 6010B	Vanadium	8/1/2012	7/31/2013	Certified
EPA 6010B	Zinc	8/1/2012	7/31/2013	Certified
EPA 6010C	Aluminum	8/1/2012	7/31/2013	Certified
EPA 6010C	Antimony	8/1/2012	7/31/2013	Certified
EPA 6010C	Arsenic	8/1/2012	7/31/2013	Certified
EPA 6010C	Barium	8/1/2012	7/31/2013	Certified
EPA 6010C	Beryllium	8/1/2012	7/31/2013	Certified
EPA 6010C	Boron	8/1/2012	7/31/2013	Certified
EPA 6010C	Cadmium	8/1/2012	7/31/2013	Certified
EPA 6010C	Calcium	8/1/2012	7/31/2013	Certified
EPA 6010C	Chromium	8/1/2012	7/31/2013	Certified
EPA 6010C	Cobalt	8/1/2012	7/31/2013	Certified
EPA 6010C	Copper	8/1/2012	7/31/2013	Certified
EPA 6010C	Iron	8/1/2012	7/31/2013	Certified
EPA 6010C	Lead	8/1/2012	7/31/2013	Certified
EPA 6010C	Magnesium	8/1/2012	7/31/2013	Certified
EPA 6010C	Manganese	8/1/2012	7/31/2013	Certified
EPA 6010C	Molybdenum	8/1/2012	7/31/2013	Certified
EPA 6010C	Nickel	8/1/2012	7/31/2013	Certified
EPA 6010C	Potassium	8/1/2012	7/31/2013	Certified
EPA 6010C	Selenium	8/1/2012	7/31/2013	Certified
EPA 6010C	Silver	8/1/2012	7/31/2013	Certified
EPA 6010C	Sodium	8/1/2012	7/31/2013	Certified
EPA 6010C	Strontium	8/1/2012	7/31/2013	Certified
EPA 6010C	Thallium	8/1/2012	7/31/2013	Certified
EPA 6010C	Tin	8/1/2012	7/31/2013	Certified

Disclaimer: A laboratory that is certified or approved has established that they have the ability to implement a quality control program in accordance with the appropriate Federal or State regulations or statutes. It is the certified laboratory's responsibility to provide their client the most current certified parameter list. Contact LCP to verify certification status.

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00922*** **Attachment to Certificate Number:** **NV009222013-1** **Expiration Date:** **7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 6010C	Titanium	8/1/2012	7/31/2013	Certified
EPA 6010C	Vanadium	8/1/2012	7/31/2013	Certified
EPA 6010C	Zinc	8/1/2012	7/31/2013	Certified
EPA 6020	Aluminum	8/1/2012	7/31/2013	Certified
EPA 6020	Antimony	8/1/2012	7/31/2013	Certified
EPA 6020	Arsenic	8/1/2012	7/31/2013	Certified
EPA 6020	Barium	8/1/2012	7/31/2013	Certified
EPA 6020	Beryllium	8/1/2012	7/31/2013	Certified
EPA 6020	Boron	8/1/2012	7/31/2013	Certified
EPA 6020	Cadmium	8/1/2012	7/31/2013	Certified
EPA 6020	Calcium	8/1/2012	7/31/2013	Certified
EPA 6020	Chromium	8/1/2012	7/31/2013	Certified
EPA 6020	Cobalt	8/1/2012	7/31/2013	Certified
EPA 6020	Copper	8/1/2012	7/31/2013	Certified
EPA 6020	Iron	8/1/2012	7/31/2013	Certified
EPA 6020	Lead	8/1/2012	7/31/2013	Certified
EPA 6020	Magnesium	8/1/2012	7/31/2013	Certified
EPA 6020	Manganese	8/1/2012	7/31/2013	Certified
EPA 6020	Molybdenum	8/1/2012	7/31/2013	Certified
EPA 6020	Nickel	8/1/2012	7/31/2013	Certified
EPA 6020	Potassium	8/1/2012	7/31/2013	Certified
EPA 6020	Selenium	8/1/2012	7/31/2013	Certified
EPA 6020	Silver	8/1/2012	7/31/2013	Certified
EPA 6020	Sodium	8/1/2012	7/31/2013	Certified
EPA 6020	Strontium	8/1/2012	7/31/2013	Certified
EPA 6020	Thallium	8/1/2012	7/31/2013	Certified
EPA 6020	Tin	8/1/2012	7/31/2013	Certified
EPA 6020	Titanium	8/1/2012	7/31/2013	Certified
EPA 6020	Vanadium	8/1/2012	7/31/2013	Certified
EPA 6020	Zinc	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 6020A	Aluminum	8/1/2012	7/31/2013	Certified
EPA 6020A	Antimony	8/1/2012	7/31/2013	Certified
EPA 6020A	Arsenic	8/1/2012	7/31/2013	Certified
EPA 6020A	Barium	8/1/2012	7/31/2013	Certified
EPA 6020A	Beryllium	8/1/2012	7/31/2013	Certified
EPA 6020A	Boron	8/1/2012	7/31/2013	Certified
EPA 6020A	Cadmium	8/1/2012	7/31/2013	Certified
EPA 6020A	Calcium	8/1/2012	7/31/2013	Certified
EPA 6020A	Chromium	8/1/2012	7/31/2013	Certified
EPA 6020A	Cobalt	8/1/2012	7/31/2013	Certified
EPA 6020A	Copper	8/1/2012	7/31/2013	Certified
EPA 6020A	Iron	8/1/2012	7/31/2013	Certified
EPA 6020A	Lead	8/1/2012	7/31/2013	Certified
EPA 6020A	Magnesium	8/1/2012	7/31/2013	Certified
EPA 6020A	Manganese	8/1/2012	7/31/2013	Certified
EPA 6020A	Molybdenum	8/1/2012	7/31/2013	Certified
EPA 6020A	Nickel	8/1/2012	7/31/2013	Certified
EPA 6020A	Potassium	8/1/2012	7/31/2013	Certified
EPA 6020A	Selenium	8/1/2012	7/31/2013	Certified
EPA 6020A	Silver	8/1/2012	7/31/2013	Certified
EPA 6020A	Sodium	8/1/2012	7/31/2013	Certified
EPA 6020A	Strontium	8/1/2012	7/31/2013	Certified
EPA 6020A	Thallium	8/1/2012	7/31/2013	Certified
EPA 6020A	Tin	8/1/2012	7/31/2013	Certified
EPA 6020A	Titanium	8/1/2012	7/31/2013	Certified
EPA 6020A	Vanadium	8/1/2012	7/31/2013	Certified
EPA 6020A	Zinc	8/1/2012	7/31/2013	Certified
EPA 7196A	Chromium VI	8/1/2012	7/31/2013	Certified
EPA 7199	Chromium VI	8/1/2012	7/31/2013	Certified
EPA 7471A	Mercury	8/1/2012	7/31/2013	Certified

Disclaimer: A laboratory that is certified or approved has established that they have the ability to implement a quality control program in accordance with the appropriate Federal or State regulations or statutes. It is the certified laboratory's responsibility to provide their client the most current certified parameter list. Contact LCP to verify certification status.

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 7471B [1/98]	Mercury	8/1/2012	7/31/2013	Certified
EPA 8015B	Diesel range organics (DRO)	8/1/2012	7/31/2013	Certified
EPA 8015B	Gasoline range organics (GRO)	8/1/2012	7/31/2013	Certified
EPA 8015B	Residual Range Organics (RRO) - Oil Range Organics	8/1/2012	7/31/2013	Certified
EPA 8015C	Gasoline range organics (GRO)	8/1/2012	7/31/2013	Certified
EPA 8015C	Residual Range Organics (RRO) - Oil Range Organics	8/1/2012	7/31/2013	Certified
EPA 8015M	Gasoline range organics (GRO)	8/1/2012	7/31/2013	Certified
EPA 8081A	4,4'-DDD	8/1/2012	7/31/2013	Certified
EPA 8081A	4,4'-DDE	8/1/2012	7/31/2013	Certified
EPA 8081A	4,4'-DDT	8/1/2012	7/31/2013	Certified
EPA 8081A	Aldrin	8/1/2012	7/31/2013	Certified
EPA 8081A	alpha-BHC (alpha-Hexachlorocyclohexane)	8/1/2012	7/31/2013	Certified
EPA 8081A	alpha-Chlordane	8/1/2012	7/31/2013	Certified
EPA 8081A	beta-BHC (beta-Hexachlorocyclohexane)	8/1/2012	7/31/2013	Certified
EPA 8081A	Chlordane (tech.)	8/1/2012	7/31/2013	Certified
EPA 8081A	Chlordane, total	8/1/2012	7/31/2013	Certified
EPA 8081A	delta-BHC	8/1/2012	7/31/2013	Certified
EPA 8081A	Dieldrin	8/1/2012	7/31/2013	Certified
EPA 8081A	Endosulfan I	8/1/2012	7/31/2013	Certified
EPA 8081A	Endosulfan II	8/1/2012	7/31/2013	Certified
EPA 8081A	Endosulfan sulfate	8/1/2012	7/31/2013	Certified
EPA 8081A	Endrin	8/1/2012	7/31/2013	Certified
EPA 8081A	Endrin aldehyde	8/1/2012	7/31/2013	Certified
EPA 8081A	Endrin ketone	8/1/2012	7/31/2013	Certified
EPA 8081A	gamma-BHC (Lindane)	8/1/2012	7/31/2013	Certified
EPA 8081A	gamma-Chlordane	8/1/2012	7/31/2013	Certified
EPA 8081A	Heptachlor	8/1/2012	7/31/2013	Certified
EPA 8081A	Heptachlor epoxide	8/1/2012	7/31/2013	Certified
EPA 8081A	Methoxychlor	8/1/2012	7/31/2013	Certified
EPA 8081A	Toxaphene (Chlorinated camphene)	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8082	Aroclor-1016 (PCB-1016)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1016 in Oil (PCB-1016 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1221 (PCB-1221)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1221 in Oil (PCB-1221 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1232 (PCB-1232)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1232 in Oil (PCB-1232 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1242 (PCB-1242)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1242 in Oil (PCB-1242 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1248 (PCB-1248)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1248 in Oil (PCB-1248 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1254 (PCB-1254)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1254 in Oil (PCB-1254 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1260 (PCB-1260)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1260 in Oil (PCB-1260 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1016 (PCB-1016)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1221 (PCB-1221)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1232 (PCB-1232)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1242 (PCB-1242)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1248 (PCB-1248)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1254 (PCB-1254)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1260 (PCB-1260)	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,1,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,1-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,2,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,2-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1-Dichloropropene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2,3-Trichlorobenzene	8/1/2012	7/31/2013	Certified

Disclaimer: A laboratory that is certified or approved has established that they have the ability to implement a quality control program in accordance with the appropriate Federal or State regulations or statutes. It is the certified laboratory's responsibility to provide their client the most current certified parameter list. Contact LCP to verify certification status.

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260B	1,2,3-Trichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2,4-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2,4-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dibromoethane (EDB, Ethylene dibromide)	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,3,5-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,3-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,3-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,4-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	2,2-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260B	2-Butanone (Methyl ethyl ketone, MEK)	8/1/2012	7/31/2013	Certified
EPA 8260B	2-Chloroethyl vinyl ether	8/1/2012	7/31/2013	Certified
EPA 8260B	2-Chlorotoluene	8/1/2012	7/31/2013	Certified
EPA 8260B	2-Hexanone	8/1/2012	7/31/2013	Certified
EPA 8260B	4-Chlorotoluene	8/1/2012	7/31/2013	Certified
EPA 8260B	4-Isopropyltoluene (p-Cymene)	8/1/2012	7/31/2013	Certified
EPA 8260B	4-Methyl-2-pentanone (MIBK)	8/1/2012	7/31/2013	Certified
EPA 8260B	Acetone	8/1/2012	7/31/2013	Certified
EPA 8260B	Acrolein (Propenal)	8/1/2012	7/31/2013	Certified
EPA 8260B	Acrylonitrile	8/1/2012	7/31/2013	Certified
EPA 8260B	Benzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Bromobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Bromochloromethane	8/1/2012	7/31/2013	Certified
EPA 8260B	Bromodichloromethane	8/1/2012	7/31/2013	Certified
EPA 8260B	Bromoform	8/1/2012	7/31/2013	Certified
EPA 8260B	Carbon disulfide	8/1/2012	7/31/2013	Certified
EPA 8260B	Carbon tetrachloride	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00922*** **Attachment to Certificate Number:** **NV009222013-1** **Expiration Date:** **7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260B	Chlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Chlorodibromomethane (Dibromochloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Chloroethane (Ethyl chloride)	8/1/2012	7/31/2013	Certified
EPA 8260B	Chloroform	8/1/2012	7/31/2013	Certified
EPA 8260B	cis & trans-1,2-Dichloroethene	8/1/2012	7/31/2013	Certified
EPA 8260B	cis-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260B	cis-1,3-Dichloropropene (cis-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	Dibromomethane (Methylene bromide)	8/1/2012	7/31/2013	Certified
EPA 8260B	Dichlorodifluoromethane (Freon-12)	8/1/2012	7/31/2013	Certified
EPA 8260B	Di-isopropylether (DIPE)	8/1/2012	7/31/2013	Certified
EPA 8260B	Ethyl acetate	8/1/2012	7/31/2013	Certified
EPA 8260B	Ethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Hexachlorobutadiene	8/1/2012	7/31/2013	Certified
EPA 8260B	Iodomethane (Methyl iodide)	8/1/2012	7/31/2013	Certified
EPA 8260B	Isopropylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	m+p-xylene	8/1/2012	7/31/2013	Certified
EPA 8260B	Methyl bromide (Bromomethane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Methyl chloride (Chloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Methyl tert-butyl ether (MTBE)	8/1/2012	7/31/2013	Certified
EPA 8260B	Methylene chloride (Dichloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 8260B	n-Butylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	n-Propylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	o-Xylene	8/1/2012	7/31/2013	Certified
EPA 8260B	sec-Butylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Styrene	8/1/2012	7/31/2013	Certified
EPA 8260B	T-amylmethylether (TAME)	8/1/2012	7/31/2013	Certified
EPA 8260B	tert-Butyl alcohol (TBA)	8/1/2012	7/31/2013	Certified
EPA 8260B	tert-Butylbenzene	8/1/2012	7/31/2013	Certified

Disclaimer: A laboratory that is certified or approved has established that they have the ability to implement a quality control program in accordance with the appropriate Federal or State regulations or statutes. It is the certified laboratory's responsibility to provide their client the most current certified parameter list. Contact LCP to verify certification status.

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260B	Tetrachloroethylene (Perchloroethylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	Toluene	8/1/2012	7/31/2013	Certified
EPA 8260B	trans-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260B	trans-1,3-Dichloropropene (trans-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	Trichloroethene (Trichloroethylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	8/1/2012	7/31/2013	Certified
EPA 8260B	Vinyl acetate	8/1/2012	7/31/2013	Certified
EPA 8260B	Vinyl chloride	8/1/2012	7/31/2013	Certified
EPA 8260B	Xylene (total)	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1,1,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1,1-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1,2,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1,2-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1-Dichloropropene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2,3-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2,3-Trichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2,4-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2,4-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2-Dibromoethane (EDB, Ethylene dibromide)	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,3,5-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,3-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,3-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,4-Dichlorobenzene	8/1/2012	7/31/2013	Certified

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260C	2,2-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260C	2-Butanone (Methyl ethyl ketone, MEK)	8/1/2012	7/31/2013	Certified
EPA 8260C	2-Chloroethyl vinyl ether	8/1/2012	7/31/2013	Certified
EPA 8260C	2-Chlorotoluene	8/1/2012	7/31/2013	Certified
EPA 8260C	4-Chlorotoluene	8/1/2012	7/31/2013	Certified
EPA 8260C	4-Isopropyltoluene (p-Cymene)	8/1/2012	7/31/2013	Certified
EPA 8260C	4-Methyl-2-pentanone (MIBK)	8/1/2012	7/31/2013	Certified
EPA 8260C	Acetone	8/1/2012	7/31/2013	Certified
EPA 8260C	Acrolein (Propenal)	8/1/2012	7/31/2013	Certified
EPA 8260C	Acrylonitrile	8/1/2012	7/31/2013	Certified
EPA 8260C	Benzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Bromobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Bromochloromethane	8/1/2012	7/31/2013	Certified
EPA 8260C	Bromodichloromethane	8/1/2012	7/31/2013	Certified
EPA 8260C	Bromoform	8/1/2012	7/31/2013	Certified
EPA 8260C	Carbon disulfide	8/1/2012	7/31/2013	Certified
EPA 8260C	Carbon tetrachloride	8/1/2012	7/31/2013	Certified
EPA 8260C	Chlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Chlorodibromomethane (Dibromochloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260C	Chloroethane (Ethyl chloride)	8/1/2012	7/31/2013	Certified
EPA 8260C	Chloroform	8/1/2012	7/31/2013	Certified
EPA 8260C	cis & trans-1,2-Dichloroethene	8/1/2012	7/31/2013	Certified
EPA 8260C	cis-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260C	cis-1,3-Dichloropropene (cis-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 8260C	Dibromomethane (Methylene bromide)	8/1/2012	7/31/2013	Certified
EPA 8260C	Dichlorodifluoromethane (Freon-12)	8/1/2012	7/31/2013	Certified
EPA 8260C	Di-isopropylether (DIPE)	8/1/2012	7/31/2013	Certified
EPA 8260C	Ethyl acetate	8/1/2012	7/31/2013	Certified
EPA 8260C	Ethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)	8/1/2012	7/31/2013	Certified

EPA Number: ***NV00922*** **Attachment to Certificate Number:** **NV009222013-1** **Expiration Date:** **7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260C	Hexachlorobutadiene	8/1/2012	7/31/2013	Certified
EPA 8260C	Iodomethane (Methyl iodide)	8/1/2012	7/31/2013	Certified
EPA 8260C	Isopropylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	m+p-xylene	8/1/2012	7/31/2013	Certified
EPA 8260C	Methyl bromide (Bromomethane)	8/1/2012	7/31/2013	Certified
EPA 8260C	Methyl chloride (Chloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260C	Methyl tert-butyl ether (MTBE)	8/1/2012	7/31/2013	Certified
EPA 8260C	Methylene chloride (Dichloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260C	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 8260C	n-Butylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	n-Propylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	o-Xylene	8/1/2012	7/31/2013	Certified
EPA 8260C	sec-Butylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Styrene	8/1/2012	7/31/2013	Certified
EPA 8260C	T-amylmethylether (TAME)	8/1/2012	7/31/2013	Certified
EPA 8260C	tert-Butyl alcohol (TBA)	8/1/2012	7/31/2013	Certified
EPA 8260C	tert-Butylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Tetrachloroethylene (Perchloroethylene)	8/1/2012	7/31/2013	Certified
EPA 8260C	Toluene	8/1/2012	7/31/2013	Certified
EPA 8260C	trans-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260C	trans-1,3-Dichloropropene (trans-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 8260C	Trichloroethene (Trichloroethylene)	8/1/2012	7/31/2013	Certified
EPA 8260C	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	8/1/2012	7/31/2013	Certified
EPA 8260C	Vinyl acetate	8/1/2012	7/31/2013	Certified
EPA 8260C	Vinyl chloride	8/1/2012	7/31/2013	Certified
EPA 8260C	Xylene (total)	8/1/2012	7/31/2013	Certified
EPA 8270C	1,2,4-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270C	1,2-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270C	1,3-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270C	1,4-Dichlorobenzene	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270C	2,3,4,6-Tetrachlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2,4,5-Trichlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2,4,6-Trichlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2,4-Dichlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2,4-Dimethylphenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2,4-Dinitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2,4-Dinitrotoluene (2,4-DNT)	8/1/2012	7/31/2013	Certified
EPA 8270C	2,6-Dinitrotoluene (2,6-DNT)	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Chloronaphthalene	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Chlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Methylnaphthalene	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Methylphenol (o-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Nitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	3 & 4-Methylphenol (m & p-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270C	3,3'-Dichlorobenzidine	8/1/2012	7/31/2013	Certified
EPA 8270C	3-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Bromophenyl phenyl ether	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Chloro-3-methylphenol	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Chloroaniline	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Chlorophenyl phenylether	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Methylphenol (p-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Nitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	Acenaphthene	8/1/2012	7/31/2013	Certified
EPA 8270C	Acenaphthylene	8/1/2012	7/31/2013	Certified
EPA 8270C	Aniline	8/1/2012	7/31/2013	Certified
EPA 8270C	Anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzidine	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270C	Benzo(a)anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzo(a)pyrene	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzo(b)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzo(g,h,i)perylene	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzo(k)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzoic acid	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzyl alcohol	8/1/2012	7/31/2013	Certified
EPA 8270C	bis(2-Chloroethoxy)methane	8/1/2012	7/31/2013	Certified
EPA 8270C	bis(2-Chloroethyl) ether	8/1/2012	7/31/2013	Certified
EPA 8270C	bis(2-Chloroisopropyl) ether	8/1/2012	7/31/2013	Certified
EPA 8270C	bis(2-Ethylhexyl)phthalate,(DEHP, Di(2-ethylhexyl) phthalate)	8/1/2012	7/31/2013	Certified
EPA 8270C	Butyl benzyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270C	Carbazole	8/1/2012	7/31/2013	Certified
EPA 8270C	Chrysene	8/1/2012	7/31/2013	Certified
EPA 8270C	Dibenz(a,h) anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C	Dibenzofuran	8/1/2012	7/31/2013	Certified
EPA 8270C	Diethyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270C	Dimethyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270C	Di-n-butyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270C	Di-n-octyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270C	Fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C	Fluorene	8/1/2012	7/31/2013	Certified
EPA 8270C	Hexachlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270C	Hexachlorobutadiene	8/1/2012	7/31/2013	Certified
EPA 8270C	Hexachlorocyclopentadiene	8/1/2012	7/31/2013	Certified
EPA 8270C	Hexachloroethane	8/1/2012	7/31/2013	Certified
EPA 8270C	Indeno(1,2,3-cd) pyrene	8/1/2012	7/31/2013	Certified
EPA 8270C	Isophorone	8/1/2012	7/31/2013	Certified
EPA 8270C	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 8270C	Nitrobenzene	8/1/2012	7/31/2013	Certified

Disclaimer: A laboratory that is certified or approved has established that they have the ability to implement a quality control program in accordance with the appropriate Federal or State regulations or statutes. It is the certified laboratory's responsibility to provide their client the most current certified parameter list. Contact LCP to verify certification status.

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270C	n-Nitrosodimethylamine	8/1/2012	7/31/2013	Certified
EPA 8270C	n-Nitrosodi-n-propylamine	8/1/2012	7/31/2013	Certified
EPA 8270C	n-Nitrosodiphenylamine	8/1/2012	7/31/2013	Certified
EPA 8270C	Pentachlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	Phenanthrene	8/1/2012	7/31/2013	Certified
EPA 8270C	Phenol	8/1/2012	7/31/2013	Certified
EPA 8270C	Pyrene	8/1/2012	7/31/2013	Certified
EPA 8270C	Pyridine	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Acenaphthene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Acenaphthylene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Benzo(a)anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Benzo(a)pyrene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Benzo(b)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Benzo(g,h,i)perylene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Benzo(k)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Chrysene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Dibenz(a,h) anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Fluorene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Indeno(1,2,3-cd) pyrene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Phenanthrene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Pyrene	8/1/2012	7/31/2013	Certified
EPA 8270D	1,2,4-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	1,2-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	1,3-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	1,4-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	2,3,4,6-Tetrachlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2,4,5-Trichlorophenol	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270D	2,4,6-Trichlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2,4-Dichlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2,4-Dimethylphenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2,4-Dinitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2,4-Dinitrotoluene (2,4-DNT)	8/1/2012	7/31/2013	Certified
EPA 8270D	2,6-Dinitrotoluene (2,6-DNT)	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Chloronaphthalene	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Chlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Methylnaphthalene	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Methylphenol (o-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Nitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	3 & 4-Methylphenol (m & p-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270D	3,3'-Dichlorobenzidine	8/1/2012	7/31/2013	Certified
EPA 8270D	3-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Bromophenyl phenyl ether	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Chloro-3-methylphenol	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Chloroaniline	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Chlorophenyl phenylether	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Methylphenol (p-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Nitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	Acenaphthene	8/1/2012	7/31/2013	Certified
EPA 8270D	Acenaphthylene	8/1/2012	7/31/2013	Certified
EPA 8270D	Aniline	8/1/2012	7/31/2013	Certified
EPA 8270D	Anthracene	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzidine	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzo(a)anthracene	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzo(a)pyrene	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00922*** **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270D	Benzo(b)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzo(g,h,i)perylene	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzo(k)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzoic acid	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzyl alcohol	8/1/2012	7/31/2013	Certified
EPA 8270D	bis(2-Chloroethoxy)methane	8/1/2012	7/31/2013	Certified
EPA 8270D	bis(2-Chloroethyl) ether	8/1/2012	7/31/2013	Certified
EPA 8270D	bis(2-Chloroisopropyl) ether	8/1/2012	7/31/2013	Certified
EPA 8270D	bis(2-Ethylhexyl)phthalate,(DEHP, Di(2-ethylhexyl) phthalate)	8/1/2012	7/31/2013	Certified
EPA 8270D	Butyl benzyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270D	Carbazole	8/1/2012	7/31/2013	Certified
EPA 8270D	Chrysene	8/1/2012	7/31/2013	Certified
EPA 8270D	Dibenz(a,h) anthracene	8/1/2012	7/31/2013	Certified
EPA 8270D	Dibenzofuran	8/1/2012	7/31/2013	Certified
EPA 8270D	Diethyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270D	Dimethyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270D	Di-n-butyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270D	Di-n-octyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270D	Fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270D	Fluorene	8/1/2012	7/31/2013	Certified
EPA 8270D	Hexachlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	Hexachlorobutadiene	8/1/2012	7/31/2013	Certified
EPA 8270D	Hexachlorocyclopentadiene	8/1/2012	7/31/2013	Certified
EPA 8270D	Hexachloroethane	8/1/2012	7/31/2013	Certified
EPA 8270D	Indeno(1,2,3-cd) pyrene	8/1/2012	7/31/2013	Certified
EPA 8270D	Isophorone	8/1/2012	7/31/2013	Certified
EPA 8270D	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 8270D	Nitrobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	n-Nitrosodimethylamine	8/1/2012	7/31/2013	Certified
EPA 8270D	n-Nitrosodi-n-propylamine	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270D	n-Nitrosodiphenylamine	8/1/2012	7/31/2013	Certified
EPA 8270D	Pentachlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	Phenanthrene	8/1/2012	7/31/2013	Certified
EPA 8270D	Phenol	8/1/2012	7/31/2013	Certified
EPA 8270D	Pyrene	8/1/2012	7/31/2013	Certified
EPA 8270D	Pyridine	8/1/2012	7/31/2013	Certified
EPA 9045C	pH	8/1/2012	7/31/2013	Certified
EPA 9045D	Corrosivity (pH)	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***SDWA (Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
Discipline Chemistry				
EPA 200.7	Aluminum	8/1/2012	7/31/2013	Certified
EPA 200.7	Barium	8/1/2012	7/31/2013	Certified
EPA 200.7	Beryllium	8/1/2012	7/31/2013	Certified
EPA 200.7	Boron	8/1/2012	7/31/2013	Nevada Approved
EPA 200.7	Cadmium	8/1/2012	7/31/2013	Certified
EPA 200.7	Calcium	8/1/2012	7/31/2013	Certified
EPA 200.7	Calcium hardness as CaCO3	8/1/2012	7/31/2013	Certified
EPA 200.7	Chromium	8/1/2012	7/31/2013	Certified
EPA 200.7	Cobalt	8/1/2012	7/31/2013	Nevada Approved
EPA 200.7	Copper	8/1/2012	7/31/2013	Certified
EPA 200.7	Hardness by calculation	8/1/2012	7/31/2013	Certified
EPA 200.7	Iron	8/1/2012	7/31/2013	Certified
EPA 200.7	Magnesium	8/1/2012	7/31/2013	Certified
EPA 200.7	Manganese	8/1/2012	7/31/2013	Certified
EPA 200.7	Molybdenum	8/1/2012	7/31/2013	Nevada Approved
EPA 200.7	Nickel	8/1/2012	7/31/2013	Certified
EPA 200.7	Potassium	8/1/2012	7/31/2013	Nevada Approved
EPA 200.7	Silica as SiO2	8/1/2012	7/31/2013	Certified
EPA 200.7	Silver	8/1/2012	7/31/2013	Certified
EPA 200.7	Sodium	8/1/2012	7/31/2013	Certified
EPA 200.7	Strontium	8/1/2012	7/31/2013	Nevada Approved
EPA 200.7	Tin	8/1/2012	7/31/2013	Nevada Approved
EPA 200.7	Titanium	8/1/2012	7/31/2013	Nevada Approved
EPA 200.7	Total hardness as CaCO3	8/1/2012	7/31/2013	Certified
EPA 200.7	Vanadium	8/1/2012	7/31/2013	Nevada Approved
EPA 200.7	Zinc	8/1/2012	7/31/2013	Certified
EPA 200.8	Aluminum	8/1/2012	7/31/2013	Certified
EPA 200.8	Antimony	8/1/2012	7/31/2013	Certified
EPA 200.8	Arsenic	8/1/2012	7/31/2013	Certified

Disclaimer: A laboratory that is certified or approved has established that they have the ability to implement a quality control program in accordance with the appropriate Federal or State regulations or statutes. It is the certified laboratory's responsibility to provide their client the most current certified parameter list. Contact LCP to verify certification status.

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***SDWA (Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 200.8	Barium	8/1/2012	7/31/2013	Certified
EPA 200.8	Beryllium	8/1/2012	7/31/2013	Certified
EPA 200.8	Boron	8/1/2012	7/31/2013	Nevada Approved
EPA 200.8	Cadmium	8/1/2012	7/31/2013	Certified
EPA 200.8	Calcium	8/1/2012	7/31/2013	Certified
EPA 200.8	Calcium hardness as CaCO3	8/1/2012	7/31/2013	Certified
EPA 200.8	Chromium	8/1/2012	7/31/2013	Certified
EPA 200.8	Cobalt	8/1/2012	7/31/2013	Nevada Approved
EPA 200.8	Copper	8/1/2012	7/31/2013	Certified
EPA 200.8	Iron	8/1/2012	7/31/2013	Certified
EPA 200.8	Lead	8/1/2012	7/31/2013	Certified
EPA 200.8	Magnesium	8/1/2012	7/31/2013	Certified
EPA 200.8	Manganese	8/1/2012	7/31/2013	Certified
EPA 200.8	Mercury	8/1/2012	7/31/2013	Certified
EPA 200.8	Molybdenum	8/1/2012	7/31/2013	Nevada Approved
EPA 200.8	Nickel	8/1/2012	7/31/2013	Certified
EPA 200.8	Potassium	8/1/2012	7/31/2013	Nevada Approved
EPA 200.8	Selenium	8/1/2012	7/31/2013	Certified
EPA 200.8	Silica as SiO2	8/1/2012	7/31/2013	Certified
EPA 200.8	Silver	8/1/2012	7/31/2013	Certified
EPA 200.8	Sodium	8/1/2012	7/31/2013	Certified
EPA 200.8	Strontium	8/1/2012	7/31/2013	Nevada Approved
EPA 200.8	Thallium	8/1/2012	7/31/2013	Certified
EPA 200.8	Tin	8/1/2012	7/31/2013	Nevada Approved
EPA 200.8	Titanium	8/1/2012	7/31/2013	Nevada Approved
EPA 200.8	Vanadium	8/1/2012	7/31/2013	Nevada Approved
EPA 200.8	Zinc	8/1/2012	7/31/2013	Certified
EPA 218.6	Chromium VI	8/1/2012	7/31/2013	Certified
EPA 245.1	Mercury	8/1/2012	7/31/2013	Certified
EPA 300.0	Bromide	8/1/2012	7/31/2013	Certified

Disclaimer: A laboratory that is certified or approved has established that they have the ability to implement a quality control program in accordance with the appropriate Federal or State regulations or statutes. It is the certified laboratory's responsibility to provide their client the most current certified parameter list. Contact LCP to verify certification status.

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***SDWA (Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 300.0	Chloride	8/1/2012	7/31/2013	Certified
EPA 300.0	Fluoride	8/1/2012	7/31/2013	Certified
EPA 300.0	Nitrate as N	8/1/2012	7/31/2013	Certified
EPA 300.0	Nitrate-nitrite	8/1/2012	7/31/2013	Certified
EPA 300.0	Nitrite as N	8/1/2012	7/31/2013	Certified
EPA 300.0	Orthophosphate as P	8/1/2012	7/31/2013	Certified
EPA 300.0	Sulfate	8/1/2012	7/31/2013	Certified
EPA 314.0	Perchlorate	8/1/2012	7/31/2013	Certified
SM 2130 B [21st]	Turbidity	8/1/2012	7/31/2013	Certified
SM 2320 B [21st]	Alkalinity as CaCO3	8/1/2012	7/31/2013	Certified
SM 2340 B [21st]	Calcium hardness as CaCO3	8/1/2012	7/31/2013	Certified
SM 2340 B [21st]	Hardness by calculation	8/1/2012	7/31/2013	Certified
SM 2510 B [21st]	Conductivity	8/1/2012	7/31/2013	Certified
SM 2540 C [21st]	Residue-filterable (TDS)	8/1/2012	7/31/2013	Certified
SM 2540 D [21st]	Residue-nonfilterable (TSS)	8/1/2012	7/31/2013	Certified
SM 4110 B [21st]	Bromide	8/1/2012	7/31/2013	Certified
SM 4110 B [21st]	Chloride	8/1/2012	7/31/2013	Certified
SM 4110 B [21st]	Fluoride	8/1/2012	7/31/2013	Certified
SM 4110 B [21st]	Nitrate as N	8/1/2012	7/31/2013	Certified
SM 4110 B [21st]	Nitrite as N	8/1/2012	7/31/2013	Certified
SM 4110 B [21st]	Orthophosphate as P	8/1/2012	7/31/2013	Certified
SM 4110 B [21st]	Sulfate	8/1/2012	7/31/2013	Certified
SM 4500-H+ B [21st]	pH	8/1/2012	7/31/2013	Certified
SM 4500-P E [21st]	Orthophosphate as P	8/1/2012	7/31/2013	Certified
SM 5310 C [21st]	Dissolved organic carbon (DOC)	8/1/2012	7/31/2013	Certified
SM 5310 C [21st]	Total organic carbon	8/1/2012	7/31/2013	Certified

Disclaimer: A laboratory that is certified or approved has established that they have the ability to implement a quality control program in accordance with the appropriate Federal or State regulations or statutes. It is the certified laboratory's responsibility to provide their client the most current certified parameter list. Contact LCP to verify certification status.

Appendix C:

Accreditations

California Environmental Laboratory Accreditation Program

(ELAP)

Advanced Technology Laboratories, Inc.

3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF ENVIRONMENTAL ACCREDITATION

Is hereby granted to

Advanced Technology Laboratories, Inc.

3151 West Post Road

Las Vegas, NV 89118

Scope of the certificate is limited to the
"Fields of Testing"
which accompany this Certificate.

Continued accredited status depends on successful completion of on-site, proficiency testing studies, and payment of applicable fees.

This Certificate is granted in accordance with provisions of Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **2676**

Expiration Date: **06/30/2013**

Effective Date: **07/01/2011**

Richmond, California
subject to forfeiture or revocation

George C. Kulasingam, Ph.D., Chief
Environmental Laboratory Accreditation Program Branch

State of California—Health and Human Services Agency
California Department of Public Health

RON CHAPMAN, MD, MPH
Director & State Health Officer

EDMUND G. BROWN JR.
Governor

February 6, 2012

Jose Tenorio Jr.
Advanced Technology Laboratories, Inc.
3151 West Post Road
Las Vegas, NV 89118

Dear Jose Tenorio Jr.:

Certificate No. 2676

Enclosed is an amended copy of your certificate.

If you have any questions, please contact our office at (510) 620-3155.

Sincerely,

Fred Chosh for

David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

Enclosure

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM
Accredited Fields of Testing

Advanced Technology Laboratories, Inc.
3151 West Post Road
Las Vegas, NV 89118
Phone: (702) 307-3248

Certificate No.: 2676
Renew Date: 6/30/2013

Field of Testing: 102 - Inorganic Chemistry of Drinking Water

102.030	001	Bromide	EPA 300.0
102.030	003	Chloride	EPA 300.0
102.030	005	Fluoride	EPA 300.0
102.030	006	Nitrate	EPA 300.0
102.030	007	Nitrite	EPA 300.0
102.030	008	Phosphate, Ortho	EPA 300.0
102.030	010	Sulfate	EPA 300.0
102.045	001	Perchlorate	EPA 314.0
102.120	001	Hardness	SM2340B
102.140	001	Total Dissolved Solids	SM2540C
102.150	001	Chloride	SM4110B
102.150	002	Fluoride	SM4110B
102.150	003	Nitrate	SM4110B
102.150	004	Nitrite	SM4110B
102.150	005	Phosphate, Ortho	SM4110B
102.150	006	Sulfate	SM4110B
102.520	001	Calcium	EPA 200.7
102.520	002	Magnesium	EPA 200.7
102.520	003	Potassium	EPA 200.7
102.520	004	Silica	EPA 200.7
102.520	005	Sodium	EPA 200.7
102.520	006	Hardness (calc.)	EPA 200.7

Field of Testing: 103 - Toxic Chemical Elements of Drinking Water

103.060	009	Iron	SM3120B
103.140	001	Aluminum	EPA 200.8
103.140	002	Antimony	EPA 200.8
103.140	003	Arsenic	EPA 200.8
103.140	004	Barium	EPA 200.8
103.140	005	Beryllium	EPA 200.8
103.140	006	Cadmium	EPA 200.8
103.140	007	Chromium	EPA 200.8
103.140	008	Copper	EPA 200.8
103.140	009	Lead	EPA 200.8
103.140	010	Manganese	EPA 200.8
103.140	012	Nickel	EPA 200.8

As of 3/30/2012 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

103.140	013	Selenium	EPA 200.8
103.140	014	Silver	EPA 200.8
103.140	015	Thallium	EPA 200.8
103.140	016	Zinc	EPA 200.8
103.140	017	Boron	EPA 200.8
103.140	018	Vanadium	EPA 200.8
103.160	001	Mercury	EPA 245.1
103.310	001	Chromium (VI)	EPA 218.6

Field of Testing: 108 - Inorganic Chemistry of Wastewater

108.020	001	Conductivity	EPA 120.1
108.090	001	Residue, Volatile	EPA 160.4
108.110	001	Turbidity	EPA 180.1
108.112	001	Boron	EPA 200.7
108.112	002	Calcium	EPA 200.7
108.112	003	Hardness (calc.)	EPA 200.7
108.112	004	Magnesium	EPA 200.7
108.112	005	Potassium	EPA 200.7
108.112	006	Silica	EPA 200.7
108.112	007	Sodium	EPA 200.7
108.113	001	Boron	EPA 200.8
108.113	002	Calcium	EPA 200.8
108.113	003	Magnesium	EPA 200.8
108.113	004	Potassium	EPA 200.8
108.113	005	Silica	EPA 200.8
108.113	006	Sodium	EPA 200.8
108.120	001	Bromide	EPA 300.0
108.120	002	Chloride	EPA 300.0
108.120	003	Fluoride	EPA 300.0
108.120	004	Nitrate	EPA 300.0
108.120	005	Nitrite	EPA 300.0
108.120	006	Nitrate-nitrite	EPA 300.0
108.120	007	Phosphate, Ortho	EPA 300.0
108.120	008	Sulfate	EPA 300.0
108.264	001	Phosphate, Ortho	EPA 365.3
108.265	001	Phosphorus, Total	EPA 365.3
108.381	001	Oil and Grease	EPA 1664A
108.390	001	Turbidity	SM2130B
108.410	001	Alkalinity	SM2320B
108.420	001	Hardness (calc.)	SM2340B
108.430	001	Conductivity	SM2510B
108.440	001	Residue, Total	SM2540B
108.441	001	Residue, Filterable	SM2540C
108.442	001	Residue, Non-filterable	SM2540D

108.443	001	Residue, Settleable	SM2540F
108.447	001	Boron	SM3120B
108.447	002	Calcium	SM3120B
108.447	003	Hardness (calc.)	SM3120B
108.447	004	Magnesium	SM3120B
108.447	005	Potassium	SM3120B
108.447	006	Silica	SM3120B
108.447	007	Sodium	SM3120B
108.448	001	Bromide	SM4110B
108.448	002	Chloride	SM4110B
108.448	003	Fluoride	SM4110B
108.448	004	Nitrate	SM4110B
108.448	005	Nitrite	SM4110B
108.448	006	Nitrate-nitrite	SM4110B
108.448	007	Phosphate, Ortho	SM4110B
108.448	008	Sulfate	SM4110B
108.490	001	pH	SM4500-H+ B
108.491	001	Ammonia	SM4500-NH3 C (18th)
108.491	002	Kjeldahl Nitrogen	SM4500-NH3 C (18th)
108.540	001	Phosphate, Ortho	SM4500-P E
108.541	001	Phosphorus, Total	SM4500-P E
108.611	001	Total Organic Carbon	SM5310C

Field of Testing: 109 - Toxic Chemical Elements of Wastewater

109.010	001	Aluminum	EPA 200.7
109.010	002	Antimony	EPA 200.7
109.010	003	Arsenic	EPA 200.7
109.010	004	Barium	EPA 200.7
109.010	005	Beryllium	EPA 200.7
109.010	007	Cadmium	EPA 200.7
109.010	009	Chromium	EPA 200.7
109.010	010	Cobalt	EPA 200.7
109.010	011	Copper	EPA 200.7
109.010	012	Iron	EPA 200.7
109.010	013	Lead	EPA 200.7
109.010	015	Manganese	EPA 200.7
109.010	016	Molybdenum	EPA 200.7
109.010	017	Nickel	EPA 200.7
109.010	019	Selenium	EPA 200.7
109.010	021	Silver	EPA 200.7
109.010	023	Thallium	EPA 200.7
109.010	024	Tin	EPA 200.7
109.010	026	Vanadium	EPA 200.7
109.010	027	Zinc	EPA 200.7

109.020	001	Aluminum	EPA 200.8
109.020	002	Antimony	EPA 200.8
109.020	003	Arsenic	EPA 200.8
109.020	004	Barium	EPA 200.8
109.020	005	Beryllium	EPA 200.8
109.020	006	Cadmium	EPA 200.8
109.020	007	Chromium	EPA 200.8
109.020	008	Cobalt	EPA 200.8
109.020	009	Copper	EPA 200.8
109.020	010	Lead	EPA 200.8
109.020	011	Manganese	EPA 200.8
109.020	012	Molybdenum	EPA 200.8
109.020	013	Nickel	EPA 200.8
109.020	014	Selenium	EPA 200.8
109.020	015	Silver	EPA 200.8
109.020	016	Thallium	EPA 200.8
109.020	017	Vanadium	EPA 200.8
109.020	018	Zinc	EPA 200.8
109.020	021	Iron	EPA 200.8
109.020	022	Tin	EPA 200.8
109.020	023	Titanium	EPA 200.8
109.104	001	Chromium (VI)	EPA 218.6
109.190	001	Mercury	EPA 245.1
109.400	001	Mercury	SM3112B
109.430	001	Aluminum	SM3120B
109.430	002	Antimony	SM3120B
109.430	003	Arsenic	SM3120B
109.430	004	Barium	SM3120B
109.430	005	Beryllium	SM3120B
109.430	007	Cadmium	SM3120B
109.430	009	Chromium	SM3120B
109.430	010	Cobalt	SM3120B
109.430	011	Copper	SM3120B
109.430	012	Iron	SM3120B
109.430	013	Lead	SM3120B
109.430	015	Manganese	SM3120B
109.430	016	Molybdenum	SM3120B
109.430	017	Nickel	SM3120B
109.430	019	Selenium	SM3120B
109.430	021	Silver	SM3120B
109.430	023	Thallium	SM3120B
109.430	024	Vanadium	SM3120B
109.430	025	Zinc	SM3120B

109.809	002	Chromium (VI)	SM3500-Cr B (20th)

Field of Testing: 114 - Inorganic Chemistry of Hazardous Waste

114.010	001	Antimony	EPA 6010B
114.010	002	Arsenic	EPA 6010B
114.010	003	Barium	EPA 6010B
114.010	004	Beryllium	EPA 6010B
114.010	005	Cadmium	EPA 6010B
114.010	006	Chromium	EPA 6010B
114.010	007	Cobalt	EPA 6010B
114.010	008	Copper	EPA 6010B
114.010	009	Lead	EPA 6010B
114.010	010	Molybdenum	EPA 6010B
114.010	011	Nickel	EPA 6010B
114.010	012	Selenium	EPA 6010B
114.010	013	Silver	EPA 6010B
114.010	014	Thallium	EPA 6010B
114.010	015	Vanadium	EPA 6010B
114.010	016	Zinc	EPA 6010B
114.020	001	Antimony	EPA 6020
114.020	002	Arsenic	EPA 6020
114.020	003	Barium	EPA 6020
114.020	004	Beryllium	EPA 6020
114.020	005	Cadmium	EPA 6020
114.020	006	Chromium	EPA 6020
114.020	007	Cobalt	EPA 6020
114.020	008	Copper	EPA 6020
114.020	009	Lead	EPA 6020
114.020	010	Molybdenum	EPA 6020
114.020	011	Nickel	EPA 6020
114.020	012	Selenium	EPA 6020
114.020	013	Silver	EPA 6020
114.020	014	Thallium	EPA 6020
114.020	015	Vanadium	EPA 6020
114.020	016	Zinc	EPA 6020
114.103	001	Chromium (VI)	EPA 7196A
114.106	001	Chromium (VI)	EPA 7199
114.140	001	Mercury	EPA 7470A
114.141	001	Mercury	EPA 7471A
114.240	001	Corrosivity - pH Determination	EPA 9040B
114.241	001	Corrosivity - pH Determination	EPA 9045C

Field of Testing: 115 - Extraction Test of Hazardous Waste

115.020	001	Toxicity Characteristic Leaching Procedure (TCLP)	EPA 1311
115.030	001	Waste Extraction Test (WET)	CCR Chapter11, Article 5, Appendix II

115.040	001	Synthetic Precipitation Leaching Procedure (SPLP)	EPA 1312
Field of Testing: 116 - Volatile Organic Chemistry of Hazardous Waste			
116.030	001	Gasoline-range Organics	EPA 8015B
116.080	000	Volatile Organic Compounds	EPA 8260B
116.080	120	Oxygenates	EPA 8260B
116.110	001	Total Petroleum Hydrocarbons - Gasoline	LUFT
Field of Testing: 117 - Semi-volatile Organic Chemistry of Hazardous Waste			
117.010	001	Diesel-range Total Petroleum Hydrocarbons	EPA 8015B
117.016	001	Diesel-range Total Petroleum Hydrocarbons	LUFT
117.110	000	Extractable Organics	EPA 8270C
117.210	000	Organochlorine Pesticides	EPA 8081A
117.220	000	PCBs	EPA 8082
Field of Testing: 120 - Physical Properties of Hazardous Waste			
120.020	001	Ignitability	EPA 1020A
120.070	001	Corrosivity - pH Determination	EPA 9040B
120.080	001	Corrosivity - pH Determination	EPA 9045C

National Environmental Accreditation Program

NELAP

Advanced Technology Laboratories, Inc.

3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

NELAP - RECOGNIZED

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF NELAP ACCREDITATION

Is hereby granted to

Advanced Technology Laboratories, Inc.

3151 West Post Road

Las Vegas, NV 89118

Scope of the Certificate is limited to the
"NELAP Fields of Accreditation"
which accompany this Certificate.

Continued accredited status depends on successful
ongoing participation in the program.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **08262CA**

Expiration Date: **3/31/2014**

Effective Date: **4/1/2013**

Richmond, California
subject to forfeiture or revocation

Fred Chosbe for
David Mazzera, Ph.D., Assistant Division Chief
Division of Drinking Water and Environmental Management

NELAP RECOGNIZED

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

NELAP Fields of Accreditation

Advanced Technology Laboratories, Inc.
3151 West Post Road
Las Vegas, NV 89118
Phone: (702) 307-3248

Certificate No. 08262CA
Renew Date: 3/31/2014

114 - Inorganic Chemistry of Hazardous Waste

114.010	001	EPA 6010B	Antimony
114.010	002	EPA 6010B	Arsenic
114.010	003	EPA 6010B	Barium
114.010	004	EPA 6010B	Beryllium
114.010	005	EPA 6010B	Cadmium
114.010	006	EPA 6010B	Chromium
114.010	007	EPA 6010B	Cobalt
114.010	008	EPA 6010B	Copper
114.010	009	EPA 6010B	Lead
114.010	010	EPA 6010B	Molybdenum
114.010	011	EPA 6010B	Nickel
114.010	012	EPA 6010B	Selenium
114.010	013	EPA 6010B	Silver
114.010	014	EPA 6010B	Thallium
114.010	015	EPA 6010B	Vanadium
114.010	016	EPA 6010B	Zinc
114.020	001	EPA 6020	Antimony
114.020	002	EPA 6020	Arsenic
114.020	003	EPA 6020	Barium
114.020	004	EPA 6020	Beryllium
114.020	005	EPA 6020	Cadmium
114.020	006	EPA 6020	Chromium
114.020	007	EPA 6020	Cobalt
114.020	008	EPA 6020	Copper
114.020	009	EPA 6020	Lead
114.020	010	EPA 6020	Molybdenum
114.020	011	EPA 6020	Nickel
114.020	012	EPA 6020	Selenium
114.020	013	EPA 6020	Silver
114.020	014	EPA 6020	Thallium
114.020	015	EPA 6020	Vanadium
114.020	016	EPA 6020	Zinc

As of 4/22/2013 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

114.103	001	EPA 7196A	Chromium (VI)
114.106	001	EPA 7199	Chromium (VI)
114.140	001	EPA 7470A	Mercury
114.141	001	EPA 7471A	Mercury

116 - Volatile Organic Chemistry of Hazardous Waste

116.030	001	EPA 8015B	Gasoline-range Organics
116.080	001	EPA 8260B	Acetone
116.080	003	EPA 8260B	Acrolein
116.080	004	EPA 8260B	Acrylonitrile
116.080	007	EPA 8260B	Benzene
116.080	010	EPA 8260B	Bromochloromethane
116.080	011	EPA 8260B	Bromodichloromethane
116.080	012	EPA 8260B	Bromoform
116.080	013	EPA 8260B	Bromomethane
116.080	015	EPA 8260B	Carbon Disulfide
116.080	016	EPA 8260B	Carbon Tetrachloride
116.080	018	EPA 8260B	Chlorobenzene
116.080	019	EPA 8260B	Chloroethane
116.080	020	EPA 8260B	2-Chloroethyl Vinyl Ether
116.080	021	EPA 8260B	Chloroform
116.080	022	EPA 8260B	Chloromethane
116.080	026	EPA 8260B	Dibromochloromethane
116.080	027	EPA 8260B	Dibromochloropropane
116.080	028	EPA 8260B	1,2-Dibromoethane
116.080	029	EPA 8260B	Dibromofluoromethane
116.080	030	EPA 8260B	Dibromomethane
116.080	031	EPA 8260B	1,2-Dichlorobenzene
116.080	032	EPA 8260B	1,3-Dichlorobenzene
116.080	033	EPA 8260B	1,4-Dichlorobenzene
116.080	036	EPA 8260B	Dichlorodifluoromethane
116.080	037	EPA 8260B	1,1-Dichloroethane
116.080	038	EPA 8260B	1,2-Dichloroethane
116.080	039	EPA 8260B	1,1-Dichloroethene
116.080	040	EPA 8260B	trans-1,2-Dichloroethene
116.080	041	EPA 8260B	cis-1,2-Dichloroethene
116.080	042	EPA 8260B	1,2-Dichloropropane
116.080	043	EPA 8260B	1,3-Dichloropropane
116.080	044	EPA 8260B	2,2-Dichloropropane
116.080	045	EPA 8260B	1,1-Dichloropropene
116.080	046	EPA 8260B	cis-1,3-Dichloropropene

116.080	047	EPA 8260B	trans-1,3-Dichloropropene
116.080	052	EPA 8260B	Ethyl Acetate
116.080	053	EPA 8260B	Ethylbenzene
116.080	056	EPA 8260B	Hexachlorobutadiene
116.080	058	EPA 8260B	2-Hexanone (MBK)
116.080	059	EPA 8260B	Iodomethane
116.080	064	EPA 8260B	Methyl tert-butyl Ether (MTBE)
116.080	065	EPA 8260B	Methylene Chloride
116.080	066	EPA 8260B	Methyl Ethyl Ketone
116.080	068	EPA 8260B	4-Methyl-2-pentanone (MIBK)
116.080	069	EPA 8260B	Naphthalene
116.080	081	EPA 8260B	1,1,1,2-Tetrachloroethane
116.080	082	EPA 8260B	1,1,2,2-Tetrachloroethane
116.080	083	EPA 8260B	Tetrachloroethene
116.080	084	EPA 8260B	Toluene
116.080	086	EPA 8260B	1,2,3-Trichlorobenzene
116.080	087	EPA 8260B	1,2,4-Trichlorobenzene
116.080	088	EPA 8260B	1,1,1-Trichloroethane
116.080	089	EPA 8260B	1,1,2-Trichloroethane
116.080	090	EPA 8260B	Trichloroethene
116.080	091	EPA 8260B	Trichlorofluoromethane
116.080	092	EPA 8260B	1,2,3-Trichloropropane
116.080	093	EPA 8260B	Vinyl Acetate
116.080	094	EPA 8260B	Vinyl Chloride
116.080	095	EPA 8260B	Xylenes, Total
116.080	096	EPA 8260B	tert-Amyl Methyl Ether (TAME)
116.080	097	EPA 8260B	tert-Butyl Alcohol (TBA)
116.080	098	EPA 8260B	Ethyl tert-butyl Ether (ETBE)
116.080	099	EPA 8260B	Bromobenzene
116.080	100	EPA 8260B	n-Butylbenzene
116.080	101	EPA 8260B	sec-Butylbenzene
116.080	102	EPA 8260B	tert-Butylbenzene
116.080	103	EPA 8260B	2-Chlorotoluene
116.080	104	EPA 8260B	4-Chlorotoluene
116.080	105	EPA 8260B	Isopropylbenzene
116.080	106	EPA 8260B	N-propylbenzene
116.080	107	EPA 8260B	Styrene
116.080	108	EPA 8260B	1,2,4-Trimethylbenzene
116.080	109	EPA 8260B	1,3,5-Trimethylbenzene
116.080	120	EPA 8260B	Oxygenates

116.110	001	LUFT	Total Petroleum Hydrocarbons - Gasoline

117 - Semi-volatile Organic Chemistry of Hazardous Waste

117.010	001	EPA 8015B	Diesel-range Total Petroleum Hydrocarbons
117.016	001	LUFT	Diesel-range Total Petroleum Hydrocarbons
117.110	000	EPA 8270C	Extractable Organics
117.110	001	EPA 8270C	Acenaphthene
117.110	002	EPA 8270C	Acenaphthylene
117.110	007	EPA 8270C	Aniline
117.110	008	EPA 8270C	Anthracene
117.110	010	EPA 8270C	Benzidine
117.110	011	EPA 8270C	Benz(a)anthracene
117.110	012	EPA 8270C	Benzo(b)fluoranthene
117.110	013	EPA 8270C	Benzo(k)fluoranthene
117.110	014	EPA 8270C	Benzo(g,h,i)perylene
117.110	015	EPA 8270C	Benzo(a)pyrene
117.110	016	EPA 8270C	Benzoic Acid
117.110	018	EPA 8270C	Benzyl Alcohol
117.110	019	EPA 8270C	Benzyl Butyl Phthalate
117.110	020	EPA 8270C	bis(2-chloroethoxy)methane
117.110	021	EPA 8270C	bis(2-chloroethyl) Ether
117.110	022	EPA 8270C	Bis(2-chloroisopropyl) Ether
117.110	023	EPA 8270C	Di(2-ethylhexyl) Phthalate
117.110	024	EPA 8270C	4-Bromophenyl Phenyl Ether
117.110	026	EPA 8270C	4-Chloroaniline
117.110	027	EPA 8270C	4-Chloro-3-methylphenol
117.110	029	EPA 8270C	2-Chloronaphthalene
117.110	030	EPA 8270C	2-Chlorophenol
117.110	031	EPA 8270C	4-Chlorophenyl Phenyl Ether
117.110	032	EPA 8270C	Chrysene
117.110	036	EPA 8270C	Dibenz(a,h)anthracene
117.110	037	EPA 8270C	Dibenzofuran
117.110	038	EPA 8270C	Dibenzo(a,e)pyrene
117.110	039	EPA 8270C	1,2-Dichlorobenzene
117.110	040	EPA 8270C	1,3-Dichlorobenzene
117.110	041	EPA 8270C	1,4-Dichlorobenzene
117.110	042	EPA 8270C	3,3'-Dichlorobenzidine
117.110	043	EPA 8270C	2,4-Dichlorophenol
117.110	045	EPA 8270C	Diethyl Phthalate
117.110	053	EPA 8270C	2,4-Dimethylphenol
117.110	054	EPA 8270C	Dimethyl Phthalate

117.110	055	EPA 8270C	Di-n-butyl phthalate
117.110	056	EPA 8270C	Di-n-octyl phthalate
117.110	060	EPA 8270C	2,4-Dinitrophenol
117.110	061	EPA 8270C	2,4-Dinitrotoluene
117.110	062	EPA 8270C	2,6-Dinitrotoluene
117.110	064	EPA 8270C	1,2-Diphenylhydrazine
117.110	067	EPA 8270C	Fluoranthene
117.110	068	EPA 8270C	Fluorene
117.110	069	EPA 8270C	Hexachlorobenzene
117.110	070	EPA 8270C	Hexachlorobutadiene
117.110	071	EPA 8270C	Hexachlorocyclopentadiene
117.110	072	EPA 8270C	Hexachloroethane
117.110	073	EPA 8270C	Hexachlorophene
117.110	075	EPA 8270C	Indeno(1,2,3-c,d)pyrene
117.110	076	EPA 8270C	Isophorone
117.110	080	EPA 8270C	2-Methyl-4,6-dinitrophenol
117.110	083	EPA 8270C	2-Methylnaphthalene
117.110	084	EPA 8270C	2-Methylphenol
117.110	086	EPA 8270C	4-Methylphenol
117.110	092	EPA 8270C	2-Nitroaniline
117.110	093	EPA 8270C	3-Nitroaniline
117.110	094	EPA 8270C	4-Nitroaniline
117.110	095	EPA 8270C	Nitrobenzene
117.110	096	EPA 8270C	2-Nitrophenol
117.110	097	EPA 8270C	4-Nitrophenol
117.110	100	EPA 8270C	N-nitrosodimethylamine
117.110	101	EPA 8270C	N-nitroso-di-n-propylamine
117.110	102	EPA 8270C	N-nitrosodiphenylamine
117.110	110	EPA 8270C	Pentachlorophenol
117.110	112	EPA 8270C	Phenanthrene
117.110	113	EPA 8270C	Phenol
117.110	119	EPA 8270C	Pyrene
117.110	120	EPA 8270C	Pyridine
117.110	129	EPA 8270C	1,2,4-Trichlorobenzene
117.110	130	EPA 8270C	2,4,5-Trichlorophenol
117.110	131	EPA 8270C	2,4,6-Trichlorophenol
117.210	000	EPA 8081A	Organochlorine Pesticides
117.210	001	EPA 8081A	Aldrin
117.210	002	EPA 8081A	a-BHC
117.210	003	EPA 8081A	b-BHC

117.210	004	EPA 8081A	d-BHC
117.210	005	EPA 8081A	g-BHC (Lindane)
117.210	007	EPA 8081A	a-Chlordane
117.210	008	EPA 8081A	g-Chlordane
117.210	009	EPA 8081A	Chlordane (tech.)
117.210	013	EPA 8081A	4,4'-DDD
117.210	014	EPA 8081A	4,4'-DDE
117.210	015	EPA 8081A	4,4'-DDT
117.210	020	EPA 8081A	Dieldrin
117.210	021	EPA 8081A	Endosulfan I
117.210	022	EPA 8081A	Endosulfan II
117.210	023	EPA 8081A	Endosulfan Sulfate
117.210	024	EPA 8081A	Endrin
117.210	025	EPA 8081A	Endrin Aldehyde
117.210	026	EPA 8081A	Endrin Ketone
117.210	027	EPA 8081A	Heptachlor
117.210	028	EPA 8081A	Heptachlor Epoxide
117.210	033	EPA 8081A	Methoxychlor
117.220	000	EPA 8082	PCBs
117.220	001	EPA 8082	PCB-1016
117.220	002	EPA 8082	PCB-1221
117.220	003	EPA 8082	PCB-1232
117.220	004	EPA 8082	PCB-1242
117.220	005	EPA 8082	PCB-1248
117.220	006	EPA 8082	PCB-1254
117.220	007	EPA 8082	PCB-1260

State of Nevada

NDEP

Advanced Technology Laboratories, Inc.

3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

STATE OF NEVADA
Department of Conservation & Natural Resources
DIVISION OF ENVIRONMENTAL PROTECTION
Brian Sandoval, Governor
Leo M. Drozdoff, P.E., Director
Colleen Cripps, Ph.D., Administrator

July 26, 2012

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W Post Rd
Las Vegas, NV 89118-

RE: Nevada Environmental Laboratory Certification 1 Year Extension.

Dear Sir or Madam:

Your laboratory's 2011-2012 Nevada scope has been extended until July 31, 2013 or until you receive the updated 2012-2013 scope.

This will serve as official notice to you and your clients.

Be advised this letter is only valid as long as your laboratory maintains compliance with State of Nevada regulation NAC 445A.0552 to .067, NAC 445A.542 to .54296 and/or NAC 459.96902 to .9699.

Failure to do so will result in invalidation of any data submitted to the Nevada Department of Environmental Protection.

If you or your clients have any questions, please contact Donald LaFara at 775-687-9491.

Sincerely,

Don LaFara

Donald LaFara, Laboratory Certification Officer
Program Manager, Laboratory Certification Program
State of Nevada Division of Environmental Protection

STATE OF NEVADA
Department of Conservation & Natural Resources
DIVISION OF ENVIRONMENTAL PROTECTION
Brian Sandoval, Governor
Leo M. Drozdoff, P.E., Director
Colleen Cripps, Ph.D., Administrator
ndep NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
protecting the future for generations

Date: 21 December 2011

To: Glen Gesmundo,

Subject: Interim Certification for Perchlorate & TOC

Based upon the successful analyses of proficiency testing samples, acceptable initial demonstrations of capability and standard operating procedures, Advanced Technology Laboratories, Inc. (EPA ID # NV00922) located in Las Vegas, Nevada is granted interim certification for the following:

Total Organic Carbon under the CWA using Standard Method 5310C,
Total Organic Carbon under the RCRA (water)using EPA 9060
Perchlorate under the SDWA using EPA 314.0.

The effective date is December 19, 2011 and will expire July 31, 2012.

This Certification is valid only as long as Advanced Technology Laboratories, Inc. maintains compliance with the applicable State of Nevada Revised Statutes (NRS 445A) and Administrative Codes (NAC) 445A.0552, NAC445A.542-.5496 and/or NAC459.96902-.9699).

If you or any or your clients have questions or concerns please contact me directly at dlafara@ndep.nv.gov or 775-687-9491.

Sara Rairick
Digitally signed by Sara Rairick
DN: c=US, postalCode=89701-5249, st=NV, l=Carson City, street=901 S. Stewart Street Suite 4001, o=Nevada Division of Environmental Protection, ou=Issued through Nevada Division of Environmental Protection E-PKI, ou=Corporate Secure Email, cn=Sara Rairick, email=srairick@ndep.nv.gov
Date: 2011.12.21 10:49:59 -08'00'

Laboratory Certification Officer — Date: 12-21-11

Sara Rairick
Digitally signed by Sara Rairick
DN: c=US, postalCode=89701-5249, st=NV, l=Carson City, street=901 S. Stewart Street Suite 4001, o=Nevada Division of Environmental Protection, ou=Issued through Nevada Division of Environmental Protection E-PKI, ou=Corporate Secure Email, cn=Sara Rairick, email=srairick@ndep.nv.gov
Date: 2011.12.21 10:50:15 -08'00'

_For DEL

Donald LaFara, Laboratory Certification Officer — Date: 12-21-11
Program Manager, Environmental Laboratory Certification Program
State of Nevada Division of Environmental Protection

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***CWA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
Discipline Chemistry				
EPA 120.1	Conductivity	8/1/2012	7/31/2013	Certified
EPA 1664A	n-Hexane Extractable Material (O&G)	8/1/2012	7/31/2013	Certified
EPA 1664A (SGT-HEM)	n-Hexane Extractable Material (O&G)	8/1/2012	7/31/2013	Certified
EPA 200.7	Aluminum	8/1/2012	7/31/2013	Certified
EPA 200.7	Antimony	8/1/2012	7/31/2013	Certified
EPA 200.7	Arsenic	8/1/2012	7/31/2013	Certified
EPA 200.7	Barium	8/1/2012	7/31/2013	Certified
EPA 200.7	Beryllium	8/1/2012	7/31/2013	Certified
EPA 200.7	Boron	8/1/2012	7/31/2013	Certified
EPA 200.7	Cadmium	8/1/2012	7/31/2013	Certified
EPA 200.7	Calcium	8/1/2012	7/31/2013	Certified
EPA 200.7	Calcium hardness as CaCO3	8/1/2012	7/31/2013	Certified
EPA 200.7	Chromium	8/1/2012	7/31/2013	Certified
EPA 200.7	Cobalt	8/1/2012	7/31/2013	Certified
EPA 200.7	Copper	8/1/2012	7/31/2013	Certified
EPA 200.7	Hardness by calculation	8/1/2012	7/31/2013	Certified
EPA 200.7	Iron	8/1/2012	7/31/2013	Certified
EPA 200.7	Lead	8/1/2012	7/31/2013	Certified
EPA 200.7	Magnesium	8/1/2012	7/31/2013	Certified
EPA 200.7	Manganese	8/1/2012	7/31/2013	Certified
EPA 200.7	Molybdenum	8/1/2012	7/31/2013	Certified
EPA 200.7	Nickel	8/1/2012	7/31/2013	Certified
EPA 200.7	Potassium	8/1/2012	7/31/2013	Certified
EPA 200.7	Selenium	8/1/2012	7/31/2013	Certified
EPA 200.7	Silica as SiO2	8/1/2012	7/31/2013	Certified
EPA 200.7	Silicon by calculation	8/1/2012	7/31/2013	Certified
EPA 200.7	Silver	8/1/2012	7/31/2013	Certified
EPA 200.7	Sodium	8/1/2012	7/31/2013	Certified
EPA 200.7	Strontium	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00922*** **Attachment to Certificate Number:** **NV009222013-1** **Expiration Date:** **7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***CWA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 200.7	Thallium	8/1/2012	7/31/2013	Certified
EPA 200.7	Tin	8/1/2012	7/31/2013	Certified
EPA 200.7	Total hardness as CaCO3	8/1/2012	7/31/2013	Certified
EPA 200.7	Vanadium	8/1/2012	7/31/2013	Certified
EPA 200.7	Zinc	8/1/2012	7/31/2013	Certified
EPA 200.8	Aluminum	8/1/2012	7/31/2013	Certified
EPA 200.8	Antimony	8/1/2012	7/31/2013	Certified
EPA 200.8	Arsenic	8/1/2012	7/31/2013	Certified
EPA 200.8	Barium	8/1/2012	7/31/2013	Certified
EPA 200.8	Beryllium	8/1/2012	7/31/2013	Certified
EPA 200.8	Cadmium	8/1/2012	7/31/2013	Certified
EPA 200.8	Calcium	8/1/2012	7/31/2013	Certified
EPA 200.8	Chromium	8/1/2012	7/31/2013	Certified
EPA 200.8	Cobalt	8/1/2012	7/31/2013	Certified
EPA 200.8	Copper	8/1/2012	7/31/2013	Certified
EPA 200.8	Iron	8/1/2012	7/31/2013	Certified
EPA 200.8	Lead	8/1/2012	7/31/2013	Certified
EPA 200.8	Manganese	8/1/2012	7/31/2013	Certified
EPA 200.8	Molybdenum	8/1/2012	7/31/2013	Certified
EPA 200.8	Nickel	8/1/2012	7/31/2013	Certified
EPA 200.8	Selenium	8/1/2012	7/31/2013	Certified
EPA 200.8	Silver	8/1/2012	7/31/2013	Certified
EPA 200.8	Strontium	8/1/2012	7/31/2013	Certified
EPA 200.8	Thallium	8/1/2012	7/31/2013	Certified
EPA 200.8	Vanadium	8/1/2012	7/31/2013	Certified
EPA 200.8	Zinc	8/1/2012	7/31/2013	Certified
EPA 218.6	Chromium VI	8/1/2012	7/31/2013	Certified
EPA 245.1	Mercury	8/1/2012	7/31/2013	Certified
EPA 300.0	Bromide	8/1/2012	7/31/2013	Certified
EPA 300.0	Chloride	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***CWA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 300.0	Nitrate as N	8/1/2012	7/31/2013	Certified
EPA 300.0	Nitrate-nitrite	8/1/2012	7/31/2013	Certified
EPA 300.0	Nitrite as N	8/1/2012	7/31/2013	Certified
EPA 300.0	Orthophosphate as P	8/1/2012	7/31/2013	Certified
EPA 300.0	Sulfate	8/1/2012	7/31/2013	Certified
EPA 314.0	Perchlorate	8/1/2012	7/31/2013	Certified
EPA 365.3	Orthophosphate as P	8/1/2012	7/31/2013	Certified
EPA 365.3	Phosphorus, total	8/1/2012	7/31/2013	Certified
EPA 608	4,4'-DDD	8/1/2012	7/31/2013	Certified
EPA 608	4,4'-DDE	8/1/2012	7/31/2013	Certified
EPA 608	4,4'-DDT	8/1/2012	7/31/2013	Certified
EPA 608	Aldrin	8/1/2012	7/31/2013	Certified
EPA 608	alpha-BHC (alpha-Hexachlorocyclohexane)	8/1/2012	7/31/2013	Certified
EPA 608	alpha-Chlordane	8/1/2012	7/31/2013	Certified
EPA 608	Aroclor-1016 (PCB-1016)	8/1/2012	7/31/2013	Certified
EPA 608	Aroclor-1221 (PCB-1221)	8/1/2012	7/31/2013	Certified
EPA 608	Aroclor-1232 (PCB-1232)	8/1/2012	7/31/2013	Certified
EPA 608	Aroclor-1242 (PCB-1242)	8/1/2012	7/31/2013	Certified
EPA 608	Aroclor-1248 (PCB-1248)	8/1/2012	7/31/2013	Certified
EPA 608	Aroclor-1254 (PCB-1254)	8/1/2012	7/31/2013	Certified
EPA 608	Aroclor-1260 (PCB-1260)	8/1/2012	7/31/2013	Certified
EPA 608	beta-BHC (beta-Hexachlorocyclohexane)	8/1/2012	7/31/2013	Certified
EPA 608	Chlordane (tech.)	8/1/2012	7/31/2013	Certified
EPA 608	Chlordane, total	8/1/2012	7/31/2013	Certified
EPA 608	delta-BHC	8/1/2012	7/31/2013	Certified
EPA 608	Dieldrin	8/1/2012	7/31/2013	Certified
EPA 608	Endosulfan I	8/1/2012	7/31/2013	Certified
EPA 608	Endosulfan II	8/1/2012	7/31/2013	Certified
EPA 608	Endosulfan sulfate	8/1/2012	7/31/2013	Certified
EPA 608	Endrin	8/1/2012	7/31/2013	Certified

EPA Number: ***NV00922*** **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***CWA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 608	Endrin aldehyde	8/1/2012	7/31/2013	Certified
EPA 608	Endrin ketone	8/1/2012	7/31/2013	Certified
EPA 608	gamma-BHC (Lindane)	8/1/2012	7/31/2013	Certified
EPA 608	gamma-Chlordane	8/1/2012	7/31/2013	Certified
EPA 608	Heptachlor	8/1/2012	7/31/2013	Certified
EPA 608	Heptachlor epoxide	8/1/2012	7/31/2013	Certified
EPA 608	Methoxychlor	8/1/2012	7/31/2013	Certified
EPA 608	Toxaphene (Chlorinated camphene)	8/1/2012	7/31/2013	Certified
EPA 624	1,1,1,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 624	1,1,1-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 624	1,1,2,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 624	1,1,2-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 624	1,1-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 624	1,1-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 624	1,2,3-Trichloropropane	8/1/2012	7/31/2013	Certified
EPA 624	1,2,4-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 624	1,2,4-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 624	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	8/1/2012	7/31/2013	Certified
EPA 624	1,2-Dibromoethane (EDB, Ethylene dibromide)	8/1/2012	7/31/2013	Certified
EPA 624	1,2-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 624	1,2-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 624	1,2-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 624	1,3,5-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 624	1,3-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 624	1,4-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 624	2-Butanone (Methyl ethyl ketone, MEK)	8/1/2012	7/31/2013	Certified
EPA 624	2-Chloroethyl vinyl ether	8/1/2012	7/31/2013	Certified
EPA 624	2-Hexanone	8/1/2012	7/31/2013	Certified
EPA 624	4-Methyl-2-pentanone (MIBK)	8/1/2012	7/31/2013	Certified
EPA 624	Acetone	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***CWA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 624	Acrolein (Propenal)	8/1/2012	7/31/2013	Certified
EPA 624	Acrylonitrile	8/1/2012	7/31/2013	Certified
EPA 624	Benzene	8/1/2012	7/31/2013	Certified
EPA 624	Bromodichloromethane	8/1/2012	7/31/2013	Certified
EPA 624	Bromoform	8/1/2012	7/31/2013	Certified
EPA 624	Carbon disulfide	8/1/2012	7/31/2013	Certified
EPA 624	Carbon tetrachloride	8/1/2012	7/31/2013	Certified
EPA 624	Chlorobenzene	8/1/2012	7/31/2013	Certified
EPA 624	Chlorodibromomethane (Dibromochloromethane)	8/1/2012	7/31/2013	Certified
EPA 624	Chloroethane (Ethyl chloride)	8/1/2012	7/31/2013	Certified
EPA 624	Chloroform	8/1/2012	7/31/2013	Certified
EPA 624	cis & trans-1,2-Dichloroethene	8/1/2012	7/31/2013	Certified
EPA 624	cis-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 624	cis-1,3-Dichloropropene (cis-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 624	Dibromomethane (Methylene bromide)	8/1/2012	7/31/2013	Certified
EPA 624	Dichlorodifluoromethane (Freon-12)	8/1/2012	7/31/2013	Certified
EPA 624	Di-isopropylether (DIPE)	8/1/2012	7/31/2013	Certified
EPA 624	Ethylbenzene	8/1/2012	7/31/2013	Certified
EPA 624	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)	8/1/2012	7/31/2013	Certified
EPA 624	Hexachlorobutadiene	8/1/2012	7/31/2013	Certified
EPA 624	m+p-xylene	8/1/2012	7/31/2013	Certified
EPA 624	Methyl bromide (Bromomethane)	8/1/2012	7/31/2013	Certified
EPA 624	Methyl chloride (Chloromethane)	8/1/2012	7/31/2013	Certified
EPA 624	Methyl tert-butyl ether (MTBE)	8/1/2012	7/31/2013	Certified
EPA 624	Methylene chloride (Dichloromethane)	8/1/2012	7/31/2013	Certified
EPA 624	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 624	n-Propylbenzene	8/1/2012	7/31/2013	Certified
EPA 624	o-Xylene	8/1/2012	7/31/2013	Certified
EPA 624	Styrene	8/1/2012	7/31/2013	Certified
EPA 624	T-amylmethylether (TAME)	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***CWA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 624	tert-Butyl alcohol (TBA)	8/1/2012	7/31/2013	Certified
EPA 624	Tetrachloroethylene (Perchloroethylene)	8/1/2012	7/31/2013	Certified
EPA 624	Toluene	8/1/2012	7/31/2013	Certified
EPA 624	trans-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 624	trans-1,3-Dichloropropene (trans-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 624	Trichloroethene (Trichloroethylene)	8/1/2012	7/31/2013	Certified
EPA 624	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	8/1/2012	7/31/2013	Certified
EPA 624	Vinyl acetate	8/1/2012	7/31/2013	Certified
EPA 624	Vinyl chloride	8/1/2012	7/31/2013	Certified
EPA 624	Xylene (total)	8/1/2012	7/31/2013	Certified
EPA 625	1,2,4-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 625	1,2-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 625	1,3-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 625	1,4-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 625	2,4,5-Trichlorophenol	8/1/2012	7/31/2013	Certified
EPA 625	2,4,6-Trichlorophenol	8/1/2012	7/31/2013	Certified
EPA 625	2,4-Dichlorophenol	8/1/2012	7/31/2013	Certified
EPA 625	2,4-Dimethylphenol	8/1/2012	7/31/2013	Certified
EPA 625	2,4-Dinitrophenol	8/1/2012	7/31/2013	Certified
EPA 625	2,4-Dinitrotoluene (2,4-DNT)	8/1/2012	7/31/2013	Certified
EPA 625	2,6-Dinitrotoluene (2,6-DNT)	8/1/2012	7/31/2013	Certified
EPA 625	2-Chloronaphthalene	8/1/2012	7/31/2013	Certified
EPA 625	2-Chlorophenol	8/1/2012	7/31/2013	Certified
EPA 625	2-Methylnaphthalene	8/1/2012	7/31/2013	Certified
EPA 625	2-Methylphenol (o-Cresol)	8/1/2012	7/31/2013	Certified
EPA 625	2-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 625	2-Nitrophenol	8/1/2012	7/31/2013	Certified
EPA 625	3 & 4-Methylphenol (m & p-Cresol)	8/1/2012	7/31/2013	Certified
EPA 625	3,3'-Dichlorobenzidine	8/1/2012	7/31/2013	Certified
EPA 625	3-Nitroaniline	8/1/2012	7/31/2013	Certified

EPA Number: ***NV00922*** **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***CWA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 625	4-Bromophenyl phenyl ether	8/1/2012	7/31/2013	Certified
EPA 625	4-Chloro-3-methylphenol	8/1/2012	7/31/2013	Certified
EPA 625	4-Chloroaniline	8/1/2012	7/31/2013	Certified
EPA 625	4-Chlorophenyl phenylether	8/1/2012	7/31/2013	Certified
EPA 625	4-Methylphenol (p-Cresol)	8/1/2012	7/31/2013	Certified
EPA 625	4-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 625	4-Nitrophenol	8/1/2012	7/31/2013	Certified
EPA 625	Acenaphthene	8/1/2012	7/31/2013	Certified
EPA 625	Acenaphthylene	8/1/2012	7/31/2013	Certified
EPA 625	Aniline	8/1/2012	7/31/2013	Certified
EPA 625	Anthracene	8/1/2012	7/31/2013	Certified
EPA 625	Benzidine	8/1/2012	7/31/2013	Certified
EPA 625	Benzo(a)anthracene	8/1/2012	7/31/2013	Certified
EPA 625	Benzo(a)pyrene	8/1/2012	7/31/2013	Certified
EPA 625	Benzo(b)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 625	Benzo(g,h,i)perylene	8/1/2012	7/31/2013	Certified
EPA 625	Benzo(k)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 625	Benzoic acid	8/1/2012	7/31/2013	Certified
EPA 625	Benzyl alcohol	8/1/2012	7/31/2013	Certified
EPA 625	bis(2-Chloroethoxy)methane	8/1/2012	7/31/2013	Certified
EPA 625	bis(2-Chloroethyl) ether	8/1/2012	7/31/2013	Certified
EPA 625	bis(2-Chloroisopropyl) ether	8/1/2012	7/31/2013	Certified
EPA 625	bis(2-Ethylhexyl)phthalate,(DEHP, Di(2-ethylhexyl) phthalate)	8/1/2012	7/31/2013	Certified
EPA 625	Butyl benzyl phthalate	8/1/2012	7/31/2013	Certified
EPA 625	Carbazole	8/1/2012	7/31/2013	Certified
EPA 625	Chrysene	8/1/2012	7/31/2013	Certified
EPA 625	Dibenz(a,h) anthracene	8/1/2012	7/31/2013	Certified
EPA 625	Dibenzofuran	8/1/2012	7/31/2013	Certified
EPA 625	Diethyl phthalate	8/1/2012	7/31/2013	Certified
EPA 625	Dimethyl phthalate	8/1/2012	7/31/2013	Certified

EPA Number: ***NV00922*** **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***CWA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 625	Di-n-butyl phthalate	8/1/2012	7/31/2013	Certified
EPA 625	Di-n-octyl phthalate	8/1/2012	7/31/2013	Certified
EPA 625	Fluoranthene	8/1/2012	7/31/2013	Certified
EPA 625	Fluorene	8/1/2012	7/31/2013	Certified
EPA 625	Hexachlorobenzene	8/1/2012	7/31/2013	Certified
EPA 625	Hexachlorobutadiene	8/1/2012	7/31/2013	Certified
EPA 625	Hexachlorocyclopentadiene	8/1/2012	7/31/2013	Certified
EPA 625	Hexachloroethane	8/1/2012	7/31/2013	Certified
EPA 625	Indeno(1,2,3-cd) pyrene	8/1/2012	7/31/2013	Certified
EPA 625	Isophorone	8/1/2012	7/31/2013	Certified
EPA 625	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 625	Nitrobenzene	8/1/2012	7/31/2013	Certified
EPA 625	n-Nitrosodimethylamine	8/1/2012	7/31/2013	Certified
EPA 625	n-Nitrosodi-n-propylamine	8/1/2012	7/31/2013	Certified
EPA 625	n-Nitrosodiphenylamine	8/1/2012	7/31/2013	Certified
EPA 625	Pentachlorophenol	8/1/2012	7/31/2013	Certified
EPA 625	Phenanthrene	8/1/2012	7/31/2013	Certified
EPA 625	Phenol	8/1/2012	7/31/2013	Certified
EPA 625	Pyrene	8/1/2012	7/31/2013	Certified
EPA 625	Pyridine	8/1/2012	7/31/2013	Certified
SM 2130 B [21st]	Turbidity	8/1/2012	7/31/2013	Certified
SM 2320 B [21st]	Alkalinity as CaCO3	8/1/2012	7/31/2013	Certified
SM 2340 B	Calcium hardness as CaCO3	8/1/2012	7/31/2013	Certified
SM 2340 B [21st]	Hardness by calculation	8/1/2012	7/31/2013	Certified
SM 2510 B [21st]	Conductivity	8/1/2012	7/31/2013	Certified
SM 2540 B-1997	Residue-total	8/1/2012	7/31/2013	Certified
SM 2540 C [21st]	Residue-filterable (TDS)	8/1/2012	7/31/2013	Certified
SM 2540 D [21st]	Residue-nonfilterable (TSS)	8/1/2012	7/31/2013	Certified
SM 2540 F [21st]	Residue-settleable	8/1/2012	7/31/2013	Certified
SM 3500-Cr B [20th]	Chromium VI	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***CWA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
SM 4500 NH3 C [18th]	Ammonia as N	8/1/2012	7/31/2013	Certified
SM 4500-H+ B [21st]	pH	8/1/2012	7/31/2013	Certified
SM 4500-NH3 C [18th]	Kjeldahl nitrogen - total	8/1/2012	7/31/2013	Certified
SM 4500-NH3 C [18th]	Kjeldahl nitrogen - total	8/1/2011	7/31/2013	Certified
SM 4500-Norg C	Kjeldahl nitrogen - total	8/1/2012	7/31/2013	Certified
SM 4500-P E	Orthophosphate as P	8/1/2012	7/31/2013	Certified
SM 4500-P E [21st]	Phosphorus, total	8/1/2012	7/31/2013	Certified
SM 4500-$S2^{=}$ D-00	Sulfide	8/1/2012	7/31/2013	Certified
SM 5310 C [21st]	Total organic carbon	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
Discipline Chemistry				
EPA 1311-Metals	TCLP extracted Metals	8/1/2012	7/31/2013	Certified
EPA 1311-SOCs	TCLP extracted SOCs	8/1/2012	7/31/2013	Certified
EPA 1311-VOCs	TCLP extracted VOCs	8/1/2012	7/31/2013	Certified
EPA 1312-Metals	SPLP extracted Metals	8/1/2012	7/31/2013	Certified
EPA 1312-SOCs	SPLP extracted SOCs	8/1/2012	7/31/2013	Certified
EPA 1312-VOCs	SPLP extracted VOCs	8/1/2012	7/31/2013	Certified
EPA 314.0	Perchlorate	8/1/2012	7/31/2013	Certified
EPA 6010B	Aluminum	8/1/2012	7/31/2013	Certified
EPA 6010B	Antimony	8/1/2012	7/31/2013	Certified
EPA 6010B	Arsenic	8/1/2012	7/31/2013	Certified
EPA 6010B	Barium	8/1/2012	7/31/2013	Certified
EPA 6010B	Beryllium	8/1/2012	7/31/2013	Certified
EPA 6010B	Boron	8/1/2012	7/31/2013	Certified
EPA 6010B	Cadmium	8/1/2012	7/31/2013	Certified
EPA 6010B	Calcium	8/1/2012	7/31/2013	Certified
EPA 6010B	Chromium	8/1/2012	7/31/2013	Certified
EPA 6010B	Cobalt	8/1/2012	7/31/2013	Certified
EPA 6010B	Copper	8/1/2012	7/31/2013	Certified
EPA 6010B	Iron	8/1/2012	7/31/2013	Certified
EPA 6010B	Lead	8/1/2012	7/31/2013	Certified
EPA 6010B	Magnesium	8/1/2012	7/31/2013	Certified
EPA 6010B	Manganese	8/1/2012	7/31/2013	Certified
EPA 6010B	Molybdenum	8/1/2012	7/31/2013	Certified
EPA 6010B	Nickel	8/1/2012	7/31/2013	Certified
EPA 6010B	Potassium	8/1/2012	7/31/2013	Certified
EPA 6010B	Selenium	8/1/2012	7/31/2013	Certified
EPA 6010B	Silica as SiO2	8/1/2012	7/31/2013	Certified
EPA 6010B	Silicon by calculation	8/1/2012	7/31/2013	Certified
EPA 6010B	Silver	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 6010B	Sodium	8/1/2012	7/31/2013	Certified
EPA 6010B	Strontium	8/1/2012	7/31/2013	Certified
EPA 6010B	Thallium	8/1/2012	7/31/2013	Certified
EPA 6010B	Tin	8/1/2012	7/31/2013	Certified
EPA 6010B	Titanium	8/1/2012	7/31/2013	Certified
EPA 6010B	Vanadium	8/1/2012	7/31/2013	Certified
EPA 6010B	Zinc	8/1/2012	7/31/2013	Certified
EPA 6010C	Aluminum	8/1/2012	7/31/2013	Certified
EPA 6010C	Antimony	8/1/2012	7/31/2013	Certified
EPA 6010C	Arsenic	8/1/2012	7/31/2013	Certified
EPA 6010C	Barium	8/1/2012	7/31/2013	Certified
EPA 6010C	Beryllium	8/1/2012	7/31/2013	Certified
EPA 6010C	Boron	8/1/2012	7/31/2013	Certified
EPA 6010C	Cadmium	8/1/2012	7/31/2013	Certified
EPA 6010C	Calcium	8/1/2012	7/31/2013	Certified
EPA 6010C	Chromium	8/1/2012	7/31/2013	Certified
EPA 6010C	Cobalt	8/1/2012	7/31/2013	Certified
EPA 6010C	Copper	8/1/2012	7/31/2013	Certified
EPA 6010C	Iron	8/1/2012	7/31/2013	Certified
EPA 6010C	Lead	8/1/2012	7/31/2013	Certified
EPA 6010C	Magnesium	8/1/2012	7/31/2013	Certified
EPA 6010C	Manganese	8/1/2012	7/31/2013	Certified
EPA 6010C	Molybdenum	8/1/2012	7/31/2013	Certified
EPA 6010C	Nickel	8/1/2012	7/31/2013	Certified
EPA 6010C	Potassium	8/1/2012	7/31/2013	Certified
EPA 6010C	Selenium	8/1/2012	7/31/2013	Certified
EPA 6010C	Silica as SiO2	8/1/2012	7/31/2013	Certified
EPA 6010C	Silicon by calculation	8/1/2012	7/31/2013	Certified
EPA 6010C	Silver	8/1/2012	7/31/2013	Certified
EPA 6010C	Sodium	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 6010C	Strontium	8/1/2012	7/31/2013	Certified
EPA 6010C	Thallium	8/1/2012	7/31/2013	Certified
EPA 6010C	Tin	8/1/2012	7/31/2013	Certified
EPA 6010C	Titanium	8/1/2012	7/31/2013	Certified
EPA 6010C	Vanadium	8/1/2012	7/31/2013	Certified
EPA 6010C	Zinc	8/1/2012	7/31/2013	Certified
EPA 6020	Aluminum	8/1/2012	7/31/2013	Certified
EPA 6020	Antimony	8/1/2012	7/31/2013	Certified
EPA 6020	Arsenic	8/1/2012	7/31/2013	Certified
EPA 6020	Barium	8/1/2012	7/31/2013	Certified
EPA 6020	Beryllium	8/1/2012	7/31/2013	Certified
EPA 6020	Boron	8/1/2012	7/31/2013	Certified
EPA 6020	Cadmium	8/1/2012	7/31/2013	Certified
EPA 6020	Calcium	8/1/2012	7/31/2013	Certified
EPA 6020	Chromium	8/1/2012	7/31/2013	Certified
EPA 6020	Cobalt	8/1/2012	7/31/2013	Certified
EPA 6020	Copper	8/1/2012	7/31/2013	Certified
EPA 6020	Iron	8/1/2012	7/31/2013	Certified
EPA 6020	Lead	8/1/2012	7/31/2013	Certified
EPA 6020	Magnesium	8/1/2012	7/31/2013	Certified
EPA 6020	Manganese	8/1/2012	7/31/2013	Certified
EPA 6020	Molybdenum	8/1/2012	7/31/2013	Certified
EPA 6020	Nickel	8/1/2012	7/31/2013	Certified
EPA 6020	Potassium	8/1/2012	7/31/2013	Certified
EPA 6020	Selenium	8/1/2012	7/31/2013	Certified
EPA 6020	Silica as SiO2	8/1/2012	7/31/2013	Certified
EPA 6020	Silver	8/1/2012	7/31/2013	Certified
EPA 6020	Sodium	8/1/2012	7/31/2013	Certified
EPA 6020	Strontium	8/1/2012	7/31/2013	Certified
EPA 6020	Thallium	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00922*** **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 6020	Tin	8/1/2012	7/31/2013	Certified
EPA 6020	Titanium	8/1/2012	7/31/2013	Certified
EPA 6020	Vanadium	8/1/2012	7/31/2013	Certified
EPA 6020	Zinc	8/1/2012	7/31/2013	Certified
EPA 6020A	Aluminum	8/1/2012	7/31/2013	Certified
EPA 6020A	Antimony	8/1/2012	7/31/2013	Certified
EPA 6020A	Arsenic	8/1/2012	7/31/2013	Certified
EPA 6020A	Barium	8/1/2012	7/31/2013	Certified
EPA 6020A	Beryllium	8/1/2012	7/31/2013	Certified
EPA 6020A	Boron	8/1/2012	7/31/2013	Certified
EPA 6020A	Cadmium	8/1/2012	7/31/2013	Certified
EPA 6020A	Calcium	8/1/2012	7/31/2013	Certified
EPA 6020A	Chromium	8/1/2012	7/31/2013	Certified
EPA 6020A	Cobalt	8/1/2012	7/31/2013	Certified
EPA 6020A	Copper	8/1/2012	7/31/2013	Certified
EPA 6020A	Iron	8/1/2012	7/31/2013	Certified
EPA 6020A	Lead	8/1/2012	7/31/2013	Certified
EPA 6020A	Magnesium	8/1/2012	7/31/2013	Certified
EPA 6020A	Manganese	8/1/2012	7/31/2013	Certified
EPA 6020A	Molybdenum	8/1/2012	7/31/2013	Certified
EPA 6020A	Nickel	8/1/2012	7/31/2013	Certified
EPA 6020A	Potassium	8/1/2012	7/31/2013	Certified
EPA 6020A	Selenium	8/1/2012	7/31/2013	Certified
EPA 6020A	Silver	8/1/2012	7/31/2013	Certified
EPA 6020A	Sodium	8/1/2012	7/31/2013	Certified
EPA 6020A	Strontium	8/1/2012	7/31/2013	Certified
EPA 6020A	Thallium	8/1/2012	7/31/2013	Certified
EPA 6020A	Tin	8/1/2012	7/31/2013	Certified
EPA 6020A	Titanium	8/1/2012	7/31/2013	Certified
EPA 6020A	Vanadium	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 6020A	Zinc	8/1/2012	7/31/2013	Certified
EPA 7196A	Chromium VI	8/1/2012	7/31/2013	Certified
EPA 7199	Chromium VI	8/1/2012	7/31/2013	Certified
EPA 7470A	Mercury	8/1/2012	7/31/2013	Certified
EPA 8015B	Diesel range organics (DRO)	8/1/2012	7/31/2013	Certified
EPA 8015B	Gasoline range organics (GRO)	8/1/2012	7/31/2013	Certified
EPA 8015B	Residual Range Organics (RRO) - Oil Range Organics	8/1/2012	7/31/2013	Certified
EPA 8015C	Diesel range organics (DRO)	8/1/2012	7/31/2013	Certified
EPA 8015C	Gasoline range organics (GRO)	8/1/2012	7/31/2013	Certified
EPA 8015C	Residual Range Organics (RRO) - Oil Range Organics	8/1/2012	7/31/2013	Certified
EPA 8015M	Gasoline range organics (GRO)	8/1/2012	7/31/2013	Certified
EPA 8081A	4,4'-DDD	8/1/2012	7/31/2013	Certified
EPA 8081A	4,4'-DDE	8/1/2012	7/31/2013	Certified
EPA 8081A	4,4'-DDT	8/1/2012	7/31/2013	Certified
EPA 8081A	Aldrin	8/1/2012	7/31/2013	Certified
EPA 8081A	alpha-BHC (alpha-Hexachlorocyclohexane)	8/1/2012	7/31/2013	Certified
EPA 8081A	alpha-Chlordane	8/1/2012	7/31/2013	Certified
EPA 8081A	beta-BHC (beta-Hexachlorocyclohexane)	8/1/2012	7/31/2013	Certified
EPA 8081A	Chlordane (tech.)	8/1/2012	7/31/2013	Certified
EPA 8081A	Chlordane, total	8/1/2012	7/31/2013	Certified
EPA 8081A	delta-BHC	8/1/2012	7/31/2013	Certified
EPA 8081A	Dieldrin	8/1/2012	7/31/2013	Certified
EPA 8081A	Endosulfan I	8/1/2012	7/31/2013	Certified
EPA 8081A	Endosulfan II	8/1/2012	7/31/2013	Certified
EPA 8081A	Endosulfan sulfate	8/1/2012	7/31/2013	Certified
EPA 8081A	Endrin	8/1/2012	7/31/2013	Certified
EPA 8081A	Endrin aldehyde	8/1/2012	7/31/2013	Certified
EPA 8081A	Endrin ketone	8/1/2012	7/31/2013	Certified
EPA 8081A	gamma-BHC (Lindane)	8/1/2012	7/31/2013	Certified
EPA 8081A	gamma-Chlordane	8/1/2012	7/31/2013	Certified

EPA Number: ***NV00922*** **Attachment to Certificate Number:** **NV009222013-1** **Expiration Date:** **7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8081A	Heptachlor	8/1/2012	7/31/2013	Certified
EPA 8081A	Heptachlor epoxide	8/1/2012	7/31/2013	Certified
EPA 8081A	Methoxychlor	8/1/2012	7/31/2013	Certified
EPA 8081A	Toxaphene (Chlorinated camphene)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1016 (PCB-1016)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1016 in Oil (PCB-1016 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1221 (PCB-1221)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1221 in Oil (PCB-1221 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1232 (PCB-1232)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1232 in Oil (PCB-1232 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1242 (PCB-1242)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1242 in Oil (PCB-1242 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1248 (PCB-1248)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1248 in Oil (PCB-1248 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1254 (PCB-1254)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1254 in Oil (PCB-1254 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1260 (PCB-1260)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1260 in Oil (PCB-1260 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1016 (PCB-1016)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1221 (PCB-1221)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1232 (PCB-1232)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1242 (PCB-1242)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1248 (PCB-1248)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1254 (PCB-1254)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1260 (PCB-1260)	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,1,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,1-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,2,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,2-Trichloroethane	8/1/2012	7/31/2013	Certified

EPA Number: ***NV00922*** **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260B	1,1-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1-Dichloropropene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2,3-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2,3-Trichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2,4-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2,4-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dibromoethane (EDB, Ethylene dibromide)	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,3,5-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,3-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,3-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,4-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,4-Dioxane (1,4- Diethyleneoxide)	8/1/2012	7/31/2013	Certified
EPA 8260B	2,2-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260B	2-Butanone (Methyl ethyl ketone, MEK)	8/1/2012	7/31/2013	Certified
EPA 8260B	2-Chloroethyl vinyl ether	8/1/2012	7/31/2013	Certified
EPA 8260B	2-Chlorotoluene	8/1/2012	7/31/2013	Certified
EPA 8260B	2-Hexanone	8/1/2012	7/31/2013	Certified
EPA 8260B	4-Chlorotoluene	8/1/2012	7/31/2013	Certified
EPA 8260B	4-Isopropyltoluene (p-Cymene)	8/1/2012	7/31/2013	Certified
EPA 8260B	4-Methyl-2-pentanone (MIBK)	8/1/2012	7/31/2013	Certified
EPA 8260B	Acetone	8/1/2012	7/31/2013	Certified
EPA 8260B	Acetonitrile	8/1/2012	7/31/2013	Certified
EPA 8260B	Acrolein (Propenal)	8/1/2012	7/31/2013	Certified
EPA 8260B	Acrylonitrile	8/1/2012	7/31/2013	Certified
EPA 8260B	Allyl chloride (3-Chloropropene)	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00922*** **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260B	Benzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Bromobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Bromochloromethane	8/1/2012	7/31/2013	Certified
EPA 8260B	Bromodichloromethane	8/1/2012	7/31/2013	Certified
EPA 8260B	Bromoform	8/1/2012	7/31/2013	Certified
EPA 8260B	Carbon disulfide	8/1/2012	7/31/2013	Certified
EPA 8260B	Carbon tetrachloride	8/1/2012	7/31/2013	Certified
EPA 8260B	Chlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Chlorodibromomethane (Dibromochloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Chloroethane (Ethyl chloride)	8/1/2012	7/31/2013	Certified
EPA 8260B	Chloroform	8/1/2012	7/31/2013	Certified
EPA 8260B	cis & trans-1,2-Dichloroethene	8/1/2012	7/31/2013	Certified
EPA 8260B	cis-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260B	cis-1,3-Dichloropropene (cis-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	cis-1,4-Dichloro-2-butene	8/1/2012	7/31/2013	Certified
EPA 8260B	Dibromomethane (Methylene bromide)	8/1/2012	7/31/2013	Certified
EPA 8260B	Dichlorodifluoromethane (Freon-12)	8/1/2012	7/31/2013	Certified
EPA 8260B	Di-isopropylether (DIPE)	8/1/2012	7/31/2013	Certified
EPA 8260B	Ethyl acetate	8/1/2012	7/31/2013	Certified
EPA 8260B	Ethyl methacrylate	8/1/2012	7/31/2013	Certified
EPA 8260B	Ethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Hexachlorobutadiene	8/1/2012	7/31/2013	Certified
EPA 8260B	Iodomethane (Methyl iodide)	8/1/2012	7/31/2013	Certified
EPA 8260B	Isobutyl alcohol (2-Methyl-1-propanol, Isobutanol)	8/1/2012	7/31/2013	Certified
EPA 8260B	Isopropylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	m+p-xylene	8/1/2012	7/31/2013	Certified
EPA 8260B	Methacrylonitrile	8/1/2012	7/31/2013	Certified
EPA 8260B	Methyl bromide (Bromomethane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Methyl chloride (Chloromethane)	8/1/2012	7/31/2013	Certified

EPA Number: ***NV00922*** **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260B	Methyl methacrylate	8/1/2012	7/31/2013	Certified
EPA 8260B	Methyl tert-butyl ether (MTBE)	8/1/2012	7/31/2013	Certified
EPA 8260B	Methylene chloride (Dichloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 8260B	n-Butylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	n-Propylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	o-Xylene	8/1/2012	7/31/2013	Certified
EPA 8260B	Propionitrile (Ethyl cyanide)	8/1/2012	7/31/2013	Certified
EPA 8260B	sec-Butylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Styrene	8/1/2012	7/31/2013	Certified
EPA 8260B	T-amylmethylether (TAME)	8/1/2012	7/31/2013	Certified
EPA 8260B	tert-Butyl alcohol (TBA)	8/1/2012	7/31/2013	Certified
EPA 8260B	tert-Butylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Tetrachloroethylene (Perchloroethylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	Toluene	8/1/2012	7/31/2013	Certified
EPA 8260B	trans-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260B	trans-1,3-Dichloropropene (trans-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	trans-1,4-Dichloro-2-butene	8/1/2012	7/31/2013	Certified
EPA 8260B	Trichloroethene (Trichloroethylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	8/1/2012	7/31/2013	Certified
EPA 8260B	Vinyl acetate	8/1/2012	7/31/2013	Certified
EPA 8260B	Vinyl chloride	8/1/2012	7/31/2013	Certified
EPA 8260B	Xylene (total)	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1,1,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1,1-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1,2,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1,2-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1-Dichloroethylene	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00922*** **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260C	1,1-Dichloropropene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2,3-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2,3-Trichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2,4-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2,4-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2-Dibromoethane (EDB, Ethylene dibromide)	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,3,5-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,3-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,3-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,4-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,4-Dioxane (1,4- Diethyleneoxide)	8/1/2012	7/31/2013	Certified
EPA 8260C	2,2-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260C	2-Butanone (Methyl ethyl ketone, MEK)	8/1/2012	7/31/2013	Certified
EPA 8260C	2-Chloroethyl vinyl ether	8/1/2012	7/31/2013	Certified
EPA 8260C	2-Chlorotoluene	8/1/2012	7/31/2013	Certified
EPA 8260C	4-Chlorotoluene	8/1/2012	7/31/2013	Certified
EPA 8260C	4-Isopropyltoluene (p-Cymene)	8/1/2012	7/31/2013	Certified
EPA 8260C	4-Methyl-2-pentanone (MIBK)	8/1/2012	7/31/2013	Certified
EPA 8260C	Acetone	8/1/2012	7/31/2013	Certified
EPA 8260C	Acetonitrile	8/1/2012	7/31/2013	Certified
EPA 8260C	Acrolein (Propenal)	8/1/2012	7/31/2013	Certified
EPA 8260C	Acrylonitrile	8/1/2012	7/31/2013	Certified
EPA 8260C	Allyl chloride (3-Chloropropene)	8/1/2012	7/31/2013	Certified
EPA 8260C	Benzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Bromobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Bromochloromethane	8/1/2012	7/31/2013	Certified

EPA Number: ***NV00922*** **Attachment to Certificate Number:** **NV009222013-1** **Expiration Date:** **7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260C	Bromodichloromethane	8/1/2012	7/31/2013	Certified
EPA 8260C	Bromoform	8/1/2012	7/31/2013	Certified
EPA 8260C	Carbon disulfide	8/1/2012	7/31/2013	Certified
EPA 8260C	Carbon tetrachloride	8/1/2012	7/31/2013	Certified
EPA 8260C	Chlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Chlorodibromomethane (Dibromochloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260C	Chloroethane (Ethyl chloride)	8/1/2012	7/31/2013	Certified
EPA 8260C	Chloroform	8/1/2012	7/31/2013	Certified
EPA 8260C	cis & trans-1,2-Dichloroethene	8/1/2012	7/31/2013	Certified
EPA 8260C	cis-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260C	cis-1,3-Dichloropropene (cis-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 8260C	cis-1,4-Dichloro-2-butene	8/1/2012	7/31/2013	Certified
EPA 8260C	Dibromomethane (Methylene bromide)	8/1/2012	7/31/2013	Certified
EPA 8260C	Dichlorodifluoromethane (Freon-12)	8/1/2012	7/31/2013	Certified
EPA 8260C	Di-isopropylether (DIPE)	8/1/2012	7/31/2013	Certified
EPA 8260C	Ethyl acetate	8/1/2012	7/31/2013	Certified
EPA 8260C	Ethyl methacrylate	8/1/2012	7/31/2013	Certified
EPA 8260C	Ethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)	8/1/2012	7/31/2013	Certified
EPA 8260C	Hexachlorobutadiene	8/1/2012	7/31/2013	Certified
EPA 8260C	Iodomethane (Methyl iodide)	8/1/2012	7/31/2013	Certified
EPA 8260C	Isobutyl alcohol (2-Methyl-1-propanol, Isobutanol)	8/1/2012	7/31/2013	Certified
EPA 8260C	Isopropylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	m+p-xylene	8/1/2012	7/31/2013	Certified
EPA 8260C	Methacrylonitrile	8/1/2012	7/31/2013	Certified
EPA 8260C	Methyl bromide (Bromomethane)	8/1/2012	7/31/2013	Certified
EPA 8260C	Methyl chloride (Chloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260C	Methyl methacrylate	8/1/2012	7/31/2013	Certified
EPA 8260C	Methyl tert-butyl ether (MTBE)	8/1/2012	7/31/2013	Certified
EPA 8260C	Methylene chloride (Dichloromethane)	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00922*** **Attachment to Certificate Number:** **NV009222013-1** **Expiration Date:** **7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260C	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 8260C	n-Butylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	n-Propylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	o-Xylene	8/1/2012	7/31/2013	Certified
EPA 8260C	Propionitrile (Ethyl cyanide)	8/1/2012	7/31/2013	Certified
EPA 8260C	sec-Butylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Styrene	8/1/2012	7/31/2013	Certified
EPA 8260C	T-amylmethylether (TAME)	8/1/2012	7/31/2013	Certified
EPA 8260C	tert-Butyl alcohol (TBA)	8/1/2012	7/31/2013	Certified
EPA 8260C	tert-Butylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Tetrachloroethylene (Perchloroethylene)	8/1/2012	7/31/2013	Certified
EPA 8260C	Toluene	8/1/2012	7/31/2013	Certified
EPA 8260C	trans-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260C	trans-1,3-Dichloropropene (trans-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 8260C	trans-1,4-Dichloro-2-butene	8/1/2012	7/31/2013	Certified
EPA 8260C	Trichloroethene (Trichloroethylene)	8/1/2012	7/31/2013	Certified
EPA 8260C	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	8/1/2012	7/31/2013	Certified
EPA 8260C	Vinyl acetate	8/1/2012	7/31/2013	Certified
EPA 8260C	Vinyl chloride	8/1/2012	7/31/2013	Certified
EPA 8260C	Xylene (total)	8/1/2012	7/31/2013	Certified
EPA 8270C	1,1'-Biphenyl (BZ-0)	8/1/2012	7/31/2013	Certified
EPA 8270C	1,2,4,5-Tetrachlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270C	1,2,4-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270C	1,2-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270C	1,2-Diphenylhydrazine	8/1/2012	7/31/2013	Certified
EPA 8270C	1,3-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270C	1,4-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270C	2,3,4,6-Tetrachlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2,4,5-Trichlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2,4,6-Trichlorophenol	8/1/2012	7/31/2013	Certified

EPA Number: ***NV00922*** **Attachment to Certificate Number:** **NV009222013-1** **Expiration Date:** **7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270C	2,4-Dichlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2,4-Dimethylphenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2,4-Dinitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2,4-Dinitrotoluene (2,4-DNT)	8/1/2012	7/31/2013	Certified
EPA 8270C	2,6-Dinitrotoluene (2,6-DNT)	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Chloronaphthalene	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Chlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Methylnaphthalene	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Methylphenol (o-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Nitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	3 & 4-Methylphenol (m & p-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270C	3,3'-Dichlorobenzidine	8/1/2012	7/31/2013	Certified
EPA 8270C	3-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Bromophenyl phenyl ether	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Chloro-3-methylphenol	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Chloroaniline	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Chlorophenyl phenylether	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Methylphenol (p-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Nitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	Acenaphthene	8/1/2012	7/31/2013	Certified
EPA 8270C	Acenaphthylene	8/1/2012	7/31/2013	Certified
EPA 8270C	Acetophenone	8/1/2012	7/31/2013	Certified
EPA 8270C	Aniline	8/1/2012	7/31/2013	Certified
EPA 8270C	Anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C	Atrazine	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzaldehyde	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzidine	8/1/2012	7/31/2013	Certified

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270C	Benzo(a)anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzo(a)pyrene	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzo(b)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzo(g,h,i)perylene	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzo(k)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzoic acid	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzyl alcohol	8/1/2012	7/31/2013	Certified
EPA 8270C	bis(2-Chloroethoxy)methane	8/1/2012	7/31/2013	Certified
EPA 8270C	bis(2-Chloroethyl) ether	8/1/2012	7/31/2013	Certified
EPA 8270C	bis(2-Chloroisopropyl) ether	8/1/2012	7/31/2013	Certified
EPA 8270C	bis(2-Ethylhexyl)phthalate,(DEHP, Di(2-ethylhexyl) phthalate)	8/1/2012	7/31/2013	Certified
EPA 8270C	Butyl benzyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270C	Caprolactam	8/1/2012	7/31/2013	Certified
EPA 8270C	Carbazole	8/1/2012	7/31/2013	Certified
EPA 8270C	Chrysene	8/1/2012	7/31/2013	Certified
EPA 8270C	Dibenz(a,h) anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C	Dibenzofuran	8/1/2012	7/31/2013	Certified
EPA 8270C	Diethyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270C	Dimethyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270C	Di-n-butyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270C	Di-n-octyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270C	Fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C	Fluorene	8/1/2012	7/31/2013	Certified
EPA 8270C	Hexachlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270C	Hexachlorobutadiene	8/1/2012	7/31/2013	Certified
EPA 8270C	Hexachlorocyclopentadiene	8/1/2012	7/31/2013	Certified
EPA 8270C	Hexachloroethane	8/1/2012	7/31/2013	Certified
EPA 8270C	Indeno(1,2,3-cd) pyrene	8/1/2012	7/31/2013	Certified
EPA 8270C	Isophorone	8/1/2012	7/31/2013	Certified
EPA 8270C	Naphthalene	8/1/2012	7/31/2013	Certified

EPA Number: ***NV00922*** **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270C	Nitrobenzene	8/1/2012	7/31/2013	Certified
EPA 8270C	n-Nitrosodimethylamine	8/1/2012	7/31/2013	Certified
EPA 8270C	n-Nitrosodi-n-propylamine	8/1/2012	7/31/2013	Certified
EPA 8270C	n-Nitrosodiphenylamine	8/1/2012	7/31/2013	Certified
EPA 8270C	Pentachlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	Phenanthrene	8/1/2012	7/31/2013	Certified
EPA 8270C	Phenol	8/1/2012	7/31/2013	Certified
EPA 8270C	Pyrene	8/1/2012	7/31/2013	Certified
EPA 8270C	Pyridine	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Acenaphthene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Acenaphthylene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Benzo(a)anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Benzo(a)pyrene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Benzo(b)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Benzo(g,h,i)perylene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Benzo(k)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Chrysene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Dibenz(a,h) anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Fluorene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Indeno(1,2,3-cd) pyrene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Phenanthrene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Pyrene	8/1/2012	7/31/2013	Certified
EPA 8270D	1,1'-Biphenyl (BZ-0)	8/1/2012	7/31/2013	Certified
EPA 8270D	1,2,4,5-Tetrachlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	1,2,4-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	1,2-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	1,2-Diphenylhydrazine	8/1/2012	7/31/2013	Certified

EPA Number: ***NV00922*** **Attachment to Certificate Number:** **NV009222013-1** **Expiration Date:** **7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270D	1,3-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	1,4-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	2,3,4,6-Tetrachlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2,4,5-Trichlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2,4,6-Trichlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2,4-Dichlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2,4-Dimethylphenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2,4-Dinitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2,4-Dinitrotoluene (2,4-DNT)	8/1/2012	7/31/2013	Certified
EPA 8270D	2,6-Dinitrotoluene (2,6-DNT)	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Chloronaphthalene	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Chlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Methylnaphthalene	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Methylphenol (o-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Nitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	3 & 4-Methylphenol (m & p-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270D	3,3'-Dichlorobenzidine	8/1/2012	7/31/2013	Certified
EPA 8270D	3-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Bromophenyl phenyl ether	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Chloro-3-methylphenol	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Chloroaniline	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Chlorophenyl phenylether	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Methylphenol (p-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Nitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	Acenaphthene	8/1/2012	7/31/2013	Certified
EPA 8270D	Acenaphthylene	8/1/2012	7/31/2013	Certified
EPA 8270D	Acetophenone	8/1/2012	7/31/2013	Certified

EPA Number: ***NV00922*** **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270D	Aniline	8/1/2012	7/31/2013	Certified
EPA 8270D	Anthracene	8/1/2012	7/31/2013	Certified
EPA 8270D	Atrazine	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzaldehyde	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzidine	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzo(a)anthracene	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzo(a)pyrene	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzo(b)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzo(g,h,i)perylene	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzo(k)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzoic acid	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzyl alcohol	8/1/2012	7/31/2013	Certified
EPA 8270D	bis(2-Chloroethoxy)methane	8/1/2012	7/31/2013	Certified
EPA 8270D	bis(2-Chloroethyl) ether	8/1/2012	7/31/2013	Certified
EPA 8270D	bis(2-Chloroisopropyl) ether	8/1/2012	7/31/2013	Certified
EPA 8270D	bis(2-Ethylhexyl)phthalate,(DEHP, Di(2-ethylhexyl) phthalate)	8/1/2012	7/31/2013	Certified
EPA 8270D	Butyl benzyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270D	Caprolactam	8/1/2012	7/31/2013	Certified
EPA 8270D	Carbazole	8/1/2012	7/31/2013	Certified
EPA 8270D	Chrysene	8/1/2012	7/31/2013	Certified
EPA 8270D	Dibenz(a,h) anthracene	8/1/2012	7/31/2013	Certified
EPA 8270D	Dibenzofuran	8/1/2012	7/31/2013	Certified
EPA 8270D	Diethyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270D	Dimethyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270D	Di-n-butyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270D	Di-n-octyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270D	Fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270D	Fluorene	8/1/2012	7/31/2013	Certified
EPA 8270D	Hexachlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	Hexachlorobutadiene	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00922*** **Attachment to Certificate Number:** **NV009222013-1** **Expiration Date:** **7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270D	Hexachlorocyclopentadiene	8/1/2012	7/31/2013	Certified
EPA 8270D	Hexachloroethane	8/1/2012	7/31/2013	Certified
EPA 8270D	Indeno(1,2,3-cd) pyrene	8/1/2012	7/31/2013	Certified
EPA 8270D	Isophorone	8/1/2012	7/31/2013	Certified
EPA 8270D	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 8270D	Nitrobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	n-Nitrosodimethylamine	8/1/2012	7/31/2013	Certified
EPA 8270D	n-Nitrosodi-n-propylamine	8/1/2012	7/31/2013	Certified
EPA 8270D	n-Nitrosodiphenylamine	8/1/2012	7/31/2013	Certified
EPA 8270D	Pentachlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	Phenanthrene	8/1/2012	7/31/2013	Certified
EPA 8270D	Phenol	8/1/2012	7/31/2013	Certified
EPA 8270D	Pyrene	8/1/2012	7/31/2013	Certified
EPA 8270D	Pyridine	8/1/2012	7/31/2013	Certified
EPA 9040B	pH	8/1/2012	7/31/2013	Certified
EPA 9040C	Corrosivity	8/1/2012	7/31/2013	Certified
EPA 9040C	pH	8/1/2012	7/31/2013	Certified
EPA 9050A	Conductivity	8/1/2012	7/31/2013	Certified
EPA 9060A	Total organic carbon	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
Discipline Chemistry				
EPA 1020A	Ignitability	8/1/2012	7/31/2013	Certified
EPA 1311-Metals	TCLP extracted Metals	8/1/2012	7/31/2013	Certified
EPA 1311-Pest	TCLP extracted Pesticides	8/1/2012	7/31/2013	Certified
EPA 1311-SOCs	TCLP extracted SOCs	8/1/2012	7/31/2013	Certified
EPA 1311-VOCs	TCLP extracted VOCs	8/1/2012	7/31/2013	Certified
EPA 1312-Metals	SPLP extracted Metals	8/1/2012	7/31/2013	Certified
EPA 1312-SOCs	SPLP extracted SOCs	8/1/2012	7/31/2013	Certified
EPA 1312-VOCs	SPLP extracted VOCs	8/1/2012	7/31/2013	Certified
EPA 6010B	Aluminum	8/1/2012	7/31/2013	Certified
EPA 6010B	Antimony	8/1/2012	7/31/2013	Certified
EPA 6010B	Arsenic	8/1/2012	7/31/2013	Certified
EPA 6010B	Barium	8/1/2012	7/31/2013	Certified
EPA 6010B	Beryllium	8/1/2012	7/31/2013	Certified
EPA 6010B	Boron	8/1/2012	7/31/2013	Certified
EPA 6010B	Cadmium	8/1/2012	7/31/2013	Certified
EPA 6010B	Calcium	8/1/2012	7/31/2013	Certified
EPA 6010B	Chromium	8/1/2012	7/31/2013	Certified
EPA 6010B	Cobalt	8/1/2012	7/31/2013	Certified
EPA 6010B	Copper	8/1/2012	7/31/2013	Certified
EPA 6010B	Iron	8/1/2012	7/31/2013	Certified
EPA 6010B	Lead	8/1/2012	7/31/2013	Certified
EPA 6010B	Magnesium	8/1/2012	7/31/2013	Certified
EPA 6010B	Manganese	8/1/2012	7/31/2013	Certified
EPA 6010B	Molybdenum	8/1/2012	7/31/2013	Certified
EPA 6010B	Nickel	8/1/2012	7/31/2013	Certified
EPA 6010B	Potassium	8/1/2012	7/31/2013	Certified
EPA 6010B	Selenium	8/1/2012	7/31/2013	Certified
EPA 6010B	Silver	8/1/2012	7/31/2013	Certified
EPA 6010B	Sodium	8/1/2012	7/31/2013	Certified

EPA Number: ***NV00922*** **Attachment to Certificate Number:** **NV009222013-1** **Expiration Date:** **7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 6010B	Strontium	8/1/2012	7/31/2013	Certified
EPA 6010B	Thallium	8/1/2012	7/31/2013	Certified
EPA 6010B	Tin	8/1/2012	7/31/2013	Certified
EPA 6010B	Titanium	8/1/2012	7/31/2013	Certified
EPA 6010B	Vanadium	8/1/2012	7/31/2013	Certified
EPA 6010B	Zinc	8/1/2012	7/31/2013	Certified
EPA 6010C	Aluminum	8/1/2012	7/31/2013	Certified
EPA 6010C	Antimony	8/1/2012	7/31/2013	Certified
EPA 6010C	Arsenic	8/1/2012	7/31/2013	Certified
EPA 6010C	Barium	8/1/2012	7/31/2013	Certified
EPA 6010C	Beryllium	8/1/2012	7/31/2013	Certified
EPA 6010C	Boron	8/1/2012	7/31/2013	Certified
EPA 6010C	Cadmium	8/1/2012	7/31/2013	Certified
EPA 6010C	Calcium	8/1/2012	7/31/2013	Certified
EPA 6010C	Chromium	8/1/2012	7/31/2013	Certified
EPA 6010C	Cobalt	8/1/2012	7/31/2013	Certified
EPA 6010C	Copper	8/1/2012	7/31/2013	Certified
EPA 6010C	Iron	8/1/2012	7/31/2013	Certified
EPA 6010C	Lead	8/1/2012	7/31/2013	Certified
EPA 6010C	Magnesium	8/1/2012	7/31/2013	Certified
EPA 6010C	Manganese	8/1/2012	7/31/2013	Certified
EPA 6010C	Molybdenum	8/1/2012	7/31/2013	Certified
EPA 6010C	Nickel	8/1/2012	7/31/2013	Certified
EPA 6010C	Potassium	8/1/2012	7/31/2013	Certified
EPA 6010C	Selenium	8/1/2012	7/31/2013	Certified
EPA 6010C	Silver	8/1/2012	7/31/2013	Certified
EPA 6010C	Sodium	8/1/2012	7/31/2013	Certified
EPA 6010C	Strontium	8/1/2012	7/31/2013	Certified
EPA 6010C	Thallium	8/1/2012	7/31/2013	Certified
EPA 6010C	Tin	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00922*** **Attachment to Certificate Number:** **NV009222013-1** **Expiration Date:** **7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 6010C	Titanium	8/1/2012	7/31/2013	Certified
EPA 6010C	Vanadium	8/1/2012	7/31/2013	Certified
EPA 6010C	Zinc	8/1/2012	7/31/2013	Certified
EPA 6020	Aluminum	8/1/2012	7/31/2013	Certified
EPA 6020	Antimony	8/1/2012	7/31/2013	Certified
EPA 6020	Arsenic	8/1/2012	7/31/2013	Certified
EPA 6020	Barium	8/1/2012	7/31/2013	Certified
EPA 6020	Beryllium	8/1/2012	7/31/2013	Certified
EPA 6020	Boron	8/1/2012	7/31/2013	Certified
EPA 6020	Cadmium	8/1/2012	7/31/2013	Certified
EPA 6020	Calcium	8/1/2012	7/31/2013	Certified
EPA 6020	Chromium	8/1/2012	7/31/2013	Certified
EPA 6020	Cobalt	8/1/2012	7/31/2013	Certified
EPA 6020	Copper	8/1/2012	7/31/2013	Certified
EPA 6020	Iron	8/1/2012	7/31/2013	Certified
EPA 6020	Lead	8/1/2012	7/31/2013	Certified
EPA 6020	Magnesium	8/1/2012	7/31/2013	Certified
EPA 6020	Manganese	8/1/2012	7/31/2013	Certified
EPA 6020	Molybdenum	8/1/2012	7/31/2013	Certified
EPA 6020	Nickel	8/1/2012	7/31/2013	Certified
EPA 6020	Potassium	8/1/2012	7/31/2013	Certified
EPA 6020	Selenium	8/1/2012	7/31/2013	Certified
EPA 6020	Silver	8/1/2012	7/31/2013	Certified
EPA 6020	Sodium	8/1/2012	7/31/2013	Certified
EPA 6020	Strontium	8/1/2012	7/31/2013	Certified
EPA 6020	Thallium	8/1/2012	7/31/2013	Certified
EPA 6020	Tin	8/1/2012	7/31/2013	Certified
EPA 6020	Titanium	8/1/2012	7/31/2013	Certified
EPA 6020	Vanadium	8/1/2012	7/31/2013	Certified
EPA 6020	Zinc	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 6020A	Aluminum	8/1/2012	7/31/2013	Certified
EPA 6020A	Antimony	8/1/2012	7/31/2013	Certified
EPA 6020A	Arsenic	8/1/2012	7/31/2013	Certified
EPA 6020A	Barium	8/1/2012	7/31/2013	Certified
EPA 6020A	Beryllium	8/1/2012	7/31/2013	Certified
EPA 6020A	Boron	8/1/2012	7/31/2013	Certified
EPA 6020A	Cadmium	8/1/2012	7/31/2013	Certified
EPA 6020A	Calcium	8/1/2012	7/31/2013	Certified
EPA 6020A	Chromium	8/1/2012	7/31/2013	Certified
EPA 6020A	Cobalt	8/1/2012	7/31/2013	Certified
EPA 6020A	Copper	8/1/2012	7/31/2013	Certified
EPA 6020A	Iron	8/1/2012	7/31/2013	Certified
EPA 6020A	Lead	8/1/2012	7/31/2013	Certified
EPA 6020A	Magnesium	8/1/2012	7/31/2013	Certified
EPA 6020A	Manganese	8/1/2012	7/31/2013	Certified
EPA 6020A	Molybdenum	8/1/2012	7/31/2013	Certified
EPA 6020A	Nickel	8/1/2012	7/31/2013	Certified
EPA 6020A	Potassium	8/1/2012	7/31/2013	Certified
EPA 6020A	Selenium	8/1/2012	7/31/2013	Certified
EPA 6020A	Silver	8/1/2012	7/31/2013	Certified
EPA 6020A	Sodium	8/1/2012	7/31/2013	Certified
EPA 6020A	Strontium	8/1/2012	7/31/2013	Certified
EPA 6020A	Thallium	8/1/2012	7/31/2013	Certified
EPA 6020A	Tin	8/1/2012	7/31/2013	Certified
EPA 6020A	Titanium	8/1/2012	7/31/2013	Certified
EPA 6020A	Vanadium	8/1/2012	7/31/2013	Certified
EPA 6020A	Zinc	8/1/2012	7/31/2013	Certified
EPA 7196A	Chromium VI	8/1/2012	7/31/2013	Certified
EPA 7199	Chromium VI	8/1/2012	7/31/2013	Certified
EPA 7471A	Mercury	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 7471B [1/98]	Mercury	8/1/2012	7/31/2013	Certified
EPA 8015B	Diesel range organics (DRO)	8/1/2012	7/31/2013	Certified
EPA 8015B	Gasoline range organics (GRO)	8/1/2012	7/31/2013	Certified
EPA 8015B	Residual Range Organics (RRO) - Oil Range Organics	8/1/2012	7/31/2013	Certified
EPA 8015C	Gasoline range organics (GRO)	8/1/2012	7/31/2013	Certified
EPA 8015C	Residual Range Organics (RRO) - Oil Range Organics	8/1/2012	7/31/2013	Certified
EPA 8015M	Gasoline range organics (GRO)	8/1/2012	7/31/2013	Certified
EPA 8081A	4,4'-DDD	8/1/2012	7/31/2013	Certified
EPA 8081A	4,4'-DDE	8/1/2012	7/31/2013	Certified
EPA 8081A	4,4'-DDT	8/1/2012	7/31/2013	Certified
EPA 8081A	Aldrin	8/1/2012	7/31/2013	Certified
EPA 8081A	alpha-BHC (alpha-Hexachlorocyclohexane)	8/1/2012	7/31/2013	Certified
EPA 8081A	alpha-Chlordane	8/1/2012	7/31/2013	Certified
EPA 8081A	beta-BHC (beta-Hexachlorocyclohexane)	8/1/2012	7/31/2013	Certified
EPA 8081A	Chlordane (tech.)	8/1/2012	7/31/2013	Certified
EPA 8081A	Chlordane, total	8/1/2012	7/31/2013	Certified
EPA 8081A	delta-BHC	8/1/2012	7/31/2013	Certified
EPA 8081A	Dieldrin	8/1/2012	7/31/2013	Certified
EPA 8081A	Endosulfan I	8/1/2012	7/31/2013	Certified
EPA 8081A	Endosulfan II	8/1/2012	7/31/2013	Certified
EPA 8081A	Endosulfan sulfate	8/1/2012	7/31/2013	Certified
EPA 8081A	Endrin	8/1/2012	7/31/2013	Certified
EPA 8081A	Endrin aldehyde	8/1/2012	7/31/2013	Certified
EPA 8081A	Endrin ketone	8/1/2012	7/31/2013	Certified
EPA 8081A	gamma-BHC (Lindane)	8/1/2012	7/31/2013	Certified
EPA 8081A	gamma-Chlordane	8/1/2012	7/31/2013	Certified
EPA 8081A	Heptachlor	8/1/2012	7/31/2013	Certified
EPA 8081A	Heptachlor epoxide	8/1/2012	7/31/2013	Certified
EPA 8081A	Methoxychlor	8/1/2012	7/31/2013	Certified
EPA 8081A	Toxaphene (Chlorinated camphene)	8/1/2012	7/31/2013	Certified

EPA Number: ***NV00922*** **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8082	Aroclor-1016 (PCB-1016)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1016 in Oil (PCB-1016 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1221 (PCB-1221)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1221 in Oil (PCB-1221 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1232 (PCB-1232)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1232 in Oil (PCB-1232 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1242 (PCB-1242)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1242 in Oil (PCB-1242 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1248 (PCB-1248)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1248 in Oil (PCB-1248 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1254 (PCB-1254)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1254 in Oil (PCB-1254 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1260 (PCB-1260)	8/1/2012	7/31/2013	Certified
EPA 8082	Aroclor-1260 in Oil (PCB-1260 in Oil)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1016 (PCB-1016)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1221 (PCB-1221)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1232 (PCB-1232)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1242 (PCB-1242)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1248 (PCB-1248)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1254 (PCB-1254)	8/1/2012	7/31/2013	Certified
EPA 8082A	Aroclor-1260 (PCB-1260)	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,1,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,1-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,2,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,2-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1-Dichloropropene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2,3-Trichlorobenzene	8/1/2012	7/31/2013	Certified

EPA Number: ***NV00922*** **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260B	1,2,3-Trichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2,4-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2,4-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dibromoethane (EDB, Ethylene dibromide)	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,3,5-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,3-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,3-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,4-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	2,2-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260B	2-Butanone (Methyl ethyl ketone, MEK)	8/1/2012	7/31/2013	Certified
EPA 8260B	2-Chloroethyl vinyl ether	8/1/2012	7/31/2013	Certified
EPA 8260B	2-Chlorotoluene	8/1/2012	7/31/2013	Certified
EPA 8260B	2-Hexanone	8/1/2012	7/31/2013	Certified
EPA 8260B	4-Chlorotoluene	8/1/2012	7/31/2013	Certified
EPA 8260B	4-Isopropyltoluene (p-Cymene)	8/1/2012	7/31/2013	Certified
EPA 8260B	4-Methyl-2-pentanone (MIBK)	8/1/2012	7/31/2013	Certified
EPA 8260B	Acetone	8/1/2012	7/31/2013	Certified
EPA 8260B	Acrolein (Propenal)	8/1/2012	7/31/2013	Certified
EPA 8260B	Acrylonitrile	8/1/2012	7/31/2013	Certified
EPA 8260B	Benzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Bromobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Bromochloromethane	8/1/2012	7/31/2013	Certified
EPA 8260B	Bromodichloromethane	8/1/2012	7/31/2013	Certified
EPA 8260B	Bromoform	8/1/2012	7/31/2013	Certified
EPA 8260B	Carbon disulfide	8/1/2012	7/31/2013	Certified
EPA 8260B	Carbon tetrachloride	8/1/2012	7/31/2013	Certified

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260B	Chlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Chlorodibromomethane (Dibromochloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Chloroethane (Ethyl chloride)	8/1/2012	7/31/2013	Certified
EPA 8260B	Chloroform	8/1/2012	7/31/2013	Certified
EPA 8260B	cis & trans-1,2-Dichloroethene	8/1/2012	7/31/2013	Certified
EPA 8260B	cis-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260B	cis-1,3-Dichloropropene (cis-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	Dibromomethane (Methylene bromide)	8/1/2012	7/31/2013	Certified
EPA 8260B	Dichlorodifluoromethane (Freon-12)	8/1/2012	7/31/2013	Certified
EPA 8260B	Di-isopropylether (DIPE)	8/1/2012	7/31/2013	Certified
EPA 8260B	Ethyl acetate	8/1/2012	7/31/2013	Certified
EPA 8260B	Ethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Hexachlorobutadiene	8/1/2012	7/31/2013	Certified
EPA 8260B	Iodomethane (Methyl iodide)	8/1/2012	7/31/2013	Certified
EPA 8260B	Isopropylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	m+p-xylene	8/1/2012	7/31/2013	Certified
EPA 8260B	Methyl bromide (Bromomethane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Methyl chloride (Chloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Methyl tert-butyl ether (MTBE)	8/1/2012	7/31/2013	Certified
EPA 8260B	Methylene chloride (Dichloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 8260B	n-Butylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	n-Propylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	o-Xylene	8/1/2012	7/31/2013	Certified
EPA 8260B	sec-Butylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Styrene	8/1/2012	7/31/2013	Certified
EPA 8260B	T-amylmethylether (TAME)	8/1/2012	7/31/2013	Certified
EPA 8260B	tert-Butyl alcohol (TBA)	8/1/2012	7/31/2013	Certified
EPA 8260B	tert-Butylbenzene	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00922*** **Attachment to Certificate Number:** **NV009222013-1** **Expiration Date:** **7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260B	Tetrachloroethylene (Perchloroethylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	Toluene	8/1/2012	7/31/2013	Certified
EPA 8260B	trans-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260B	trans-1,3-Dichloropropene (trans-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	Trichloroethene (Trichloroethylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	8/1/2012	7/31/2013	Certified
EPA 8260B	Vinyl acetate	8/1/2012	7/31/2013	Certified
EPA 8260B	Vinyl chloride	8/1/2012	7/31/2013	Certified
EPA 8260B	Xylene (total)	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1,1,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1,1-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1,2,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1,2-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,1-Dichloropropene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2,3-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2,3-Trichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2,4-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2,4-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2-Dibromoethane (EDB, Ethylene dibromide)	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,2-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,3,5-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,3-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	1,3-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260C	1,4-Dichlorobenzene	8/1/2012	7/31/2013	Certified

EPA Number: ***NV00922*** **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260C	2,2-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260C	2-Butanone (Methyl ethyl ketone, MEK)	8/1/2012	7/31/2013	Certified
EPA 8260C	2-Chloroethyl vinyl ether	8/1/2012	7/31/2013	Certified
EPA 8260C	2-Chlorotoluene	8/1/2012	7/31/2013	Certified
EPA 8260C	4-Chlorotoluene	8/1/2012	7/31/2013	Certified
EPA 8260C	4-Isopropyltoluene (p-Cymene)	8/1/2012	7/31/2013	Certified
EPA 8260C	4-Methyl-2-pentanone (MIBK)	8/1/2012	7/31/2013	Certified
EPA 8260C	Acetone	8/1/2012	7/31/2013	Certified
EPA 8260C	Acrolein (Propenal)	8/1/2012	7/31/2013	Certified
EPA 8260C	Acrylonitrile	8/1/2012	7/31/2013	Certified
EPA 8260C	Benzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Bromobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Bromochloromethane	8/1/2012	7/31/2013	Certified
EPA 8260C	Bromodichloromethane	8/1/2012	7/31/2013	Certified
EPA 8260C	Bromoform	8/1/2012	7/31/2013	Certified
EPA 8260C	Carbon disulfide	8/1/2012	7/31/2013	Certified
EPA 8260C	Carbon tetrachloride	8/1/2012	7/31/2013	Certified
EPA 8260C	Chlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Chlorodibromomethane (Dibromochloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260C	Chloroethane (Ethyl chloride)	8/1/2012	7/31/2013	Certified
EPA 8260C	Chloroform	8/1/2012	7/31/2013	Certified
EPA 8260C	cis & trans-1,2-Dichloroethene	8/1/2012	7/31/2013	Certified
EPA 8260C	cis-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260C	cis-1,3-Dichloropropene (cis-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 8260C	Dibromomethane (Methylene bromide)	8/1/2012	7/31/2013	Certified
EPA 8260C	Dichlorodifluoromethane (Freon-12)	8/1/2012	7/31/2013	Certified
EPA 8260C	Di-isopropylether (DIPE)	8/1/2012	7/31/2013	Certified
EPA 8260C	Ethyl acetate	8/1/2012	7/31/2013	Certified
EPA 8260C	Ethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260C	Hexachlorobutadiene	8/1/2012	7/31/2013	Certified
EPA 8260C	Iodomethane (Methyl iodide)	8/1/2012	7/31/2013	Certified
EPA 8260C	Isopropylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	m+p-xylene	8/1/2012	7/31/2013	Certified
EPA 8260C	Methyl bromide (Bromomethane)	8/1/2012	7/31/2013	Certified
EPA 8260C	Methyl chloride (Chloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260C	Methyl tert-butyl ether (MTBE)	8/1/2012	7/31/2013	Certified
EPA 8260C	Methylene chloride (Dichloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260C	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 8260C	n-Butylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	n-Propylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	o-Xylene	8/1/2012	7/31/2013	Certified
EPA 8260C	sec-Butylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Styrene	8/1/2012	7/31/2013	Certified
EPA 8260C	T-amylmethylether (TAME)	8/1/2012	7/31/2013	Certified
EPA 8260C	tert-Butyl alcohol (TBA)	8/1/2012	7/31/2013	Certified
EPA 8260C	tert-Butylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260C	Tetrachloroethylene (Perchloroethylene)	8/1/2012	7/31/2013	Certified
EPA 8260C	Toluene	8/1/2012	7/31/2013	Certified
EPA 8260C	trans-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260C	trans-1,3-Dichloropropene (trans-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 8260C	Trichloroethene (Trichloroethylene)	8/1/2012	7/31/2013	Certified
EPA 8260C	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	8/1/2012	7/31/2013	Certified
EPA 8260C	Vinyl acetate	8/1/2012	7/31/2013	Certified
EPA 8260C	Vinyl chloride	8/1/2012	7/31/2013	Certified
EPA 8260C	Xylene (total)	8/1/2012	7/31/2013	Certified
EPA 8270C	1,2,4-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270C	1,2-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270C	1,3-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270C	1,4-Dichlorobenzene	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00922*** **Attachment to Certificate Number:** **NV009222013-1** **Expiration Date:** **7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270C	2,3,4,6-Tetrachlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2,4,5-Trichlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2,4,6-Trichlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2,4-Dichlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2,4-Dimethylphenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2,4-Dinitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2,4-Dinitrotoluene (2,4-DNT)	8/1/2012	7/31/2013	Certified
EPA 8270C	2,6-Dinitrotoluene (2,6-DNT)	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Chloronaphthalene	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Chlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Methylnaphthalene	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Methylphenol (o-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270C	2-Nitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	3 & 4-Methylphenol (m & p-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270C	3,3'-Dichlorobenzidine	8/1/2012	7/31/2013	Certified
EPA 8270C	3-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Bromophenyl phenyl ether	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Chloro-3-methylphenol	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Chloroaniline	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Chlorophenyl phenylether	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Methylphenol (p-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270C	4-Nitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	Acenaphthene	8/1/2012	7/31/2013	Certified
EPA 8270C	Acenaphthylene	8/1/2012	7/31/2013	Certified
EPA 8270C	Aniline	8/1/2012	7/31/2013	Certified
EPA 8270C	Anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzidine	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270C	Benzo(a)anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzo(a)pyrene	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzo(b)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzo(g,h,i)perylene	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzo(k)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzoic acid	8/1/2012	7/31/2013	Certified
EPA 8270C	Benzyl alcohol	8/1/2012	7/31/2013	Certified
EPA 8270C	bis(2-Chloroethoxy)methane	8/1/2012	7/31/2013	Certified
EPA 8270C	bis(2-Chloroethyl) ether	8/1/2012	7/31/2013	Certified
EPA 8270C	bis(2-Chloroisopropyl) ether	8/1/2012	7/31/2013	Certified
EPA 8270C	bis(2-Ethylhexyl)phthalate,(DEHP, Di(2-ethylhexyl) phthalate)	8/1/2012	7/31/2013	Certified
EPA 8270C	Butyl benzyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270C	Carbazole	8/1/2012	7/31/2013	Certified
EPA 8270C	Chrysene	8/1/2012	7/31/2013	Certified
EPA 8270C	Dibenz(a,h) anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C	Dibenzofuran	8/1/2012	7/31/2013	Certified
EPA 8270C	Diethyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270C	Dimethyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270C	Di-n-butyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270C	Di-n-octyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270C	Fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C	Fluorene	8/1/2012	7/31/2013	Certified
EPA 8270C	Hexachlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270C	Hexachlorobutadiene	8/1/2012	7/31/2013	Certified
EPA 8270C	Hexachlorocyclopentadiene	8/1/2012	7/31/2013	Certified
EPA 8270C	Hexachloroethane	8/1/2012	7/31/2013	Certified
EPA 8270C	Indeno(1,2,3-cd) pyrene	8/1/2012	7/31/2013	Certified
EPA 8270C	Isophorone	8/1/2012	7/31/2013	Certified
EPA 8270C	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 8270C	Nitrobenzene	8/1/2012	7/31/2013	Certified

EPA Number: ***NV00922*** **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270C	n-Nitrosodimethylamine	8/1/2012	7/31/2013	Certified
EPA 8270C	n-Nitrosodi-n-propylamine	8/1/2012	7/31/2013	Certified
EPA 8270C	n-Nitrosodiphenylamine	8/1/2012	7/31/2013	Certified
EPA 8270C	Pentachlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270C	Phenanthrene	8/1/2012	7/31/2013	Certified
EPA 8270C	Phenol	8/1/2012	7/31/2013	Certified
EPA 8270C	Pyrene	8/1/2012	7/31/2013	Certified
EPA 8270C	Pyridine	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Acenaphthene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Acenaphthylene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Benzo(a)anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Benzo(a)pyrene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Benzo(b)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Benzo(g,h,i)perylene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Benzo(k)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Chrysene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Dibenz(a,h) anthracene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Fluorene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Indeno(1,2,3-cd) pyrene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Phenanthrene	8/1/2012	7/31/2013	Certified
EPA 8270C SIM	Pyrene	8/1/2012	7/31/2013	Certified
EPA 8270D	1,2,4-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	1,2-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	1,3-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	1,4-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	2,3,4,6-Tetrachlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2,4,5-Trichlorophenol	8/1/2012	7/31/2013	Certified

EPA Number: ***NV00922*** **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270D	2,4,6-Trichlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2,4-Dichlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2,4-Dimethylphenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2,4-Dinitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2,4-Dinitrotoluene (2,4-DNT)	8/1/2012	7/31/2013	Certified
EPA 8270D	2,6-Dinitrotoluene (2,6-DNT)	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Chloronaphthalene	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Chlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Methylnaphthalene	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Methylphenol (o-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270D	2-Nitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	3 & 4-Methylphenol (m & p-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270D	3,3'-Dichlorobenzidine	8/1/2012	7/31/2013	Certified
EPA 8270D	3-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Bromophenyl phenyl ether	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Chloro-3-methylphenol	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Chloroaniline	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Chlorophenyl phenylether	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Methylphenol (p-Cresol)	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Nitroaniline	8/1/2012	7/31/2013	Certified
EPA 8270D	4-Nitrophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	Acenaphthene	8/1/2012	7/31/2013	Certified
EPA 8270D	Acenaphthylene	8/1/2012	7/31/2013	Certified
EPA 8270D	Aniline	8/1/2012	7/31/2013	Certified
EPA 8270D	Anthracene	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzidine	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzo(a)anthracene	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzo(a)pyrene	8/1/2012	7/31/2013	Certified

EPA Number: ***NV00922*** **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270D	Benzo(b)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzo(g,h,i)perylene	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzo(k)fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzoic acid	8/1/2012	7/31/2013	Certified
EPA 8270D	Benzyl alcohol	8/1/2012	7/31/2013	Certified
EPA 8270D	bis(2-Chloroethoxy)methane	8/1/2012	7/31/2013	Certified
EPA 8270D	bis(2-Chloroethyl) ether	8/1/2012	7/31/2013	Certified
EPA 8270D	bis(2-Chloroisopropyl) ether	8/1/2012	7/31/2013	Certified
EPA 8270D	bis(2-Ethylhexyl)phthalate,(DEHP, Di(2-ethylhexyl) phthalate)	8/1/2012	7/31/2013	Certified
EPA 8270D	Butyl benzyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270D	Carbazole	8/1/2012	7/31/2013	Certified
EPA 8270D	Chrysene	8/1/2012	7/31/2013	Certified
EPA 8270D	Dibenz(a,h) anthracene	8/1/2012	7/31/2013	Certified
EPA 8270D	Dibenzofuran	8/1/2012	7/31/2013	Certified
EPA 8270D	Diethyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270D	Dimethyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270D	Di-n-butyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270D	Di-n-octyl phthalate	8/1/2012	7/31/2013	Certified
EPA 8270D	Fluoranthene	8/1/2012	7/31/2013	Certified
EPA 8270D	Fluorene	8/1/2012	7/31/2013	Certified
EPA 8270D	Hexachlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	Hexachlorobutadiene	8/1/2012	7/31/2013	Certified
EPA 8270D	Hexachlorocyclopentadiene	8/1/2012	7/31/2013	Certified
EPA 8270D	Hexachloroethane	8/1/2012	7/31/2013	Certified
EPA 8270D	Indeno(1,2,3-cd) pyrene	8/1/2012	7/31/2013	Certified
EPA 8270D	Isophorone	8/1/2012	7/31/2013	Certified
EPA 8270D	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 8270D	Nitrobenzene	8/1/2012	7/31/2013	Certified
EPA 8270D	n-Nitrosodimethylamine	8/1/2012	7/31/2013	Certified
EPA 8270D	n-Nitrosodi-n-propylamine	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***RCRA (Solid & Waste Materials)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8270D	n-Nitrosodiphenylamine	8/1/2012	7/31/2013	Certified
EPA 8270D	Pentachlorophenol	8/1/2012	7/31/2013	Certified
EPA 8270D	Phenanthrene	8/1/2012	7/31/2013	Certified
EPA 8270D	Phenol	8/1/2012	7/31/2013	Certified
EPA 8270D	Pyrene	8/1/2012	7/31/2013	Certified
EPA 8270D	Pyridine	8/1/2012	7/31/2013	Certified
EPA 9045C	pH	8/1/2012	7/31/2013	Certified
EPA 9045D	Corrosivity (pH)	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***SDWA (Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
Discipline Chemistry				
EPA 200.7	Aluminum	8/1/2012	7/31/2013	Certified
EPA 200.7	Barium	8/1/2012	7/31/2013	Certified
EPA 200.7	Beryllium	8/1/2012	7/31/2013	Certified
EPA 200.7	Boron	8/1/2012	7/31/2013	Nevada Approved
EPA 200.7	Cadmium	8/1/2012	7/31/2013	Certified
EPA 200.7	Calcium	8/1/2012	7/31/2013	Certified
EPA 200.7	Calcium hardness as CaCO3	8/1/2012	7/31/2013	Certified
EPA 200.7	Chromium	8/1/2012	7/31/2013	Certified
EPA 200.7	Cobalt	8/1/2012	7/31/2013	Nevada Approved
EPA 200.7	Copper	8/1/2012	7/31/2013	Certified
EPA 200.7	Hardness by calculation	8/1/2012	7/31/2013	Certified
EPA 200.7	Iron	8/1/2012	7/31/2013	Certified
EPA 200.7	Magnesium	8/1/2012	7/31/2013	Certified
EPA 200.7	Manganese	8/1/2012	7/31/2013	Certified
EPA 200.7	Molybdenum	8/1/2012	7/31/2013	Nevada Approved
EPA 200.7	Nickel	8/1/2012	7/31/2013	Certified
EPA 200.7	Potassium	8/1/2012	7/31/2013	Nevada Approved
EPA 200.7	Silica as SiO2	8/1/2012	7/31/2013	Certified
EPA 200.7	Silver	8/1/2012	7/31/2013	Certified
EPA 200.7	Sodium	8/1/2012	7/31/2013	Certified
EPA 200.7	Strontium	8/1/2012	7/31/2013	Nevada Approved
EPA 200.7	Tin	8/1/2012	7/31/2013	Nevada Approved
EPA 200.7	Titanium	8/1/2012	7/31/2013	Nevada Approved
EPA 200.7	Total hardness as CaCO3	8/1/2012	7/31/2013	Certified
EPA 200.7	Vanadium	8/1/2012	7/31/2013	Nevada Approved
EPA 200.7	Zinc	8/1/2012	7/31/2013	Certified
EPA 200.8	Aluminum	8/1/2012	7/31/2013	Certified
EPA 200.8	Antimony	8/1/2012	7/31/2013	Certified
EPA 200.8	Arsenic	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***SDWA (Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 200.8	Barium	8/1/2012	7/31/2013	Certified
EPA 200.8	Beryllium	8/1/2012	7/31/2013	Certified
EPA 200.8	Boron	8/1/2012	7/31/2013	Nevada Approved
EPA 200.8	Cadmium	8/1/2012	7/31/2013	Certified
EPA 200.8	Calcium	8/1/2012	7/31/2013	Certified
EPA 200.8	Calcium hardness as CaCO3	8/1/2012	7/31/2013	Certified
EPA 200.8	Chromium	8/1/2012	7/31/2013	Certified
EPA 200.8	Cobalt	8/1/2012	7/31/2013	Nevada Approved
EPA 200.8	Copper	8/1/2012	7/31/2013	Certified
EPA 200.8	Iron	8/1/2012	7/31/2013	Certified
EPA 200.8	Lead	8/1/2012	7/31/2013	Certified
EPA 200.8	Magnesium	8/1/2012	7/31/2013	Certified
EPA 200.8	Manganese	8/1/2012	7/31/2013	Certified
EPA 200.8	Mercury	8/1/2012	7/31/2013	Certified
EPA 200.8	Molybdenum	8/1/2012	7/31/2013	Nevada Approved
EPA 200.8	Nickel	8/1/2012	7/31/2013	Certified
EPA 200.8	Potassium	8/1/2012	7/31/2013	Nevada Approved
EPA 200.8	Selenium	8/1/2012	7/31/2013	Certified
EPA 200.8	Silica as SiO2	8/1/2012	7/31/2013	Certified
EPA 200.8	Silver	8/1/2012	7/31/2013	Certified
EPA 200.8	Sodium	8/1/2012	7/31/2013	Certified
EPA 200.8	Strontium	8/1/2012	7/31/2013	Nevada Approved
EPA 200.8	Thallium	8/1/2012	7/31/2013	Certified
EPA 200.8	Tin	8/1/2012	7/31/2013	Nevada Approved
EPA 200.8	Titanium	8/1/2012	7/31/2013	Nevada Approved
EPA 200.8	Vanadium	8/1/2012	7/31/2013	Nevada Approved
EPA 200.8	Zinc	8/1/2012	7/31/2013	Certified
EPA 218.6	Chromium VI	8/1/2012	7/31/2013	Certified
EPA 245.1	Mercury	8/1/2012	7/31/2013	Certified
EPA 300.0	Bromide	8/1/2012	7/31/2013	Certified

Disclaimer: A laboratory that is certified or approved has established that they have the ability to implement a quality control program in accordance with the appropriate Federal or State regulations or statutes. It is the certified laboratory's responsibility to provide their client the most current certified parameter list. Contact LCP to verify certification status.

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *NV00922* **Attachment to Certificate Number: NV009222013-1** **Expiration Date: 7/31/2013**

Advanced Technology Laboratory, Inc. - Las Vegas
3151-3153 W. Post Rd Las Vegas, NV 89118-

Matrix: ***SDWA (Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 300.0	Chloride	8/1/2012	7/31/2013	Certified
EPA 300.0	Fluoride	8/1/2012	7/31/2013	Certified
EPA 300.0	Nitrate as N	8/1/2012	7/31/2013	Certified
EPA 300.0	Nitrate-nitrite	8/1/2012	7/31/2013	Certified
EPA 300.0	Nitrite as N	8/1/2012	7/31/2013	Certified
EPA 300.0	Orthophosphate as P	8/1/2012	7/31/2013	Certified
EPA 300.0	Sulfate	8/1/2012	7/31/2013	Certified
EPA 314.0	Perchlorate	8/1/2012	7/31/2013	Certified
SM 2130 B [21st]	Turbidity	8/1/2012	7/31/2013	Certified
SM 2320 B [21st]	Alkalinity as CaCO3	8/1/2012	7/31/2013	Certified
SM 2340 B [21st]	Calcium hardness as CaCO3	8/1/2012	7/31/2013	Certified
SM 2340 B [21st]	Hardness by calculation	8/1/2012	7/31/2013	Certified
SM 2510 B [21st]	Conductivity	8/1/2012	7/31/2013	Certified
SM 2540 C [21st]	Residue-filterable (TDS)	8/1/2012	7/31/2013	Certified
SM 2540 D [21st]	Residue-nonfilterable (TSS)	8/1/2012	7/31/2013	Certified
SM 4110 B [21st]	Bromide	8/1/2012	7/31/2013	Certified
SM 4110 B [21st]	Chloride	8/1/2012	7/31/2013	Certified
SM 4110 B [21st]	Fluoride	8/1/2012	7/31/2013	Certified
SM 4110 B [21st]	Nitrate as N	8/1/2012	7/31/2013	Certified
SM 4110 B [21st]	Nitrite as N	8/1/2012	7/31/2013	Certified
SM 4110 B [21st]	Orthophosphate as P	8/1/2012	7/31/2013	Certified
SM 4110 B [21st]	Sulfate	8/1/2012	7/31/2013	Certified
SM 4500-H+ B [21st]	pH	8/1/2012	7/31/2013	Certified
SM 4500-P E [21st]	Orthophosphate as P	8/1/2012	7/31/2013	Certified
SM 5310 C [21st]	Dissolved organic carbon (DOC)	8/1/2012	7/31/2013	Certified
SM 5310 C [21st]	Total organic carbon	8/1/2012	7/31/2013	Certified

California Unified Certification Program

Woman Owned Business (WBE/UDBE)

Advanced Technology Laboratories, Inc.

3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CALIFORNIA UNIFIED CERTIFICATION PROGRAM
DISADVANTAGED BUSINESS ENTERPRISE CERTIFICATE

ADVANCED TECHNOLOGY LABORATORIES INC

3151 W POST ROAD
LAS VEGAS, NV 89118

Owner: PURIFICACION ROMUALDO
Business Structure: CORPORATION

This certificate acknowledges that said firm is approved by the California Unified Certification Program (CUCP) as a Disadvantaged Business Enterprise (DBE) as defined by the U.S. Department of Transportation (DOT) CFR 49 Part 26, as may be amended, for the following NAICS codes:

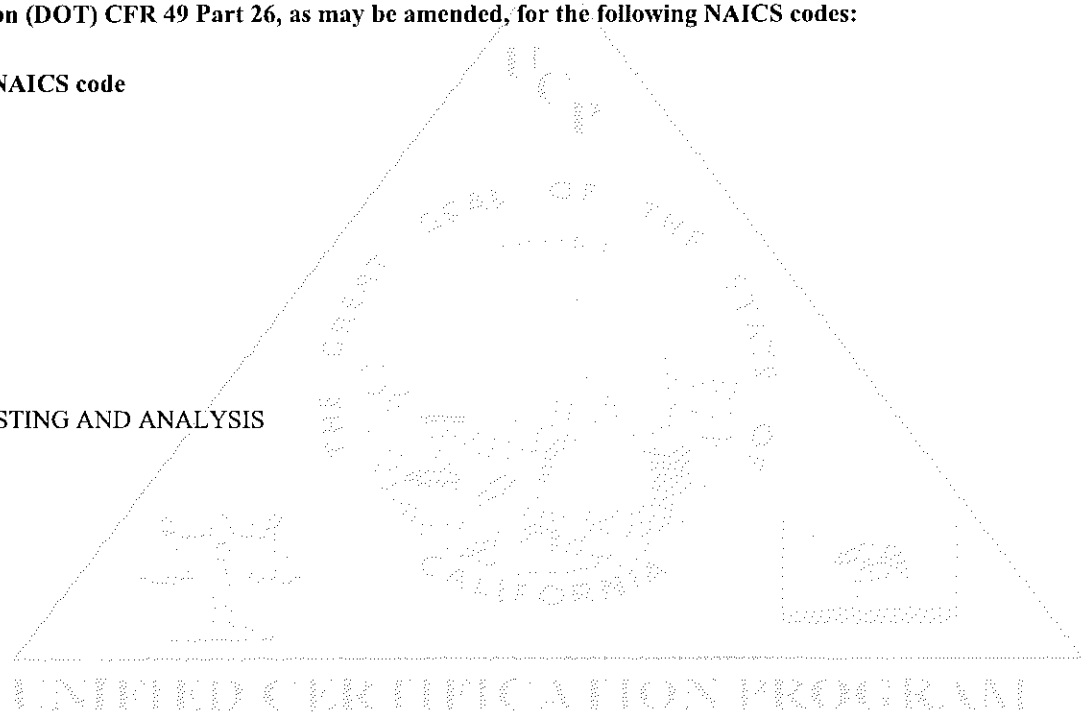
NAICS Code(s) * Indicates primary NAICS code

* 541380 Testing Laboratories

Work Category Code(s)

I8734 LABORATORY TESTING AND ANALYSIS

Licenses



CERTIFYING AGENCY:

DEPARTMENT OF TRANSPORTATION
1823 14TH STREET
SACRAMENTO, CA 95811 0000
(916) 324-1700

UCP Firm Number : 38687

CUCP OFFICER

October 29, 2010

It is CUCP's policy and objective to promote and maintain a level playing field for DBEs in California on Federal-aid contracts. We ensure nondiserimination in the award and administration of U.S. DOT assisted contracts based on the requirements of 49 CFR Parts 21 and 26.

CALIFORNIA UNIFIED CERTIFICATION PROGRAM (CUCP)

DEPARTMENT OF TRANSPORTATION
OFFICE OF BUSINESS AND ECONOMIC OPPORTUNITY
1823 14th STREET
SACRAMENTO, CA 95811
Phone: (916) 324-1700
Toll Free (866) 810-6346
Fax : (916) 324-1862
TTY: 711

October 26, 2010

Ms. Purificacion Romualdo
Advanced Technology Laboratories Inc.
3151 W. Post Road
Las Vegas, NV 89118

File Number: 38687

Dear Ms. Romualdo:

We are pleased to advise you that after careful review of your application and supporting documentation, the California Department of Transportation (Department) has determined that your firm meets the eligibility standards to be certified as a Disadvantaged Business Enterprise (DBE), as required under the U. S. Department of Transportation (U.S. DOT), Code of Federal Regulation (CFR) 49, Part 26, as amended.

The enclosed DBE certification will be honored by all U. S. DOT recipients in California, and your firm will continue to be listed in the California Unified Certification Program (CUCP) database of certified DBEs under the following specific areas of expertise:

NAICS Category Codes	Description
541380	Testing laboratories

Work Category Codes	Description
I8734	Laboratory testing and analysis

Your DBE certification is good for five years from the date of this letter and applies only for the above codes. You may review your firm's information in the CUCP DBE Database, which can be accessed at the California Department of Transportation's website at www.dot.ca.gov/hp/bep/. Any additions and revisions must be submitted to the Department for review and approval. Near the five-year certification period, your entire file will be reviewed in order to ascertain continued DBE certification status. You will be notified of the pending DBE status review and any documentation updates necessary several weeks prior to the renewal due date.

The Regulations also require annual updates during this five-year period. In order to assure continuing DBE status, you must submit annually a No Change Declaration form (which will be sent to you), along with supporting documentation. Based on your annual submission that no change in ownership and control has occurred, or if changes have occurred, they do not affect your firm's DBE standing, the DBE certification of your firm will continue until the five-year certification period.

Also, should any changes occur that could affect your certification status prior to receipt of the DBE Declaration, such as changes in your firm's name, business/mailing address, ownership, management or control, or failure to meet the applicable business size standards or personal net worth standard, please notify me immediately. DBE certification is subject to review at any time. Failure to submit forms and/or change of information will be deemed as failure to cooperate under Section 26.109 of the Regulations.

You should know that all U. S. DOT recipients in California will honor your DBE certification status if your firm is certified by **any** one of the CUCP certifying agencies listed below:

- California Department of Transportation (Caltrans)
- Central Contra Costa Transit Authority (CCCTA)
- City of Fresno
- City of Los Angeles
- Los Angeles County Metropolitan Transportation Authority (METRO)
- San Diego County Regional Airport Authority
- San Francisco Bay Area Rapid Transit District (BART)
- San Francisco International Airport
- San Francisco Municipal Transportation Agency (SFMTA)
- San Mateo County Transit District (Sam Trans)/Peninsula Corridor Joint Powers Board (JPB)
- Santa Clara Valley Transportation Authority (VTA)
- Yolo County Transportation District (Yolobus)

Congratulations, and thank you for your continued interest in participating in DBE Program. I wish you every business success and look forward to hearing from you if I may be of any assistance to you in this regard.

Sincerely,

Janice Salais

JANICE SALAIS
Chief
Certification Unit

California Supplier Clearing House
(WBE/DBE)

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

SUPPLIER CLEARINGHOUSE

CERTIFICATE OF ELIGIBILITY

CERTIFICATE EXPIRATION DATE: 3/29/2013

The Supplier Clearinghouse for the Utility Supplier Diversity Program of the California Public Utilities Commission hereby certifies that it has audited and verified the eligibility of

Advanced Technology Laboratories, Inc. of Las Vegas, NV as a Multi-Status

pursuant to Commission General Order 156, and the terms and conditions stipulated in the Verification Application Package. This Certificate shall be valid only with the Clearinghouse seal affixed hereto.

Eligibility must be maintained at all times, and renewed within 30 days upon any changes of ownership or control. Failure to comply may result in a denial of eligibility. The Clearinghouse may reconsider certification if it is determined that such status was obtained by false, misleading or incorrect information. Decertification may occur if a verification criterion under which eligibility was awarded later becomes invalid due to Commission ruling. The Clearinghouse may request additional information or conduct on-site visits during the term of verification to verify eligibility.

This certification is valid only for the period that the above named firm remains eligible as determined by the Clearinghouse. Utility companies may direct inquiries concerning this Certificate to the Clearinghouse at 800-359-7998 in Los Angeles.

VON: 10BS0055

3/29/2010

Approval Notice for Start Up Company

The Supplier Clearinghouse
Public Utilities Commission - State of California

Monday, March 29, 2010

Puri Romualdo
Advanced Technology Laboratories, Inc.
3151 W. Post Road
Las Vegas, NV 89118

CHS Verification Order Number 10BS0055
Expiration Date 3/29/2013

In accordance with General Order 156, the Supplier Clearinghouse has verified and certified your firm as follows:

Multi-Status

This status enables your firm to be recognized as a women and/or minority-owned business when competing for procurements by public utilities participating in the Utility Supplier Diversity Program.

Certification is valid for three years with the following conditions:

1. You must notify the Clearinghouse of any change in ownership and/or control of your firm within 30 days of the change. Failure to notify the Clearinghouse violates section 8285 of the Public Utilities Code, which is cited in the application.

2. The Clearinghouse may reconsider your certification status:
   a. If it is determined that such status was knowingly obtained by false, misleading or incorrect information.
   b. If, in a formal opinion, the California Public Utilities Commission determines that the WMBE verification criteria under which you were deemed eligible are no longer valid.

3. The Clearinghouse may request additional information or conduct on-site visits at any time during the term of your verification.

If the Clearinghouse has verified you under the Comparable Agency Verification process, your certificate will expire on the same day as that of the comparable agency. Because firms verified by the Clearinghouse are required to submit application forms at least once every three years, we will not certify you for more than three years at a time even if your other agency's certificate is valid for longer than that. After expiration of the Comparable Agency Certificate, you must submit the full Clearinghouse verification application package in order to retain your eligibility.

Please notify us of any change in address so that you will receive renewal notices. We wish you success in your future endeavors.

THE SUPPLIER CLEARINGHOUSE

Nevada State
Dept of Transportation
(DBE/WBE)

Advanced Technology Laboratories, Inc.

3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

NEVADA DOT
775 888-7497

Reno-Tahoe Airport Authority
775 328-6400

LAS VEGAS • McCARRAN • INTERNATIONAL • AIRPORT • CLARK COUNTY • NEVADA •
702 261-3443

Nevada Unified Certification Program

This is to Certify that:

ADVANCED TECHNOLOGY LABORATORIES, INC.

Is registered as a Disadvantaged Business Enterprise in the Nevada Unified Certification Program

Under the Provisions of 49 CFR Part 26

And is Therefore Recognized This 1ST Day of January, 2013

And supersedes any certification or listing previously issued

Certificate No. NV01226UCPN

REGIONAL TRANSPORTATION COMMISSION
RTC
OF SOUTHERN NEVADA
702 676-1500

Carson Area Metropolitan Planning Organization
CAMPO
702 887-2355

RTC
775 348-0400

Litho. in U.S.A.

Small Business Certification
(SBA Administration)

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

01/04/2011 9:32 PM EST

SBA Small Business Types

Note: The information shown below has been validated by the SBA.

If the information you provided represents your firm as a small business, please be aware that, for fraudulent misrepresentation as a small business, 15 U.S. C 645(d) provides for imposition of fines, imprisonment, or both; that your firm be subject to administrative remedies, including suspension and debarment; and that your firm be ineligible for participation in programs conduced under the Small Business Act.

If you do not agree with these results, please review your input for number of employees and annual receipts (please note that the size of your business must include the employees and receipts of all affiliates.) You may also need to review your business type selections. If you consider your entity a small business, it must be one that is organized for profit, with a place of business in the United States, and meets the size standard for its industry. For information about the SBA size standards go to http://www.sba.gov/size/. If you have questions and would like to speak with your firm's closest SBA Area Office Size Specialist go to http://www.sba.gov/size/indexcontacts.html.

DUNS #:	831228627
SBA UserID:	P1151311
SBA Information:	

NAICS	Description	Small Business	Emerging Small Business
541380	Testing Laboratories	Y	N

Note to all Users: This is a Federal Government computer system. Use of this system constitutes consent to monitoring at all times.

For Official Use Only

FIBERQUANT ANALYTICAL SERVICES

Statement of Qualifications

The Corporation

The parent company of Fiberquant, Inc., SEMTEC Laboratories, Inc. was founded in 1977 by Edward F. Holdsworth. Then, as now, SEMTEC Laboratories utilizes electron beam analytical technology to solve a wide variety of chemical and metallurgical problems, including semiconductor materials characterization, failure analysis, metallurgical examinations and micro-analysis. SEMTEC's philosophy is to provide the state-of-the-art in analytical techniques, a philosophy that has continued on in Fiberquant. In 1979, Larry S. Pierce, after consulting for several years with SEMTEC in mineralogical matters, joined the firm after receiving his Ph.D. in geochemistry/mineralogy. In approximately 1980, SEMTEC began receiving requests for asbestos analysis. Since Dr. Pierce was already on staff, the ability to perform bulk sample analysis was easily attained. The first analyses were performed using the scanning electron microscope, but soon after, polarized light microscopy became the standard method. At nearly the same time, the capability of asbestos filter sample analysis using phase contrast microscopy was added. In those days, the control and analysis of asbestos was in its infancy. The OSHA permissible exposure limit for asbestos in air was 2 fibers/cc, and people entered containment wearing 3M dust masks. As the concern over the effects of asbestos grew in Arizona, so did the number of asbestos samples to be analyzed at SEMTEC. With the passage of AHERA legislation, the number of asbestos analyses grew to the point that it was decided to split SEMTEC into two parts: asbestos and non-asbestos. The asbestos analysis arm of SEMTEC became Fiberquant, Inc. in 1988.

In those days, Fiberquant consisted of Larry S. Pierce, period. Reports were fill-in-the-blank forms. But that would soon change. Fiberquant analyzed samples during the heyday of the initial AHERA inspections, when every school was to be inspected. In one month, we received more samples than we could analyze in 3 months and we didn't catch up until the AHERA deadline. Fortunately, we had already hired and trained a second PLM analyst, Stacy Doorn, who eventually worked in the TEM accreditation program at Research Triangle Institute (RTI). During the AHERA rush, JoAnn Lutz joined us as our office manager, and has continued in that capacity ever since. As the demand for asbestos analysis grew, the number of Fiberquant personnel was increased to handle the load. Dr. Pierce became the Lab Director and Quality Assurance Officer instead of the chief analyst. Reports were generated by computer, using a database and word processor. Eventually, a custom-designed laboratory information management system (LIMS) was implemented that electronically stores all sample log, analysis, client, job, *etc.* data collected in the lab.

The state-of-the-art analysis of asbestos in air began to change. Whereas much PCM data had already been gathered, it was becoming clear that PCM results did not always adequately characterize airborne exposures. Transmission electron microscope (TEM) analysis was needed to distinguish airborne asbestos fibers from interference fibers. TEM asbestos analysis requires a person trained in the operation of the instrument and who is also trained in the use of electron diffraction and energy dispersive x-ray spectrometer (EDS). In a stroke of luck or coincidence, Dr. Pierce had already been trained in exactly those areas. He wrote his Ph.D. thesis on transmission electron microscopy of minerals, and had used the EDS extensively during his first 8 years at SEMTEC, thereby instantly making him one of the most qualified experts in TEM analysis in the

country. Because of his background and expertise in the TEM and mineralogy, he has been designated a "Technical Expert" and on-site accreditation assessor for the National Voluntary Laboratory Accreditation Program (NVLAP), and has been visiting labs to investigate their personnel, training, procedures and records since 1989. The graduate program that he attended has produced a prodigious number of the nations TEM asbestos investigators. So it was natural that Fiberquant obtain a TEM. Our first TEM samples were done in late 1988.

After becoming established in asbestos, Fiberquant took over all branches of environmental analysis from SEMTEC. In 1990 we obtained XRF instrumentation with which we conduct on-site lead-based paint surveys then in 1992 we purchased an atomic absorption spectrometer, which is used to analyze such metals as Pb, Cr, Cd, Zn, Cu, Ni, As and Se in samples down to the parts per million (ppm) or sometimes parts per billion (ppb) range. That same year Title X was signed into law leading to a large increase in the demand for on site lead-based paint testing in housing as well as FAA analyses of samples for lead. Most recently, we have seen exponential growth in the Indoor Air Quality field, especially with regards to mold. Fiberquant already employed two degreed biologists in 1998 so the decision was made to provide fungal analyses. Those analysts were then formally trained and soon after were producing data for both culturable and non-cultured samples.

Fiberquant and SEMTEC share a 10,000 square foot facility just three blocks south of Broadway Road near 32nd Street in Phoenix. Fiberquant is just 7 blocks from the Maricopa freeway, and only 10 minutes from Sky Harbor airport, providing ready access from anywhere in the state or nation.

A Commitment to Quality

Fiberquant has always believed that a lab is only as good as its quality assurance (QA) program. While other labs maximize production and minimize quality assurance activities, Fiberquant's consuming pursuit of the most accurate and precise analyses has made quality assurance a major part of our activities. For every analysis type attempted, a comprehensive QA program (including analyst background and training, routine analysis of reference samples, routine calibration and equipment checks, routine re-analysis, analysis of blanks and spikes, the exchange of samples with other labs, and precise record keeping) is established. When national proficiency programs are available for an analysis type, Fiberquant participates. We have been in the NVLAP programs for PLM and TEM analysis from their start-up in 1988, we gained AIHA accreditation for our PCM and industrial hygiene AA programs, and were one of the first labs in the nation to be accredited by AIHA and thereby recognized by the National Lead Laboratory Accreditation Program (NLLAP) for Pb in paint, soil and wipes. Quality assurance is a special interest of Dr. Pierce, since he routinely sees the short-comings of other labs during his on-site NVLAP assessments.

Fiberquant is a high quality lab. We think that our choice to have highly qualified personnel, our choice to have well-maintained equipment, and our choice to have numerous checks and re-checks of data and records is reflected in the accuracy and reliability of our analyses. It is not easy to remain competitive with laboratories who do not share our "quality first" approach to business. We spend more time analyzing your sample than other labs, and so our prices tend to be higher than theirs, but considering the stakes riding on environmental analysis, we feel that we cannot take any other approach.

Fiberquant's commitment to quality extends from the choice of personnel through the development of standard operating procedures through the analysis to the report issued. At no point are compromises made for economy or for the sake of profit that would be detrimental to the accuracy or precision of the analysis. For example, if a bulk asbestos sample is complex and will take an hour to do rather than the usual 15 minutes, so be it. Fiberquant is run by analysts, not accountants.

Personnel

Fiberquant currently employs fifteen employees. We try to provide a challenging, rewarding, yet pleasant, family-like work environment. We prefer to keep the same, highly trained and experienced employees for a long period of time, rather than to pay less and have a constant turnover of less-trained analysts. Amongst Fiberquant analysts, you will find a great number of college degrees including 4 Master's degrees and one PhD. Some people have joked that even our janitor has a degree. We feel that quality analysis requires more than merely task-specific training. To be a scientist, one must be trained extensively in the scientific method - and that takes four years of college. Therefore, all of our analysts have college degrees that are pertinent to their area of analysis. PLM analysts have at least bachelor's degree in a physical science (most of them geology), AA analysts have chemistry degrees, *etc.* Our scientific backgrounds lend a degree of professionalism at Fiberquant not often found at other laboratories.

Services Provided

1) Asbestos

Fiberquant provides a full range of asbestos analytical services, including polarized light microscopy (PLM) with optical dispersion staining for the analysis of bulk samples, gravimetric analysis of bulk samples for more precise quantitation, phase contrast optical microscopy (PCM) for filter samples, scanning electron microscopy (SEM) with energy dispersive x-ray spectrometry (EDS) for confirmation of bulk asbestos identification, and transmission electron microscopy (TEM) with energy dispersive x-ray spectrometry for final clearance filter samples, water samples, sludge samples and bulk confirmation.

2) Environmental Lead

Fiberquant conducts on-site Lead-Based Paint (LBP) surveys on housing using RMD LPA-1 Spectrum Analyzers. Fiberquant also conducts surveys prior to demolition or renovation of LBP using physical samples. Fiberquant provides in-house Flame Atomic Absorption Spectroscopic Analysis (FLAA) to determine the presence of Pb in paint, soil, wipes, MCE and glass fiber filters.

3) Industrial Hygiene

Fiberquant has the capability of analyzing many industrial hygiene analytes on filters, including nuisance dust by gravimetric analysis and Pb, Cr, Cd, Zn, As, Se, Cu, Ni, and many other metals by atomic absorption spectroscopy.

4) Indoor Air Quality

Fiberquant also performs mold spore identification and quantification. In addition to mold genus identification from bulk and tape samples, our McCrone Research Institute-trained analysts can identify and quantify mold types on spore traps and on culture media. In certain cases, both the genus and species can be identified using viable methods.

5) Miscellaneous

Other services provided are: X-ray diffraction analysis of soils and minerals, petrography, custom computer design and programming, TEM of semiconductors.

National Quality Assurance Programs and Accreditations

- NVLAP Lab # 101031-0, accredited for PLM bulk sample analysis and TEM air sample analysis
- AIHA Accreditation # 452, for PCM and metals in air samples, #10873 for environmental lead samples, AND 101593 for fungal samples
- EPA National Performance Audit for lead on filter strips ID # 0794
- Reference Laboratory, New York State ELAP for PLM asbestos, PCM asbestos, TEM asbestos in air and TEM asbestos in water
- NLLAP- recognized for environmental lead in paint, soil and wipe samples

Copies of accreditations are attached.

Company Objectives:

To provide analytical results that can be trusted and understood

To ensure client satisfaction by providing high quality analysis and timely results at reasonable prices

To apply this high level of quality and service to all future analytical services

FIBERQUANT ANALYTICAL SERVICES

Fiberquant Analytical Services 5025 S. 33rd St.; Phoenix, AZ 85040; Phone: 602-276-6139; FAX: 602-276-4558; info@fiberquant.com

Analysis Request/Chain-of-Custody Form

Submitted by (Company)	
Address	
City, State, Zip Code	
Phone	FAX
Email	

Invoice to (Company)	
Address	
City, State, Zip Code	
Phone	FAX

Contact (print)
Sampled by (signature)
Job Number or Project Name
PO Number

<Analysis Method Requested> ONLY ONE METHOD per COC			Turn-around-time (circle one) Rush		Norm	Ext.
Asbestos by **PLM**	Method > Improved Interim		Urgent Rush <3 hrs	<6 hrs	1-3 days	15-30 days
	Analyze > All ATPF					
	If ATPF then > by Layer by Sample					
	Single Layer Protocol > Yes No					
Fibers by **PCM**	Method > 7400 (Area) ORM (Personal)		<4 hrs		24 hrs	-
Asbestos by **TEM**	in Air > AHERA Mod. AHERA		<6 hrs		24 hrs	3-5 days
	in Water* > Water Sludge		1-2 days		3-5 days	N/A
	in Bulk (Annex2) > Chatfield Full Quant.					
	in Dust > ASTM D5755-03		3-5 days		5-10 days	N/A
Pb by FL**AA**	Analyte > Pb Other		<6 hrs		2-3 days	N/A
	Matrix > Filter > MCE FG					
	Paint > by Area (mg/cm²) by Weight (ppm)					
	Soil >					
	Wipe >					
	Initial here certifying wipes used are ASTM E1792 compliant _____					
Fungi	Air Sample > Zefon Aller Other		<6 hrs		1-2 days	N/A
	Bulk > Sample Swab					
	Tape Lift > Qualitative (% & type)					
	Quantitative (type/cm2)					
Soot	ASTM D6602-03b	Optical	<6 hrs		1-2 days	N/A
		Optical & TEM	1-2 days		3-5 days	N/A
Other			**Call**		**Call**	

Sample # (1 per line)	Description/Location	Sample Date	Sample Time	Vol. or Area
1)				
2)				
3)				
4)				
5)				
6)				
7)				
8)				
9)				
10)				
11)				
12)				
13)				
14)				
15)				
16)				
17)				
18)				
19)				
20)				

1)Relinquished by:	Date:	Time:	3)Relinquished by:	Date:	Time:
2)Received by:	Date:	Time:	4)Received by:	Date:	Time:
*** TEM Water: Sampler's name Required by State of Arizona**	Print Name		Fiberquant assigned Job Number>		
Review of Analysis Request (Initials):				Page of	

Note: Data completed by client (including number and identity of samples) is assumed to be correct until it is verified at time of sample preparation.

PARTIAL LIST OF CLIENTS

United States Veteran's Administration
City of Tucson
City of Phoenix
City of Tempe
City of Scottsdale
City of Mesa
City of Glendale
Maricopa County
Mohave County
Phoenix Unified School District
Mesa Unified School District
Florence Unified School District
Fountain Hills Unified School District
Clark County School District
University of Arizona
Northern Arizona University
Luke Air Force Base
Williams Air Force Base
Gila River Housing Authority
Bureau of Indian Affairs
United States Department of Energy, Western Office
United States Army Corps of Engineers
Speedie and Associates
Western Technologies, Inc.
FM Group
Hutzel & Associates
Scott, Allard and Bohannan, Inc.
Certified Health and Safety
IHI-Southwest
AMEC
Project Development Group
Spray Systems
Scottsdale Memorial Hospital
St. Joseph's Hospital
Motorola
US West
Arizona Public Services
Salt River Project
Hilton Financial Corporation
Homeward Bound

Vita

August 8, 2003

Name	Larry S. Pierce	
Education	B.S., chemistry; University of Wisconsin, Madison, WI	1971
	M.S., geochemistry; Arizona State University, Tempe, AZ	1975
	Ph.D., geochemistry; Arizona State University, Tempe, AZ	1979
	NIOSH 582, University of Southern California, Los Angeles, CA	1982
	QC in Asbestos Lab, University of Southern California, Los Angeles, CA	1989
	TEM Asbestos Analysis, ETC/JEOL, Peabody, MA	1988
	Bldg Insp/Mngmnt Planner, Environmental Sciences, Tucson, AZ	1988
	Asbestos Identification, Microlab NW, Seattle, WA	1988
	Certified Industrial Hygienist, chemical principles	1987-
	Lead Inspector, Asbestos Institute, Phoenix, AZ	1994
Areas of Specialization	Mineralogy, high resolution electron microscopy of minerals, geochemistry	
Professional Employment	President/Lab Director/QA Officer Fiberquant Analytical Services, Phoenix, AZ	1988-
	NVLAP On-site Assessor, Air/Bulk Asbestos	1989-
	Vice President/mineralogist/chemist SEMTEC Laboratories, Inc., Phoenix, AZ	1977-1988
	Graduate Research Associate Arizona State University, Tempe, AZ	1973-1977
	Graduate Teaching Assistant Arizona State University, Tempe, AZ	1971-1973
	Assistant Chemist Freeman Chemical Co., Port Washington, WI	1969-1971
Fellowships, Honors, and Professional Organizations	Graduate College Fellowship, Ariz St University, Tempe, AZ	1974-1975
	Phi Lambda Upsilon (chemistry honor society)	1972-
	Mineralogical Society of America	1971-
	Electron Microscopy Society of America	1976-
	American Society for Testing Materials	1988-
	National Asbestos Council/Environmental Information Association	1988-
	American Industrial Hygiene Association	1988-
	AIHA ELLAP committee (chair, 2003)	1999-2003
	AIHA Analytical Accreditation Board	2003-2004
	Environmental Information Association (secretary AZ section 1993-1996; Board Member National 2000-2002)	

Fiberquant Duties: Lab Director, QA Officer, TEM Supervisor, PLM Microscopist, PCM Microscopist, TEM Microscopist, Lead Technician, Lead Assessor, AA Spectroscopist, XRD Operator, Radiation Safety Officer, XRF Technician; Spore Trap Microscopist

SOP and
Quality Assurance Manual

Written by: Larry S. Pierce, QAC

Version: 25 02.28.13

Expires 03-01-2014 Do not use after this date.

File Created: 11/5/09 10:00 AM

Last Revised: 2/22/13 8:28 AM

Printed: 03/05/13

Approved:

Revision History

Revision History:

Edition No.	Issued Date
001	02.11.1987
002	12.12.1988
003	04.20.1990
004	03.06.1991
005	12.04.1991
006	03.04.1993
007	02.22.1994
008	04.07.1995
009	04.12.1996
010	05.16.1997
011	06.30.1998
012	06.30.1999
013	06.29.2000
014	08.08.2001
015	07.22.2002
016	08.01.2003
017	09.01.2004
018	09.01.2005
019	09.15.2006
020	10.04.2007
021	10.17.2008
022	11.17.2009
023	12-03-2010
024	01-01-2012
025	02-15-2013

Table of Contents

1. INTRODUCTION

Printed: 03/05/13

1.1. Background and history of the laboratory

SEM/TEC Laboratories, Inc., was founded in 1977 by Edward F. Holdsworth, who was and still is its president and general manager. The small group of stockholders were from among professors and employees of Arizona State University, where Mr. Holdsworth had run the Electron Microprobe Laboratory for 10 years. In the early years, the main instrumentation was a scanning electron microscope (SEM) with attached energy dispersive spectrometer (EDS). SEM/TEC specialized in non-routine, mostly qualitative, micro-analysis using this instrumentation. Failure analysis, fracture analysis and contamination analysis were the primary services offered.

Larry S. Pierce, a mineralogist with transmission electron microscope (TEM) experience, joined the staff in 1979. In the early 1980's, client/customerclient/customer/customers asked for analysis of bulk asbestos samples. Dr. Pierce was able to comply with the requests, first using the SEM/EDS and later using the polarized light microscope. He also attended a NIOSH 582 course (Sampling and Evaluating Airborne Asbestos Dust) and added the phase contrast microscope (PCM) method of filter analysis to SEM/TEC's capabilities.

As interest in asbestos problems grew in the 1980's, so did the asbestos section of SEM/TEC. In December, 1987, it was decided to make the asbestos analysis section of SEM/TEC a separate company. That company was Fiberquant. Its legal name is Fiberquant, Inc., and its common name is Fiberquant Analytical Services. Thus, in July, 1988, Fiberquant, Inc. took over the asbestos analyzing from SEM/TEC. SEM/TEC still performed all of the non-routine analyses.

Also in December, 1987, it was agreed that in order to provide a full-service asbestos analysis service, a TEM would be purchased. An instrument was purchased from Arizona State University and installed in November, 1988, an EDS system was installed, and TEM analysis was offered in June, 1989.

The period March, 1988 through March 1989 was a period of unprecedented growth in the companies. Prior to this time, the asbestos analyses were usually performed by Dr. Pierce personally, with some back-up PCM counting by Pat Clark, still an employee of SEM/TEC. During the mentioned year, however, six more employees were added, including five analysts. The standard operating procedures and quality assurance procedures have necessarily become more explicit and rigid with the addition of multiple analysts. They are needed to continue to provide our client/customerclient/customer/customers with the high reliability results that they have come to expect over the years.

Fiberquant continued to expand, but in diversification of analysis types rather than in personnel. It acquired a portable X-ray fluorescence spectrometer for lead-in-paint surveys in 1991 and an atomic absorption spectrometer for other lead testing in 1992. Fungal spore counting capability was added in 1998, and fungal culture analysis in 2001.

It is inevitable that Fiberquant will expand into other environmental fields in the future. Whatever the future holds, Fiberquant will continue the high standards of quality control set by its asbestos beginnings.

In October, 1996, Fiberquant and SEMTEC moved to their current location, a 10,000 square foot, two story facility.

In December, 2007, the outstanding stock of SEM/TEC was purchased by Larry S. Pierce and Michael A. Breu.

1.2. Scope of Analysis

Currently, Fiberquant performs 1) PLM analysis for asbestos of bulk samples, 2) PCM analysis for fibers of filter samples, 3) TEM analysis for asbestos in air of filter samples and in bulk and water samples, 4) Flame AA analysis for lead in paint, soil, wipes, and air filter samples, 5) gravimetric analysis of filter samples, 6) portable XRF surveys for lead in paint, and 7) analysis of bulk and air samples for fungi and molds, using optical microscopy and/or culturing techniques.

1.2.1. Scope of Accreditation

Fiberquant is accredited by NVLAP for the analysis of a) asbestos in air (TEM), and b) bulk asbestos (PLM) matrices. The lab/ID number is 101031-0.

Fiberquant is accredited by AIHA-LAP, LLC for a) fibers in air (PCM), b) bulk asbestos (PLM), c) Pb in paint, soil, wipe and MCE filter matrices, and d) fungal spores, direct air, direct bulk and direct surface scopes.

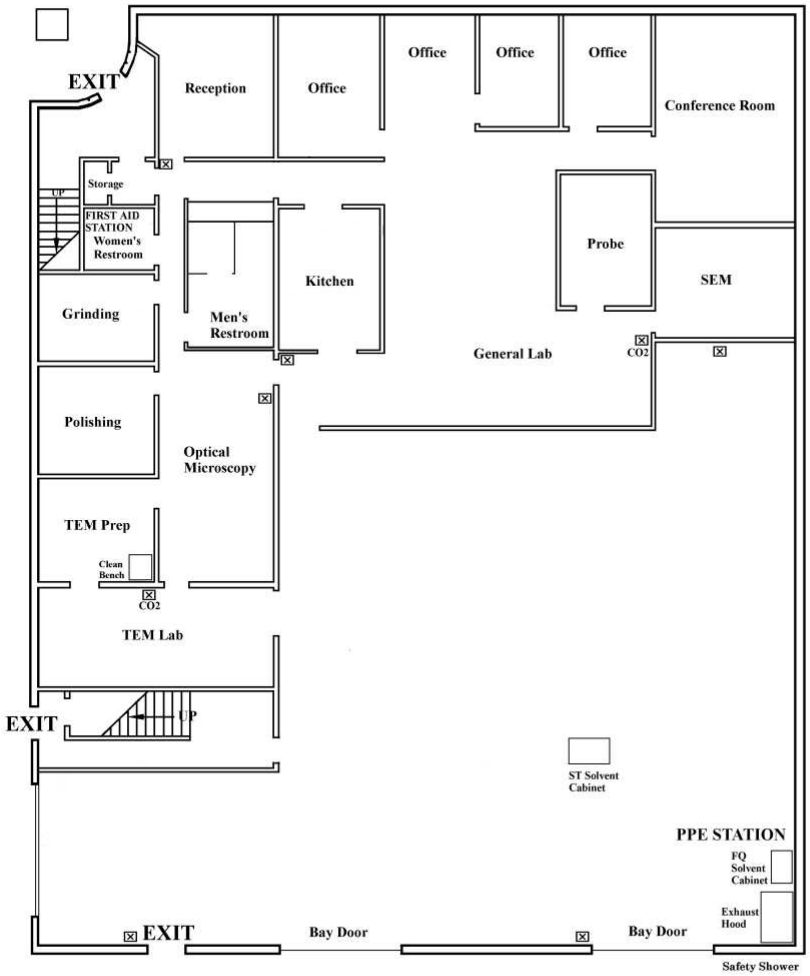
Fiberquant is accredited by Arizona DEQ and Nevada DEQ for asbestos analysis in water matrix.

For any of the above accreditations, major changes (i.e., changes in the location of the lab, technical manager of a scope, or QA manager) must be reported to (and approved by) the appropriate accreditation agency, usually within 20 business days.

1.3. Physical Facilities

SEMTEC and Fiberquant jointly occupy a 10,000 square foot facility at 5025 S. 33rd St., Phoenix, AZ**.** Floor plans are shown below:

SEMTEC/FIBERQUANT BUILDING LAYOUT
FIRST FLOOR

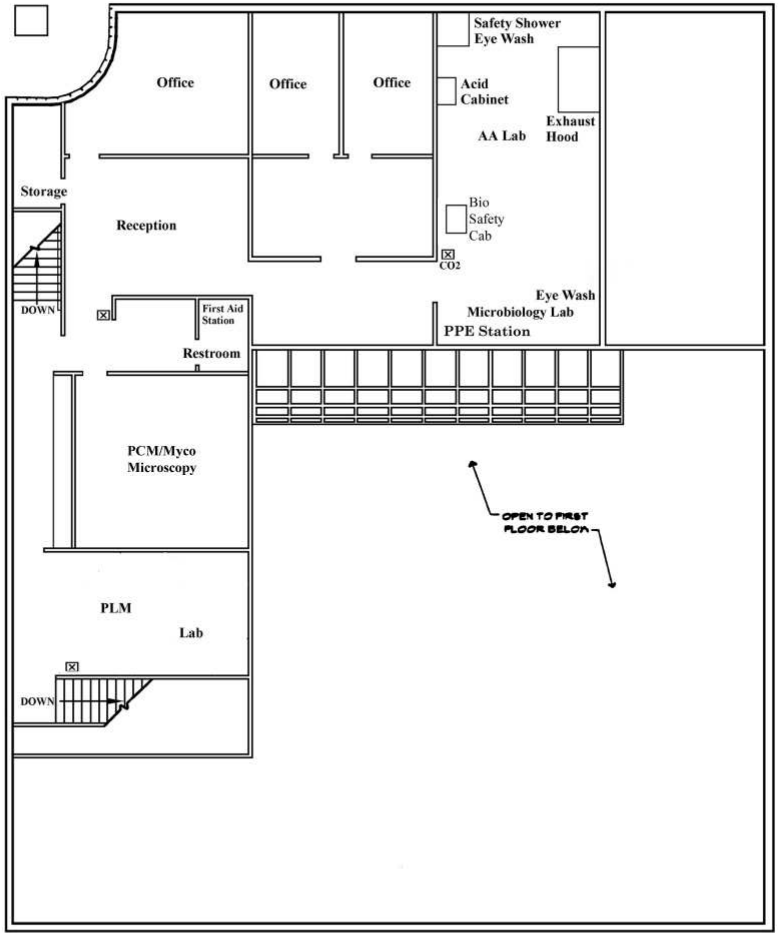


☒ - FIRE EXTINGUISHER (ABC)

☒ $_{CO2}$ - FIRE EXTINGUISHER (CO_2)

X - YOU ARE HERE

SEMTEC/FIBERQUANT BUILDING LAYOUT
SECOND FLOOR



☒ - FIRE EXTINGUISHER (ABC)

☒ $_{CO2}$ - FIRE EXTINGUISHER (CO_2)

X - YOU ARE HERE

1.4. Staff

Currently, Fiberquant staff stands at approximately 15, including 10 analysts and 1 technician.

1.5. Definitions

AA Analysis	Measurement of the content of an analyte using a flame atomic absorbance spectrometer (FLAA). The analyte may be Pb,Cd,Cr,Zn,Cu,Ni. The matrix may be AAfg (fiberglass air filter reported in mg/m3), AAmc (mixed cellulose ester air filter reported in mg/m3), AApq (paint by area reported in mg/cm2), AApw (paint by weight reported in mg/kg or ppm), AAs (soil reported in mg/kg or ppm), AAw (wipe sample reported in ug/ft2)
Agar	A prepared medium for fungal growth containing powdered seaweed (agar) and any of a number of other nutritive contents
Analytical Sensitivity	for TEM and spore trap analysis, the hypothetical observation of 1 structure or spore carried through the calculations to give a structures/cc or spores/m3 value.
Blank, matrix	(AA) media and reagents without sample; to detect contamination or background level.
Blank, method	(AA) reagents only without sample
Blank, box	(TEM/PCM) an unopened cassette from the same box or lot as a sample set.
Blank, field	(TEM/PCM) a cassette carried with a set of samples during sampling, and opened for 30 seconds without a pump attached.
Blank, prep	(TEM/PCM/AA) a new filter taken from lab stock and prepared or otherwise treated the same as a sample would be.
Blank, PLM	a non-asbestos containing material is mounted and analyzed to check for contamination of slides, tools, media or cover slips.
Calibration	comparison or adjustment of a measurement system to a standard.
CFU	Colony-forming-unit. A colony observed on a culture plate (but may not represent a one-to-one relationship to viable spore levels)
Contamination	The occurrence of a substance or organism in a sample that was not originally in the material sampled.
Continuing Calibration Blank (CCB)	for AA, a blank (no sample, and either distilled water or acid solution, analyzed just after every CCV (every ten samples) - used to check whether the zero absorbance has drifted and also to check for sample carryover from the CCV analyzed just before.
Control, Negative	In microbiology, culture media to which no organism has been added – used to demonstrate that the media is not been contaminated
Control, Positive	In microbiology, culture media to which a known organism has been added – used to demonstrate that the media supports the organism and also that the incubation conditions have been such that the growth rate of that organism has been within expected norms.
Debris Rating	For spore trap filters, the maximum observed percentage of a field of view covered by particulate. This would normally be in the middle of the deposit strip, where the deposit is the heaviest.
Dispersion Staining (Focal Screening)	For PLM, a technique which utilizes the mis-match of optical dispersion (the variation of refractive index vs. wavelength of light) between a solid and the liquid in which it is immersed to determine the refractive indices of the solid
DS	In TEM, a recount of a different wedge than the one counted in the first count by the same analyst as the first count
Fungal Bulk Analysis (SPB)	The identification and estimation of percent of fungal material on bulk material using non-culturing techniques
Fungal Culture Analysis (SPCP,SPSCP,SPDCP)	The identification and counting of fungal colonies grown on one or more agar culture plates. The analysis may be of an air sample (e.g., Andersen) taken directly on the plate (SPCP), or of plates prepared from a swab sample (SPSCP), or of plates prepared from a dust or bulk sample (SPDCP). Results are in CFUs per unit air volume, swab area, or dust weight.
Fungal Tape Analysis (SPT)	The counting of fungal particulate directly from a tape sample (usually used for estimating contamination or clearance cleanliness)
Gravimetric Analysis	Measurement of total dust on a filter sample using the analytical balance or electro-balance

Gravimetric TEM Analysis	Estimate of the asbestos content of a bulk sample using matrix reduction procedures followed by TEM Analysis
Initial Calibration Blank (ICB)	for AA, a blank (no sample, and either distilled water or acid solution, analyzed just prior to samples - used to zero the absorbance).
Initial Calibration Verification (ICV)	an AA standard run to check the validity of the normal series of calibration standards - it must be made from a different source (e.g., weighed chemical instead of pre-mixed concentrates from Fisher).
Lab air monitoring	air samples taken to determine background levels within the lab.
Laboratory Characterization Standard (LCS)	in AA, a standard of known concentration and variability that is run routinely over time in order to characterize the laboratory precision and bias.
Method Limit of Detection (MDL or LOD)	for AA, that level (in the analyzed solution) that is the appropriate students t-value times the standard deviation of a series of measurements near the limit of detection; for PLM, 1% by weight, the nominal value stated in the method; for PCM, 1.645x the standard deviation of a reference standard near the LOD; for TEM, not defined as yet.
Out of Control (OOC)	The situation of a quality control test being outside of its control range. Such an occurrence always requires a root cause investigation and documentation of the incident.
PCM Analysis (7400, ORM, 74OR)	A count of fibers on an air filter using a phase contrast microscope. The analysis may be 7400 (NIOSH 7400 A rules), ORM (OSHA Reference Method) or 74OR (a job where each filter sample is analyzed by either 7400 or ORM, depending on whether it is an area sample or a personal sample)
PCM recount	the re-analysis of the same slide mount. Two types are performed at Fiberquant: RS (recount by the same analyst) and RD (recount by a different analyst).
PCM reference slides	a set of twenty mounted slides, taken from commercially produced standards, PAT samples and client/customer samples, used daily to show that an analyst is capable of counting within 2σ of the published or average value.
PLM Analysis (PLMn, PLMi)	An estimate of asbestos content of a bulk material using a polarized light microscope. The analysis may be PLMn (EPA 1993 "new" method) or PLMi (EPA 1982 "interim" method)
PLM qualitative standards	a set of ~40 different types of fibers of all types - asbestos, interferences, synthetic, etc., drawn from mineral specimens, standards, round robin samples and client/customer samples; used to check the analysts ability to identify unknowns.
PLM quantitative standards	a set of >40 different samples of known asbestos content; some samples are NIST proficiency samples and others are purchased (in wt. %) proficiency samples; used to check the analysts ability to quantify fiber levels in a variety of matrices.
PLM reference materials	bulk mineral specimens, NIST standard 1866, round robin samples and client/customer samples of asbestos and interferences; used to provide examples of species for comparison to unknowns.
RD	In PCM or Spore Trap Counting, a recount by a different analyst than the one who performed the first count
RD Diff GOs	In TEM, a recount of different grid openings than the first count by a different analyst than the one who performed the first count
RD Same GOs	In TEM, recount of the same grid openings as the first count by a different analyst than the one who performed the first count
Reporting Limit (RL or MQL) Reported on Reports	(a value which the client/customer can compare to theirs to see how close the measurement was to the limits of the method); for AA, twice the method detection limit as calculated using AIHA-LAP, LLC guidelines; for PLM, no limit of detection other than 1% is reported); for PCM, the MDL as defined above; for TEM, reporting limit is the analytical sensitivity; for XRF, the MDL as defined above.
Root Cause Investigation	An investigation into why a given quality control test was out of its control range. Determining a cause may be easy or short (as with paint duplicates, which are notoriously inhomogeneous), or may require instrument checks, experiments with standards, etc.
RPD	Relative Percent Difference; for two values, x & y, RPD = 2*(y-x)/(Y+X)
RSD	Relative Standard Deviation; = (standard deviation)/mean. There are two types of standard deviation, one for a population, and the other for estimation. The difference is that in the

	standard deviation calculation of n samples, population uses (n) in the divisor, whereas estimation uses (n-1). This is most important in recounts, where n=2, and the population RSD = 0.707* estimation RSD.
RS	In PCM or Spore Trap Counting, a recount by the same analyst who performed the first count
RS Diff GOs	In TEM, a recount of different grid openings than the first count by the same analyst as the first count
RS Same GOs	In TEM, a recount of the same grid openings as the first count by the same analyst as the first count
Spike	in AA, the addition of a precise aliquot of analyte to a blank matrix (MCE or wipe) or to a client/customer sample (soil or paint) in order to check matrix interference. For wipe matrix, the aliquot must be a solid (i.e., another LCS).
Spore Trap Counting (SPCT, SPCT1, SPCT2)	A count of fungal particulate on a spore trap sample.
Stain	In microbiology, a solution applied to organisms to add or change their color. The color may allow clear organisms to be more readily observed, or may allow organisms to be identified based on how they respond to a certain stain.
Stock Solution, Working	In microbiology, a suspension of fungal material used to create standard cultures.
Stock Solution, Backup	In microbiology, a suspension of fungal material, similar to the working stock solution, but to be used only if the working solution becomes contaminated.
TEM Analysis (TEMa,TEMm,7402,TEMw)	A count of asbestos fibers using a transmission electron microscope. The analysis type may be TEMa (air filter, AHERA protocol), TEMm (air filter, modified AHERA protocol for filters not part of an AHERA set), TEM 7402 (air filter, NIOSH 7402 protocol), TEMw (filtered water sample, EPA 100.1 protocol).
TEM counting standard	SRM 1876b, SRM 8410; mounted grids having a known level of asbestos; used to test analysts ability to quantify asbestos.
TEM duplicate count	recount of a different preparation of a sample; two types are performed at Fiberquant: DS (performed by the same analyst) and DD (performed by a different analyst); used to check the variation in fiber level over the filter.
TEM qualitative standards	~20 mineral species; performed once/month to test analysts ability to identify unknowns.
TEM replicate count	recount of the same grids; 4 types are performed at Fiberquant: RS same gos (by the same analyst of the same grid openings), RS diff gos (by the same analyst of different grid openings), RD same gos (by a different analyst of the same grid openings), and RD diff gos (by a different analyst of different grid openings); used to test the overall counting process: scanning procedure, structure characterization, analyst care, precision and accuracy.
TEM verified analysis	recount of the same grid opening by a different analyst in a way which permits each structure identification and classification to be discussed and unambiguously determined; used to test analysts' scanning procedures and identification and categorization skills.

2. JOB DESCRIPTIONS

2.1. Laboratory Director
Qualifications: working knowledge of all analytical techniques performed at the laboratory, bachelor's degree in business or science.

General: supervises all managerial, clerical and corporate functions.

Specific:
1. oversees the operation and interaction of the AA, Micro, PCM, PLM and TEM labs
2. OK's equipment purchases.
3. develops budget, signs checks.
4. hires personnel.
5. arranges and coordinates applicable accreditations.
6. handles or delegates public relations and advertising.
7. signs company documents.
8. develops future company directions, functions and capabilities, new methods.
9. mediates conflicts between departments.

QA Procedures:
1. Match sample load with number of personnel, so that undue pressure is not placed on analysts.
2. See that analysts with the appropriate background, training and personality are hired.

Assigned Staff: Larry S. Pierce; Deputy: M.A. Breu

2.2. IH Laboratory Technical Manager
Qualifications: those specified for Technical Manager for AIHA accreditation, namely: that the TM is an employee of the laboratory, possess a bachelor's degree in an appropriate physical or biological science, have finished a NIOSH 582 course or equivalent, has a minimum of three years experience of non-acedemic analytical chemistry experience, of which a minimum of two years experience is in industrial hygiene analyses within the scope of AIHA accreditation

General: responsible for day-to-day supervision of the industrial hygiene operations of the laboratory: PCM, PLM, TEM, Gravimetry and all other IH fields of testing

Specific:
1. approves or chooses equipment and service purchases.
2. keeps up with PCM analysis innovations, safety procedures, procedural changes or advances.
3. develops and implements changes in PCM procedures, and reports same to the QA Officer for inclusion in the SOPs.
4. trains or arranges initial or remedial training of staff.
5. takes part in IH personnel decisions.
6. must be on site >=50% of the time or >=20 hours per week.

QA Procedures:
1. writes & authorizes revisions of IH SOPs and is responsible that the revised procedures are in use.
2. makes sure that purchased IH equipment is capable of performing the task required.
3. responsible for the proper training and certification of IH analysts.
4. handles discrepancies and client/customer complaints in a professional manner
5. responsible for assuring that procedures are in compliance with AIHA, ISO 17025, NVLAP and any other accreditations held by the IH divisions
6. responsible for IH corrective actions
7. is a designee approved signatory

Assigned Staff: Michael A. Breu (Robert A. McCormick, deputy for PCM, PLM; David M. Schaller, deputy for TEM; Martin A. Esquer, deputy for AA and Gravimetry)

2.3. PCM Laboratory Supervisor
Qualifications: bachelor's degree in a physical or biological science, NIOSH 582 course or equivalent, 1 year experience in PCM analysis.

General: supervises daily PCM laboratory operations

Specific:
1. has input into equipment purchases. Arranges equipment service, cleaning and repair.
2. handles client/customer complaints, answers client/customer questions about the analysis.
3. handles non-routine projects.
4. performs routine maintenance or repair of PCM equipment.
5. takes part in PCM personnel decisions.
6. mediates personality conflicts within the department.

Assigned Staff: Robert A. McCormick (Uwe Steimle, deputy)

2.4. PCM Microscopist
Qualifications: college level science course experience, NIOSH 582 course.

General: mount filter samples and analyze.

Specific:
1. receive and store samples in an orderly manner.
2. mount PCM samples on slides according to SOP.
3. count slides according to marked method.
4. perform calculations and reports as needed.

QA Procedures: see Lab Summary PCM-2
1. perform sample or QA counts with strict adherence to counting rules.
2. clean sample prep area and microscope table when needed.
3. align and adjust microscope before counting and during counting if needed.
4. make and count sample prep blanks daily.
5. check all reported f/cc mentally against the LOD.
6. calculate by hand: one f/cc per each report.

Assigned Staff: Robert A. McCormick, Larry S. Pierce, David M. Schaller, Uwe Steimle, Martin Esquer, Michael A. Cook, Michael A. Breu, Ruth F. Vivas

2.5. PLM Supervisor
Qualifications: bachelor's degree in a physical or biological science, training in PLM analysis, 1 year experience in PLM analysis.

General: supervises daily PLM laboratory operations

Specific:
1. has input into equipment purchases. Arranges equipment service, cleaning and repair.
2. handles client/customer complaints, answers client/customer questions about the analysis.
3. handles non-routine projects.
4. performs routine maintenance or repair of PLM equipment.
5. takes part in PLM personnel decisions.
6. mediates personality conflicts within the department.

Assigned Staff: Robert A. McCormick (Uwe Steimle, deputy)

2.6. PLM Microscopist
Qualifications: B.S./B.A. in science, geology preferred, 5-day training course in PLM analysis of asbestos or equivalent.

General: analyses bulk asbestos samples using polarized light microscopy.

Specific:
1. perform analyses according to most recent SOP.
2. Keep work area clear of contamination during analysis, clean hood at end of day.
3. report non-centered objectives to lab manager.
4. obtain second or third opinion on problem or unknown samples.

QA Procedures: see Laboratory Summary PLM-1

Assigned Staff: Robert A. McCormick, Larry S. Pierce, David M. Schaller Uwe Steimle; Michael A. Cook, Galina Volkova, Mark C. Jefferson

2.7. TEM Laboratory Supervisor

Qualifications: bachelor's degree in a physical science, geology prefered, experience in mineralogy using TEM, extensive experience in diffraction, EDS analysis, TEM and mineralogy, experience in TEM preparation of filter samples and analysis of asbestos.

General: supervises TEM laboratory operations and analyses.

Specific:
1. has input into equipment purchases.
2. handles client/customer relations, complaints and technical questions about the analyses.
3. handles non-routine analyses.
4. keeps up with current TEM techniques, as applied to mineral identification.
5. performs or arranges for routine maintenance and repair of equipment.

Assigned Staff: Larry S. Pierce; Deputy: D.M. Schaller

2.8. TEM Microscopist

Qualifications: B.S./B.A. in science, geology preferred, 5-day TEM course and 5-day TEM analysis of asbestos course or equivalents.

General: prepare and analyze TEM grids from samples.

Specific:
1. receive and store logged-in samples in an orderly manner.
2. prepare samples according to current SOP's, noting any variation from SOP on sample submittal form.
3. analyze sample grids according to SOP's, noting variations or problems on the count sheets.
4. perform calculations and generate reports as needed.
5. record problems and actions performed on the TEM in the TEM logbook.

QA Procedures: see Lab Summary T-31

Assigned Staff: Larry S. Pierce, David M. Schaller, Uwe Steimle

2.9. Quality Assurance Officer/Quality Manager

Qualifications: B.S./B.A. in science, one year non-academic experience appropriate to the types of analyses performed in the laboratory, documented course-work in quality control procedures and statistics

General: develop, write and analyze QA procedures for the lab.

Specific:
1. maintain SOP/QA Manual, marking revision copy, updating and printing complete manual and SOP's for sections at least once per year, or as needed.
2. develop QA and control procedures
3. responsible for QA procedures being current, in line with other laboratories, and meeting accreditation criteria.
4. writes monthly QA reports for each section; responsible for reviewing QA data and staff competency as shown by the QA data.
5. keeps and updates QA files, calibration binder and personnel files.
6. keeps technical files not kept by lab managers.
7. Responsible for training or arranging for training of personnel.
8. Responsible for performing or arranging the yearly QA System Audit.
9. Report significant changes (location, ownership, TM, QM) to the appropriate accreditation body.

QA Procedures: all tasks are QA related.

Assigned Staff: L.S. Pierce; Deputy: M.A. Breu

2.10. Office Personnel

Qualifications: clerical experience, high school or college science preferred.

General: clerical manager, main client/customer/lab interface.

Specific:
1. answer phone.
2. route inquiries to correct section or person.
3. present verbal results to client/customers.
4. pay invoices in a timely manner, organize p.o.'s and shipments.
5. receive and deposit payments.
6. keep financial books by quarters, take quarterly papers to accountant.
7. receive jobs, log jobs and log samples into general log.
8. keep financial and report files.

QA Procedures:
1. logs jobs into job log book.
2. logs samples into general sample log.
3. receives samples, starting sample tracking and chain of custody.

Assigned Staff: Karen E. Grant, Kathy Knowles, Elyssa Craig, JoAnn Lutz

2.11. Safety Officer

Qualifications: College degree in science, chemistry preferred

General: Handles all aspects of safety and chemical hygiene for the lab.

Specific:
1. write and update the chemical hygiene plan
2. update MSDS books
3. conduct worker training in safety and chemical hygiene
4. perform safety related monitoring

QA Procedures: none

Assigned Staff: Martin A. Esquer

2.12. Marketing Director

Qualifications: College degree in business with science background or degree in science with business background

General: Oversees sales efforts, gives quotes, bids, etc. other than on standard price list, determines sales and marketing strategies and priorities.

Specific:
1. Periodically meets with current client/customers to determine their needs.
2. Provides copy for advertising, including yellow pages.
3. Scouts likely regions for expansion.
4. Develops new client/customers via direct mailing, phone surveys, and booths at technical conferences.

QA Procedures: None

Assigned Staff: Michael A. Breu

2.13. Atomic Absorption Analyst

Qualifications: College degree in science, chemistry preferred, or college chemistry courses and experience in lab work; 1 month supervised experience for digestions and 1 month for spectroscopy.

General: Performs AA sample prep and analysis.

Specific:
1. receive and store logged-in samples in an orderly manner.
2. prepare samples according to current SOPs.
3. analyze solutions according to current SOPs.
4. perform calculations as needed.
5. field questions on analysis as needed.
6. perform routine equipment maintenance.

QA Procedures:
1. add into analysis stream the proper QA samples, including blanks, duplicates, spikes, LCS.
2. check instrument performance before and during analysis according to SOPs.
3. check precision (repeatability of the three measurements) for each analysis.
4. after a run, plot precision and yield of spikes on control chart.
5. after a run, plot LCS result on control chart.

6. report out-of-control situations to QA Officer.

Assigned Staff Larry S. Pierce, Martin A. Esquer, Michael A. Cook, Michael A. Breu

2.14. Technician

Qualifications: High school diploma, training in chemistry (college chemistry courses and experience in lab work preferred); 1 month supervised experience in house

General: Performs AA sample prep, mounts PCM samples, filters and prepares Annex 2 and TEM water samples.

Specific:
1. receive and store logged-in samples in an orderly manner.
2. prepare samples as directed according to current SOPs.

QA Procedures:
1. add into analysis stream the proper QA samples, including blanks, duplicates, spikes, LCS.

Assigned Staff Joeseph Ciesco

2.15. AA Laboratory/Lead Technical Manager

Qualifications: those specified for Technical Manager for AIHA accreditation, namely: that the TM is an employee of the laboratory, possess a bachelor's degree in an chemistry or equivalent appropriate physical science, has a minimum of three years experience of non-acedemic analytical chemistry experience, of which a minimum of two years experience is in lead or other appropriate analyses

General: Responsible for the technical content of AA laboratory analyses.

Specific:
1. advises analysts on technical aspects of sample prep, sops and AA operation.
2. handles client/customer relations, complaints and questions about AA.
3. develops and implements changes in method, QA or other procedures in the AA lab, advising QA officer of changes.
4. trains or arranges for training for AA analysts.
5. responsible for meeting the requirements of AIHA LQAP policies and ISO 17025 for AA lab.
6. must be on site >=20 hours per week
7. responsible for Pb section corrective actions
8. approved signatory

Assigned Staff: Martin A. Esquer; Mike Cook deputy

2.16. AA Laboratory/Lead Supervisor

Qualifications: college degree in chemistry or related science, chemistry preferred; minimum of 1 year non-academic analytical lab experience, at least 1 year experience in metals analysis; also knowledge of IH calculations.

General: Supervises daily AA laboratory operations and analyses.

Specific:
1. advises analysts on technical aspects of sample prep, sops and AA operation.
2. handles client/customer relations, complaints and questions about AA.
3. handles non-routine analyses, if performed.
5. oversees ordering of supplies for AA and AA support.
6. trains or arranges for training for AA analysts.
7. performs or arranges for maintenance on AA equipment.
8. reviews QA data and provides any remedial training.

QA Procedure:
1. check AA worksheets monthly to document compliance
2. keep instrument in functioning condition

Assigned Staff: Martin A. Esquer; Michael A. Cook, deputy

2.17. X-ray Fluorescence Technician or Risk Assessor

Qualifications: College degree in science, Radiation Short Course, EPA certification as Pb-inspector or Risk Assessor.

General: Operates portable XRF and performs Pb-in-paint surveys

Specific:
1. Operates portable XRF and does portable XRF surveys
2. Takes physical Pb samples : paint, soil, wipes.
3. Generates reports of Pb-in-paint surveys.
4. Risk assessments as required

QA Procedures:
1. add to analysis stream duplicates and standards as required

2. make sure via standards that machine is functional before survey
3. report any malfunctions to supervisor

Assigned Staff:: Robert M. McCormick, Martin A. Esquer; Uwe Steimle, Michael A. Breu, Michael A. Cook

2.18. X-ray Fluorescence Supervisor
Qualifications: College degree in science, radiation short course, EPA certification as Risk Assessor

General: Oversee portable XRF operations.

Specific:
1. Keep use log
2. Keep machine functional, replace batteries, arrange source replacement
3. train personnel
4. Keep AZ Rad paperwork

QA Procedures:
1. Perform calibrations and cross checks to AA

Assigned Staff: Michael A. Breu (deputy: Larry Pierce)

2.19. Microbiology Laboratory Technical Manager
Qualifications: those specified for Technical Manager for AIHA accreditation, namely: that the TM is an employee of the laboratory, possess a bachelor's degree in an appropriate physical or biological science, , has a minimum of three years experience of non-acedemic micro experience, of which a minimum of two years experience is in appropriate to the scope of AIHA accreditation; other specific classes as listed in AIHA policies 2D.

General: responsible for the technical content of the microbiology department.

Specific:
1. Prepares stains.
2. Arranges interlab and proficiency testing.
3. Monitors performance of analysts.
4. must be on site >=20 hours per week
5. responsible for Micro area corrective actions
6. approved signatory

QA Procedures:
1. Responsible for assuring that the micro lab meets AIHA and 17025 requirements for microbiology.

Assigned Staff Michael A. Breu; Deputy: Larry Pierce

2.20. Microbiology Laboratory Supervisor
Qualifications: those required for AIHA accreditation, namely: combination of microbiology degree, course work and experience as listed in AIHA policies module 2D, training specific to identification .

General: oversees daily operation of the microbiology department.

Specific:
1. Prepares stains.
2. Answers client/customer questions or complaints
3. Performs non-routine analyses
4. Addresses technical or personal disputes

Assigned Staff Michael A. Breu; Deputy: Ruth Vivas

2.21. Microbiology Analyst
Qualifications: College degree in biology or microbiology; training specific to spore identification (McCrone course or equivalent).

General: Performs fungal spore counting and identification, culture identification.

Specific:
1. Prepares spore samples.
2. Counts/identifies species as required.
3. Prepares stains.
4. Maintains incubations.
5. Handles/identifies cultures

QA Procedures:
1. Performs recounts/re-analyses as required.
2. Participates in interlab and proficiency testing.

Assigned Staff Michael A. Breu, Craig, Ruth F. Vivas (anticipated degree), Galina Volkova

2.22. Spore Trap Microscopist (AIHA EMLAP Technician)
Qualifications: College degree in science (biology or life science preferred); training specific to spore identification (McCrone course or equivalent).

General: Performs fungal spore counting and associated categorization of spores.

Specific:
1. Prepares spore trap and bulk samples.
2. Counts/categorizes spores as required.

QA Procedures:
1. Performs recounts/re-analyses as required.
2. Participates in interlab and proficiency testing.

Assigned Staff Larry S. Pierce, Galina B. Volkova

2.23. LIMS Specialist
Qualifications: College degree preferred.

General: Performs all computer-related tasks.

Specific:
1. Maintains computer network and computers.
2. Purchases computer parts, equipment and software.
3. Trains personnel on use of computers and programs.
4. Alters LIMS according to needs.

QA Procedures:
1. Maintains LIMS security.

Assigned Staff Larry S. Pierce

3. CURRENT PERSONNEL

Personnel folders are kept for each employee. Included are a) position description and job responsibilities, b) a resume of qualifications, c) training, d) assigned laboratory procedures, e) the results of QA testing, f) accuracy and precision data, and g) any deficiency corrections. Resumes are included here.

3.1. Personnel Records

For each analyst, a file folder is kept in the LIMS, which contains: 1) the name of the analyst, 2) their title, 3) assigned duties or job descriptions, 4) precision and accuracy data, and 5) deficiency corrections. Resumes, training certificates and other paper records are kept in physical folders.

3.2. Vitae

Following are the vitae or resumes of technical staff. All staff are certified and trained in their areas of assigned duties. Their certificates or training records are included in their personnel files and are not included here.

Vita

March 5, 2013

Name	Larry S. Pierce	
Education	B.S., chemistry; University of Wisconsin, Madison, WI	1971
	M.S., geochemistry; Arizona State University, Tempe, AZ	1975
	Ph.D., geochemistry; Arizona State University, Tempe, AZ	1979
	NIOSH 582, University of Southern California, Los Angeles, CA	1982
	QC in Asbestos Lab, University of Southern California, Los Angeles, CA	1989
	TEM Asbestos Analysis, ETC/JEOL, Peabody, MA	1988
	Bldg Insp/Mngmnt Planner, Environmental Sciences, Tucson, AZ	1988
	Asbestos Identification, Microlab NW, Seattle, WA	1988
	Certified Industrial Hygienist, chemical principles	1987
	Lead Inspector, Asbestos Institute, Phoenix, AZ	1994
	IAQ: Advanced Fungal Spore Counting, McCrone Research Inst.	2002
Areas of Specialization	Mineralogy, high resolution electron microscopy of minerals, geochemistry	
Professional Employment	President/Lab Director/QA Officer Fiberquant Analytical Services, Phoenix, AZ	1988-
	NVLAP On-site Assessor, Air/Bulk Asbestos	1989-2011
	Vice President/mineralogist/chemist SEMTEC Laboratories, Inc., Phoenix, AZ	1977-1988
	Graduate Research Associate Arizona State University, Tempe, AZ	1973-1977
	Graduate Teaching Assistant Arizona State University, Tempe, AZ	1971-1973
	Assistant Chemist Freeman Chemical Co., Port Washington, WI	1969-1971
Fellowships, Honors, and Professional Organizations	Graduate College Fellowship, Ariz St University, Tempe, AZ	1974-1975
	Phi Lambda Upsilon (chemistry honor society)	1972-
	Mineralogical Society of America	1971-
	Electron Microscopy Society of America	1976-
	American Society for Testing Materials	1988-
	National Asbestos Council/Environmental Information Association	1988-
	American Industrial Hygiene Association	1988-
	AIHA ELLAP committee (chair, 2003)	1999-2003
	AIHA Analytical Accreditation Board	2003-2006 2009-Present
	Environmental Information Association (secretary AZ section 1993-1996; Board Member National 2000-2002)	
	ASTM D-22.08 Vice Chair	2005-Present
	ASTM D-22 Member-at-Large, Conferences	2008-2009
	ASTM D-22 Administrative Vice-Chair	2009-Present

Fiberquant Duties: Lab Director, QA Officer, TEM Supervisor and NVLAP TM, PLM Microscopist, PCM Microscopist, TEM Microscopist, AA Spectroscopist, XRD Operator, Radiation Safety Officer, XRF Technician; Spore Trap Microscopist

Vita

March 5, 2013

Name	David M. Schaller	
Education	A.B., Geology, Occidental Coll., Los Angeles, CA	1983
	M.S., Geology, Arizona State Univ., Tempe, AZ.	1989
	Samp/Eval Airborne Asbestos Dust (NIOSH 582), Univ. Southern Cal.	1990
	Radiation Safety Short Course, Radiation Safety Eng.	1993
	Lead Inspector, Asbestos Institute, Phoenix, AZ	1994
	Asbestos Building Inspector, ETC, Tucson, AZ	1995
Areas of Specialization	Optical/X-ray mineralogy, petrology, clay mineralogy, archaeological geology	
Professional Employment	Microscopist Fiberquant Analytical Services, Phoenix, AZ	1990-
	Geologist Soil Systems, Inc., Phoenix, AZ	1989-1990
	Geological Consultant Petrography, Archeological Geology	1987-
	Geologist Northland Research, Inc., Tempe, AZ	1987
	Research Assistant Arizona State University, Tempe, AZ	1985-1986
	Teaching Assistant Arizona State University, Tempe, AZ	1983-1985
	Research Assistant Occidental College, Los Angeles, CA	1982-1983
Fellowships, Honors, and Professional Organizations	Student Award, Geological Society of America, Archeological Geology Environmental Information Association	1987
Fiberquant Duties	PLM Microscopist, PCM Microscopist, TEM Microscopist, XRF Technician, XRD Technician	

Vita

March 5, 2013

Name	Robert A. McCormick	
Education	B.S., Geology, Whitworth Coll., Spokane, WA	1985
	B.A., Physics, Whitworth Coll., Spokane, WA	1985
	Micro. Identification of Asbestos, McCrone Research Inst.	1992
	Asbestos Fiber Counting (582), McCrone Research Inst.	1993
	Radiation Safety Short Course, Radiation Safety Eng.	1993
	Lead Inspector, Asbestos Institute, Phoenix, AZ	1994
	Asbestos Building Inspector, ETC, Tucson, AZ	1995
Areas of Specialization	Computer Use	
Professional Employment	Microscopist Fiberquant Analytical Services, Phoenix, AZ	1992-
	Senior Engineering Aide	1991-1992
	Garrett Auxiliary Power Division, Phoenix, AZ	
	Engineering Aide	1989-1991
	Garrett Auxiliary Power Division, Phoenix, AZ	
	Engineering Aide	1986-1989
	Garrett Turbine Engine Co., Phoenix, AZ	
	Tour Guide Yankee Fork Gold Dredge Association, Boise, ID	1985
Fellowships, Honors, and Professional Organizations	Affiliation of Christian Geologists	
Fiberquant Duties	PLM Supervisor, PLM Microscopist, PCM Microscopist, TEM Prep, XRF Technician	

Vita

March 5, 2013

Name	Michael A. Breu	
Education	B.S., Biology, Univ. of Iowa, Iowa City, IA	1996
	CIH, General Practice	2008
	Lead Inspector, Asbestos Institute, Phoenix, AZ	1998
	Lead Risk Assessor, Acme Environmental, Phoenix, AZ	2004
	Indoor Air Quality: Microscopy of Dust, Spores & Pollen	
1998		
	McCrone Research Institute, Chicago, IL	
Professional	Marketing Director, Mycology Technical Manager	
Employment	Fiberquant Analytical Services, Phoenix, AZ	1998-
	Study Coordinator	1997-
1998		
	Hilltop Research, Scottsdale, AZ	
	Research Assistant/Laboratory Manager	1994-
1997		
	University of Iowa Hospitals and Clinics, Iowa City, IA	
Fellowships,	Iowa Academy of Science, Cedar Falls, IA	
Honors, and	Member ASTM, EIA-USA, EIA-AZ, AZ Lab Assoc., ABIH, AIHA	
Professional		
Organizations		

Fiberquant Duties: IH Technical Manager, Deputy Lab Director, XRF Technician, Lead Risk Assessor, Mycology Technical Manager, Mycology Analyst; Spore Trap Microscopist, PCM Supervisor, PCM Microscopist, AA Analyst

Vita

March 5, 2013

Name	Uwe Steimle	
Education	Diplom Geologe (recognized as a Masters degree in Geology Eberhard-Karls Universitat, Tubingen, West Germany	1990
	Asbestos Fiber Counting, McCrone Research Inst.	1993
	Lead Inspector, The Asbestos Institute, Phoenix, AZ	1998
Areas of Specialization	Vulcanology, geochemistry, fluid flow mechanisms, igneous and metamorphic petrology and petrography	
Professional Employment	Optical Microscopist Fiberquant Analytical Services, Phoenix, AZ	1992-
	Graduate Teaching Assistant Arizona State University, Tempe, AZ	1990-1993
	Student Assistant, petrography lab Eberhard-Karls Universitat, Tubingen, West Germany	1987-1989
Fiberquant Duties	PLM Microscopist, PCM Microscopist, TEM Microscopist, XRF Technician	

Vita

March 5, 2013

Name	Martin A. Esquer	
Education	B.S., Chemistry	
1997	Arizona State University, Tempe, AZ	
	Asbestos Fiber Counting, McCrone Research Inst.	1998
	Lead Inspector, The Asbestos Institute, Phoenix, AZ	1998
Areas of Specialization	analytical chemistry	
Professional	Optical Microscopist, AA Analyst	
1997- Employment	Fiberquant Analytical Services, Phoenix, AZ	
Fiberquant Duties	Pb-AA Technical Manager, PCM Microscopist, AA Analyst, XRF Technician, Safety Officer	

Vita

March 5, 2013

Name	Galina B. Volkova	
Education	B.S., Geology, St. Petersburg St. Univ., St. Petersburg, Russia	1994
	M.S., Paleontology-Biostratography, St. Petersburg St. Univ., St. Petersburg, Russia	1997
	Certificate, Advanced Fungal Spore Identification and Bioaerosol Samplers Workshop, Aerobiology Instruction and Research	2003
	Advanced Asbestos ID Using PLM, MICA, Chicago	2012
Areas of Specialization	Paleontology, biostratigraphy, and optical mineralogy methods	
Professional Employment	Microscopist/Mycologist Fiberquant Analytical Services, Phoenix, AZ	2003-
	scientific Associate All Russian Scientific Research Institute of Geology	2000-2003
	Teaching Assistant St. Petersburg State University	1997-2000
	Biology Teacher Preparatory School of St. Petersburg State University	1994-1997
Fiberquant Duties:	Spore Trap Microscopist, PLM Microscopist	

Vita

March 5, 2013

Name	Michael A. Cook	
Education	B.S., Chemistry, Southern Utah State College, Cedar City, Utah	1981
	Microscopical Identification of Asbestos, McCrone R.I.	1988
	NIOSH 582, Nat. Inst. Occupational Safety & Health	1994
	IAQ: Fungal Spore Identification, McCrone R.I.	2002
	EPA Lead Inspector, Allstate Services Environmental, Inc.	2003
	EPA Lead Risk Assessor, Allstate Services Env., Inc.	2003
Areas of Specialization	Quality Assurance, Water Analysis, Microscopy	
Professional Employment	Microscopist Fiberquant Analytical Services, Phoenix, AZ	2003-
	Asbestos Laboratory Manager/Quality Control Manager Law Engineering and Environmental Services, Inc.	1988-2002
	Chemist III Western Technologies, Inc.	1984-1988
	Laboratory Manager Dairy Nutrition Services, Inc.	1981-1982
Fiberquant Duties:	PLM, PCM Microscopist, AA Analyst, Lead Inspector, XRF	

Vita

March 5, 2013

Name	Ruth F. Vivas	
Education	B.S., Biology, Arizona State Univ., Tempe, AZ	2006
	Introductory Fungal Spore Identification, Aerobiology Instruction and Research, Boston, MA	2006
Areas of Specialization	Biology	
Professional Employment	Microscopist Fiberquant Analytical Services, Phoenix, AZ	2006-
Fiberquant Duties:	Spore Trap Microscopist, Mycology Analyst in Training, PCM Microscopist	

Vita

March 5, 2013

Name	Mark C. Jefferson	
Education	B.S., Geology, Northern Arizona Univ.	2011
	Advanced Asbestos ID Using PLM, MICA, Chicago, IL	2011
Areas of Specialization	Geology, PLM	
Professional Employment	PLM Microscopist Fiberquant Analytical Services, Phoenix, AZ	2011-
Fiberquant Duties:	PLM Microscopist	
Other:	Trained photographer; knowlegeble in computer hardware and software inc. Adobe Creative Suite, Quark, ArcGIS.	

4. MANAGEMENT REQUIREMENTS

4.1. Organization

4.1.1. Legal description

Fiberquant, Inc., d.b.a. *Fiberquant Analytical Services*, is incorporated as Type C in the state of Arizona. It is a Type C incorporated in the state of Arizona.

4.1.2. Business goals

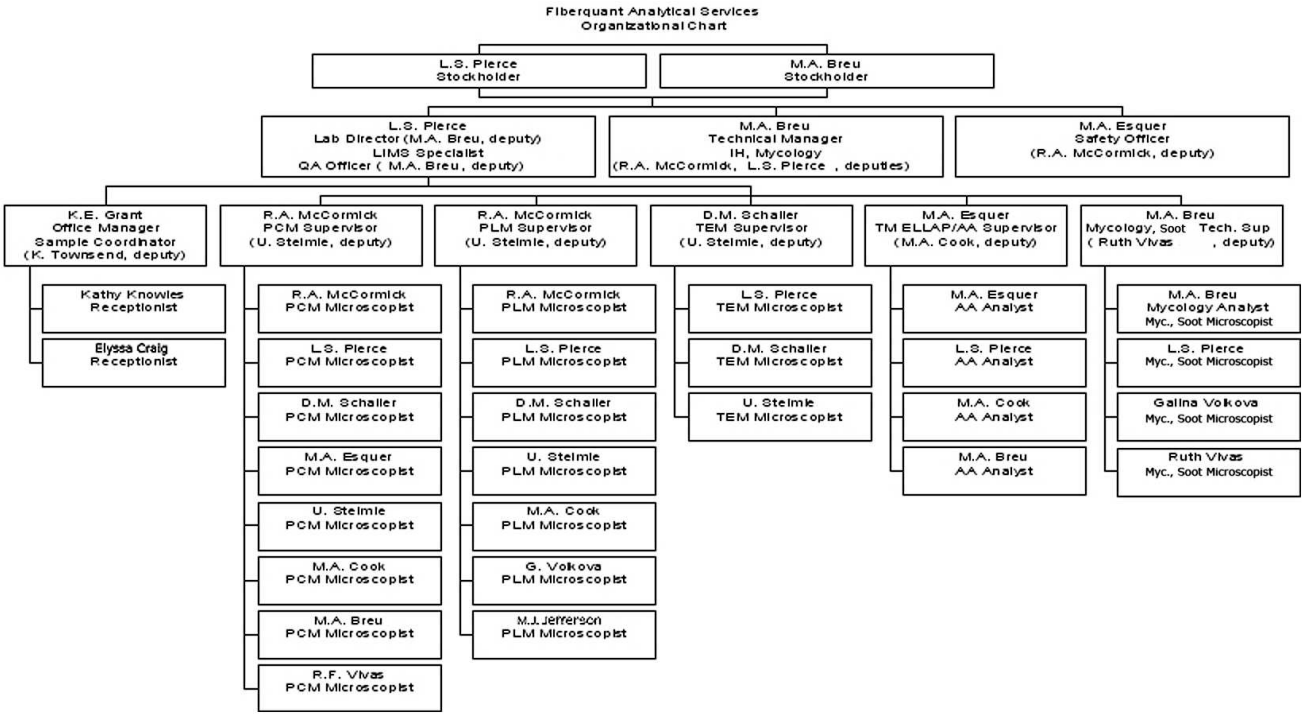
It is Fiberquant's foremost intention to meet the needs of its client/customers. Fiberquant also attempts to meet or exceed the program requirements of its accreditation and certification agencies (NVLAP, AIHA, *etc.*) and their underlying requirements (*i.e.*, ISO 17025), where applicable.

4.1.3. Management scope

The laboratory management and management system of Fiberquant is described in this manual. The policies and procedures in the manual covers all Fiberquant operations, at any permanent, temporary or mobile locations, on-site or off-site.

4.1.4. Organization

Fiberquant does not perform activities other than testing. The organizational chart is shown below, containing the job titles, person holding the title and the chain of command. Job descriptions are given in 3. and personnel vitae in 4



4.1.5. Managerial policies

a) It is the policy of Fiberquant, Inc. to provide its personnel with the authority and resources to perform analyses and quality procedures according to the SOP/QA Manual and SOPs.

b) It is the policy of Fiberquant, Inc. that its personnel are to be free from pressure (e.g., time, financial) that may negatively affect the performance of their duties. Analysts are to be salaried, and are not to be paid by the piece of work. Quotas of work per time are not to be used or discussed. Turn-around-time is discussed with client/customers before work is submitted, to avoid having too much work due at one time. Sample load is tracked via the LIMS by 1) the <QA Status> form, which gives the number of samples received for each division during the last two weeks (to be consulted primarily by the QA Officer), and 2) reports of samples in house, which is printed regularly for PLM, but can be printed, if desired, for any sample type.

c) Fiberquant realizes that client/customer confidentiality and property rights are important, The following procedures are intended to maintain confidentiality: Analytical results and reports are the property of the submitting client/customer. Verbal, hard copy, or electronic results are only given to the submitting client/customer and those agents specified by the submitting client/customer. Paperwork is not to be left in situations in which unauthorized persons could gain access. Computerized data is to be protected by password entry to client/customer data. When results are given via fax or electronically, the fax number/e-mail address is checked or retrieved from memory to ensure that data does not go to the wrong party. In addition, all fax cover sheets and email templates contain a confidentiality statement. If fraud is suspected, such as report results being altered, or samples appearing to be proficiency samples, then client/customer confidentiality may be breached in order to contact the authorities.

d) Employees agree to follow the guidelines present in the AIHA publication: *Canons of Ethical Conduct and Interpretive Guidelines*, which covers activities which would bring into question conflict of interest, impartiality, judgment, competence or integrity by signing a form pledging adherance to the above guidelines.

e) The organizational structure is shown in 4.1.4. Fiberquant acts independently of its parent company, and operates in different analytical areas than SEMTEC. The quality assurance officer reports directly to the lab director, and is independent of the various divisions.

f) Responsibilities and authorities of personnel are detailed in the job descriptions in Chapter 2.

g) It is Fiberquant's policy to provide technical supervision that is competent, experienced and knowledgeable in the testing and qa procedures. The current personnel are listed in Chapter 3.

h) The technical managers (TM) have responsibility for the science that goes on at the laboratory. The TMs are listed under *Job Descriptions*.

i) The quality assurance officer is responsible for maintaining the management system, and ensuring that personnel follow quality procedures. The QA Officer is listed under *Job Descriptions*.

j) When the above TMs and QA Officer are unavailable for an extended period of time or for a critical decision, their duties are performed by deputies. Deputies are listed under *Job Descriptions*.

k) The analysts read relevant parts of each yearly revision of the manual in order to be aware of the relevance of their activities to the quality of their data and other objectives of the company, as well as changes to procedures. Compliance is documented on a sign-out sheet containing, for each employee, initials and date completed.

4.1.6. Laboratory Communication

Communication regarding OOC, proficiency testing results and other quality objective information are passed from the Laboratory Director to the Lab Supervisors (and appropriate Technical Manager if a different person) and thence to analysts.

4.2. Management system

4.2.1. General model for quality assurance

For each type of analysis undertaken, Fiberquant develops a quality assurance system that is appropriate to the method, addressing at least the following:

General Quality Assurance Plan – Fiberquant Analytical Services

1. Contamination Control

1.1 housekeeping, cleaning procedures and schedules

1.2 airborne contamination monitoring

1.2.1 active sampling (air samples)

1.2.2 passive sampling (media or blanks left out during analysis)

1.3 incoming media sampling/testing

1.4 workplace sampling (wipes)

1.5 matrix or reagent blanks, if applicable, during batch analysis. For single analysis, see 1.2.2

2. Analyst Competency

2.1 analyst background consistent with quality results

2.2 analyst training program

2.3 100% re-analysis or standards until competency demonstrated

2.3.1 batch runs – 4 independent runs of CRMs

2.3.2 individual analyses - % true or % in control

2.4 precision = relative % difference in control on re-analyses, per batch, if applicable

2.5 bias = % yield in control on standards

2.6 accuracy (for qualitative tests) = & true

For 2.4-2.6, all analysts and the lab are calculated.

2.7 develop control charts for the above, as applicable

2.8 determine procedure for establishing statistically-based control limits and deetermine starting control limits

3. Method Validation

3.1 SRM, CRM analysis – at least 4 runs of 5

3.2 inter-analyst comparison

3.3 inter-lab comparison, if possible

3.4 proficiency demonstration through nation program

4. Calibrations

4.1 unless otherwise, all major equipment (pieces having serial numbers) have calibrations tracked. Calibrations are generally performed on a schedule that yields <5% variation between calibrations.

5. Proficiency and Comparison with Other Organizations

5.1 national proficiency program when available

5.2 interlab comparison at least 2x/year

5.3 analyst demonstration of proficiency at least 2x/year

6. Documentation. SOPs to be written for the above and:

6.1 instrumentation (what is suitable), maintenance, calibration

6.2 sample prep, batch make-up, if applicable

] 6.3 materials, standards, reagents required

6.4 calculations

6.5 interferences and other pitfalls

6.6 report content and generation (make sure report indicates that blanks are not used for correction)

7. Records to be maintained

7.1 major equipment, descriptions, maintenance, repair records

7.2 personnel/lab precision, bias, accuracy, corrections, education, continuing education

7.3 documents and forms used

7.4 communication with client/customers – sampling, interpretation

7.5 client/customer complaints

7.6 chain of custody, work orders

7,7 reports

7.8 calibrations

The adopted quality procedures are documented in the SOP/QA Manual (this document). The SOP/QA Manual and any separate SOPs or work practices are delivered to laboratory areas where they are likely to be needed (e.g., each analytical work room, log-in, quality control). Personnel are required to read applicable sections of the manual each year when the new version is issued. Throughout the year and between printings, staff is alerted to changes in procedures via memos.

4.2.2. Quality policy statement

It is the policy of this laboratory and the management of this laboratory to provide a consistently high standard of analytical services, and to follow good laboratory and professional practice in dealing with client/customers. The quality objectives are reviewed during the management review, annually. The purpose of this management system is to assure that this high standard of service is maintained through the implementation of calibrations and checks of analysis. Quality assurance procedures are designed generally to assure that data or information disseminated to the client/customer is not inaccurate or erroneous. Certain procedures ensure that equipment is functioning within expected parameters. Certain procedures qualify analysts as being capable of performing the techniques required of them. Certain procedures minimize conflicting data, thereby reducing the time spent clearing up discrepancies. The procedures contained in this manual are specifically designed for the analytical methods in use at Fiberquant, and have been adapted from 1) the NIOSH Manual of Analytical Methods, 4th. ed., May, 1996, 2) the NVLAP Bulk Asbestos Handbook, NISTIR 150-3, 1995, 1988, 3) the NVLAP Airborne Asbestos Analysis Program Handbook, NISTIR 150-13, 1996, 4) Asbestos-Containing Materials in Schools: Final Rule and Notice, Federal Register 52, #210 Pt.III, #40 CFR Part 763: 10/30/87, 5) Sampling and Evaluation of Airborne Asbestos Manual by Reginald Jordan, 1986, 6) the AIHA Polices, 7)) the NVLAP General Requirements Handbook, NISTIR 150-1, 1994), 8) ISO 17025 General Requirements for the Competence of Testing and Calibration Laboratories.

Since environmental analyses are performed because of concern for health, any data incorrectly reported too low may cause inaction in a toxic situation, resulting in a possible increase in risk of disease in the tested area. Conversely, any data incorrectly reported too high may cause unwarranted action, resulting in needless expense. Either of these situations may 1) diminish the perceived integrity and reputation of the analyst and laboratory in general, and/or 2) result in legal action against Fiberquant. The following procedures have therefore been designed to be industry standard quality assurance procedures, which will, if possible, circumvent the above situations.

Before performing client/customer work, newly hired personnel study and familiarize themselves with the contents of this manual, and are thereafter responsible for following the procedures herein. In adopting policies and procedures, it is Fiberquant's goal to comply with the requirements of International Standards Organization (ISO) Standard 17025. Fiberquant will also comply with the policies of the American Industrial Hygiene Association (AIHA) Laboratory Accreditation Program, the National Voluntary Laboratory Accreditation Program (NVLAP) and any other program in which we hold accreditation, as applicable to our scope of accreditation with them.

4.2.3. Developing the Management System

The management is committed to developing and implementing the quality and management system and to continually improve its effectiveness through the monthly, quarterly and annual reviews and revisions made to the system.

4.2.4. Meeting Customer Requirements

From the contents of this section of the manual, as well as other sections where goals are discusse, Fiberquant's employees are expected to realize that the lab must seek to meet customer requirements as well as statutes and regulations. Many of the procedures contained herein are designed to meet one or more of these requirements.

4.2.5. Quality Manual

The SOP/QA Manual generally includes all technical procedures utilized in the laboratory. Sone procedures may be used that are not in the manual, but, in that case, they are referenced in the manual as to location, contents, *etc*. The SOP/QA Manual numbering scheme used for chapters 4 and 5 coincides with the numbering scheme used in ISO 17025 and the NVLAP General Checklist. Succeeding chapters contain the SOPs and quality procedures for the lab.

The SOP/QA Manual is to be revised annually. The revision procedure is to 1) make non-critical notes and changes in the file named *Current SOPs* throughout the year; 2) perform the annual internal audit and management review, making additional changes as needed; 3) read through the document for non-current information, paying special attention to changes in personnel (vitae and org chart), procedures (the affected SOP) and the title page and header information; 4) print at least the following hard copies: revision (Larry), Breu, Reception, Log-in, Pb, PCM/Micro, PLM, and TEM; 5) the previous year's hardcopy SOPs are destroyed except for the revision copy, which is to be kept as a backup record to the electronic version, which is also archived in a directory of obsolete SOPs. Rename to *SOPs & year*, reserving a fresh *Current SOPs* having tracked changes to be used until the next hard copy is printed. Critical revisions between printings may be made by hand-writing (with date and initials) or by stapling a revised page into the appropriate copies in the lab.

4.2.6. TM and QA Officer responsibilities

The authority and responsibilities of the TMs and QA Officer are given in the job descriptions in Chapter 2.

4.2.7. Changes to the Management System

Changes to the management system (e.g., after audits, management reviews, manual revisions) are inevitable. Before making changes, it is necessary to consider the effect of such changes, in order to maintain the integrity of the management system. That is, how a particular change will affect other parts of the operations and management system.

4.3. Document Control

4.3.1. General

A document, for the purpose of this section, includes printed matter, electronic files including excell spreadsheets used for calculations and originals of forms, manuals, externally produced copies of methods upon which our SOPs are based, accreditation policies we must meet, regulations we must meet, and test methods that are issued to laboratory personnel, if applicable. Documents do not include data or records. Copies of controlled documents are not themselves controlled.

1) Controlled documents that exist here in hardcopy only are listed in a database called <controlled documents master list> in the LIMS.

2) Controlled documents that exist electronically are stored in a directory on the <z:\controlleddocuments\>. Sub-directories of <controlleddocuments> include "forms-word", "forms-excel", "external-documents", and an "obsolete" sub-directory for each. The <obsolete> directories contain documents that have previously been controlled, but have now been superceded. The <obsolete-uncontrolled> directory is not controlled. All documents on the controlleddocuments directory are maintained read-only by the QM.

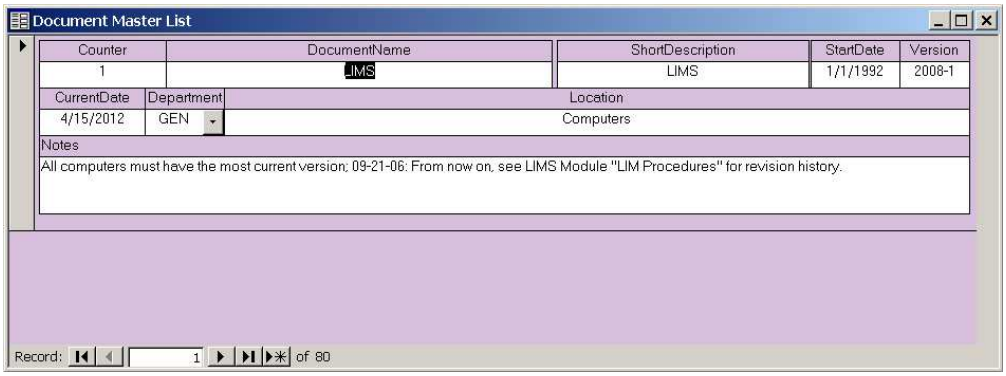
If a document exists both electronically and in hardcopy, it is the electronic version that is controlled. The hardcopy is assumed to be a copy and is not controlled.

4.3.2. Document approval and issue

4.3.2.1. Master Document List

All documents that are part of the management system are 1) reviewed by the QA Officer or other designated technical reviewer (generally the TM for the appropriate division), 2) approved to be issued to personnel

Figure 4.3.2.1 Master Document Form



(approval is indicated by initials and date), and 3) entered into the <controlled-documents> directory or entered on the *Master Document List*. The Master Document List is a computerized database in the Laboratory Information Management System (LIMS). The LIMS itself is the first document on the Master List. Master list data includes the name of the form, the use of the form, start date, revision, current date. In addition, each document on the list contains, as its last line, the file name, start date, revision number and last save date.

4.3.2.2. Handling of documents

The Lab Director, with input from the QA Officer and/or Department Supervisors/Technical Managers approves and takes authorship of documents. The QA Officer keeps approved documents and is responsible for the handling of documents. Forms, spreadsheets, external methods, drawings are kept in <//Larry/c:/controlled-documents> direcory. The SOP/QA Manual is kept in <//Larry/c:/sops>. The LIMS is at <//Larry/c:/Fqlim>. Those documents which are needed for laboratory operation (generally only one: the SOP/QA Manual) are distributed by the QA Officer to appropriate areas. When documents are revised, the QA Officer gathers the obsolete documents, replaces them with current documents, and either destroys the obsolete documents, or marks them as obsolete. The LIMS reminds the QA Officer when 11 months have passed since the last review and reprint of the SOP/QA Manual, so that he has 1 month to review and reprint.

4.3.2.3. Identification of documents

Each FQ word document or form issued is uniquely identified by a name or title at the top of form or document, and the following at the bottom of the document: 1) author initials (nominally the Laboratory Director, and for our purposes, identical to the "authorizing identity", that is, the person or title who should authorize any changes or future versions of the document), 2) the original date of the document, for our purposes, this is the date of issue, 3) current date or date of revision, 4) a file name or location, and 5) for multi-page documents, the page number and total number of pages.

Documents that do not allow the above data to be stored with their contents (.xls, .pdf files) are identified by their filename and date of storage. The authorizing authority for all electronic files is the Laboratory Director, who must authorize changes to them, and physically stores and names them. Often, a multi-page document of a method, regulation or the like, as issued by a government agency or an accredited entity, will have the above information integral to its content. If not, the end of the file is considered the end of the document. Likewise, for .xls or other format document that does not allow for normal page numbering, the document is considered to be the entire file, and the end of the file is the end of the document.

For all controlled documents having multiple versions, only the most current or the one used by the laboratory (if not the most current) will be stored in the direcories listed above. All other versions should be transferred to the appropriate file named <obsolete>. Files in obsolete folders or directories named obsolete or having obsolete in its title are for historical use only. They are not controlled, and, as such, may not be used for their original purpose in the lab.

4.3.3. Changes to documents

4.3.3.1. Approval of changes

The same approval and authorization is required for changes or revisions as for initial approval, i.e, the Lab Director, with input from the QA Officer and/or Department Supervisors/Technical Managers. The QA Officer implements the changes (*e.g*., types them into the documents).

Potential editorial changes in the SOP/QA Manual are kept as notes throughout the year between printings in a printed copy of the manual marked "Revision Copy". A working copy of the SOP/QA Manual is also stored electronically as *CurrentSOPs.doc*. The official SOP/QA Manual for the year is a change-protected document, *e.g., 2002SOPs.doc*. Changes may be made throughout the year to the current copy. Approximately once a year, all revisions are incorporated into the quality manual and a fresh copy of it and the standard operating procedures printed. It is then that all the changes are officially approved by the Lab Director.

4.3.3.2. Notification of changes

For changes in forms, .spreadsheets, and drawings, the affected personnel are notified personally or via memo.

For the SOP/QA Manual, the tracked-changes version is available electronically for personnel to be easily allerted to changes from the previous year. Occasionally, when numerous figures have been added to the manual, tracked changes creates such a mess that tracked changes for that year are available only up to the point that the many figures have been added. To ensure that every employee is up-to-date, a "Read and Understood" form is added to every copy of the manual distributed. Employees fill out a line in the form to document which chapters they have read and understood.

4.3.3.3. Amendments to documents

Personnel are notified of changes as needed during the year (but not necessarily triggering a re-printing) via printed memos as well as verbally. Only the QA/SOP Manual would need amending rather than replacing. The current QA/SOP Manual may be altered by: 1) handwritten changes bearing authorizing initials (QA Officer or TM) and a date of change, or 2) stapled in addendum, also bearing authorizing initials and date. The addendum must have the numbering (*e.g*., this section, 4.3.3.3) intact to indicate which section of the document it replaces.

4.3.3.4. Changes to electronic documents

With few exceptions, most documents are electronically stored. The Lab Director or deputy is the only person authorized to edit electronic versions of documents in those directories. Should a TM desire a revision, a copy of the section may be copy-and-pasted, then changed, or a new document typed and submitted to the QA Officer, who is solely responsible for inserting the changes and maintaining the document integrity.

Whenever a controlled document is revised or replaced (whether FQ generated or merely FQ stored): 1) it is stored electronically using an incremented name (*e.g*., *Pricelist016.doc*; the only exception is the LIMS, which must be always the same name in order to function – its version number is stored in the module named <LIMS Procedures>.) to keep it separate from the old version, and to make it obvious to anyone opening a file which is the latest version. 2) its revision number, save date, and filename are updated on the document itself, and 3) the document is stored having a read-only attribute (at this point changes can only be saved as a different filename). When there is a question as to whether a document is current, the master list may be consulted to answer the question. Alternatively, if the document is came from <//Larry/c:/controlled-documents>, the directory itself may be consulted to determine the current version. Whenever a form is needed, a new print is to be made from the electronic version, then xeroxed. Copies of copies are not to be made.

A master .mdb file is kept of the LIMS program by the LIMS specialist. When changes are made to the LIMS, the LIMS version is incremented in the module "LIMS Procedures" along with a brief list of the type of changes made for this version. An achive is made of the new .mdb file for reference in the server archive. Then a read-only .mbe file is distributed to the working computers via a batch file scheduled to periodically copy the Fqlim from <//Larry/c:/Fqlim/Fqlim.mde> to the local <c:/Fqlim>– everyone gets the current version.

4.4. Review of analysis requests, tenders and contracts

4.4.1. Review procedure

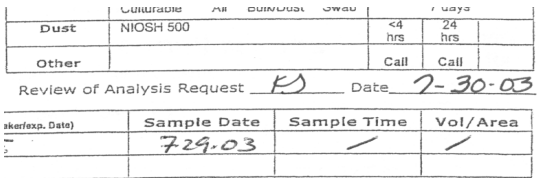
For the vast majority of Fiberquant's work, the request for work consists of an informal request for analysis upon presenting samples for analysis. Occasionally, Fiberquant engages in written contracts. For the former case, the client/customer is choosing a method (on the chain of custody (coc)) that Fiberquant already offers. The receiving person briefly checks the appearance of the samples to check that they are suitable for the type of analysis, that the sample container is not damaged, that the equipment for the requested method is not down and that the number of samples can be completed with available personnel in the turnaround time requested If the client/customer and his needs are not well known, the receiving person also makes sure that the selected analysis type is suitable for the type of sample and type of information desired by the client/customer. If the number of samples or previous sample load is such that the requested turn-around-time is unattainable, the client/customer is immediately informed and a new turn-around-time negotiated. This cursory review is documented on the coc by the initials of the receiving person. For formal contracts, the TM of the affected division and the Lab Director consult to determine the ability of the lab to meet the terms of the contract. It is assumed that the client/customer producing a written contract knows what kind of analysis they want, so that part of the review is dismissed. In this case, the signing of the contract is the documentation that the potential work has been reviewed, and copies of the documents are kept in front office

records. Any changes in the scope of work or procedures between the initial request and the contract have to be resolved before work is started.

4.4.2. Records of review of analysis requests

For routine sample submittals, the initials of the receiving person in the *review of request* blank on the coc, and the date and signature on the coc is the record of the review. For written contracts, the signature of the lab director or other authorizing signer is the record of review. Records are also maintained of discussions of major issues, such as methods, turnaround time or other game-breakers; such record may be placed in phone log, or handwritten in the notes of the work order.

Figure 4.4.2 Routine Review of Analysis Request



4.4.3. Review of work to be sub-contracted

Should any work or samples be sub-contracted to another laboratory, Fiberquant follows the usual procedures, as if the samples were being analyzed in-house.

4.4.4. Deviations from request

If there is any deviation from the analysis and conditions (*e.g.*, analysis method, analyte or micro-organism, turn-around-time) that were originally determined at submittal or by contract (oral or written), it is imperative that the client/customer be informed of the change or inability to meet the terms.

4.4.5. Amendments to contracts

If a contract needs to be amended or changed after the original review, repeat the review process in its entirety.

4.5. Sub-contracted analyses

4.5.1. Selection of a lab for sub-contracting

Usually, if Fiberquant cannot respond to a given client/customer request, referral (rather than sub-contracting) is given to a lab known to be capable of performing the analysis, and known to be respected (such as one that Larry S. Pierce has already performed an on-site assessment of). This is be the primary option. However, if Fiberquant sub-contracts any analyses, it will be to a lab that is ISO 17025 compliant and accredited to whatever scope the method requires (this would be some AIHA or NVLAP scope, or equivalent), if accreditation is required. The choice of sub-contracted lab will be qualified by 1) obtaining applicable accreditation certificates, and 2) review of the premises and/or quality assurance procedures. Since Fiberquant may take liability for the accuracy of sub-contracted analysis, such a review is not lightly taken. The above is to be documented in a file for each sub-contract lab containing the results of their review including documentation of ISO compliance and a list of any jobs that have been sub-contracted to them. The client/customer is informed prior to the sub-contracting that Fiberquant intends to sub-contract the work. To report the findings of sub-contracted analyses, Fiberquant will include the original report issued by the sub-contract lab (which naturally contains the lab identity)..

4.5.2. Client/customer notification

When analyses are to be sub-contracted, Fiberquant notifies the client/customer in advance, that their samples will be sub-contracted and to whom, and the approval (written, if possible) of the client/customer is documented on the work order for the subbed work.

4.5.3. Responsibility for results

Fiberquant accepts full responsibility for any sub-contracted results for which Fiberquant has selected the sub-contractor.

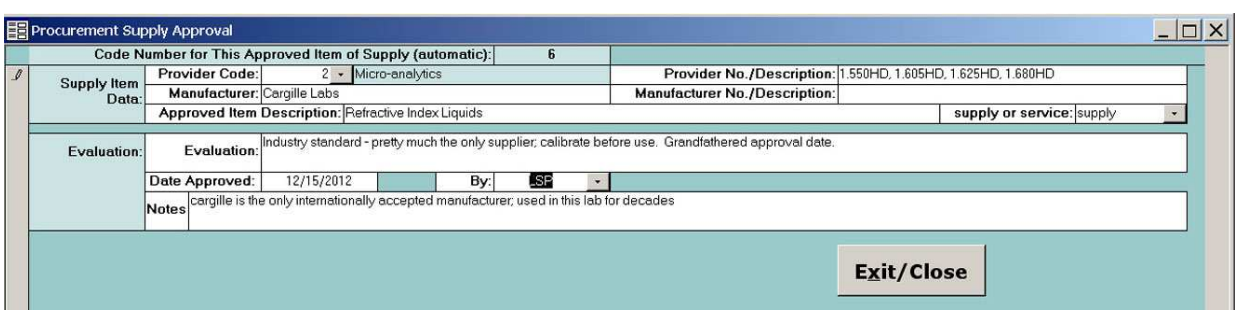
4.5.4. Registry of acceptable sub-contractors

Fiberquant maintains a file of all laboratories who have been authorized as sub-contractors, including certificates or other evidence of accreditation or ISO compliance.

4.6. Purchase of services and supplies

4.6.1. Procedures for purchasing of technical supplies and services

Figure 4.6.1.2 Approved Supply or Service Form



Non-technical supplies and services may be purchased by verbal contract with the laboratory director or deputy and the vendors. Technical supplies and services, because they may have technical requirements to be met, must be obtained throught the Procurement module of the LIMS, described as follows.

Procurement of technical supplies and services are placed in the hands of one person, the supply officer, to whom all division supervisors go to obtain services or supplies. A single person is used because of the complex web of requirements that must be met to purchase according to policies of accrediting bodies.

Figure 4.6.1.3 Purchased Supply

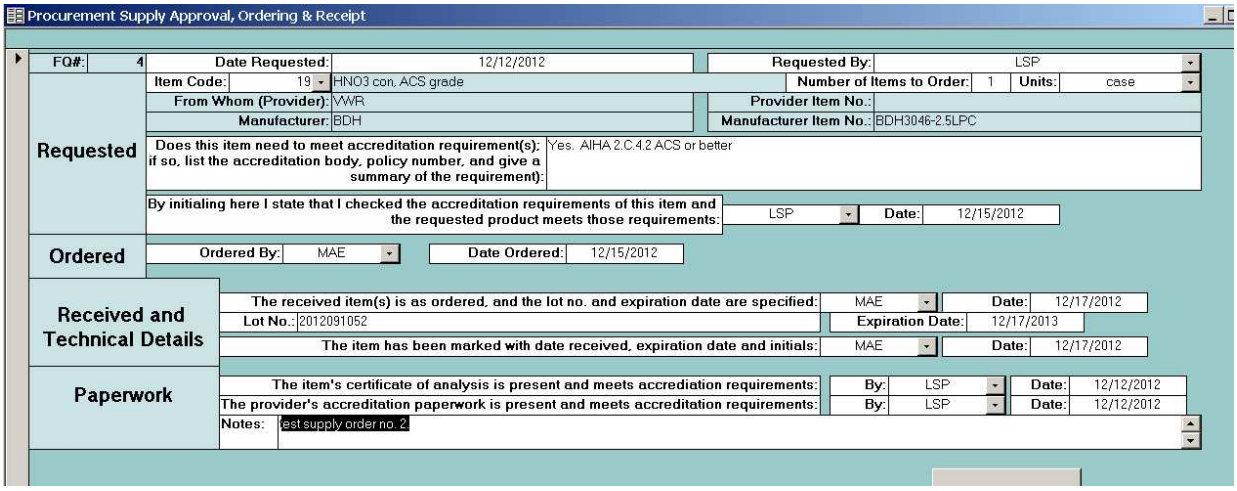
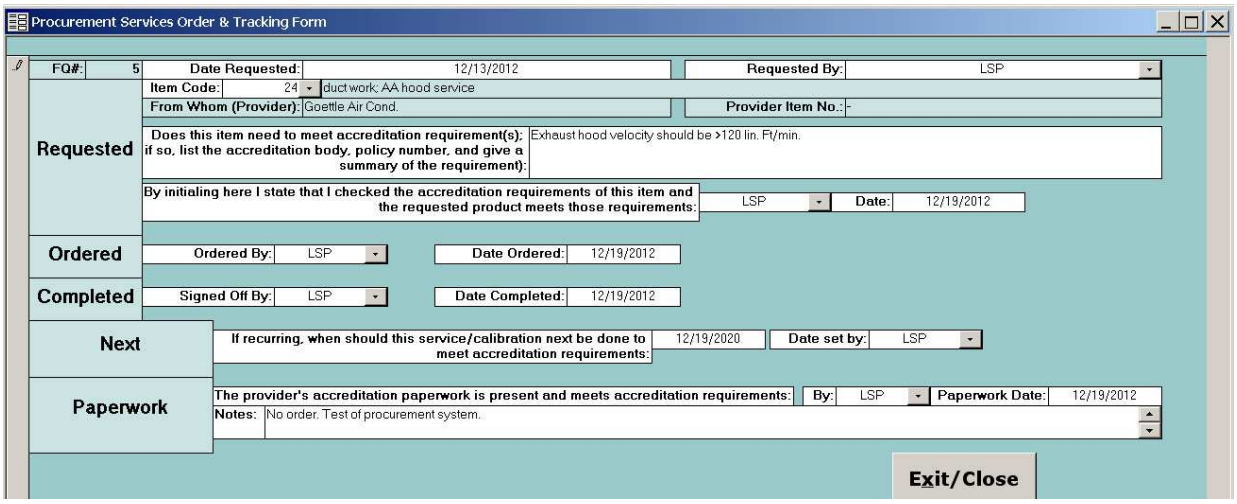


Figure 4.6.1.4 Purchased Service



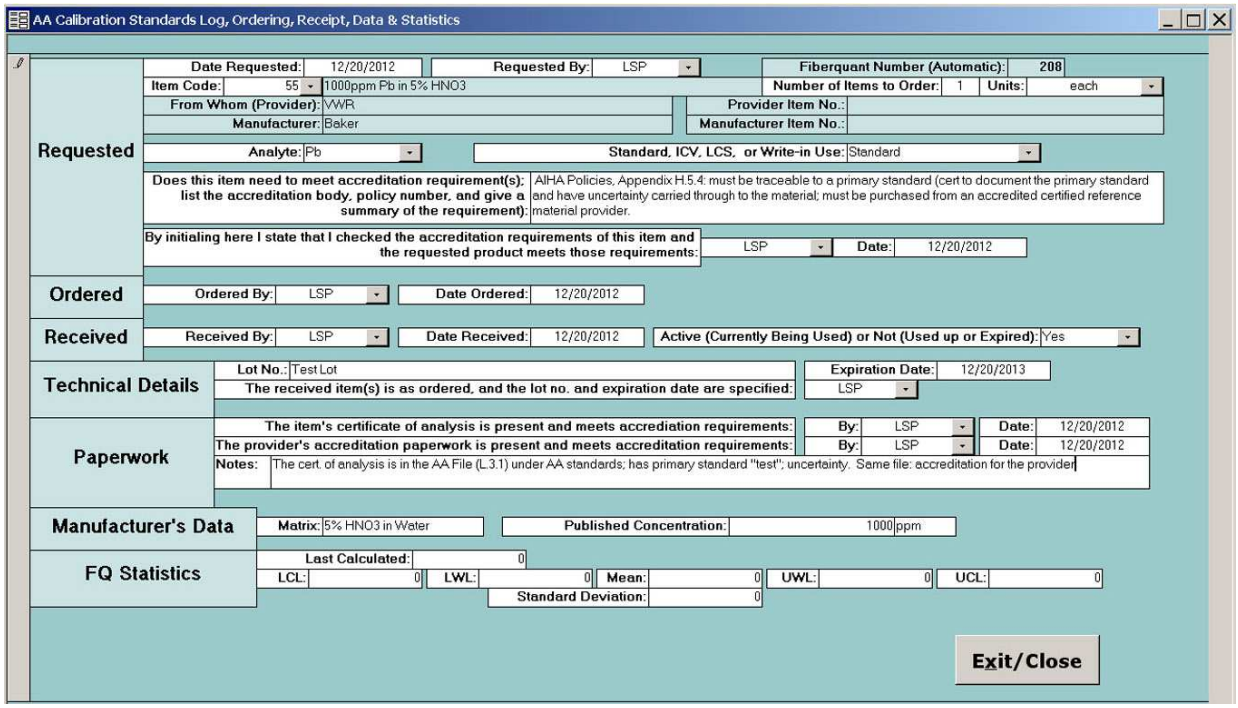
The documentation of the purchase of services and supplies is handled by the LIMS. Four nested database tables and associated forms compise the procurement module. The tables are 1) <Approved Suppliers>, 2) <Approved Supplies and Services> and one table each for 3) <Purchased Supplies> 4) <Purchased Services>, and 5) <Purchased AA Standards>. Supplies, services and AA standards could have been put into one table, but having separate tables due to backwards compatability.

Many items to be purchased must meet minimum requirements of our accreditations. Because of requirements of traceability, purchase of calibration services (balances, weights, thermometers, pipetters, stage micrometers), liquid reference materials (calibration liquids, ICV), solid reference materials (LCS), and other reference materials (cultures) are some of these. Since requirements are prone to change, accreditation policies are considered before each purchase, whether supply, service or standard. To fill out the form for a purchase, the policies to be met are summarized and signed off that, indeed, the proposed purchase meets them. Between policy changes, the data can be copied from a previous purchase, but the presence of the question at purchase in theory prevents a purchase which does not meet accreditation requirements.

Because write-ins are not allowed in the drop-down menus of vendors, supplies and services, it is not possible to enter a supply, service or AA standard to be purchased (tables 3, 4 or 5) without having first evaluated and documented the item as an approved supply or service (table 2). In turn, to enter an approved supply or service into table 2 requires that the provider of that supply or service has already been evaluated and documented as an approved supplier in table 1. This system ensures that a purchase of a supply or service cannot be made without being documentation of its suitability and the suitability of its provider.

The appearance of tables 1-4 are shown by their associated forms in Figures 4.6.1.1, 4.6.1.2, 4.6.1.3, 4.6.1.4, and 4.6.1.5.

Figure 4.6.1.5 Purchased AA Standard



That an approved product or service can only be supplied by a drop-down list of approved suppliers means that every item on the approved suppies and services list is supplied by an appropriated evaluated and documented approved vendor.

4.6.2. Inspection of supplies

Upon receipt, the supply officer inspects the supplies to determine that 1) they have not been damaged, 2) that they are the supply or material desired, 3) that they are the purity desired, and 4) whether they need calibration or are ready to be used. The purchase supply form prompts the receiver to document the above as well as obtain and store any associated certificates or accreditation paperwork.

4.6.2.1. Expiration Dates

The supply officer labels the container of all solid and liquid reagents with initials and the date received. Opened reagents get a second initial and date - the date they were opened.

If the manufacturer sets an expiration date, then this is adopted as the Fiberquant expiration date.

In the absence of a Manufacturer's expiration date, Fiberquant assigns one. For a solid reagent, this expiration date is 10 years from the date it was received. For a liquid reagent, the expiration date is 1 year from the date of receipt. If, at expiration, a product is not used up, and can be determined to be still useful, a new expiration date can be assigned.

Neither a standards nor a reagents can be used beyond its assigned expiration date – the proper order is to assign a new expiration date, then the material can be used before its expiration date.

4.6.3. Documents for Purchasing

Each record of the three tables comprising the procurement system: 1) approved vendors/suppliers, 2) approved supplies/services and 3) purchases of supplies/service contains the requirements or grade of supply need to satisfy

accreditation (and the exact accreditation policy number) that has been researched and signed off by a person authorized to do so. Inspection of the actual supply as received is documentd on the Table 3 purchase record. If a PO is required by a vendor, give them today's date verbally and notate in the Table 3 purchase record.The data in the LIMS is FQs purchasing documents; verbal p.o.s are used as needed, the p.o. number being the FQ Number automatically assigned to the applicable purchase page.

4.6.4. Approved supplies and suppliers

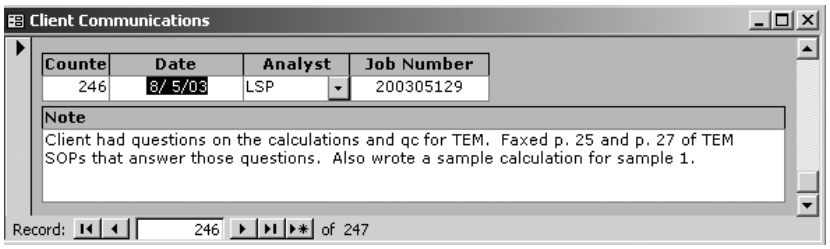
Each Fiberquant SOP lists technical supplies that would affect the quality of testing results. For each of these materials, a supplier (and possibly secondary supplier) and catalog number for the material has been entered into the procurement module of the LIMS. Before evaluation can prove that the particular vendor or matierial should be approved, data may be entered into a form in the LIMS, but leaving the <active> field as false. Evaluation differs depending on the material or service, usually a series of blanks and/or performance checks. The exact evaluation isdetermined by the division supervisor. The evaluation results are documented on the approved provider or approved supply/service form in the LIMS, after which the record is made <active>, which allows the record to be seen in the drop-down lists, and thus be used. The philisophical approval is the <date approved> field on the form, but in a mechanical sense, approval is the act of changine the <active> field from false to true.

4.7. Service to the client/customer

Client/customers are welcome to tour the laboratory, usually by prior arrangement, to see how samples are handled and analyzed.

Communication with client/customers about analysis details, methods, sampling materials, etc., is documented in the LIMS under <Utilities><Client/customer Communication>, and also on the "notes" section of the work order, if pertinent to a specific job.

Figure 4.7 Client/customer Communication Form



4.7.1. Providing Sample Media; Providing Sampling Information

Fiberquant regularly supplies PLM sample bags – some marked with the FQ logo and asbestos hazard warning, but also sometimes plain. AA wipes and centrifuge tubes are also supplied regularly, in order to ensure that wipes coming back will digest. Fiberquant also supplies small numbers of TEM, PCM and Gravimetric (double filter) cassettes. These are usually supplied on an emergency basis only, as we do not intend to get in the supply business. All personnel are authorized to distribute these materials as supplies allow. In this case, Fiberquant does not qualify the materials. It is suggested to client/customers, however, that cassettes should be qualified by the following process. Upon receipt of a lot of filters or filters in cassettes, a 1% sample (one cassette per box, or two filters per filter pack) is chosen for qualification. The chosen filters are to be counted as blanks, according to which method they are to be used, and their results compared to acceptable blank values for the method. Fiberquant supplies swabs for microbiological sampling; culture plates are supplied at a nominal cost. Zefon air cassettes are supplied at a nominal cost.

Fiberquant also supplies information about how to properly sample, contain and ship a given type of material. Sometimes this information is given verbally by an analyst trained in that area or by the Lab Director. Sampling information (or other technical information) should not be given by the office personnel for liability sake, but portions of our information circulars may be quoted by office personnel. Copies of published methods containing sampling procedures should be given to client/customers when appropriate. Also to be given to client/customers is our series of Information Circulars, which cover many aspects of sample suitability and tips for submitting samples.

Whenever such information is given, it is documented in the *Client/customer Communication* database in the *Utilities* menu of the LIMS.

4.7.2. Customer Feedback

Feedback from customers is welcomed: a sign is displayed in the reception area encouraging customers to provide feedback. Feedback, both positive and negative should be recorded in the *Client/customer Communication* database by whomever takes the call. During each year, a customer survey will be sent out, to gauge client/customer satisfaction; the results are documented in their own file and also attached to the management review for that year. Letters from customers are usually shared with the employees, either to let them know that they have done well, or to discuss responses to customer complaints. Such letters are eventually filed in the *Communications* file in Larry File Drawer 1.3.

4.8. Complaints

Complaints can be categorized as one of two types, 1) technical, *i.e.*, arising from a question about analysis results (discussed below), and 2) other complaints, which may be involve personalities, turnarounds, grounds issues, or any other issue brought up as a complaint.

Regardless of source, complaints are documented in the LIMS via the complaint form shown in Figure 4.8, which basically is a date, the person filling out the form and a memo field for explaining what the complaint was and what was done to resolve it. Each complaint is brought to the Technical Manager/Supervisor, if *technical*, and to the Lab Director, if *other*. For any complaint, the goal is to bring out and understand the issue for all sides involved, then formulate actions or compromises which will be acceptable to all. A face-to-face meeting is helpful sometimes for resolving conflict.

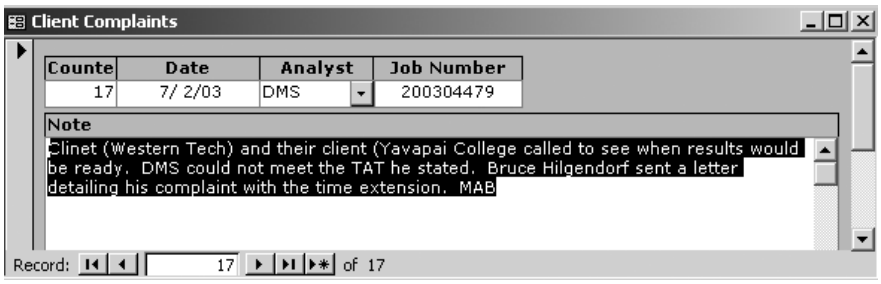
Technical complaints (the analytical type) generally are of one of two types: 1) a questionable result, e.g., another lab said …, or are you sure this result is … rather than …, is dealt with by re-analyzing the sample. Both the original analyst and at least one other should re-analyze, one being the lab supervisor; discrepancies are discussed and resolved and a definitive answer returned to the client/customer. Further analysis, such as gravimetry, may be suggested to be more definitive. If the client/customer wants more, suggest a referee lab, such as Forensic Analytical, or MVA. Throughout the process, our attitude should be "let's see what the answer is", rather than a defensive posture or. 2) a custody problem, such as mis-labeled samples or switched results are immediately rectified and an amended report issued

Things to remember in resolving a technical complaint:

- If the result of an analysis are in question, immediately offer to check or redo the analysis, to make sure that our report was not in error.

- If, after the check, the client/customer is still not satisfied with the results, invite him to view the analysis, showing him the observations that lead us to the result that we report.

Figure 4.8 Complaint Form



- If a question still remains, suggest that the samples be sent to a neutral, third party laboratory agreeable to both parties for a mediating opinion.

- At all times during a complaint or question, an attitude of " lets see what the sample contains" shouldbe maintained for good client/customer relations, rather than a defensive attitude sure to make the situation worse. Mistakes happen, and it is much better to catch one early than to insist on being right until later.

4.9. Control of non-conforming testing

4.9.1. Procedures for non-conforming work

There are two types of nonconformitynonconformity: 1) an incident where data is out-of-control, and 2) an incident where procedures have not been followed.

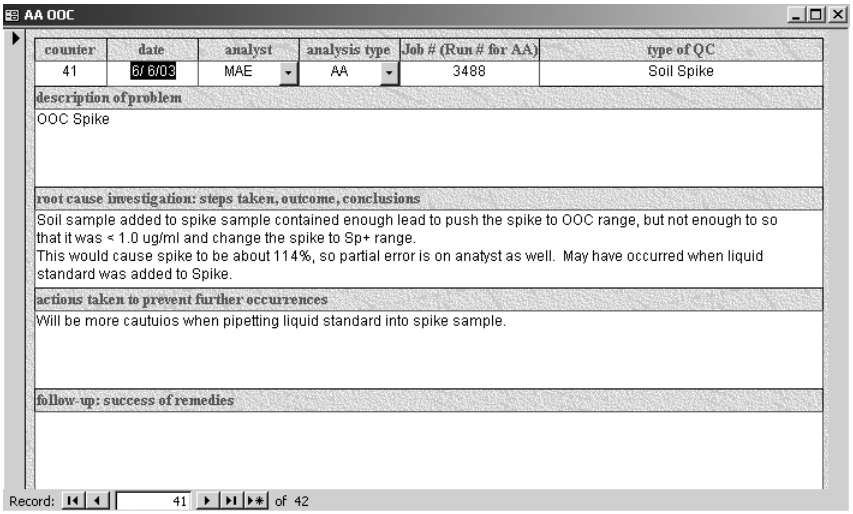
1) Control charts are used to track conformance with quality objectives for analysis parameters that are appropriate. Whether a piece of data is within or without of acceptance criteria is determined by calculations made by the LIMS, which immediately confirms that data is in control or that it is not. Analogously, whenever a external PT, internal PT or round robin sample (either for the lab or for an individual result) is outside the acceptable range for the round, it is logged as a nonconformity in the LIMS OOC Table.

2) The second kind of nonconformity is a departure from procedures or specifications, *i.e.*, personnel do not follow the SOPs, or the SOPs are wrong. This type of nonconformity would usually be spotted during an internal audit, but might also be discovered through the investigation of an out-of-control incident. For example, in a non-batch analyses, such as PCM, PLM, TEM, and microbiological analyses, QA tasks such as magnification calibration, blanks, reference analyses, and re-analyses, may be put off while busy or eventually forgotten. This type of nonconformity can only be detected by observing the analysts and by monitoring the QA results in a timely manner.

When nonconformity or and out-of-control incident is indicated by the LIMS or otherwise, the nonconfomity is addressed immediately; that type of analysis work is halted and the incident investigated before any results are reported to the client/customer. The purpose of the investigation is to find the cause of the nonconformitynonconformity.

Non-significant nonconformity: If there is indication that the OOC was random rather than systematic (*e.g.*, other control data being in control), and not likely to recur, then the nonconformity is non-significant. If possible, remedial action is taken, *e.g.*, re-analysis. If re-analysis is not possible, the data may be reported without a flag or note. Included in this category is data that is OOC at Fiberquant, yet meets minimum method requirements (such as in environmental Pb analysis, where AA data may be routinely tighter than necessary for meaningful results). If results have gone out to the client/customer prior to the finding of the OOC, and the results change as a result of the investigation or re-analyses, then the client/customer must be informed of the problem and new results immediately, and an amended report issued. Details of the incident, investigation, and resolution are placed in the LIMS database . In this case, the review or QC analyst takes responsibility for determining that the cause is random, it probably will not recur, and to resume work and release the data.

Figure 4.9.1 Out of Control Documentation



Significant nonconformity: If a systematic cause for the incident is found, or there is some reason to think that the problem will recur, then all the procedures above are performed, and, additionally, the QC Officer must be informed of the situation for further action. Generally, the further action is that the OOC investigation is broadened, and some sort of corrective action (see 4.10) is taken. The results of investigations of OOC incidents is recorded in the OOC database. The OOC database is queried for the monthly or quarterly qa reports for their review by the QA officer at the annual audit time to ascertain whether the corrective procedures have been effective.

4.9.2. Use of corrective action

For a significant nonconformity, or when the investigation of non-conforming work indicates the potential for recurrence, or that the SOPs appear to need changing in order to prevent further non-conforming work, then a corrective action (4.11) is needed.

4.10. Improvement

The ultimate purpose of quality procedures, such as the quality policy, quality objectives, audit results, analysis of data, corrective actions, preventive actions, and the management review is to improve the quality of the laboratory. This is our goal.

4.11. Corrective action

4.11.1. General

Corrective action is a procedure designed to minimize or eliminate incorrect or imprecise data or a procedural problem. Corrective action may be initiated by any of the following: 1) a nonconformity, specifically when the preliminary investigation of a problem or out-of-control incident suggests that it is anything except random error, 2) a finding/deficiency from an internal or external audit, or a management review, or 3) feedback or suggestion from staff or client/customers.

Corrective actions are documented as a continuation of the LIMS nonconformity database called <OOC>, since most corrective actions are caused by out of control (OOC) incidents. The OOC incidents there undergo a rudimentary root cause analysis, and if the problem is not random, or liable to recur, it is taken to corrective action.

Most OOC incidents are 1) differing % for PLM, 2) missing a layer for PLM, 3) AA OOC, or 4) out of range on a proficiency sample. These are usually not slated for corrective action, except when the error is consistently repeated or a problem for multiple analysts.

Any proficiency sample(s) which causes the lab to fail a PT round will go through the full corrective action procedure (as opposed to PT samples that are out of range, but do not cause a fail, which are treated as a nonconformity, and thus do not necessarily lead to corrective action).

4.11.2. Corrective Action Root Cause analysis

The first step in corrective action is to continue or further investigate to get to the root of the nonconformity or problem. Typical causes to be considered are: client/customer requests, inhomogeneity, matrix or other characteristic of the sample(s), methodology, the procedures followed, analyst skill or experience, reagent or supplies problem, equipment malfunction or calibration. The procedure is to ask "why" five times or until the question can't go any further. Example: a mouse ate the cheese in the house; why – because a mouse was in the house; why was a mouse in the house – because the door was left open; why was the door open – because the house rules were to leave the door open during the day. In this case 3 whys were the end of it, and some plan can be formulated to keep the door closed. The steps and conclusions of the root cause are documented in the OOC LIMS database.

4.11.3. Selection and implementation of corrective action

When the cause analysis has identified a systematic problem, or a problem likely to recur, then a corrective action is required to be implemented. The selection of an appropriate corrective action is up to the QA Officer and Supervisor of the method involved, and is best designed to minimize the chance of recurrence. Typical corrective actions might involve: 1) change or amplification of SOPs, 2) training or re-training, or 3) improved forms. As above, the selection and implementation of the corrective action is to be documented in the LIMS OOC database. The actions should be comensurate with the magnitude of the problem, from a minor tweak in a procedure, to a "heads up" to alert an analyst to an analytical challenge, up to and including suspending all client analyses until correction is confirmed.

4.11.4. Monitoring of corrective action

Once the corrective action has been implemented, the QA Officer monitors its effectiveness, *e.g.*, one week or month later depending on the frequency of the action, but no later than one year. Has the problem been lessened or eliminated? The result is documented in the same LIMS database as above.

4.11.5. Additional audit

If the cause analysis has found that the root of the problem is personnel's non-compliance with the laboratories policies and procedures (enough to be a threat to the viability of the laboratory), then , after the re-training or whatever corrective action was taken, the affected staff, division or analysis type can be audited between normal annual audits to ensure that policies and procedures are followed. For serious issues, an extra audit should be undertaken.

4.12. Preventive action

4.12.1. General

Any action that results in an improvement in the laboratory, in results, service to the customer, etc., that was not the the result of corrective action is, for our purposes, preventive action. The response to the annual internal audit includes a section marked "Preventive Action" for yearly review, when actions can be considered. Actions may also be suggested by trends observed in the QA Reports, which also have a summary of preventive. These items would be analogous to "suggestions for improvement" in an AIHA audit summary. Look to complaint records and audits for suggestions. Suggestions for improvement by the staff should also be considered

4.12.2. Documentation and monitoring

The QA Officer collects preventive action ideas, determines the action plan, initiates any responses and actions with financial support of management, and monitors the effectiveness of the results. These steps are documented on the LIMS form <Preventive Action>. A summary of current preventive actions is given (repeated) in each of the quarterly reports for PCM, PLM, AA, and Micro.

4.13. Control of records

4.13.1. General

4.13.1.1. Record procedures

Records are kept of all analyses, quality assurance procedures, and correspondence referring to analyses. Paper records are compiled and transferred to record storage as soon as practical after the analyses and report are completed. The log-in, data, and results records are stored in the LIMS, and so do not have to be compiled or transferred to storage. Exceptions that do need to be transferred or otherwise stored include: 1) work orders and cocs – current year's are stored in filing cabinets in the records hallway; other years stored on the high shelves in the storage bay, 2) correspondence, printed methods, all paper quality records (such as audits, personnel records, client/customer communications, complaints, equipment field repair records, and technical records not in the LIMS– are assigned a file folder and stored in the filing cabinets in the Lab Director's office. LIMS records are indexed by the MS Access program, and data can be accessed in many different ways. The work orders/cocs are indexed by their Fiberquant job number. Miscellaneous hard copy technical records are stored with their work orders. Every report is stored on the server hard drive in .pdf format, taking the place of hard copies. Fiberquant keeps cardboard file drawers for such records, which keeps them in retrievable order and in good shape until such time that they are disposed. Technical records are disposed of along with normal lab waste.

4.13.1.2. Retention procedure

Old records are stored in a cooled bay, protected from moisture, excessive heat, etc. that might cause them to become illegible or unreadable. Electronic records are stored in multiple locations, some off site, to prevent loss of data.

Record	**Minimum Retention Time**
Analytical data, qc data, qa data, calibrations, test reports	5 years or 30 data points, whichever is lesser
Personnel files/data, training files, proficiency records	While employed + 4 years
Training files	While employed + 4 years
Ledger, Minutes, Corporation Records	Permanent
Equipment records	While <active> in use + 3 years
Bank Statements, cancelled checks, tax records, invoices, sales	7 years
401k records	Permanent
Contracts	While in force + 7 years
Correspondance, memos, non-spam email	The same as the subject(s), data, documents to which they refer
Insurance Policies	While in force + 10 years
Payroll	While employed + 4 years
NVLAP related	3 years
AIHA related	5 years
NLLAP related	10 years

If the company stops doing business, it is the responsibility of the Laboratory Director to arrange the storage of the company records for the requisite length of time.

4.13.1.3. Security

Access to documents or records is limited to Fiberquant personnel. Some records are to be viewed by external assessors. The contents are subject to client/customer confidentially policy.

4.13.1.4. Electronic security

Back-ups: Electronic archives consist of a copy of the data file along with a copy of the LIMS program that can be used to access that data. Both must be stored because future modifications may make older data inaccessible. An archive is produced approximately every 6 months, after which older (paid for) jobs and their associated data are purged from the current data file. This is necessary since much old data slows the manipulation of new data. Archives are stored on a different hard drive than the current data, and also are burned onto CD ROM. Backups of the data file are made 1) several times a day to another hard drive on the network, 2) once a day to a CD writer on Larry's computer; 3) once every 6 months to a CD taken home by Larry. In addition, an off-site backup is made via external hard drive approximately every quarter.

Access to computer records: Each employee has a password for computer operations. The passwords are stored in a paper file, and are also (obviously) stored by the LIMS. These passwords are required to: 1) log on to a computer at all, 2) recover from the screen savers, and 3) print reports. The first two of these are standard features of the software, the last is specific to the LIMS. Each report is "signed" by an analyst who takes responsibility for the content of the report. Their signature is released for use on the report by their password. Should a report be altered at a later date, the same or another analyst would have to "re-sign" to again take responsibility. LIMS security is enhanced by building security, which is a Sonitrol system which uses its own password system.

4.13.2. Technical records

4.13.2.1. Data records

The technical data recording system (either paper or electronic) that contains information about observations, data, calibration, conditions, etc. attempts to store enough information to know how the data was gathered, and, if desired, to be able to repeat the test as close to the original as practically possible. The records include the 1) person and date of sampling, analyzing, and checking of results, as applicable, 2) the results and documentation of any QA procedures, 3) the data logged in the LIMS, work sheets, notes, reports, client/customer-supplied papers, calibrations, re-analysis sheets, feedback. Whenever possible, the original data (rather than derived or calculated values) is recorded. The retention time is at least 5 years.

For hard-copy data outside the LIMS, an indelible pen is to be used, not a pencil or erasable ink. The idea in records is to have all records, even those that have been changed, but to know when and by whom each record has been changed (see Changing of data).

4.13.2.2. Timing

Observations, data and calculations, whenever possible, are recorded at the time they are made, and recorded on the work sheet or LIMS page corresponding to the job.

4.13.2.3. Changing of data

When changes are made to hard-copy written data, the original is crossed out with a single strike-through (so that the original may still be legible). Correction fluid or tape is not be be used by FQ staff (client/customers may prefer to use correction tape, but that is their call). Such a struck-through change is initialed and dated by the person making the change. LIMS data is locked by the original analyst. When unlocked, the LIMS keeps track of the date of last change, and the person who changed it, since they must re-sign the report.

4.14. Internal audits

4.14.1. General

At least once each year, a management system audit/quality manual update is undertaken. The exact timing is controlled by the LIMS. Sections of the audit can be done separately, as long as all sections are done each year. The goal of the audit/update is to 1) compare the procedures currently being performed in the lab, determine whether they are fulfilling the function they are designed for, 2) compare current policies to accreditation program requirements, and 3) make sure that the quality manual reflects current procedures. Since the SOP/QA Manual contains all SOPs, the SOPs are also updated annually. Results of audits are stored in a file "QA Audits" in Larry Technical File Drawer 1-3.

The audit is done by the QA Officer or his assignee. The parts of the audit include: 1) Accreditation Checklists. Use two the AIHA Assessor checklist (**Note:** the AIHA checklist changes yearly, so a new one must be asked for from AIHA staff before the audit can start), and the NVLAP Specific Operations Checklists for PLM and TEM. Their use ensures that each requirement is on the audit. 2) In addition, the When a non-conformity is found, it is input into the non-conformities system, as any other non-conformity. Hardcopies of the completed non-conformity records are to be added to the end of the checklists. In addition, a narrative report from the audit is added to the front of the audit paperwork , the general form of which can be found in <z:/controlleddocuments/forms word/Annual Audit Narrative.Template.doc>.

Quarterly (monthly for TEM and PLM) QA Reports are also made (see section 13), which provide some auditing of QA objectives in between the yearly audits.

4.14.2. Corrective actions from audit

When a non-conformity is revealed by the audit, a non-conformance form , and, if warrented, a corrective action (see 4.10) is initiated. The results of the action will be referenced (non-conformity FQ#) on the response page (form) at the end of the audit. The corrective action is designed and initiated by the QA Officer, and reviewed by management, as normal. If the gap or problem revealed by the audit has significantly affected the validity of data, the affected client/customers are to be notified immediately by the QA Officer of the fact, analysis stopped until remedied, etc. as with any corrective action.

4.14.3. Documentation

The documentation from an audit consists of the audit checklist, non-conformity list, short responses, action items, and follow-up monitoring of the action items. At a minimum, each non-conformity is documented by non-conformity FQ# and a short summary on the audit's non-conformity list. Full documentation of root cause, action items, and follow-up is in the non-conformance records in the LIMS.

4.14.4. Follow-up

The effectiveness of corrective action arising from an audit is monitored and documented on its non-conformity form in LIMS, as any other corrective action.

4.14.5. Sharing with Employees

If appropriate, any or all of an audit or findings should be shared with appropriate personnel, e.g., to explain a corrective or preventive action.

4.15. Management reviews

4.15.1. General

Each year, as the final part of the internal audit, the management (namely the lab director and the president of the corporation) undertakes a review of overall laboratory performance, including policies, procedures, QA reports, internal and external audits, corrective actions, preventative actions, interlaboratory samples, proficiency tests, client/customer complaints, and recommendations for improvement. Additional non-conformities to those from the

audit may be enumerated during the management review, in which case, the normal non-conformity procedure is initiated. The management review considers all the non-conformities since the last review, hopefully to indicate where improvement is needed. The end result of the review is a list of problems (usually non-conformities or groups of non-conformities) and responses to the problems. Management responses have to take into account quality objectives, available manpower and resources, *etc*. A response may or may not include an action item. If action is required, the action is to be detailed in the response (or refer to a non-conformity FQ#), along with Xerox copy, data, or other documentation of completion of the action item. Another object of the management review is to assess training or re-training needs, if these have not already been addressed by other corrective actions. If appropriate, findings will be shared with personnel. The main documentation of the Management Review consists of an outline attached to that year's annual audit. The outline references relevant non-conformity FQ#s.

4.15.2. Documentation

The outline, any response summaries, and results of actions are stored along with the audit in the File 1-3 "General Lab Records" under Annual Audits File Drawer.

5. TECHNICAL POLICIES

5.1. Choosing methods and procedures

Methods and procedures are chosen or developed for use which provide accuracy, precision and reliability. When choosing or developing a particular method, choosing or training personnel for the method, or choosing equipment and calibration procedures for the method, the following factors are considered: 1) personnel, 2) facilities, 3) method validation, 4) equipment, 5) traceability, 6) sampling, and 7 handling requirements.

5.2. Personnel

5.2.1. Competence for tasks

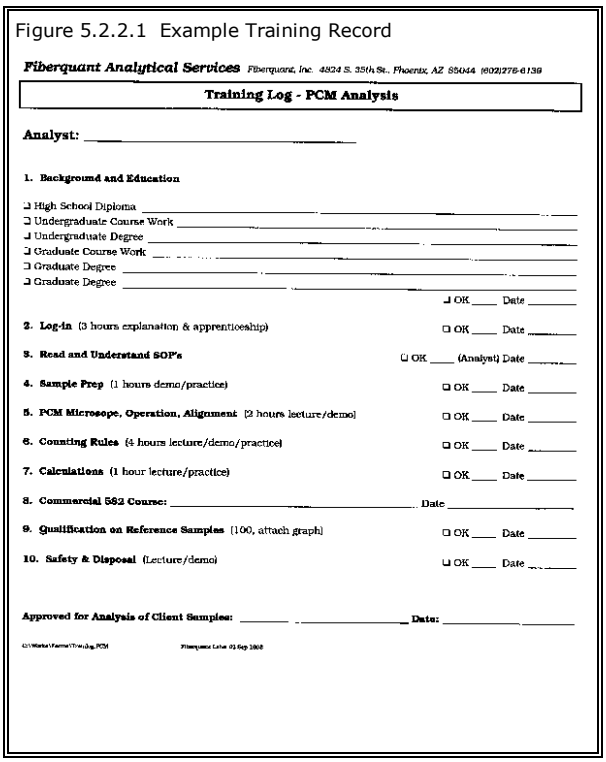
Fiberquant ensures that persons are competent to perform the duties assigned to them by participation in the QC system, including review of personnel performance. Opinions and/or interpretations are not generally given; to do so takes on liabilites the company is not eager to assume. If they are given in addition to testing results, the persons expressing need to have the knowledge and experience to do so, namely the Lab Director or Acting Lab Director. Specifically, employee competence is ensured by 1) the background and previous experience of the employee, 2)

training specific to the assigned tasks, and 3) quality assurance checks. In cases in which certification or external training is required by law to perform certain tests (*e.g.*, Pb Inspection, asbestos inspection), Fiberquant personnel performing those tests must maintain that certification; the certificate or other documentation is placed into their personnel file).

5.2.2. Training programs

The analysis of the types of samples Fiberquant receives requires extensive training, not only to ensure that the analyses are satisfactorily performed, but also to ensure that the analysts are not exposed to excessive hazards during the analysis. Therefore, safety training as well as procedural training is presented at Fiberquant. Below is given the basic outline of training for each type of analysis; more specific duration, outlines, etc. are given on the Training Checklists, which are specific for each type. An example of a training checklist is shown in Figure 1. In preparing a training log, Fiberquant (and AIHA) requires all analysts to have undergo training over at least 20 business days before being approved for client/customer samples. Each analyst going through a training process has his or her training documented by filling out the appropriate checklist. The effectiveness of training is monitored via reference samples performance.

Figure 5.2.2.1 Example Training Record



Fiberquant Analytical Services Fiberquant, Inc. 4924 S. 35th St., Phoenix, AZ 85044 (602)276-6139

Training Log - PCM Analysis

Analyst: _____

1. Background and Education

❑ High School Diploma _____
❑ Undergraduate Course Work _____
❑ Undergraduate Degree _____
❑ Graduate Course Work _____
❑ Graduate Degree _____
❑ Graduate Degree _____

❑ OK ____ Date _____

2. Log-in (3 hours explanation & apprenticeship) ❑ OK ____ Date _____

3. Read and Understand SOP's ❑ OK ____ (Analyst) Date _____

4. Sample Prep (1 hours demo/practice) ❑ OK ____ Date _____

5. PCM Microscope, Operation, Alignment [2 hours lecture/demo] ❑ OK ____ Date _____

6. Counting Rules (4 hours lecture/demo/practice) ❑ OK ____ Date _____

7. Calculations (1 hour lecture/practice) ❑ OK ____ Date _____

8. Commercial 582 Course: _____ Date _____

9. Qualification on Reference Samples [100, attach graph] ❑ OK ____ Date _____

10. Safety & Disposal (Lecture/demo) ❑ OK ____ Date _____

Approved for Analysis of Client Samples: _____ **Date:** _____

5.2.2.1. Procedural Training for PCM Analysts

Prerequisites

-High school diploma, college level course work in science (degree preferred)

Training

-attendance and certification from an accredited NIOSH 582 or 582 Equivalent course (Sampling and Analysis of Airborne Asbestos Samples), but no such courses are available any more. If a 582 Equivalent Course is used, then the curriculum for that course is stored in the personnel file along with the certificate of completion.

-one-day or more of familiarization with Fiberquant SOP for receiving samples and PCM sample prep and analysis

-follow-up deficiency training as required

Qualification

-100 counts of reference samples (10 counts each of 10) for which 95% are within 2s of the lab or reference value, and yielding a CV vs. load curve approximately the equal of the lab CV vs. load.

-continuing qualification through routine recounts, interlab samples and proficiency samples

5.2.2.2. Procedural Training for PLM Analysts

Prerequisites

-B.A. or B.S. in science, geology or geochemistry preferred

Training

-5-day intensive commercial course in polarized light microscopy (Crutcher, Seattle or McCrone, Chicago, or equivalent), or , for analysts already possessing formal college training in PLM, optical mineralogy and petrology, an in-house 5-day training program, including the topics:

-review of mineralogy, crystallography and asbestos minerals

-review of PLM and PLM scope, adjustments and alignment study of asbestos standards, comparing optical properties -study of asbestos fiber interferences

-optical dispersion staining theory and practice

-orientation and review of Fiberquant SOP for receipt and analysis of PLM samples

For in-house training and qualification, notes should be kept which detail the specific training received on specific dates for each trainee.

Qualification

-successful analysis of 20-40 Fiberquant reference samples, RTI round robin samples and NVLAP proficiency samples

-100% re-analysis of at least the first 100 samples

-25% re-analysis of at least the second 100 samples (PLM supervisor to decide when the & of re-analysis is lowered.

-continuing qualification through qualitative and quantitative standards, replicate and duplicate analyses, interlab samples and proficiency samples

5.2.2.3. Procedural Training for TEM Analysts

Prerequisites

-B.S. or B.A. in science, geology, mineralogy or previous TEM experience preferred

Training

-5-day course in TEM operation and 5-day course in TEM analysis of asbestos, or equivalent experience

-~2 month apprenticeship in TEM analysis at Fiberquant, including the topics:

Fiberquant SOP for receiving, sample prep and analysis

TEM operation and alignment

review of crystallography

ED theory, ED patterns of asbestos species and interference species

EDS theory and operation

TEM calibrations

Sample prep procedures, problems and solutions

analysis of asbestos standards

As for PLM, in-house training should be documented with specific topics, dates and times.

Qualification

-continuing counts of SRM 8410 until the latest 5 are shown to be statistically equivalent to published level

-100% recount for first 20 samples

-continuing qualification through verified analyses, replicate counts, duplicate counts, count of SRM 8410, interlab samples and proficiency samples, and verification of EDS and ED calls

5.2.2.4. Procedural Training for AA Analysts and AA Technicians

Prerequisites

-B.A. or B.S. in science, chemistry preferred, or college course work in chemistry and lab experience.

Training

-5 days training (not necessarily consecutive)

Flame AA theory

Current AA controls & operation

Paint and Soil specimen prep

Filter and Wipe specimen prep

Calibrations and calculations

Safety

Qualification

-Successful analysis of NIST SRMs and FQ reference materials

-Apprenticeship for 5 runs

-EPA qualification 4 runs of at least 5 known samples, the known sample loading to vary and to be typical of the sample range of analyte; answers to be within 10% of known value at least 75% of the time.

-continuing qualification every 6 months >5 smps each matrix & through blanks, spikes & repeat analyses.

5.2.2.5. Procedural Training for Portable XRF Operators

Prerequisites

-college course work in science

Training

-manufacturer's or manufacturer's equivalent course

-1 day radiation safety course

-1 day operation & practice with machine

-familiarization with sops

Qualification

-EPA certification through course and test

5.2.2.6. Procedural Training for Mycology Analyst

Prerequisites

-B.A. or B.S. in science, microbiology, or mycology, or biology preferred, or college course work in mycology and lab experience.

Training

-5 days training (not necessarily consecutive) or McCrone course or equivalent in fungal identification, including

Microscope construction, alignment, maintenance

Fungal Taxonomy

Sample and reagent prep

Counting technique

Calibrations and calculations

Safety

Qualification

-Successful analysis of at least 20 cultured reference standards, successful analysis of counting (spore trap) standards when they become available

- 6-months apprenticeship with qualified analysts; strain by strain and SPCT track by track comparison

-continuing qualification through bi-weekly cultured references, weekly flash cards, proficiency tests and round robins

5.2.2.7. Procedural Training for Mycology Technician

Prerequisites

-B.A. or B.S., science preferred, or college course work in mycology and lab experience.

Training

-5 days training (not necessarily consecutive) or McCrone course or equivalent in fungal identification, including

Microscope construction, alignment, maintenance

Fungus Taxonomy

Sample and reagent prep

Counting technique

Calibrations and calculations

Safety

Qualification

- for technician tasks, apprenticeship until Technical Manager signs off training task

- for spore counting, 12-months apprenticeship with qualified analysts; track by track comparisons and checking of counts; performing the recounts for other spore counters

-continuing qualification through flash cards, proficiency tests and round robins

5.2.2.8. Safety Training

All full and part-time employees are given an 8-hr hazard awareness training seminar, and also sign out, read and pass a test on our Chemical Hygiene Plan. The plan itself, and the results of employee training are kept in the safety records by the safety officer. It is up to the safety officer to keep abreast of all new chemicals and other hazards that arrive in the laboratory, and to update the safety plan accordingly.

5.2.2.9. Demonstration of Analyst Competence

Per AIHA policy, analysts performing industrial hygiene program or lead program analyses are required to demonstrate proficiency approximately every 6 months. For PCM, all analysts count the quarterly AIHA PAT samples and are expected to achieve acceptable results. For PLM, all analysts analyze the quarterly AIHA PAT samples and the twice yearly NVLAP proficiency samples, and are expected to achieve acceptable results. For TEM, all analysts participate in the NVLAP proficiency tests. For mycology, all analysts are to participate in the appropriate AIHA proficiency test. For gravimetry, there are no proficiency programs available. Since all gravimetry analysts are also lead program analysts, the successful participation in the quarterly ELPAT paint and soil samples (which involve weighing as an integral step) is considered demonstration of weighing competence. The above activities are documented in their various LIMS databases. For the lead program, demonstration of competence is through ELPAT, or a run of client/customer samples including QC, and is documented in its own demonstration of competence database in the LIMS.

5.2.2.10. On-going Training Needs

The need for on-going training, whether remedial (*e.g.*, as a corrective action), or as a routine brush-up, is determined by the technical manager of the division. To determine the type and extent of re-training, the TM considers information from: the annual management review, QA Reports and the trends indicated by the quality control charts within them, the prevalence of out-of-control incidents, client/customer complaints, the adoption of new procedures or whether the current procedures have been changed or updated.

5.2.3. Temporary personnel

All persons performing analyses for Fiberquant are employed by or under contract to Fiberquant. Before using contracted or temporary personnel, the Lab Director determines that their background and training is such that they should be competent to perform the duties they are assigned. Extra supervision is needed for temporary personnel, just as would be for new permanent personnel.

5.2.4. Job descriptions

Each job to be performed at Fiberquant has a job description that spells out the prerequisite experience, training, responsibilities, and management tasks of the job. One person may fulfill multiple job descriptions, just as multiple persons may perform one job. The current job descriptions are given in section 2.

5.2.5. Technical personnel files and job authorization

The ultimate goal of employee training is that the employee be authorized to perform a job or specific tasks. The training form for each field of testing documents the date that the employee is authorized to perform (*e.g.*, to analyze with 100% re-test; to analyze with 25% re-test; to analyze with 10% re-test). The employee may be authorized to perform every task on the form or only specific tasks, as indicated by the sign-offs. If the employee has a complete training form for a given job description, they are authorized to perform any task related to that job description (*e.g.*, log-in samples, prepare samples for analysis, analyze, interpret results, perform reviews of that job type, perform the QA/QC functions related to that job, sign reports, give technical information related to the analysis to the client/customer). No-one at Fiberquant in authorized to give opinions about potential hazards, methods of remediation, or other consulting services. A second type of authorization to use specific equipment is documented separately (see 5.5.3).

A technical personnel file is kept for each employee, including temporary or part time employees, that includes 1) the person's title and job description(s), 2) a resume or description of background, 3) records of training, 4) results of quality assurance activities, such as precision and accuracy summaries, proficiency testing, etc., and 5) deficiency corrections. These technical files are in two locations. The LIMS stores items 1, 4 and 5, whereas items 2 and 3 are paper records and reside in the technical files in the Lab Director's office.

5.3. Accommodation and environmental conditions

5.3.1. Maintenance of suitable conditions

Each SOP lists any environmental conditions (e.g., lighting, temperature) that would invalidate or adversely affect the test results. When performing that SOP, such adverse conditions are avoided. Where conditions may invalidate a method, generally the LIMS bench sheet documents the actual environmental condition during analysis (*e.g.*, temperature during PLM analysis).

In the laboratory, potentially harmful items – compressed gases, chemicals, samples, waste, glassware, standards – are stored in a manner to prevent injury – compressed gases are chained (as per government regulation), , hazardous chemicals, samples or waste is contained (sealed plastic bag, marked cupboard or drawer) in an

appropriate way. Work surfaces are chosen to be non-porous (and therefore not capable of holding potentially hazardous materials). The lunch area is downstairs and separated from laboratory space. Food is not allowed in the laboratory. Drink is to be left outside at the shelf or area provided. Smoking is not permited in the building.

It is a goal of the laboratory management that no employee or customer ever be exposed to a condition or chemical that is hazardous. OSHA 29 CFR 1910.1450 should be followed to establish safety procedures and exposure limits for chemicals. Other information may come from the EPA Good Laboratory Practice Standards.

Specific procedures pertinent to safety and emergencies are to be found in the Chemical Hygiene Plan, maintained by the Safety Officer.

5.3.2. Monitoring of conditions

Those critical environmental conditions listed as invalid in the SOPs are monitored and documented to be suitable. Tests are immediately stopped (or accounted for, *e.g.*, correcting refractive indicies in PLM) if environmental conditions are found to be not suitable. Examples of monitored conditions at Fiberquant include 1) biological sterility in the incubators, monitored by negative controls for each client/customer batch/day, and for each batch of agar produced and documented in the LIMS, 2) biological activity, monitored by positive controls for each client/customer batch/day and for each batch of agar produced and documented in the LIMS, and 3) temperature in each laboratory. Acceptable limits are given in the QA section of the SOPs for those methods. The AA and Micro departments document using paper records; the PLM/PCM department temperature is documented on the microscope alignment form. Types of conditions to be considered for future analyses are dust, electro-magnetic disturbances, radiation, humidity, electrical supply, temperature, sound, and vibration.

5.3.3. Separation of incompatible activities

Where the conditions of one type of analysis or area are incompatible with those of another, effective separation (e.g., separate room, separate air supply) is made. For example, the air supply of the bulk PLM lab is separate from that of the TEM prep lab.

5.3.4. Laboratory access

Access to laboratory areas is limited to employees having business in those areas. Non-employees do not have access to any laboratory area except as accompanied by an employee, such as during a tour or demonstration. Certain doors are designed so that they can remain closed so as to limit casual entry.

5.3.5. Housekeeping

The lab is cleaned professionally once per week. That cleaning is limited to non-counter or laboratory space. Each analyst is responsible for maintaining clean conditions in their space. Cleaning may consist of dusting, wet-wiping, sterilization with bleach, etc. Specific procedures for each analysis type are contained in the SOPs, as well as any monitoring (*e.g.*, air or wipe samples) and documentation of cleanliness.

5.4. Test and calibration methods and method validation

5.4.1. General

Following are general guidelines for choosing, modifying, documenting and validating the analytical methods used at Fiberquant.

Each method has its own SOP or WI (Work Instruction), which may be divided into parts (e.g., digestion and analysis for AA). The SOP/WI may follow a published method closely, or may be a modification of a published method, or may be an new method. The SOP/WI will address title, scope (analyte and matrix), definitions, principle or summary including type of item to be tested and parameters to be determined, symbols and units, reagents, and reference materials, apparatus, sampling (if appropriate), handling, environmental conditions, transport, safety, , storage, preparation, analysis, calculations, performance characteristics, reporting, quality control and quality assurance, estimate of uncertainty, and disposal. The SOP/WIs are 1) read and understood by the personnel before performing them, and 2) accessible in the laboratory where the procedures are being performed (see 4.3). Instructions for equipment (if not already contained in the SOPs) are also readily accessible near the laboratory where the equipment is being used.

5.4.2. Selection of methods

Generally, Fiberquant uses the analytical method or SOP specified by the client/customer on our chain-of-custody (coc)/analysis request. If an analytical method is not specified, then, whenever possible, Fiberquant chooses for the client/customer an internal SOP that we commonly perform (if possible) based on established, published or standard methods of analysis, such as those developed by NIOSH, ASTM, or EPA. Fiberquant does not used such methods directly, but uses each to develop an SOP that includes the procedures of the standard method - possibly modified for expedient use at Fiberquant with Fiberquant's equipment and Fiberquant's personnel. For each standard method so used as a basis for an SOP(s), the SOP(s) will be updated every time that the underlying standard method is updated. Therefore, it is imperative that Fiberquant obtain and store (as a controlled document) the most current version of each standard method upon which an SOP(s) is based.

The client/customer's choice of method for a job is reviewed, based on the apparent or discussed needs of the client/customer, and also taking into account the limitations of the methods. The client/customer agrees to the choice of method during sample drop-off (*i.e.*, they are forced to choose one of our stock methods) by witnessing the checking of a method box on our coc form. If the client/customer is not present during sample receipt (samples shipped), and a method is not specified, then the client/customer must be contacted in order to know what they want analyzed and to agree to a method or SOP. If the client/customer has specified a method that is inappropriate, then a qualified and knowledgeable officer or analyst must contact the client/customer to obtain agreement to an alternative method that is more appropriate. If the available choices of method do not precisely fit the needs of the client/customer, the client/customer is made aware of that fact before any analysis begins, to allow them to send it elsewhere. When a method other than the method specified by the client/customer is to be used, the client/customer has to be informed before analysis, likewise to give them the alternative to send it elsewhere. When a method other than published or standard methods is to be employed, the client/customer has to be aware of it, having discussed it at some time before analysis. In this case of non-standard method, the full procedure to be followed is included in the report (as normal). Any non-standard method to be used is subject to our method adoption procedures.

5.4.3. Laboratory-developed methods and SOPs

The introduction of new types of analysis, new methods or SOPs is supervised and controlled by the Laboratory Director. Before a new procedure can be used by analysts, it must be planned (as a desirable and profitable function of the lab – not as a hurried response to a submitted job), developed into an SOP(s) by one or more analysts or officers having the time, knowledge and equipment to adequately test the procedure, and thoroughly tested via verification or validation (see 5.4.5).

5.4.4. Non-standard methods

When necessary to perform methods that are not published methods, or modifications of published methods, SOPs are to be developed, covering the same topics listed in 5.4.1 above.

5.4.5. Validation of methods

5.4.5.1. Definition

For our purposes, there are two procedures related to validation: 1) performance verification and 2) full method validation. Performance verification is to be used for a minor change(s) in published method or previous SOP. Full validation is to be used for major change(s) to a published method or previous SOP, or for a procedure that is novel (not based on a published or previously used method.

Examples of a minor change would be: 1) altering the procedure (temperature, solvent or acid mix) of a step intended to go to completion, 2) altering quantity or types of QA, 3) altering the magnification or optical set-up of a microscopical method, or 4) any change which would not be expected to alter the detection limit, or range of use. A major change would be any but a minor change. Another way of looking at it is that the performance check is used when the results of the check are not expected to change between the old and new method. In this sense, if a performance check indicates there is a difference, then a full validation is warrented.

5.4.5.2. Performance verification procedures

The performance verification is designed to confirm that the improved or changed method produces results identical to (within statistical limits) the old method.

The training runs for environmental Pb serve as an example of a verification: independent (not in the same batch) runs consisting of four known samples plus qc. For extremely minor changes, a single such run would be sufficient, whereas, usually, the set of four independent runs should be done. The materials used for the runs should be (from most desirable to least desirable) 1) standard reference materials (SRM), 2) certified reference materials (CRM), 3) consensus standards, 4) samples analyzed by a different method, 5) inter-laboratory samples. The verification runs should be performed on more than one occasion on more than one day, on a variety of analyte or micro-organism levels and matrices, if applicable. The previously established or published acceptance limits should be used to evaluate the results, which should confirm that the altered procedure has statistically acceptable results. The change, the check runs and the results are stapled together, dated and stored in hardcopy in the Larry 1-3 file draw under the "Method Validation" folder.

5.4.5.3. Validation procedures

Major changes to methods are required to be validated. Validation includes the above performance check runs, but also covers other topics. Many validation schemes may be found by searching the internet, and any coming from a respected source may be used. AIHA policies require the following topics to be covered: minimum acceptance criteria, analyte specificity, linearity, range, accuracy, precision, detection limit, quantification limit, stability of reagents, interlaboratory precision, and analysis robustness. Definitions of these topics may be found on those internet sources mentioned above. Additional information may be found by reading the validation study done by Fiberquant on our SPCT2 direct microscopical method for spore counting, which can be found in the Method Validation file. Not every topic is applicable, ie, robustness, for a microscopical method.

5.4.5.4. Applicability to client/customer's needs

When developing a method, the client/customers' needs should be remembered – otherwise, it is a waste of effort. During the method development/validation process, if such parameters such as detection limit and precision are changed, the usefulness of the method to the client/customer should be re-evaluated.

5.4.6. Estimation of uncertainty of measurement

5.4.6.1. Uncertainty of calibrations

Strictly speaking, Fiberquant does not perform calibrations. Fiberquant does perform checks that are normally (if incorrectly) called calibrations of magnifications or fields of view in methods, including the SOPs following. In all analyses in which the equipment magnification or field of view is calibrated (namely: PCM, TEM and Fungal Spore Trap), the uncertainties related to sub-sampling (not reading the entire sample) far exceed the uncertainty from the magnification calibration, so the exact determination of uncertainty from magnification calibration is not critical. The relative uncertainty for one such measurement can be estimated as:

$$\frac{smallest\,division\,read}{total\,measurement}$$

In the case of calculations after the measurement, the relative uncertainty does not change, unless another of the factors in the measurment also has an uncertainty, *e.g.*, the area of a square for which both sides were measured. In that case, the total relative uncertainty is calculated as the sum of the individual relative uncertainties.

5.4.6.2. Uncertainty of analyses

Fiberquant calculates uncertainty to gauge analysis effectiveness. Uncertainty is separately estimated for each method, analyte and matrix analyzed, as applicable. The reason for reporting uncertainty is to inform the client/customer as to the reliability of the data.

The uncertainty varies with procedure; obviously it must be calculated separately for each matrix or variation in procedure, and re-calculated whenever a procedure changes

5.4.6.2.1. Calculating Overall Uncertainty

The universal causes of uncertainty to be considered in our analysis are given in the Fiberquant version of AIHA Chemistry Uncertainty Calculation Spreadsheet or the Fiberquant version of AIHA Micro Uncertainty Calculation Spreadsheet. Rather than calculate each cause of error independently, Fiberquant calculates "Type A" uncertainty estimates in four ways from its QC data.

Overall precision is estimated to a coverage factor of 2 (95% confidence range). The 95% confidence range is considered to be, for our purposes, either:

1) as directed by the method (NIOSH 7400

2) +/- twice the pooled (average) relative standard deviation (RSD of population) in duplicate samples or duplicate analyses, for methods in which reference standards are not available (Micro, TEM, Soot)

or 3) twice the combined pooled RSD from duplicate analysis pairs and reference standards (AA, PLM).

For all analysis types, some simple statistics are calculated in the quarterly QA Reports to track trends, but, for convenience, the overall uncertainty is calculated using the AIHA Example Uncertainty Spreadsheets for Chemistry and Micro, each altered to represent Fiberquant's scope (template spreadsheets as well as current calculations are stored in <z:/controlleddocuments/excel/>). Both spreadsheets are set up (only duplicate analyses for Micro, and both duplicate and reference standard data for Chemistry) to calculate pooled RSD, then contain instructions for combining the RSDs, calculating the 95% uncertainty, and expressing the uncertainty per AIHA policies. Both these spreadsheets were altered by Fiberquant to automatically combine the pooled RSDs and calculate the uncertainty. Note that the example reporting must still be filled in by hand.

Either by hand or automatically calculated, the combined standard deviation is equal to the square root of the squares of the individual pooled standard deviations. And, for our purposes (coverage of 2 or 95%), the overall uncertainty is twice the combined standard deviation.

5.4.6.2.2. Calculating Bias

In the above Chemistry Uncertainty Spreadsheet, bias is pooled (averaged) from the reference standard data. Bias is also calculated, where possible, in the quarterly QA Reports for PLM and AA, using a much larger pool of data than the spreadsheet.

5.4.6.2.3. Idenfication Accuracy

Where an identification is a part of an analysis, pure standards or strains are used to test analyst proficiency. The "accuracy" of these identifications are tracked for the lab and analysts as 4) % correct or % true identifications. These are also summarized monthly in the QA Reports.

Table of Overall Uncertainty – Grouped by Type of Analysis					
Scope/Type	PCM	PLM; Soot	TEM	Mycology	AA
Measurand	fibers/cc	% asbestos % soots	str/mm2; str/cc	spores/m3 (SPCT&); % (SPB); spores/cm2 (SPT) spore type (all)	% (paint); ppm (paint and soil);. mg/ft2 (wipe); mg/m3 (air)
Coverage Factor	2	2	2	2	2
Estimated (CV)	0.3 – 0.5	0.2 – 1.0	0.3 - 1.0	0.2	0.23 (paint) 0.10 (soil) 0.06 (wipe) 0.05 (air)
Source or Calculation	Interlaboratory Sr from Round Robins.	Mean RSD for Re-analyses by different analyst.	Mean RSD for Re-analyses on diifferent grid openings.	AIHA Micro Uncertainty Spreadsheet.	AIHA Chemistry Uncertainty Spreadsheet.

5.4.6.2.4. Reporting Uncertainty

Fiberquant includes some indication of uncertainty in each report. For PCM, such an indication takes the form of a 95% confidence range, as required by the method. The remainder of our analytes do not appear to require the reporting of uncertainty. In those cases, that indication takes the form of a statement of estimated coefficient of variation (CV) or range of of CV (because CV varies over the range of reported values), or, in cases where the result has been estimated by eye instead of being counted or calculated (PLM, Soot), that indication takes the form of a range of result rather than a single reported value.

5.4.7. Control of data

As previously stated, data in the laboratory is recorded as near to observation as practicable. It is recorded either onto pre-printed forms, using indelible ink, or directly into the computer program, LIMS. The data recorded is generally original observations rather than calculated values (e.g., absorbance units for AA rather than ug/ml). This allows for all calculations to be checked or qualified. Errors in data recording are to be corrected by a single line crossed through the erroneous value followed by the corrected value. The cross-out is to be initialed and dated by the analyst making the correction (usually the original analyst). Data forms are stored with the work orders. If possible, the data record includes enough detail to reconstruct the analysis and to allow a second analyst to review the work and presumably arrive at the same conclusions.

5.4.7.1. Data checks

Each job is reviewed. The review is performed by a qualified (usually an current analyst, but can be a person trained to review that type of analysis, *e.g.*, the QA Officer) person different than the original analyst. The review is performed and documented before the final report is sent to the client/customer. Prior to review, data can be reported, but it is to be understood by the client/customer that data is preliminary until the review has been performed, and a report printed before review has a note directly under the report title that announces that the report is preliminary awaiting review.

Calculations are generally made by the LIMS without transcription or data transfer. If a transcription or data transfer is involved, such as in the AA division, the job reviewer spot checks the data entry, while the original analyst is responsible for a 100% check of data entry. To accomplish this check for calculations performed by the LIMS, one result is calculated by hand by the analyst, which documents that the formula and the computer are functioning correctly. The review also includes checking all QC data for acceptance. The reviewer of a job requiring RD-type QC is responsible for a re-analysis of one or more samples to produce that QC data.

The review is documented by initials/date on the work order form. For each time a report has been amended, another review and data/QC check is performed exactly the same as the first review and documented on the work order form.

5.4.7.2. Computer use/LIMS system

Computers are PC-type. Although varying in speed, chipset, and brand, they are chosen/upgraded with respect to their purpose. PLM computers and the server are generally be faster and newer than other computers, owing to the complex calculations required of them. Other computers may be upgraded by using parts from these fastest computers, as they are upgraded. Computers are usually purchased from ICS Computers, Tempe, AZ. Periphery and support equipment are usually purchased from Fry's Electronics. The chipsets (Intel, AMD, etc.) can be relied upon to calculate correctly, and are not specifically tested each time.

The computers are connected via 1G baseT ethernet cables and a series of hubs into a intralab network. Computers share printers, hard drives and other resources.

Maintenance and repair of computer and network hardware is performed by Larry S. Pierce. Equipment that is out-dated or un-repairable is retired, replaced, cannibalized as needed.

The operating system on all computers is Microscoft Windows ME, XP, or 2000. The operating system on the server is Microsoft Windows ME. Word processing, spreadsheet, etc. programs are Microsoft Office 2000. Internet access is though a dial-up service; computers use Netscape or Microsoft Explorer. Turbocad is used for drawings. Adobe Photoshop is used for photo manipulation. These commercial programs are not tested since they are not used to generate report data, but are only used for support purposes. They are upgraded as needed.

The vast majority of Fiberquant' s data management is performed on the laboratory information management system (LIMS), a custom program based on Microsoft Access, with programming written in that programs native Visual Basic capabilities. Data is not exported nor imported to other programs for calculations.

The LIMS has an overall framework, to which more programming or modules may be added (or subtracted) without affected previous programming or modules. Modules are accessed by simply clicking a button on the main LIMS screen. Among the tasks the LIMS currently handles are: log-in and sample tracking, employee records, equipment records, data reduction and report generation for PLM, PCM, TEM, Spore Trap and AA analysis.

Each computer at Fiberquant has loaded its own copy of the LIMS program. The data (accessed by the LIMS) resides on the computer named SERVER. Each computer maps a directory on the SERVER as its Z: drive to access the data.

5.4.7.2.1. LIMS Development

All LIMS programming and module development is done in-house by Larry S. Pierce, LIMS Specialist. If Fiberquant undertakes a new type of analysis, the LIMS is not immediately employed for it, except to log-in samples, usually as "other". Paper forms are developed for data collection, calculations, and reports for the new type of analysis. The form of reports from the LIMS (which is printed by Microsoft Access) and non-LIMS Microsoft Word reports are purposely made to mimic each other if possible. As the analysis process settles in, paper forms usually change, rapidly becoming more efficient. At a time when the effort seems justified by continuing interest in the new analysis area, a module for that analysis is created for the LIMS. When such a need for a new module or modifications to an existing module is perceived, a request is made to Larry Pierce. The components of a new module are based on past modules, and the particular requirements of the analysis, which include: 1) log-in under a specific sample type (rather than "other"), 2) entry of data results, 3) calculations and generation of reports specific to the analysis, 4) calibration storage, 5) reference standards data storage, 6) re-analysis data entry, 7) blanks or contamination control, 8) proficiency testing data storage, 9) calculations of control vs. out-of-control for QC activities, and 10) inclusion of the analysis type in lab performance statistics. These topics may not all be addressed prior to any one of them being utilized. For instance, the sample data entry and report generation sections may be used prior to the inclusion of all QA activities in the LIMS. QA activities would continue to be performed on paper while their sections were being developed.

5.4.7.2.2. LIMS Testing and Quality Assurance

Changes in LIMS are developed on one computer (Larry's office). While software is being modified, this computer does not map the SERVER, but rather maps a second, mirror copy of the data on another computer. In this way, sample data can be used and changed without adding to or affecting the actual lab data. Each modification or calculation is thereby checked using sample data. The sample data used to check the calculations should exercise all possible entries: high results, medium results, low but reportable results, non-zero results below the reporting limit, zero results. If volumes or weights are part of the calculation, high, low and zero should be part of the data set. Copies of all data checking, reports, QC checking, *etc*. go into the *Computer Program Validation* file in Larry 1-2 file drawer.

When preliminary checking is complete, a beta version is copied to those computers that are utilized in the area where changes had been made. Staff are made aware that the program has changed and how it has changed (usually by memo), and are instructed to bring all reports to the LIMS specialist to be checked by him/her prior to release. This constitutes the last check of calculations. The version history, *i.e*., the version number (*e.g*., 2004-3) and significant changes that occurred in that version, are stored in the Access Module named "LIMS Procedures", and the current version is also listed in the Master List of Documents in the LIMS.

5.4.7.2.3. Archives and Backup

Archives consist of a copy of the data file along with a copy of the LIMS program that can be used to access that data. Both must be stored because future modifications may make older data inaccessible. An archive is produced approximately every 6 months, after which older (paid for) jobs and their associated data are purged from the current data file. This is necessary since much old data slows the manipulation of new data. Archives are stored on a different hard drive than the current data, and also are burned onto CD ROM. Backups of the data file are made 1) several times a day to another hard drive on the network, 2) once a day to a CD-RW drive on the log-in computer, 3) once a day to a CD writer on Larry's computer; 4) once every ~3 months to an external hd taken home by Larry. Paper archives are kept in the storage bay (temperature

semi-controlled) or in a mobile mini storage container (temperature not controlled). Paper archives consist of work orders, and a few types of paper forms. Hard copies are generated for most data, including the work order or submittal form, which includes log-in and sample data, bench sheets, invoices, etc. Currently, reports are not copied, since they can be retrieved in their entirety from the LIMS. These records are stored for the current year in filing cabinets, for past years in filing boxes. Hard records are kept for at least 10 years.

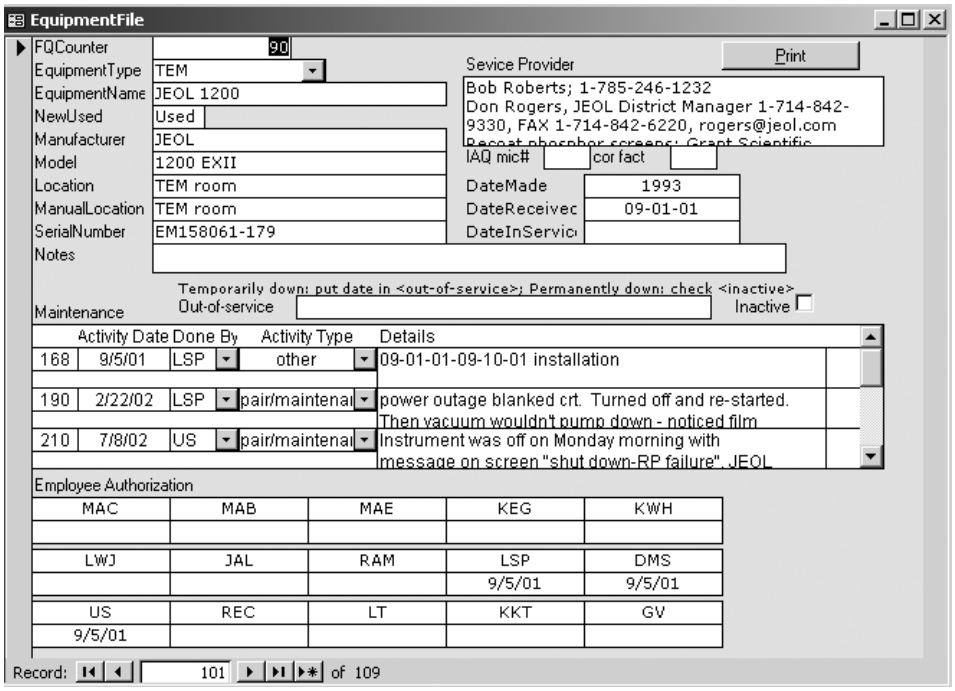
5.4.7.2.4. LIMS Security

Each employee has a password for computer operations. The passwords are stored in a paper file, and are also (obviously) stored by the LIMS. These passwords are required to: 1) log on to a computer at all, 2) recover from the screen savers, and 3) print reports. The first two of these are standard features of the software, the last is specific to the LIMS. Each report is "signed" by an analyst who takes responsibility for the content of the report. Their signature is released for use on the report by their password. Should a report be altered at a later date, the same or another analyst would have to "re-sign" to again take responsibility. LIMS security is enhanced by building security, which is a Sonitrol system which uses its own password system.

5.5. Equipment

"Equipment" for records purposes at Fiberquant is defined as a mechanical or electrical device having a unique serial number. The history of such equipment is documented in a table in the LIMS (<utilities><equipment>). The table includes, for each piece of equipment, the 1) designation or name of the equipment, 2) a type descriptor, 3) the manufacturer, 4) its model number, 5) its serial number, 6) when made, 7) when received, 8) whether new or used, 9) when placed in service, 10) its location, 11) the location of its manuals or instructions, 12) the phone numbers of service, repair or parts providers, 13) a linked table of maintenance and repair incidents, and 14) a list of the employees authorized to use it and the dates of authorization.

Figure 5.5 Equipment Record



5.5.1. Required equipment

The laboratory purchases, qualifies and maintains all necessary equipment for the procedures it performs. The list of apparatus and performance criteria of each is listed in the SOP for each method. If Fiberquant uses equipment that is off-site or not owned by Fiberquant, that equipment has to meet the same minimum performance criteria as does Fiberquant equipment before being used for analysis.

5.5.2. Performance checks

To show that equipment is capable of meeting the performance criteria of the methods/SOPs, calibration and/or check programs are to be in place. The type of program varies with the equipment and the method, and specific checks can be found in the QA/QC section of each SOP. Equipment subject to such checks will be checked before being placed into service, when being placed back into service after being out of Fiberquant control, and checked routinely. The acceptance limits of such calibrations/checks as well as their routine frequencies are given in the QA/QC section of each SOP.

5.5.3. Authorization to use equipment

Each employee must be authorized to use each piece of equipment (see 5.5). This authorization is based on training specific to the equipment (training which may be grand-fathered, a few minutes in length, or up to 6 months duration). The authorization is stored in the equipment database in the LIMS (see Figure 5.5). Instructions for equipment use and/or maintenance manuals are kept and are available to be studied for each piece of equipment for which authorization is needed.

5.5.4. Identification of equipment

"Equipment" for records purposes is defined as a mechanical or electrical device having a unique serial number. It is further identified by a Fiberquant number and nickname upon being entered into the equipment database.

5.5.5. Equipment database

The equipment database is accessed in the LIMS through <Utilities><Equipment>. The information contained includes, for each piece of equipment, the 1) designation or name of the equipment, 2) a type descriptor, 3) the manufacturer, 4) its model number, 5) its serial number, 6) when made, 7) when received, 8) whether new or used, 9) when placed in service, 10) its location, 11) the location of its manuals or instructions, 12) the phone numbers of service, repair or parts providers, 13) a linked table of maintenance and repair incidents, 14) a list of the employees authorized to use it, and, if authorized, 15) the date each employee was authorized.

5.5.6. Equipment handling

For each piece of measuring equipment, the following handling rules should be used:

1) Storage: Measuring equipment is to be stored in an environment that is not detrimental to its operation. Factors to be considered include temperature, vibration, and acid or caustic air. If it is unavoidable that equipment be stored or used in a detrimental environment (*e.g.*, the AA lab), then the equipment should be covered or protected when not in use, and monitored for function before use.

2) Transport: If measuring equipment is to be moved, the Lab Director and/or QA Officer must be notified to arrange for a move which will not damage the equipment.

3) Handling: Only persons authorized to analyze using the equipment are allowed to handle the equipment, unless directed to do so by the Lab Director or QA Officer.

4) Maintenance: Measuring equipment, in general, is cleaned and has routine maintenance once per year by an outside source (*e.g.*, microscopes, balances). Other measuring equipment is on service contract and receives preventative maintenance once per year. The TEMs have their own schedule of routine maintenance (see Work Practices)

5.5.7. Equipment having suspect results

Equipment or instruments that are defective or not performing properly or suspected of not performing properly should be immediately brought to the attention of the QA Officer. If further investigation by the QA Officer shows that a piece of equipment is deemed to be not suitable for use, it will be immediately removed from service, marked as such via a label in a prominent position, and not used until repaired and/or re-calibrated. Data just previous to the notice of the problem has to be examined to determine whether it is sound (4.9)

5.5.8. Calibration labels

Balances have labels showing calibration date, expiration date, *etc*. placed there by the calibration vendor. Calibrations routinely handled by the LIMS (e.g., refractive index liquids, TEM plasma asher, TEM camera constants, TEM magnifications) are not labeled, since the LIMS controls expiration.

5.5.9. Equipment outside the direct control of the laboratory

Any equipment that is sent out for repair, loan, or any other reason is deemed to be out of our direct control (*i.e.*, we don't know what happened to it). Likewise, instruments repaired or worked on by outside contractors (even inside the lab) are technically out of our control. Therefore, the function, alignment, results, etc. of such equipment must be checked before being used for client/customer samples. This is especially applicable to the yearly PLM microscope cleaning, during which it has been repeatedly shown that the cleaning personnel cannot align a microscope correctly. Any re-calibrations, re-alignment, etc. resulting from checks are to be documented in the normal manner. That the equipment was checked should also be documented in the equipment database in LIMS.

5.5.10. Intermediate checks of equipment

Equipment currently being checked are 1) balance (each day of use; see AA chapter QC for procedure), 2) CCV (also each day of use; see AA chapter QC for procedure), 3) automatic pipetters (monthly; see AA chapter QC for procedure).

5.5.11. Correction factors

A correction factor (CF) is the value which must be added to the reading of a non-adjustable device to yield to actual value. The only example at Fiberquant is thermometers. When the NIST-traceable thermometer is calibrated (at an external company), it may have a CF associated with it upon return. Then, when calibrating our other thermometers against it, its CF and the two readings (NIST thermometer reading and thermometer being calibrated reading) are used to calculate the CF of the thermometer being calibrated. When being used, a thermometer's CF is added to its reading to get the actual temperature. When specific thermometers are used for specific purposes (e.g., AA oven, various rooms), the CF for the thermometer used there should be posted near it for convenient use.

5.5.12. Equipment security

If hardware contains knobs, switches or other devices, which, if changed from their setting, would invalidate the calibration or results, then said knobs, etc. need to be fixed between calibrations or checks by some means such as a set-screw, lock, cover, tape, etc. An example is the eyepiece containing the cross-reticle on a PLM scope. From the factory, such an eyepiece has a screw on the eyepiece that slips into a slot in the microscope, fixing the eyepiece at a 0°/90° relationship to the polarizer. If the screw has been lost, or the wrong kind of eyepiece is used (as can happen with used equipment), then some sort of method needs to be found to fix the angle of the reticle verses the polarizer, or else the extinction angle will be wrong. Another example is the LIMS software, which is distributed as .mbe (read-only), where formulas, sub-routines, functions, etc. cannot be changed. In addition, the correctness of LIMS calculation is checked by performing one calculation checked by hand.

5.6. Measurement traceability

5.6.1. General

Each piece of equipment that can have a significant effect on the accuracy, precision or validity of results is calibrated before being used for client/customer samples, and is likewise re-calibrated on a regular schedule to assure continuing validity. Procedures for obtaining and maintaining traceability are given in Work Instructions GEN- and GEN-.

5.6.2. Specific requirements for traceability

5.6.2.1. In-house calibration for calibration laboratories

Not applicable; we are not a calibration laboratory.

5.6.2.2. In-house calibration or calibrated measurement for testing laboratories

This section applies to devices used by Testing Laboratories that have a measuring function of any kind.

5.6.2.2.1. That are traceable

Where possible, measuring systems will be calibrated or checked using a reference calibration standard that is traceable to NIST. The current such items in use at Fiberquant are: 1) the balances, 2) check weights for the balances, 3) the NIST-traceable thermometer and working thermometers, 4) automatic pipetters, and 5) centrifuge tubes, 6) the Dry-Cal calibrator, 7) measuring reticles.for microscopes (Walton-Beckett, 10x10x1cm, 100x0.1x1mm), 8) NIST stage micrometer and working stage micrometers, and 9) refractometer,

5.6.2.2.2. That are non-traceable

If traceable standards are not available for a method, then consensus standards, or interlaboratory comparisons will be used to provide some kind of agreement with other laboratories. The only example of this type at Fiberquant is the use of carbon replicas of optical grating that is used to check the magnification of the TEMs and to calibrate the EDS photo measurement system. It qualifies as a consensus standard because, regardless of where or in what form purchased, the exact same grating appears to be used by everyone who calibrates the magnification of their TEM. Per NVLAP, the frequency of the TEM magnification check is monthly.

5.6.3. Reference standards and reference materials

5.6.3.1. Reference standards

Reference standards (non-consumed items for comparison) are usually purchased having calibration characteristics, but must be re-calibrated with appropriate frequency. For the items listed in 5.6.2.2.1 above, and similar needed for future use, the procedures for purchase, calibration and re-calibration are given in Work Instruction GEN-9 Purchase, Calibration, and Handling of Reference Standards, Reference Materials, and Reagents.

5.6.3.2. Reference materials

Reference materials are consumables, *e.g.*, a SRMs (a reference material made by NIST) or a CRM (a reference material made by someone else). Reference materials used at Fiberquant include: 1) 1000ppm Pb in 5%HNO3 solution, 2) Pb in various matrices to be used as LCSs in AAS, and 3) reference cultures for Micro. Each reference material, regardless of source, must be traceable to NIST, *i.e.*, have a certificate stating the NIST standard to which they are traceable, with an overall propagated uncertainty (the same as devices, above), It used to be, on the advice of NIST (who worried about the depletion of SRMs), that AIHA allowed labs to make their own CRMs traceable by analyzing them with SRMs, but that is no longer allowed. At present, all reference materials must be purchased from a supplier who is accredited by an ILAC signatory accreditation body in the scope of reference material production. Purchase of reference materials is through the procurement module of the LIMS, which is designed to ensure that proper services are used and proper documentation is received. Generally, these are consumed without intermediate checks. The 1000ppm liquid is used to make working standards (See also AAS-4 Work Practice for Preparing Calibration Standards).

5.6.3.3. Intermediate checks

For some devices, checks between calibrations are done to maintain confidence in their calibration. At Fiberquant, these include balances (daily, see 14.10.2.2), automatic pipetters (daily, see 14.10.2.4), thermometer (annually, see 11-13). The training for performing calibration checks is documented in the training log specific to the type of analysis for which the check is applicable, *e.g.*, AA for balance, pipetter and thermometer check, microscope methods for alighnment check, TEM for magnification and cc check.

5.6.3.4. Transport and storage

Reference standards are not removed from the laboratory except for calibration. They are stored in the boxes in which they were received to prevent deterioration, oxidation, *etc*.

5.7. Sampling

5.7.1. Sampling plan

Normally, Fiberquant accepts samples taken by other companies, but occasionally, sampling is performed by Fiberquant personnel. When sampling is carried out as part of a sub-contracting arrangement, Fiberquant personnel act on the behest of the contractor, and according to their sampling protocols and plans. When sampling is carried out by Fiberquant as the primary contractor, then the sampling process is described in a sampling procedure, which is specified in each SOP. A sampling plan is developed in the lab, taking into account factors affecting the validity of the testing, then taken to site and followed, if applicable. An example of a sampling plan used at Fiberquant is the random selection process for HUD inspections for Pb-based paint.

5.7.2. Deviations

If the client/customer requires deviation, additions or subtractions from the sampling plan or procedure, then the details of the changes will be distributed to all concerned.

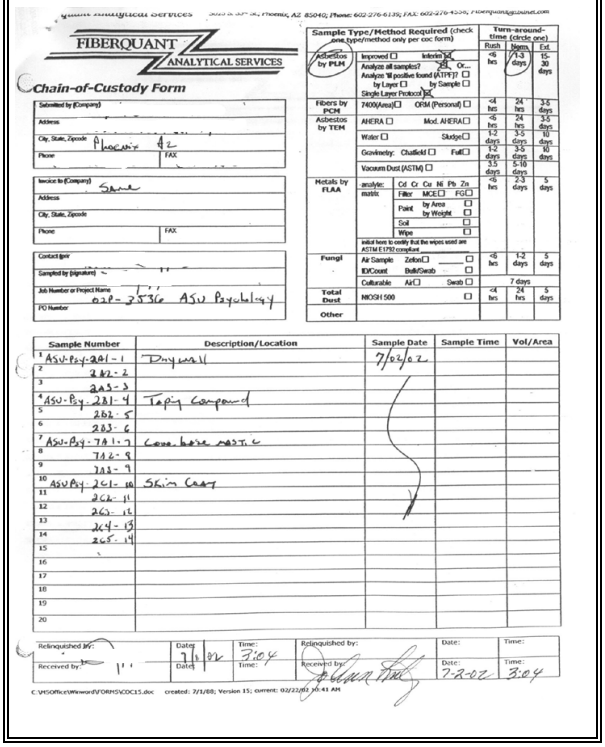
5.7.3. Documentation

The data from the sampling includes the procedure, the identity of the sampler, the date, location of samples, or other pertinent data sufficient to reconstruct the sampling process.

5.7.4. Sub-sampling in the Lab

Sub-sampling is the process of reducing the size of a submitted sample to a size or weight that appropriate for the analysis procedure. Sometimes, the client/customer is given an appropriately sized bag and requested to submit an appropriately sized sample in it (leaving sub-sampling to them). Usually, however, sub-sampling is done in the lab since the entire sample usually cannot be analyzed according to the method. In all cases, the guiding principle for the analyst is to obtain a representative sub-sample by whatever means are possible. For Pb in paint or soil, small subsamples are taken from various parts of the sample, then composited to form a subsample that visually mirrors the sample (all colors/layers). For PLM, separate sub-samples are analyzed separately.

Figure 5.8.2.2a Chain-of-Custody Form


FIBERQUANT ANALYTICAL SERVICES

Chain-of-Custody Form

Sample Type/Method Required (check one type/method only per coc form)

Turn-around-time (circle one)

Asbestos by PLM: Improved ☐ Interim ☒; Analyze all samples? Yes ☒ Or... Analyze 'til positive found (ATPF)? ☐ by Layer ☐ by Sample ☐; Single Layer Protocol ☒

Fibers by PCM: 7400(Area) ☐ ORM (Personal) ☐

Asbestos by TEM: AHERA ☐ Mod. AHERA ☐; Water ☐ Sludge ☐; Gravimetry: Chatfield ☐ Fwtl ☐; Vacuum Dust (ASTM) ☐

Metals by FLAA: analyte: Cd Cr Cu Ni Pb Zn; matrix: Filter MCE ☐ FG ☐; Paint by Area ☐ by Weight ☐; Soil ☐; Wipe ☐; initial here to certify that the wipes used are ASTM E1792 compliant

Fungi: Air Sample Zefon ☐ ID/Count Bulk/Swab ☐; Culturable Air ☐ Swab ☐

Total Dust: NIOSH 500 ☐

Other

Submitted by (Company) / Address / City, State, Zipcode / Phone / FAX

Invoice to (Company) Same / Address / City, State, Zipcode / Phone / FAX

Contact per / Sampled by (signature) / Job Number or Project Name 02P-2536 ASU Psychology / PO Number

Sample Number	Description/Location	Sample Date	Sample Time	Vol/Area
1 ASU-Psy-201-1	Drywall	7/02/02		
2 202-2				
3 203-3				
4 ASU-Psy-231-4	Tapy Compound			
5 262-5				
6 263-6				
7 ASU-Psy-701-7	Concrete mast. c			
8 702-8				
9 703-9				
10 ASUPsy 261-10	Skim Coat			
11 262-11				
12 263-12				
13 264-13				
14 265-14				
15				
16				
17				
18				
19				
20				

Relinquished by / Date 7/1/02 Time 3:04 / Received by / Relinquished by: / Date: 7/2/02 Time: 3:04 / Received by:

C:\MSOffice\Wword\FORMS\COC15.doc created: 7/1/02; Version 15; current: 02/22/03 10:41 AM

5.8. Handling of test and calibration items

5.8.1. General

The purpose of procedures for receiving samples and sample handling are 1) to document those samples that come in (and to document which samples said to have been sent by client/customers that have never arrived), 2) to provide a unique identity for each sample, independent of client/customer identification, in a job and for the job itself, 3) to provide guidance for receiving personnel to determine whether the incoming samples can be analyzed or must be rejected, 4) to have a framework that will follow the samples through the analysis, which provides a chain of custody within the lab, so that which person performed which part of prep or analysis is known, 5) to document, when a job leaves the lab, when it left and who picked up the reports or samples, and 6) to avoid invalidating the sample while it is in our possession.

Lab Summary G-1 briefly lists the steps performed in sample receipt. Detailed discussion is given below.

5.8.2. Log-in

5.8.2.1. Sample Categories

The following kinds of analysis are performed at Fiberquant: 1) PCM analysis of filter samples, 2) PLM analysis of bulk samples, 3) TEM analysis of filter samples or bulk samples, 4) Rotameter calibration, 5) Paint chips or other bulk materials to be analyzed for Pb, 6) Filters (MCE or FG) to be analyzed for Pb, 7) bulk or spore trap (non-viable) samples to be analyzed for fungal type, 8) air or bulk (viable) samples to be cultured for fungal type identification, 9) matched-weight filters for gravimetry, and 10) wipe or cassette soot samples. Most bulk samples come in either film canisters or plastic bags (occasionally without any containment), and so can be easily discriminated from the filter cassettes which contain the filters to be analyzed by PCM or TEM. The filter cassette is the same for either PCM, TEM or Pb, so the client/customer must indicate, either in person, or via an enclosed note, chain of custody or sample request form, which type of analysis is required. Other types of samples may be analyzed. The person accepting the samples examines the paperwork and samples to confirm that we routinely perform the analysis requested, that we have the equipment (operational), sufficient personnel, and time to perform the analysis for the turnaround time requested, etc. (See 4.4, Review of Requests, Tenders and Contracts.)

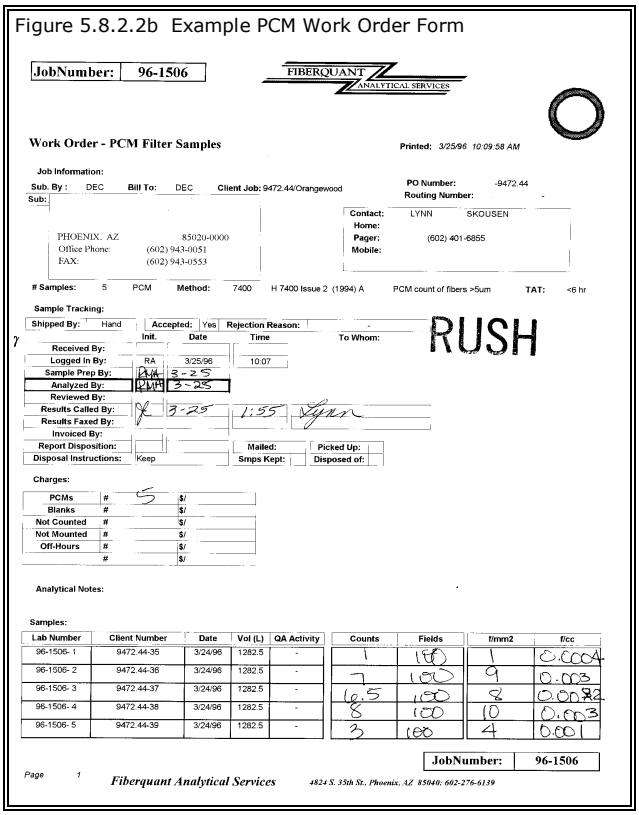
5.8.2.2. Job and sample identification

Most jobs are submitted with accompanying paperwork, such as a *chain-of-custody (COC)* form. Every job must have an accompanying Fiberquant COC, even if the client/customer uses their own COC; this is to make sure that we obtain the information we need, including documentation of the review of request. Any data on our COC duplicated by the customer's paperwork need not be repeated. An example of a Fiberquant COC is given in Figure 5.8.2.2a.

All paperwork is scanned to a pdf file, which will be combined with the report pdf later. The original is clipped to the sample bag, to remain with it throughout analysis.

Each job is logged in one at a time. The information supplied with the samples is input into a computer program designed around MS-Access. The program contains databases for client/customer information, job information, sample information, as well as information pertaining to accounts receivable. The program is menu driven, so that a person logging-in a job selects a <new job> button, then is prompted to fill in the appropriate data. After data pertaining to a job has been input, the <Samples> button is pressed and a new screen prompts the logger to enter data for a sample or samples. The assignment of unique job numbers and sample numbers is performed automatically by the computer and are of the form 1996-99999 for jobs received in 1996 and of the form 1996-99999-999 for samples. These unique designations are retained for each sample from the time that it is logged to until it is logged out of the laboratory to be disposed or returned.

Figure 5.8.2.2b Example PCM Work Order Form



JobNumber: 96-1506

FIBERQUANT ANALYTICAL SERVICES

Work Order - PCM Filter Samples

Printed: 3/25/96 10:09:58 AM

Job Information:

Sub. By : DEC Bill To: DEC Client Job: 9472.44/Orangewood

PO Number: -9472.44

Routing Number:

Sub:

Contact: LYNN SKOUSEN

Home:

Pager: (602) 401-6855

Mobile:

PHOENIX, AZ 85020-0000

Office Phone: (602) 943-0051

FAX: (602) 943-0553

Samples: 5 PCM Method: 7400 H 7400 Issue 2 (1994) A PCM count of fibers >5um TAT: <6 hr

Sample Tracking:

Shipped By: Hand Accepted: Yes Rejection Reason:

RUSH

	Init.	Date	Time
Received By:			
Logged In By:	RA	3/25/96	10:07
Sample Prep By:	PLM	3-25	
Analyzed By:	PLM	3-25	
Reviewed By:			
Results Called By:		3-25	1:55
Results Faxed By:			
Invoiced By:			
Report Disposition:			
Disposal Instructions:	Keep	Mailed:	Picked Up:
		Smps Kept:	Disposed of:

To Whom: Lynn

Charges:

PCMs	# 5	$/
Blanks	#	$/
Not Counted	#	$/
Not Mounted	#	$/
Off-Hours	#	$/
	#	$/

Analytical Notes:

Samples:

Lab Number	Client Number	Date	Vol (L)	QA Activity	Counts	Fields	f/mm2	f/cc
96-1506- 1	9472.44-35	3/24/96	1282.5	-	1	100	1	0.0004
96-1506- 2	9472.44-36	3/24/96	1282.5	-	7	100	9	0.003
96-1506- 3	9472.44-37	3/24/96	1282.5	-	16.5	100	8	0.0082
96-1506- 4	9472.44-38	3/24/96	1282.5	-	8	100	10	0.003
96-1506- 5	9472.44-39	3/24/96	1282.5	-	3	100	4	0.001

JobNumber: 96-1506

Page 1

Fiberquant Analytical Services 4824 S. 35th St., Phoenix, AZ 85040; 602-276-6139

After data entry, a *Work Order* form is printed that accompanies the samples while they are in house. The forms are specific for each type of analysis (see example PCM Work Form). All sample submittal forms contain 1) client/customer information, 2) method of analysis, 3) internal sample tracking information, 4) special instructions, 5) sample information, and 6) billing information.

The samples are contained in a plastic bag on which is stuck a label marked with the FQ job number, client/customer code and date of receipt, and to which is clipped any original paperwork and our generated submittal form. Additionally, for samples in cassettes (e.g., PCM, TEM), the FQ sample number is printed by the computer on a label, and the label is attached to each sample. The samples and their paperwork are taken to the

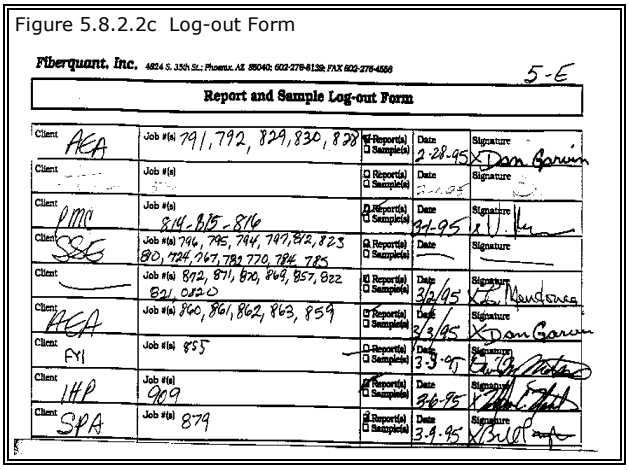
appropriate location: PCM or Micro holding trays in the PCM/Micro area, bulk cabinet in the bulk area, TEM holding trays in the TEM prep room, the AA area for AA jobs, or Larry's desk for Other-type jobs.

During the preparation or analysis of samples, analysts are prompted by the submittal forms to initial when they have performed various tasks. This way, for a given job, it is known who prepped it and when, who analyzed it and when, and who checked it and when.

Log data is stored in the computer; a hard copy of a list of jobs logged in is printed daily.

When reports or samples are removed from the lab by client/customers, they are logged out using the form shown below.

Figure 5.8.2.2c Log-out Form



Fiberquant, Inc. 4624 S. 35th St.; Phoenix, AZ 85040; 602-276-6132; FAX 602-276-4556

5-E

Report and Sample Log-out Form

Client	Job #(s)	Report(s) / Sample(s)	Date	Signature
AEA	791, 792, 829, 830, 828		2-28-95	Don Garvin
	Job #(s)	Report(s) / Sample(s)	Date	Signature
PMC	Job #(s) 814-815-816	Report(s) / Sample(s)	3-1-95	
SSG	Job #(s) 796, 795, 794, 797, 812, 823 80, 724, 267, 783 770, 784 785	Report(s) / Sample(s)	Date	Signature
	Job #(s) 872, 871, 870, 869, 857, 822 821, 0820	Report(s) / Sample(s)	Date 3/2/95	Signature
AEA	Job #(s) 860, 861, 862, 863, 859	Report(s) / Sample(s)	Date 3/3/95	Signature Don Garvin
FYI	Job #(s) 855	Report(s) / Sample(s)	Date 3-3-95	Signature
IHP	Job #(s) 909	Report(s) / Sample(s)	Date 3-6-95	Signature
SPA	Job #(s) 879	Report(s) / Sample(s)	Date 3-9-95	Signature

5.8.3. Abnormalities during log-in

The samples are examined during log-in. The request and analysis type has already been reviewed (see 4.4.1). The examination, as much as possible, is done through the containment bags, so as to prevent contamination to the log-in area. If containers need to be opened, they are opened by an analyst appropriate to the sample type and in a safe location (*e.g.*, a hood). When it is found that samples or sample containers are in less than normal or good condition, the condition is noted during log-in (a <condition> cell is provided on the log-in screen), and a note specifying the problem. If an item(s) appears to be unsuitable for the test called for (e.g., wrong media, wrong volume for AHERA, etc.), then the client/customer is called before proceeding with the log-in. The incident is then documented both handwritten on the Work Order and electronically in the LIMS <notes> area, including any client/customer instructions (*e.g.*, analyze anyway).

5.8.3.1. Sample Rejection Criteria

Samples are rejected for analysis mainly for reasons of sample integrity and documentation. The reasons vary with the type of sample, so rejection criteria and provisional acceptance criteria for each sample type are listed separately below.

5.8.3.1.1. PCM Samples

The rejection criteria are:

1. The samples are **not uniquely identified** (have the same exact numerical, date and all other designations). The customer is called and apprised of the situation. In rare cases, the filters may be analyzed anyway (e.g., they were from the same containment or area and the client/customer would like the information regardless of non-uniqueness.

2. The **filter is missing**. This would not be found out until the sample preparation stage, so the samples would have already been accepted and logged in. In such a case, the sample is marked void and a note is added to the paperwork explaining the reason.

3. The cassettes are open and **filters are loose** in the bag. This rejection is due mainly to a filter not being identifiable, but also due to the rough handling making a representative analysis very unlikely. The sample is not mounted, and a note is added to the paperwork.

4. The samples are **grossly overloaded**. Again, this would only be discovered as the cassette is opened. Any time loose material or powder is found in the cassette, a representative analysis would be impossible. The sample is not mounted and a note is added to the paperwork.

5. The **filter and pad are installed upside-down** and the cassette was sealed when opened. Obviously no sample could be taken under these circumstances. If, however, the cassette is not sealed, then the sample could have been collected on the filter, and the switching of filter and pad could have happened later. In this case, the filter might be contaminated, but otherwise useful, so, at the client/customer's discretion, we will analyze such a case.

6. The prepared filter wedge is **too heavily loaded to count**. The 7400 method suggests that a given microscope field of view be rejected if it is over 1/6th obscured by particles. Obviously, if all fields of view are over 1/6th loaded, then the wedge cannot be counted. However, if more than a few fields during a count are rejected, the result becomes biased. For our purposes, a heavily loaded sample is quickly scanned before beginning the counting, and if 10-15 fields out of 100 would be rejected by the 1/6th criteria, then the sample is not counted, and the paperwork marked THLTC (too heavily loaded to count).

If the sample is loaded near the 1/6th criteria but still counted, a note is added to the paperwork that the filter was heavily loaded.

7. The **filter is wet**. Personal samples may become wet during the work period. In this case, the amount of air drawn through the filter is drastically reduced if not eliminated. Therefore, the true volume for the filter is unknown, and the sample is not mounted and a note added to the paperwork stating the reason. For our purposes, a wet filter is defined as one whose pad is saturated. Damp filters with dry pads (also common) will be analyzed but notated.

8. The **filter is torn**, and sample can be observed on the pad. The sample is not mounted, and a note is added to the paperwork.

9. The filter shows **uneven particle distribution**. Both the 7400 and ORM methods require rejection for unevenness of the sample, but do not explain how to determine unevenness. Macroscopic unevenness, such as pieces of debris, often with water spots, can be seen as the cassette is opened. In this case, the filter is not mounted and a note added to the paperwork. When a filter is macroscopically even and has been mounted, unevenness is, for our purposes, defined as a >20% portion of the filter having more than twice or less than 1/2 the particulate as other portions of the filter.

Samples are provisionally accepted and analyzed for circumstances which might or might not affect the analytical result. The integrity of the sample has been breached in some way, but the breach might not be fatal, and some information may be had from the analysis. If we were the agent collecting such samples, we would reject the results and re-sample, if possible. However, since in the vast majority of cases, someone else has controlled the sampling, we must leave it to them to reject or accept the results of their sampling. We always note the problem(s) with a sample so that the hygienist or sampling agent can use their judgment as to how much weight to give the data.

Some of the circumstances to which this policy might apply would be:

1. One sample from a job is unmarked. The client/customer may be able to identify it by process of elimination. If the client/customer is sure enough of the identity (and they assume responsibility for the identification), we analyze it, adding a note to the paperwork stating that the sample was originally unmarked, and that the identity was later supplied by the client/customer.

2. A filter is torn, and the pad appears pristine clean. In this case, the filter could have torn as the pump was being turned off. The filter is analyzed, a note about the tear being included in the report.

3. The wrong kind of filter material has been used. The usual case is that a TEM filter cassette (.45 pore size and an extra filter present) has been used for PCM. The presence of an extra filter in the cassette and the possibility of it being a TEM cassette is posted as a note on the report.

4. The outside of the cassettes are contaminated. If visible debris or powder can be seen on the cassettes, it may constitute a hazard during sample prep. We are in a better position to decontaminate than the client/customer, so the samples are accepted, taken to a bulk station hood, wet-wiped, placed in a new plastic bag, and then logged and analyzed normally.

5.8.3.1.2. PLM Samples

In the case of PLM samples, the criteria of sample acceptance are broader than the other types of analysis we perform. For example, single samples having no identification or designation other than the person submitting it are often accepted, a home-owner being quite aware of what the sample is. Also, it is common for several materials (for instance of vinyl tile or roofing) to be submitted as one sample, which we analyze normally as one sample having multiple layers. Often, if two samples have been mistakenly marked the same, their identity can be obvious due to them being different types of building materials. For these reasons, the only reason for rejection of bulk samples hinges around contamination of the lab. That is, if samples are so poorly contained that it would be a hazard to us to handle them, then they are rejected. Samples which are marginally contained must be properly contained before handling. A supply of plastic bags is kept at the front desk to deal with the occasional unconfined sample. Packages may be opened in one of the bulk hoods if they appear to have been damaged.

Rejection is justified if several samples have become intermingled due to damaged or inadequate containment. In this case, the reason is that it may not be possible to tell which sample is loose, if all are the same type of material, and that other samples may be contaminated with asbestos from one sample. However, even in this case, provisional analyses may be performed and reported, in case the situation can be sorted out, e.g., all the samples are negative, or some samples are of a type (floor tile) that exterior contamination will not affect the integrity of the analysis if suitable precautions are taken. In general, for bulk samples, each case of compromised sample integrity must be examined logically to determine whether the analyses are worthwhile performing. The decision is made by the PLM Lab Supervisor.

Samples may be rejected if they are in a condition not amenable to accurate PLM analysis. For example: roofing inside metal sampling tubes cannot be completely extracted, and therefore may, if analyzed, produce

results in error. Extremely wet and soupy samples may be rejected for the same reason, although, in this case, they may also be simply dried before analysis, at extra cost.

5.8.3.1.3. TEM Samples

Some specific guidelines for rejection of TEM samples have been laid down by the AHERA rule and the NVLAP Handbook for Air Samples. Generally, the rejection hinges on the integrity of the sample and its identification. Specific instances are listed below.

1. The sample **identification is not complete or unique**. This is a matter to be decided after consultation with the client/customer, who may not want to pay for samples whose validity is in question. If the client/customer insists, we will analyze, but with notes outlining the inadequacies of the identification.

2. The **cassettes are open-ended or apparently tampered with**. Again, such samples should have been rejected by the collecting party before reaching the lab. If the client/customer desires the analysis anyway, we will comply, adding notes. For instance, an open-ended cassette may have become contaminated, but if the analysis result is under the 70 str/mm^2 screening criteria, the client/customer may decide that it wasn't.

3. **Bulk samples have been included in the packaging with the TEM cassettes**. The AHERA TEM method is very specific that these samples must be rejected, and we must follow the method. However, if the client/customer wishes us to analyze anyway, calling them non-AHERA samples under these circumstances, we will, noting the possibility of contamination.

4. The sampling **volumes do not meet the testing criteria**. This case would be the submittal of only 5 AHERA samples supposedly to meet the screening criteria, but one or more of the volumes is under 1199 L. In this case, analyzing the samples would be meaningless, since the screening criteria can not be used for samples of less than 1199 L. The client/customer would be contacted in order to re-sample or to supply the other 8 cassettes of a full AHERA set (for which there is no volume limit).

5. The **filter loading is found to be uneven**. This event would not be discoverable until after the sample preparation is completed, unless the filter were so heavily loaded as to show a color gradation to the eye. Clearly, with the small amount of filter scanned during TEM analysis, any variation in loading will cause the result to be virtually meaningless, so the sample(s) result should be rejected, but generally, we leave it to the client to use or ignore a result, but give them an extensive note indicating the problem and possible effects to the data.

6. The **filter loading is too high**. Too high according to AHERA is 10%. Presumably this is an average filter loading, although it doesn't specify.

7. TEM **water sample is beyond 48 hour window for filtering**. The client/customer is called; it is their call as to whether to continue analyzing (a note would be added to indicate out of window).

5.8.3.1.4. Rotameters

There are no rejection criteria for rotameter calibration. All samples are logged in. Certain rotameters are not able to be calibrated, or their calibration curves are not smooth enough to be dependable, but these are found out during calibration and reported to the client/customer. If rotameters are not uniquely identified, they are given unique identification by us.

5.8.3.1.5. Pb-in-Paint chips, wipes or other bulk sample

Rejection criteria are:

1. The **sample is not properly contained**. A powdered or chipped sample must not contaminate the laboratory or lab personnel.

2. The **sample is not uniquely identified** if more than one sample is submitted. We may add unique identification of the nature "green" or "white".

3. The **sample is too small** for the technique to be used. For the portable XRF, a paint chip should be at least 1x1" square (2x2" is better) and in no more than a few pieces which can easily be taped back together to form a continuous film. The film must be full thickness, not individual separated layers. For AA, enough sample must be present to produce the level of sensitivity desired (nominally several tenths of a gram). AA samples do not have to be intact.

Recognizing ASTM wipes:

EPA requires that ASTM spec wipes are to be used for wipe sampling. Currently, there are only two types: Ghostwipes and Pacewipes. Ghost wipes are MCE material having a visible waffle-like weave and are 10cmx10cm. Pacewipes are smooth, thin paper and are 15cmx10cm, similar to a KFC wet-nap. If wipes are observed that appear to be baby wipes (thick, large sheets) or other than the materials listed above, notate the WO that the submitted wipes apparently did not meet ASTM specs.

5.8.3.1.6. Pb Filters

Samples are rejected if:

1) **samples are not uniquely identified**.

2) **filter is not complete or is torn.**

3) **blow-by** can be seen on the filter.

4) the **filter is overloaded** (more than 2mg sample) as evidenced by loose material or particulate in the cassette.

5.8.3.1.7. Mycology Samples

Samples are rejected if:

1) **samples are not uniquely identified**.

2) sample containers (bag, cassette or petri dish) **is not complete or is damaged**.

3) sample is **not contained** in a biologically safe manner.

5.8.3.1.8. Matched Weight (N500) Filters for Gravimetry

Samples are rejected if:

1) **samples are not uniquely identified**.

2) filter is not complete or **torn**.

3) loose **debris** is present.

5.8.4. Procedures for maintaining sample integrity

The following procedures ensure that samples are not lost, damaged or deteriorated during storage, handling and preparation.

--Each job, a sample or group of samples, when received, is placed in its own zip-loc bag, if they are not already suitably contained. This prevents incidental contamination as well as keeps the samples in one job together.

--At log-in, samples which arrived together, but are to be analyzed differently (*e.g.* PCM and TEM samples) are separated and given their own zip-loc bags and separate job numbers.

--Incoming paperwork is checked to ensure that the samples are analyzed as requested, since AA samples can appear similar to PCM and TEM samples.

--Any questions regarding the type of analysis should be cleared up by contacting the submitting client/customer prior to log-in.

--Log-in supplies a unique job number and for each sample a unique lab number, so that even sample starting with the same or similar numbers are unambiguously identified.

--During analysis, slides, vials, or other containers are marked with either the lab number or a batch number (which is unique for a run of samples).

--An in-house tracking table is on every work order, so that the location of a job at a certain date is known.

--Jobs are kept sealed in their zip-loc bags until analysis.

--Only one sample is open at any given time in any analysis station, whether they are being weighed (as in AA), or examined (as in PLM), or cut (as in PCM or TEM).

--Jobs are logged out as well as logged in, to maintain the chain of custody all the way out of the lab.

--The lab is set up in such a way that types of analysis that are incompatible are separated. For example, the PLM area, which might contaminate the TEM area, is separated in distance and air supply. PLM samples are not to be taken through the TEM prep area.

--If incoming samples are required to be stored at certain conditions (*e.g.,* in a refrigerator), then those conditions are maintained, monitored and documented (*e.g.*, the refrigerator temperature log).

--If samples are accepted that require secure (locked) storage, Fiberquant will arrange for locked storage.

Once samples are in our care, they must be handled in a way that will not contaminate, invalidate or otherwise compromise the integrity of the samples. Precautions to be taken include, but are not limited to:

--Bulk asbestos samples must be kept apart from asbestos filter samples to minimize cross-over contamination.

--Fungal swab samples are refrigerated, if not to be prepared within 1 hour .

--Asbestos in water samples are refrigerated between log-in and filtering, if the samples are not to be filtered less than one hour from receipt (downstairs "chemical" refrigerator).

--Filter samples are not to be subjected to shaking or vibration.

These handling tasks are to be performed by the analytical personnel. It is the responsibility of the receiving/log-in personnel to inform the appropriate analytical personnel that samples are in house either before or after log-in, so that the measures can be taken (such as transferring to a refrigerator).

5.8.5. Sample storage

All analyzed samples are retained for at least 30 days after analysis, and thereafter disposed of in a manner consistent with local regulations.

While awaiting analysis, bulk asbestos samples are contained in large zip-loc bags in drawers in a steel cabinet in the PLM analysis area; PCM samples are contained in large zip-loc bags in a series of organizational shelves in the PCM area; TEM samples are held in a box for that purpose in the TEM prep room; and AA samples are contained in large zip-loc bags and held in a box for that purpose in the chem lab.

After analysis, bulk asbestos samples are taken directly to the disposal area (as discussed below) or held in a steel cabinet for client/customer retrieval; PCM samples are temporarily placed in one of two boxes: one for samples to be returned to the client/customer and one for disposal; then later taken to the hold or disposal area; AA samples are segregated into lead-containing and non-lead-containing boxes, to be either disposed of as hazardous waste or in our normal waste stream; TEM samples are held temporarily in a box in the prep room, then later taken to the disposal/hold area.

5.8.6. Disposal procedures

Each client/customer is asked to indicate in writing whether they in general want their samples returned or disposed of. Their answer is kept on file. Additionally, individual jobs may be marked on their sample submittal forms that they are to be returned or kept. Indication on the sample submittal form always has precedence over the general client/customer preference. The sample submittal forms have spaces to indicate that this particular set of samples has been retained, disposed of, or returned to client/customer. Samples that are to be returned are bagged and logged out via the form in Figure 5.8.2.2 previously shown. Samples that are to be disposed of are kept at least 30 days before disposal. Samples to be retained are boxed and kept in the back storage area.

5.8.6.1. Asbestos samples

Two 55 gal. plastic drums are kept in the back storage area. One is marked for the current month's samples to be disposed of. The other is marked for last month's samples to be disposed of. During the month, all asbestos samples to be disposed of, positive or negative, bulk or air, are placed in the current month drum. A client/customer's preference of return or disposal is printed on each job rider. When a job is placed in the drum, its number is added to a list (Figure 5-7), which is kept on top of each drum. This list constitutes the log-out of disposed-of samples; the data is not repeated on the normal log-out sheets. On the first of the month, the oldest month's samples are bagged up and marked with the month. The now empty drum is then marked with the current month. This way, samples to be disposed of are automatically kept at least one month, and in their bagged-up state, usually about 3 months. Approximately quarterly, the bagged-up bulk samples are picked up by previous arrangement with one of our abatement client/customers, who dispose of them. Our bags are marked with our name, address, etc. as required. Paperwork generated during the disposal (bills of lading, etc.) are filed in the "Disposal Records" notebook kept by the Safety Officer.

Samples to be returned to the client/customer are placed in wire basket bins. Certain client/customers have specified areas for their samples in the cabinets, while other client/customers samples are placed in an area marked "miscellaneous". Approximately once a month, the samples in the cabinets are bagged up for each client/customer, logging each job out as it is bagged. Each bag (now containing a number of logge8out jobs) is sealed and marked with the jobs contained, that they have been logged out, the client/customer identity, and that they are to be returned to the client/customer.

5.8.6.2. Solvents

Dirty or spent solvents are placed temporarily into a 5 gal. fire-proof can kept in the SEM/TEC Laboratories solvent cabinet for that purpose. Since we use vanishingly small amounts of solvents, we are exempt from EPA regulations as a small user. SEM/TEC is responsible for disposal of the solvent.

5.8.6.3. Acids

All acidic waste is to be dumped into the 55 gal. acid waste container for that purpose which is near the AA hood. When full, the container is to be disposed of as hazardous waste by a commercial disposal service.

5.8.6.4. Pb samples

Old Pb samples that have not already been returned to client/customers are to be double bagged and disposed of along with our asbestos samples, by Spray Systems, Inc. The Safety Officer makes or fills out the manifest, etc.

5.8.6.5. Biologically active samples

All cultures, stocks and other active wastes are to be decontaminated before disposal by autoclaving or soaking in full-strength bleach solution. All materials are to be decontaminated on site, then bagged in 6 mil bags to prevent growth on the still attractive media. Zefon cassettes may be disposed of normally, since the spore trap has been removed. Prepared slides may be disposed of normally, since they have been fixed.

5.9. Quality assurance

5.9.1. General

Fiberquant uses many types of quality assurance/quality control (QA/QC)procedures to monitor the validity of testing. Specific QA/QC tasks are listed for each SOP or analysis type. See 4.2.1 for a general plan to be used to develop QA/QC plans for new analysis types, or to evaluate current QA/QC plans.

5.9.2. Acceptance Limits, Review of Acceptance Limits and Trends

Part of the QA/QC plan is to establish acceptance limits for all quality control tests. When a quality control datum is outside of its acceptance limits, the non-conformance procedure is commenced. Acceptance limits are reviewed quarterly for AA, yearly for PCM, PLM, TEM, Micro, Soot. The statistics plotted in the quarterly QA Report (for each program of analysis) include plots from which trends can be tracked and acted upon, if warrented.

5.9.3. Review of Data and Report

The original analyst creates a preliminary report (stored in ,pdf and printed) to be used mainly for review. The preliminary report bears the statement: "Preliminary Data (unreviewed). Note: preliminary data are not covered by accrediation." Before data are reported to the customer without qualification, the preliminary report, along with the job work order, and bench sheets, if applicable, are reviewed by a second qualified individual. A qualified individual is defined as a person having the background, knowledge and prerequisites that are required to become an analyst for the analyte being reviewed, although not necessarily a current analyst. The review procedures are located in Chapter 11 Work Instructions and are specific to each analyte. In some cases, the review also includes the re-analysis of samples.

Generally, the review should cover: comparison of QC data to acceptance limits, a check of the calculations, transcription correctness, if applicable (AA, Micro), and that proper procedures have been followed, if possible. Specific checks for each type of analysis is given in Chapter 11, Work Practices.

In the event that results are needed before such a review is possible (*e.g.*, weekends or nights), the preliminary report may be e-mailed or faxed to the client/customer. When the report has been reviewed (and documented by review initials in the LIMS), then the printed report does not contain the preliminary statement.

5.10. Reporting the results

5.10.1. General

Results may communicated to the client/customer verbally, by fax, by email or by hard copy. At a minimum, each client/customer must receive a written report either a hard copy or pdf email. The written report has been designed to be clear yet complete, containing the items below and any additional items mentioned in the appropriate SOP chapter. The final report for Fiberquant is defined as one that does not bear the "preliminary" statement, above, regardless of how communicated. A preliminary report may be issued prior to the 2nd analyst review, as above. Results may change between preliminary and final without amendment, whereas once a final report has been sent, any change in the report is handled as an amendment (see 5.10.9).

Most reports are generated from the LIMS. Specifically, the <samples> button on the main job page is clicked. This action opens a form devised for data entry into the LIMS. The exact form of data entry depends on the type of analysis, but is designed to mimic any "by-hand" forms used in data-gathering, so as to make the data entry as error free as possible. The analyst who gathered the data also enters the data into the LIMS to his or her satisfaction, minimizing transcription errors. During data entry, the LIMS checks instrument and analyst QA status, so that minimum QA objectives are met. For example, as the PLM analyst enters for a given sample the hood at which he or she was working, the LIMS checks when 1) the hood was checked for air flow, 2) the refractive index liquids were calibrated, 3) when the refractometer was last calibrated, and 4) when the last blank was performed and, 5) when the microscope at that hood was last aligned. If any of these are outside of QA requirements, that hood number cannot be used for this analysis, and a message is given on the computer screen which requirement(s) has not been met. Likewise, when the analyst enters his or her initials as being the analyst of a given PLM sample, the LIMS checks when the analyst last did 1) a qualitative unknown, and 2) a quantitative reference sample. In this way, QA objectives are seamlessly kept up to date in the lab. When the data has been entered, a <lock> button is clicked, which disables the data entry fields for that sample or job. This way, the data is not accidentally changed by stray keystrokes. Also, the lock step is a key step in tracking data integrity. The data entry screen is then closed out, and the report may be printed starting with the <print> button and following any options that follow. Even though more than one analyst may have analyzed samples in one job (and entered their own data), one analyst, usually the last to work on the job, takes responsibility for printing the job and initial report checking. It is this analyst whose signature appears on the job. All analysts are authorized to sign reports in this way. Signatures are stored as bitmaps by the LIMS. The report is "signed" during the printing process by the analyst entering their signature password when prompted. A bitmap signature of the Lab Director is also included on each report as the official accreditation signatory.

Reports not generated by the LIMS must take the same form and contain the same information (5.10.2, 5.10.3, 5.10.4). They are generated by MS Word templates stored in <z:/controlleddocuments/forms/>.

5.10.2. Test reports and calibration certificate items

The general form of the test report includes:

1) the title, describing generally what was analyzed using what means (*e.g., Analysis of Bulk Sample for Asbestos Using Polarized Light Microscopy*)

2) the Fiberquant logo, name, address, phone numbers, email

3) Fiberquant job number (each page)and client/customer job designation; also page number and total number of pages in the report on each page

4) client/customer name, address, phone numbers, submitting person or contact person at the client/customer

5) the official designation in title and number of the test method

6) Fiberquant lab number and client/customer number/designation for each sample, whether tested or not

7) The condition of each sample that is not in excellent, undamaged, unbiased condition. Any condition adverse to unbiased, accurate analysis (*e.g.*, sample is wet, cassette cap is missing) is reported in the *Analytical Notes* section.

8) Date of sample receipt, date of analysis, date of report issue, and any other critical dates (such as date and time of TEM water sample filtration)

9) If sampling was performed by Fiberquant, the sampling plan/location map, or reference to sampling plan

10) Sample raw data, if useful, other testing parameters, such as dilution factors, grid opening areas, etc., and the sample results, reported in the units most commonly encountered, intermediate calculated values, if desired, the analytical sensitivity or reporting limit (depending on type of analysis). Fiberquant reports to the client/customer a calculated reporting limits (see glossary). The reporting limit is that number below which results are reported as a "<". The reporting limit is always greater than the detection limit, but its exact relationship to detection limit varies with the type of analysis, and is discussed or defined in the *Method and Analysis* section of the report. The reporting limit is listed near the analytical value, so that the client/customer is aware of how close the reported value was to the reporting limit. The number of significant digits used in reports is controlled for each type of analysis by a subroutine in the LIMS called SigFig(x,n). The number of significant digits that we report is every digit that is certain plus one that is not certain – to be determined from QC data

11) The name and signature (may be electronic) of the analyst, and of the approved signatory (Larry S. Pierce) who take responsibility for the report

12) The statement: "Accreditation does not imply endorsement by the EPA, any other United States governmental agency or any private agency or association. Each lab analysis refers only to the sample tested, and may not, due to the sampling process, be representative of the material sampled. This report may not be reproduced except in full, without the approval of Fiberquant Analytical Services."

13) Information of whether the test method was modified and how it was modified

14) Clear indication of which, if any, of the analyses were sub-contracted and to whom

15) Clear indication of which, if any, of the analyses are not covered by accreditation that normally would be covered by accreditation

16) Results of field blanks, and a statement as to whether blank results have been used to correct non-blank results

17) an estimation of uncertainty, either in the form of 95% confidence ranges, specific CVs or generally expected CVs

5.10.3. Additional items on test reports

Where necessary for the client/customer to interpret results, the following will also be included, if not on the COC:

1) opinions and interpretations

2) any additional information requested by the client/customer

When sampling has been performed by Fiberquant, and where necessary for the client/customer to interpret results, the following will also be included:

1) date of sampling

2) identification (*e.g.*, manufacturer, lot number) of material, if appropriate

3) sample map, diagram, sketches, photographs

4) reference to sampling plan (*e.g.*, AHERA, HUD Chapter 7)

5) environmental conditions during sampling that may have affected the results

6) reference to applicable standards or specifications of sampling and any deviations from same

5.10.4. Additional items on calibration certificates

not applicable to Fiberquant

5.10.5. Opinions and interpretations

Fiberquant does not engage in consulting activities (i.e., advising a client/customer whether a situation is hazardous, designing removals, on-site evaluations). Therefore, it is Fiberquant' s policy not to dispense such information or opinions either verbally or in writing. Employees are cautioned to not say anything you would not put in writing on one of our reports.

Fiberquant does dispense information as to 1) how to take proper samples, 2) how to contain samples, 3) things that may invalidate samples, 4) what reported numbers mean relative to current standards. These opinions are to be given by qualified staff only (lab supervisor or analysts) and are not to be given by non-degreed personnel. Such information may be contained in a published Fiberquant Information Circular, which may be distributed or quoted by non-degreed personnel. When such information is given, it should be documented in the <client/customer communication> database table in the LIMS.

Should opinions and interpretations be included in a report, the basis for such an opinion would have to be documented in the <client/customer communication> database, and such opinions and interpretations would be rendered by one of the staff possessing a CIH, as only they are authorized to render opinions.

5.10.6. Mixed Results (Fiberquant/subcontractors, and accredited/non-accredited)

When results have come from a subcontractor, they are not passed through the LIMS; the results are presented in total as the subcontractors report. That way, subcontracted results are clearly separated from Fiberquant results.

Accredited and non-accredited results are not mixed on Fiberquant reports. They are presented as separate jobs, since each Fiberquant report contains results from only one method.

5.10.7. Electronic transmission of results

Preliminary and final results are transmitted by fax and by email. Prior to transmission, the receiving number/address is checked to minimize a breach of client/customer confidentiality.

5.10.8. Format of reports and certificates

Reports should be clear and easy to read, yet comprehensive. Tables of data usually provide the best compromise. The report format for the LIMS is fixed by *Report Main Top* and *Report Main Bottom* report forms, where the data for each analysis type is added between.

5.10.9. Amendments to test reports and calibration certificates

The LIMS keeps a record of report versions via a version counter. Both the report date and printed date are given on a report, so that reports re-printed without change are given a new print date but retain the same report date. When a report has been printed and sent to the client by whatever means (e.g., hardcopy, fax, email), and subsequently a change is necessary, the procedure in *Work Practice GEN-5 Amendeding Reports* is followed.

If, after a report is issued, information arises indicating that data in a report is invalid or in significant error, we need to notify the client/customer immediately, in case they are acting on our information. If the error has been already corrected or can be corrected, then an amended report will be issued as soon as practical – with the notification is always appreciated by the client/customer.

Figure 5.10.9a Amended Report Database

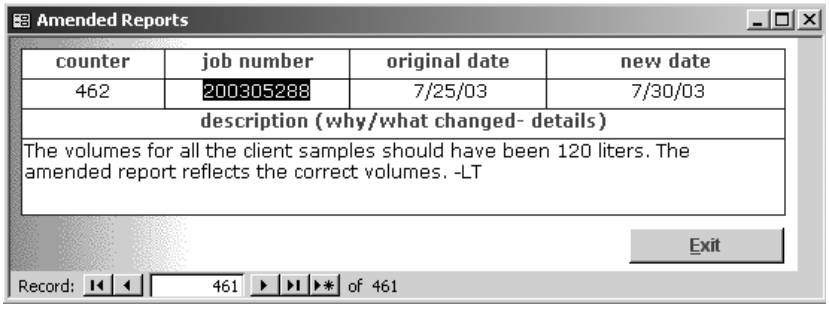
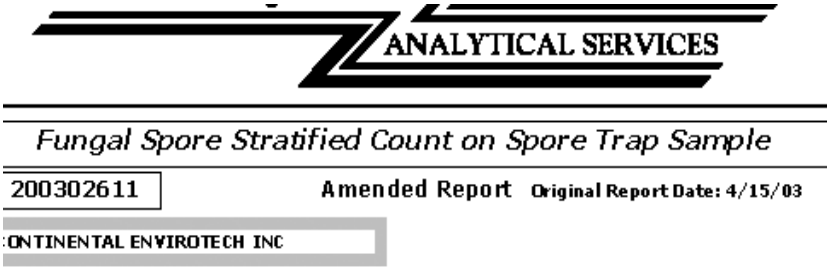


Figure 5.10.9b Example Amended Report



6. STANDARD OPERATING PROCEDURES FOR THE ANALYSIS FIBERS ON FILTER SAMPLES USING PHASE CONTRAST MICROSCOPY (PCM)

6.1. INTRODUCTION

These standard operating procedures are instituted so that a consistent and standard analysis can be performed no matter who in the laboratory is performing it. These procedures have been written to a level of detail fine enough so that someone with only a passing knowledge of the analysis would be able to perform it. Naturally, it is not expected that an analyst would page through a document of this size on a daily basis, for example, to be reminded of the order of certain steps or of counting rules. For daily reference, Work Practices have been written, which are step-by-step but brief summaries of the procedures detailed here. The Work Practices are kept in a bound notebook or, in some cases, posted in the analysis area, for easy reference.

6.2. ORGANIZATION OF PERSONNEL AND TRAINING

The job descriptions, prerequisites and organization of personnel at Fiberquant, Inc. are given in Section 4 of the SOP/QA Manual. Training procedures and requirements for personnel are given in Section 9 of the same.

6.3. EQUIPMENT AND SUPPLIES

6.3.1. Equipment

The current equipment used for PCM analysis is as follows:

1) Hot Block Mounters

1. SKC 714; location: PCM prep hood.
2. Biosphere Environmental Products AV-1; location: back-up in PCM prep desk.
3. Quickfix from the R.J.Lee Group; backup.

4. BGI Inc. VAP 300; in TEM hood for backup..

2) Microscopes

Several Nikon Labphot microscope; location: mycology microscope room.

Scopes to be used for PCM analysis must have 40x phase contrast objective and a matching phase contrast condenser; also they are required to have a Walton-Beckett reticle that is calibrated as to apparent diameter on the focal plane (see below).

3) Hood

MAC hepa hood (made for PLM) for sample prep, HEPA and activated charcoal filtration.

6.3.2. Maintenance

1. Hot Block Mounters

The interior airway of the mounter is blown out with compressed gas when blanks show dirt. When the septum (rubber disc through which the syringe needle is pressed) starts to leak (indicated by samples not completely clearing with the usual amount of solvent), it is replaced. Repairs are made on an as needed basis, by the Lab Manager.

2) Microscopes

The exterior surface of the microscope is cleaned during the normal lab clean-up. The interior of the microscope is cleaned and inspected once per year by a professional microscope maintenance service, Bender Associates, Tempe, AZ. Other maintenance is of the trouble-shooting type, and is performed as needed by the Lab Manager. Manuals for the optical scopes are kept in the scope tables.

6.3.3. Supplies

The analysis depends in large part on the availability of uncontaminated supplies and so the following list of expendables and target inventories has been compiled to aid in supply maintenance.

ITEM (SOURCE)	TARGET INVENTORY
glass slides, 1x3" (Abatix; Chem Lab Supply; Fisher)	50 gross
cover slips, #11/2, 22mm square (Abatix; Fisher))	20 packs
slide holders (Fisher #12-558-30)	1
syringe, disposable Tuberculin (Fisher#14-823-220)	10
MCE filters, .8um (Millipore, Nuclepore 141679 or Gelman from Fisher)	100
acetone, optima (Fisher#A929-4); acetone, tech grade (hardware store)	4 L
triacetin (Aldrich 102-76-1)	4 oz.
clean room wipes, 4x4" DURX 770 (Fisher#06-665-33F)	4 pks.
Kimwipes, large and small (Fisher#06-666A,B)	8 pks.
forceps, jewelers (Fisher#08-953E)	1
scalpel (Fisher#08-914-5)	1
scalpel blades, #10 (Fisher# 08-916-5A)	10
markers, Sanford sharpie (office supply)	2
screwdriver, large blade (hardware store)	1
nail polish, clear (Walgreens drug store)	1
duster, EFFA, nozzle and gas can (Fullam)	3
vials, GC,2 dram with caps and septa (Alltech Assoc., 9526,95261,95262)	10
septa, 3/8" rubber (Alltech Assoc. 6514)	>3
phase contrast test slide (PTR Optics Corp.)	1

6.4. SAMPLE LOG-IN AND HANDLING

The general log-in and sample handling procedures are described in Section 5 of the SOP/QA Manual, and will not be repeated here. Handling of the samples and job in the PCM lab is described below.

The samples are placed by front office personnel in the sample prep rack in the order received. Rush samples are placed on the prep desk and in this case, the analyst is notified that rush samples are present in the lab. Present with each bag of samples is the partially completed sample submittal form.

The job is mounted and counted usually in turn. Multiple jobs may be mounted before counting, or one person may mount samples while another counts them. When the job is being counted, the number of counts and the number of

fields are filled in on the job rider sheet. Any same analyst recounts are performed and written at the end of the samples. One non-zero count is chosen for calculation check and is calculated to f/mm2 and f/cc manually. Then, the job is brought up on the computer, and the numbers of counts and numbers of fields are filled in on the screen for all the samples in the job. The data entry is checked on the screen. The manual calculation is compared to the computer calculation and any discrepancy investigated. If the data entry is OK and the check of calculations is also OK, the data is locked and the report printed, review and signed.

When the analyst exits the main data entry field, the recount data entry form will automatically appear if a same analyst recount was to be performed. The analyst fills in the counts and fields for the recount, and the computer calculates the required square root difference and compares it to the control curve and indicates whether the recount is in control or not. Different analyst recounts are deferred until another analyst is available, up to but not more than 30 days after the original analysis, and the recount results checked in the same manner as same analyst recounts. In this case, the recount data screen is entered through the "QC" button on the job screen. When complete and signed, the job paperwork is returned to the front desk while the samples are either saved or disposed of, according to the directions given in Section 5.7.

6.5. SAMPLE PREPARATION

The steps performed in sample preparation are summarized in SOP Work Practice PCM-1. Detailed notes are given below. The procedure is essentially the same for all diameters of filters, except that the ratio of acetone and triacetin to the amount of cut filter must be adjusted to achieve the ideal of having the filter fully cleared and 100% wetted by the triacetin without excess liquid.

The sample cassettes should already have had their unique lab numbers written on them. If they do not, or if they are illegible, write the numbers on them or reconcile the numbers seen with the proper numbers as listed on the sample submittal form. A suitable number to be mounted at one time would be no more than ~20. Any more mounted at once would not leave enough room in the hood to maneuver.

Sample prep is ordinarily performed in the PCM hood. Before starting, turn on the hood fan and adjust to a setting that is at least 3/4 maximum to maximum. Check the cleanliness of the prep area. If visible dust is present, wet-wipe the area using a kimwipe. Set out tools and materials. Place the cassettes to be prepped in a row, in an orderly progression of lab numbers. Place out a matching number of clean glass slides. Add one extra glass slide at the top of the row for a blank, if a blank is to be run on this series. A blank is run once per day on one or more jobs. The typical blank would have been exposed during 5-10 sample preps. If there is no 5-10 sample job in house, several small jobs are mounted with the blank exposed.

Mark the lab number of each cassette on each corresponding slide. Wipe each slide with a clean room wipe and blow off any visible dust, if necessary. If cassettes to be prepped are taped shut, slit the tape with the scalpel. This is done now so that as little manipulation as possible takes place while the blank and samples are exposed to the air.

Place a wedge of clean, stock 0.8 MCE filter material on the slide for the blank. The wedge is left exposed while the remainder of the samples are prepared.

Turn on the hot block.

Move the first cassette to be mounted and its marked slide from the line of cassettes to a spot in front of the hot block. For the last time, check that the lab numbers on the cassette and slide match. Then, take apart the cassette at the lowest break point. If is does not readily come apart, use a screwdriver blade to twist between the cassette parts until they become free. Pull the cassette apart to expose the filter. Sample rejection at this point could occur if: 1) there is no filter in the cassette, 2) a blue, non-porous, protective sheet is present in the cassette along with the filter, 3) the filter and pad are in reversed positions, and the cassette was sealed, 4) the filter is torn, and there is obvious deposition of material on the pad, or 5) the filter is grossly overloaded, as indicated by caking or loose dust in the cassette. The sample might be rejected (after discussion with the client/customer) if: 1) the filter is torn and there is no obvious deposition of material on the pad, 2) there has been leakage around the cassette seal, as indicated by deposition being present all the way to the edge of the filter, or 3) the wrong filter has been used (e.g., a TEM cassette which has two filters and one pad; in this case only the top filter is mounted, the bottom merely aids in even distribution of samples). If a sample is rejected, its slide is marked as such along with the reason for rejection, and kept with the other slides for the job, if any. The full rules for rejection of PCM samples are given in Section 5.2.1, and will not be repeated here.

If the filter is in shape to be mounted, stabilize the cassette, if necessary, by placing it in a holding jig. Wipe the scalpel and forceps with a clean room towel (use one new towel for each separate job or on large jobs, for approximately 10-20 cassettes). Cut a wedge of filter (1/4 of the filter for 25mm dia. cassettes or 1/6 of the filter for 37mm dia. cassettes). Usually, the filter is uniform, so any part of it may be sub-sampled. However, if there is a visible defect (e.g., water spot, rip), choose a part of the filter without the defect for the sub-sample wedge. The scalpel has replaceable blades. New blades produce clean cuts either by drawing the cutting edge toward the middle, or by rocking the cutting edge, working out to the edge. If ragged cuts are noticed, the blade should be changed.

Figure 6.5 PCM Sample Setup

Transfer the wedge of filter, particle side up, to the marked slide, positioned so that horizontal traverses on the microscope will run from all the way from the center to the outside of the filter, as shown in Figure 6.5.

The wedge will adhere to the slide quite well due to static charge. Place the wedge and slide on the slide carrier of the quickfix. Position the slide so that the wedge is at the center of the carrier. Using the large syringe, inject approximately 0.2 ml of acetone through the septum of the hot block and into the hot chamber, where it is vaporized. The acetone vapor settles onto the filter wedge, and should clear the wedge in about 5-10 seconds. The concentrated acetone vapors should not be breathed (the threshold of smell for acetone is 2 ppm, while the OSHA permissible exposure limit is 750 ppm, so if one avoids smelling the vapor, one is well under the allowable exposure). If acetone is smelled, increase the speed of the hood fan to disperse it. If the corners or edges of the wedge are still white, then inject more acetone until the entire wedge is clear. Consistent partial clearing is a symptom of either improper wedge centering or a leak in the hot block septum.

Draw ~0.35 µl Triacetin into the syringe. Select a cover-slip. A cover-slip with visible dust or debris is either discarded or the dust is cleaned off with the clean room wipe. Holding the cover-slip is one hand and the loaded glass syringe in the other, place the triacetin drop on the cleared wedge (ideally in the center), by depressing the plunger of the syringe. The needle of the syringe must not touch the filter, which might contaminate the needle.

Immediately after the triacetin is deposited onto the wedge, place the cover-slip on top of it. Bubbles in the mount can be minimized by placing one side of the slip down on the slide first and then lowering the other side the rest of the way. Full coverage of the wedge may be aided by gently pressing the non-covered areas of the slip with the forceps. If the drop of triacetin falls at the edge of the wedge instead of the middle, the mount may be able to be saved by placing one edge of the slip on the slide on the opposite side of the wedge as the triacetin drop, then lowering the slip slowly until the drop is contacted. Capillary action will tend to draw the liquid towards the middle of the wedge. When the droplet is again centered, lower the slip fully onto the wedge.

An ideally mounted wedge looks transparent when fully cleared, and be wetted to the cover-slip 100%. Routine mounts are expected to be fully cleared and have at least 50% of the wedge wetted to the cover-slip.

If a filter or cassette has a problem, such as torn filter, pad and filter upside down, loose material, etc., that fact is noted by writing a short descriptive phrase or abbreviation on the mounted slide. Typical abbreviations are HL (too heavily loaded to count, WF (wet filter), TF (torn filter), LM (loose material), NA (not analyzed), PA (previous analysis, wedge already missing), and HL (heavily loaded). If the problem resulted in the filter not being mounted, its slide (without a wedge) is marked anyway.

Each remaining cassette is prepared as above in turn, leaving only one cassette open and only one wedge out on a slide at a time. When all samples from a job have been mounted, the slides from the job are placed in a slide holder for the analysts to count. The cassettes for the job are placed back in their containment bag, and the bag is returned to the front desk or designated temporary cassette storage area. The sample submittal sheet and other attached paperwork, if present, is placed next to the mounted slides, to be used by the analyst.

After all cassettes in a mounting series have been mounted, the blank is cleared and cover-slipped as above. Its mounted slide is placed in front of the jobs for which it is a blank, so that it is counted first, to find contamination before spending time analyzing samples. If its count is >5.5 fibers per 100 fields, contact the lab manager; the series may have to be re-mounted.

6.6. MICROSCOPE PREPARATION

There is a microscope dedicated to PCM analysis. Since its objective is not moved, nor its apertures or other adjustments moved, they do not frequently need alignment or adjustment. The alignment is nonetheless checked before work each day. Checked are the 1)condenser alignment and field aperture size adjustment and 2) the phase ring centering. Not needed to be checked is the filament centering (the microscopes have only Pseudo-Koeller illumination and their filaments are pre-centered).

1) Eyepiece setup

Remove the eyepiece containing the reticle and, looking at a blank, lit background, turn the focus of the eyepiece until the reticle appears sharp. Make sure that your eye is relaxed (e.g., focus outside of the eyepiece in the distance then bring the eyepiece in front of the eye; the eye should not have to re-focus). Replace the eyepiece and focus on a recognizable object using the microscope focus but looking only through this eyepiece. Finally, turn the eyepiece focus of the non-reticle eyepiece until the recognizable object is sharply focused as well. For eyes that are matching in focus power (e.g., 20/20), both eyepieces should be focused to approximately the same spot relative to the ring showing on the barrel.

2) Condenser alignment and field aperture size adjustment

With a focused slide on the stage, the field aperture (in the base) is dialed down to a small diameter. If the hexagonal shape of the iris is in focus, its edges will appear sharp and have a faint purple color, not red or blue. If the aperture is

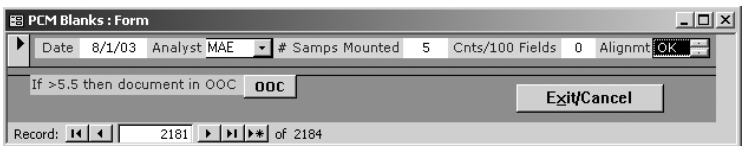
not in focus, focus it by turning the 1" dia. knob on the left side of the sub-stage assembly. A centered aperture would be concentric with the eye-piece reticule circle. If the aperture is not centered, center it using the two 1/2" dia. knobs on the sub-stage assembly. Finally, dial the size of the aperture larger until it falls just outside the field of view.

3) Phase ring centering

For proper operation of the 40x phase objective used in PCM analysis, a ring in the condenser must be concentric with a ring in the objective. Both rings are visualized by replacing one of the eyepieces with a telescope, kept in the microscope table drawer. The rings are made concentric using the Allen sockets on both sides of the right hand side of the plate on the non-turret condenser of the scope. It is worthwhile noting that ring alignment can be affected by cover slip position. Specifically, if a cover slip is tilted, the phase rings will be out of alignment relative to their position during observation of a parallel slip. Any out-of-alignment condition may be apparent in the image as fuzziness, low contrast or astigmatism. If any of these conditions are noted, the scope should be re-aligned before work continues.

The first analyst to use the scope for the day indicates that the above have been checked by placing their initials in the "blanks/alignment" computer form, shown in Figure 6.6.

Figure 6.6 Blank Count and Alignment Form



6.7. ANALYSIS

Before counting any sample slides on a given day, an analyst must count one of the twenty reference slides. The full procedure for reference slide use is given in Section 6.9.4.1.

The sample slides are then counted according to the NIOSH 7400A rules, unless other rules are specified on the paperwork. The total counts observed and the total fields counted are recorded in the boxes provided on the sample submittal form/worksheet, already shown in Figure 5-2. Notes on loading, probable types of asbestos present and probable types of interferences present are recorded under "notes" during counting.

In any analysis like this, where lengths are measured by comparison to a standard, there are bound to be ambiguous particles, which are right at 5μm length or right at a 3:1 aspect ratio, and the analyst cannot be sure whether they should be included in the count or not. For such particles, the analyst will alternate counting and not counting them, so that, on average, half of the ambiguous particles are counted. As desired, the count can be done by either 1) counting each ambiguous particle as 1/2, 2) counting every other ambiguous particle, or 3) counting ambiguous particles in odd numbered fields only.

6.8. CALCULATIONS

6.8.1. Manual Calculations

For 25mm cassettes, the LIMS performs the calculations that are reported. However, one manual calculation is performed per job to check that the LIMS is functioning correctly. Additionally, if any but a 25mm cassette is analyzed, then all calculations must be done manually, since the LIMS only does 25mm.

If sample volumes have not already been calculated from the time and flow rate of a filter, they are calculated now:

$$\text{Volume (L)} = \text{Time (minutes)} \times \text{Flow (L/min.)}$$

If the volume has already been calculated by Fiberquant, then the analyst checks the calculation for one sample.

The total counts are divided by the number of fields to yield the average count per field.

$$\text{Ave. (counts/field)} = \text{Total Counts / Total Fields}$$

The average counts per field are not written on the form, but immediately multiplied by the fields per mm^2 (127 for the dedicated PCM microscope) to yield the fibers/mm^2, which is then filled in its blank on the form. Fibers/mm^2 are reported to the nearest 1.

$$F/mm^2 = \text{Ave. (counts/field)} \times 127 \text{ fields}/mm^2$$

The fibers/cc are then calculated, according to the equation below, and filled in its blank on the form. Fibers/cc are reported to one significant figure, as befitting the method CV of 30% or more.

$$F/cc = \frac{F/mm^2 \times 385 mm^2 \times 0.001 \text{ L/cc}}{\text{Volume (L)}}$$

Not normally calculated by hand, but included here for an emergency, are the limit of detection and the 95% confidence (two sided) limits for the analysis. These values are derived from the table below.

PCM ERRORS AND DETECTION CHART

LOD METHOD 7400 (25MM FILTER) ERRORS

" Published LOD"	VOLUME	RAW COUNT	ERROR RANGE
.05	53	0	<5
.03	88	1	1/4 - 6
.02	132	2	1/3 - 5
.01	265	3	1/2 - 4.5
.009	294	5	1/2 - 4
.008	331	7	1/2 - 2.8
.007	378	10	1/2 - 2.4
.006	441	25	1/2 - 2
.005	529	50	1/2 - 1.9
.004	662	>=100	1/2 - 1.8
.003	882		
.002	1323		
.001	2646		
.0009	2940		
.0008	3308		
.0007	3780		
.0006	4410		
.0005	5292		

Revision 11-8-89

The "Published LOD" limits of detection above were obtained by assuming a hypothetical 7 F/mm^2 loading, then calculating through to f/cc for various sample volumes. For a given actual sample, the "LOD" nearest the actual sample volume would be transferred to the "Quant Limit" blank on the count sheet. "LOD's" for volumes outside those listed on the table, or for other than 25mm dia. filters can be calculated hypothetically as described above.

The 95% confidence limits in the table are nominally +/- 2xCV (where CV = Coefficient of Variation) and were calculated for hypothetical raw counts per 100 fields based on a coefficient of variation of 30% + the Poison component (the square root of the raw count divided by the raw count). The value of 30% was arrived at through reference sample and interlab sample results. For raw counts below the stated detection limit for the 7400 method (7 F/mm^2), the 95% confidence limits were calculated assuming a coefficient of variation of 45% + the Poison component. For an actual sample the 95% confidence range is obtained by multiplying the F/cc for the sample by the values read off the chart for that sample's raw count. For example, a sample which had 10 raw counts per 100 fields has a F/cc that has been calculated to be 0.01. The error range for a raw count of 10 is 1/2 to 2.4, so the 95% confidence range is reported as 0.005 to 0.024. The range is recorded in the "95% range" blank on the counting form.

The above calculations are routinely performed and a report is printed by computer, as described below.

6.8.2. Computer Calculations and Report Generation

For 25mm cassettes, the Fiberquant LIM, the custom laboratory information program, will already have client/customer, job and sample data stored from the log-in process for a given job in house. All that needs to be done to generate a report is to choose "Samples" on the job screen for the specific job. The computer displays sample numbers to allow the operator to enter the counts and fields for each sample. If the sample was not mounted or counted, there is a cell to report that event. When data entry is complete "Close" is clicked, and the report can be printed from the job screen. For cassettes other than 25mm, an MS-WORD report form must be filled in manually (and printed to PDF when done, as all reports). A form for 37mm cassettes is to be found at Larry//C:\Msoffice\MSWord\Forms\PCM report 37mm cassettes.01.doc.

A typical report is shown below.

Figure 6.8.2 Typical PCM Report

FIBERQUANT ANALYTICAL SERVICES

Phase Contrast Microscope (PCM) Analysis of Fibers

JobNumber: 96-1432

Client:

TEMPE, AZ 85283-0000
Office Phone: (602) 777-2900
FAX: (602) 777-2899

 # Samples: 5 PCM **Rec:** 3/20/96 **Method:** NIOSH 7400 Issue 2 (1994) A-rules PCM count of fibers >5um
Client Job: SRP/Kyrene GS **PO Number:** - **Routing Number:** -

Method and Analysis Information:

Each incoming sample cassette is dissassembled and a wedge of filter is excised using a cleaned scalpel. The sample wedge is placed on a 1x3" new glass slide marked with the sample's unique lab identification number. The wedge is cleared using hot acetone vapor in a "hot block" apparatus. A syringe is used to place 0.3 ml of triacetin on the wedge, and a glass cover slip is placed on top of the triacetin to complete the sample mounting preparation. The mounted sample is then scanned at 400x magnification on a Nikon Labphot phase contrast microscope until 100 fibers or 100 fields of view have been observed.

The counting rules used are NIOSH 7400, Revision 3 (1989), A Rules, in which a fiber is counted if its length is >5um and its length/width ratio is >=3:1. Such a counted fiber is not necessarily asbestos, even though this method is often used for asbestos compliance testing. Unambiguous identification of asbestos fibers requires a TEM method, such as modified AHERA or NIOSH 7402. The coefficient of variation for NIOSH 7400 method can be expected to range from 0.3 to 0.45, depending on fiber loading. Accordingly, our results are rounded to one significant figure. For example, a F/cc value that calculates to 0.145 will be reported as 0.1. The most meaningful representation of the results will be given by the 95% (+/- 2 standard deviations) confidence ranges provided below. Please consider these factors when making pass/fail decisions. The below F/cc (Meas) and F/mm2 (Meas) values are reported to the analytical sensitivity of 1 fiber per analysis. Actual counts of less than the analytical sensitivity are reported as "<" (less than). The "LOD" (limit of detection) reported is calculated as the F/cc that would result from a hypothetical observation of 7 F/mm2 (as in 7400). The "LOD" is a value much higher than the average of our blank counts, and so may be considered to be a limit under which the analytical uncertainty is higher than the usual 0.3 to 0.45.

One lab blank per day provides a long-term track record of lab cleanliness. Each analyst has attended the 5 day intensive NIOSH 582 training course, and additionally has been qualified by reference slide performance before being allowed to count client slides. Each day, the scope alignment is checked, and each analyst must count a reference slide within 2 standard deviations of its historical average. Monthly, each analyst is calibrated for vision using the HSE phase object reference slide. Five percent of client samples are re-analyzed by the same analyst, and another five percent of client samples are re-analyzed by a different analyst, to provide a measure of reproducibility. All analysts participate in interlab round robins and the AIHA/NIOSH PAT program for PCM counting. Fiberquant Lab is fully accredited for PCM fiber analysis through the American Industrial Hygiene Association (AIHA). Accreditation does not imply endorsement by the EPA, any other United States governmental agency or any private agency or association. Each lab analysis refers only to the sample tested, and may not, due to the sampling process, be representative of the material sampled. This report may not be reproduced except in full and with the approval of Fiberquant Analytical Services.

Analysis Results:

Lab Number	Client Number	Date	Vol (L)	Cnts	Flds	f/mm2	f/cc	"LOD"	95% Conf. Range
96-1432- 1	HA-SRP-3-20-1	3/20/96	2345	11	100	14	.002	.0002	.001 to .007
96-1432- 2	HA-SRP-3-20-2	3/20/96	2340	20	100	25	.004	.0002	.002 to .01
96-1432- 3	HA-SRP-3-20-3	3/20/96	2335	7	100	9	.001	.0002	.0007 to .004
96-1432- 4	HA-SRP-3-20-4	3/20/96	2360	12	100	15	.002	.0002	.001 to .007
96-1432- 5	HA-SRP-3-20-5	3/20/96	2340	20.5	100	26	.004	.0002	.002 to .01

Analysis Notes:

25-Mar-96

Analyst: PAUL W. BARBERA

4824 S. 35th Street Phoenix, Arizona 85040-2852 Phone: 602-276-6139 1-800-743-2687 FAX: 602-276-4558

6.9. QUALITY ASSURANCE PROCEDURES

6.9.1. General Requirements

Quality assurance procedures are designed generally to assure that data or information disseminated to the client/customer is not inaccurate or erroneous. Certain procedures minimize conflicting data, thereby reducing the time spent clearing up discrepancies. The following procedures are specifically designed for asbestos sampling and testing and have been adapted from 1) the NIOSH Manual of Analytical Methods, 3rd. ed., 1984, 2) NIOSH Method 7400, Revision 2 8/15/87, and 3) the Federal Register 29 CFR Parts 1910 and 1926 "Occupational Exposure to Asbestos, Tremolite, Anthophyllite and Actinolite; Final Rules; Amendment.

The quality control program consists of three parts: 1) calibrations, 2) contamination control, and 3) precision and accuracy checks. Calibrations ensure that data is not biased due to instrumental errors. Contamination control ensures that the data is not erroneously high due to fibers introduced during handling. Precision and accuracy checks ensure that the data is not compromised due to operator bias or error. The details of each of these programs is discussed below:

Figure 6.9.2.1 Optical Microscope Calibration Form

Fiberquant, Inc. 5035 S. 33rd St.; Phoenix, AZ 85040; 602-276-6139 FAX 602-276-4558

Optical Microscope Calibration Bench Sheet

Microscope Calibrated (FQ#):	Location
Stage Micrometer (1mm x 100 units) Used (FQ#):	

I. Walton-Beckett Reticle Area Determination (PCM)

Procedure: View the stage micrometer using 400x phase contrast through the Walton-Beckett reticle (each scope has its own unique Walton-Beckett reticle, they are not to be interchanged). Focus the stage micrometer using the stage "z" control and focus the eyepiece reticle by twisting the eyepiece focus. Report how many stage micrometer units are encompassed by the diameter of the reticle.

Diameter of reticle (to the nearest 0.1 unit) = _____ stage micrometer units

Area of reticle = .000025 * pi * (# of stage micrometer units)^2 = _____ mm^2

II. [a] 10x10 x 1cm Reticle Width Determination (Micro)
[b] 100 units x 1cm Occular (eyepiece) Micrometer Size Check(Micro)

Procedure: View the stage micrometer using 1000x oil through the 10x10x1cm square reticle (each scope keeps its own unique reticle and they are not to be interchanged). Focus the stage micrometer using the stage "z" control and focus the eyepiece reticle by twisting the eyepiece focus. Report how many stage micrometer units are encompassed by the entire width of the reticle. Repeat with occular micrometer instead of the square reticle.

[a] Width of 10x10x1cm reticle (to the nearest 0.1 unit)=_____ stage micrometer units

Width of 10x10x1cm square reticle in microns = (# stage micrometer units) * 10 = _____µ

[b] Length of 100x0.1x1cm occular micrometer (to the nearest 0.1 unit)=_____ stage micrometer units

Each unit of the 100x0.1x1cm occular micrometer = (# stage micrometer units)/100 = _____µ

III. Magnification

Procedure: View the stage micrometer (100 x 0.01 = 1mm) with the eyepiece containing a 100 x 0.1 =1cm reticle, for which the length has just been determined in II, above. Focus the stage micrometer using the stage "z" control and focus the eyepiece reticle by twisting the eyepiece focus. Report how many stage micrometer units are encompassed by the entire 100 eyepiece units.

Magnification 1	Objective:	Eyepiece: 10x (or fill in other _____)
Number of stage micrometer units (to the nearest 0.1 unit, e.g., 25.1) = _____		
Magnification = 10 * Length of eyepiece reticle (line **[a]** above / # stage micrometer units = _____		
Magnification 2	Objective:	Eyepiece: 10x (or fill in other _____)
Number of stage micrometer units (to the nearest 0.1 unit, e.g., 25.1) = _____		
Magnification = 10 * Length of eyepiece reticle (line **[a]** above / # stage micrometer units = _____		

Performed by _____ Date _____

C:\controlledDocuments\Forms Word\OpticalMagnification004.doc Created: 3/1/2013 8:23 AM1/2/13 8:59 AM; Version: 06; Current 3/1/2013 8:23 AM; reviewed by LSP Page 1 of 1

6.9.2. Calibrations

6.9.2.1. Microscope Magnification

Purpose: calibration ensures that the correct figure is used in calculations

Responsible Party: IH TM

Timing & Frequency: at least once per year, after the routine service of the scopes; and after any service or repair.

*SOP:*Work Practice TEM-9

Data Form: Figure 6.9.2.1

Record Storage: equipment files, with microscope records

Summary & Review: no charts or summaries made.

The NIOSH 7400 provides for the use of a standard sized field

of view encompassed by an eyepiece reticule having an area that is nominally 0.00785 mm^2. Since microscope objectives are only expected to be +/- 5% accurate in magnification, in order that the field of view truly be standard, the reticule must be ordered after the microscope is physically on the premises and its magnification has been calibrated.

6.9.2.2. Field of View

Once the magnification is known for a scope, a reticule can be ordered that will be the correct size. If the magnification of the microscope is 420x instead of 400, then a reticule 105 um in diameter instead of 100 um is ordered. Once the reticule is received and fitted to the scope, its actual diameter is measured and actual field area is calculated, since its diameter may be off slightly. The diameter of the reticule is measured with a stage micrometer. The field area is then calculated as below:

Field of View (mm^2) = (diameter mm / 2)^2 x 3.1416

The result for each microscope is kept in the equipment file.

6.9.2.3. Phase Resolution

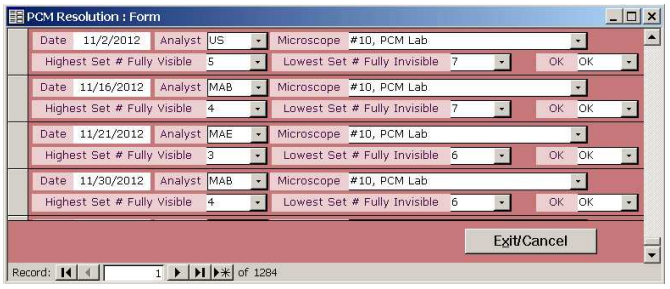
Purpose: to ensure that scope/analyst combination has proper resolution for the analysis.

Responsible Party: each PCM analyst

Timing & Frequency: once a month, first analysis

SOP: The HSE/NPL phase resolution test slide is in the PCM desk drawer. It contains numbered sets of etched lines, each higher number fainter than the previous. Each analyst records 1) the highest set number that they can resolve every part of every line, and 2) the lowest set number which is completely invisible.

Figure 6.9.2.3 Phase Contrast Resolution Form



Data Form: computer record, Figure 6.9.2.3

Record Storage: computer

Summary & Review: no charts or summary.

Out-of-control: according to NIOSH 7400, sets one through three must be fully visible, although young eyes may be able to completely resolve 4, and sets 6 and 7 should be fully invisible, although young eyes can see parts of six. For our purposes, in control is 3-4 and 6-7.

6.9.3. Contamination Controls

6.9.3.1. Housekeeping

Once a week, usually over the weekend, the entire laboratory is cleaned and dusted by a cleaning service. The PCM areas consist of the mounting desk and the two microscope tables. If these areas are noticed to be dusty, the analyst should wet wipe the offending area. If a cleaning is not at the very end of a day or at the very beginning of the next day (and therefore having a blank with the next set), then a blank will be added to the first set of samples mounted.

6.9.3.2. Blanks

Purpose: to qualify the sample prep area as clean.

Responsible Party: the first person to mount slides each day.

Timing & Frequency: once a day, during the first set of samples mounted.

SOP: A blank prep mount is made by leaving a clean MCE filter out during the mounting process for the samples, then clearing and mounting the blank. The blank is counted before the samples for which it is a blank.

Data Form: computer record, Figure 6-2

Record Storage: computer

Summary & Review: number run per month and cumulative average are documented in the PCM QA monthly report.

Out-of-Control: If the blank count is >2 fibers per 100 fields, recount. If normal (<2), then the blank was an random anomaly. If still high, mount and count another blank. If normal, then the mount was an anomaly. If still high, the cause of the high count must be found. Possible causes are 1) fibers in the lab air, which have settled onto the blank, 2) fibers on the "clean" slide (this has been observed once), 3) fibers in the acetone, 4)

fibers in the triacetin, or 5) fibers on the cover-slip. The possible source of fibers can be arrived at by observing the morphology of the fibers, where they occur in the mount (the top of the filter, the bottom of the filter, the cover-slip plane, or the slide plane). Possible corrective actions would be to reject slide shipments, discard and replace acetone or triacetin, clean slips, etc. Note: does not apply to customer-supplied blanks.

6.9.3.3. Hood Face Velocity Check

Purpose: to measure the face velocity of the PCM prep hood.

Responsible Party: PCM analyst.

Timing & Frequency: six months.

SOP: set hood to normal operating speed; use vaneometer to measure velocity at center, upper left and right, and lower left and right. Record the five readings and average on the equipment page in the LIMS.

Data Form: LIMS, equipment page

Record Storage: computer

Summary & Review: as performed

Out-of-Control: average <40; if OOC, the contact QC officer.

6.9.4. Precision and Accuracy Determinations

With the wide range of results to be expected from PCM analyses, the term precision is almost a misnomer, but nonetheless, recounts provide a measure of analytical precision for each analyst and for the lab. The types of recounts performed are: 1) reference slides, 2) replicate counts on sample slides, 3) duplicate mounts of sample slides, and 4) interlab sample exchanges. A measure of accuracy of sorts is provided through proficiency testing. These programs are discussed below.

6.9.4.1. Reference Slides

Purpose: to qualify an analyst for client/customer samples, to obtain precision data.

Responsible Party: each analyst.

Timing & Frequency: once per day, before counting client/customer samples.

Figure 6.9.4.1a Record of Reference Counts

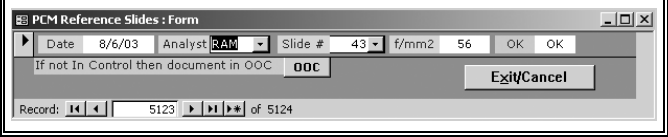
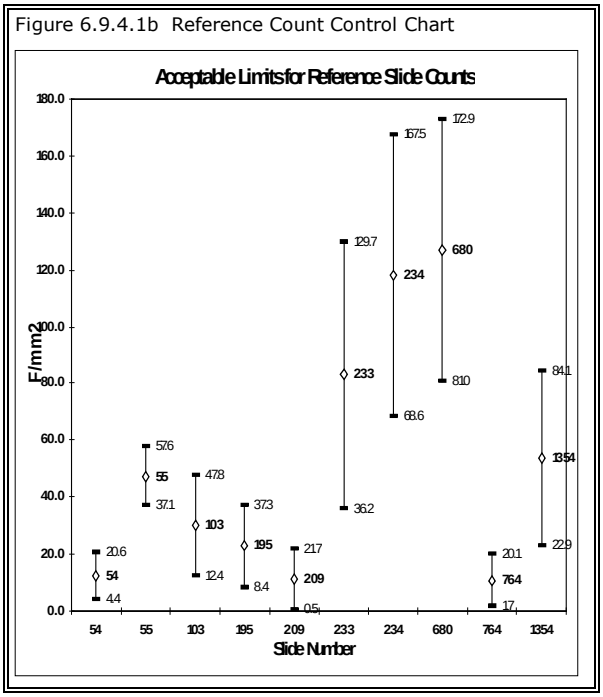
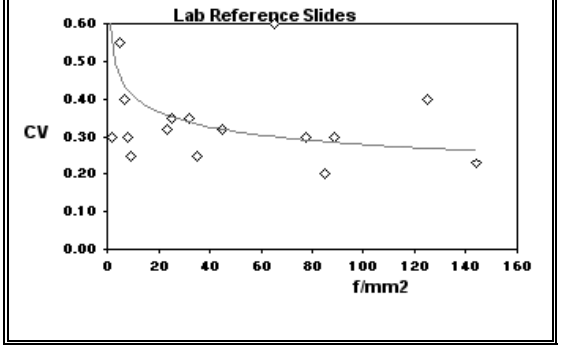


Figure 6.9.4.1b Reference Count Control Chart



SOP: a series of 20 slides, selected from previous samples, NIOSH PAT samples and commercial reference samples, are kept on the microscope table. The fiber loading of the reference slides ranges from <1 to >120 F/mm^2, which, although mostly below the stated target range of loading for Method 7400, accurately represents the usual range of real samples analyzed. The reference samples have a blacked out area, under which the sample number lies. That way, a slide is read without knowing what number it is.

Figure 6.9.4.1c CV vs. f/mm2 for Reference Slides



Data Form: computer record, Figure 6.9.4.1a

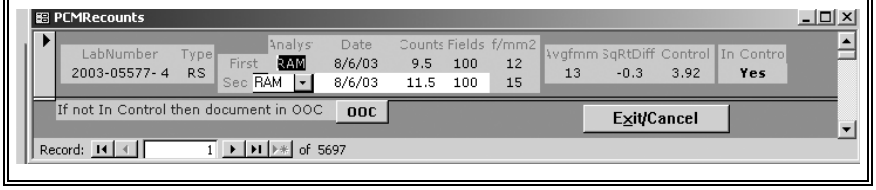
Record Storage: PCM files.

Summary & Review: 1) acceptable limits (example in Figure 6.9.4.1b) and 2) cumulative CV vs f/mm2 for each analyst and lab (example in Figure 6.9.4.1c) are plotted in PCM QA monthly report.

Out-of-Control: For each reference count, outside of acceptable limits; resolution: count another reference slide until an acceptable count is achieved. For CV plot (Figure 6.9.4.1c), analyst should show about 0.2 at 100 f/mm2 and rise at lesser f/mm2 - qualitative judgment.

6.9.4.2. Re-Counts

Figure 6.9.4.2a PCM Recount Form



A recount is a re-analysis of the same mounted slide. At Fiberquant, a recount is sometimes (10% of analyses) performed by the same analyst as the original count (RS), and is sometimes (1%) performed by a different analyst than the one who performed the original count (RD). The sample on which to perform the recount and whether the same or different analyst should count is controlled in an arbitrary way by a counter in the Fiberquant LIM log-in program. As samples are logged-in, certain are designated for RS or RD recount on the sample submittal form.

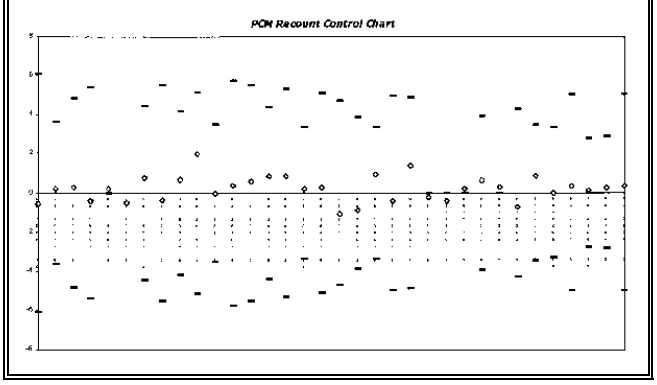
Purpose: to check analyst performance

Responsible Party: each analyst

Timing & Frequency: frequency as assigned by log-in and indicated on the count form; timing for RS - immediately following completion of job counts; timing for RD - as soon as practical, but within 2 weeks of job completion.

SOP: After all samples have been counted, replace the indicated re-count slide on the microscope and count again as if a client/customer sample.

Figure 6.9.4.2b Recount Control Chart



Data Form: computer form, Figure 6.9.4.2a, for comparison & calculations.

Record Storage: computer.

Summary & Review: number of recounts, recount control chart (example in Figure 6.9.4.2b), and out-of-control incidents are documented in the PCM QA monthly summary.

Out-of Control: difference of square roots is compared by the computer to each analysts' historical standard deviation in each of three f/mm2 categories, as described in NIOSH 7400. A control chart is printed monthly, Figure 6.9.4.2b. Resolution by original analyst recount or third party recount until consensus value is obtained. If different than reported, report is amended.

6.9.4.3. Interlab Samples

Purpose: compare lab/analyst results to those of other labs; to obtain an interlab CV to be used for calculation of 95% confidence ranges.

Responsible Party: arrangements by Larry S. Pierce, analysis by either one or all PCM analysts, depending on type of interlab being done.

Timing & Frequency: at least twice a year (historically, Forensic Analytical arranges four per year).

SOP: varies - generally contact labs, generate slides, and count all slides (Forensic has been generating them all).

Data Form: Larry//c:\msoffice\forms\PCM round robin 07-01.xls.

Record Storage: PCM file "Interlab".

Summary & Review: provided by organizing lab.

Out-of-Control: for analyst, >3σ on any slide; response: none specific since slides are not generally available for recount; training if a general trend.

6.9.4.4. Proficiency Samples (is also 6-month Demonstration of Competency)

Purpose: compare lab/analyst results to those of other labs; to obtain analyst bias..

Responsible Party: Larry S. Pierce for paperwork, all analysts to count all samples.

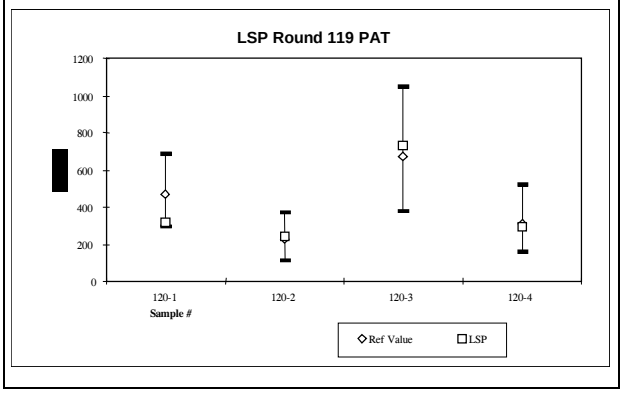
Timing & Frequency: once per quarter

SOP: 1) one analyst is randomly selected for result submittral before counting by the QM. 2) All analysts count samples the same as client/customer samples, 4) do not discuss results with other labs.

Data Form: same as counting form, multiple analysts to use the back of the form.

Record Storage: PCM files "PAT Worksheets", "PAT Results", and "PAT Communications".

Figure 6.9.4.4 PAT Comparison



Summary & Review: each round results for each analyst plotted as in Figure 6.9.4.4. Current plots for each analyst are included in the PCM QA monthly report. Proficiency results are used to demonstrate 6-month analyst proficiency in PCM counting.

6.9.5. Limit of Detection/Reporting Limit

Purpose: to calculate the minimum count that is 95% certain to be significantly over background. This number is also used as the reporting limit for PCM analysis.

Responsible Party: Larry S. Pierce.

Timing & Frequency: reviewed once per year; changed as needed

SOP: LOD = Student's t value x standard deviation of a data set from a reference slide averaging near the LOD.

Data Form: none – just data crunching.

Record Storage: calculations stored in LOD file in PCM file drawer.

6.9.6. Uncertainty

Purpose: to review the 95% confidence limits reported to the client/customer.

Responsible Party: Larry S. Pierce.

Timing & Frequency: reviewed once per year; changed as needed

SOP: CV for each slide in each interlaboratory round robin is supplied with the paperwork with each round from FAS. If the mean CV for the last 4 rounds differs by more than 8%, then new confidence limit %s should be calculated and the LIMS updated to reflect them (note: since 16 values are involved, the mean CV has never differed by that much).

Data Form: none.

Record Storage: calculations, if new ones are done, stored in LOD file in PCM file drawer, and the LIMS is updated.

6.9.7. QA Report

A report is prepared which summarizes the QA activities and results for the samples received during a period, nominally quarterly. Since the completion of samples is dependent on backlog, the timing of the QA Report may be irregular. The exact items to be included in the report are listed and discussed fully in Section 13 of the SOP/QA Manual and will not be repeated here.

6.9.8. Record Keeping

The written records of lab activities are listed in Table 6-9, below. The locations of current records are also given. Records older than one year may be archived. These records are to be held secure and confidential. The original client/customer has full access to data and reports relating to his samples, of course. But if other than the original client/customer asks for information about the samples (e.g., a contractor wants to know whether samples taken by a consultant passed or failed), then the original client/customer is first contacted to obtain approval (verbal is required, written desirable) to release the data. Usually, the client/customer will prefer to release the information himself. All records are chronological unless stated otherwise.

TABLE 6.9

PCM Lab Records

Record	Location
Job Log Book	LIMS/hardcopy in Login Book
Sample Submittal Form	Office File
Invoice	Office File
Calibrations	Equip. File in LIMS/hardcopy in Tech. File
Reports	Office File
Prep Blank Results	LIMS
Reference Sample Results	LIMS
Recounts (Rep + Dup)	LIMS
Interlab Results	Tech File
Proficiency Sample Results	Tech File/summarized in LIMS

7. STANDARD OPERATING PROCEDURES FOR THE ANALYSIS OF ASBESTOS IN BULK SAMPLES USING POLARIZED LIGHT MICROSCOPY (PLM)

7.1. INTRODUCTION

The analysis of bulk samples by polarized light microscopy is a procedure that tends to take different forms depending upon who is performing the analysis. For this reason, these standard operating procedures set down in concrete steps the observations needed to perform every part of the analysis and identifications. The goal of this document is to provide our analysts with guidelines which tend to produce a uniform and consistent style and quality of analysis, rather than variations of terminology and identifications depending upon the analyst. The procedures described here are to be detailed enough that someone who is not intimately familiar with the techniques can follow them.

It is unlikely that this document will be paged through and referred to on a daily basis, so we have instituted the use of Work Practices. Work Practices are designed for someone already familiar with the techniques, but who could use a

reminder as to the order of steps, or the particulars of a seldom required identification call. The Work Practices are listed in Section 12 of the SOP/QA Manual, and are also out, either posted or in a Work Practice Notebook, in the PLM Lab.

7.2. ORGANIZATION AND TRAINING OF PERSONNEL

The job descriptions, prerequisites and organization of personnel at Fiberquant, Inc. are given in Sections 2 and 4 of the SOP/QA Manual. Training procedures and requirements for personnel are given in Section 9 of the same.

7.3. EQUIPMENT AND SUPPLIES

7.3.1. Equipment

The current equipment used for PLM analysis is as follows:

Each PLM station has a self-contained re-circulating HEPA hood for specimen manipulation. Inside each hood is a stereoscope and specimen preparation supplies, such as slides, liquids, etc. Each station has a Nikon Labphot PLM microscope for observation of mounts. An Abbe refractometer provides calibration of liquids. Details (exact models, serial #'s, etc. are contained in the equipment files in the LIMS.

7.3.2. Equipment Maintenance

1. Hoods

The counter of the hood and the face of the HEPA filter are is vacuumed as needed using a portable HEPA vacuum cleaner to prevent build-up of particulate. Performance of the hoods is monitored through air flow monitoring, and by air sampling in the bulk room. Loading of the HEPA filters is monitored by vane air velocity meters and checked every 90 days at each hood by the analyst in association with r.i. liquid calibration. If the average air velocity drops to less than 80 ft/min, and the motor is functioning correctly, then the filter is assumed to be loaded and is changed out (after the front side is sealed).

2. Microscopes

All optical microscopes are cleaned and inspected once per year by a professional microscope maintenance service, Bender and Associates. Other maintenance is of the trouble-shooting type, and is performed as needed by the Lab Manager. Manuals for the optical scopes are kept in the scope tables.

7.3.3. Supplies

The analysis depends in large part on the availability of uncontaminated supplies and so the following list of expendables and target inventories has been compiled to aid in supply maintenance.

Item (Source)	Target Inventory
refractive index liquids (Cargille, Micro-Optical):	
a) Series RF (1.400-1.720 in 0.004)	1 set
b) Asbestos Set (6 HD liquids)	1 set per station
c) Stock 1.550HD	16 oz.
d) Stock 1.68	8 oz.
e) Stock 1.605HD	8 oz.
f) Stock 1.625HD	4 oz.
g) Stock 1,640HD	4 oz.
glass slides, 1x3" plain	50 gross
cover slips, #11/2, 18mm square	20 packs
forceps (medium point, smooth jaws)	6
mortar and pestle	5
nail pushers (rubber tipped, drug store)	6
viscous medium (Fisher Permount SP15 or equivalent)	16 oz.
floor tile solvent (Dynasolve 180 or 1-methyl-2-pyrrolidinone)	8 oz.
floor tile solvent (tetrahydrofuran)	32 oz.
acetone	8 oz.
HCl, 1 N, for acid dissolution	from AA area as needed
Ivory dish detergent for amended water	2-16 oz.
black paper, ~4x6	2000
bowls, ceramic, 6". dia.	4
eye-dropper bottles, 1 oz	12
Kimwipes, large and small	1 case
wash bottles, poly, 8 oz	6
scissors, stainless steel	1
wire cutters, heavy	1
mineral standards (NIST SRM 1866 + 1867 + various others)	1 set

mounted fiber standards (McCrone Asb.Ref.set + various others)	1 set
Alignment slides (anthophyllite in permount)	1 per station5
refractive index standards (Cargille glasses, McCrone)	1 set
projector lamps (EKE or ENL) for stereoscopes	4
bulbs (Osram HLX 64250 ESB 6V 20W) for Labophots 5	
zip-loc bags	3 boxes each
sample bags, zip-loc 4x6" printed	1000
asbestos disposal bags	10-50

references: *Asbestos Identification*, Crutcher, 1988; *Asbestos Identification*, McCrone, 1987; *MAC Asbestos Reference Manual*, McCrone, 1989; *Optical Mineralogy*, Sheriden, 1978, *NVLAP Bulk Asbestos Handbook*, *ASTM Draft Standard Method for Asbestos Containing Materials by Polarized Light Microscopy*, *EPA Interim Method for Determination of Asbestos in Bulk Insulation Samples*, *EPA Method 600/R-93/116*.

7.4. SAMPLE LOG-IN AND HANDLING

The general sample handling procedures and forms are described in Section 5 of the SOP/QA Manual, and not repeated here. After log-in, the samples are transferred to the bulk lab with their sample submittal sheet. They are placed in the PLM sample storage cabinet, and their accompanying paperwork is placed in the rack on top of the cabinet. Handling of samples and disposal after analysis is covered in section 5.7.

7.5. ANALYSIS

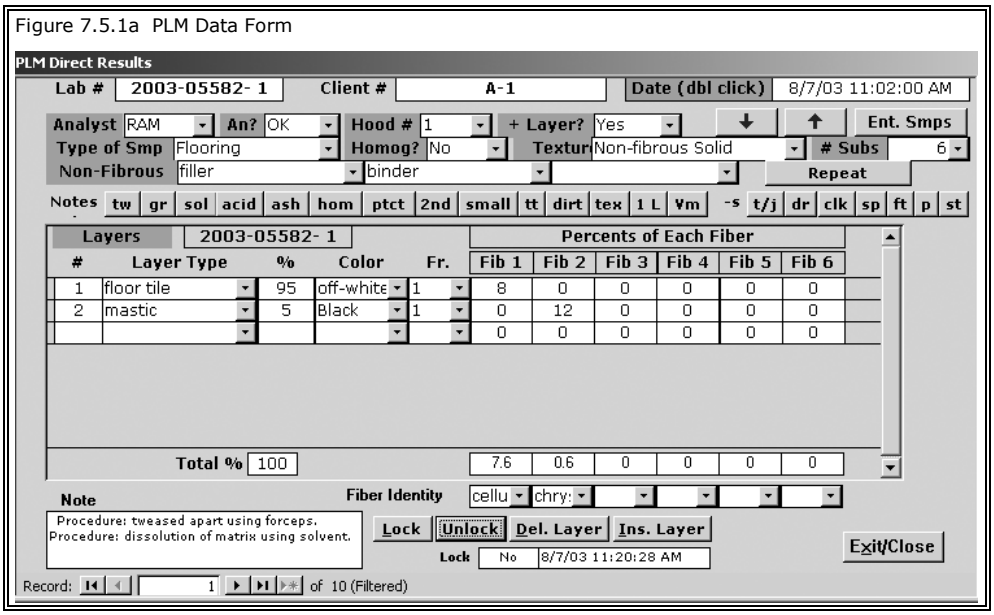
The procedures herein meet the requirements of both EPA Method 600/M4-82-020 (The Interim Method) and EPA Method 600/R-93/116 (The New Method); the bench sheet and report are designed so as to satisfy the requirements of both methods. Amphibole fibers are differentiated into fibrous and non-fibrous categories, according to mean aspect ratio and other morphological characteristics described in "Characterizing and Discriminating Airborne Amphibole Cleavage Fragments and Amosite Fibers - Implications for the NIOSH Method", *Am. Ind. Hyg. Assoc. J. 46(4)*:197-201 (1985). A copy of the EPA publication is kept under methods in the PLM file.

Generally, the procedure is as follows: The sample is observed at ~6-30x magnification under a stereoscopic microscope. Selected fiber types or general sub-samples of the sample are then mounted in one or more mounting media. The mounts are observed with the polarizing light microscope. Enough optical characteristics are observed to enable the identification of the fibers present in the sample. If these procedures do not produce unambiguous identifications, the fiber(s) identity can be confirmed analyzed using an energy dispersive spectrometer (EDS) a transmission electron microscope (TEM).

7.5.1. Stereoscopic Observations

A sample is chosen for analysis. Data about the sample or layers in it are entered into the custom LIMS on either the Sample/Layer Data Screen (Figure 7.5.1a) which is accessed by clicking the "Samples" button on the Job Screen. Items are highlighted in red until entered, when they turn green.

Figure 7.5.1a PLM Data Form



To prevent cross-contamination, only one sample per hood is analyzed at one time. When multiple samples are received from one homogeneous area, several mounts may be made at one time, but still, only one sample is to be open at one time. If samples must be dried, they are placed in disposable petri dishes, and dried overnight in a hood where other samples are not being analyzed.

The initial examination is at ~6x magnification under the stereoscope, increasing magnification as needed. The entire contents of the container are examined, if possible. For samples too large to be examined without operator

contamination, five or more sub-samples may be taken as representative of the whole. The sample is dissected using two un-serrated forceps, in order to free any enclosed fiber types from their matrix. The following data are entered on the report screen. The fields may be clicked, or <tab> may be used to go from field to field. "Autofill", a feature of MS Access, fills in a field as letters are typed, so that only 1-3 letters are all that have to be typed.

Date/Time

The field is double clicked to enter the current date and time.

Analyst

The box is clicked and the correct initials are chosen. The LIMS checks at this time to see whether a quant standard has been read during the past week, whether a qual standard has been read during the past week, and whether the latest NVLAP data is in the computer. An analyst without these is not allowed by the computer to enter their initials.

Hood Number

The box is clicked and the hood number chosen. The LIMS checks to see whether the blanks, liquid calibration, and face velocity for the hood is current. If not, the number cannot be entered.

+ Layer?

Yes or No – a cross-check independent of the fiber identities and percents assigned..

Type of Smp

A short phrase describing the apparent type of sample as completely as possible without making any assumptions. This information provides a cross-check on sample mix-up, since adjacent samples are more often completely different materials than the same material. For large, relatively undamaged samples, the type of construction material can usually be seen (e.g., TSI, ceiling tile, flooring); for small samples or powdered samples, only the evident material can be described (e.g., powder, miscellaneous). The computer only allows certain types to be chosen, to maintain consistency between analysts.

Texture

Choose the most applicable from the computer list (e.g., fibrous solid, sticky).

 # Subs

The number of sub-samples or mounts made.

Non-Fibrous Components

The most abundant 3 types of non-fibrous material in the sample.

Layer Descriptions Box

In order to give an accurate representation of the sample components, this box lists the types of layers or materials present in a sample, and details the percentages of each fiber type in each layer or material. For each layer or material, the following is entered:

Layer #

Automatically assigned by the computer.

Layer Type

The apparent type of material that this layer is (e.g., insulation, mastic, tile) – the computer limits the choices to provide more consistency between analysts.

Volume % of Each Layer in Sample

The estimated proportion of the whole sample that this layer constitutes.

Color

The major or predominant macroscopically visible color of this layer.

Friability

Friable means "able to be crumbled to powder using hand pressure". The most accurate assessment of friability would be performed in the field on the material in place, but we can make an estimation in the lab. What we estimate, however, is the friability of the sample in its sampled (and therefore damaged) state. For instance a painted material which may not be friable in the field may be friable once the paint is disturbed by the sampling process. This we cannot help. Call the friability as it is seen under the stereoscope.

Since friability as well as non-friability covers a wide range of properties, we have developed a number of categories, numbered 1-4 in order of increasing friability) for friable and non-friable, as detailed below:

Non-friable: 1) NESHAPS Category "Non-Friable Type I": roofing, mastics, vinyl flooring, caulking or packing

2) NESHAPS Category "Non-Friable Type II": transite, stucco, other non-friable not in type I.

Friable: 3) Low: *e.g.,* plaster, joint compound, ceiling tile

4) High: *e.g.*, spayed ceilings, 85 magnesia pipe insulation, fiberglass batting)

For each layer, fill in the number category of its friability.

% of each fiber in each layer

Enter the estimated value. The fiber types are populations of fibers in the layers that can be distinguished or identified during the analysis. Most would be able to be seen under the stereoscope, but some may not be discovered until the PLM examination of sub-samples. For each layer, list the estimated percent of each distinct fiber type. Estimate the percent by a combination of:

1. For fibers visible under the stereoscope, compare the relative abundance of the fiber bundles with our quantitative standards, NVLAP proficiency samples of the same type, standard petrographic photos and charts (kept at the hoods), and/or volume comparisons using the reticule eyepiece in the stereoscope.

2. For mounted sub-samples, compare the fiber abundance to our mounted sub-samples of NVLAP proficiency samples, and/or count matrix particles and fibers of approximately equal size (more useful in determining whether a material contains <<1% fiber).

3. For those layers that are friable and also contain asbestos that have been estimated by the above two methods to be <10%, quantitation by point counting is required by NESHAPS, unless the client/customer treats the material as positive. For samples estimated to be >1 and <10%, we consider our estimates to be reliable enough to allow the client/customer to assume those samples are positive. For friable samples estimated <=1%, we point count in order to keep our client/customers compliant with NESHAPS. To point count, 2-8 representative sub-samples are mounted in a suitable medium (viscous or 1.55HD liquid probably would be the best to visualize fibers). Several eyepieces are available that contain an array of 25 points. A field of view is randomly selected on the first mounted sub-sample. The 25 points either fall on asbestos (count one asbestos point), matrix material (count one matrix point) or mounting medium (do not count as a point). Continue selecting fields of view until 400 non-empty points have been counted, spread evenly among the mounts. Fill in the layer number, asbestos counts, and total counts in the point count form accessed via the point count button on the sample screen.

The designation "Trace" is not used at Fiberquant, due to the computer calculations made. The analyst should assign 0.1% or some other low percentage to a fiber thought to be at the limit of detection, but it is still reported to the client/customer as <=1%. The analyst should make a note for the sample if a trace only is intended. If a point count has resulted in 0 counts per 400 fields, but asbestos is present, the industry standard is to call it "trace" - enter 0.1% in the computer.

Percentages for floor tiles are the best estimate of what is visible in the microscope. It is well documented in recent literature that the light microscope is not capable of resolving all the fine chrysotile fibers normally present in asbestos floor tile, so percentages determined by PLM are usually much lower than the percentage that is actually present in the tile. Therefore, the % seen by PLM has to be considered the minimum that could be present. The maximum that could be present is about 30%, according to the manufacturer's formulas.

All tiles for which a question of negative or positive exists should be checked by either a second opinion, TEM, XRD or SEM before being reported, since a tile in which PLM sees a trace could easily contain more than 1%. Tiles in which we see no chrysotile using the PCM-PLM method (below) appear to be true negatives the vast majority of the time, based on XRD and SEM checks so far.

Fiber Type 1,2,3,4,5,6

Based on optical characteristics (documented below), the fiber types in the sample are selected from the choices on the multiple choice box. If a box becomes red (indicating that an asbestos type has been chosen), further data must be entered on the Fiber Data Screen. If a non-asbestos fiber has unusual color or other characteristics, the data should be entered on the Fiber Data Screen.

Overall Area % of Each Fiber Type in Sample and Total Layer %

Automatically calculated by the computer. The Total Layer % is automatically calculated but the analyst must adjust the layer percents so they sum to 100.

Fiber Data Screen

The Fibers Screen, Figure 7.5.1b, is activated by double-clicking any fiber identification box. Those characteristics (namely morphology, color, birefringence, extinction, isotropism, pleochroism and sign of elongation), that do not change for a population of a given fiber, are filled in by the computer when the fiber choice is made. The analyst can alter any one, if desired, though. Those characteristics expected to change from sample to sample, even for the

same fiber type (namely r.i. liquid, r.i. color, and r.i.) are not filled in automatically. The analyst must determine these for each asbestos species identified. When these are not present when required, the computer flags the fiber type red, which changes to white when the data has been entered.

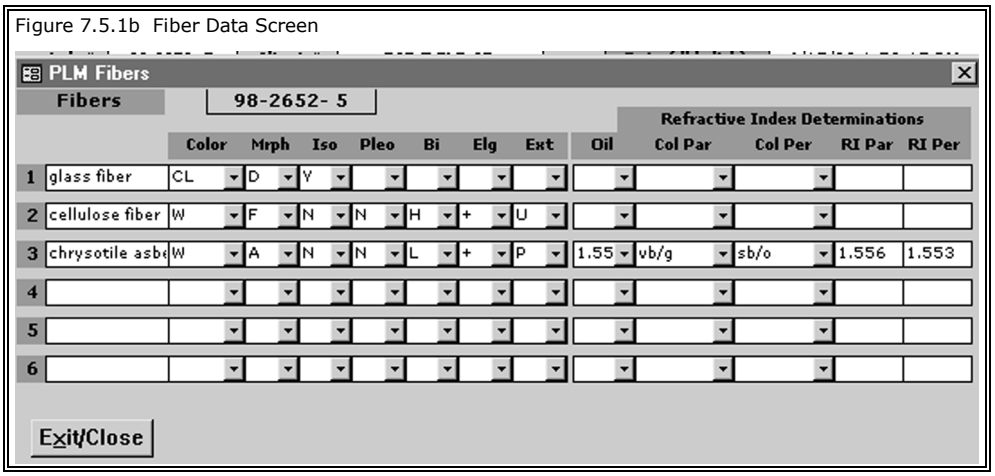
Fiber type color

The apparent color of fibers not coated with matrix.

Fiber type morphology

A preliminary categorization of fibers is made based mostly on morphology but also including such characteristics as color and flexibility. The categories follow those listed in Asbestos Identification by W.C. McCrone (1987). The categories and their criteria are as follows:

Figure 7.5.1b Fiber Data Screen



A: Fine fibers and fiber bundles; dead white color; sinewy, curved shape or short straight sections in meandering path; silky luster; flexible when bent and no backlash back to straight (typical of chrysotile).

B: Fine fibers and fiber bundles; white in thin fibers to brown in large bundles; straight sections or smoothly curved; silky luster; fibers are flexible, bundles may break or become broom-ended (typical of amosite, anthophyllite, tremolite and actinolite).

C: Same as B, only black or blue in color (typical of crocidolite).

D: Fine to coarse individual fibers (rarely bundles); brittle (typical of glass fibers or glass wool). Glass fibers are clear, white or other colors due to resin binder (usually pink or yellow), have long, straight, constant-diameter fibers which are flexible but can be broken or shattered with forceps. Glass wool or ceramic fibers are gray, brown or black, straight or curved, have varying diameters, and have beads of glass.

E. Relatively coarse individual fibers; clear to white or dyed colors; straight; long; constant diameter; round cross-section, striations along length (typical of synthetic extruded fibers).

F. Relatively coarse individual fibers or connected into splinters; white to tan to brown color; short; tapered; ribbon-shaped (wood or paper) or bi-lobately cylindrical (cotton); irregular or shredded sometimes (typical of cellulose).

G. Lath-like fibers. Short (aspect ratios 3:1 to 8:1); sometimes tapering; flat ends (typical of wollastonite or other non-fibrous silicates). These fibers are often too small to be categorized under the stereoscope, and thus are usually only able to be categorized from PLM observation.

Refractive Indices

R.I. Liquid, R.I. Dispersion Staining Colors, and R.I.'s to be filled in as determined below.

7.5.2. Sample Preparation Techniques

7.5.2.1. Sub-sample Selection and Mounting

After the stereoscopic examination, fiber or powder mounts of the sample on glass slides are made for PLM examination. A mount is made by placing a fiber or fibers of interest on a clean glass microscope slide, adding a drop of an appropriate medium in which to suspend the fibers, placing a cover slip on top of the drop, and finally pressing or squishing the cover slip using a nail pusher to suspend the fiber(s) in the medium and to strip any adhering matrix from the fiber(s).

When fibers have not been observed during stereoscopic examination, naturally none can be selected for mounting. In this case, visually (under the stereoscope) representative sub-samples are mounted. To be sure of getting a representative sampling, at least two and preferably three sub-samples are mounted for each such layer having no obvious fibers. The number of sub-samples and mounts is left to the analyst's discretion, except that the 1993 EPA method recommends three sub-samples to show that a layer is negative. Whether or not individual fiber mounts have been made, representative mounts must be made to assist in quantitation.

Care must be exercised when placing the medium on a slide containing sample. If the droplet of medium touches the sample while still connected to the dropping tube or rod, then fibers could be picked up on the tube or rod and deposited in the supply of medium. For this reason, the medium is to be dropped from some height onto the slide, the greater the height, the safer.

The choice of medium depends on what category of fiber has been seen during the stereoscopic examination.

Viscous Medium

Fibrous glass, synthetic fibers, cellulose, and usually chrysotile can be distinguished without refractive index measurements, so as a first mount, fiber types A,D,E and F can be mounted in a general purpose, viscous mounting medium similar to balsam. The refractive index of the medium is approximately 1.49, making fibers of >= 1.55 r.i. easy to see due to good contrast. It is suggested that samples having no fibers visible under the stereoscope also be mounted in viscous medium to start with, precisely because of the good contrast that the low r.i. medium gives. In this case, it is wise to make two sub-sample mounts at once, in order to be surer of finding any low percentage fibers.

The viscous nature of the medium allows the sub-sample to be readily crushed and dispersed, as well as allowing matrix to be stripped from fibers by mashing or rotating the cover-slip. In tar, asphalt or bitumen-containing samples, such as mastic or roofing, the xylene solvent in the viscous medium readily dissolves the organic goo, producing sample dispersion superior to that obtainable from r.i. liquids.

1.55HD Refractive Index Liquid

This is an liquid suited to exhibit dispersion staining colors in chrysotile, so Type A fibers or a sample suspected of containing chrysotile would be mounted in this medium. Most samples can be dispersed in 1.55 HD liquid. However, some problems in dispersion can arise. 1) If the sub-sample contains large chunks, the low-viscosity liquid will be drawn away to the margins of the mount until the sample can be crushed to uniformly small sized particles. This can be avoided by crushing the sample on the slide before adding the liquid. 2) Wet samples contain fibers coated with a thin layer of water, which will prevent the liquid from wetting the fiber to produce the desired dispersion colors. In the case of dampness, the sub-sample to be mounted should be crushed on the slide, and left in the hood for a few minutes to dry before adding the liquid. 3) The tar and asphalt in roofing and mastics does not readily dissolve in r.i. liquids, so dispersion of the sample is rarely entirely satisfactory. Also, the dispersion colors in such samples are masked by the heavily colored organics, so identification of fibers in these materials is usually easier in the viscous medium, despite the lack of r.i. data in that medium.

1.55 HD liquid will slowly dissolve the binder in most floor tile and sheet flooring, and is used to confirm the presence of chrysotile in these materials. The tile material is crushed and mashed in the jaws of the forceps, then the liquid and cover-slip are added. The sample is further crushed in the mount by manipulating the cover slip with a nail pusher or eraser. The mount is then observed on the PLM. If not yet dispersed, the sample is again manipulated via moving the cover slip until a decent dispersal is obtained.

1.68 refractive index liquid

This liquid is suited to display the dispersion staining colors in amosite, so fibers of Type B are mounted in this medium. It has the same sample dispersing drawbacks as the 1.55 HD liquid, discussed above.

Other refractive index liquids

If an observed fiber is found not to match either the 1.55 HD or 1.68 liquids, then it is mounted in other liquids, such as 1.605HD (good for tremolite, anthophyllite), 1.625HD (good for tremolite, actinolite), 1.640 HD (good for actinolite) or any of the full set RF series r.i. liquids in order to determine the refractive indices of the fiber. The exact liquids and the order of mounting would be expected to vary with the individual fiber being analyzed.

Floor tile solvent (Dynasolve 180, 1-methyl,2-pyrrolidinone (1M2P), tetrahydrofuran (THF)

We stock solvents that dissolve vinyl materials with much greater facility than r.i. liquids. Both of the above materials are equivalent in solvating ability, relatively non-volatile and non-toxic and therefore a mount can be made with the solvent as a medium. Their refractive indices are about that of the viscous medium, 1.49, so fibers dispersed in them produce a high-contrast black image against a white background. Small fibers of chrysotile in flooring can often be easily seen when mounted in these solvents and observed at 400x phase contrast. THF is the best vinyl solvent, but evaporates much faster than either of the other two solvents, so the best procedure with it involves making a quick mount in THF to look for fibers, then pulling the cover slip off to allow the solvent to evaporate, then mounting in r.i. liquids to identify the fibers. A step-by-step description of the analysis of floor tile and other vinyl materials is given in Lab Summary PLM-2, which is to be attached to the PLM lab copy of the SOPs.

Dilute HCl

For a first mount of a calcareous sample (such as wall texture, joint compound or pool plaster) in order to see if any fibers are present at all, nothing beats dilute (~1 N) HCl. The sample will evolve CO2, so a few seconds must pass to allow the reaction to subside, then more gas will be evolved when the cover slip is pressed down, but in just a few seconds, a stable mount can be achieved. Any fibers present will have been stripped of matrix, and that, along with the reduction in matrix percentage, makes fibers extremely obvious. The mount however, is useless for identification or quantification. It is especially useful in proving that a given layer does not have asbestos at all.

7.5.2.2. Pre-Mounting Techniques

Not all samples will yield identifiable fibers by the simple mounting techniques above. Fibers may be obscured by clinging matrix, or masses of interference fibers. The following techniques are recommended for such situations.

Grinding

Samples containing hard mineral grains that are too large for normal mounting (*e.g.,* mortar, brick, concrete) should be ground to powder in a mortar and pestle. Acetone is a good lubricant which readily evaporates.

Homogenization

Certain samples, such as textures, may contain only occasional but large pieces of asbestos. Quantitation of such samples as received using the point counting procedure may give widely varying and misleading results. A short grinding of such samples in a mortar and pestle will increase the precision of the analysis significantly. Excessive grinding may cause the asbestos to be broken up into all but invisible strands, so only slight grinding should be performed. Additionally, a client/customer may desire that two or more layers , ordinarily analyzed separately, to be analyzed as one. In this case, the layers are ground together into a homogeneous material before quantifying.

Ashing

The sample is placed in an aluminum weighing dish or crucible and placed in the muffle furnace at ~400ºC for an hour or more. The high temperature oxidizes organic compounds, such as cellulose, vinyl and plastic, from the sample, leaving only mineral and glass. Chrysotile will be destroyed at approximately 450º, so it is vital that the temperature be below this temperature.

Acid Dissolution

Much of the matrix of building materials is calcium or magnesium carbonate, and is readily dissolved in acid. The sample is placed in the mortar and pestle, a few drops of 1N HCl is added, and the sample ground until all evolution of gas has ceased (about 20 sec.). Alternatively, a drop of acid can be carefully dropped onto previously dispersed powder on a glass slide. After the acid evaporates, the sub-sample can be mounted in the usual manner. Acid may alter the refractive indices of chrysotile, so the total dissolution time should be limited to about 10 minutes, or the fibers should be identified before the dissolution step. Acid also dissolves glass and glass fibers, so may be helpful for such samples as ceiling tiles. Some tiles contain fine fibers of chrysotile, which may only become visible after the glass is removed from the sample.

Solvent Dissolution

Organic or floor tile matrices can sometimes be stripped from asbestos by dissolving them in solvent such as 1M2P or THF. A drop of the chosen solvent is placed on a powdered sub-sample on a glass slide. The mixture is stirred with a tweezers. A mount can be made in the solvent itself or, in the case of THF, the solvent will evaporate to dryness, and the sub-sample is then mounted in the usual manner. This procedure should be performed in a well ventilated area, as THF fumes are irritating.

When such techniques are used, notes are added to the sample report by clicking the appropriate button on the computer form. Other notes to the analysis can be added by either clicking a button for a standardized note or by typing the note in the memo field directly. These consist of any additional information or clarification of the data already given. For example, if the sample was wet when received, this would be noted, since it might have affected our ability to identify the fibers present or the type of material present in the sample. For another example, if a sample is very small, there is a good probability that it is not representative of the whole. For example, a too small sample of an asbestos-containing ceiling acoustical texture may not contain observable asbestos. Some materials, such as amosite-containing ceiling tile, may contain widely separated but large bundles of asbestos, in which case a small sample would either contain no asbestos or much asbestos, depending on location. For this reason, a small sample is noted.

7.5.3. Preparation of the polarizing light microscope

To correctly observe the optical characteristics that distinguish asbestos fibers from each other and possible interferences, the polarizing microscope must be aligned and set up in a standard way. The adjustments that are made are: 1) condenser alignment and condenser aperture size adjustment, 2) polarizer alignment, 3) objective centering, 4) cross-hair alignment, and 5) phase ring alignment. Adjustments that are not necessary are: 1) filament centering (the Labphot has a pre-centered pseudo-Koeller illumination), 2) red-plate alignment (is automatically 45º when the polarizers are at 0º, and 3) stage centering (taken care of by centering each objective). The alignment procedures are discussed below.

1) Eyepiece setup

Remove the eyepiece containing the reticle and, looking at a blank, lit background, turn the focus of the eyepiece until the reticle appears sharp. Make sure that your eye is relaxed (e.g., focus outside of the eyepiece in the distance then bring the eyepiece in front of the eye; the eye should not have to re-focus). Replace the eyepiece and focus on a recognizable object using the microscope focus but looking only through this eyepiece. Finally, turn the eyepiece focus of the non-reticle eyepiece until the recognizable object is sharply focused as well. For eyes that are matching in focus

power (e.g., 20/20), both eyepieces should be focused to approximately the same spot relative to the ring showing on the barrel.

2) Condenser alignment and field aperture size adjustment

With a focused slide on the stage, the field aperture (in the base) is dialed down to a small diameter. If the hexagonal shape of the iris is in focus, its edges will appear sharp and have a faint purple color. If the aperture is not in focus, focus it by turning the 1" dia. knob on the left side of the substage assembly. A centered aperture would be bisected by both the cross-hairs of the right-hand eyepiece reticule. If the aperture is not centered, center it using the two 1/2" dia. knobs on the substage assembly. Finally, with the magnification 100x (10x objective), dial the size of the aperture larger until it falls just outside the field of view.

3) Polarizer alignment

Two polarizers are contained in the instrument, and both must be aligned. The upper polarizer is located in a modular unit which also contains the compensation plates. This unit is aligned by assuring that the thumbscrew fits into the detent designed for alignment purposes. This sounds a little simple, yet the microscope cleaning technicians routinely do not align this piece correctly. The lower polarizer, located at the bottom of the substage assembly, is easily removed or rotated relative to the upper polarizer module, which is held in place by a thumbscrew. With the upper polarizer inserted, rotate the lower until the field is darkest. This indicates that their directions of polarization are perpendicular.

The orientation of the lower polarizer is now parallel to the horizontal cross-hair in the eyepiece (this can be tested by observing crocidolite, which should be blue parallel to the polarizer and gray perpendicular to the polarizer).

4) Objective centering

Objectives are centered first when a new microscope is set up, and have so far not been observed to change over time, so it is not anticipated that much adjustment will be necessary. Instructions for centering are contained in the Labphot manual (kept in the microscope tables). An objective would be out of center if the position of a particle located at the cross hairs moves as the stage is rotated. The Lab Manager is contacted if this condition is noted.

5) Cross-hair Alignment

The eyepiece containing the cross-hair has a peg that allows it to be inserted either approximately parallel or approximately 45 degrees to the polarizers. The fine adjustment to make it exactly parallel is made by rotating the binocular or trinocular head module. To align the head relative to the analyzer, place a sample, such a chrysotile or rayon, known to always have parallel extinction, on the stage. Cross the polars and rotate the stage until a fiber is extinct, then loosen the head set-screw and rotate until one of the perpendicular cross-hairs is parallel to the fiber.

6) Phase ring centering

A 40x phase objective is installed in the nosepiece. For proper operation a ring in the condenser must be concentric with a ring in the objective. Condenser position P3 is the correct one for use with the 40x objective. Both rings are visualized by flipping in the Bertrand lens (small lever marked "B" just under the eyepieces). The rings are made concentric using the lockable 3/4" dia. knobs on the condenser turret. Unlock before adjustment and lock after the rings are centered. It is worthwhile noting that ring alignment can be affected by cover slip position. Specifically, if a cover slip is tilted, the phase rings will be out of alignment relative to their position during observation of a parallel slip. The out-of-alignment condition is readily apparent in the image as fuzziness, low contrast and astigmatism.

Figure 7.5.3 PLM Microscope Alignment Form

The above alignment is checked daily before the first analysis. The LIMS will not allow a hood # to be entered that does not have an alignment on record. That the alignment of the scope has been checked is entered into the computer, on the form shown in Figure 7.5.3. To check alignment, the analyst: 1) observes during analysis maximum dark background with crossed polars, 2) briefly closes the field aperture to check condenser alignment, 3) observes during analysis that the objectives are well centered, and 4) observed during analysis that anthophyllite becomes extinct at 0 and 90◦ (a mounted anthophyllite slide is provided at each microscope).

7.5.4. PLM Observations

Mounted sub-sample slides are observed under varying optical conditions on the polarizing light microscope. The guiding principle as to which optical characteristics to document is to observe enough characteristics to unambiguously identify the fiber, but to not waste time documenting characteristics that would be redundant or non-distinguishing. For example, once a fiber is determined to be isotropic, it is glass regardless of any other optical characteristics it possesses. For another example, cellulose, chrysotile and shredded polypropylene all have similar

r.i.'s and give similar dispersion staining colors; these 3 fibers are better distinguished by their morphologies than optical properties.

The possible optical characteristics that may be observed for each fiber type are listed below, and are reported on the appropriate line or box on the report form.

Isotropic?

An isotropic fiber is totally black under crossed polars. However, very thin fibers of anisotropic fibers can appear nearly black under the same conditions, so experience must guide the analyst as to how thick a fiber is necessary to determine isotropism.

Pleochroic?

A pleochroic fiber exhibits different color or transmittance when aligned parallel to the polarizer than it does aligned perpendicular to the polarizer. The only asbestos mineral or interference that exhibits pleochoism regularly is crocidolite, which is blue parallel and gray perpendicular. Amosite which has been heated to a brown color may also be pleochroic.

Birefringence

Technically, the birefringence is the difference between the refractive index parallel to the fiber length and the refractive index perpendicular to the fiber length. If precise refractive indices are generated, then a number, e.g., 0.01 for chrysotile, can be obtained. However, almost as useful as a hard number, and a lot easier to obtain, is an estimate of birefringence, categorized as none, low, medium or high.

The estimate of birefringence is obtained by observing fibers (approximately 10-20 um in diameter) of a fiber type. Such small fibers will be black if they have no birefringence (isotropic), gray if they have low birefringence, white if they have medium birefringence and bright white or pale yellow if they have high birefringence. Chrysotile fibers generally fall into the low category while amphibole fibers fall into the medium category. One can calibrate one's eye for this relative scale by observing mounts of standard chrysotile and amphiboles.

Sign of elongation

A positive sign of elongation indicates that the refractive index parallel to the fiber length is greater than that perpendicular to the fiber length. It is quite easily determined by crossing the polars and inserting the red plate. Under these conditions, a positive fiber tends towards bluish while pointed to the upper right, and tends toward yellowish while pointed towards the upper left. A negative fiber has colors the reverse of these. Only fibers that have enough retardation to be gray without the red plate in show the above colors.

The sign of elongation is an important characteristic only in the identification of crocidolite (negative), wollastonite (positive and negative, depending on orientation), and brucite (positive and negative). All other fibers are positive. Extreme heat, such as experienced by steam pipe insulation, may alter the sign of elongation.

Extinction

Under crossed polars, fibers become extinct by going dark or black as the stage is rotated. A fiber can become extinct at a position parallel to a eyepiece cross-hair (parallel), or at some other angle (oblique), or parts of the fiber can become extinct at different angles (wavy), or not go black at all (none). Chrysotile, amosite, anthophyllite, crocidolite, wollastonite, and synthetic fibers are parallel. Tremolite and actinolite are oblique. Cellulose is parallel or wavy. Mature cotton has little or no extinction.

Refractive Index

Becke Line Method If a fiber is mounted in liquid medium, its relative relief (the clarity with which it stands out from the background) indicates how closely its refractive indices match that of the medium. A close match is indicated by low contrast (the disappearance of the Becke lines) when viewed with uncrossed polars. An exact match (at a median wavelength at least) is indicated by the presence of colored Becke lines, which move in opposite directions when the focus is changed. The refractive index of the medium when the colored Becke lines are bluish and reddish is the refractive index of the fiber.

Dispersion Staining Method Dispersion staining is the apparent coloring of a particle due to a mis-match between the dispersion (refractive index vs. wavelength) of the fiber and the dispersion of the medium that the fiber is in. In order to see colors, the fiber must be mounted in a medium very close in refractive index to it. Specially formulated high dispersion (HD) liquids give the best colors, but pale colors may also be observed in the RF series liquids. Chrysotile is mounted in 1.55HD liquid, amosite in 1.68, and anthophyllite, actinolite or tremolite are mounted in either 1.605 HD, 1.625, 1.640 or other liquids in between.

Two methods of dispersion staining are used at Fiberquant. The most commonly used is phase contrast dispersion staining. In this type, the dispersion colors are observed with the 40x phase contrast objective combined with the P3 position of the phase condenser and the rings aligned. A color for the fiber and a complimentary color as a halo are observed. These colors are identical to those which would be observed using oblique dispersion staining. Each

observed color is indicative of λ_o, the wavelength at which the refractive index of the fiber matches that of the medium. The matching wavelengths can be directly translated into refractive indices, according to the chart shown in Figure 7-4. In practice, the following information is gathered and documented on the report. The basic identification of the fiber is determined by its approximate refractive indices and other optical characteristics. The fiber is mounted in the appropriate liquid for r.i. determination (1.550HD for chrysotile, 1.605HD, 1.625HD or 1.640HD for tremolite/actinolite and anthophyllite, and 1.68 for amosite). The r.i. of the liquid to be used for dispersion staining is documented in the blank provided on the report. The dispersion staining color of the fiber is observed for approximately a half-dozen fibers when the polarizer direction is parallel to the fiber and when it is perpendicular to the fiber. The consensus parallel and perpendicular colors are filled into their fields provided on the fiber characteristics form, accessed by double-clicking a fiber identification box on the PLM sample screen, using the multiple choices available. Because actinolite and tremolite are monoclinic, one must determine the colors of a number of fibers of these species individually, then choose the highest observed parallel r.i. as gamma and the lowest observed r.i. as alpha. Amosite and crocidolite, though monoclinic, are twinned enough that only one apparent gamma and alpha are seen. Finally, the refractive indices parallel and perpendicular for the fiber type are obtained from the chart in Figure 7-4 by matching the observed colors to the appropriate mineral column. Interpolation can be made between the choices on the chart. The calculated r.i. values are input on the fiber characteristics form. The values are checked with known r.i.'s to make sure that the observed dispersion matches the typical dispersion of the species and that the preliminary identification was correct.

Figure 7- 1 Matching Wavelengths and Refractive Indices from Phase Contrast Microscopy

---

λ_o from *Analysis of Asbestos in Bulk Insulation Samples* (V. Crutcher, 1988); conversion to refractive indices from "Calculation of Refractive Indices from Dispersion Staining Data" (W.C. McCrone, in *Microscope 37*, pp 47-51, 1989) and "Rapidly and Accurately Determine Refractive Indices of Asbestos Fibers using Dispersion Staining Method", (Shu-Chun Su, Hercules, Inc. SOP); compiled by Larry S. Pierce, 9-13-91 and revised 3-7-95.

Fiber Color	Halo Color	λ_o	refractive index (25° C)													
			Chrys (1.55)		Trem (1.605)		Trem (1.625)		Actin (1.640)		Antho (1.605)		Antho (1.625)		Amos (1.68)	
			par	per	γ	α	γ	α	γ	α	par	per	par	per	par	per
black	white	<400	>1.576	>1.581	>1.626	>1.632	>1.651	>1.664	>1.669	>1.685	>1.630	>1.632	>1.655	>1.653	>1.720	>1.731
dark gray	pale yellow	400	1.576	1.581	1.626	1.632	1.651	1.664	1.669	1.685	1.630	1.632	1.655	1.653	1.720	1.731
violet gray	yellow	440	1.568	1.572	1.619	1.622	1.642	1.651	1.659	1.669	1.621	1.623	1.645	1.644	1.707	1.715
dark blue	lemon yellow	480	1.561	1.563	1.613	1.616	1.636	1.641	1.652	1.658	1.616	1.616	1.638	1.636	1.697	1.702
vivid blue	gold	520	1.556	1.557	1.609	1.611	1.631	1.634	1.647	1.650	1.610	1.611	1.633	1.631	1.689	1.693
sky blue	orange	560	1.553	1.553	1.606	1,607	1.627	1.628	1.642	1.644	1.607	1.607	1.629	1.627	1.684	1.685
pale blue	red	600	1.549	1.549	1.604	1.604	1.624	1.624	1.639	1.639	1.603	1.604	1.624	1.624	1.678	1.678
paler blue	dark red	640	1.547	1.545	1.601	1.601	1.622	1.620	1.637	1.635	1.601	1.601	1.620	1.622	1.674	1.673
white	black	>640	<1.547	<1.545	<1.601	<1.601	<1.622	<1.620	<1.637	<1.635	<1.601	<1.601	<1.620	<1.622	<1.674	<1.673

The second type of dispersion staining used is central stop dispersion staining. In true central stop staining, a special objective is required, which contains a disk which occludes the central light beams traversing the objective. We stock this objective, but space considerations on the microscopes precludes its permanent installation. However, central stop dispersion colors can be obtained using the P4 position of the condenser (which contains a central stop) in conjunction with the 10x or 20x normal objectives. In this case, only the fiber body is colored; no halo appears. A chart of the colors and their matching wavelengths can be found in *Asbestos Identification* by W.C. McCrone, which is kept in the lab. Refractive indices can be obtained from the matching wavelengths using the same chart (7-4) above.

Fiber Type Identification

The identity of the fiber type, specifying for tremolite/actinolite and anthophyllite whether the fiber type matched the fibrous population profile or the non-fibrous population profile (see below).

7.5.5. Asbestos Yes or No?

Based on the various optical characteristics and all other information gathered, each fiber type observed in the sample is identified. A table of optical properties of asbestos (from EPA/600/R-93/116) is given below:

TABLE 2-2. OPTICAL PROPERTIES OF ASBESTOS FIBERS

Mineral	Morphology and Color[1]	Refractive Indices[2] α	Refractive Indices[2] γ[5]	Birefringence[6]	Extinction	Sign of Elongation
Chrysotile (asbestiform serpentine)	Wavy fibers. Fiber bundles have splayed ends and "kinks". Aspect ratio typically >10:1. Colorless[3]	1.493-1.546 1.532-1.549 1.529-1.559 1.544-1.553	1.517-1.557 1.545-1.556 1.537-1.567 1.552-1.561	0.004-0.017	Parallel	+ (length slow)
Amosite (asbestiform grunerite)	Straight to curved, rigid fibers. Aspect ratio typically >10:1. Colorless to brown, nonpleochroic or weakly so.[4] Opaque inclusions may be present	1.657-1.663 1.663-1.686 1.663-1.686 1.676-1.683	1.699-1.717 1.696-1.729 1.696-1.729 1.697-1.704	0.021-0.054	Usually parallel	+ (length slow)
Crocidolite (asbestiform riebeckite)	Straight to curved, rigid fibers. Aspect ratio typically > 10:1. Thick fibers and bundles common, blue to dark-blue in color. Pleochroic.	1.693 1.654-1.701 1.680-1.698	1.697 1.668-1.717 1.685-1.706	0.003-0.022	Usually parallel	- (length fast)
Anthophyllite-asbestos	Straight to curved fibers and bundles. Aspect ratio typically > 10:1. Anthophyllite cleavage fragments may be present with aspect ratios <10:1. Colorless to light brown.	1.598-1.652 1.596-1.694 1.598-1.674 1.6148[7]	1.623-1.676 1.615-1.722 1.615-1.697 1.6362[7]	0.013-0.028	Parallel	+ (length slow)
Tremolite-Actinolite-asbestos	Straight to curved fibers and bundles. Aspect ratio typically > 10:1. Cleavage fragments may be present with aspect ratios <10:1. Colorless to pale green	Tremolite 1.600-1.628 1.604-1.612 1.599-1.612 1.6063[7] Actinolite 1.600-1.628 1.612-1.668 1.613-1.628 1.6126[7]	Tremolite 1.625-1.655 1.627-1.635 1.625-1.637 1.6343[7] Actinolite 1.625-1.655 1.635-1.688 1.638-1.655 1.6393[7]	0.017-0.028 0.017-0.028	Parallel and oblique (up to 21°); Composite fibers show parallel extinction.	+ (length slow)

[1]Colors cited are seen by observation with plane polarized light.

[2]From references 2, 11, 12, and 18, respectively. Refractive indices for n_d at 589.3nm.

[3]Fibers subjected to heating may be brownish. (references 13, 14, and 15)

[4]Fibers subjected to heating may be dark brown and pleochroic. (references 13, 14, and 15)

[5]∥ to fiber length, except ⊥ to fiber length for crocidolite only.

[6]Maximum and minimum values from references 2, 11, 12, and 18 given.

[7]± 0.0007

Specific observations required for the identification of a fiber are listed below:

Chrysotile

Generally, like any asbestos, the observation of all listed optical characteristics, including optical dispersion is required for chrysotile. The r.i. values for chrysotile may vary widely from locale to locale, but its birefringence is always ~0.007.

There may be cases, such as mastics or roofing, in which the analyst can be relatively certain that chrysotile is present, yet unable to confirm the dispersion colors due to interference by a colored matrix. In such cases, an approximate r.i. is determined using Becke lines, and the identification is made, but a note is added that the dispersion was not able to be confirmed.

Amphiboles

The morphology of all amphiboles is similar, so any amphibole identification (with the exception of crocidolite) requires the observation of every optical characteristic listed on the report form. The color and pleochroism of crocidolite prevent the determination of refractive index by phase contrast dispersion staining, so the Becke' line method must be used (the fibers are to be mounted in 1.700 liquid to confirm that their r.i. is near 1.7). Crocidolite has parallel extinction generally, but may show a slight obliqueness.

The amphiboles actinolite and tremolite are members of a solid solution series. Compositions and therefore optical characteristics in the series can occur anywhere in between actinolite and tremolite, making the determination of

what to name a particular occurrence problematical. For this reason, we do not attempt to distinguish actinolite from tremolite, referring to an occurrence of either as actinolite/tremolite.

The amphiboles occur in nature in both fibrous and non-fibrous forms. The fibrous form has fibers with aspect ratios averaging about 10:1 or higher, with broomed fiber ends. The non-fibrous form has fibers with aspect ratios averaging about 4:1, and with blocky fiber ends. There had been an on-going controversy regarding the microscopic definition of asbestos. One view has that any amphibole particle with an aspect ratio greater than 3:1 is asbestos. The other side holds that such a definition is contrary to geological and mineralogical definitions, and that fibrous and non-fibrous varieties exhibit different mean aspect ratios and morphologies under the microscope. The controversy was resolved with the publication of the revised EPA Draft Method of PLM (1993), which utilizes the mean aspect ratio of a population, broomed ends, extinction characteristics, etc. to differentiate between fibrous and non-fibrous species of amphibole.. Our policy, following the EPA and NIST, is to 1) differentiate on the basis of mean aspect ratio and morphology populations of fibrous and non-fibrous amphiboles, 2) report as asbestos only those amphiboles determined to be fibrous in nature, 3) report non-fibrous amphiboles in the fiber identification boxes, and 4) include a note on the cover sheet explaining that the non-fibrous amphiboles, under certain situations, may be regulated (e.g. during PCM or TEM air sample analysis), and also that non-fibrous amphiboles may be hazardous.

For the determination of fibrous vs. non-fibrous, use the following guidelines:

1. Determine the number of fiber-like components in a sample. A single component consists of all fibers with the exact same properties, including dispersion staining colors (except wollastonite). Note that mixtures commonly occur, talc with anthophyllite, talc, tremolite and anthophyllite, etc.

2. Assume that all fibers of a given component are from the same source, either fibrous or non-fibrous, and therefore, the aspect ratios seen in the sample are typical and representative of one deposit. From the range of aspect ratios in our sample, we determine whether the deposit was fibrous or non-fibrous.

3. For our purposes, a fibrous asbestos component meets one or more of the following three criteria:

->three fibers having broomed ends observed

->50% of the fibers have an aspect ratio of >10:1

->three of the fibers have an aspect ratio of >50:1

Note that, regardless of what the court says, any fibers over 3:1 aspect ratio in a PCM analysis and over 5:1 in a TEM analysis meets the counting criteria and will therefore nevertheless be regulated. So, if a material containing non-fibrous amphiboles is removed, airborne fibers from it will show up and be included among regulated fibers. This is probably fair, since non-fibrous amphiboles may be hazardous, regardless of size or whether they are regulated.

Distinguishing anthophyllite from actinolite/tremolite

Lath shaped fibers that show gray/pale yellow phase contrast dispersion staining colors in 1.605HD liquid could be anthophyllite, actinolite/tremolite or wollastonite. That these minerals have nearly the same refractive indices is confusing, that they can occur in the same sample is more confusing.

Anthophyllite as well as actinolite/tremolite can have varying refractive indices. For this reason, the small differences observed in the dispersion staining colors of standards are not thought to be definitive in unknown samples. The only definitive difference between these amphiboles is their extinction behavior, anthophyllite being parallel and actinolite/tremolite being oblique. It must be noted that in certain orientations, actinolite/tremolite can appear parallel. Therefore, in a population of actinolite/tremolite fibers, some will be close to parallel and some will be distinctly oblique. The problem becomes whether the observations indicate the normal population of actinolite/tremolite, or whether a mixture of actinolite/tremolite and anthophyllite is present. In some cases, morphology may be different, as in our example above containing one fibrous fiber and one non-fibrous. Or dispersion staining colors may indicate the presence of two types of fibers. As mentioned above, the dispersion staining colors are not thought to be definitive on their own to identify the minerals. However, in a population of fibers from one locality, it would be expected that all the fibers would have very nearly the same refractive indices, so would be expected to produce approximately the same dispersion colors (although different orientations of the same fiber may produce slightly different colors). Therefore, the observation of two very distinctly different dispersion staining behaviors in a population of fibers indicates that two fiber types are present.

Wollastonite

Wollastonite is unique among commonly observed fibers in that it has a positive sign of elongation in one orientation and negative in another. McCrone states that in a population of wollastonite, 20% of the fibers would be expected to lie in the negative orientation. We have found in our samples, that the percent in negative orientation may be considerably less. For this reason, rotation of a possible wollastonite fiber is required for identification. The easiest mount for manipulation is the viscous medium. A likely fiber is lined up to the upper left or upper right, in order to show its sign of elongation colors. Then the cover slip is gently pushed with the tip of a nail pusher. With care, the fiber can be rotated, similar to rolling a log. If the fiber is wollastonite, it will flash bluish and yellowish as it rolls. Wollastonite has parallel extinction generally but not always.

Cellulose

Cellulose has approximately the same refractive index as chrysotile, so it is usually distinguished by morphology and extinction behavior. If large fibers are present, the ribbon-like morphology and cell wall cross-structures are distinctive. Even shredded or very small cellulose fibers will usually show the ribbon-like morphology. The smallest cellulose fibrils may have oblique extinction, while most cellulose exhibits undulose or wavy extinction, significantly different than chrysotile. Cotton is a form of cellulose which has a dumbbell-shaped cross-section instead of ribbon-shaped. Mature cotton fibers have little or no extinction.

Fibrous Glass

The only characteristic necessary for the identification of glass is its isotropism. Glass wool has shorter fibers and glass beads present, while glass fiber has longer fibers and no glass beads. The terms glass fiber and glass wool are preferable to the terms fiberglass (a brand name), and mineral wool, or rock wool (we can't tell which kind of wool it is).

Shredded polyolefin (polyethylene or polypropylene)

This is a fiber which looks very much like chrysotile, both under the stereoscope and PLM. It can be distinguished from chrysotile by tensile strength, morphology, and birefringence.

Chrysotile has a high tensile strength and simply can't be pulled into two shorted pieces. If a bundle of chrysotile is pulled at its ends, it will eventually part along its length, leaving two thinner bundles of the same length as the original. In contrast, if a fiber of synthetic is pulled at its ends, it will first be observed to stretch, then to become thinner in the middle and finally break in the middle, leaving two shorter fibers.

Shredded polyolefin usually appears under the stereoscope or PLM to be more convoluted and tangled than chrysotile usually is. Under crossed polars, it does not show the length-wise striations that chrysotile does. At 400x phase contrast, it does not show the very thin fibrils and bundle ends that chrysotile does. It has a higher birefringence than chrysotile, usually being quite white in fiber sizes for which chrysotile would appear gray. Several standard mounts are available which contain a mixture of shredded polyolefin and chrysotile to practice on.

If the above considerations do not produce a definitive decision, the fibers in question can be heated with a match to see whether they melt, which would indicate synthetic. Or, a fiber could be analyzed on the SEM/EDS, which would readily distinguish the two quite different compositions.

Talc or other sheet silicate

Talc is a Mg-containing sheet silicate. Usually, the sheets are intact, and there is no problem mistaking sheet which are edge-on for fibers. However, talc can be severed into ribbons, which are very fiber-like. In this case, the resulting ribbons will have a r.i. of about 1.60 parallel and about 1.55 perpendicular, and therefore give dispersion staining colors in both 1.605 HD and 1.55 HD liquids. The high birefringence (.05) can be attributed to the extreme difference in structure present parallel to vs. perpendicular to the sheets. Any other mineral fiber with a birefringence >0.04 is probably a sheet silicate

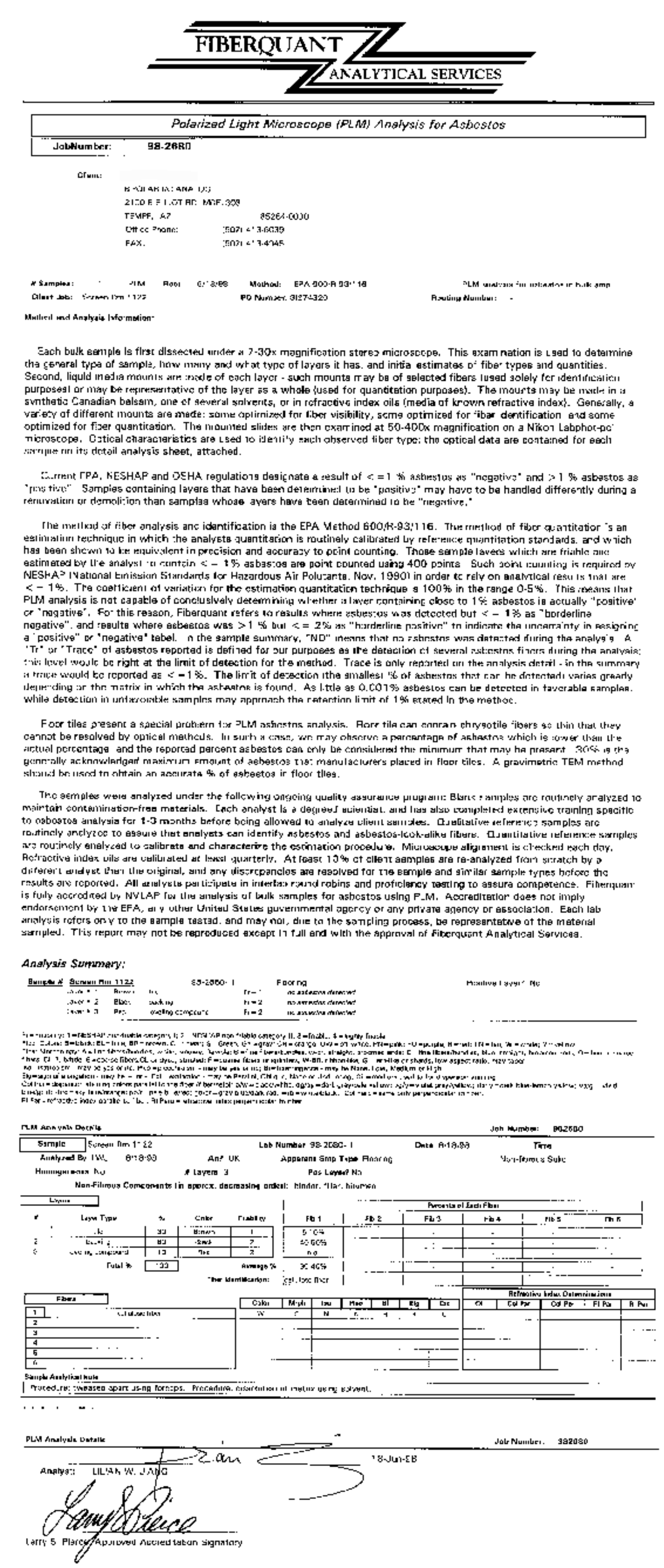
A complication is that "fibrous talc", which is to say talc possibly pseudomorphous after fibrous anthophyllite. Sometimes the replacement is not quite complete producing a fiber type which has been called "transitional talc", which can be pictured as a core of anthophyllite surrounded by a shell of epitaxial talc. The optical characteristics of such a material can be expected to lie somewhere in between talc and anthophyllite. Its refractive index parallel to the polarizer is approximately 1.6. We have found that commercial sources of fibrous talc have rather small percentages of transitional talc, so as to make the resulting percentage of anthophyllite also small. Despite the fact that some anthophyllite asbestos may be present in such transitional talc, the EPA has stated that they do not intend to regulate “fibers of mixed assemblage”, and so we do not report transitional talc as asbestos. The question may be asked, since all anthophyllite contains intimately mixed talc, whether any anthophyllite is regulated, even SRM anthophyllite asbestos.

7.5.6. Quantitation and Point Counting

For every layer, the percentage of fibrous components is quantified by visual estimate. A visual estimate is made by observing the fibers using both the stereoscope (if possible) and the polarizing light microscope. Volume-percentages are observed under the stereoscope, while area-percentages are observed in mounted slides. The observations of one should be used to temper the observations of the other to obtain a balanced estimate – such an estimate is neither by volume or by area, but any estimate is ball-park.. Ratios should be used (*e.g.*, this component is three times amount of this second component, *etc.*). Relative size of particles and material densities may have to be taken into account in the estimate. A component in small particles or fibers may appear numerous, but be inconsequential in volume or weight relative to large particles. The analysts’ skill at estimating is tested and honed by analyzing quantitative reference standards (section 7.6.4.1.2) In 1990, NESHAP was revised to require point counting (400 points) for those samples, or layers of samples, containing <10% asbestos. This policy was altered shortly after 1990 to allow client/customers to accept visual estimates for those samples or layers which are positive (technically, the consultant is *assuming* that it is positive, which can be done even without test results) or which have no observed asbestos. For samples or layers which are estimated to be =<1%, point counting is still required. Our policy is to point count friable layers that are estimated to contain =<1%, and to use visual estimation on all others.

If two layers (e.g. joint compound) appear identical in one sample, only one point count is used to calculate the % in both layers. The point counting procedure is described in section 7.5.1 and will not be repeated here. In interpretation of point counting, it must be noted that the point count must calculate to >3.2% to be 95% confident that the answer is >1%, and that the point count must calculate to <0.4 to be 95% confident that the answer is =<1% (source: Eric Chatfield).

Figure 7.5.7 Typical PLM Report


FIBERQUANT ANALYTICAL SERVICES

Polarized Light Microscope (PLM) Analysis for Asbestos

JobNumber: 98-2680

Client:

Method and Analysis Information

Each bulk sample is first dissected under a 7-30x magnification stereo microscope. This examination is used to determine the general type of sample, how many and what type of layers it has, and initial estimates of fiber types and quantities. Second, liquid media mounts are made of each layer - such mounts may be of selected fibers (used solely for identification purposes) or may be representative of the layer as a whole (used for quantitation purposes). The mounts may be made in a synthetic Canadian balsam, one of several solvents, or in refractive index oils (media of known refractive index). Generally, a variety of different mounts are made: some optimized for fiber visibility, some optimized for fiber identification and some optimized for fiber quantitation. The mounted slides are then examined at 50-400x magnification on a Nikon Labphot-pol microscope. Optical characteristics are used to identify each observed fiber type; the optical data are contained for each sample on its detail analysis sheet, attached.

Current EPA, NESHAP and OSHA regulations designate a result of < = 1 % asbestos as "negative" and > 1 % asbestos as "positive". Samples containing layers that have been determined to be "positive" may have to be handled differently during a renovation or demolition than samples whose layers have been determined to be "negative."

The method of fiber analysis and identification is the EPA Method 600/R-93/116. The method of fiber quantitation is an estimation technique in which the analysts quantitation is routinely calibrated by reference quantitation standards, and which has been shown to be equivalent in precision and accuracy to point counting. Those sample layers which are friable and estimated by the analyst to contain < = 1% asbestos are point counted using 400 points. Such point counting is required by NESHAP (National Emission Standards for Hazardous Air Polutants, Nov. 1990) in order to rely on analytical results that are < = 1%. The coefficient of variation for the estimation quantitation technique is 100% in the range 0-5%. This means that PLM analysis is not capable of conclusively determining whether a layer containing close to 1% asbestos is actually "positive" or "negative". For this reason, Fiberquant refers to results where asbestos was detected but < = 1% as "borderline negative", and results where asbestos was > 1 % but < = 2% as "borderline positive" to indicate the uncertainty in assigning a "positive" or "negative" label. In the sample summary, "ND" means that no asbestos was detected during the analysis. A "Tr" or "Trace" of asbestos reported is defined for our purposes as the detection of several asbestos fibers during the analysis; this level would be right at the limit of detection for the method. Trace is only reported on the analysis detail - in the summary a trace would be reported as < = 1%. The limit of detection (the smallest % of asbestos that can be detected) varies greatly depending on the matrix in which the asbestos is found. As little as 0.001% asbestos can be detected in favorable samples, while detection in unfavorable samples may approach the detection limit of 1% stated in the method.

Floor tiles present a special problem for PLM asbestos analysis. Floor tile can contain chrysotile fibers so thin that they cannot be resolved by optical methods. In such a case, we may observe a percentage of asbestos which is lower than the actual percentage and the reported percent asbestos can only be considered the minimum that may be present. 30% is the generally acknowledged maximum amount of asbestos that manufacturers placed in floor tiles. A gravimetric TEM method should be used to obtain an accurate % of asbestos in floor tiles.

The samples were analyzed under the following ongoing quality assurance program: Blank samples are routinely analyzed to maintain contamination-free materials. Each analyst is a degreed scientist, and has also completed extensive training specific to asbestos analysis for 1-3 months before being allowed to analyze client samples. Qualitative reference samples are routinely analyzed to assure that analysts can identify asbestos and asbestos-look-alike fibers. Quantitative reference samples are routinely analyzed to calibrate and characterize the estimation procedure. Microscope alignment is checked each day. Refractive index oils are calibrated at least quarterly. At least 10% of client samples are re-analyzed from scratch by a different analyst than the original, and any discrepancies are resolved for the sample and similar sample types before the results are reported. All analysts participate in interlab round robins and proficiency testing to assure competence. Fiberquant is fully accredited by NVLAP for the analysis of bulk samples for asbestos using PLM. Accreditation does not imply endorsement by the EPA, any other United States governmental agency or any private agency or association. Each lab analysis refers only to the sample tested, and may not, due to the sampling process, be representative of the material sampled. This report may not be reproduced except in full and with the approval of Fiberquant Analytical Services.

Analysis Summary:

PLM Analysis Details Job Number: 982680

Sample: Screen Rm 1122 Lab Number 98-2680-1 Date 6-18-98

Analyzed By LWJ 6-18-98 Apparent Smp Type Flooring

Homogeneous No # Layers 3 Pos Layer? No

Non-Fibrous Components (in approx. decreasing order): binder, filler, bitumen

Sample Analytical Note: Procedure: teased apart using forceps. Procedure: dissolution of matrix using solvent.

PLM Analysis Details Job Number: 982680

Analyst: LILIAN W. JANG 18-Jun-98

Larry S. Pierce, Approved Accreditation Signatory

The reporting limit used is 1%, taken from the method unverified.

7.5.7. Job Completion

When a job is completed, the analyst prints the report by choosing "print" from the job screen, "PLM", then one of the report-printing options. The analyst does the checks described in Work Practice PLM-4.

If the job has duplicates assigned, the computer will print out a dup analysis sheet. The indicated samples are given to a second analyst to analyze and fill in the sheet. In this case the procedure for duplicate analyses is followed (see section 7.6.4.3). When completed, the dup analyst (who is different that the original analyst), makes the checks listed in Work Practice PLM-4.

The job finally is sent to the front desk for dissemination of the data to the client/customer. The office personnel often give verbal results to the client/customer, reading the summary conclusions on the report, shown in Figure 75.7.

7.6. QUALITY ASSURANCE PROCEDURES

Quality assurance procedures are designed generally to assure that data or information disseminated to the client/customer is not inaccurate or erroneous. Certain procedures minimize conflicting data, thereby reducing the time spent clearing up discrepancies. The following procedures are specifically designed for asbestos sampling and testing and have been adapted from 1) the NIOSH Manual of Analytical Methods, 3rd. ed., 1984, and 2) the NVLAP Bulk Asbestos Handbook, NISTIR 88-3879, 1988.

The management system for PLM can be summarized as follows. The integrity of the samples (once they have passed our threshold) is assured by the log-in, sample handling, chain-of-custody, record-keeping and contamination control procedures. That gathered data is not erroneous is assured by the equipment and materials calibrations. That analysts are accurate in the identification of asbestos minerals and interferences is assured by our qualitative standards program, duplicate analyses and proficiency testing. That analysts are precise in their quantitation of fibers is tested by our quantitative standards program, duplicate analyses and proficiency testing. The accuracy of data disseminated to client/customers is assured by a check of results by at least two separate people.

QA analyses are to be => 10% of original analyses. We accomplish this by having our duplicate analyses nominally 10%. That way, the additional analyses (blanks, qualitative and quantitative standards, *etc.*)

provide a buffer over 10% to make sure we do not fall under . To help maintain a high level of quality in our analyses, Fiberquant participates in the NVLAP Bulk Asbestos program, which provides an acceptable agenda of quality assurance procedures to follow.

The quality procedures employed for PLM fall into the following general categories: 1) general procedures, 2) calibrations, 3) contamination control, 4) precision and accuracy determinations, 5) QA monthly reports, and 6) record keeping.

7.6.1. General Procedures

The refractive index of refractive index liquids is temperature dependent, so it is important that the laboratory be maintained at 25+/- 2º C. Toward this end, two thermometers are kept to monitor the temperature of the lab. If the temperature is found outside of the acceptable limits, the thermostat of the lab is adjusted slightly. If the temperature is found to be out of this range, then the r.i.'s determined at this temperature should be adjusted (using Shu-Chun Su paper "Rapidly and Accurately Determine…" in tech file marked "dispersion staining". The temperature of each station is documented along with microscope alignment daily.

7.6.2. Calibrations

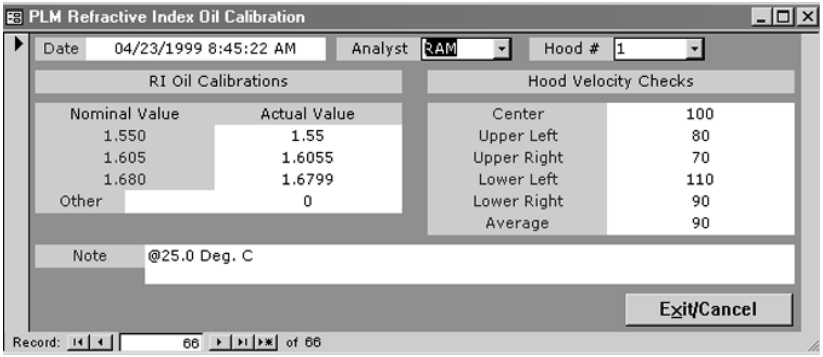
7.6.2.1. Microscopes

Since no length measurements are taken during PLM analysis of bulk asbestos samples, the stereoscopes and polarizing scopes used for the analysis are not routinely calibrated for magnification. Occasionally, one of the pol scopes may be used for TEM grid opening measurement, at which time it will be calibrated according to the procedures detailed in the TEM SOP's.

The alignment procedures and checks are given in Section 7.5.3.

7.6.2.2. Refractive Index Liquids

Figure 7.6.2.2 R.I. Liquid Calibration and Hood Velocity Form



Purpose: to prevent changes in refractive index (due to oxidation, evaporation, *etc.*) from affecting the accuracy of our identifications.

Responsible Party: the analyst assigned to each hood checks their own set of liquids (three sets).

Timing & Frequency: quarterly for commonly used liquids. If an uncommon liquid is to be used that has not been calibrated for a year, then it is calibrated before mounting.

SOP: PLM-5 (see Chapter 11).

Data Form : Figure 7.6.2.2.

Record Storage: stapled to PLM QA monthly report; temporarily stored in the PLM QC notebook.

Summary & Review: any problems mentioned in PLM QA monthly report.

Out-of-Control: liquids must be within 0.004 of expected; otherwise, the QC Officer or deputy can adjust by adding another liquid (all except a few of them are mixtures of liquids) or discard.

7.6.2.3. Lab Thermometer Check

Purpose: to ensure that the lab thermometer is reading correct temperature.

Responsible Party: Senior AA Analyst.

Timing and Frequency: Once per year

SOP: Work Practice GEN-6

Data Form: LIMS

Record Storage: LIMS

Summary & Review: as performed.

Out-of-Control: >+/-2 for 0-50C; >+/-5 for >50C.

7.6.3. Contamination Controls

The control of contamination in the bulk lab is important for two reasons. First, contamination indicates a condition in which potentially hazardous fibers are escaping into the lab, which may cause lung cancer in lab personnel. Second, contamination may affect the result of a given bulk analysis, or even affect the outcome of TEM analyses performed in another part of the lab. Three types of procedures minimize contamination: 1) good housekeeping practices, 2) monitoring of materials through the analysis of blanks, and 3) monitoring the lab air.

Some quality procedures are performed by the PLM analysts and some by the QA Officer. Reminders of each positions QA procedures are given in Lab Summaries PLM-1 and G-2, respectively.

7.6.3.1. Housekeeping, Environment and Contamination Prevention

Uncontained samples, liable to contaminate the laboratory, are either immediately contained or rejected, as detailed in Section 5 of the SOP/QA Manual.

Samples awaiting analysis are kept in a file cabinet for that purpose in the bulk area.

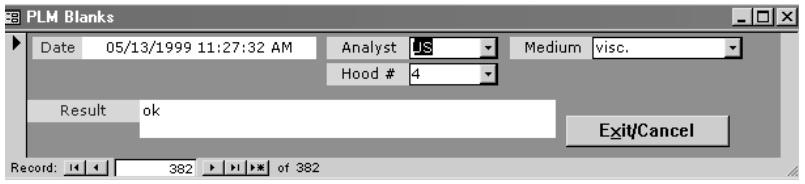
One sample per hood is opened, analyzed, and closed before the next sample is opened, thereby minimizing the chance of sample mix-up or cross-contamination. In between each sample, the stage of the stereoscope, the tools, hood surface (if needed), hands and the sample container of the previous sample are wet wiped with amended water to prevent fibers from escaping the hood and to minimize the chance of cross-contamination. Disposable black paper is used for stereoscopic examination of the sample. Kimwipes and wash bottles filled with amended water are available for cleanup. Black paper, contaminated Kimwipes and any other asbestos-containing waste is temporarily deposited in 1 gallon size ziploc bags located in each hood. When such a bag is full, it is sealed, the exterior wet-wiped and then deposited in the asbestos-waste container, a steel trash can lined with an commercially manufactured asbestos disposal trash bag. The trash bags are disposed of by arrangement with a local abatement company (AEA).

Reports and paperwork cannot be decontaminated and so are to be left outside the hood. Hands should be wet wiped or washed every time an analyst that has been working in the hood leaves it. The hood surface should be relatively un-cluttered, in order to maintain its laminar flow characteristics. The metal retainer for the HEPA filter should be vacuumed with the Nilfisk HEPA vac once per week to prevent build-up of particulate. The proper operation of the hoods is monitored via vane air velocity gauges, as detailed in section 7.3.2.

7.6.3.2. Blanks

No amount of checking of blanks can assure that a given analysis has not been contaminated. Therefore, regardless of blank frequency, it is up to each analyst to be aware of the types of fibers being seen and their percentages. If a low percentage of one type of fiber is consistently seen, then contamination is a possibility. Additionally, the presence of a fiber type is not to be concluded from the observation of one or two stray fibers in one mount. The analyst must make sure that the fiber consistently occurs in all mounts, or that there is a reason other than contamination why it only occurred in one mount. To document that contamination is not a problem, two series of blanks are run: monthly material checks (during which the liquids are checked for refractive index as well as contamination and routine blanks.

Figure 7.6.3.2 Routine Blank Form



Purpose: to document that contamination is not present in PLM materials.

Responsible Party: each PLM analyst.

Timing and Frequency: once each common liquid, every day, tracked by LIMS.

SOP: a drop of medium is placed on a clean slide, a small amount of fiberglass, cornstarch or other non-asbestos containing solid is added, and then a cover slip installed. The fiberglass provides a way to determine the plane of focus for the liquid. The slide is then examined for fibers.

Data Form: Figure 7.6.3.2.

Record Storage: computer.

Summary & Review: contamination noted in the PLM QA monthly report.

Out-of-Control: If asbestos contamination is found, then other blanks , such as those made with cleaned slides or cover slips, must be used to determine and eliminate the source of the contamination. If non-asbestos contamination is found, source elimination is optional depending on the amount of contamination.

7.6.3.3. Hood Face Velocity Check

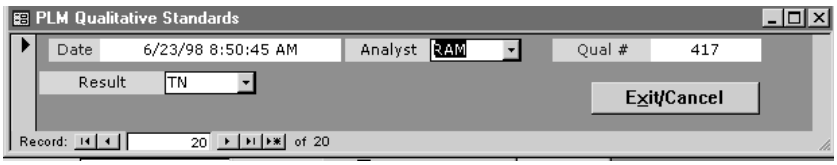
Purpose: to measure the face velocity of a PLM hood.

Responsible Party: each PLM analyst.

Timing & Frequency: three months, same time as liquids calibration.

SOP: set hood to normal operating speed; use vaneometer to measure velocity at center, upper left and right, and lower left and right. Record the five readings and average on the equipment page in the LIMS (can be accessed through QC button).

Figure 7.6.4.1.1 Qualitative Standards Form



Data Form: LIMS, liquid calibration form

Record Storage: computer

Summary & Review: as performed

Out-of-Control: average <80; if OOC, the contact QC officer.

7.6.3.4. Lab Air Monitoring

Purpose: to check possible contamination of lab air by asbestos.

Responsible Party: safety officer.

Timing and Frequency: once every three months, at the beginning of the quarter.

SOP: a ~1800 L sample is collected either as an area sample at the exit of the hoods or as a personnel sample on one of *Data Form:* normal sample submittal and analysis forms.

Record Storage: safety officer files.

Summary & Review: by safety officer.

Out-of-Control: >0.01 asbestos fibers/cc. If exceeded, PLM analysis is suspended until the source is found and eliminated, and a clearance sample is in control.

7.6.4. Precision and Accuracy Determinations

The use of the analyses to client/customers and our future as a lab depends upon producing analyses that are accurate and precise. These parameters are kept high by monitoring with reference samples, replicate analyses, duplicate analyses, interlab samples and proficiency samples.

7.6.4.1. Reference Samples

Reference samples provide the chance to compare unknown samples to known fibers and concentrations. In the absence of objective means of quantitation, they are essential to the accuracy of an analysis.

7.6.4.1.1. Qualitative

Purpose: to hone or develop the identification skills of the analysts on both common fibers and also fibers not usually encountered.

Responsible Party: each PLM analyst.

Timing & Frequency: one per week.

SOP: approximately 30 pre-mounted slides are available. The slides are marked on their reverse side only, and blacked out on the top side. The analyst identifies the fiber type, then checks the bottom for immediate feedback.

Data Form: Figure 7.6.4.1.1

Record Storage: computer.

Summary & Review: number run, cumulative false + and - %'s for each analyst and for lab documented in PLM QA monthly report.

Out-of-Control: >10% errors. Consistent mis-identification of a particular fiber indicates that corrective action (remedial training) is needed.

7.6.4.1.2. Quantitative

Purpose: to calibrate the quantitation skills of the analysts, and to generate precision and bias data.

Responsible Party: each PLM analyst.

Timing & Frequency: one per week.

SOP: Quantitative standards are 1) purchased from Kevin Malott, San Diego, CA, 2) purchased from RTI, and 3) old proficiency samples. These standards contain weighed or known amounts of standard asbestos in various matrices. The % of asbestos ranges from 1% to 20% and the matrices are spray texture, polystyrene spray texture, and unaggregated binder. Asbestos types represented are chrysotile, tremolite and amosite. These samples along with various old proficiency samples were split into three samples and marked with arbitrary numbers in order to generate a large number of sub-samples identical except for numbering. When the analyst has analyzed a sample which is marked "quant std" on the work sheet, he or she chooses a quant standard vial at random and analyses as usual. The reference or known % asbestos is kept on a key sheet (in the same drawer as the quant standards) and is also filled in on the form. Feed-back is immediate, which should keep quantitation of individual analysts close to reference values.

Data Form: Figure 7.6.4.1.2

Record Storage: temporarily in PLM QC folder, then stapled to the PLM QA monthly report.

Summary & Review: number run, cumulative CV, cumulative bias calculated for each analyst and for lab documented in PLM QA monthly report, most current plot of analyst vs. reference (Figure 7.6.4.1.2b) in PLM QA monthly report.

Out-of-Control: For a reference sample containing less than 2.1% asbestos, an analyst reporting less than 0.5% or greater than 4.1%; for a reference sample containing greater than 2.1, an analyst reporting% less than 0.5 x the ref. % or greater than 2.0 x the ref. %.

7.6.4.1.3. General Reference Samples

A set of reference samples is kept, consisting of previously analyzed samples or samples of known composition. The samples consist of 1) NIST SRM 1866 (standard reference material chrysotile, amosite, crocidolite and fibrous glass), 2) RTI round robin samples from round 12 to present, 3) mineral specimens purchased from commercial sources or collected in the field, 4) selected samples from client/customers, and 5) the MAC reference set of asbestos fibers and interferences. The above are present sometimes as bulk samples, sometimes as slide mounts (in meltmount) and sometimes as both.

Figure 7.6.4.1.2a Quantitative Standards Form

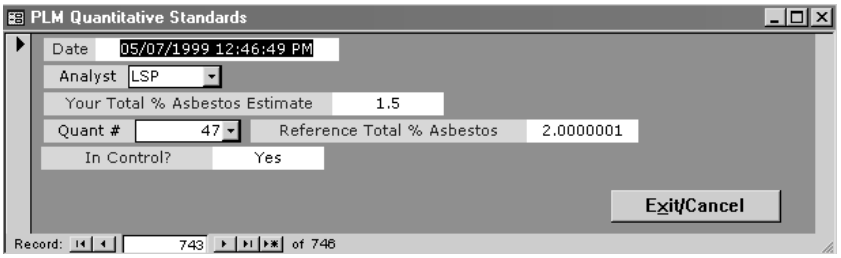
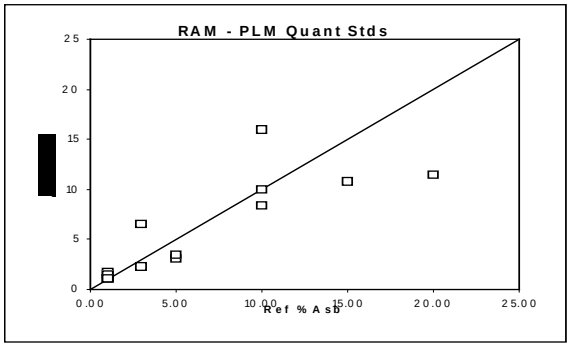


Figure 7.6.4.1.2b Quant. Result vs. Reference Result



The reference samples are used three ways. First, since they contain a wide variety of commonly and rarely encountered fibers, they are used to train and qualify newly hired analysts. Second, they are used to compare optical properties to during a difficult analysis. Third, they are used to re-qualify analysts if a problem is found.

7.6.4.2. Re-Analyses

A re-analysis of a sample from scratch (formerly called a duplicate by Fiberquant) is our basic 10% quality control. RD designates that a different analyst is to re-analyze; RS that the same analyst is to re-analyze.

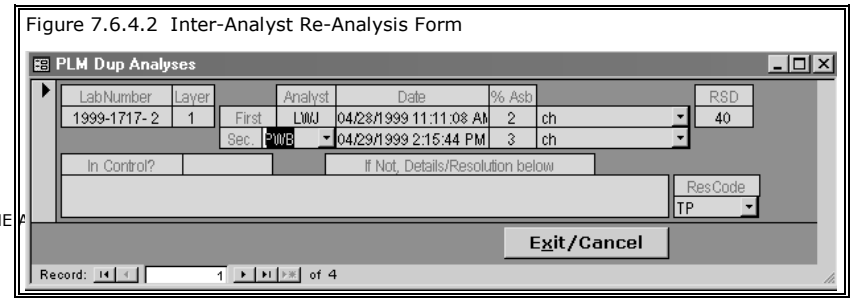
Purpose: to control errors in PLM analysis, and to generate lab precision data.

Responsible Party: each PLM analyst.

Timing & Frequency: RD: one per 10 samples; RS one per 100 samples.

SOP: The LIMS nominally designates samples as RD or. When all the samples in a job have been analyzed, a dup sheet is printed, showing which one are to be re-analyzed. The results of the original analyses are not filled in at this time. The form and the samples to be duplicated are then passed over to a different analyst (or the Lab

Figure 7.6.4.2 Inter-Analyst Re-Analysis Form



Manager if no different analyst is available). The second analyst then re-analyzes the samples, filling in the results in the box provided. Point counting is not used for the duplicate analysis, nor are the minimum sub-sample recommendations. The second analyst transfers the original results to the dup sheet, and then performs the checks listed in Work Practice PLM-4 (Checking a PLM Report).

Data Form: Figure 7.6.4.2

Record Storage: PLM lab file "Duplicate Sheets"

Summary & Review: cumulative %diff/mean calculated for each analyst and for lab monthly in PLM QA monthly report.

Out-of-Control: for a mean % > 1%: >100% RPD and both analysts must be > 1%; for a mean % < 1%: both analysts must be < 1%. An out-of-control indication from the computer must be resolved and the situation, type of sample, and resolution, including false negative or false positive will be documented on the OOC LIMS form.

GUIDELINES FOR PLM DUPLICATE SAMPLE DISCREPANCIES

1. The original analysis in on the report and the duplicate analysis in written on the Dup form. The original analysis is then transferred to the Dup form. Temporarily save the mounted slides for dup analyses.

2. Discrepancies are classified as major and minor:

Major: 1) one analyst has a layer >1% asbestos and the other analyst has the layer <=1%.

2) in a positive analysis, one analysts reports one type of asbestos and the other analyst reports a different kind (e.g., one is act/trem and one is anthoph.).

3) major amounts of non-asbestos fiber (>10%) reported in one analysis and not reported at all in the other.

4) percentages are not in adjacent ranges.

Minor: 1) small amounts of non-asbestos fiber (<10%) in one analysis not reported in the other.

2) traces of asbestos in one analysis and not the other.

3. Procedures for resolving the discrepancy are different depending on type of discrepancy.

4. For major, you must, before the job goes out, reach a consensus as to whether to call the sample + or -, or what type of asbestos it is First, both analysts look at the Dup form so they know what the difference is. Then each explains what they had seen and under what light conditions. Illustrate with the saved slides. Call in another opinion, if you want. Document the discrepancy in the LIMS OOC database if the LIMS has indicated an OOC condition.

5. For minor, merely pass the dup form around to both analysts, so that the difference can be mentally noted. No other action is needed.

7.6.4.3. Interlab Samples

Purpose: to compare lab results and reporting practices with other labs.

Responsible Party: Larry S. Pierce

Timing and Frequency: quarterly.

SOP: 4 samples from the AIHA bulk proficiency program

Data Form: as supplied.

Record Storage: PLM file "AIHA Bulks" and LIMS.

Summary & Review: summary charts in monthly report, same as for NVLAP, Figure 7.6.4.4.

Out-of-Control: acceptance limits as published by AIHA.

7.6.4.4. Uncertainty

Purpose: to determine reported ranges for reports.

Responsible Party: Larry S. Pierce

Timing and Frequency: reviewed annually.

SOP: For our purposes, the overall uncertainty of a PLM analysis is defined as the mean inter-analyst re-analysis relative percent difference. A cumulative calculation is made in each QA Monthly Report. If the result indicates that our reported ranges are too broad or too narrow, then an adjustment should be made.

Data Form: none.

Record Storage: none. If adjustment is made, make the calculations on the QA Monthly Report from which the data is derived.

7.6.4.5. Proficiency Samples (also 6-month Demonstration of Competency)

Purpose: to continue NVLAP accreditation; to evaluate analyst and lab bias.

Responsible Party: Larry S. Pierce, paperwork; each PLM analyst, analysis.

Timing & Frequency: approximately twice yearly, scheduled by NVLAP.

SOP: 1) all analysts analyze each sample the same as client/customer samples, 2) results are compiled by the QA Officer. 3) Just as with any duplicated analyses, discrepancies, both qualitative and quantitative, are resolved before the job goes out. 4) When discrepancies are resolved, one analysts (chosen at random prior to the analyses) results are submitted to NVLAP, 5) do not discuss the results with other labs.

Data Form: analysts use our normal PLM data form, results submitted on NVLAP form (not illustrated).

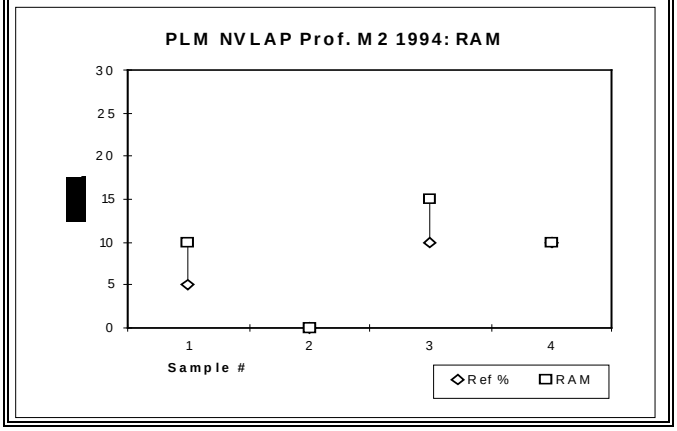
Record Storage: PLM file "NVLAP Raw Data" and "NVLAP Results".

Summary & Review: analysts results compared to reference results using the plot in Figure 7.6.4.4.

Out-of-Control: an analyst is out-of-control when his results are outside the acceptable range determined by NVLAP. Serious or pervasive problems are to be discussed in a non-routine PLM workshop.

Proficiency results are used to demonstrate 6-month analyst proficiency in PLM analysis.

Figure 7.6.4.4 Proficiency Sample Comparison



7.6.4.6. Report Check

The report is our final product. All the accuracy in analysis is worthless if the proper result has not been transcribed correctly and reported correctly. Therefore, each report is checked by the original analyst, the duplicate analyst, and an office worker. The items to be checked are given in Work Practice PLM-4, Checking PLM Reports.

7.6.5. QA Monthly Reports

Each month, a report is prepared which summarizes the quality assurance procedure results for that month's samples. The timing of the report will depend on the backlog of samples, since samples received during a month may not be analyzed until some time after the month is over. The items to be included in the report are detailed in Section 13 of the SOP/QA Manual.

7.6.6. Record Keeping

The written records of PLM lab activities are listed in the table below. The locations of the current records are also given. Records older than one year may be archived. These records are to be held secure and confidential. The original client/customer has full access to data and reports relating to his samples, of course. If another party desires results, the original client/customer must approve beforehand, at least verbally, but preferably in writing. All records are chronological unless stated otherwise.

RECORDS PERTAINING TO PLM ANALYSIS

RECORD	LOCATION
Job Log Book	LIMS
Sample Submittal Form	OfficeFile
General Log Form	LIMS/OfficeFile
Invoice	Office File
Reports	Office File
Routine Blanks	LIMS
Qualitative Standards	LIMS
Quantitative Standards	LIMS
Duplicate Analysis Record	LIMS
Interlab Analysis Form	Monthly QA Report
Proficiency Testing Results	Tech File

Operator and Lab Accuracy and Precision Determinations Monthly QA Report/LIMS Personnel Files

7.7. ANALYST PROFICIENCY AND DEFICIENCY

An analyst is first deemed proficient when their level of false negatives and false positives drops to a base level (nominally 1%) from duplicate analyses. A continuing record of false negatives and positives is kept on the monthly QA summary sheet (see Section 13). More salient than percentage of false readings is usually what kind of samples the false readings occur on.

Individual analyst precision is defined for our purposes as his/her cumulative average standard deviation for our series of quantitative standards. Bias is defined as the cumulative average bias for the same standards. These values are re-calculated monthly and are documented in the PLM QA Monthly Summary.

If an analyst is found to have a consistent level of false readings on one or two types of samples, a tutorial session is set up, consisting of 2-4 hours of one-on-one instruction, discussion, and analysis of the trouble sample type(s). Any other problems, such as r.i. determination, are dealt with similarly. An analyst who has a consistently high false reading level with all kinds of samples should be trained in number of mounts to make, types of solvents, illumination setups, time to scan mounts, or other techniques which generally aid in visualizing fibers.

Deficiency training sessions are noted both on the QA monthly summary and on the personal summary.

7.8. LAB CHARACTERIZATION

Fiberquant performs ~9000 jobs per year containing ~60,000 samples during a typical year. Of these samples, ~1/2 are PLM samples.

Lab characterization is defined as a description of the precision and bias that the lab delivers on a day to day basis on actual samples. The lab precision is calculated here as the average Difference/Mean for cross-check re-analyses. The lab bias is calculated as the average cumulative bias of our series of quantitative standards.

Based on the results of our duplicate analyses and proficiency testing over the last 5 years, the following conclusions can be made.

1) Fiber types are identified and reported with essentially 100% accuracy. Fiberquant has never misidentified a fiber type in proficiency testing.

2) False positives and false negatives during duplicate analyses average ~0.1% overall.

3) Precision during duplicate analyses has been 20-50% in the 0-50% asbestos range.

4) Fiberquant appears to not have the positive bias that is so pervasive in other labs. Samples known to have 1% chrysotile by weight will usually be reported in the 0.5-2% range. This bias may be considerably less than the bias of other laboratories that do not have our extensive program of quantitative standards analysis. This expectation is borne out in statistical analysis of proficiency testing, in which we are closer to the true weight percent that the majority of labs, and interlab testing, in which we consistently report lower values for low level samples than the other labs in the round.

5) Transcription errors in generating the summary page are ~0.007% (after the direct entry system was started).

8. STANDARD OPERATING PROCEDURES FOR THE ANALYSIS OF ASBESTOS FILTER SAMPLES BY TRANSMISSION ELECTRON MICROSCOPY

8.1. INTRODUCTION

The preparation and analysis of filter samples using the transmission electron microscope (TEM) involves many varied procedures, each relatively complicated in itself. It is not likely, therefore, that our current standard operating procedures (SOP's) for every process can be remembered by personnel no matter how experienced they become. Also, the full SOP for the analysis is cumbersome and hard to refer to on a regular basis. Therefore, we have adopted the "Work Practice" as a working reminder of procedures. For each separate process or procedure performed, an Work Practice is prepared, which consists of a brief but complete compilation of what has to be done and when it has to be done in that process or procedure. The Work Practice is designed to assist personnel that have already been trained in a procedure to perform the procedure in a consistent manner. The Work Practices do not explain why steps are performed, so it is incumbent upon the analyst to thoroughly read the full SOPs when issued. Work Practices are kept 1) complete in this document, 2) complete in a folder in the TEM room, and 3) as individual summaries taped up or kept near the area where the procedure is performed. They are to be referred to on a daily basis and need to be as handy as possible for this reason.

The TEM Work Practices are given in Chapter 11 of the Quality Manual.

The default method is based on AHERA (40 CFR Part 763 Appendix A to Subpart E). Other counts are given as variations.

8.2. ORGANIZATION AND TRAINING OF PERSONNEL

The job descriptions, prerequisites and organization of personnel at Fiberquant Inc. are given in Section 4 of the Quality Assurance Manual. Training procedures and requirements for personnel are given in Section 9 of the same document

8.3. EQUIPMENT DESCRIPTIONS AND MAINTENANCE

8.3.1. Equipment Descriptions

The current equipment used for TEM procedures is as follows:

1. Transmission Electron Microscope

JEOL 1200 EXII, serial number EM158061-179, goniometer stage; purchased used from Emispec 2001. This microscope can operate at 40-120 kV, can produce electron diffraction patterns of single fibrils of chrysotile, is capable of magnifications from 50-500,000 and capable of displaying and resolving hollow tubes of chrysotile fibrils, has inscribed circles on its display screen which correspond to 0.5 um and 5.0 um diameters at 20,000 magnification, has an x-y mechanical stage, produces a spot at crossover which is <250 nm size, and can record images and diffraction patterns on 3.25x4" electron micrograph film, as well as digital images via a CCD camera detector in the column. Energy Dispersive X-ray Analyzer: 4pi purchased 2007.

2. Transmission Electron Microscope

JEOL 1200 Mark 1 , serial number EM157058-82, goniometer, 1 plain holder. Purchased used from Bob Roberts in 2005, placed in service 2005. 40-120kV, 15-100,000x, camera, etc. Added digital image capture 2005. EDS: 4pi purchased 2007.

3. Clean Bench

Nuaire Labgard Class II Type A2 Biological Safety Cabinet, model NV425-300, ser#145475072611. Purchased new placed in service in June, 2012. Certified annually along with the Mycology BSE. There is no flow that can be checked except by the certification.

4. Exhaust Hoods

If needed for some extraordinary sample(s), the AA exhaust hood should be used, which has a documented flow rate stored in the LIMS. Local exhaust is used at the condensation washer, even though the manufacturer states that exhaust is not necessary.

5. Carbon Evaporator

Denton 502A Auto evaporator with carbon electrodes, metal basket electrodes. Purchased new in Jan. 1990. Has been altered to vent through a valve to control flow and cassette containing a 0.45 um MCE filter to prevent contamination of its contents by lab air.

Backup evaporator is a Varian VE-10 basic evaporator with carbon electrodes and two spare electrodes with Pirani vacuum gauge. Owned by SEMTEC Laboratories, purchased used from Chemistry Dept., Arizona State University on or about 1982. Placed in service 1985. The evaporator achieves a vacuum of approximately 2x10-5 mmHg. It has been altered so that it vents through a 0.8um MCE filter.

6. Plasma Ashers

1) Glow Research Autoglow Ser# GRL40863 purchased new in 2012, 2) backup: March Instruments Plasmod Ser. # 1008, purchased used and placed in service 3-3-95; 3) for backup EMScope (Biorad) 850-X barrel asher (150 watts max), serial number 20053, purchased new from EMScope and placed in service: December, 1988, 4) SPI Plasma Prep II, ser. # 001549, acquired used, 5) EMSL I-5000, ser. # 1003, acquired used. The ashers have never been used for any samples but asbestos filter samples, and all have been modified so that venting is slow enough not to visibly disturb shreds of Kimwipe. Venting occurs through a 0.45um MCE filter.

7. Optical Microscopes

See PCM and PLM chapters.

8. Prep Lab

On a separate air system from the PLM lab; PLM samples are forbidden to traverse the TEM lab.

8.3.2. Equipment Maintenance

All maintenance, either routine or otherwise, is documented in the LIMS equipment files. If field sheets are part of the maintenance record, they are stored in the physical equipment files in Larry's office.

1. Transmission Electron Microscope

The maintenance procedures for the TEMs are exhausting enough that they are given their own Work Practice, #TEM-22. The technical manuals are kept in the TEM room.

The water chiller tanks should be examined periodically and filled/cleaned if necessary. The chiller manuals are kept on the chillers themselves and also in the instructions file.

2. Energy Dispersive X-ray Spectrometer

The EDS dewars must be kept filled with liquid nitrogen. This is the only routine maintenance procedure. Other maintenance procedures are precipitated by the results of the Spectrometer Performance Checks, namely warming the Dewar if the low energy signal is low or resolution is >175eV. Trouble-shooting and maintenance procedures are described in built-in electronic manuals. The electronics need no routine maintenance; the analyzers are kept on constantly for stability.

3. Clean Bench

The Biological Safety Cabinet which serves as a clean bench is certified yearly. Any failures in certification are discussed and repaired with the certifying company or the manufacturer.

4. Carbon Evaporator

The carbon evaporator employs both mechanical and diffusion pumps. If the vacuum degrades (so that 2x10-6 mmHg cannot be attained), or approximately once a year, the pumps are drained and re-filled with oil. The diffusion pump insides at that time are cleaned as much as possible, for most efficient operation. Document in LIMS equipment file.

Periodically, the bell jar will become dark with deposits, at which time is cleaned with soap and water, or ethanol, or steel wool, if necessary.

The Carbon Coater Manual is kept in the instructions file.

5. Plasma Asher

The plasma asher pump is a mechanical pump charged with Fomblin oil. Depending on sample load, the oil is changed every 1-2 years. The oil first has to be ordered, then the pump drained and re-filled. The asher itself requires no maintenance, unless inoperable, or excessive drift is evident. If 100 watts are unobtainable, the two RF tubes may be bad. Drift or inconsistent calibration may indicate a vacuum leak. The asher technical manual is kept in the same desk.

6 Optical Microscopes

The optical microscopes are cleaned and inspected once per year by a professional microscope service, Bender and Associates, Tempe, AZ. Other maintenance is of the trouble-shooting type, and is performed as needed by the lab manager affected. Manuals for the optical scopes are kept in the scope tables. Both types of service are to be documented in the LIMS.

8.3.3. Supplies

The supplies that are stocked for the TEM division are listed below, with suppliers and target inventories.

Description (Supplier)	Target Inventory
0.45 um, 25mm MCE filter cassette (Poretics or Nuclepore 322375)	100
0.4 UM, 25MM PC filter cassette (Poretics or Nuclepore 312375)	150
compressed gas duster (Fullam 11670 or eq)	3
fine point tweezers (Fullam 11020 or eq)	4
deionized water, filtered through 0.1 um PC	2 gal
0.1 um 47mm and 25mm PC filters (Nuclepore or eq)	100 ea
Parafilm M (Fisher)	20 ft
Nitrile gloves	50
tungsten wire baskets, fine (Fullam 12070 or eq)	20
1/4" x 12" carbon rods (Fullam or eq)	20
1/8" x 12" carbon rods (Fullam or eq)	20
bell jar to fit carbon coater+ seal (Dynatech or eq)	1 besides current
Set of seals and o-rings for carbon coater (Denton)	1
wash bottles, poly, 8 oz (Fisher or eq)	20
3" plastic petri dishes (Fisher 08-757-13 or eq)	100
1.5" plastic petri dishes (Fisher 08-757-19 or eq)	200
funnels, various sizes	
gold wire, 0.008" dia (Fullam 12201 or eq)	5 ft
methyl cellulose powder (Fisher or eq)	20 gm
acetone, optima (Fisher or eq)	1 gal
chloroform, HPLC (Fisher or eq)	1 gal
1-methyl, 2-pyrolidinone (Fishe or eq r)	1 gal
denatured alcohol (ethanol, hardware store)	1 gal
disposable pipettes and bulb (Fisher or eq)	20
micro pipette tips, 50 ul (Fisher or eq)	50
EM grids, indexable (SPI 3020C)	500
Stender dishes (Fisher or eq)	20
vials, 20 ml (fisher or eq)	50
stainless steel mesh (Fisher or eq)	1 sq. ft
glass bottles, 8 oz (Fisher or eq)	5
liquid nitrogen	as required
apertures for TEMs (SPI, JEOL)	2 ea
lens tissue (Fullam 15420 or eq)	3
vacuum grease, Thomas Lubriseal (Fisher or eq)	1
vacuum grease, Apiezon L and M (Fullam or eq)	1 ea
compressed oxygen	1 tank
References: see Reference file	
SRM 2063 or equivalent	1

SRM 1876 or equivalent	1
Asbestos and look-alike standards, mounted on grids	1 each (list in NVLAP Handbook)

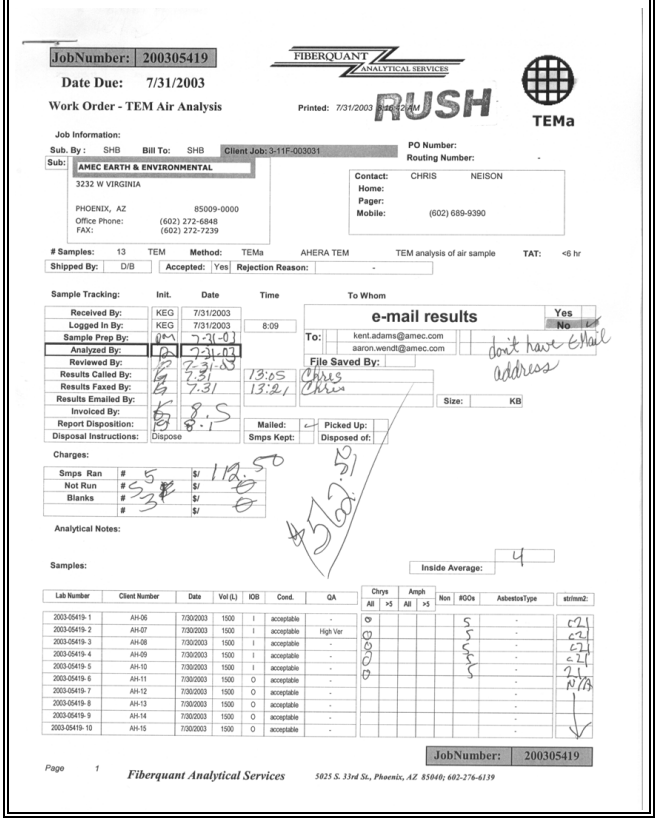
8.4. SAMPLE LOG-IN AND HANDLING

General log in and handling instructions are given in section 5. of the SOP/QA Manual. Below is a brief description, and instructions specific to TEM samples

Incoming samples of all kinds are received at the front desk. Immediately upon receipt, the LIMS assigns a job number to the lot of samples and a lab number to each received sample as the client/customer and sample data is input.

The acceptance or rejection of TEM samples hinges on sample integrity. Specifically, a sample may be rejected (after consultation with the client/customer) if 1) sample identification is not unique and complete, 2) cassettes are open-ended, or broken, or apparently tampered with, 3) bulk samples have been included with TEM samples during transport (must be rejected for AHERA), 4) the sampling volumes do not meet the testing criteria (e.g., only 5 samples received for AHERA analysis and the volumes are <1200 L), or 5) the filter loading on the sample is found to be uneven or too highly loaded (in this case the samples would have been initially accepted, but would have been terminated during mounting).

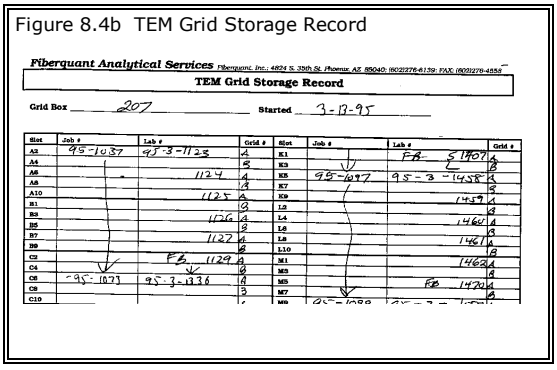
Figure 8.4a TEM Sample Submittal Form


JobNumber: 200305419
Date Due: 7/31/2003
Work Order - TEM Air Analysis
FIBERQUANT ANALYTICAL SERVICES
RUSH
TEMa
Job Information:
Sub. By : SHB Bill To: SHB Client Job: 3-11F-003031
PO Number:
Routing Number:
Sub: AMEC EARTH & ENVIRONMENTAL
3232 W VIRGINIA
PHOENIX, AZ 85009-0000
Office Phone: (602) 272-6848
FAX: (602) 272-7239
Contact: CHRIS NEISON
Home:
Pager:
Mobile: (602) 689-9390
Samples: 13 TEM Method: TEMa AHERA TEM TEM analysis of air sample TAT: <6 hr
Shipped By: D/B Accepted: Yes Rejection Reason:
Sample Tracking: Init. Date Time To Whom
Received By: KEG 7/31/2003
Logged In By: KEG 7/31/2003 8:09
Sample Prep By:
Analyzed By:
Reviewed By:
Results Called By:
Results Faxed By:
Results Emailed By:
Invoiced By:
Report Disposition:
Disposal Instructions: Dispose
e-mail results Yes No
To: kent.adams@amec.com aaron.wendt@amec.com
don't have e-Mail address
File Saved By:
13:05 Chris
13:21 Chris
Size: KB
Mailed: Picked Up:
Smps Kept: Disposed of:
Charges:
Smps Ran # $/
Not Run # $/
Blanks # $/
Analytical Notes:
Samples:
Inside Average:
Lab Number | Client Number | Date | Vol (L) | IOB | Cond. | QA | Chrys All | Chrys >5 | Amph All | Amph >5 | Non | #OOs | AsbestosType | str/mm2:
2003-05419-1 AH-06 7/30/2003 1500 I acceptable
2003-05419-2 AH-07 7/30/2003 1500 I acceptable High Ver
2003-05419-3 AH-08 7/30/2003 1500 I acceptable
2003-05419-4 AH-09 7/30/2003 1500 I acceptable
2003-05419-5 AH-10 7/30/2003 1500 I acceptable
2003-05419-6 AH-11 7/30/2003 1500 O acceptable
2003-05419-7 AH-12 7/30/2003 1500 O acceptable
2003-05419-8 AH-13 7/30/2003 1500 O acceptable
2003-05419-9 AH-14 7/30/2003 1500 O acceptable
2003-05419-10 AH-15 7/30/2003 1500 O acceptable
JobNumber: 200305419
Page 1
Fiberquant Analytical Services 5025 S. 33rd St., Phoenix, AZ 85040; 602-276-6139

When the samples are logged-in, the computer prints a work order sheet (Figure 8.4a), which will stay with the samples while they are being analyzed. The lab number for each sample cassette is then written with a marking pen (Sanford Sharpie, e.g.) on the cassette itself. The cassettes are then returned to the bag that they came in, or if they did not arrive in a suitable bag, one is provided, to keep the job together. Finally, the Job#, client/customer code and date received are written with a marking pen on the outside of the bag for ready reference.

The bag of samples along with their sample submittal form and any accompanying paperwork is placed in the TEM prep area. The analyst is informed of the job and may want to observe stages in the preparation personally, or the analyst and preparer may be the same person. The samples are then prepped, after which the appropriate line on the Sample Submittal form is signed off.

Figure 8.4b TEM Grid Storage Record


Fiberquant Analytical Services Fiberquant, Inc.; 4824 S. 35th St. Phoenix, AZ 85040; (602)276-6139; FAX: (602)276-4855
TEM Grid Storage Record
Grid Box 207 Started 3-13-95
Slot | Job # | Lab # | Grid # | Slot | Job # | Lab # | Grid #
A3 95-1037 95-3-1125 1 K1 FB 1107
A4 2 K2
A6 1124 4 K5 95-1037 95-3-1438
A8 3 K7
A10 1125 2 K9 1439
B1 3 L2
B3 1126 4 L4 1461
B5 3 L6
B7 1127 4 L8 1461
B9 3 L10
C3 FB 1129 4 M1 1462
C4 3 M3
C6 -95-1037 95-3-1336 4 M5 FB 1470
C8 3 M7
C10 M9

One wedge consisting of 1/4 of a 25mm dia. filter of each sample or blank is prepped, yielding at least two TEM grids. The grids are visually evaluated. When suitable appearing grids are obtained, the grids are placed in grid holders and their location and identity recorded in the grid storage record (Figure 8.4b). Grid holders are only used once, to prevent contamination from previous samples. Grids holders which are full are archived, allowing grids to be recounted at any time.

The analyst selects grids from grid storage or directly from sample prep as the grids dry and partially fills in count sheets (Figure 8.4c), one per each sample to start (more may be required, depending on how many fibers are observed), with the client/customer name, job, job#, lab#, filter type, sample volume and current grid opening area. Then, based on the sample volume and grid opening area, the number of grid openings that need to be analyzed to achieve an analytical sensitivity of 0.005 structures/cc is calculated and filled in on the form. The formula is given below:

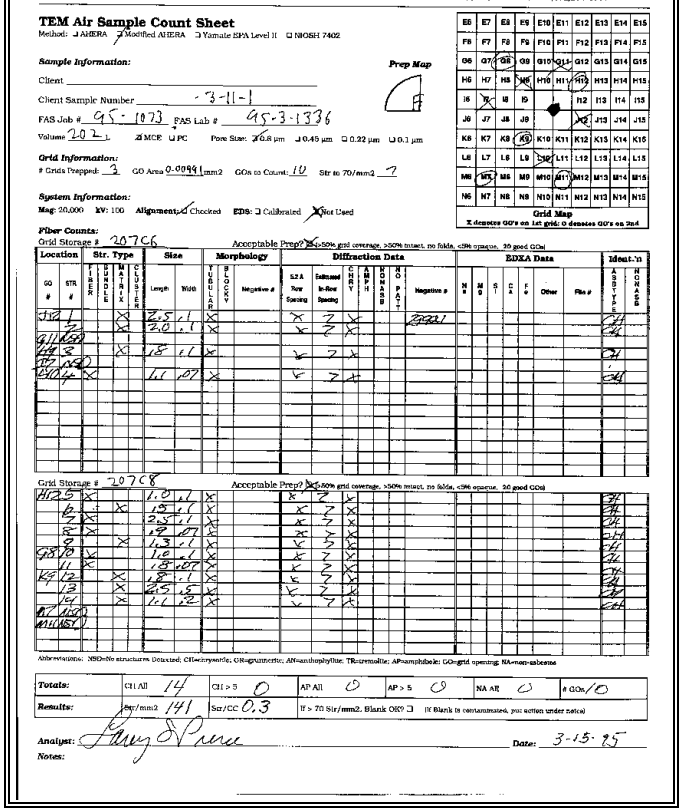
$$\#\,G.O.'s = \frac{1str. \times 385\ mm^{2}\ /\ filter}{G.O.Area\ (mm^{2}\ /\ G.O.) \times 0.00549\ \ str\ /\ cc \times Vol\ (L\ /\ filter\ ) \times 1000\ cc\ /\ L}$$

A chart of # grid openings and sensitivities vs volume routinely takes the place of the above calculation and is posted in the TEM room to assist. A spreadsheet (*Analsens.xls*) is available on several computers in the lab and can also perform the calculation. Also, if the sample is to be analyzed using the AHERA protocol, the number of structures that would result in a failure (usually 5) are calculated:

$$\#StrToFailure = \frac{70str/mm^2 \times \#G.O.'s \times G.O.Area(mm^2)}{1str}$$

This value is also listed on the chart in the TEM room and by the *Analsens* spreadsheet for routine use. Then, the analyst performs the counts according to the level of analysis requested on the sample submittal form and marked on the count sheets. The results are hand calculated (see 8.9) and filled in on the bottom of the count sheet. Later, the final report is generated by computer. The analyst checks that both the calculations match, and then signs the report, the line "analyzed by" on the Sample Submittal Form, and returns the samples, sample submittal form and associated paperwork to the lab coordinator.

Figure 8.4c TEM Air Sample Count Sheet



The customer is notified by the front desk that the job has been completed. Verbal results are customarily given, and a FAX may be sent of the report. The customer is asked whether the report and/or samples should be mailed or held for pickup. Normally, the sample cassettes would be returned to the client/customer immediately, but, if desired, Fiberquant archives cassettes for at least 30 days following an analysis. The archive area is a box in the rear storage area of the lab. The disposition of samples is recorded on the last line of the sample tracking portion of the sample submittal form. The job is invoiced through the LIM program before being packaged up for dispersal.

8.5. SAMPLE PREPARATION

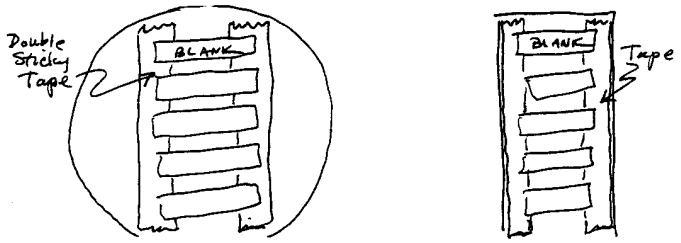
The preparation of TEM filter samples is complicated, but can be broken down into separate steps, each of which will be discussed separately. The sections on PC and MCE filters will concentrate on the differences between the preps of the two kinds of filters used, while the other sections will be specific for a prep step or instrument.

8.5.1. Mounting of Filter Samples for Plasma Ashing or Carbon Coating

The plastic bag containing the sample cassettes, our sample submittal form and any accompanying paperwork are received by the sample preparer from the lab coordinator. On the general TEM sample temp storage table, the bag is opened and the cassette exteriors are wiped down with a kimwipe wetted with amended water (water and a small amount of ivory soap). If the cassettes can be seen through the plastic bag to be dusty or visibly contaminated, the wet wiping should take place in a PLM fume hood. As each cassette is cleaned, it is placed in order inside of the clean bench.

If blanks are included along with the samples, and their identities are known, they are to be prepared along with the samples, since they may need to be counted if the samples are dirty. Outside samples are not prepared at this time; they are only prepped when needed. A disposable petri dish is marked with the job number, client/customer code and date of prep in anticipation of carrying the prep slide. A drawing is made on the cover of the petri dish illustrating the layout of samples on the slide, so that sample wedges can be identified later.

Figure 8.5.1a PC Filter Preparation Configurations

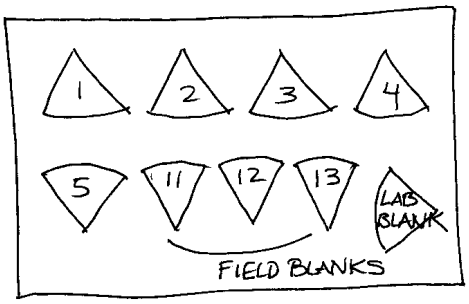


When all cassettes from a job are clean and in the clean bench, the cutting of samples can begin. The first sample cut and mounted is a prep blank, which is a check of contamination during the entire sample prep procedures. Use PC stock material for a prep series of PC

filters,; use MCE stock material for a prep series of MCE filters. Then each sample filter in order is cut and mounted, the mount marked with the identity of the sample. As an option, another piece of blank can be mounted as a check of contamination that might happen after mounting or during plasma etch or carbon coating.

The mounting and marking procedure is slightly different for PC material than for MCE. For PC filter material, a glass slide or small disposable petri dish is designated to receive the samples. Two lengths of double-sticky tape are attached parallel to each other and approximately 1/2" apart. A scalpel is used to cut a strip of sample (or blank) which is slightly longer than the gap between the pieces of tape (approximately 1/8" by 3/4"). The strip is placed between the pieces of tape where it is held by the sticky surface. The lab number or shortened version of the lab number is marked next to the strip. The typical setups are shown in Figures 8.5.1a and b.

Figure 8.5.1b MCE Filter Preparation Typical Configuration



For MCE filter samples, a quarter of filter is cut, placed on a 2"x3" slide and cleared using a "hot shot" hot acetone vaporizer. 2x3" slides are used to keep the wedges away from the edges of the slide, where our research has shown that etching is more intense. The positioning of the wedges on the slide must follow the drawing on the disposable petri dish; the slide cannot be marked, as the ashing would remove the ink. The typical setup is shown below. The typical setup is shown in Figure 8-5.

Regardless of the filter type or how they have been mounted, they must be protected from incidental contamination while being transported around the lab outside of the clean bench. For samples that have been mounted inside of a small disposable petri dish, the top is merely placed on to provide a tight seal for transport. Samples mounted on glass slides are placed in their disposable petri dish with cover for transport. The disposable petri dish, large or small, stays with the mounted samples throughout their residence in the lab. Even after grids have been prepared from them, the mounts in their petri dishes are archived for at least 30 days, to allow for more grids to be made in the event of questions or discrepancies in the analysis results. After thirty days, the disposable petri dishes and mounts are bagged and discarded as normal trash.

8.5.2. Collapsing of MCE Filters

Particles and fibers collected on MCE filters are enmeshed in a tortuous path through the filter material rather than sitting on the surface of the filter, such as on PC filters. For this reason, two extra steps are required for MCE filter preparation than are required for PC filter preparation. The first of the extra steps is to collapse the filter with solvent.

We have found that full collapse is necessary for dimensional stability of the resulting plastic film. Any instability of the film results in carbon film rupture at a later point in the prep. Therefore, the MCE sample wedges are fully collapsed onto the slide using a hot acetone vapor "hot shot" unit. Each sample in turn is cut, its wedge placed on the slide and collapsed. Multiple samples can be placed on one slide, but must be collapsed in turn, as the vapor will curl a wedge not directly under the vapor outlet. Only samples from the same containment of job should be placed on any one slide. Samples from different jobs, or samples known to contain different levels of loading cannot be placed on the same slide (or ashed) together. The collapsed filter sticks to the glass after collapsing, and so does not require addition materials for adherence. If the filter adheres to vigorously to the slide later, after carbon coating, the act of removing it and placing it on the TEM grid can break the carbon, producing parallel cracks. To minimize this problem, freshly mounted wedges may heated at 65ºC on a hot plate for up to 10 minutes before etching. Possibly the removal of the last bit of acetone from the filter causes them not to stick as strongly to the slide. A new razor blade can be used to slice under wedges to dislodge them from the slide, although this must be done carefully so as not to cause parallel cracks in the replica

Alternative Cold Acetone Vapor Method

A 4" diameter glass petri dish is used as a chamber to contain solvent vapors. Several sheets of 4" diameter filter paper are placed in the petri dish bottom. Placed on top of the filter papers is a stainless steel mesh, which has been bent so that its surface rests about 1/4" above the filter paper. Two to three ml of acetone are then placed on the filter papers.

The filter circles to be collapsed have already been mounted on a glass slide using reinforcement rings. The rings seal the edges of the filter circles so that solvent can only get to the top surface of the filters. If solvent reaches both sides, the filter will shrink so much it will pull away from the mounting ring, and be unusable. The glass slide with the mounted filters is placed in the petri dish and the petri lid is put on. After 30 seconds to several minutes, depending upon temperature and brand of filter material, the filter will become a translucent gray color instead of opaque white color, then later become completely transparent and stick to the slide. When all samples are transparent, the petri lid is lifted, which immediately dilutes the solvent vapors in the dish with fresh air, stopping the collapsing.

Alternative DMF Procedure

A third method of collapse used is called the Burdett method. A wedge is cut as in the hot block method. A drop of Burdett solution (50% distilled water, 35% dimethylformamide and 15% glacial acetic acid) is placed on a clean slide. The wedge is placed on the drop, wetting it thoroughly. Any excess solution is wicked off with a clean room wipe. The wedge is allowed to clear at room temperature (which gently collapses the structure), then warmed at <65 deg. C for 10 minutes to evaporate the remainder of the solvent. DMF is toxic so the collapsing is performed in the exhaust hood. The DMF procedure is used when the hot acetone/1m2p method has failed to produce a suitable replica. The Jaffe wick used for DMF-collapsed filters is filled with pure DMF.

Regardless of method of collapse, the collapsed slides are returned to their disposable petri dish for transport to the second extra step: plasma ashing.

8.5.3. Plasma Ashing of MCE Filters

The second step in MCE filter preparation (not required in PC filter preparation; also not used for NIOSH 7402 preparation) is to etch the collapsed filter material using an oxygen plasma. All the ashers are dedicated to filter ashing. Under no circumstances should it be used for ashing other types of samples, such as VAT floor tile, which would contaminate the interior. The venting of the ashers is controlled by valves added to the air inlet ports

After solvent collapse, the top surface of the filter has been melted to form a continuous mass instead of a porous mesh. The particles and fibers that had been enmeshed in the filter material are now embedded in the upper part of the continuous mass. The plasma ashing will vaporize the continuous mass, leaving the particles behind, sitting on top of a fairly smooth surface. The detailed procedures for plasma-ashing are as follows:

The mounted and collapsed filter wedges are stored inside of disposable petri dishes unless in process. The exact steps for etching are to be found in Work Practice #TEM-5.

8.5.4. Carbon Coating of TEM Filter Samples

PC filter samples are to be coated immediately after being mounted and marked on glass slides or disposable petri dishes. MCE filters must be mounted, then collapsed, then plasma ashed before they are coated. Mounted samples are to be transported in disposable petri dishes in order to prevent contamination during travel.

The evaporator in current use is the Denton 502A. This is an evaporator dedicated to TEM prep. The evaporator consists of a bell jar, a pumping system and a control system which features automatic pumping and venting once the pumps are warmed up.

Briefly, the operation of the coater is as follows: the evaporation takes place inside the bell jar, which has been evacuated to prevent oxidation of the carbon atoms before they can reach the sample. The level of vacuum is first monitored by the Pirani gauge, and later by the High Vac gauge. The bell jar, in addition to housing the samples, contains one set of electrodes which are loaded with carbon rods for carbon evaporation, and another set having a tungsten boat containing gold wire for gold evaporation. Evaporation is commenced when current is passed through one set of electrodes. The electrical resistance of the carbon rods or tungsten heats the carbon or gold to its vaporization temperature. The carbon or gold vapor then condenses on the contents of the chamber. Detailed operation instructions are given in Work Practice #TEM-29 (Turn-on and turn-off) and #TEM-6 (coating) in Chapter 11.

8.5.5. Dissolving of Filter from Carbon Coated Samples

To make the TEM grid assembly thin enough that electrons can make it through, it is necessary to remove the filter substrate from the carbon film. With normal time available, the filter dissolving is performed in a Jaffe washer. The Jaffe washer is made up as follows. A clean Stender dish is obtained. The rim has a ground glass seal when purchase, but the fit is not very tight, so it is customarily ground finer using 30 um diamond paste. A square of coarse (~20 mesh) stainless steel mesh is placed in the bottom of the dish. Solvent (acetone or 1M2P for MCE dissolving and chloroform for PC dissolving) is added until it just wets the mesh.

To use the Jaffe Washer, it is taken to the clean bench. New TEM grids are first laid out on small (~3/4"x1/2") pieces of fine (~60 mesh) stainless steel mesh, up to 18 grids on each piece. The grids are laid shiny side up to orient the registering mark correctly. Three grids are made for each sample to be mounted, two to be counted according to AHERA protocol, and one as a back-up, in case something should happen to one of the other grids. Two grids only are made for prep blanks. Approximately 3mm-sized pieces of prepared filter material are cut and then placed down on each grid. The placing can be done dry and the small screen placed in the washer at once, or the small screen can be placed in the washer before the cut filter pieces are applied. If the later is attempted, it must be done in one motion, to prevent wrinkling of the filter material as it hits the grid.

Once the grids and sample pieces are in the washer, the solvent level is topped up so that the small meshes are fairly awash. Too little solvent will increase the clearing time, whereas too much solvent may float the replicas off the grids. The top is then replaced and the filters allowed to dissolve for approximately 5 hours or overnight. The washer may need to be topped up again at closing time if acetone or chloroform are used.

After sufficient time has elapsed, the small meshes are removed from the washer and placed on the clean bench to dry. When the solvent has evaporated, a few grids are picked up and held up to a light, to make sure that enough of the grid is covered (>50%) and that the carbon film has held up during the dissolution. If many holes are seen at

this point, the prep may have to be re-done. If the replicas are intact, they are placed in a grid box and the grid storage record is marked with their locations.

An alternative to dissolving the filter material completely in the Jaffe washer is to start the dissolution in the Jaffe washer and finish it in the condensation washer. In fact, even samples left overnight in the Jaffe washer may have remnants of undissolved filter which will have to be removed in the condensation washer. For MCE filters, approximately 15 minutes in a 1M2P Jaffe washer produces the following changes: 1) samples look very convex, as the filter absorbs solvent, 2) samples look lumpy and less convex as the filter material is diffused away, 3) samples look flat when most filter material is gone. At stage 3, a given sample group is transferred on its small screen to the arm of the condensation washer. The condensation washer is charged with acetone for MCE material and with chloroform for PC material. The condensation washer is kept in the exhaust hood, and that hood is to be turned on whenever the condensation washer is in use. When the condensation washer is not in use, the top of the condenser is to be plugged to prevent the contamination of lab air by its solvent. The heater of the condensation washer is set at 55% 120V, and the water to the condenser turned on. 15-30 minutes of condensation washing is usually sufficient to completely clear MCE samples. PC samples may take longer, depending on the amount of polymerization that occurred during the carbon coating process.

8.6. TEM OPERATION AND MAINTENANCE

Since the TEM is a complex instrument, many complicated procedures incidental to the actual counting and identification of asbestos fibers must be detailed. The procedures discussed here include routine operations and maintenance procedures: 1) TEM turn-on, 2) TEM turn-off, 3) TEM system check and daily alignment, 4) EDS system check and calibration, 5) TEM condenser aperture alignment, 6) Changing TEM filaments, 7) Replacing Filament in spare Wehnelt Assembly, 7) Observing diffraction patterns on the TEM screen, 8) Observing images and diffraction patterns on the TEM screen, 9) TEM photography, 10) TEM Routine maintenance procedures, and 11) EDS system maintenance procedures. All of these operations are described in steps in the TEM Work Practices. The detailed descriptions are given below.

8.6.1. TEM Daily Turn-on/off

Both instruments meant to be on constantly. If they are off, each has a "start" button which pumps the system down in the proper sequence. The CM10 ultra vacuum light should be on, and the P4 pressure should be <~15. If not, the vacuum system may have to be cycled or initiated by going to stand-by and back to on, or even sometimes going to off and then to on. The JEOL ready light should be on, and its Penning gauge (left drawer) should be reading <0.5. EDS Analyzer boxes are usually left on.

At the end of the day, the CRT screen brightness is turned down – otherwise no action – the TEMs are left on.

8.6.2. TEM System Check and Daily Alignment

For every job, a system check and alignment is performed, Work Practice #TEM-1, in Chapter 11. The check is documented on the run sheet.

8.6.3. EDS System Check and Calibration

For every day that the EDS is used, a system & calibration check is performed to ensure that the system is functioning and that the energy shown for each peak position is correct. The detailed steps are given in Work Practice #TEM-2, in Chapter 11.

8.6.4. Changing TEM Filaments

The steps in changing the filament/Wehnelt cup assembly in the TEM are very specific and must be performed exactly and in the order given in the Work Practice TEM-15. No further description of steps is required here. However, some aspects of post-filament-changing alignment will be discussed.

As the Thomas Technical Services personnel have stated, ideally, the gun translation stick should not be required to be moved. If they are, they move relative to the column and the scope is not precisely in mechanical alignment anymore. This is true if and only if the filament in replaced in the exact center of the cup assembly each time. Any small error in filament centering may be able to be compensated for with the beam deflectors, but relatively large errors in filament centering may require the gun translators to be adjusted in order to allow the beam to be centered during use. Should use of the gun translation sticks be required, they should only be used to the extent of bringing the beam back to a point where the deflectors can center it, not all the way to center.

Another consequence of irregular filament centering is a weak or absent beam when the filament current is increased to its normal setting. In this case, the beam must first be found in this un-aligned condition, then slowly brought into alignment without losing the beam. To facilitate finding what may be a very dim beam, the room should be made as dark as possible, with all doors closed, panel lights down and EDS screen dimmed. Lower magnifications are helpful, so the scan mode, setting 11 is chosen. Both the diffraction and objective apertures are removed if they are not already out. Starting at filament current zero, the current is brought up very slowly, looking for any sign of illumination. At some current less than normal, a beam will be seen. With the current at that setting, the gun tilt sticks are adjusted to obtain maximum beam brightness. Then the current is nudged upwards until the beam intensity starts to drop off. The gun tilt is again adjusted for maximum brightness. The process is iterated until the

beam can be saturated normally without any drop-off in intensity. Finally, the remainder of the daily alignment is performed as usual.

8.6.5. Replacing Filament in Spare Wehnelt Assembly

Like the changing of Wehnelt cup assemblies, the replacement of a filament in the assembly must follow specific steps without exception. Those steps are adequately described in Work Practice TEM-16. The procedure is the same for either TEM.

8.6.6. Observing Images and Diffraction Patterns on the TEM Screen

JEOL 1200

Images: There are several mag modes: mag1, mag2, low mag. These all zoom, and allow one to set them for stock magnifications (e.g., 20,000 for mag1) for convenience. Diffraction: When a suspect chrysotile fiber is scanned, it is prudent to immediately de-focus the condenser in order to limit beam damage. Do the following in the reduced light: Remove objective lens and insert (usually the smallest) diffraction aperture and center on fiber. Press the <Diff> button to obtain the pattern. Camera length can be adjusted using the rocker lever.

8.6.7. TEM Photography

See Work Practice TEM-10.

8.6.8. TEM Routine Maintenance Procedures

The routine maintenance procedures are described or referenced adequately in Work Practice TEM-22.

8.6.9. EDS System Maintenance Procedures

Maintenance procedures and troubleshooting guides are adequately presented in the 4pi on line Detector Manual and will not be repeated here. The nitrogen Dewar requires topping up every Monday and Friday. The computers are left on.

8.7. ANALYSIS OF MOUNTED REPLICAS

8.7.1. Insertion of Grid

The grids used have an asymmetrical mark at their centers. A map replicating the mark is reproduced on the count sheet so that analyzed grid openings may be uniquely identified. For the JEOL 1200, if a grid is placed dull side up in the non-tilting holder (holder tip pointing right) so that the SPI logo (just visible to the naked eye around the edge of the grid) is at the 3 o'clock position, then the mark will be approximately in the same orientation in the scope as on the page when the grid is examined in scanning mode. For the CM10, the SPI logo should also be at 3:00 o'clock, but the grid should be placed shiny side (for us, carbon side) up.

The JEOL has a two-grid holder. To move from one grid to another, a knurled knob on the left side of the column is turned. Since this means there are two y-controls, an extra procedure is required for the JEOL to ensure that the center of the grid has been placed in the center of the column (were it not, shadowing of the EDS detector might result). The normal JEOL y-control encompasses 42 revolutions from one stop to the other. Assuming that the stops are symmetrical, the center of the y travel is 21 revolutions. To place a grid correctly: 1) insert, 2) go to the end of y travel in either direction, 3) go to center of y travel by turning the y-knob 21 full times, 4) bring the asymmetric mark in the center of the grid to the center of the fluorescent screen by turning the grid select knurled knob.

8.7.2. Evaluation of Sample Preparation

The first item to be determined after a specimen grid is placed in the TEM is whether the grid preparation has been successful. The scan mode at setting 11 (objective aperture out) is chosen to provide the widest view of the grid possible. The following are criteria required by the AHERA protocol and AHERA samples must pass all to be counted. Samples other than AHERA are not required to pass all, criteria, but the results may be suspect if they do not.

1. The fraction of grid openings covered by replica: >50% of the available grid openings on the grid.
2. The fraction of intact grid openings in the replica: >50%.
3. The fraction of replica made non-countable by undissolved filter: <10%.
4. The fraction of grid squares made uncountable by folded or overlapping replica: <50%.
5. The loading should be even.
6. An acceptable grid is one having approximately 20 or more countable grid openings. A countable grid opening is intact, has no folds or overlapping replica, has <5% holes, and <5% opaque area due to incomplete dissolution of filter.

One other characteristic which should be met by grids is that the particulate loading should be <10%. Otherwise, fibers may be hidden by the particles. Usually, by the time the loading is this high, the carbon film will not be intact, either, so the grids will be rejected by several criteria. AHERA samples must be rejected if their loading is >10%.

If an observed grid meets the above criteria, then its grid evaluation space on the count sheet (Figure 8-3) is checked. If two of the three prepared AHERA grids cannot pass the criteria, then more grids must be prepared. For non-AHERA samples, exceptions to the criteria may be made by the technical advisor, depending on the nature of the grid short-coming and the urgency of the analysis.

8.7.3. Counting Procedures

Five types of counting procedures are offered by Fiberquant, even though the majority of the work is AHERA protocol. The methods are AHERA, Yamate Level I, Yamate Level II, Yamate Level III, and NIOSH 7402. Normally, people relate better to fibers or structures per cc, rather than ng/m3, so we recommend an AHERA-type counting, which we refer to as "modified-AHERA" for all samples. The modification that we make is merely to record the length and width of all structures, so that weights could be calculated later, if necessary. Work Practices TEM-17-20 give itemized and specific steps that are to be followed when analyzing grids using each of the methods. Notes to the procedures and further descriptions of procedures are given below.

8.7.3.1. Choosing Grid Openings

A grid to be counted has to contain at least 20 suitable grid openings, any one of which could be counted. Since the deposition of the sample onto the filter may not have been homogeneous, it is desirable for the counted grid openings to be from as wide an area on the grid as possible. Therefore, grid opening should be chosen to form an arbitrary or semi-random pattern having widely spaced grid openings. Counting adjacent grid openings is to be avoided.

The grids used have an asymmetrical mark in the center, to be used for orientation. If a grid is placed shiny side up as described in 8.7.1, the mark and the grid will be oriented in scanning mode as illustrated on the count sheet grid map. The best way to prevent mix-ups in grid opening designation is to always return to the mark in between grid opening scans, and to choose the next grid opening to be a simply-reached one, *e.g.*, straight up from the mark four openings, or straight on a diagonal three openings. When an opening is chosen, it is marked off on the grid map, with an "x" for the first grid, an "o" for the second grid, and a "+" for the third grid, if used. This gives a graphical representation of the coverage of the grid.

8.7.3.2. Scanning Procedure

In order that the reported numbers be as meaningful as possible, 100% of each grid opening must be observed. Therefore, a systematic and foolproof scanning system must be adopted.

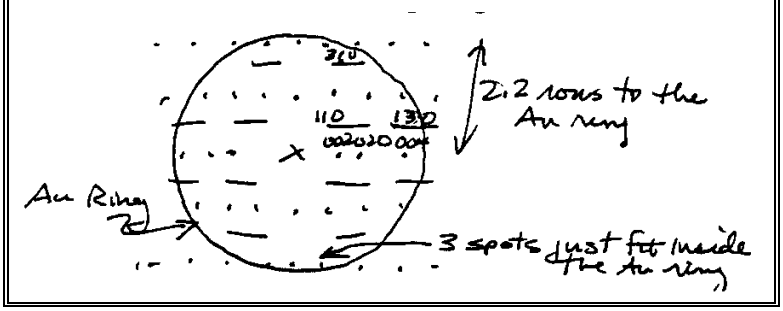
Scanning of each grid should be started in the same corner each time, say, the upper left hand corner, and scanning should proceed in the same direction for each grid opening, say to the right, until the other side of the grid is reached. A raster-like back and forth scanning is performed in such a way to observe all parts of the grid. Overlap of about 1/3 is recommended, so that the observed area for each field of view is within the outermost (5cm dia.) inscribed circle on the large screen. It is best to move the stage in increments along its track, rather than continuously, allowing the image intensity to build up at each stop for maximum fiber visibility. A minimum of 1-3 seconds observation of each field of view is required even on the cleanest of specimens, to avoid missing small fibers. For 80 fields of view on 7 grid openings, this means that a sample cannot be completely in less than about 10 minutes. Naturally some fields of view, because of sample load, will require more than 3 seconds of observation to make sure that no fibers are present, and the observation and actual analysis of fibers will cause a sample to take much longer than 10 minutes to complete. On the other hand, a clean filter requiring only 4 grid openings to be scanned may be able to be analyzed in ~5 minutes.

Since we are allowed by AHERA to scan at as little as 15,000 magnification, scanning can be performed at that magnification, giving some reduction in scan time. Any measurement must still be performed at the 16 setting, of course. Scanning at 15,000 results in a time saving of 50% over the values given above.

If, during a detailed analysis of a fiber, one forgets which way the scan was proceeded, one must go back and re-trace in both directions, to be sure of observing the entire grid opening. Notes may be helpful in preventing this occurrence.

An observed structure is classified and identified using morphology, electron diffraction and energy dispersive analysis.

Figure 8.7.3.4a Chrysotile Diffraction Pattern



8.7.3.3. Morphology

A chrysotile fibril has a peculiar "rolled tube" structure that can be observed at 20,000 magnification using the binoculars. Amphiboles are somewhat blocky in appearance. These typical morphologies are illustrated in Figure 8.7.3.3.

The observed morphology of a structure is marked on the count sheet in the "morphology column". Structures are further classified as Fiber, Bundle, Cluster or Matrix, as adequately described in the AHERA document (Figure 2, p 41866) kept in the EM room.

8.7.3.4. Identification of Electron Diffraction Patterns

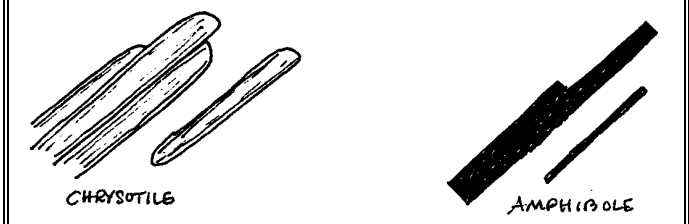
Most of the identification of fibers on the TEM will hinge upon correct recognizing of electron diffraction patterns, and the analyst being able to distinguish an asbestos diffraction pattern from those of asbestos look-alikes. In the case of asbestos minerals, diffraction spots are much closer together in one direction than the other, so the patterns can be thought of as rows of spots. Since silicate minerals share a 5.3A Si-Si atomic separation, all silicates may show in certain directions a 5.3A spacing in their diffraction patterns.

CHRYSOTILE

The diffraction spacings for chrysotile can be found in JCPDS file 22-1162. A schematic diffraction pattern of chrysotile is shown in Figure 8.7.3.4a. It can be thought of as consisting of rows of spots. The rows are perpendicular to the long direction of the fibril. The row containing the central spot is termed row 0. The spacing between the rows is the 5.3A addressed above. The spacing along the rows is 7.3A, most easily seen in even numbered rows. Spacings may be measured on the screen by putting in the 1st objective aperture (50um), which approximates the gold ring size.

The structure of a chrysotile fibril is that of a rolled tube, similar to a rolled up piece of paper. This structure leads to the most obvious characteristic of the chrysotile diffraction pattern - streaks along odd numbered rows, as shown in the figure. The scrolled structure of chrysotile results in its diffraction pattern being the same no matter what the orientation of a fiber. Other silicates have a rolled structure, such as vermiculite, talc and sepiolite, can take a scroll form, and therefore have streaked ED patterns. Some of these would also have the 5.3A row spacing and so would have diffraction patterns very similar to chrysotile. However, they would not share the 7.3A spot spacing with chrysotile.

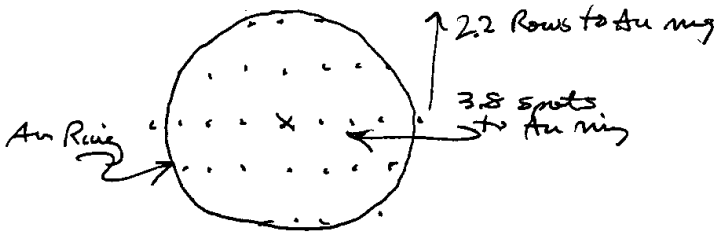
Figure 8.7.3.3 Typical Asbestos Fiber Morphologies



To identify a chrysotile electron diffraction pattern on the screen, it is necessary to observe the 5.3A spacing of the rows (2.2 rows within the first Au ring), the streaking along the odd rows, and the 7.3 spacing along the rows (spots in even rows have a spacing which is about 3/4 of the spacing between rows or 3 spots to the Au ring). A fibril which is tilted relative to the beam, as can happen for matrix fibers, will show slightly different spacings and a streak instead of spots on the 2nd layer line (see R.J. Lee articles).

AMPHIBOLES

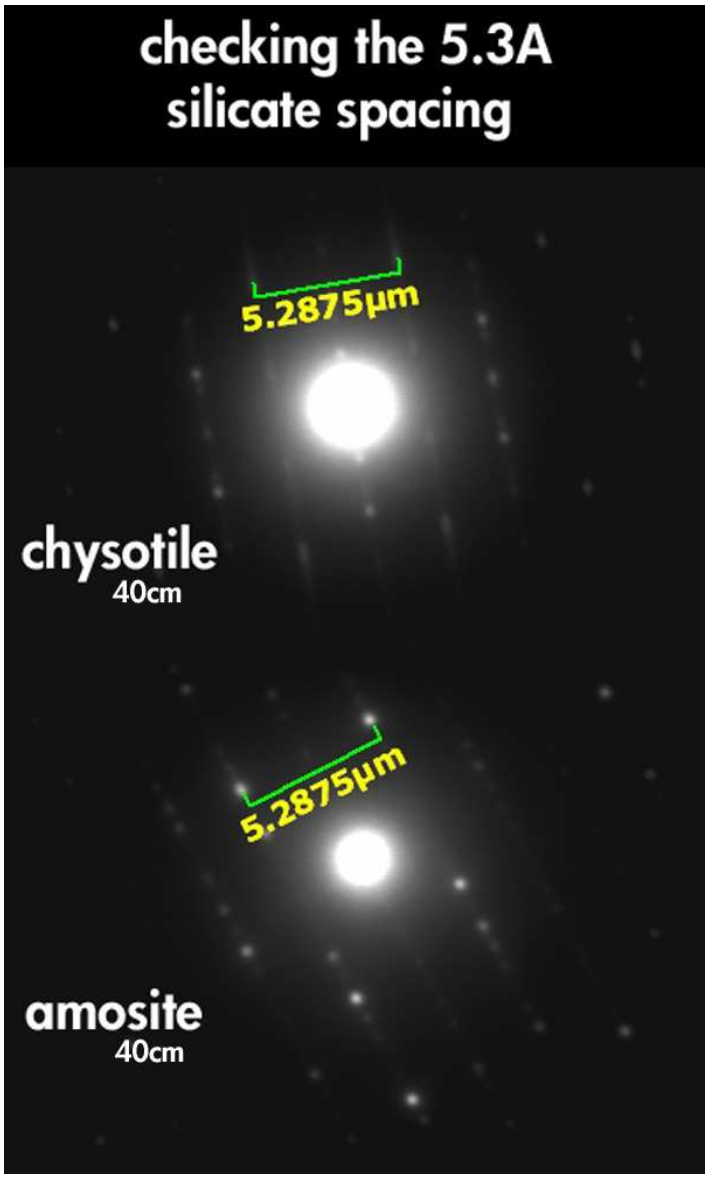
Figure 8.7.3.4.b A Common Grunerite Diffraction Pattern



Unlike chrysotile, which presents almost the same diffraction pattern regardless of orientation, amphiboles may present many different patterns depending upon crystal orientation. The most easily recognizable patterns occur when the electron beam is perpendicular to a plane of the reciprocal lattice of the crystal, resulting in a symmetrical pattern of spots about the central spot. Such a pattern is called a zone-axis pattern. An example of a common zone-axis pattern of grunerite is shown in Figure 8.7.3.4b.

Again, the pattern can be understood as a number of rows of spots, with row 0 containing the central spot. In this zone axis pattern, the rows have a 5.3A spacing, but other zone axis patterns can have larger (in reciprocal space, smaller in A) spacing between rows. The spots in the rows of this zone have a 18A or 9A spacing (3.8 to the Au ring) depending on whether the fiber is twinned or not. Grunerite (amosite) and crocidolite are almost always twinned, while tremolite, actinolite and anthophyllite are usually not twinned. Anthophyllite sometimes can have streaks in the pattern, but overall, amphibole patterns are composed of discrete spots. The example in the figure is not twinned, a twinned example of the same zone would have more closely spaced spots on the rows. Pyroxenes, though possessing the 5.3A row spacing, would not have spots on the rows as closely spaced as even untwinned amphiboles, but may be close enough to require indexing of a photo for positive id. Bipyriboles (mixed double and/or triple chain silicates) would give spots with closer spacings than amphiboles, but are exceedingly rare and would occur in the presence of amphibole.

Figure 8.7.3.4.c Checks of 5.3A basic silicate spacings in chrysotile and amosite at 40cm camera length.



Identification of an amphibole electron diffraction pattern on the screen requires the observation of the 5.3A spacing of the rows (2.2 to the Au ring), and the observation of the 8.3 or 9A spacing in the rows (3.8 to the Au ring when untwinned, very closely spaced spots if twinned). Any fiber which does not show the above amphibole spacings should be tilted through the entire range of tilt before categorizing its pattern as non-asbestos. This is especially important on MCE filter samples, in which the fiber may not be lying perpendicular to the beam at 0º tilt. If there is reasonable doubt about the identification of a fiber as amphibole exists, a zone axis pattern should be photographed and the spacings measured and indexed.

MEASURING DIFFRACTION SPACINGS USING THE 4Pi IMAGE CAPTURING PROGRAM

Diffraction checks may be made at any

camera length, as in Figures 8.7.3.4.c & d.

The camera constants recorded in the LIMS are cc_{radius}, that is: even though we measure the diameter, we calculate the cc as if we had measured the radius, so it is to be used with single spacings.

The basic formula is cc = d-spacing * measurement. The 4pi thinks the measurement is µm, so the units of our cc is Å-µm. The reverse is d-spacing = cc/measurement.

To obtain a measurement on a diffraction pattern

1. display the pattern
2. click the <M> button at the top of the 4pi control banner to put it into measurement mode.
3. move the cursor to a point within one layer line that it is desired to measure and click, keeping your finger down.
4. With finger down, move several (eg. 4) spacings over to another convenient layer line and lift the finger. (Measuring multiple spacings will be more accurate than trying to measure just one)
5. the line between the two points will be displayed and a measurement also displayed.
6. Divide said measurement by the number of spacings it was to obtain what a single spacing would have been had you measured it that way.
7. camera length correction: multiply the measurement in step 6 by 80cm/camera length used.
8. Now divide the current cc by that single spacing measurement in 7 to obtain the d-spacing in Å
9.

To index the diffraction pattern using the above measured d-spacings, open and follow the instructions on the self-explanatory .xls worksheet: Larry//c:\Msoffice\Excel\ElectronDiffractionWorksheet. A filled out example is in the TEM forms paper file.

INTERFERENCES

Many minerals give electron diffraction patterns that are similar to those obtained from asbestos minerals. Differentiating characteristics are listed if available, but many of these would have to be differentiated using zone axis pattern photographs.

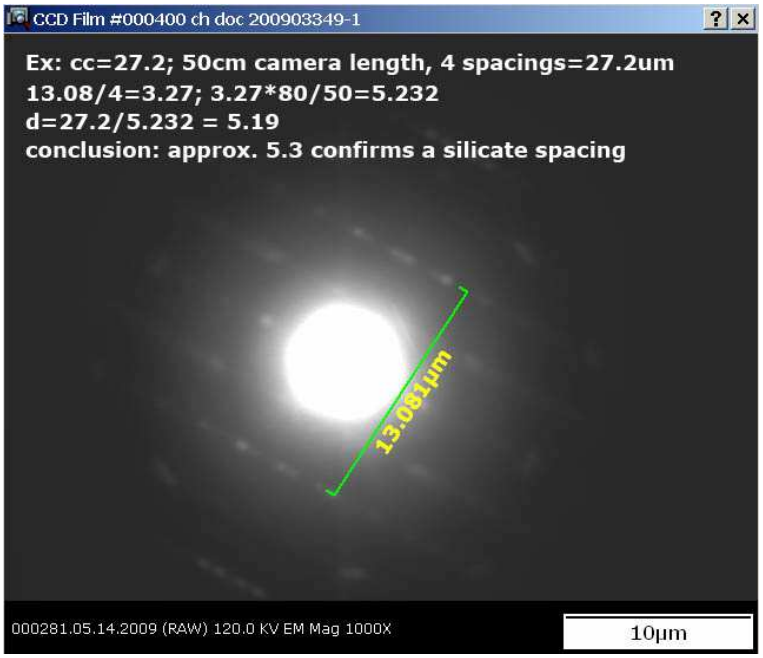


Figure 8.7.3.4.d. Example measurement of a d-spacing.

1. Pyroxenes

Structurally related to amphiboles, and so gives the 5.3A spacing between rows. Spacings along rows will be wider than amphiboles. Crystals are usually not fibrous.

2. Talc

Talc is a sheet silicate containing Mg and Si. It sometimes rolls up, similar to chrysotile in morphology. Its diffraction pattern is hexagonal appearing (three approximately equal axes).

3. Sepiolite

This is a Mg-silicate sheet silicate which is used in commercial products such as pipes (meerschaum). Its diffraction pattern resembles amphiboles in that it has rows of closely spaced spots. However, its 0-row contains spots which are 1.9 to the Au ring due to the 010 and 030-type spots being forbidden. It usually occurs in short, thin, ribbon-like fibers.

4. Laumontite

A Ca,Al-silicate zeolite with closely spaced spots that could be mistaken for amphibole, but the spacing of the spots in its rows is 4.0 to the Au ring. The chemistry is really sufficient to eliminate it from contention.

5. Minnesotaite

This Fe,Mg-silicate sheet silicate gives patterns similar to amphibole, and has a composition near grunerite. It does give a three-fold twin, like amosite, however.

6. Palygorskite (attapulgite)

This Mg,Al-silicate sheet silicate is used in commercial products such as kitty litter and dry-cleaning supplies. It has spot spacings in its rows that are 4.2 to the Au ring, but the Al in the EDS spectrum eliminates it.

7. Vermiculite

This is a K,Mg,Al-silicate sheet silicate which can scroll to a similar morphology as chrysotile. The presence of K and Al distinguishes it from chrysotile and the morphology distinguishes it from amphibole.

8. Unidentified Scrolled Fiber

This is a fiber which looks very much like chrysotile, in that it occurs in tubes. Because of the tubes, it has a streaked ED pattern very similar to chrysotile. It is distinguished by 1) the tubes are slightly smaller diameter than chrysotile, often bend at their ends unlike chrysotile, and occur in matted clumps which are more dense than chrysotile clusters, 2) its diffraction pattern is less distinct that chrysotile, and it never shows distinct spots in the 2nd layer line, and 3) the EDS spectrum, even for large bundles, indicates very little Si and no Mg, as if the material were composed of carbon. It is possible that this fiber is some kind of ash from wood or paper.

8.7.3.5. Energy Dispersive Analysis

Obtaining an EDS analysis for a fiber is relatively straightforward given the equipment. Complications such as escape peaks and addition peaks are not a problem with asbestos analysis because of the low signal to noise ratios of the peaks of interest.

Owing to the design of the specimen holders, the grid must be tilted by releasing the clutch and rotating the stage clockwise to at least 30º in order to receive x-rays from the sample. If the stage has not been tilted, a spectrum with a very high Cr peak will result. The inside of the TEM is composed of Cr, Ni, Cu and Zn and the grids are Cu, so these peaks may appear as artifacts. None of these elements interfere with Mg,Al,Si,Ca, or Fe. The Cu-Lα peak interferes with Na, however. It is relatively easy to forget to tilt the specimen before starting the analysis; in this case, the count rate will be much lower than usual, and even the Cu peak, normally quite large, will be weak.

If no spectrum of a fiber is obtained, even though the Cu and other holder peaks are their normal large size, then it is the specimen causing the lack of spectrum, that is, either 1) the specimen contains no elements above 8 in atomic number (those detectable to the thick window EDS), or 2) the fiber is so small or thin that the signal to noise ratios of the elements present are low, or 3) the beam has moved off the fiber during analysis. In this case, the analysis should be repeated after re-centering the beam on the fiber. The counting time can be increased in an attempt to pick up peaks with poor signal to noise ratios. Since we prove regularly that the EDS is capable of detecting Mg and Si in even single fibrils of chrysotile, then if no recognizable spectrum is obtained under those conditions, then the fiber may be assumed to contain no detectable elements (probably organic). More organic fibers can be expected to be encountered on a PC filter sample than an MCE filter sample, which has been ashed, although MCE filter replicas sometimes show shadows of organic fibers.

The use of the EDS to determine interferences was given in Section 8.7.3.4 along with diffraction characteristics.

8.7.3.6. Asbestos or not?

Ideally, every structure seen would have all of its data (morphology, electron diffraction pattern and EDS spectrum) consistent with one species. In the case of large fiber bundles and many amphibole fibers, this is indeed the case, and so identification is definitive and easy. For some fibers, however, some data is incomplete, ambiguous or missing. A common example is a small fiber having tubular morphology, an EDS spectrum showing Mg and Si only and a diffraction pattern which is absent. In this example, if we knew that chrysotile was the only Mg-silicate in the sample, then we could assume that the small fiber is chrysotile. Small fibers of chrysotile are sometimes too thin to produce a recognizable diffraction pattern. However, if we do not know whether chrysotile is present in a sample, or if the sample contains several Mg-silicates which could scroll into a tube, then our assumption that the small fiber is chrysotile would not be valid. For this reason, such ambiguous fibers are placed into their own category during counting. For an AHERA job, after the count is completed, the ambiguous counts are either included in the asbestos count if the confirmed asbestos count is greater than 70 str/mm^2, or they are not included in the asbestos count if the confirmed asbestos count is less than 70 str./mm^2. For a Yamate count, the ambiguous structures are reported separately from confirmed structures.

If a fiber has a recognizable chrysotile diffraction pattern, it need not be confirmed by EDS, since no other mineral can give the exact chrysotile pattern. If a fiber has a recognizable amphibole pattern, EDS is always required to determine which amphibole. If an amphibole-like fiber has an ambiguous ED pattern then a photo of it is taken for later indexing and a confirming EDS spectrum is obtained. In this case, the fiber is classes as ambiguous for now and only counted if the filter has >70 structures/mm2 or if the indexing proves that it is amphibole.

8.7.3.7. Pass/Fail Criteria

For non-AHERA samples, the pass/fail criteria are determined by contract or individual judgment, so for these cases, the lab merely reports the observed fiber loadings in structures/mm^2 and structures/cc.

For AHERA clearance, there are two ways to pass: initial screening, and comparison to outside levels. A group of five interior AHERA samples pass clearance if the average of the five filter results is less than 70 structures/mm^2, and if each volume is 1200L or greater. In this case, the other 8 cassettes including the exterior samples and blanks (which may or may not have been submitted) do not have to be mounted or analyzed. However, if the five inside do not pass the 70 structures/mm^2 screening criteria, then more work must be done. First, a blank must be checked, a mounted field blank, if available, otherwise, our prep blank. If the blank contains >53 structures/mm^2, then the samples must be re-mounted under more clean conditions, or may have to be retaken. If the prep blank reads >18 structures/mm^2, then we may or may not want to re-test the samples. That decision is to be made by the Lab Director, or deputy, in consultation with the client/customer. If the lab prep blank is 18 structures/mm^2 or less, then the prep was obviously not responsible for the samples failing the screening criteria. In this case, two possibilities exist: 1) if the exterior and blank samples had been collected, then we can, with the client/customer's agreement after being apprised of the interior results, the other 8 cassettes are prepared and analyzed. In this case, the z-test, as listed in the AHERA final rules and notice, will be used to determine pass-fail, if the client/customer desires us to make that determination, 2) the client/customer may not have collected the other 8 samples, or may desire a re-clean, anyway, in which case the site is re-cleaned and at least another 5 interior samples are collected. In Arizona, where background asbestos counts are likely to be relatively low, most consultants choose option 2, collecting only 5 interior samples. Regardless of whether a set of samples will pass or fail, we are not privy to information at the site that would affect that judgment. Therefore, our reports only show the average str/mm^2 and the client/customer must make the final pass/fail determination. Analysts should refrain from reporting verbal results as pass or fail, but merely give the data.

8.7.3.8. Other Methods and Deviations from Standard Procedures

The preparation and QC procedures described in above and below are tailored to AHERA protocol, because AHERA and NVLAP accreditation for AHERA samples together describe a fairly intensive QC program. Fiberquant offers other methods of analysis, however. These methods are described in this chapter. Since all TEM methods utilize the same data to identify fibers, only differences or preparation procedures are described here. We have found that it is simpler to use AHERA QA procedures for all samples, rather than keep track of separate QA programs for each method. Therefore, QA procedures, documentation and records are merged and virtually identical for all methods. Fiberquant offers the methods 1) modified AHERA, 2) NIOSH 7402, 3) Yamate, and 4) EPA 100.1 (asbestos in Water).

Any other deviations or variations on procedure must be first OK'd by the lab director, and are also to be mentioned in the notes of the report, or written up in letter form.

8.7.3.8.1. Modified AHERA

Often, a client/customer with a sample taken from an abatement may want a TEM determination. NIOSH 7402 could be used. But since AHERA is the accepted state-of-the-art, we consider that the client/customer's needs are met better by the AHERA protocol, since thin or short fibers are counted by AHERA. Such a single sample (or anything that is not 5 interior samples from the same clearance area) is not strictly an AHERA sample, and therefore cannot be analyzed by strictly AHERA protocol. In these types of cases, we can use the sample preparation part of AHERA protocol, and can also use the counting rules of AHERA, but we cannot say that it is AHERA without some modifying statements. Such statements are placed in the report automatically if the "modified AHERA" method is chosen rather than "AHERA".

If the volume of the sample is >1200L, then the usual number of grid openings are counted. If the volume is <1200, we count the normal number of grid openings when a sensitivity of 0.005 f/cc is obtainable, but a maximum of 10 grid openings, accepting the corresponding rise in analytical sensitivity. In such samples, usually sensitivity is not an issue, but rather, the only issue is whether there is any asbestos or not.

8.7.3.8.2. NIOSH 7402 Issue 2: 15 August 1994

*****Note:** Preparation of samples for 7402 is identical to AHERA with the exception that plasma ashing is <u>not</u> performed. It is not needed to free the large bundles counted here, and also, cellulose fibers are counted, which might be destroyed by plasma ashing.

1. There are three grids in storage for each lab number. Counts should be divided equally among all grids.

2. Load one of the grids into the tilting or rotating holder. Put the holder in the TEM.

3. Turn on 100kV and saturate filament. Check alignment. Be sure that the specimen is in the eucentric position.

4. Turn on EDS and calibrate if necessary.

5. At low magnification (scan mode), orient and evaluate grid openings. Grid is countable only if <u>≥</u>75% of grid openings (GO's) have carbon film intact.

6. Find center μ marker and orient grid for easy scanning. Mark prominent features on grid map if desired.

7. To determine number of GO's to be counted, evaluate grid loading at 1000x magnification. Classify loading as follows:

a) Light loading: <5 fibers/GO. Count 40 GO's.

b) Moderate loading: 5-25 fibers/GO. Count a minimum of 40 GO's or 100 fibers.

c) Heavy loading: >25 fibers/GO. Count a minimum of 100 fibers and at least 6 GO's.

8. The GO's should be selected equally from each of the three grid preparations, and as randomly as possible. Mark the designation of each counted GO (e.g., F3) on the count sheet. Do not count any of the small GO's adjoining the μ marker or any without intact carbon film.

9. Systematically traverse each GO at 10000x magnification, if the sample is dirty. If the sample is clean, GO's may be read at 1000x until a fiber is observed; then increase magnification to 10000x to measure and analyze. Countable fibers are defined as follows:

a) length >5 μm, diameter >0.25 μm

b) aspect ratio ≥3:1.

Note that substantially parallel sides is not a requirement. The goal is to count any fibers that would be counted in the 7400 PCM method, asbestos or not.

Fibers which are partially obscured by the grid bar or edge should be counted as half-fibers if >2.5 μm of fiber length is visible.

10. Measure the length and diameter of each fiber at 20,000x in the usual way, using the inscribed circles and/or the hash marks on the large screen.

11. Classify all fibers by morphology. Analyze to confirm the ID at least 10% of the fibers and at least 3 asbestos fibers (if present), using morphology, SAED and EDXA (see below). Particles having similar morphology at 20,000x may be counted without SAED or EDXA. Photos are not required by the method but may occasionally be useful.

12. Selected area electron diffraction (SAED): For all analyzed fibers, observe the SAED pattern on small screen and identify as chrysotile, amphibole, ambiguous or none, using the following guidelines:

a) SAED pattern is chrysotile if 1) 2.2 rows fit into the Au ring, i.e., three spots in the #2 row just fit into the Au ring; and 2) odd rows are streaked.

b) SAED pattern is the most common zone of amphibole if 1) all spots are sharp (unless there are multiple fibers); 2) there are 2.2 rows to the Au ring; and 3) four spots in the #2 row (7 if twinned) just fit into the Au ring. Match other observed patterns using the in-house fiber atlas.

c) SAED pattern is classified as ambiguous if neither of the above.

d) Record SAED pattern as "none" if no diffraction spots are observed, or too few to apply the above criteria.

13. Energy-dispersive X-ray analysis (EDXA): for analyzed chrysotile fibers, for the first 5 fibers and 10% thereafter; for analyzed amphibole fibers, for the first 10 fibers and 10% thereafter.

a) Use acquisition times sufficient to show a Si peak of at least 375 counts. Minimum acquisition time = 100 seconds.

b) Assign an arbitrary height of 10 to the Si peak, and ratio all peaks to Si.

c) Determine an elemental ratio profile using the elements Na, Mg, Si, Ca, and Fe. For example, 0-4-10-3-<1.

d) Classify the EDS spectrum as chrysotile, possible amosite, possible crocidolite, possible tremolite, or possible anthophyllite, using the following ratio profile guidelines:

Chrysotile:	0-5-10-0-0 through 0-10-10-0-0
Amosite:	0-2-10-0-7 ± 1
Crocidolite:	1-1-10-0-6 ± 1
Tremolite:	0-4-10-3-<1 ± 1
Anthophyllite:	0-3-10-0-1 ± 1

14. Continue the analysis on two other grids.

15. Report the types of asbestos present. Also report the following fiber counts:

f_S = number of asbestos fibers in all of the GO's analyzed for the sample filter

F_S = total number of fibers, regardless of identification, in all of the GO's analyzed for the sample filter

16. Field blanks must be prepared and analyzed in an identical manner. For each field blank, analyze the same total number of GO's as analyzed for the sample filter. Count at least two field blanks per sample set, or 10% of the total number of samples, whichever is greater. Record the following fiber counts:

f_b = number of asbestos fibers in all of the GO's analyzed for the field blank

F_b = total number of fibers, regardless of identification, in all the GO's analyzed for the field blank

17. Calculate the fraction of optically visible asbestos fibers on the filter:

$$(f_s - f_b) / (F_s - F_b)$$

Multiply this fraction by the PCM fiber concentration obtained for the same or related sample(s). The final result is an asbestos concentration in fibers/cc.

8.7.3.8.3. Yamate (not accredited; use modified AHERA)

8.7.3.8.4. Asbestos in Water

As with the other procedures mentioned above, the identification of asbestos fibers, once they are on a filter, is pretty much the same whether the original medium was air or water. However, the water method, EPA 100.1, from which these SOPs was adapted, has significant differences from air methods in fiber identification and reporting as well as the obvious differences in specimen preparation.

8.7.3.8.4.1. Additional Equipment and Supplies for Water Samples

In addition to the equipment (including TEM, carbon coater, *etc*.) and supplies listed in Section 8 for TEM analysis of air samples, the following are required for water analysis.

Description (Supplier)	Target Inventory
Filters: 47&25mm dia. 0.1 PC (Poretics)	100
47&25mm dia. 0.22 MCE (Poretics)	100
47&25mm dia. 5 um MCE (Poretics)	100
47mm dia. 0.1 Teflon (Millipore)	100
Filter Apparatus: 47mm dia. glass (Millipore)	2
25mm dia. glass (Millipore)	5
or disposable, as required	
Vacuum pump, hand (Millipore)	1
deionized water on tap	
particle free water made by filtering deionized water through 0.1 PC, as required	
refrigerator for storing samples	
bleach, 5% hypochlorite, filtered through 0.1 Teflon, as required	

8.7.3.8.4.2. Water Sample Preparation

Pre-treatment of Water

Water samples are time sensitive, as microscopic flora may multiply to the point that asbestos fibers are obscured. Additionally, the organic material makes fibers more likely to adhere to glass containers. Incoming samples are refrigerated immediately to stop growth. Many water samples, such as drinking water samples, have little enough organic material that they may be analyzed directly without further treatment, provided that they are filtered soon enough after being gathered. The EPA guidance for drinking water testing mandates that those samples be filtered within 48 hours of being taken. Grids prepared from such clean samples will show a preponderance of inorganic particulate. If grids are found to be overloaded with organic particulate, then pretreatment is necessary. Failure to pretreat samples having significant organic load will cause the fiber count to be low.

Pretreatment to decrease organics in the water consists of adding enough particle-free 5% hypochlorite solution to make the sample 0.5% in hypochlorite. 24-48 hours are required for the bleach to dissolve the organic material, after which the samples can be filtered and new grids prepared. This procedure is an improvement over the ozone and ultraviolet light procedure mentioned in the EPA method, and is described in "An Alternative Method of Water Sample Preparation for TEM Analysis", by S.Y. Chun, H.P. Spielman and W. Shehan, RJ Lee Group, Berkeley, CA, presented at an NAC Professional Development Seminar 18 Feb, 1990.

For samples required by the drinking water standard, guidelines issued in January, 1992 state that if samples are filtered within 48 hours, the method ozone/ultraviolet treatment is not required.

Filtration

Filtration is accomplished using either glass or disposable plastic filter equipment. If glass is to be used, cleanliness is paramount: glass should never be allowed to dry with sample, glass is to be washed and wiped immediately. One of three glass setups are to be used, depending on anticipated cleanliness of the samples, one for making particle-free water (low level of asbestos, and the receptacle is kept clean), one for filtering tap water (medium level of asbestos), and one for filtering reservoir or waste samples (high level of asbestos). Normally, glass equipment of 47mm dia. is used, but 25mm dia. equipment is available. The 25mm dia. glass equipment has an effective area of 195 mm^2, into which no less than 10ml should be filtered. The 47mm dia. glass equipment has an effective area of 960 mm^2, into which no less than 50ml should be filtered. To reach an analytical sensitivity of 0.2 MFL (million fibers per Liter), the sensitivity mandated by the EPA guidance, approximately 80-90 ml must be filtered into a 47mm filter and 5-7 grid openings must be counted. Smaller filtered volumes merely require more grid openings to be counted to achieve the required analytical sensitivity.

The first sample to be filtered is a blank of 250ml of particle-free water as is anticipated to be filtered for samples. The water is filtered through either a 0.1 um pore size polycarbonate (PC) filter or a 0.22 um pore size mixed cellulose ester (MCE) filter. A 5 um pore size MCE filter is used as a diffuser for either type of main filter. A choice of filter type is allowed: EPA Method 100.1 uses 0.1um PC, while 100.2 uses 0.2um MCE. Since we are only counting fibers > 10 um long, any contamination on the PC filters is not of concern.

After placing the two filter sandwich on top of the glass frit, the top part of the apparatus is placed and locked with the supplied clamp. The water to be filtered is poured in, then the vacuum tube attached and a slight vacuum created with the hand pump. No rinsing is required, and might result in an uneven distribution on the filter. After the water has gone through, the clamp and top portion are removed, the top filter is placed in a disposable petri dish to dry, and the bottom filter is discarded. The glassware is immediately rinsed and wiped where possible using particle-free water and clean room wipes. The frit is dried with a clean room wipe.

If the filter shows a deposit which significantly affects the luster of the filter, then it is probably too highly loaded to count, and another filter should be prepared from the same sample, except with less volume filtered. The volume on this second filter should be about 1/3 that of the original, measured with graduated cylinders and using particle-free water to make up the minimum 50 ml volume to filter. If, in turn, this filter is still highly loaded, yet another with an even smaller volume should be prepared, *etc*., until a suitable filter is obtained. All the filters should be prepared to TEM grids, in case one of the higher volumes is suitable despite its appearance.

The samples are filtered as above, one at a time. After the samples, a second blank may be run but is not required, to produce a track record of glassware cleanliness. If more than 10 samples are run, a blank will be added after every tenth sample.

MCE filters are dried overnight in a dessicator or drying oven (<90^{o}C). PC filters do not need drying.

Preparation of Filters

The physical acts of making TEM grids from dry MCE and PC filters have been described in Section 8 under air analysis, and will not be repeated here. The only differences from air analysis are: 1) the active area of filtration for water samples is considerably smaller than for air samples, so only the very middle of the filter can be used; and 2) since grids are to be chosen from 3 grids for water analysis, 4 grids should be made, to allow the best three to be chosen.

Evaluation of Grids

Grids suitable for analysis are the same as for AHERA grids, i.e., >50% coverage, <5% holes, >50% intact, <10% particulate load, <5% opaque due to undissolved filter, etc. If the grids are overloaded, then new preps are to be made, using a smaller volume of water. If the minimum volume has already been used, the sample can be diluted with particle-free water, although the analytical sensitivity will be correspondingly reduced. If the grids contain significant organic material, as evidenced by clumps and ratio of organic to inorganic load, then new filters of the samples should be prepared <u>after</u> treatment with bleach to remove the organics.

8.7.3.8.4.3. Water Analysis

Counting Protocol

The grid opening choice and documentation, scanning and identification of fibers in water samples is identical to procedures already described for air samples, and will not be repeated here. However, the counting and documentation of fibers in water samples is significantly different than fibers in air samples. The analyst should review the following before counting a water sample.

Counting rules appear starting on page 35 of the method, and are summarized as follows:

1) Count fibers wholly inside the grid opening or intersecting the top or left side of the grid opening.

2) Measure the length and width of each fiber. For inconsistent length of width, average so as to estimate as closely as possible the area of the aggregate.

3) For matrix fibers with hidden ends, assume twice the observed length.

4) Classify fiber identification by type of data:

CD = chrysotile confirmed by electron diffraction

CM = chrysotile morphology

CX = chrysotile chemistry, qualitative

CQ = chrysotile chemistry, quantitative

and combinations thereof, e.g., CMQ, CMX

AD = amphibole with random SAED

AX = amphibole with qualitative EDXA

AZ = amphibole with zone axis SAED

AZQ = amphibole with zone axis and quantitative EDXA

and combinations

NAM = non-asbestos mineral

Normally, we would be making CD and AZQ identifications, and these are assumed unless extra information on the count sheet indicates otherwise.

The method was written before the drinking water standard was enacted, so makes no distinction of fibers >10 um long. We can perform two types of drinking water standard analysis: an inexpensive one in which only fibers > 10 um are counting, and an expensive one, in which all fibers are counted and the background subtracted from the smaller sizes.

The stopping rules are 20 grid openings or 100 fibers, whichever comes first, but no fewer than 4 grid openings can be counted. However, the guidelines of Jan 1992 state an analytical sensitivity of 0.2 mfl is sufficient, which would be 10 grid openings of our current size.

Figure 8.7.3.8.4.3 Asbestos in Water Report

Fiberquant Analytical Services
Fiberquant, Inc. 4824 S. 35th St., Phoenix, Arizon 85040; (602)276-6139; FAX (602)276-4558

Analysis of Drinking Water for Asbestos Fibers by Transmission Electron Microscopy

Job No. 95-0793

Client:
Address: PO BOX 395

AZ 85923-

Client Job: Well #1 & Well #2 **Client P.O.:** Prepaid **Method:** TEM Water **Received:** 02/22/95
Contact: **Phones:** (602)739-4464 ( ) -

1 sample was received for TEM analysis as per EPA Method 600/4-84-043 (1984) and guidence (1993) The samples were first ultrasonicated, then agitated, then ultrasonicated again. An aliquot to be filtered was withdrawn immediately after sonication. The subsample was then filtered through a 0.1 pore size polycarbonate filter backed by a 5.0 um pore size mixed cellulose ester filter. The polycarbonate filter containing the sample particulate was then carbon coated using a Denton 502A carbon evaporator. Pieces of the coated filter were placed on TEM grids and the filter material dissolved in chloroform. Portions of the TEM grids were examined at a magnification of 10,000 to 20,000 on a Phillips 300 transmission electron microscope to which is attached with a Tracor energy dispersive X-ray spectrometer "Asbestos Buster". Enough of each sample was scanned to produce an analytical sensitivity (the hypothetical observation of 1 asbestos structure) of 0.2 million fibers per liter (MFL).

The data are presented in terms of "fibers", each of which may represent an individual fiber, a bundle of several fibers, a fiber or fibers extruding from a matrix particle, or a cluster of many matted fibers. The estimated coefficient of variation for this method is ~0.5. Accordingly, our results are rounded to one significant figure. For example, a MFL value that calculates to 7.4 will be reported as 7 MFL. Please consider these factors of structure definition, method precision and reporting when determining pass/fail compliance.

Analytical Notes:
Sample received: 02-22-95 Time: 10:20 AM
Sample filtered: 02-22-95 Time: 14:00 PM
Sample analyzed: 03-21-95 Time: 08:45 AM

Sample Number	Lab Number	Vol. Filtered	F/mm2	MFL	Analytical Sensitivity, MFL
09-009	95-02-1484	20.0 ml	< 5	< 0.2	0.2

03/21/95
LARRY S. PIERCE, Analyst

Calculations

The original water method comes with a computer program that performs a vast number of statistical calculations on the data. In lieu of using the program, which provides information useless to the end user of the data, we normally provide two figures: 1) "best estimate" asbestos fibers > 10 um long, and 2) the analytical sensitivity. The best estimate consists of confirmed and probable asbestos (with either diffraction or EDXA data) but not mere possibles (morphology alone). This reporting gives the most useful estimate of asbestos content, without excess statistics. If mass data, aspect ratio statistics, or numbers for individual fiber classifications are desired, they may be calculated at a later date using the program. The formula used is:

$$MFL = \frac{f / mm^2 \times 962\ mm^2 \times 10^{-6} MF / F}{V(ml) \times 1L / 1000\ ml}$$

Report

The report is generated by our normal database program. A typical example is shown in Figure 8.7.3.8.4.3.

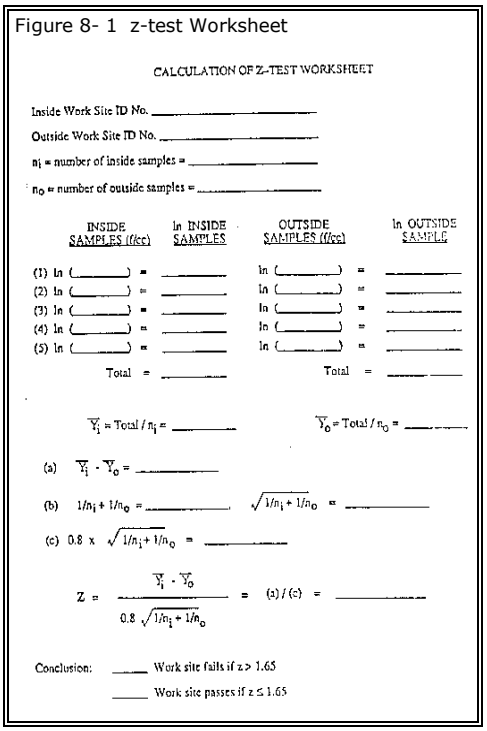
Generally, photos or electron diffraction patterns are not included in the report, although at least one clear ed pattern of each type of asbestos found in the samples is documented, as always, in our records. If the client/customer requests, copies of the photos may be provided.

8.7.3.8.4.4. Additional QA Procedures for Water

In order to prove that samples have not been contaminated during sample preparation, or, in the case of contamination, in order to show during which step the contamination took place, blanks of two types are used. The first type is a water blank, which consists of a volume of particle-free water filtered as if it were a sample. This type of blank is made before or after actual samples have been filtered, and at a minimum, once every ten samples, if a large number of samples are being filtered. The second type of blank is a laboratory blank, unused filter material as received from the manufacturer. The lab blank is routinely mounted during sample prep as the first wedge cleared on a slide. It therefore sits out during the mounting of the remaining samples, and therefore would have the greatest level of contamination from lab air. Since it is mounted on the same glass slide as the sample filter segments, it is treated exactly the same as the samples. Another lab blank, the post-mounting blank, may be mounted, again on the same glass slide as the samples, after the sample filters are mounted. This blank would only be contaminated during that part of the prep that occurs after mounting. This blank would be used for troubleshooting a source of contamination. If greater than 10 samples are mounted at one time (unlikely given the capacity of the carbon coater), then a prep blank will be mounted for each 10 samples, for a 10% level of blanks.

The lab blanks may not always be counted. If a given supply of filter media has an adequately characterized and low asbestos load (5 or more counts and <12 str/mm2), then the blanks may be prepared only. In this case, which has been true for the last 10 years or more from Poretics and Nuclepore, the blanks will be read per the normal rate for AHERA, 1 in 25 samples.If contamination from the lab is suspected from blank results, the source must be found and eliminated before more client/customer samples are analyzed. Several blanks should be run from various points in the preparation in order to pinpoint the source of contamination. An acceptable cumulative level for blanks is 18 str/mm2; it may not be possible to meet this criteria using PC filter material.

Figure 8- 1 z-test Worksheet



CALCULATION OF Z-TEST WORKSHEET

Inside Work Site ID No. _____

Outside Work Site ID No. _____

n_i = number of inside samples = _____

n_o = number of outside samples = _____

	INSIDE SAMPLES (f/cc)	ln INSIDE SAMPLES	OUTSIDE SAMPLES (f/cc)	ln OUTSIDE SAMPLE
(1)	ln (_____) =	_____	ln (_____) =	_____
(2)	ln (_____) =	_____	ln (_____) =	_____
(3)	ln (_____) =	_____	ln (_____) =	_____
(4)	ln (_____) =	_____	ln (_____) =	_____
(5)	ln (_____) =	_____	ln (_____) =	_____
	Total =	_____	Total =	_____

$\bar{Y}_i$ = Total / n_i = _____ $\bar{Y}_o$ = Total / n_o = _____

(a) $\bar{Y}_i - \bar{Y}_o$ = _____

(b) $1/n_i + 1/n_o$ = _____ $\sqrt{1/n_i + 1/n_o}$ = _____

(c) 0.8 x $\sqrt{1/n_i + 1/n_o}$ = _____

$$Z = \frac{\bar{Y}_i - \bar{Y}_o}{0.8\sqrt{1/n_i + 1/n_o}} = (a)/(c) = \_\_\_\_\_$$

Conclusion: _____ Work site fails if z > 1.65

_____ Work site passes if z ≤ 1.65

8.8. CALCULATIONS

8.8.1. Hand Calculations

The data generated by a count consists of: 1) the raw counts of chrysotile, the various amphiboles and non-regulated fibers (specifically chrysotile .5-5µ, chrysotile > 5m, any amphibole seen .5-5µ, any amphibole seen >5µ, and non-asbestos structures of any size) that were analyzed and tabulated, 2) the number of grid openings counted, and 3) the volume of air drawn through the cassette. Also used in the calculation is the average grid opening area, previously determined for the lot of grids from which the sample grids were obtained.

Two values are calculated for each raw count: structures/mm2 and structures/cc. The structures/mm2 for a category are the structures observed from that category that occur on the average on 1 square millimeter of filter area. The value is calculated as below:

$$str / mm^2 = \frac{RawCount}{\#\ GridOpenings \times AverageGOArea}$$

The structures/mm2 values are used for the initial screening portion of the AHERA protocol, in which a final clearance passes if the 5 interior samples (having volumes greater than 1199L) have an average str/mm2 of less than 70.

The other calculated value for each category is structures/cc, the average number of structures which would be observed per cubic centimeter of air drawn through the cassette. This calculation is identical to the PCM calculation and is shown below:

$$str / cc = \frac{str / mm2 \times Eff.FilterArea\ (usually\ 385\,mm)}{SampleVolume\ (L) \times 1000\,cc / L}$$

Also calculated for each cassette is the analytical sensitivity in str/mm2 and in str./cc. Analytical sensitivity is defined by AHERA as the hypothetical observation of one asbestos structure per analysis. Therefore, the numerical values of

analytical sensitivity for a given analysis can be calculated by merely substituting a raw count of 1 in the above two equations. The sensitivity is used as our reporting limit for TEM analysis.

Should a full set of AHERA samples require the z-test after failing the screening criteria, the directions included in the Federal Register are explicit enough to be understood. Figure 8-12 shows a work form which may be used for a z-test. All z-tests are hand calculated at this time.

Figure 8.8.2 Summary Page, TEM Air Report

FIBERQUANT ANALYTICAL SERVICES

Determination of Asbestos Structures in Air

JobNumber: 98-2738

Client:
1700 GALLERIA DR BLD C

HENDERSON, NV 89014-0000
Office Phone: (702) 799-0994
FAX: (702) 799-0994

 # Samples: 7 TEM **Rec:** 6/23/98 **Method:** AHERA TEM TEM analysis of air sample
Client Job: Booker/2857 **PO Number:** **Routing Number:** -

Method and Analysis Information:

The samples were prepared and analyzed using AHERA (Appendix A to Subpart E - Interim Transmission Electron Microscopy Analytical Methods, US EPA 40 CFR Pt. 763, Mandatory Method) protocols. Each cassette is first wiped with a damp cloth to prevent contamination of the filter insides. Then, a wedge of filter is excised using a cleaned scalpel. The wedge is placed on a new glass slide, and cleared using hot acetone vapor from a "hot block" apparatus. The cleared filter is then ashed in a plasma etcher to remove 1-2 um of filter from its surface, then coated with 100-200 um of carbon in a Denton 502A Carbon Evaporator. The carbon encapsulates all of the larger and most of the smaller particulate on the filter. Three mm square pieces of the coated filter are placed on copper TEM grids, and the original filter material is dissolved away in a Jaffe wick and/or condensation washer. The finished replica in carbon containing the particulate is then examined on a Phillips 300 transmission electron microscope at 10,000 to 20,000x magnification. All asbestos fiber structures >0.5um in length are characterized as asbestos or non-asbestos using a combination of morphology, electron diffraction characteristics, and elemental composition. A "structure" has certain narrow characteristics as defined in AHERA, and may be a single fiber, a bundle of parallel fibrils, a "matrix" structure (a fiber(s) extending out of a non-fibrous particle), or a cluster of matted or inter-connected fibers. Results are calculated both in structures/mm2 of filter surface and as structures/cc of air. The grid is scanned until an analytical sensitivity (the hypothetical observation of one structure) of 0.005 str/cc is reached.

For clearance monitoring, AHERA (Asbestos Hazard Emergency Response Act) states that an area in a school may be re-occupied when the average of 5 inside air samples having a minimum volume of 1200 liters is <70 str/mm2 when measured by this method; or when 5 interior air samples have been shown to be statistically indistinguishable from 5 exterior air samples using the z-test.

The coefficient of variation for this method is estimated to be approximately 0.5 for analyses in which >20 asbestos fibers have been counted, ranging up to 1.00 for analyses in which only a few asbestos fibers are counted.

The analysis was performed under an ongoing quality assurance program which includes: Client supplied blanks are prepared with each set of samples, and analyzed when sample asbestos levels are found to average >70 f/mm2, or at a level of one blank analysis per every 25 sample analyses. Lab blanks are also prepared with each set of samples, and analyzed in place of client blanks when none are submitted. Each analyst has suitable background credentials, such as at least a bachelor's degree in geology or chemistry, and has undergone extensive 2-6 month training in TEM techniques and mineralogy specific to TEM asbestos analysis before being allowed to perform client analyses. Unknown reference samples are routinely identified to ensure that each analyst can collect and correctly interpret TEM information. The TEM is aligned and its performance checked daily. Magnification, electron diffraction pattern size, and analytical performance characteristics are calibrated routinely. Samples are re-analyzed sometimes by the same analyst and sometimes by a different analyst in order to determine accuracy and precision. The total of QC analyses (blanks + recounts) are greater than 10% of analyzed samples. Each analyst participates in interlab round robins and proficiency testing in order to show correlation to other lab's analyses. Fiberquant is fully accredited by NVLAP to perform TEM analysis of asbestos in air samples. Accreditation does not imply endorsement by the EPA, any other United States governmental agency or any private agency or association. Each lab analysis refers only to the sample tested, and may not, due to the sampling process, be representative of the material

Blanks

Lab Number	Client Number	Date	Vol (L)	Location	#GOs	GO Area	AmphiboleType(s)	str/mm2:	str/cc:
98-2738- 6	2857-6		0	Blank	7	0.00936	Not Analyzed		
98-2738- 7	2857-7		0	Blank	7	0.00936	Not Analyzed		

Inside Samples

Lab Number	Client Number	Date	Vol (L)	Location	#GOs	GO Area	AmphiboleType(s)	str/mm2:	str/cc:
98-2738- 1	2857-1		1800	Inside	10	0.00936	-	11	.002
Chrysotile All: 1 str, 11 str/mm2, .002 str/cc. Chrysotile >5um: 0 str, <11 str/mm2, <.002 str/cc.									
Amphibole All: 0 str, <11 str/mm2, <.002 str/cc. Amphibole >5um: 0 str, <11 str/mm2, <.002 str/cc. Non-Asbestos: 0 cnts									
98-2738- 2	2857-2		1800	Inside	10	0.00936	-	<11	<.002
Chrysotile All: 0 str, <11 str/mm2, <.002 str/cc. Chrysotile >5um: 0 str, <11 str/mm2, <.002 str/cc.									
Amphibole All: 0 str, <11 str/mm2, <.002 str/cc. Amphibole >5um: 0 str, <11 str/mm2, <.002 str/cc. Non-Asbestos: 0 cnts									
98-2738- 3	2857-3		1800	Inside	10	0.00936	-	<11	<.002
Chrysotile All: 0 str, <11 str/mm2, <.002 str/cc. Chrysotile >5um: 0 str, <11 str/mm2, <.002 str/cc.									
Amphibole All: 0 str, <11 str/mm2, <.002 str/cc. Amphibole >5um: 0 str, <11 str/mm2, <.002 str/cc. Non-Asbestos: 0 cnts									
98-2738- 4	2857-4		1800	Inside	10	0.00936	-	<11	<.002
Chrysotile All: 0 str, <11 str/mm2, <.002 str/cc. Chrysotile >5um: 0 str, <11 str/mm2, <.002 str/cc.									
Amphibole All: 0 str, <11 str/mm2, <.002 str/cc. Amphibole >5um: 0 str, <11 str/mm2, <.002 str/cc. Non-Asbestos: 0 cnts									
98-2738- 5	2857-5		1800	Inside	10	0.00936	-	11	.002
Chrysotile All: 1 str, 11 str/mm2, .002 str/cc. Chrysotile >5um: 0 str, <11 str/mm2, <.002 str/cc.									
Amphibole All: 0 str, <11 str/mm2, <.002 str/cc. Amphibole >5um: 0 str, <11 str/mm2, <.002 str/cc. Non-Asbestos: 0 cnts									
							Average Str/mm2	4.3	

Job Analysis Notes:

Analyst: DAVID M. SCHALLER 23-Jun-98

Larry S. Pierce, Approved Accreditation Signatory

8.8.2. Data Entry and Report Creation

The Fiberquant LIMS has a provision for inputting TEM count results. As with all types of analysis on the LIMS, results are entered by clicking the <Samples> button for a given job. This brings up an on-screen results-entry form specific for the type of analysis (whether AHERA, 7402 or EPA 100.1). Simply by <tab>ing through the form, the analyst is prompted to enter the required data for each sample in turn. The on screen form mimics the paper form on which the original observations were made, in order to minimize transcription problems. As the data (numbers of grid openings counted, numbers of structures or fibers observed in various categories of size) are entered, the calculations (str/mm2, str/cc, MFL, *etc*.) are updated on the fly. The analyst can therefore verify sensitivity targets while the data is being entered. To save space, numbers of all 5 amphibole types are lumped into one category. Therefore, the type or types of amphibole asbestos, if observed, must be put in the <type of asbestos> note box provided. The analyst must perform the calculations for one sample using a calculator, to ensure that the LIMS calculations are correct. When the data is entered, checked for accuracy and validated, then the results form is exited, and the report printed by clicking <print>. The analyst is asked for their password, which verifies to the LIMS that the analyst takes responsibility for signing the report.

A typical report is shown in Figure 8.8.2.

8.9. QUALITY ASSURANCE PROCEDURES

8.9.1. General Requirements

Quality assurance procedures are designed generally to assure that data or information disseminated to the client/customer is not inaccurate or erroneous. Certain procedures minimize conflicting data, thereby

reducing the time spent clearing up discrepancies. The following procedures are specifically designed for asbestos sampling and testing and have been adapted from 1) the NIOSH Manual of Analytical Methods, 3rd. ed., 1984, 2) the NVLAP Airborne Asbestos Analysis Program Handbook, NISTIR 89-4137, 1989, and 3) Asbestos-Containing Materials in Schools: Final Rule and Notice, Federal Register 52, #210 Pt.III, #40 CFR Part 763: 10/30/87.

To help maintain a high level of quality in our analyses, Fiberquant participates in the NVLAP Airborne Asbestos Analysis program, which provides an acceptable agenda of quality assurance procedures to follow.

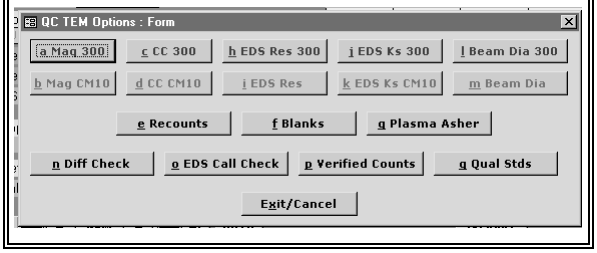
Quality assurance procedures can by categorized as calibrations, contamination checks or precision/accuracy determinations. Calibrations cover every piece of equipment used in the preparation or analysis of TEM samples. Calibration in some cases ensures consistent preparation. In other cases, it ensures that calculations have the correct starting points. Contamination monitoring and control ensures that reported results are due to the sample, not due to laboratory handling. Verified counting, recounts of various kinds, and quantitative standard counting ensure that different analysts count the same number of structures on a given analysis. Qualitative standards analysis and proficiency testing are used to ensure that analysts are accurate in their fiber identifications.

The QC activities can be summarized as follows:

prep blank	1/batch (for both water filtration and air or water evaporator batch)	
read prep blank	1/25 analyzed samples	4.0%
verified counts (low level)	Same as RD same gos	
verified counts (high level)	1 go/100 analyzed samples	0.2%
recounts:		
RS same gos	1/50 analyzed samples	2.0%
RD same gos	1/50 analyzed samples	2.0%
RS diff gos	1/100 analyzed samples	0.5%
RD diff gos	1/100 analyzed samples	0.5%
DS	1/100 analyzed samples	0.5%
DD	1/100 analyzed samples	0.5%
		Total 10.2%
optical microscope calibration	every lot of grids	
grid opening Area	every lot of grids	
EDS energy calibration	every day of use	
EDS performance checks	bi-yearly	
TEM alignment	every day of use	
TEM magnification calibration	weekly	
TEM camera constant calibration	weekly	
TEM beam dose	yearly per analyst	
TEM minimum beam size	bi-yearly	
TEM stage drift	bi-yearly	
plasma asher calibration	monthly	
qualitative standard	Bi-yearly	
quantitative standard (1876b)	once/year	

Most QA measurements are entered directly into computer records via screen forms. The individual screen forms are accessed by clicking the "QC" button on the main LIM screen, then clicking the "TEM" button, which opens the "TEM QC Options" screen, Figure 8.9.1. A data entry screen for each type of QA for each procedure is accessed by clicking one of the buttons there. The data entry screens are rather self-explanatory and will not be pictured here. If a physical form is used it is shown below.

Figure 8.9.1 TEM QC Options Screen



8.9.1.1. Photo Log

Photos are taken for camera constant measurements and to document at least one electron diffraction pattern of one of each type of asbestos seen per each job (see 8.9.4.6). Since photos are stored electronically on the JEOL 1200s, no photo log is used. Rather, the subject, lab number, analyst, mag or cc is stored as part of the file name. For that purpose, there are two directories to use: <Camera Constants> and <Spectra>.

8.9.2. Calibrations

8.9.2.1. Grid Opening Area Measurements

Purpose: to determine the average area of a lot of TEM grids; this area is crucial to TEM sample calculations.

Responsible Party: analyst assigned by Larry S. Pierce.

Timing & Frequency: performed for every lot of grids received.

SOP: TEM-9

Data Form: Figure 8.9.2.1

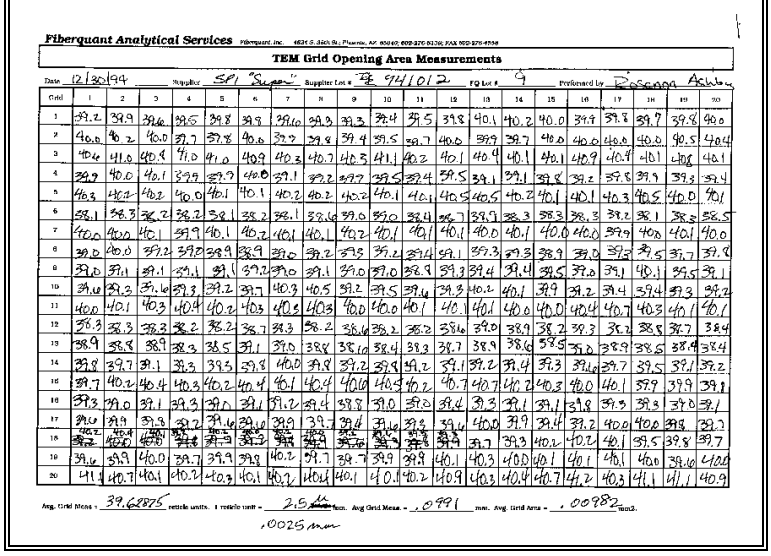
Record Storage: TEM calibration notebook; later, TEM file "GO Area Determinations".

Summary & Review: none

Out-of-Control: none

Grids are purchased in large lots to minimize the measurement process.

Figure 8.9.2.1 Grid Opening Measurement Form



Fiberquant Analytical Services Fiberquant, Inc. 6624 S. Dick St., Phoenix, AZ. 85040; 602-276-8236; FAX 602-276-4556

TEM Grid Opening Area Measurements

Date 12/30/94 Supplier SPI "Super" Supplier Lot # TE 94/1012 EQ Lot # 9 Performed by DeGrana Akwo

Grid	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	39.2	39.9	39.6	39.5	39.8	39.8	39.60	39.3	39.3	39.4	39.5	39.8	40.1	40.2	40.0	39.9	39.8	39.9	39.8	40.0
2	40.0	40.2	40.0	39.7	39.8	40.0	39.9	39.8	39.4	39.5	39.7	40.0	39.9	39.7	40.0	40.0	40.0	40.0	40.5	40.4
3	40.4	41.0	40.8	41.0	41.0	40.9	40.3	40.7	40.3	41.1	40.2	40.1	40.9	40.1	40.1	40.9	40.9	40.1	40.5	40.1
4	39.9	40.0	40.1	39.9	39.9	40.0	39.1	39.2	39.9	39.5	39.4	39.5	39.1	39.1	39.8	39.2	39.8	39.9	39.3	39.4
5	40.3	40.2	40.2	40.0	40.1	40.1	40.2	40.2	40.2	40.1	40.1	40.5	40.5	40.2	40.1	40.1	40.3	40.5	40.0	40.1
6	38.1	38.3	38.2	38.2	38.1	38.2	38.1	38.6	39.0	39.0	38.4	38.7	38.9	38.3	38.3	38.3	38.2	38.1	38.5	38.5
7	40.0	40.0	40.1	39.9	40.1	40.2	40.1	40.1	40.2	40.1	40.1	40.1	40.0	40.1	40.0	40.0	39.9	40.0	40.1	40.0
8	39.0	40.0	39.2	39.2	38.9	38.9	39.0	39.2	39.5	39.2	39.4	39.1	39.3	39.3	38.9	39.0	39.3	39.5	39.7	39.8
9	39.0	39.1	39.1	39.1	39.1	39.2	39.0	39.1	39.0	39.0	38.9	39.3	39.4	39.4	39.5	39.0	39.1	40.1	39.5	39.1
10	39.6	39.2	39.6	39.3	39.2	39.7	40.3	40.5	39.2	39.5	39.6	39.3	40.2	40.1	39.9	39.2	39.4	39.4	39.3	39.2
11	40.0	40.1	40.3	40.4	40.2	40.3	40.3	40.3	40.0	40.0	40.1	40.1	40.1	40.0	40.0	40.4	40.7	40.3	40.1	40.1
12	38.3	38.3	38.3	38.2	38.2	38.7	38.3	38.2	38.6	38.2	38.2	38.6	38.9	38.9	38.2	38.3	38.2	38.5	38.7	38.4
13	38.9	38.8	38.9	38.3	38.5	39.1	39.0	38.8	38.6	38.4	38.3	38.7	38.9	38.6	38.5	39.0	38.9	38.5	38.8	38.4
14	39.8	39.7	39.1	39.3	39.3	39.8	40.0	39.8	39.2	39.9	39.2	39.1	39.2	39.4	39.3	39.0	39.7	39.5	39.1	39.2
15	39.7	40.2	40.4	40.3	40.2	40.4	40.1	40.4	40.0	40.9	40.2	40.7	40.7	40.2	40.3	40.0	40.1	39.9	39.9	39.8
16	39.3	39.0	39.1	39.3	39.0	39.1	39.2	39.4	38.8	39.0	39.0	38.4	39.3	39.1	39.1	39.8	39.3	39.3	39.0	39.1
17	39.0	39.9	39.8	39.2	39.6	39.0	39.9	39.7	39.4	39.6	39.8	39.4	40.0	39.9	39.4	39.2	40.0	40.0	39.8	39.7
18	39.2	40.0	40.0	39.4	39.3	39.3	39.8	39.9	39.5	39.6	39.3	39.8	39.9	39.7	39.3	40.2	40.2	40.1	39.5	39.8
19	39.6	39.9	40.0	39.7	39.9	39.9	40.2	39.7	39.7	39.9	39.9	40.1	40.3	40.0	40.1	40.1	40.1	40.0	39.6	40.0
20	41.1	40.7	40.1	40.2	40.3	40.1	40.2	40.1	40.1	40.1	40.2	40.9	40.3	40.4	40.7	41.2	40.3	41.1	41.1	40.9

Avg. Grid Meas. = 39.68875 reticle units. 1 reticle unit = 2.5 μm = .0025 mm Avg Grid Meas. = .0991 mm. Avg. Grid Area = .00982 mm2.

Timing & Frequency: Calibration must be checked whenever the analyzer is used

SOP: observe the centroids of the Cu-Kα and Cu-Lα peaks (EDS System Check, Work Practice TEM-2), and compare to the stock klm markers placed by the EDS software. If the peaks are not within 10 eV of the standard values, the system must be calibrated (see WP #TEM-2).

Data Form: document that a check has been performed and whether calibration was needed for a particular job on the TEM count sheet (*e.g.*, 8.4c)

Record Storage: on count sheets.

Summary & Review: none

Out-of-Control: greater than +/- 10ev for both CuKα and CuLα peaks (8.040 and 0.930).

8.9.2.2. Optical Microscope Calibration

The optical microscope used to calibrate the area of grid openings must itself be calibrated. This subject has already been covered in section 6.9.2.1 of the PCM chapter and will not be repeated here.

8.9.2.3. EDS Energy Calibration

Purpose: to check and maintain the energy calibration (what eV the peaks occur) of the EDXA.

Responsible Party: each TEM analyst, as required.

8.9.2.4. Energy Dispersive Spectrometer Performance Monitoring

The monitoring of the EDS performance consists of 1) K-factor measurement, 2) Spectrometer Resolution, 3) Na-peak in Crocidolite, 4) Mg,Si peaks in Chrysotile, 5) Map of EDS Response over a Grid, and 6) 2% LOD for Na, Mg, Al, Si and Fe. Raw data is recorded on the form in 8-15, then transferred to computer files using a number of computer screens all accessed by the QC button on the main screen.

8.9.2.4.1. K-factors

Purpose: to monitor EDXA performance though k-ratios, energy resolution, Na-peak in crocidolite, and Mg and Si peaks in chrysotile.

Responsible Party: Larry S. Pierce

Timing & Frequency: Twice yearly

SOP: First, the EDS calibration procedure is run to ensure that peak intensities are to be calculated correctly. The standard 2063 is to be placed in the microscope with its dark side facing the x-ray detector (face down in the holder). The probe size and electron dose should be reduced to normal analytical levels by setting C1 at setting 20, and the probe should be expanded into a wide area rather than focused. Five 300 second spectra are obtained from different spots on the specimen. Once the spectrum is collected, then, find net counts in each window of the elements Mg,Si,Ca and Fe (Emispec). The K-factor for each is calculated as follows, then the average and standard deviation is calculated:

$$K_{El/Si} = \frac{\%_{El}}{\%_{Si}} \times \frac{I_{Si}}{I_{El}}$$

A quantitative measure of detector contamination is obtained by calculating a Mg/Fe sensitivity factor, as shown below:

$$SensitivityFactor_{Mg/Fe} = \frac{K_{Mg/Si}}{K_{Fe/Si}}.$$

Data Form: Figure 8.9.2.4

Record Storage: TEM file "EDS Performance Checks"for the paper form. An Excel spreadsheet has been developed to perform the above caculations automatically. A template can be found at *Larry//c:/msoffice/excel/temkfactorstemplate.xls*. Past data is stored at *Larry//c:/msoffice/excel/tem k-facors/…*

Summary & Review: the control chart for k-factors is shown in Figure 8.9.2.4.1. The most current version is printed in the TEM QA monthly report.

Out-of-Control: A change of more than 20% of K_{Na}, or 10% for others. Also, Mg to Fe sensitivity is required to be < 1.5. If sensitivity decreases,, de-contamination or de-icing of the detector or window should be performed. Also, the settings of the fast and slow discriminators of the analyzer should be re-set if not per Emispec on-line instructions. If problem persists, service is required. Before a repaired unit is placed in service, the full performance check should be seen to pass.

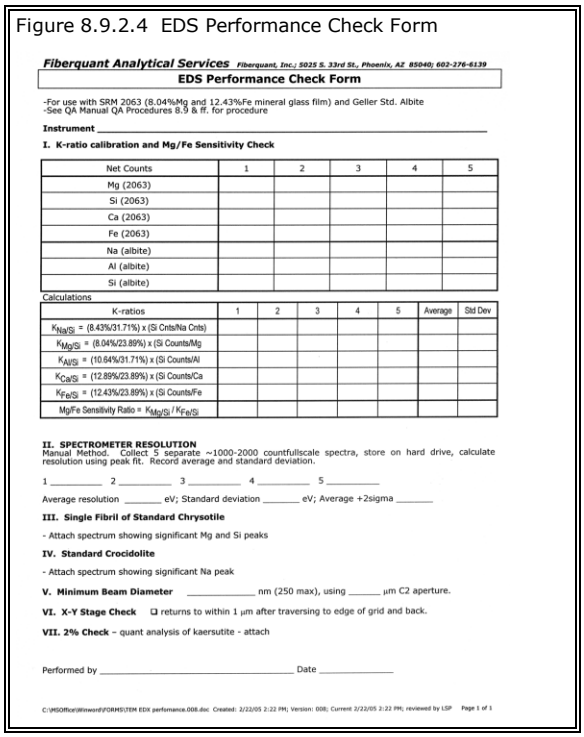
8.9.2.4.2. Spectrometer Resolution

Purpose: to ensure minimum resolution for NVLAP purposes; ensures proper elemental ratio calculations.

Responsible Party: Larry S. Pierce.

Timing & Frequency: Twice yearly

Figure 8.9.2.4 EDS Performance Check Form



Fiberquant Analytical Services Fiberquant, Inc.; 5025 S. 33rd St., Phoenix, AZ 85040; 602-276-6139

EDS Performance Check Form

-For use with SRM 2063 (8.04%Mg and 12.43%Fe mineral glass film) and Geller Std. Albite
-See QA Manual QA Procedures 8.9 & ff. for procedure

Instrument _____

I. K-ratio calibration and Mg/Fe Sensitivity Check

Net Counts	1	2	3	4	5
Mg (2063)					
Si (2063)					
Ca (2063)					
Fe (2063)					
Na (albite)					
Al (albite)					
Si (albite)					

Calculations

K-ratios	1	2	3	4	5	Average	Std Dev
$K_{Na/Si}$ = (8.43%/31.71%) x (Si Cnts/Na Cnts)							
$K_{Mg/Si}$ = (8.04%/23.89%) x (Si Counts/Mg							
$K_{Al/Si}$ = (10.64%/31.71%) x (Si Counts/Al							
$K_{Ca/Si}$ = (12.89%/23.89%) x (Si Counts/Ca							
$K_{Fe/Si}$ = (12.43%/23.89%) x (Si Counts/Fe							
Mg/Fe Sensitivity Ratio = $K_{Mg/Si}$ / $K_{Fe/Si}$							

II. SPECTROMETER RESOLUTION
Manual Method. Collect 5 separate ~1000-2000 countfullscale spectra, store on hard drive, calculate resolution using peak fit. Record average and standard deviation.

1 _____ 2 _____ 3 _____ 4 _____ 5 _____

Average resolution _____ eV; Standard deviation _____ eV; Average +2sigma _____

III. Single Fibril of Standard Chrysotile

- Attach spectrum showing significant Mg and Si peaks

IV. Standard Crocidolite

- Attach spectrum showing significant Na peak

V. Minimum Beam Diameter _____ nm (250 max), using _____ µm C2 aperture.

VI. X-Y Stage Check ❑ returns to within 1 µm after traversing to edge of grid and back.

VII. 2% Check – quant analysis of kaersutite - attach

Performed by _____ Date _____

C:\MSOffice\Winword\FORMS\TEM EDX performance.008.doc Created: 2/22/05 2:22 PM; Version: 008; Current 2/22/05 2:22 PM; reviewed by LSP Page 1 of 1

Figure 8.9.2.4.1 EDS K-factor / Sensitivity Chart

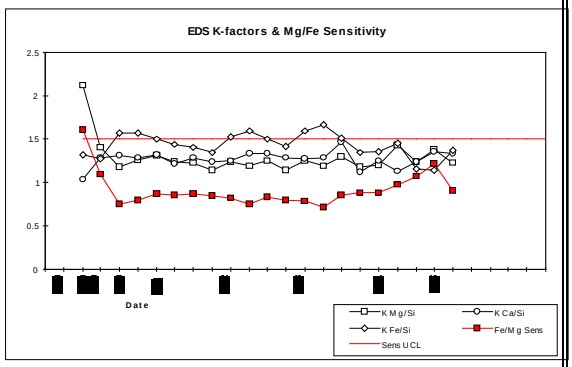
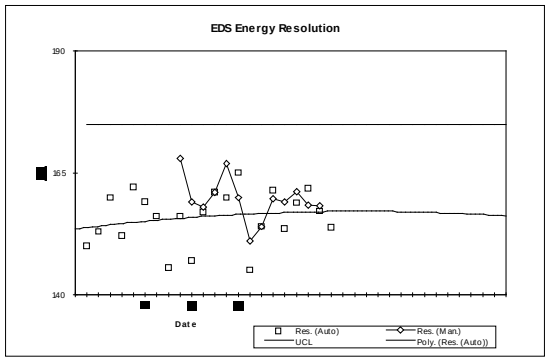


Figure 8.9.2.4.2 EDS Resolution Chart



SOP: Spectrometer resolution is defined as the full width at half maximum of a peak at the position of the Mn k-alpha x-ray. We therefore have prepared a grid containing a Mn-oxide ore. This grid is placed in the TEM, the system checks are performed and the EDS energy calibrated on the usual Cu line. Then a piece of ore is selected and the beam placed on it. Five 300 sec spectra are obtained and printed out. The width at half maximum is calculated graphically for each, then a mean and standard deviation is calculated.

Data Form: EDS performance form, Figure 8.9.2.4

Record Storage: EDS Performance file, TEM drawer.

Summary & Review: 50 most recent checks are charted approximately as shown in Figure 8.9.2.4.2; most current chart is printed monthly in the QA report.

Out-of-Control: >175 or mean+ 2σ >180 eV

8.9.2.4.3. Na Peak in Crocidolite Observation

Purpose: to ensure that crocidolite can be distinguished from amosite.

Responsible Party: Larry S. Pierce.

Timing & Frequency: twice yearly

SOP: This is a test to be sure that the Na-peak in crocidolite (which is crucial to its correct identification) is observable. A grid of standard crocidolite (from SRM 1866) is placed in the TEM, the system checks and EDS calibration are performed, the spot size is reduced and the specimen tilted to obtain normal EDS conditions. Spectra of crocidolite are obtained using a 300 sec. count time (even though as small fiber theoretically absorbs fewer Na x-rays, a large fiber is chosen for good signal to background ratio).

Calculation: Obtain the total channel output for the Na peak, I, by 1) setting a ROI around the peak, 2) hit <process><sum>, 3) observing the sum number on the *measurement* tab. Obtain the background for the Na peak, I_b, by subtracting the integrated Na peak from peak quantify from I. The peak is significant if:

$$I - I_b > 3*(2*I_b)^{1/2}$$

Data Form: attach a hard copy of the spectra to the concurrently done EDS Performance form. Spectrum is also stored on hard drive of EDS computer.

Record Storage: EDS Performance file, Figure 8.9.2.4.

Summary & Review: qualitative pass/fail.

Out-of-Control: no statistically significant Na peak. Lack would indicate spectrometer problem with may be alleviated by de-icing or factory service.

8.9.2.4.4. Mg, Si Peaks in Chrysotile Observation

Purpose: to ensure that chrysotile can be identified, even in single fibrils.

Responsible Party: Larry S. Pierce.

Timing & Frequency: Twice yearly.

SOP: A grid of standard chrysotile is examined. Single fibrils of chrysotile are chosen, the stage tilted, the beam made as small as possible, and a 300 sec. spectra obtained. The peak significance of both the Mg and Si peaks are calculated as above to determine whether they are statistically significant

Data Form: attach spectra to concurrently done EDS Performance form.

Record Storage: EDS Performance file, Figure 8.9.2.4.

Summary & Review: qualitative pass/fail.

Out-of-Control: no statistically significant Mg or Si peak. Lack would indicate spectrometer problem with may be alleviated by de-icing or factory service.

8.9.2.4.5. Map of EDS Performance over Grid Area

Purpose: to make analyst aware of where on grid shadowing may produce atypical EDS spectra.

Responsible Party: Larry S. Pierce.

Timing & Frequency: once for each TEM, or whenever grid design or TEM geometry is changed.

SOP: A grid of standard amosite is examined. Fibrils are analyzed at various areas of the grid. Comparison of the spectra and calculated elemental ratios is used to determine which of the areas is subject to shadowing.

Data Form: obtain hard-copies of all spectra.

Record Storage: EDS Map file, TEM drawer.

Summary & Review: map made up indicating shadowed areas.

Out-of-Control: no standards.

Summary of Results: JEOL North: no shadowing

8.9.2.4.6. 2% LOD for Na, Mg, Al, Si, Ca and Fe

Purpose: to ensure all significant asbestos elements can be adequately detected.

Responsible Party: Larry S. Pierce.

Timing & Frequency: Twice yearly

SOP: 300 sec spectra are obtained of Geller standard hornblende. Peak net results are compared to its composition to document 2% limit of detection.Cr is 2.25%; Na is 2.44%.

Data Form: obtain hard-copy of spectrum.

Record Storage: EDS Performance file, TEM drawer.

Summary & Review: pass/fail.

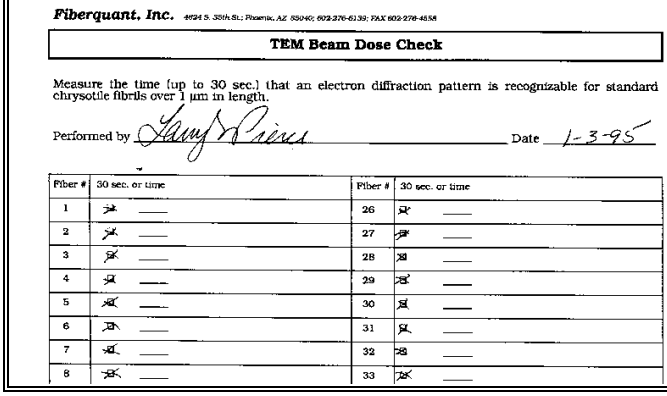
Out-of-Control: <2% LOD. Failure would indicate a spectrometer problem possibly alleviated by de-icing or factory service.

8.9.2.5. TEM Beam Dose Calibration

Purpose: Often the identification of a fiber as chrysotile pivots upon being able to observe and recognize its diffraction pattern. Unfortunately, chrysotile (and also anthophyllite to a lesser extent) is sensitive to electron flux. If exposed to too high an electron flux (too bright a beam), the atoms in chrysotile may disorder, destroying the diffraction pattern. It is therefore necessary, in our day to day observation of asbestos specimens, to limit the exposure of fibers to electrons. The electron flux which is penetrating any given area of the sample during the normal 20,000x scanning procedure is low, but not low enough that damage does not occur. Therefore, it behooves one not to sit on a fiber for very long before attempting to obtain a diffraction pattern. The danger of destroying a diffraction pattern is greatest during EDS analysis, during which the entire beam is concentrated on the crystal. For this reason, the different types of data should be collected in a specific order, namely,

1. Recognize during scanning a possible structure
2. Immediately defocus C2 condenser to lessen energy input into the fibers
3. Obtain and identify diffraction pattern if possible
4. Note and record size and morphology
5. Obtain EDS analysis

Figure 8.9.2.5 Beam Dose Form



Fiberquant, Inc. 4924 S. 35th St.; Phoenix, AZ 85040; 602-276-6139; FAX 602-276-4858

TEM Beam Dose Check

Measure the time (up to 30 sec.) that an electron diffraction pattern is recognizable for standard chrysotile fibrils over 1 µm in length.

Performed by Larry S Pierce Date 1-3-95

Fiber #	30 sec. or time	Fiber #	30 sec. or time
1	___	26	___
2	___	27	___
3	___	28	___
4	___	29	___
5	___	30	___
6	___	31	___
7	___	32	___
8	___	33	___

The diffraction pattern is attempted as soon after structure discovery as possible. Once a possible structure is found, the beam is immediately broadened by over-focusing C2 by one click clockwise. The image will, of course, become much dimmer, but not so dim that the diffraction aperture cannot be located on the structure. Then the mode is changed to D+I, the projection lens activated, and the diffraction pattern is observed on the small screen. With the beam this broad, only the central spot may be visible, but once the diffraction setup is achieved, the C2 may be slowly turned back counterclockwise to increase the electron flux and therefore brightness of the electron beam. If there is a diffraction pattern present, this procedure gives ample opportunity to observe it before beam damage destroys it. Some very thin chrysotile fibrils will not give a strong diffraction pattern even with these precautions; this is a signal to noise problem: the fiber occupies too small a percentage of the diffraction aperture. But a dim pattern will be seen if the above precautions are followed.

Responsible Party: Since different operators may have a lighter or heavier hand in regards to beam dose, each must establish that they are not needlessly destroying diffraction patterns.

Timing & Frequency: once per year, at beginning of year.

SOP: TEM-24

Data Form: Figure 8.9.2.5

Record Storage: TEM Technical file "Beam Dose"

Summary & Review: as done; no charts.

Out-of-Control: < 90% of diffraction patterns of fibrils > 1 μm last > 15 seconds.

Generally, the conditions under which chrysotile patterns persist for more than 15 seconds are: 1) PH 300: bias at 1-3, corresponding to a filament current of <10 and C2 spread one large click; 2) CM10 spot size 8 or higher, bias 1, and beam size equal to the small screen (the beam cannot be spread on the CM10 because of the lack of a diffraction aperture).

8.9.2.6. TEM Magnification Calibration

Purpose: to ensure that fiber lengths are measured accurately.

Responsible Party: David M. Schaller; Uwe Steimle

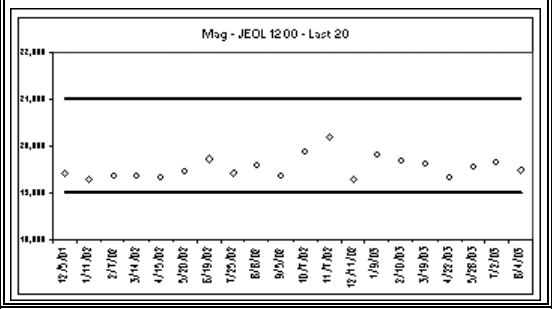
Timing & Frequency: at least monthly, prompted by the LIMS

SOP: TEM-13 (counting gratings within the 5 um circle). This action also calibrates the 0.5 um circle, since there is a fixed ratio between the 5 and 0.5 um circles.

Data Form: Hard copy for calculations and LIMS computer screen form for results

Record Storage: LIMS is the official record of magnification. The hard copy provides a work sheet for magnification calculations.

Figure 8.9.2.6 TEM Magnification Control Chart



Summary & Review: control chart for the latest 20 measurements (Figure 8.9.2.6) printed monthly in TEM QA monthly report.

Out-of-Control: must be 20,000 +/- 1000; if not – current magnification multiplication factor [20K/actual mag] must be posted on instrument column).

8.9.2.7. TEM Film Camera Constant Calibration

Purpose: to ensure that d-spacings in sample diffraction patterns can always be determined to within +/- 5%.

Responsible Party: David M. Schaller, Uwe Steimle

Timing & Frequency: weekly (required by AHERA), prompted by LIMS with a one day grace period.

SOP: TEM-14. Several problems are inherent in the measurement of camera constant.

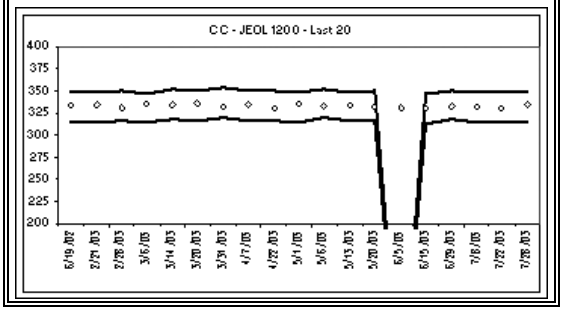
1. The camera constant is measured at 0º tilt, even though the camera constant can be expected to change with tilt, and the diffraction patterns for which the camera constant would be most critical would be expected to occur at anything but 0 tilt.

2. The camera constant varies with d-spacing, that is the camera constant determined from the first gold ring will differ from that determined from the second gold ring.

3. The camera constant may not be constant through 360 degrees.

For these reasons, the camera constant can only be expected to be accurate to approximately 5%, a fact which must be taken into account when indexing diffraction patterns.

Figure 8.9.2.7 Camera Constant Control Chart



Data Form: LIMS.

Record Storage: LIMS.

Summary & Review: the current camera constant control chart containing the latest 20 measurements (Figure 8.9.2.7) is printed each month in the TEM QA monthly report.

Out-of-Control: +/- 5% from last week's constant (shown on the control chart as horizontal bars). If cc is over 5%, another cc is measured; if consistently over 5%, then the TEM is taken out of service until the cause of the instability is determined.

8.9.2.8. TEM Screen Camera Constant Calibration

Purpose: to enable on-the-fly estimation of d-spacings on the TEM fluorescent screen during analysis.

Responsible Party: David M. Schaller, Uwe Steimle

SOP: Load standard chrysotile grid into the TEM, obtain a strong diffraction pattern; insert the first (300 um) objective aperture; measure the number of layer lines that fit into the aperture (e.g. 4.8).

Data Form: LIMS

Record Storage: LIMS

Summary & Review: none

Out-of-Control: no control – useful for the purpose no matter what the value

8.9.2.9. TEM Minimum Beam Size Measurement

Purpose: to obtain a good signal to noise ratio during an EDS analysis, it is desirable to have the entire beam on the fiber, rather than half the beam on the fiber and half off. Therefore, the smaller the beam during analysis the better.

Responsible Party: Larry S. Pierce

Timing & Frequency: Twice a year, along with the EDS performance check.

SOP: Collect an image of a beam @75,000-100,000x. Set up line scan. Width is the full width at 1/10 maximum.

Data Form: EDS Performance Check Form

Record Storage: TEM file EDS Performance and LIMS.

Summary & Review: reviewed at measurement; chart printed in QA report monthly.

Out-of-Control: diameter must be < 250 nm; if not, TEM is out of service until condenser apertures are cleaned or replaced, and another measurement of minimum beam diameter shows the diameter to be in control.

8.9.2.10. Plasma Asher Calibration

Purpose: the ideal of ashing MCE filters is to ash 1-2 μm from the surface of a collapsed filter. The ashing time is therefore chosen to remove 1.5 μm.

Responsible Party: Uwe Steimle

Timing & Frequency: yearly, in conjuction with the 2nd EDS performance check

SOP: TEM-28

Data Form: measurement on Plasma Asher Calibration Form, Figure 8.9.2.10a.

Record Storage: times in LIMS, papers in TEM file "Plasma Asher Calibrations".

Summary & Review: current asher calibration trend chart (Figure 8.9.2.10c) is printed every month in the TEM QA monthly report. The new ash time is checked by observing the etch pattern on samples. Document with a photo at 45 degrees 20,000x. Compare with previous images of good etch (nice orange-peel effect). If the etch appears to be too heavy (etch pits interfering with observation of particles), then the etch time is adjusted to maintain the result of a good image.

Figure 8.9.2.10a Plasma Asher Calibration Form

Fiberquant, Inc. 4424 S. 35th St.; Phoenix, AZ 85040; 602-276-0129

PLASMA ASHER CALIBRATION FOR MCE FILTER ASHING
Weight Method

Performed By Dan **Date** 12-2-94

PROCEDURE (CLEARED FILTER ASHING)

1) Weigh a clean, dry, 2x3" glass slide (in desiccator) to 0.1mg. 2) Cut one unused 25mm dia. MCE filters into four quarters and mount using the hot acetone method. 3. Heat for 10 min. @65C, then place in desiccator overnight. 4. Weigh slide to 0.1mg. 5) Ash normally at 20 watts in oxygen but for the 60 minutes. 6) Weigh slide to 0.1 mg. 7) Make the following calculation:

#1 Empty Slide Weight	9.1781	gms
#2 Slide and Cleared Filter Weight	9.2021	gms
#3 Filter Weight (#2-#1)	0.0240	gms
#4 Slide and Etched Filter Weight	9.1949	gms
#5 Filter Weight Loss During Etching (#2-#4)	0.0072	gms
#6 %Filter loss during Etching (100 * #5 / #3)	30.00	%
#7 Filter thickness Lost (34.5 um * #6)	10.35	um
#8 Etch Rate (#7 / 60 minutes)	0.3450	min
New Etch Time for Samples (1.5 ug / #8)	4min 21sec	min

Copyright Fiberquant, Inc. 1993; Form F Ash, Wk063

Out-of-Control: ashing is a variable process; subsequent calibrations should be within 100% of each other; more of concern than short term variations would be a long term drift to longer times, which might foretell catastrophic failure of the instrument.

8.9.2.11. Stage Drift

Purpose: to ensure that the scanning procedure does not miss any part of the grid opening due to wear or instability of the translation controls.

Responsible Party: Larry S. Pierce

Timing & Frequency: Twice yearly, during the EDS performance check.

SOP: The stage is centered on the corner of a grid and the x-stage knob is used to drive the stage down to the other side of the grid opening and back again. Then the y-stage control is used to drive the stage to the other side of the grid opening and back again. The stage is said to be reproducible enough if the final positions of the corner is within 1 μu of its starting position.

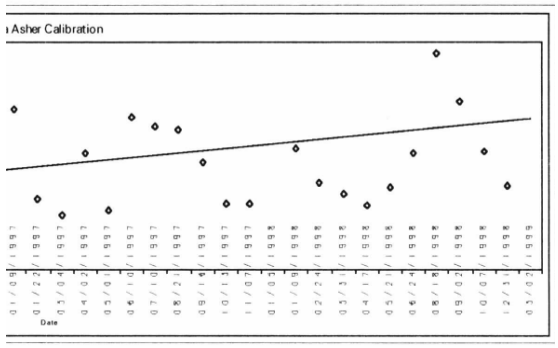
Data Form: EDS performance form.

Record Storage: TEM file EDS Performance.

Summary & Review: reviewed at measurement; no chart.

Out-of-Control: no strict out-of-control. If the stage does not return to 1 μm of its starting position, Thomas Technical Services should be called to check out the goniometer. As an interim solution, the overlap of scans should be increased to ensure that the entire grid opening is scanned.

Figure 8.9.2.10c Plasma Asher Trend Plot



8.9.3. Contamination Control

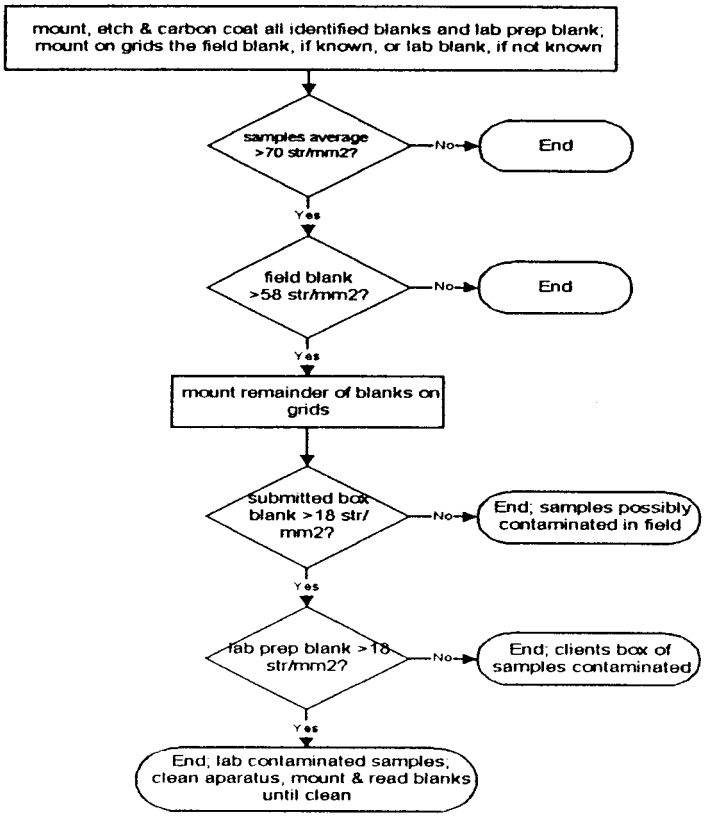
TEM analysis of asbestos consists of the observation of a very few fibers on a very small area of analyzed filter. Any contamination can send calculated concentrations skyrocketing. Such sensitivity of the method to contamination makes contamination monitoring and control extremely important to the success of an analysis. Contamination monitoring can be separated into two broad categories: 1) contamination monitoring during sample preparation, and 2) non-sample preparation contamination monitoring. The results of contamination monitoring are reported in the TEM monthly QA report.

8.9.3.1. Contamination Monitoring During Sample Preparation

In order to prove that samples have not been contaminated during sample preparation, or, in the case of contamination, in order to show during which step the contamination took place, laboratory blanks are used. Laboratory blanks are unused filter material as received from the manufacturer. For most of our work, this means that they are 0.45 um MCE filter cassettes. A blank is routinely mounted during sample prep as the first wedge cleared on a slide. It therefore sits out during the mounting of the remaining samples, and therefore would have the greatest level of contamination from lab air. Since it is mounted on the same glass slide as the sample filter segments, it is treated exactly the same as the samples. Another lab blank, the post-mounting blank, may be mounted, again on the same glass slide as the samples, after the sample filters are mounted. This blank would only be contaminated during that part of the prep that occurs after mounting. This blank would be used for troubleshooting a source of contamination. If greater than 10 samples are mounted at one time (unlikely given the capacity of the carbon coater), then a prep blank will be mounted for each 10 samples, for a 10% level of blanks.

In addition to the above, internal blanks, all known field or box blanks submitted with samples are to be mounted and prepared along with the samples through the carbon coating stage, but not necessarily placed on grids. One field blank in this case should be placed on grids as the prep blank in lieu of our prep blank.

Whether a blank is counted depends upon the results of the sample analysis. For instance, if a series of 5 samples are found to all have less than 58 structures/mm^2 and an average of less than 18 structures/mm^2, then the level of contamination during their preparation was within tolerances. Usually the observed results for a clearance are even lower than these. In this case, a blank would not have to be counted before the results are sent out. If not, a blank may be looked at to determine whether contamination had occurred. If the average of AHERA sample results is >70 structures/mm^2, then the field blank if available or the general prep blank must be looked at or counted (10 grid openings) before the sample results can be relayed to the client/customer. If the blank is contaminated at a level high enough to change the outcome of the test (pass or fail), then the source of



the contamination must be found (see below), eliminated and the samples re-prepped and possibly re-taken (if the contamination occurred during mounting). Above is a flow chart for blank analysis.

Regardless of the results of the sample analyses, a general prep blank for samples other than water is read (0.057 mm^2, or about 7 grid openings) every 25 samples. A general prep blank for water samples is read (20 grid openings) one per prepatory session or one in every 10 samples, whichever is greater. The determination of which blanks are routinely read is handled by the computer at log-in; the chosen samples are marked on the TEM log-in sheet by "blank" in the QC column.

The results of the blank counts are recorded in the LIMS. A cumulative average of blanks, which must be maintained to be less than 18 str./mm^2, is also reported monthly in the QA monthly report.

If significant contamination levels are found on the prep blank (>53 str./mm^2) for a given sample series, then steps must be taken to find and eliminate that source of contamination. The first step is to count the post-mounting blank, to ascertain whether the contamination occurred as the samples were mounted (the general lab blank is high and the post-mounting blank is low) or after the samples were mounted (both the lab blanks are high). From that determination, other blanks will have to be initiated (e.g., asher blank, coater blank, Jaffe washer blank, condensation washer blank, prep room fallout sample, clean bench blank, solvent or material blanks, etc.) to determine the exact source of the contamination.

If field blanks have been collected and analyzed, and are known to the lab, then their concentration must not be over 70 str./mm^2. If they are, then the entire sampling series should be rejected and a new set collected.

8.9.3.2. Non-Sample Preparation Contamination Monitoring

Purpose: Since samples are prepared in a clean bench yet transported outside of the clean bench, it is important that a general cleanliness of the general prep room be maintained.

Responsible Party: safety officer

Timing & Frequency: approximately annually, prompted by LIMS.

SOP: collect a 1200L air sample in prep room; analyze by TEM.

Data Form: normal count sheet.

Record Storage: safety files.

Summary & Review: by safety officer.

Out-of-Control: >18 str/mm^2; if contamination is found, prep is suspended until source is located and eliminated.

8.9.3.3. Housekeeping and Contamination Prevention Measures

Once a week, usually over the weekend, the entire laboratory is cleaned and dusted by a cleaning service. If areas of the lab are found to be dusty during the week, they are wet-wiped. The clean bench is wet wiped once a week or whenever visible debris or dust is observed. In the event that excess contamination is found on a TEM prep blank, all items in the clean bench and the bench itself is wet-wiped, and the bench filter integrity and blower checked out.

The main concern in the TEM laboratory is the lab contaminating the samples rather than the samples contaminating the laboratory. TEM samples will primarily be final clearance samples, and so will have lightly loaded filter material, and will also be unlikely to have contaminated cowling or packaging. Nonetheless, upon receipt, TEM filter cassettes are taken to the general work bench in the TEM lab and their exteriors wet wiped with amended water and Kimwipes. If debris or dust can be seen on them, they are wet-wiped in the exhaust hood.

Bulk asbestos samples commonly arrive in a condition that could result in contamination to the laboratory. Un-contained bulk samples are not received as is, but are taken outside and bagged before being received. Any bulk samples with dusty or bagging in poor shape are re-bagged or double bagged. The bulk analysis area, where the sample bags or cans are opened and analyzed, has HEPA-filtered exhaust hoods. Also, the air circulation system is separate from the TEM facility. Bulk samples are not allowed in the TEM laboratory.

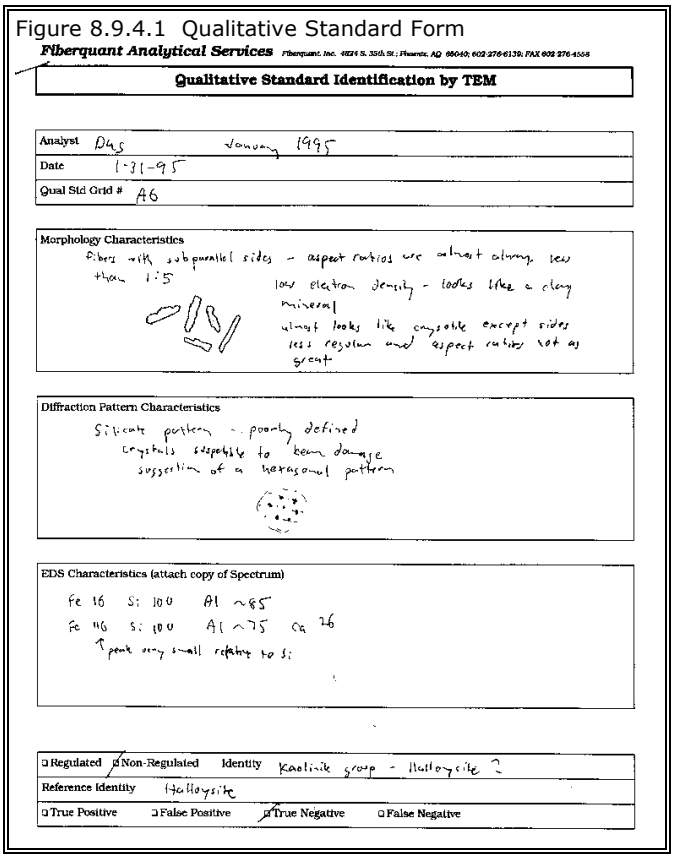
After being wet-wiped, the TEM cassettes are handled and opened in the clean bench, in which HEPA-filtered air is constantly flowing past the samples and out into the lab. The clean bench is not turned off, except for servicing.

Hazardous solvents, such as chloroform and methylene chloride are to be used in the fume hood. This is especially important in the case of chloroform, whose OSHA ceiling exposure limit is above the threshold of smell. Other non-volatile or relatively non-toxic solvents, such as acetone and 1M2P may be used in the general lab area or in the clean bench.

8.9.4. Precision and Accuracy Determinations

Both precision and accuracy are calculated monthly for the laboratory overall and also for each analyst. In order to gauge precision and accuracy, a number of procedures and counts and used: 1) analysis of reference materials, 2) replicate counts, 3) duplicate counts, 4) verified analyses, 5) inter-laboratory analyses and 6) proficiency sample analyses. The procedures for each of these are discussed below.

Figure 8.9.4.1 Qualitative Standard Form



Fiberquant Analytical Services Fiberquant, Inc. 4824 S. 35th St.; Phoenix, AZ 85040; 602 276-6139; FAX 602 276-4568

Qualitative Standard Identification by TEM

Analyst	DAS January 1995
Date	1-31-95
Qual Std Grid #	A6

Morphology Characteristics

Fibers with subparallel sides - aspect ratios are almost always less than 1:5

low electron density - looks like a clay mineral

almost looks like chrysotile except sides less regular and aspect ratios not as great

Diffraction Pattern Characteristics

Silicate pattern - poorly defined crystals susceptible to beam damage suggestion of a hexagonal pattern

EDS Characteristics (attach copy of Spectrum)

Fe 16 Si 100 Al ~85

Fe 46 Si 100 Al ~75 Ca 26

↑ peak very small relative to Si

☐ Regulated	☑ Non-Regulated	Identity	Kaolinite group - Halloysite ?
Reference Identity	Halloysite		
☐ True Positive	☐ False Positive	☑ True Negative	☐ False Negative

8.9.4.1. Analysis of Reference Materials

Reference materials are available in two forms: bulk reference materials and counting reference materials. Bulk reference materials are analyzed as qualitative unknowns and the counting reference material (1876b) is counted yearly.

Chrysotile, grunerite and crocidolite standards are present in SRM 1866; tremolite, actinolite and anthophyllite in SRM 1867. These consist of relatively pure samples of the minerals. These reference materials have been dispersed onto TEM grids to provide training in morphology, electron diffraction pattern, and energy dispersive spectra identification. For each material, a profile has been prepared, consisting of images, electron diffraction patterns, and an energy dispersive spectrum, all taken from our instrumentation. In addition, the grids made from the chrysotile reference material are used to calibrate beam dose (see 8.9.3.4), and both chrysotile reference and crocidolite reference grids are used to monitor EDS spectrometer performance (Section 8.9.2.3).

8.9.4.1.1. Qualitative Unknowns (Demonstration of Competency)

Purpose: To gauge analyst accuracy in fiber identification.

Responsible Party: Each analyst.

Timing & Frequency: every 120 days, as prompted by the LIMS

SOP: past NVLAP unknowns have been placed randomly in a grid box marked "qualitative standards." Each month, each analyst chooses one grid to identify.

Data Form: Qualitative Standard form, Figure 8.9.4.1; also documented in LIMS

Record Storage: Qualitative Standard file, TEM drawer.

Summary & Review: cumulative % correct is calculated in the QA report.

Out-of-Control: < 80% correct; if OOC, an analyst must continue to identify more until the % is >80.

8.9.4.1.2. 1876b Counting Reference Standard

Purpose: To gauge analysts ability to count using a set of counting rules.

Responsible Party: Each analyst.

Timing & Frequency: yearly, as prompted by the LIMS

SOP: 9 grids from the 2000 prep of 1876b are stored in a small blue grid box in slots D1-D4 and E1-E5 (do not use the 1990 prep stored in slots A and B). Review 1876b counting rules – they are different than AHERA and give rise to more structures. Count 2 go's on each of 6 randomly chosen grids for a total of 12 go's. The highest and lowest go counts are dropped and an average calculated from the remaining 10. Alternate: starting 1-1-2012, count using AHERA counting rules, and use grids from either the "A" row or the "B" row (do not mix A and B). We will calculate acceptance ranges.

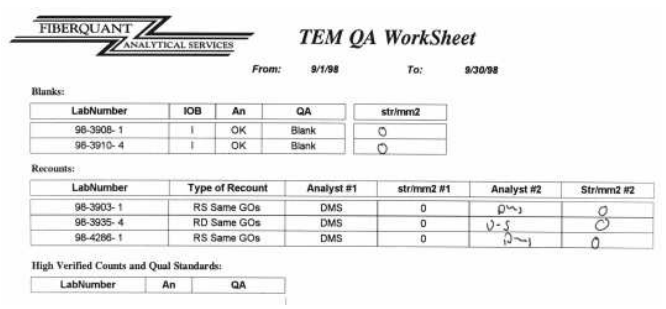
Data Form: Record counts on the Verified Counting Form; perform calculation on the 1876b Worksheet. Also document in LIMS the date completed.

Record Storage: SRM 1876b file, TE Counting drawer.

Summary & Review: compare to acceptable range as given for SRM.

Out-of-Control: < 80% of the 95% range given in instructions: 11.8 – 23.9 str/0.01 mm. Historically, 1876 has presented problems for analysts to score high enough. I believe this is because the analysts use a hybridization of AHERA and the 1876 rules. Since it doesn't affect AHERA counts, no action for OOC except for the analyst to review the rules before counting next time.

Figure 8.9.4.2a TEM Blanks & Recount Worksheet



FIBERQUANT ANALYTICAL SERVICES

TEM QA WorkSheet

From: 9/1/98 To: 9/30/98

Blanks:

LabNumber	IOB	An	QA	str/mm2
98-3908- 1	I	OK	Blank	0
98-3910- 4	I	OK	Blank	0

Recounts:

LabNumber	Type of Recount	Analyst #1	str/mm2 #1	Analyst #2	Str/mm2 #2
98-3903- 1	RS Same GOs	DMS	0	DMS	0
98-3935- 4	RD Same GOs	DMS	0	VS	0
98-4286- 1	RS Same GOs	DMS	0	DMS	0

High Verified Counts and Qual Standards:

LabNumber	An	QA

8.9.4.2. Recounts

Purpose: Recounts provide day-to-day verification of the counting procedures, and generate precision data. Six different variations of replicate counts are routinely performed as part of our 10% QA counting. These are

1) same sample, same grid openings as original count and same analyst as original analyst (RS same GO); once for every 50 TEM samples analyzed

Figure 8.9.4.2b CV vs. str/mm2 for Same GO Recounts

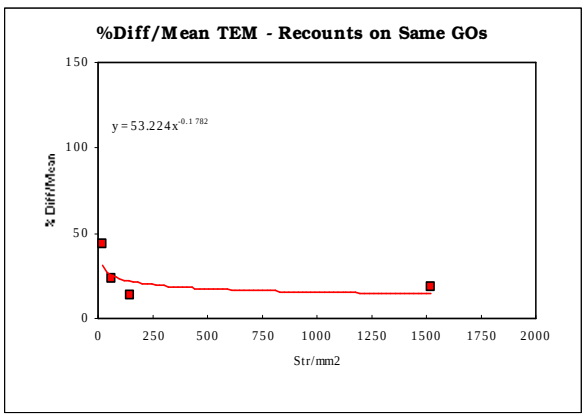
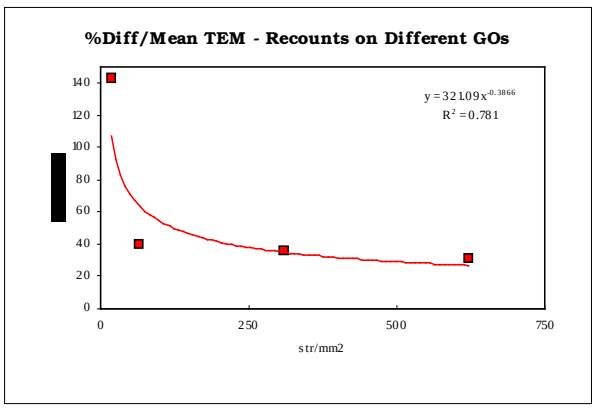


Figure 8.9.4.2c CV vs. str/mm2 for Diff GO Recounts



2) same sample, same grid openings as original count but a different analyst than the original (RD same GO); 1/50. This type of recount is identical to a verified count on a low level filter, and is used to satisfy the 80% of verified counting that can be performed on low level filters.

3) same sample, using different grid openings than the original count, and same analyst as the original count (RS diff GO); 1/200.

4) same sample, using different grid openings than the original count but a different analyst than the original count (RD diff GO); 1/200.

5) different sample prep, same analyst as original; naturally the grid openings are different (DS); 1/200.

6) different sample prep, different analyst as original (DD); 1/200.

Responsible Party: all analysts.

Timing & Frequency: assigned by computer at log-in, according to above schedule.

SOP: recounts on the same prep by the same analyst are performed immediately after the analysis. Different analyst recounts and different prep recounts are counted one month in arrears. Normal count sheets are used, and the sheets are stapled to the sample count sheets.

Data Form: normal count sheets.

Record Storage: stapled to the sample count sheets and stored with them.

Summary & Review: all recounts are summarized on the form shown in Figure 8.9.4.2a. Recount values are entered into the LIMS – the original analysis is entered automatically into the recount database. Recounts are there divided into two natural divisions: recounts of the same grid openings and recounts of different grid openings. The results of these two groups are plotted vs. str/mm2 as shown in Figure 8.9.4.2b and c.

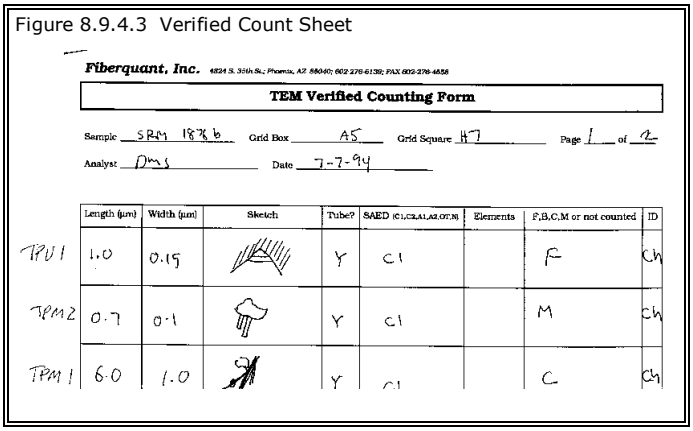
Out-of-Control: control on recounts is statistically based on the CV vs. str/mm2 charts: the current controls are:

	Same Grid Openings	Different Grid Openings
<40 str/mm2:	201%	400%
40-100 str/mm2:	50%	180%
>100 str/mm2:	50%	100%

8.9.4.3. Verified Analyses

Purpose: to provide analysts with feedback from other analyst(s) as to their identification and counting efficiency, and second, to enable a quantitative measure of analyst accuracy to be made, by calculating the percentage of true positives, false positives and false negatives. Since the number of fibers seen in the typical TEM fiber count is so small, the only way to determine whether a call made by a novice analyst is correct or not is to have an experienced analyst view that same exact structure, or have a panel of analysts come to a consensus about that same exact structure. This type of re-analysis, structure by structure, is called a verified analysis.

Figure 8.9.4.3 Verified Count Sheet



Fiberquant, Inc. 4834 S. 35th St.; Phoenix, AZ 85040; 602 276-6139; FAX 602 276-4858

TEM Verified Counting Form

Sample SRM 1876b Grid Box A5 Grid Square H7 Page 1 of 2

Analyst DMS Date 7-7-94

	Length (µm)	Width (µm)	Sketch	Tube?	SAED (C),CS,A1,A2,OT,N	Elements	F,B,C,M or not counted	ID
TPV1	1.0	0.15		Y	C1		F	Ch
TPM2	0.7	0.1		Y	C1		M	Ch
TPM1	6.0	1.0		Y	C1		C	Ch

Responsible Party: all analysts.

Timing & Frequency: low level 1 GO/50 GOs analyzed; high level 1 GO/500 GOs analyzed.

SOP: Two types of verified counting are performed, low level and high level. The low level is performed on day-to-day samples, to test, under normal conditions, our accuracy. Because not many fibers will be seen this way, normal counting procedures and count forms are used. High level verified counting, on filter loadings of 500-2000, is also performed. The number of fibers seen on these counts requires the use of a special form. Additionally, analysts must draw the structures observed. Usually, the grid is kept in the TEM and the GO is counted consecutively by each analyst. In both loadings, the structures are matched (reviewing the structure in the TEM if necessary), and each analyst is assigned true positives, false positives and false negatives for the GO. The procedure is fully described in NISTIR 5351: *Airborne Asbestos Method: Standard Test Method for Verified Analysis of Asbestos by Transmission Electron Microscopy - Version 2.0.*

Data Form: Figure 8.9.4.3

Record Storage: TEM file "Verified Counts".

Summary & Review: number of high and low verified GO's counted for the month, and cumulative true positives, false positives and false negatives are reported each month in the TEM QA monthly report.

Out-of-Control: cum. true positives <80%; cum. false positives >10%, or false negatives >20%.

8.9.4.4. Inter-laboratory Analyses

Purpose: to validate our prep and counting procedures by analyzing the same filter or grid openings as another lab.

Responsible Party: Larry S. Pierce, or other analyst, as assigned by Larry S. Pierce.

Timing & Frequency: 2x per year

SOP: Every batch: send 2 grid for verified counting of 4-6 gos.

Data Form: normal count and verified count sheets.

Record Storage: TEM File "Interlab"

Summary & Review: results summarized in TEM QA monthly report.

Out-of-Control: no strict control limits. However, consistent lower or higher counts than other lab would be investigated.

Current Exchange Lab: Forensic Analytical Specialties, Hayward, CA.

8.9.4.5. Proficiency Samples

Purpose: to retain NVLAP accreditation, to validate all parts of the TEM analysis process.

Responsible Party: Larry S. Pierce

Timing & Frequency: as supplied

SOP: varies, instructions come with the samples. 1) The analyses cannot not be contracted out to another laboratory. 2) Samples are kept as standards or training materials. 3) As much as possible, all analysts participate (either all analyzing each sample, or alternating proficiency tests if only one analysis is possible), and 4) samples should be done as similar to client/customer samples as possible. 5) Each participating analyst performs their work alone, rather than by committee. 6) One set of results is returned to NVLAP. Which analysts results to be returned is determined randomly or alternatingly. 7) Do not discuss the results with other labs.

Data Form: varies, included with samples.

Record Storage: TEM File "NVLAP".

Summary & Review: results summarized in TEM QA monthly report.

Out-of-Control: determined by NVLAP.

Proficiency results are used to demonstrate 6-month analyst proficiency in TEM analysis counting.

8.9.4.6. Verification of Screen ED Calls/EDXA Spectra

Purpose: to ensure that analysts can correctly interpret diffraction patterns and EDXA spectra; to demonstrate that analysts can obtain and measure diffraction and chemical properties, and can draw proper conclusions from these data for the identification of asbestos *vs*. non-asbestos fibers.

Responsible Party: Larry S. Pierce.

Timing & Frequency: data collected during analysis; review is monthly.

SOP: As asbestos is observed, at least one photo is taken of the ED pattern of each type of asbestos observed on each sample set. In addition, each time the EDXA is used to confirm or identify a species, one hard copy of a typical spectrum is made and included in the report. The photos are later indexed and the confirmed identification is compared to the call originally made by the analyst on the screen. The spectrum hard copies are reviewed to check the conclusions of the analyst. Each call is stored in a LIMS database.

Data Form: input directly to LIMS.

Record Storage: hard copy diffraction negatives and/or EDXA spectra are stapled to original count sheets.

Summary & Review: current cumulative % correct calls for each analyst and lab are reported each month in the TEM QA monthly report.

8.9.4.7. Inter-microscope Analysis

Purpose: if more than one TEM is used for analysis, to ensure that the analysis and measurements from one microscope is the same as from any other.

Responsible Party: Larry S. Pierce.

Timing & Frequency: at least once.

SOP: At least 4 high level verified counts are performed where the two counts are performed on different TEMs. The comparison of structures observed must confirm that the same images and data are being gathered from all scopes, or indicate where differences lie. This procedure need not be repeated, as the other QA/QC procedures (magnification, resolution of inner channel in chrysotile, *etc*.) are sufficient to ensure correlation.

Data Form: verified count form.

Record Storage: verified counts file.

Summary & Review: As done - no chart.

8.9.5. Control and Corrective Action/ Analyst Proficiency & Deficiency

The general principle of quality assurance procedures is to keep the quality of the analysis high by meeting certain criteria. Therefore, if at any time, if any of the above criteria are not met or the analysis system is found to be out-of-control, be it calibration of equipment, or performance checks of either equipment of personnel, then the analyses must stop until the criteria are again met. For equipment, re-calibration, maintenance or repair may be required. For personnel, corrective training and re-certification may be required. For either, the occurrence of out-of-control results , the corrective actions taken and the return to control parameters must be documented before any client/customer samples are analyzed. The documentation is included in the monthly report, below.

Analyst proficiency is best determined subjectively, but certain benchmarks must be maintained: 1) the analyst must maintain averages on SRM 1876b that are within the stated tolerances for the standard; 2) the analyst must maintain a cumulative average of >80% true positives, and <5% false positives during verified counting; 3) the analyst must maintain a cumulative average of >80% correct diffraction screen calls, and >80% correct EDXA spectrum calls. A drop below these benchmarks requires cessation of client/customer sample analyses and corrective procedures or training. Other factors which may be considered for possible corrective procedures would be 1) consistent mis-identification of qualitative standards; 2) poor proficiency test performance; 3) non-adherence to sop's; 4) poor prep or blank results. Since all these are on-going demonstrations of proficiency, a TEM analyst has no single demonstration that must take place every 6 months, as in other analytes.

Any corrective actions or remedial training should be documented in the personnel file of the analyst, and on the monthly QA report. Any out-of-control situations should be documented on the QA monthly report.

8.9.6. Monthly QA Summary

A summary of QA activities is to be produced which covers those samples received during each calendar month. A full discussion of the contents of monthly reports for the lab is given in Section 13.

8.9.7. Uncertainty

For the purposes of reporting to client/customers, the overall uncertainty for TEM analysis is defined (for Fiberquant) as the mean relative percent difference for recounts in which different grid openings were counted than during the original analysis. This value is plotted vs. structure loading for each QA Monthly Summary.

8.9.8. Record Keeping

The written records of lab activities are listed below. The locations of current records are also given. Records older than one year may be archived in boxes and stored in the back mezzanine level.. These records are to be held secure and confidential. The original client/customer has full access to data and reports relating to his samples, of course. But if other than the original client/customer asks for information about the samples (e.g., a contractor wants to know whether samples taken by a consultant passed or failed), then the original client/customer is first contacted to obtain approval (verbal is required, written desirable) to release the data. Usually, the client/customer will prefer to release the information himself.

Hard copies are kept of all forms previously described, work orders, reports, and chains-of-custody. Computer records are also kept of jobs, sample and lab numbers and the raw data associated with them. Hard copies are kept on site in filing cabinets. Computer records are kept on hard drive, backed up daily on tape on site, and backed up weekly off site. Computer records are archived on and off-site yearly. All records are chronological unless stated otherwise.

RECORD	LOCATION
Job Log	LIMS, hard copy in log in room
Sample Submittal Form	Office File
Invoice	Office File

TEM Sample Log	LIMS
TEM Filter Analysis Count Form	Tech File
Report (Detailed and Summary pages)	Office File
Grid Opening Measurement	Calibration Binder
Optical Microscope Calibration	LIMS Equip. File
EDS Performance Calibration (+Chart)	Tech File
TEM Blank Results (+Chart)	Monthly Summary
TEM Beam Dose Check	Tech File
TEM Magnification Calibration.(+Chart)	LIMS
TEM Camera Constant Calibration (+Chart)	LIMS
TEM Minimum Beam Size Measurement (+Chart)	LIMS
TEM Monthly QA Report	Tech File

8.10. Lab Characterization for TEM

Three analysts currently perform TEM analysis. All have been documented to be proficient according to the criteria established above. Summarizing from past discrepancies intralab and interlab, the following conclusions can be made:

1) fiber identification is >99% accurate on client/customer samples

2) agreement on structure assignments of complex structure groups is >90%

3) recounts are generally within +/-20%

4) at no time has a set of AHERA samples been erroneously failed or passed due to analytical error

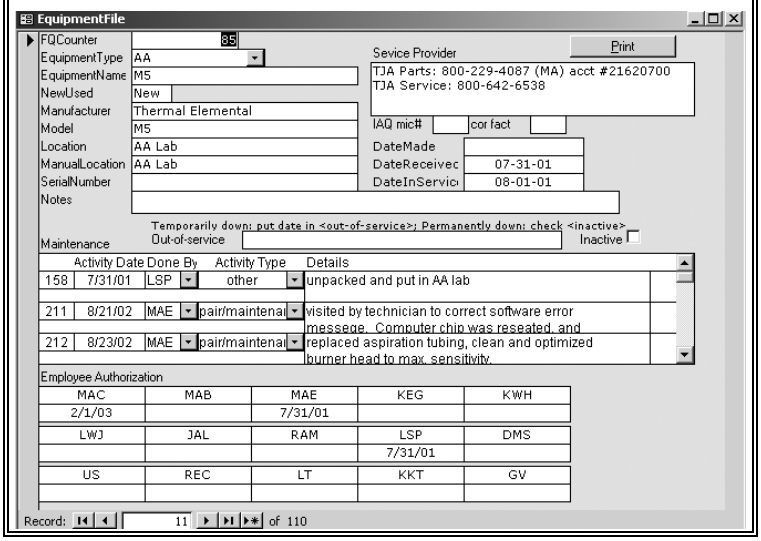
9. EQUIPMENT MAINTENANCE AND REPAIR

Each item of capital equipment brought into service is recorded on the LIMS form shown in Figure 9 and in some cases, a paper version. Each piece is uniquely identified on its form, if not by serial number, by location or usage. Maintenance and repairs are also recorded on this form as they occur. The forms are kept in the equipment file in the Gen. Tech drawer.

Maintenance records newer than 1999 are kept in the LIMS. Field service reports and papers associated with maintenance or repair are still kept in the files.

Policies of when to service and how to determine when an item needs service are dependent on the particular type of equipment, and the demands the laboratory places on it. Categories of equipment to be discussed are 1) stereomicroscopes, 2) compound microscopes, 3) the transmission electron microscope, 4) hoods and clean benches, 5) plasma asher, 6) carbon evaporator, 7) analytical balance, 8) computers, and 9) AA.

Figure 9 Equipment Form



Equipment requires written authorization to use. Employees are authorized 1) if they need to use the equipment and 2) after training on the equipment. Training may be short (as with pipetters) or continuing (as with computers) or extensive (as with a TEM). Short training usually is not documented as such, except as a bullet item in method training documents. Authorization is documented at the bottom of each equipment record page in the LIMS. Equipment requiring authorization to use is indicated by a tag or note on the equipment stating that authorization is required to use and where to locate who is authorized.

9.1. STEREOSCOPES

The stereoscopes are used for the initial examination of bulk samples. They are low power scopes more prone to mechanical failures than optical degradation. They are serviced during the yearly microscope service by Bender Associates. If, prior to a service, the image is thought to be degraded, an intermediate service call will be made. Mechanical adjustments or lubrication may be made throughout the year by the Lab Manager. Light sources are adjusted and bulbs changed by the analysts, as required.

9.2. COMPOUND MICROSCOPES

Compound microscopes are used for PCM analysis, PLM analysis and for TEM grid opening measurement. Their exposed optics (eyepiece and objective exterior surfaces) are examined and cleaned once per week or more often as smudges or debris is noted. Surfaces are cleaned with Kodak cleaning fluid, or ethanol. The analyst is responsible for keeping the scope clean.

Alignment procedures for each analysis type are documented in the SOPs for each analysis (Sections 6,7,8).

Yearly the scopes are dismantled, cleaned and lubricated by Bender Associates. If problems are noted between scheduled maintenance, at the Lab Managers discretion, a service call will be ordered. Possible problems would be 1) mechanical breakdown, 2) rough mechanical action, 3) insufficient resolution as indicated by the phase resolution test slide, 4) dim or variable light source.

9.3. TRANSMISSION ELECTRON MICROSCOPE

The routine maintenance procedures for the TEM are discussed in Section 8, and will not be repeated here. Non-routine procedures are performed by reference to the technical manuals for the instrument, or are referred to Thomas Technical Services, a TEM service company.

9.4. HOODS AND CLEAN BENCHES

Hoods, which draw in over a surface, are used in the bulk analysis area, AA prep, Mycology area, and the TEM prep area. A clean bench, which blows air out over a surface, is used in the TEM prep area.

The clean bench contains a pre-filter, which is changed every 3 months or sooner if found to be dirty.

For all hoods or clean benches, the fan operation and loading of the HEPA filters is monitored by in-hood velocometers. The air velocity of PLM hoods is checked and documented monthly. The face air velocity of the AA fume hood is checked and documented every six months. If air velocity drops to <80 ft/min, the HEPA filter may be loaded and need changing out. The clean bench HEPA can be changed normally, but the bulk hood HEPAs must be sealed before removal, since they are contaminated with asbestos. The TEM exhaust hood contains no filters, so if its velocity changes, some other cause is responsible. The Biological Safety Hood must be certified to function yearly by an outside agency.

The clean bench performance efficiency is monitored by the prep blanks mounted within it. Should blank readings become high, a service call to the supplier or equivalent will be made. The performance efficiency of the bulk hoods are monitored by the monthly air samples taken in the bulk area. If asbestos fibers are found, the hoods will have service as above.

9.5. PLASMA ASHER

The performance of the plasma asher is checked monthly by calibrating the amount of MCE filter that is ashed per time. A comparison to previous performance checks is given in the QA monthly report. Possible causes of performance degradation are 1) vacuum leaks, and 2) weak RF tubes. If the problem cannot be solved in house, the unit must be sent to the manufacturer for service. After service or change in tubes or operating parameters, re-calibration and possibly multiple calibrations to establish consistency, is required.

9.6. CARBON EVAPORATOR

Routine maintenance of the carbon evaporator consists of cleaning the bell jar (described in Section 8), and changing the oil in the mechanical and diffusion pumps at ~1 year intervals. Break-downs are dealt with as they occur by consulting the manual or Denton.

9.6.1. Preventative Maintenance: oil change (Denton Auto)

The equipment must be turned off, and the diffusion pump must be cold, water supply off.

1. Use a 9/16” wrench to disconnect the two copper tubing water supply lines from the diffusion pump. Capture any outflowing water in a small plastic bowl and discard it.
2. Use a 7/16” wrench to disconnect the four bolts on the lower u-shaped arm of the diffusion pump.
3. Use a ½” wrench to disconnect the four bolts which attach the top of the diffusion pump to the bottom of the vacuum chamber.
4. Break most of the vacuum but not all using the vent toggle. With one hand each supporting the top and the lower u-shaped arm of the diffusion pump, carefully slide it sideways to break the remaining vacuum. The diffusion pump is heavy, so position yourself properly before doing this step.
5. Remove the vane insert from the main body of the diffusion pump and wipe it down with paper towels. For proper function, the bottom of the outer wall of the vane insert must protrude below the bottom of the small diameter inner tube. To adjust, insert a sturdy screw driver into the inner tube and tap the grip end gently on the floor until the outer wall is in the proper position.
6. Pour out the old oil from the diffusion pump and discard it into the wast oil containers. Clean the interior of the diffusion pump using paper towels.
7. Fill the diffusion pump with 100ml of new DS-7040-500 silicone diffusion pump fluid. More than 100ml will contaminate the bell chamber and the samples with oil.
8. Install the vane insert all the way into the bottom of the diffusion pump, ends of the small wings pointing upwards.

9. Check the o-rings of the two connections of the diffusion pump for condition and proper position. Reverse steps 4,3,2 and 1 to re-attach it.

9.7. ANALYTICAL BALANCE

The analytical balance is used for weighing filter material in calibrating the plasma asher and in AA analysis. A calibration weight is present in the chamber and calibration should be checked monthly. The balance is cleaned and serviced once a year (see equipment file for contractor).

9.8. COMPUTERS

Data are manipulated and reports printed using IBM compatible micro-computers. Calculations are checked according to the procedures described in each SOP (Sections 6,8). If the mechanics of the systems fail, they will be repaired in house or replaced. LIMS or other software problems are solved by the LIMS Specialist.

9.9. AA

Checks are made of alignment and sensitivity before each sample run. Should the instrument fail to attain usual sensitivity, the full alignment procedures should be performed, as listed in the technical manual, which is stored in the instrument bench. Continued mal-performance will be referred to the manufacturer's service department.

9.10. Incubators

Routine maintenance consists of cleaning the interiors and exteriors as necessary and ensuring that the doors close and latch properly. Break-downs are dealt with by replacing the units with new ones if necessary.

9.11. Biological Safety Cabinet

The biological safety cabinet is used when handling potentially infectious agents such as fungi. Routine maintenance consists of cleaning the work surface before and after analytical sessions using a disinfecting agent such as chlorine bleach. The cabinet is certified to the NSF 49 Standard once per year by C-Scan Technologies. Break-downs and trouble shooting are dealt with by C-scan technologies.

9.12. X-ray Fluorescence analyzers

The RMD LPA-1 analyzers are maintained exclusively by the factory at RMD. Physical wipe tests of the instruments for radioactive leakage are performed once per year by either Radiation Safety Engineering or by the RMD factory depending on whether that particular instrument is being serviced that year. The calibration of the instrument is performed at the beginning and end of each inspection and at least every four hours in between if the inspection takes longer than 4 hours to complete.

9.13. Bios Dry-cal Defender 510 Primary Flowmeter

Annual maintenance and calibration of the unit are performed at the factory. Break-downs are dealt with exclusively by Bios at their factory.

10. SAFETY PROCEDURES

The safety section of the quality manual has been expanded to include all aspects of the Chemical Hygiene Plan as required by OSHA. The plan and associated safety paperwork is stored in the safety file cabinet.

11. WORK PRACTICES

11.1. Work Practice #AAS-1 Running Atomic Absorption Samples

Revised: 06/22/99 Printed: 03/05/13

AA Turn-on and set up

M5

1. -Turn AA on by switch located on the right-rear side of the instrument.
2. -From the home screen, select **Element Sets** option.
3. -Use arrow keys to select which element to be analyzed.
4. -Select **Edit** option to make sure the proper parameters have been set, according to the element to be analyzed, such as wavelength, band-pass, etc.
5. -Select the **Next** option to continue setting parameters using flame parameters screen.
6. -Check to make sure the flame parameters are set to their proper settings.
7. -Select the **Next** option to continue to **Sample Parameter** screen. These parameters are only used with an auto sampler. Since one will not be used just press the **Next** option to move to the **Calibration Parameters** screen.
8. -Change the **Calibration Type** to **None**, and select the **OK** option to return to **Set Up** screen.
9. -Select **Set Up** option to go to list of set up choices.
10. -Select **Set Up Lamps** option.
11. -Move appropriate lamp into beam path using **Move To** option.
12. -Highlight lamp to be used.
13. -Turn Lamp on and D2 on.
14. -Select **Done** when complete to return to set up screen.
15. -Select **Set Up Spectrometer** option.
16. -Select **Set Up Optics** to optimize lamps.

17. -Select **Done** when complete this will take you back to the **Set Up** screen.
18. -Turn Flame on by holding **flashing** ignition button on left front side of the instrument.
19. -From the **Set Up** screen, select **Set Up Flame** option and select the **Autozero** option.
20. -Select **Done** when complete this will take you back to the **Set Up** screen.
21. -Select **Done** this will take you back to the **Parameters** screen.
22. -Select **Home**, this will take you back to the main menu screen.
23. -Select **Run Analysis** to begin analysis and follow on screen instructions.
24. -When finished with analysis, remove aspiration tube from water, and press **Red** flame off button to turn off flame. Be sure to look away from flame when this is done.

To analyze a different element other than Pb

25. From the Home screen, select Run Analysis. This takes you to the Setup Method screen.
26. Select Next, this will take you to the Method Element Sets screen. The element you want to analyze for must always be first on the list; by default it is Pb.
27. Move the highlight bar to the element on the list you wish to analyze for, then select Remove.
28. Move the highlight bar to the top of the list and select Insert. This takes you to the Select Element Set screen.
29. Move the highlight bar to the element you wish to choose and press OK. Now the element you selected should be at the top of the Method Element Sets screen.
30. Press OK and begin analysis.

Turn-off

1. Aspirate DI water for at least 5 minutes.
2. Remove tube from the water, let the last water go through the tube
3. Press <Flame Off> button
4. Press <Stop Analysis> button on the central panel.
5. Press <Done> to return to the name screen.

Sample Run

1. AA data sheet should already have job numbers, lab numbers, sample weights, and extract volumes filled in for each sample to be run. QA samples, such as spikes, blanks, and std. additions should have their own lines on the page, as well as the CCV and CCBs..

2. Start from the top of the page and run each liquid in order, starting with low ppm std, med ppm std, high ppm std, *etc*.

3. For each solution aspirate the solution and record the three tests that the instrument does. Discard and repeat if not stable (std. dev is >~.002). Record a CCB every 10^{th} sample on its line on the form.

4. The form indicates when the CCV should be run. If its absorbance differs from the initial standards run by more than 10%, then all the samples after the last acceptable standard must be re-run after the problem (usually a clogged tube) is remedied and the standards read at the same level they did before. If the standards cannot be gotten to read as before, then a new batch must be made with the remaining standards, with its own distinct calibration curve.

5. If a sample absorbance is greater than that of the highest standard, set it aside for dilution, and continue with the other samples. If the absorbance is <1.000, then make a 10:1 dilution; if >1.000, then make a 50:1 dilution. Mark the dilution on the data sheet at this time to remind you which you want to make later. Make all your dilutions at one time (after the undiluted samples are all done) so the instrumental conditions do not drift for the remaining samples, and document the CCV for the undiluted samples before leaving the AA. For a 10:1 dilution use 1000 ul of sample in a 10 ml centrifuge tube and fill with DI water. For a 50:1 dilution use 1000 ul sample in a 50 ml tube. When dilutions are ready to roll, check the CCV again to make sure it is still within 10% of the original. The dilutions may have to have their own calibration curve.

5. When finished, double click one of the coefficients on the runs page to enter standards data and calculate the curve. Manually enter the calculated coefficients and lock the data. Then close the form to enter the sample data. Hit "Recalculate" to check the qc sample data against the control limits, then print the run sheet.

11.2. Work Practice #AAS-2 AA Sample Preparation

Revised: 08/02/01 Printed: 03/05/13

Paint Sample Preparation

1. Calibrate balance daily using 1 gm weight.

2. Break or grind sample, if possible, until the sample consists of many small pieces. Choose a sub-sample of some of these small pieces that appears to represent the sample. If multi-colored, make sure each color is represented in the sub-sample to the approximate extent it is represented in the whole sample. Weigh to .00001gm approx. 0.15gm of sub-sample representative of the sample; document on AA data form. Weigh directly into tared polyethylene 50 ml centrifuge tube. Homogenize paint first, if necessary, by crushing the sample in its bag, or by grinding in a mortar and pestle.

3. Add 6 ml conc. HNO3 and 1 ml 30% H2O2 and cap.

4. Heat at ~95 deg. C (oven or hot block) for at least 1 hour.

5. Bring volume in centrifuge tube up to 25 ml with DI water, cap, shake, then centrifuge.

MCE Filter Preparation

1. Place entire filter into a 150 ml glass beaker.

2. Add 6 ml conc. HNO3.

3. Heat at near boiling until filter is dissolved; solution may be colorless or straw colored.

4. Add 1 ml con. H2O2 three times at 1-2 minute intervals.

5. Cool.

6. Transfer quantitatively (at least 2 rinses) to a 15 ml centrifuge tube, add DI water to the 10 ml mark and shake.

7. Centrifuge if not clear.

Glass Filter Preparation

1. Cut 3/4" wide strip across folded width of filter, place in bottom of 150 ml beaker so that it lays flat.

2. Add 15 ml of 3 N HNO_3 (192ml conc. in 1 L). Top with watch glass

3. Gently boil (setting 3.5) for 30 minutes, adding more acid to keep at 15 ml.

4. Let cool.

5. Decant into 50ml centrifuge tube, leaving filter in beaker.

6. Add 30 ml DI water to beaker. Let sit for 30 min.

7. Decant into centrifuge tube, rinse beaker twice into tube, and fill up to 50 ml with DI water.

8. Let tube settle for about 1 hour or centrifuge and run immediately.

Wipe Sample Preparation

1. Place entire wipe in 150ml beaker.

2. Add ~30 ml conc. HNO3.

3. Heat at near boiling until wipe is dissolved; solution will be bright orange.

4. Add 1-2 ml H2O2 three times at 1-2 minute intervals.

5. Cool

6. Transfer quantitatively (at least 2 rinses) to a 50 ml centrifuge tube, rinse beaker into tube three times & add DI water to the 50 ml mark.

"GhostWipe" Wipe Sample Preparation

1. Place entire wipe in 150ml beaker.

2. Add 6-10 ml conc. HNO3.

3. Hold at room temperature until the vigorous reaction subsides.

4. Heat at near boiling until wipe is dissolved; solution will be bright orange.

5. Add 1-2 ml H2O2 three times at 1-2 minute intervals.

5. Cool

6. Transfer to a 50 ml centrifuge tube, rinse beaker into tube three times & add DI water to the 25 ml mark.

Soil Preparation

1. Pass soil through a >60 mesh sieve. Break up if necessary to get it through the sieve. Place the sieved material in a glass vial. Dry at 65 C overnight if necessary. Take the sub-sample from various parts of the vial to obtain a random, representative sub-sample.

2. Calibrate balance daily using 1 gm weight.

3. Weigh to .00001 g approx. 0.2 gm of soil into a tared 50 ml polyethylene centrifuge tube.

4. Add 6 ml conc. HNO3 and 1 ml 30% H2O2.

5. Heat at ~95 deg. C for at least 1 hour.

6. Bring tube up to 25 ml volume with DI water, shake, then centrifuge.

Sample Preparation for Multiple Elements

Perform normal digestion as above, but add a volume of conc. HCl equal to 10% of the final volume.

Waste Water Preparation

1. Place 25 ml aliquot into a labeled 150 ml beaker.

2. Add 15 ml conc. HNO3

3. Heat on hotplate ~15 min. until volume is ~30 ml.

4. Add 1-2 ml H2O2.

5. Cool, then transfer to 50 ml centrifuge tube and add de-ionized water to 50 ml.

6. Calculation: (conc (ug/ml) x vol x dil)/original vol.

7. Use spreadsheet XLS, not LIMS, for calculation.

11.3. Work Practice #AAS-3 AA Settings and Expected Sensitivities

Revised: 06/29/00 Printed: 03/05/13

Elem.	λ	Slit	mA	Aspir.	Target Sens (absorbance)	Max Linear	LOD	Notes
Pb	283.3	0.5	6	High	2 ppm = 0.60 (M5s)	15 ppm	.09 ppm	
Cd	228.8	1.0	5	High	.5 ppm = 0.250 (M5s)	1.0 ppm	.009 ppm	
Cr	357.9	0.5	7	Low	2.5ppm = 0.045 (M5s)	15 ppm	.08 ppm	
Zn	213.9	1.0	7	High	.3 ppm = 0.200 (M5s)	.6 ppm	.005 ppm	
Cu	324.7	1.0	5		1 ppm = 0.050	2.5 ppm	.0085 ppm	
Ni	232.0	0.15	10		1.5ppm = 0.050	2.0	.019 ppm	air has great effect
As	193.7	2.0	8		10 ppb = 0.050	15 ppb	.00012 ppb	

others to be added as needed.

11.4. Work Practice #AAS-4 Handling of Reagents and Standards

Revised: 06/22/99 Printed: 03/05/13

Reagent Receipt

1. Record all reagent or LCS receipt in the AA logbook, including source, date, expiration date, type of reagent.

2. Is the reagent what was ordered, in the grade needed? If not, return and obtain correct type.

3. Use manufacturer expiration dates, but assign an expiration date if none is present: 1 year for 1000ppm reagents, 3 years for digestion chemicals, 10 years for dry chemicals. Also record data in the LIMS form "AA Calibration Standards"

4. Place reagent in an AA cabinet, acid cabinet or other authorized location.

Reagent Check

1. Make up a blank (diluting if necessary to the concentration normally used. Record a n.d. blank on the reagent log "notes". Reject a non n.d. blank material.

Working Standards Makeup

1. Check the expiration date of the Calibration and ICV concentrates. Do not use out of date concentrate.

2. Working standards are to be made fresh weekly; do not use if over 6 days old.

3. Six working standards are made: 4 of varying concentrations that will be used to construct the calibration curve and two check solutions.

4. Mark each centrifuge tube with the solution analyte (element), use (Std, ICV), date of preparation, date of expiration (7 days from date of preparation), and analyst preparing the standards.

5. Write in AA Logbook the same information as in #3, but also add the FQ numbers of the concentrates used, and reference to this SOP.

6. Add 1 ml HNO3 (for stability) and the following to a clean 50 ml centrifuge tube, then fill to mark with de-ionized water and agitate..

Element	Reporting Limit Cal. Standard	Low Cal. Standard (to be near level of concern)	Med. Cal. Standard	High Cal. Standard	ICV same pipette as Cal. Standards
Pb	**0.13ug/ml**: 313ul of the Medium (10 ug/ml) Cal. Standard for 25ml final volume (188ul for 15ml; 125ul for 10ml)	**2 ug/ml**: 100 ul of 1000 ug/ml Calibration concentrate	**10 ug/ml**: 500 ul of 1000 ug/ml Calibration concentrate	**15 ug/ml**: 750 ul of 1000 ug/ml Calibration concentrate	**2 ug/ml**: 100 ul of 1000 ug/ml ICV concentrate

ICV Concentrate Preparation

1. Same as *Working Standards Makeup*, above, but made from 1000 ppm conc. from a supplier other than the one used to prepare the working standards.

11.5. Work Practice #AAS-6 Checks of AA Data

Revised: 03/09/98 Printed: 03/05/13

The analyst will check the following items:

Absorbance of ICV is within 10% of the matching standard.

First standard is within 10% of the expected sensitivity.

Continuing calibration standards are within 10% of the initial value.

Continuing calibration blanks are .000±.001.

Method blank is <0.004.

Coefficient of x2 in the parabolic calibration curve is <.0005.

Correlation coefficient >.995.

If computer does not already do it, plot spike yields, duplicate %diff/mean, and LCS values on the corresponding control charts. A quality control sample is out of control if it lies outside the out of control limits or if two consecutive samples lie in the warning area of the control chart.

Calculate the concentration of one sample by hand to check the calibration curve coefficients and document check by initialing "ug/ml check" on the AA Run Results sheet.

Calculate the result of one sample by hand to check proper worksheet calculation and document check by initialing "calculations check" on the AA Run Results sheet.

Initial and date any value that has been changed.

Check ml, dilution, absorbance readings, weights or volumes on spreadsheet.

Document check by initialing and dating the data sheet.

Review of AA data

A second analyst will review the following:

Check worksheet data (ml, dilution, absorbance, and weights, volumes or areas) against values entered into AA Run Results.

Calibration curve coefficients entered properly.

Quality control values in control.

Check spreadsheet results against printed report results.

Document check by initialing and dating "Reviewed by" on the work order.

11.6. Work Practice #AAS-7 Procedures for the Hydride Generator

Revised: 06/15/99 Printed: 03/05/13

Obsolete: do not use until SOPs are changed for M5 AAs.

Turn on AA:

Turn on AA power and exhaust fan.

Adjust wavelength and slit width for element of choice (As = 193.7nm and 1.0); install lamp if necessary.

Press [Mode] and then from the mode screen press [1][Enter] to select the element. Next, press [33][Enter] to select As.

From the mode screen press [3][Enter] to chose the background correction. Press [4][Enter] to select A-bkg (S-H).

From the mode screen press [5][Enter] to chose the statistics. Press [3][Enter] for the number of runs. Press [1][Enter] to choose Mean, SD, RSD.

From the mode screen press [9][Enter] to exit the mode screen

Press [Int] to select the integration time. Press [1][Enter] to select Auto. Press [5][Enter] to select an integration time of 5 seconds. Press [0][Enter] to select a 0 second delay.

Set High Voltage to a setting of 900.

Flip the Signal/Bkg switch to Bkg. Turn the Bkg portion of the Hallow Cathode knob until the energy is approx. 0.6 (Current $\cong$ 2.0). Switch from I to Io and make sure that both beams are in the green part of the Energy scale.

Flip the Signal/Bkg switch to Signal. Turn up the lamp current to match the Energy of the background. Switch from I to Io and make sure that both beams are in the green part of the Energy scale.

Press [A/Z][Read] to zero out the reading.

Warm up the electronics for approximately 30 minutes before analyzing samples.

Hydride Generator Set-up:

Place the metal cell holder onto the burner head.

Place the quartz cell into the holder and rotate the cell towards you until the intake is as far away from the flame as possible.

If there is any liquid in the tubing labeled 'gaseous hydride', drain it into the waste bottle.

Attach the tubing labeled 'gaseous hydride' to the intake of the quartz cell. Make sure this connection is secure before starting the analysis. DEADLY ARSINE GAS WILL BE GENERATED IN THE ANALYSIS. In order for the analysis to be carried out in a safe manner the gas must not be introduced into the air before reaching the flame. Once in the flame, the gas is burned and is no longer in this deadly form.

Adjust the burner position so that the beam is traveling through the center of the quartz cell.

Place the tube labeled 'drain' into the waste bottle.

Light the flame on the AA and allow the instrument to warm up for about 10 minutes.

Turn on the Hydride Generator with the large red switch on the back of the instrument. Do not flip the small switch above it as this will cause the solutions to flow in reverse or stop the flow.

Set the argon flow rate to 1.0 SCFH.

Place the long tube in the middle into the 6N HCl.

Once the HCl is drawn up into the tube, place the long tube furthest away from you into the 2%NaBH4 solution. It is important that there is always enough HCl to react with all of the NaBH4 solution. If the NaBH4 solution reaches the mixing chamber before reacting with HCl, it could reach the waste bottle and react with the acid to form hydrogen gas. NEVER RUN THE NaBH4 SOLUTION THROUGH THE HYDRIDE GENERATOR WITHOUT THE HCl SOLUTION.

Place the short tube into the DI water used as a blank. This short tube is the tube used to deliver the sample.

Hydride Generator shut-down:

NaBH4 solution is unstable. Therefore, any remaining solution must be ran through the hydride generator to react with HCl.

Make sure that there is more HCl than NaBH4. Let the hydride generator run until all the NaBH4 is gone and hydrogen gas is no longer generated in the reaction chamber.

Remove the tubing from the NaBH4, HCl, and blank solutions. When there are no solutions left in the tubing, turn off the hydride generator with the large red switch on the back of the instrument.

Turn the knob that controls the argon flow rate to zero, and close the argon valve on the wall above the hydride generator.

Shut down the AA using the procedures for the Video 12E

Preparation of 6N HCl Solution:

250ml conc. HCl brought up to a volume of 500 mL with DI water.

Preparation of 2% Sodium Borohydride Solution:

NaBH4 solution is unstable. Make up a fresh solution on the day that the samples will be ran. Run any remaining solution through the hydride generator so that it can react with the HCl and so that the hydrogen gas generated can be burned-off.

Add 2g NaOH to 500ml DI water.

Add 10g reagent-grade NaBH4.

As wipe preparation:

1. Place sample in a labeled 150ml beaker.

Add 25ml conc. HNO3 to each wipe sample.

Heat on hotplate at a setting of 100 until the wipes are dissolved

Slowly add 3ml H2O2 taking care to avoid spattering that may lead to sample loss.

Add 5ml HCl.

Reduce volume to approx. 5ml (hotplate setting approx. 130) and remove from hotplate.

Add 5g urea, 1g L-cysteine, and 20ml HCl.

After effervescence subsides place samples on hotplate at a setting of approx. 60).

Remove samples from hotplate, transfer to a 50ml centrifuge tube rinsing beaker 3 times, and bring up to 50 ml with DI water. (Cooling samples completely can cause crystals to form. If this occurs heat on the hotplate until the crystals are dissolved.)

Make 10:1 dilutions of all samples.

11.7. Work Practice #AAS-7 Procedures for adding an Element

Revised: 08/01/00 Printed: 03/05/13

Things to do before analyzing client/customer samples for a new analyte

1. Make working standards (4) and ICV (1). Place the instructions in AAS-4. Guess at level for lowest standard.

2. Run calibration curve. Use manufacturers recommended wavelength, instrumental settings. Write down aspiration rate, abs units observed on standard 2, etc. Place these in the chart in AAS-3.

3. Compare observed sensitivity with manufacturer's suggested. If too low, adjust parameters to achieve decent sensitivity.

4. Make a run consisting of 3 spikes and 4 LCSs and analyze. Values must be within 20%.

5. Repeat 4 until 4 runs in a row with no OOC are obtained.
6. Do linearity and MDL studies.
7. Set reporting limit and lowest standard level based on MDL.

11.8. Work Practice #GEN-1 Sample Log-in

Revised: 07/08/2002 Printed: 03/05/13

1. Accept or reject the samples from the client/customer as discussed in Chapter 5.

Mark problems in [condition] when entering samples

2. Start LIM program, if not running. Choose then choose New Job - fill in job info (at least all in red

3. When done inputting job data click [Samples] to enter sample data, one at a time.

4. Print all reports that LIMS previews (e.g., work order, count sheets, job label, sample labels). Paste sample labels on each submitted filter cassette (not necessary to write lab numbers on bulk sample bags).

5. Contain the samples in a large bag, if not already in one. Paste Job Label on bag, or write job number and client/customer using a sharpie.

6. Sign and date client/customer chain of custody form, if present. Copy, giving original back to client/customer and stapling copy to Sample Submittal Form.

11. Deliver: -PCM air samples to PCM sample prep rack

-TEM air/bulk samples to TEM sample box and let analyst know

-PLM bulk samples to bulk area storage cabinet

-AA samples to AA lab bench sample boxes

-Mold samples to mold optical lab; culturables to an analyst.

11.9. Work Practice #GEN-2 Quality Procedures for the Log-in Clerk/Receptionist

Revised: 03/10/93 Printed: 3/5/13

1. Log incoming jobs into the computer.

2. Route samples to correct location, keeping bulk samples out of the TEM area.

3. Keep records of invoices, completed sample submittal sheets, reports and report and sample disposition sheets.

4. For outgoing samples or reports, fill in sample/report disposition sheet, having agent sign for items.

11.10. Work Practice #GEN-3 Air Quality Checks

Revised: 02/24/94 Printed: 03/05/13

QUARTERLY

1. Collect a 1200 L air filter sample on 0.8 MCE from <u>one</u> of the following locations: PCM prep room, PLM bulk area, or reception area/sample storage, TEM prep room. Analyze using 7400A, except TEM- analyze by TEM. Collect a 1200L air sample during AA operation; analyze using AA.

2 Change lab and office air return filters.

YEARLY

1. Change the TEM clean bench pre-filter.

2. Check the air velocity in TEM exhaust hood, TEM clean bench using vanometer.

3. Check xylene and toluene in bulk area using Drager Tubes.

4. Check acetone in PCM prep using Drager Tube (during mounting)

11.11. Work Practice #GEN-4 Gravimetry for Nuisance Dust (Sartorius and Electrobalance)

Revised: 05/16/02 Printed: 03/05/13

1. Samples have been collected on 0.8 PVC dual filter cassettes (two filters per cassette, matched to 0.02 mg)
2. Dry the sample (with the top stopper removed) for at least 2 hours in the small dessicator near the balance.
3. Remove filters from cassette – they will be stuck together.
4. Using needle-sharp forceps, tweeze filters apart without ripping or damage.
5. Zero balance. *Sartorius*: Push zero button. Make sure it is stable and reads 0.00mg for at least 30 sec. *Electrobalance*: set up balance for "A" tray at the 20 mg limit. Unlock the collar around the fine zero knob, and

adjust as needed until it reads 0.000mg for at least 30 sec. Only use the coarse zero dial if the zero knob fails to return the balance to the zero setting.

6. For each day of use, weight the check weight (20 mg) and record in balance log book.
7. Remove static from top filter by holding over nuclear source (in balance) for 5-10 sec.
8. Weigh to 0.01mg (*Sartorius*) or 0.001mg (*Electrobalance*)
9. Repeat for bottom of filter.
10. Subtract bottom weight from top for net weight.
11. Weigh 3 times, alternating top and bottom filters. Document using the worksheet printed along with the work order.
12. QC. For each batch, minimum 10% or at least one filter, re-weigh as above the bottom and top filters of a sample. Net weight must be within 0.03 mg; if not, re-weigh entire series. Six-month proficiency is proven each time check weight is weighed (step 5 above)
13. Enter results into LIMS and print report
14. Detection limit = 3.14 x std dev. Of 7 blanks. Currently 0.05mg. If calculations to mg/m3 are to be done and some samples are nd, then use the detection limit (.05) as a hypothetical weight, divide by the volume to get a hypothetical value, then report "<" that value.

11.12. Work Practice #GEN-5 Amending Reports

Revised: 01/01/13 Printed: 03/05/13

To be used when a written report (not verbal results) has been sent to a client/customer, and the report has to be changed. The boiler-plate description of procedures, quality control, etc. are exempt from triggering amendment; in fact, those are a record of what was in place when the samples were analyzed, and should remain the same.

1. Go to the job page on the main LIMS form. Open <Samples>. Click <Unlock>. A purple form will open, having three buttons <Data sent – increment version and amended report entry>, <No data sent – do not increment version + no amended report>, and <No – Exit/Cancel>.
2. Having already determined that data was sent (you are, after all, in this Work Practice), click the left hand <Data sent – increment…> button. The version will be incremented automatically behind the scenes. A form will be opened called *Amended Reports*.
3. Fill in the form *Amended Reports*, detailing what is to be changed, who is changing, the date, *etc*. Close.
4. Change data or information to the make every aspect of the report correct. Put into the <Analytical Notes:> cell on the job page a brief description of exact what or which information was changed, why it had to be changed, date of change, *etc*. a repeat, essentially, of the information you just put into our *Amended Reports* form.
5. After changing the data or information for an amended report (including documenting that it was amended in the <amended reports> database), fill in your initials and date next to <Amended Report Saved:> on the paper *Work Order*.
6. Next, it only makes sense to review the job with a second pair of eyes, just like the first report, so pass the amended report/work order to a second analyst.
7. As usual, leave the printing for the review analyst (I think that is easier to remember – always print when you are reviewing).
8. The second analyst should check *the information that was changed, to make sure what was wrong is now fixed, *that the analytical note contains a description of what was changed and why, and then, finally, *that the version number is 2 or greater. If the version number is still on "1", the version number can be changed by merely clicking into its cell on the job page and changing the number. But if you are careful to choose the right button when unlocking your data, you will never have to change it on the job page.
9. If the version is wrong, then chances are the *Amended Reports* database was not updated either. In that case, click <Utilities> then <Amended Reports Database>, which will open it, last entry first. If a record of this amendment is not there, then document in a new entry that this report was amended.
10. Another way for a version number to be stuck on 1 is when you are only changing a job number or similar data that does not involve unlocking the sample data. This is too much like filling out the form in the first place, so through no fault of anyone, the version will still be at its previous number (probably 1), and there will be no record in the *Amended Reports* database. In that case, perform the steps in 5), above, except the one about complaining.

11. After the 2nd analyst check, fill in with initials and date and the current (as amended) report version in the respective blanks on the work order.

11.13. Work Practice #GEN-6 Retrieving or Changing Archived Data

Revised: 07/03/00 Printed: 03/05/13

1. Archives are located on the Server C: drive, under the sub-directory Archives. A second copy is on CD-ROMs in Larry's oak desk. Each archive has its own folder, named for the date that it was created. Inside the folder are fqdata (the file containing all the data) and fqlim or fqlim2000 (the program to present the data). A contemporary fqlim is included, since we may have changed the way data are used since the archive. Two computers are needed: *Computer #1* (to store the data) and *Computer #2* (with which to look at the data)

2. Copy the appropriate archived file fqdata.mdb to Computer #1/access/fqlim/fqdata/ directory. Any computer may be used as long as the path (directory names) are as above. Create the directories if they do not already exist.

3. Copy the associated fqlim.mdb or fqlim2000.mdb to the main c: directory of Computer #2.

4. Open "My Computer" on Computer #2.

5. Select the G: drive, then "disconnect" under the file menu. This severs the connection between the computer and *Server*.

6. Now use "network neighborhood" to open Computer #1; select its C: drive; then select <map network drive> under the <file> menu. Make sure that the new network drive connection is to be named *G*:. You may have to choose G. This now makes Computer #1 the server for Computer #2.

7. Open the archive fqlim2000 or fqlim by double clicking it under the C: drive of Computer #2. Do not use the desktop icon, since it is the latest fqlim, not the archive fqlim. Then use the program as normal to print a report or invoice. Do not change data unless Larry is present.

8. When done, reverse the actions, namely: disconnect the g: drive from Computer #2 and reconnect the server as the G: drive, and put back the CD ROM, if used.

11.13. Work Practice #GEN-7 Calibration Check of Thermometers

Revised: 12/22/12 Printed: 03/05/13

Locate NIST Traceable thermometer (FQ #120); usually kept in the AA pipette drawer

For each Thermometer to be checked:

1. Place traceable thermometer next to the thermometer

2. equilibrate for 1 hour

3. read both thermometers to 0.1 deg in deg. C.

4. calculate the actual temperature: [Actual Temp] = [Nist Thermometer reading] + [latest NIST Thermometer Correction Factor].

5. calculate a correction factor for non-Nist thermometer: Correction = [NIST Temp (corrected)] - [other temp]

6. document the check in the LIMS, using the correction factor from the traceable certificate: <QC><AA><Thermometer Cal> (form "tempcal")

7..Post the new correction factor in the area where the thermometer is used (thermometer number and its correction factor).

Check the following: PLM Lab thermometer (@25C), AA Lab Incubator 1 thermometer (@25 C), AA Lab Incubator 2 thermometer (@37C), AA Lab AA Oven thermometer (@95C). In control is +/- 2 degrees for 0-120C. If OOC, contact the Quality Control Officer for replacement or temporary correction factor.

11.14. Work Practice #GEN-8 Alignment of Optical Microscopes

Revised: 01/05/05 Printed: 03/05/13

Applicable to all microscopes. Microscopes are to be aligned each day of use

Interpupillary Distance Adjustment:

1. Place a specimen on the stage.
2. Focus the specimen
3. Adjust the binocular top eyepiece spacing, so that both the right and left viewfields become one.

Diopter Adjustment:

1. Rotate the diopter ring on the eyepiece that contains the reticle until the reticle design becomes sharp and clear
2. Place a specimen on the stage
3. Focus the specimen until it becomes sharp and clear through the eyepiece that contains the reticle (the sharp reticle will be superimposed on the sharp specimen)
4. Without changing the focus, turn the diopter ring of the other eyepiece until the specimen becomes sharp and clear through that eyepiece.

Centering and Sizing the Condenser Lens:

1. Rotate in the lowest magnification objective normally used for analysis (*e.g.*, 50x for micro).
2. Close the field diaphragm in the base to its smallest size.
3. Focus the diaphragm edge using the condenser focus knob (sharp may be indicated by a purple, rather than red or blue, color to the edge).
4. Bring the diaphragm image to the center of the field using the condenser centering screws.
5. Open the diaphragm until it is just barely larger than the field of view.

Centering Objectives (Additional for PLM scopes):

For Nikon scopes, objectives are each centered to the stage, which is not centerable.

1. Place a specimen on the stage and focus
2. Bring a small particle to the center of the cross-hairs.
3. Insert the two centering tools into the centering screws on the eyepiece being used.
4. Rotate the stage 180 degrees. The target particle will be displaced from the center of the cross-hairs.
5. Move the centering screws until the target particle is half-way back to the center of the cross-hairs.
6. Repeat steps 2-5 until no displacement is seen throughout 360 degrees of rotation.
7. Repeat for each objective.

Orientation of the Polarizer (Additional for PLM scopes):

1. Place anthophyllite alignment specimen on the stage and focus.
2. Insert the analyzer rod. Make sure the rotation of the analyzer is set to zero. Do not have any plates inserted (*e.g.*, red plate).
3. Rotate the polarizer to maximum black.
4. Check position of extinction. It must be 0/90 degrees exactly. If not, the analyzer is not positioned correctly (the microscope is improperly assembled or the analyzer is not set to zero).

Centering of Phase Rings (Additional for PCM scopes and PLM scopes having PCM):

1. Place a specimen on the stage and focus.
2. Insert phase contrast objective and its matching condenser ring.
3. Insert either the Bertrand lens (if present) or the telescope in order to observe the rings in the objective and the condenser.
4. Center the condenser ring to the objective ring using either the phase centering knobs (rotating condenser) or the phase centering tools (push-in condenser).

11.15. Work Practice #GEN-9 Purchase, Calibration, and Handling of Reference Standards, Reference Materials, and Reagents

Revised: 01/03/13 Printed: 03/05/13

The responsible party for the actions below is the Purchasing Agent/AA Supervisor with aid from the Lab Director or a Program Supervisor unless otherwise stated.

Preliminary:

Are you using a measuring device? A measuring device may be anything that gives a measurment or a number (e.g., balance, microscope reticle). Counting devices do not measure. If a measuring device is purchased, and cannot be sent out of the lab, then you will need to already have or purchase a corresponding reference standard in order to calibrate the measuring system.

Purchasing a Reference Standard

1. *Research* - Find the type or types of standards that can do what you require and their providers. The prospective standard does not have to be already traceable, but if you can find one, it may save time.

2. *Calibration Certificate* (AIHA 5.1 & 5.2) - Regardless of whether the standard comes with a traceability certificate or whether the item is sent out for calibration after receipt, the same rules apply before use: a) It must have a certificate of traceability (however named), b) the certificate must list the specific NIST material(s) or standard permanently residing at NIST to which it is traceable, c) the certificate must include the measurement result for the standard (*e.g.*, how long it is, distance between hash-marks and the uncertainty of that measurement result, and d) the measurement and uncertainty above must have been measured by a firm/calibration lab that has is accredited to 17025 by an accreditation body recognized by ILAC. This is proven by an associated accreditation certificate specifying 17025 and having an ILAC Logo (or equivalent words to that effect).

Calibration or Re-calibration of a Reference Standard

When to calibrate: a) If you have the item but it does not have certificates as in item #2 above, or b) you have a previously calibrated item that needs its regular re-calibration, or c) after an adjustment (physical change of the standard, *e.g.*, shaving a little weight off). Procedure:

3. Find the firm that previously calibrated the balance and its check weights in the LIMS <Approved Suppliers> Form.

4. Check via www or calling that they can perform the type of calibration you need with a certificate containing everything listed in (2) above. If not, find via www or calling a firm that can comply.

5. Go to a new page in the <Purchase Services> form under Procurement in the LIMS. If this firm does not show up in the drop-down list of suppliers, then close and first fill in a new <Approved Suppliers> form for them, and then start filling in a new <Purchase Services> page. Copy the current version of (2) above into the field that asks for accreditation requirements. Fill out down through the <Date Ordered> field.

6. Take the standards to be calibrated to the calibration lab.

7. When ready, pick the standards up.

8. Fill in the rest of your <Purchase Supplies> form. Check particularly that each standard has a measurement/traceability certificate of as in (2), and that the firm has an accreditation certificate as in (2), because even if the firm did what you asked, the certificates will probably not be complete.

9. Document the calibration of an item in the LIMS equipment file. Place the hardcopy certificates in the physical equipment file that has been made up for the same item.

10. *Intermediate checks* – In addition to the above calibration by an external supplier, Fiberquant also performs checks of accuracy in between calibrations. The SOPs for each check can be found in the QA/SOP Manual, chapters 6, 7, 8, 14, 15, and any SOPs separate from the manual.

11. The following table lists the reference standards in use at Fiberquant, their Equipment FQ Numbers, calibration frequency and verification frequency.

Reference Standard / Equipment	**Equipment FQ#**	**Calibration Frequency**	**Verification Frequency**
Reference Thermometer	120	Initial and every 5 years	Not applicable
Working Thermometer	21, 22, 23, 116, 117, 118, 119	Initial and when verification fails	Annually
Reference Masses	150 (20mg), 151 (1g)	Initial and every 5 years	Not applicable
Working Masses	-	NA	Initial and then annually
Stage Micrometer	126 (traceable), 125 (working), 152 (working)	Initial and if damaged	Not applicable
Balance	12 (Sartorius), 103 (electrobal.)	Initial and following service/repair or when verification fails	Each day of use
Mechanical Pipettes	63-74, 110, 111, 112, 113, 140, 143, 149	Initial and when verification fails	Annual
Volumetric Containers for critical functions (non-Class A)	15ml centrifuge tubes at 10 & 15, and 50ml centrifuge tubes at 25 and 50	Not applicable	Each lot prior to use
Dry-Cal calibrator	132	Initial and then annually	Not applicable
Microscope measuring reticles	Mic 1 (FQ#95), Mic 9 (FQ#109),	Initial and then annually	Not applicable

	Mic 10 (FQ#134)		

Reference Materials and Reagents

Reference Materials are consumables used to qualify AA runs. . Reagents are also consumed, but do not contain an analyte. PCM and Micro do not have NIST traceable materials available. PLM has the lifetime supply of SRM 1866 and SRM 1867.

Purchase of Reference Materials or Reagents

1. *Research* – For Reference Materials, find, on the www or from already known supplier, the analyte and ppm of standard needed. The supplier must be accredited to the scopes of 17025 and reference material provider by an accrediting body recognized by ILAC. For reagents, choose a known supplier of chemicals (*e.g.*, Fisher or VWR), who already has a page in the <Approved Suppliers> list of the LIMS Procurement module; choose an appropriate grade of the reagent (e.g., ACS grade or higher (AIHA Policy 2.C.4.2)).

2. *Analysis Certificate* (AIHA 5.4) – A Reference Material must meet the following: a) It must have a certificate of analysis (however named), b) The certificate must list the specific NIST material(s) or standard permanently residing at NIST to which it is traceable, c) The certificate must include the analyte and its concentration, as well as the overall uncertainty of that concentration, and d) The concentration and uncertainty above must have been measured by a firm/calibration lab that has is accredited to 17025 by an accreditation body recognized by ILAC. This is proven by an associated accreditation certificate specifying 17025 and having an ILAC Logo (or equivalent words to that effect). A Reagent does not need a certificate beyond its label.

3. For a liquid (*e.g.*, 1000ppm Pb) or solid Reference Material (*e.g.*, LCS for a matrix), go to a new page in the <Purchase AA Calibration Standards> form under Procurement in the LIMS. For reagents, go to a new page in the <Purchase Supplies> form. For either, if the supplying firm does not show up in the drop-down list of suppliers, then close and first fill in a new <Approved Suppliers> form for them, and then start filling in a new <Purchase Supplies> page. Copy the current version of (2) above into the field that asks for accreditation requirements

4. Fill out the <Purchase AA Calibration Standards> or <Purchase Supplies> page (one per item ordered) down through the <Date Ordered> field. Then order the item(s) by phone, fax or email.

5. *Document Receipt:* When delivered, fill in the rest of your <Purchase AA Calibration Standards> or <Purchase Supplies> form, Check particularly that each item s as ordered, the lot number, expiration date, and, if a reference material, that it has a measurement/traceability certificate of as in (2), and that the firm has an accreditation certificate as in (2), because even if the firm did what you asked, the certificates will probably not be complete. *Expiration Dates:* Liquid Calibration Materials (1000ppm) usually have an expiration date marked by the manufacturer already on the bottle, but if not, assign one of one year from date of receipt. Reference Materials (solids for paint, soil, wipes and filters) may not generally have expiration dates assigned by the manufacturer, and, if so, assign one of 10 years from date of receipt.

6. *Marking the Containers:* all reference materials and reagents are to be marked with 1) the date received, 2) the initials of the receiver, 3) the expiration date, and 4) if a Reference Material, the FQ line number in the "AA Calibration Standards" db.

7. *Re-qualifcation of Solids:* If a solid standard exceeds its assigned expiration date, it may be re-qualified by being analyzed against a current liquid standard (namely by the normal calibration curve). Make up a run of at least 5 tests of the material being qualified. The Lab Director will compare the mean and standard deviation of these to the published values. If within 5%, then a new expiration date is assigned. If not, discard and re-supply.

11.16. Work Practice #MYCO-1 Preparation of Inertial Impactor Cassettes for Spore Counting

Revised: 06/27/99 Printed: 03/05/13

Mounting and Staining

1. Cassettes will be found in a large bag having its job number and client/customer written on it. The sample submittal form will also be present with the bag of samples.
2. Place new glass slides out, one for each cassette.
3. Mark the appropriate lab number on each glass slide.
4. For the first job of the day, place out an additional slide for a blank. Mark the blank slide "B<date>", e.g. B 10-5-98
5. If not clean, wipe each glass slide with a clean room wipe and blow off any visible debris.
6. Make a blank by placing a piece of double sticky tape on a slide. The blank is to be left out in the open while the sample slides are being mounted.
7. Place the first cassette to be mounted and its slide in the middle of the prep area. Check that client/customer number on the cassette corresponds to the lab number on the slide by crosschecking the sample submittal form.
8. Remove the sample collection glass piece from the cassette taking care not to touch the tacky area.
9. Transfer the sample collection piece to the glass slide and place it tacky side up in the middle of the slide with the long axis of the sample collection area parallel to the long axis of the glass slide.
10. Secure the sample collection piece to the glass slide using tape or fingernail polish.
11. Apply 10-15 ul of stain to the center of the sample collection area.
12. Place a clean cover slip over the stained sample collection area such that trapped air is minimized; spread stain, if necessary, by pressing the cover slip with a forceps or other implement.
13. Repeat for the remaining samples and finally the blank.
14. Analyze the blank first and enter results in the <LIMS><QC><Microbiology><Blanks>. If the blank shows significant contamination from the room air, then the samples may have to be remounted under cleaner conditions.

11.17. Work Practice #MYCO-2 Preparation of Bulk Samples for Spore Identification

Revised: 08/24/04 Printed: 03/05/13

1. Bulk samples will be found in a large bag having its job number and client/customer written on it. The sample submittal form will also be present with the bag of samples.
2. Place new glass slides out, one for each bulk sample.
3. Mark the appropriate lab number on each glass slide.
4. For the first job of the day, place out an additional slide for a blank. Mark the blank slide "B<date>", e.g. B 10-5-98
5. If not clean, wipe each glass slide with a clean room wipe and blow off any visible debris.
6. Place a fresh double-sided sticky tape section on the blank slide. The blank is left out in the open, uncovered while the sample slides are being mounted, but in a position where the air being drawn into the hood meets the blank first and any bulk sample last, to avoid contaminating the blank with sample.
7. Place the first sample to be mounted and its slide in the biological safety cabinet. Check that the number of the sample corresponds to the lab number on the slide.
8. Using clear scotch tape or double sticky tape, lightly touch the tacky side to the sample making sure to represent the entire sample. For bulk cultured samples, transfer some of the culture to a glass slide using a tape lift.
9. Transfer the tape to the glass slide and place it in the middle of the slide with the sample side up and parallel to the long axis of the glass slide.
10. Apply a drop of stain to the center of the tape. Place a clean cover slip over the stained sample collection area such that trapped air is minimized.
11. Repeat for the remaining samples and finally the blank.

12. Analyze the blank first and enter results in the <LIMS><QC><Microbiology><Blanks>. If the blank shows significant contamination from the room air, then the samples may have to be remounted under cleaner conditions.

11.18. Work Practice #MYCO-3 Preparation of Tape Samples for Direct Count

Revised: 08/24/04 Printed: 03/05/13

1. Tape samples will be found in a large bag having its job number and client/customer written on it. The sample submittal form will also be present with the bag of samples.
2. Each sample will already be mounted on a glass slide and marked by the client/customer with their identification number on it. Check that the number of the sample corresponds to the sample number on the chain of custody.
3. Taking care not to erase any of the client/customer's identification information, clean the top and bottom of the slide using a wet wipe (if necessary).
4. Mark the appropriate lab number on each glass slide.
5. For the first job of the day, place out an additional slide for a blank. Mark the blank slide "B<date>", e.g. B 10-5-98.
6. Since the client/customer's tape should only be removed from its slide when absolutely necessary, the above steps will typically be all that are necessary to complete the prep. If the client/customer's sample was not properly taken or improperly mounted then it will be necessary to remount it using Crystal Clear tape and/or mounting it on a proper slide.
7. Repeat the mounting process for the rest of the samples and finally the blank.
8. Analyze the blank first and enter results in the <LIMS><QC><Microbiology><Blanks>. If the blank shows significant contamination from the room air, then the samples may have to be remounted under cleaner conditions.

11.19. Work Practice #MYCO-4 Analysis of Bulk Samples

Revised: 08/24/04 Printed: 03/05/13

1. Scan mounted bulk slide at 400-600x magnification to locate areas having fungal spores or hyphae. If possible, estimate different types of spores/hyphae and their approximate relative percentages.
2. Also estimate the relative percentage of fungal material to total (fungal + non-fungal) material.
3. Rotate 100x oil objective into position and re-focus.
4. Scan fungal material. Categorize the genera present as one of the types listed, on the count sheet, as a write-in type, or as misc/unidentifiable, and report the relative results.
5. On results page of LIMS, enter the relative percentages of fungal types and hyphae (trace may be entered as <-1>), and the relative percent of fungal material/total material.

11.20. Work Practice #MYCO-5 Analysis of Direct Count Samples

Revised: 08/02/01 Printed: 03/05/13

Use Nikon Labphots only for Direct Count Samples, note number of microscope on count sheets (they do not all have the same field of view).

1. Add a drop of immersion fluid to the top surface of the tape where the sample was taken.
2. Rotate 100x oil objective into position to obtain 1000x. When oil wets lens, focus.
3. Examine 100 fields of view. When a fungal spore is observed, categorize it as one of the types listed on the count sheet, as misc/unidentifiable, as a write-in type, or as a mycelial fragment.
4. If an observed spore is not completely in the field of view, then record it only if it is partially outside of the right half of the field of view and ignore it if it is partially outside of the left half of the field of view.
5. On results page of LIMS, enter the total counts of each category.

11.21. Work Practice #MYCO-6 Analysis of Spore Trap Samples (retired; see Larry//C:/SOPs/Individual SOPs in ISO Format/SOP SPCT.001.doc; Larry//C:/SOPs/Individual SOPs in ISO Format/SOP SPCT2.003.doc)

11.22. Work Practice #MYCO-7 Checks of Mycological Data

Revised: 08/24/04 Printed: 03/05/13

Review #1

The original analyst will check the following items:

1. That the data has been entered correctly, namely:
2. That each result has been reported under the correct sample number, and that the sample number is as on the chain of custody.
3. That each count or % estimation has been correctly added and entered into the LIMS correctly
4. That the LIMS has performed the calculations
5. Re-calculate one result per each job by hand, to confirm that the calculation is correct
6. That the report printing is acceptable (margins, appearance)
7. That the results make sense, *i.e.*, blanks are low or n.d., outside samples have spore types and counts consistent with outside samples, that inside samples are lower than outside unless loaded with one or two spore types from an infestation, that the results of all the samples appear to make sense from an IAQ standpoint.

Review #2

A second analyst will review the following:

1. That bulk reports add up to 100%
2. That calculations for spore trap counts are in the ballpark (*e.g*. 1 count = 71 spores/m3 for 15 passes and 75L)
3. That all samples have been done
4. Report is presentable and ready to go to client/customer
5. That any additional genera that have been typed in by the analyst are spelled correctly. That genera are capitalized and that species are not.
6. That the analytical notes, if any, have correct spelling and punctuation
7. That the correct numbers are in their correct places and that they match the data sheets for the genera, loading, and volumes.

11.23. Work Practice #MYCO-8 Preparation and Analysis of Viable Bulk Samples for Culture Counts (Non-Routine).

Revised: 08/24/04 Printed: 03/05/13

Preparation:

1. Swabs or dust samples for viable analysis will be found in the 2nd floor chemical refrigerator if >1hr after receipt.
2. Suspend sample in 0.02% Tween 20 solution: For swab sample, bring submitted swab/solution up to 15ml using 0.02% Tween 20. For dust sample, first homogenize as well as possible by agitating the original container, then tare a 50 ml centrifuge tube and weigh into it up to 1 gm (or entire sample), then fill to the 15 ml mark with 0.02% Tween 20.
3. Vortex the tube for 30 seconds.
4. If a swab sample, remove swab, place it with waste to be autoclaved.
5. Mark this tube with unique lab number; also mark as "stock" (dilution factor 1).
6. To a 15 ml centrifuge tube, add 1.5ml of stock solution and bring up to 15 ml with 0.02% Tween 20. Mark this with the lab number and "10^{-1}" (dilution factor 10).

7. Select 3 previously prepared MEA (or agar of client/customer's choice) culture petri dishes.
8. Mark the top of each dish with the lab number, type of agar and date of agar preparation (should already be there), and date of inoculation. Mark one dish "stock", one dish "10^{-1}", and the last dish "10^{-2}" then initial all preps.
9. Inoculate the stock dish with 10 ul of stock solution; inoculate the 10^{-1} dish with 10 ul of 10^{-1} solution; inoculate the third dish with 1 ul of 10^{-1} solution using disposable, calibrated loops. Uniformly streak the entire surface.
10. For each batch of samples, start a negative control (uninoculated agar) and a positive control (same type of agar inoculated with *Aspergillus niger* standard).
11. Incubate at 25C for 7 days (or temperature and time specified by client/customer), or until the plates start to overgrow (colonies overlapping).
12. Monitor plates daily to check for overgrowth and to document observations. Record observations on work order data sheets.
13. Only one plate will be analyzed. Choose a plate that contains >20 colonies, if possible.

Analysis: (see full SOP at Larry//C:/SOPs/Individual SOPs in ISO Format/SOP SPCp.001.doc)

1. Choose the one petri dish for each sample for which the colonies are separable and countable.
2. Using colony color, morphology, etc. and microscopic properties of sub-samples of colonies, identify and count the colonies present on that petri dish. For identification, any of the reference books in the bookshelf may be used. The primary references found to be of greatest utility are:

Medically Important Fungi: A Guide to Identification, 3rd ed.; Davise H. Larone, ASM Press, Wash., D.C.; 1995

Compendium of Soil Fungi, Vol. 1 and Vol. 2; K.H. Domsch, W. Gams and T. Anderson; IHW-Verlag; Reprint 1993

Atlas of Clinical Fungi, 2nd ed.; de Hoog, et al.; Centraalbureau voor Schimmelcultures; Utrecht, The Netherlands; 2000

3. For each genus/type of mold, calculate the number of colony forming units (CFUs) per cm2 (for a swab) or per gram (for dust):

CFU/cm2 = CFUs counted x 1500 x dilution factor / swab sample area (cm2) or dust weight (gram)

4. If no colonies are observed, report <1500 x dilution factor/ swab sample area (cm2) or dust weight (gram)

11.24. Work Practice #MYCO-9 Handling and Analysis of Viable Culture Plates (Retired – do not use)

Revised: 08/24/04 Printed: 03/05/13

Handling

1. Client/customers may supply their own culture plates, or Fiberquant may supply plates. Record type of agar, lot #, and expiration date during log-in.
2. Log-in will be completed within 1 hour of receipt.
3. Senior analyst present will be given plates and paperwork after log-in.
4. Plates will be incubated for 7 days (or as specified by client/customer)
5. Each dish is marked with lab number, type of agar (if not already marked), and the date the dish was exposed or inoculated.
6. Check dish daily during incubation period for over-growth.

Andersen Sample Analysis:

1. A dish has 400 possible sites for colony growth.
2. Count and identify each colony. Identify a colony by colony morphology, color, etc. and microscopic properties.
3. For each genus/type of mold, calculate the number of colony forming units (CFUs) per m3:
4. CFUs/m3 = CFUs counted/volume of air in cubic meters.
5. If no colonies are observed, report < 1/volume of air in m3.

11.25. Work Practice #MYCO-10 Fungal Contamination Emergency Procedures

Revised: 05/22/02 Printed: 03/05/13

All fungal cultures will be kept in either the Biological Safety Cabinet, the incubators or in the lockable fungal culture library cabinet (Michael has the key). However, in the event that a fungal culture should accidentally contaminate any part of the laboratory, IMMEDIATELY implement the following procedures.

1. Get the nearest bottle of bleach.
2. Cover all of the contaminated area with 100% bleach and notify Technical Manager or Deputy or Martin Esquer (Safety Officer) to be the responder.
3. Prepare yourself to identify which fungal strain(s) were involved and exactly what happened.
4. The responder will do the following:
    a. Put on rubber gloves
    b. Blot the affected area with clean paper towels removing any visible debris
    c. Place debris in an autoclave bag along with the paper towel used to remove it.
    d. Cinch the autoclave bag with an autoclave bag rubber band.
    e. Set the autoclave bag aside and continue to clean the area using the following procedures
        i. Spray generously with bleached based cleaning solution (i.e. Tilex) and allow this to soak for 30 seconds.
        ii. Blot the area dry with a clean paper towel and set towel aside.
        iii. Repeat these steps two more times each.
        iv. Place all used paper towels in the autoclave bag containing the visible debris and towels.
        v. Sterilize the contents of the autoclave bag immediately at 250 degrees F for 60 minutes.
        vi. Dispose of the autoclave bag as non hazardous waste.
        vii. Test the affected area using a swab and culture method.

If a qualified responder is not available, report to Mycology Supervisor Michael immediately so that he may contact Joe Simmons and/or James McGrew at the Arizona Department of Agriculture (602-542-0955).

Finally, the key to the cabinet containing the fungal strains is held by the Mycology Supervisor. This cabinet will be locked daily in the evening but kept unlocked during business hours. A spare key will be kept in Larry's top drawer in case Michael is not available.

11.26. Work Practice #MYCO-11 Preparation of phenosafranin stain

Revised: 07/24/02 Printed: 03/05/13

1. Use fume hood, wear neoprene gloves, lab coat and safety goggles, as phenol is rapidly absorbed through the skin, and may be fatal if swallowed, inhaled or absorbed through the skin.
2. Heat 30 ml water to near boiling.
3. Add 1.8 grams gelatin and stir the mixture with glass stirring rod.
4. Add 30 ml glycerol to the heating mixture.
5. Heat and stir the mixture until cloudiness nearly disappears.
6. Remove mixture from heat and add 1.0 grams of phenol crystals.
7. Add 0.5 ml of a 5% phenosafranin solution (5mg/ml water).
8. Add a drop of lactophenol cotton blue stain to the freshly prepared phenosafranin glycerin jelly at the concentration of 1mg stain to 10 ml jelly
9. Solution can be safely frozen and stored for extended periods of time.

11.27. Work Practice #MYCO-12 Preparation of modified lactophenol cotton blue stain

Revised: 07/24/02 Printed: 03/05/13

1. heat 30 ml de-ionized water to near boiling
2. add 30 ml of glycerol; stir until mixed and solution is clear

3. remove from heat
4. add 1.0 gm phenol; stir until dissolved
5. add 0.5 ml of lactophenol cotton blue stain (prepared solution, VWR catalog # VW3427) or equivalent

11.28. Work Practice #MYCO-13 Preparation of lacto cotton blue (LCB) stain

Revised: 07/24/02 Printed: 03/05/13

Glycerol - 250ml

85% Lactic acid - 100ml

Cotton Blue Stock - 3ml

de-ionized water - 50ml

LCB Mounting Medium

1. Mix the water, lactic acid, and glycerin (in that order) for one hour on a stir plate.
2. Once the solution is homogenous, add 0.3ml of Cotton Blue Stock solution (recipe given below) to the above solution.
3. Stir the entire mixture for an additional hour.
4. Cover the flask with Parafilm while the mixture is stirring to insure against airborne contamination.

Cotton Blue Stock Solution

85% Lactic acid - 99ml

1. Aniline (Cotton) Blue crystals - 1.0g
2. Add Cotton Blue crystals to lactic acid while stirring vigorously on a stir plate.
3. Stir until Cotton Blue crystals are dissolved.
4. Filter the solution through a #50 Whatmann 90mm filter disc.
5. After filtration has occurred, check the clarity of the stock dye solution by placing one drop of the dye on a clean microslide and examine at 400X. Particles of dye should be approximately 2μm or less in diameter.

11.29. Work Practice #MYCO-14 Preparation of Acid Fuchsin Stain

Revised: 08/25/04 Printed: 03/05/13

1. 1. Heat 40 mls of 85% (or higher) purity lactic acid to near boiling.
2. Add 0.04 g of acid fuchsin and stir on hotplate until completely dissolved.
3. Remove solution from heat.
4. Aliquot into 4 ml screw cap vials with septated caps.
5. Label and date with "Acid Fuchsin" and date.

11.30. Work Practice #MYCO-15 Handling and Interpretation of Positive and Negative Controls for Cultured Samples and Media Preparation

Revised: 08/25/04 Printed: 03/05/13

1. Immediately after preparing a batch of agar, 2 dishes are randomly selected.
2. One dish is labeled Negative control and dated. The other dish is labeled Positive Control, dated, and the name of the inoculate species.
3. Transfer both dishes to the Biological Safety Cabinet. Inoculate the Positive Control plate with a 10 ul aliquot of *Aspergillus niger* from the working stock located in the mold cabinet. Place the aliquot in the center of the media and cover with the petri lid.
4. Transfer both dishes to the 25°C incubator.
5. Fill out the Agar Batch Control forms located under the mold cabinet. Place the form in the file for that day such that the plates are examined one week from assimilation.
6. After the 7-day incubation period, remove the plates from the incubator for examination.

7. Determine morphologically that the resulting colony in the positive control is Aspergillus niger and measure its diameter. Record this on the Agar Batch control form.
8. Examine both the Positive Control plate and the Negative control plate and note any unexpected growth. For the Negative Control, unexpected growth would be any colonies. For the Positive Control, this would be any colonies besides the Aspergillus niger or any Aspergillus niger colonies not located in the center of the plate (where the inoculate was placed). Record this data on the Agar Batch Control Form, even if no unexpected colonies are observed.
9. Transfer the data into the FQLIMS system under QC.
10. To ascertain the viability of the agar batch, the resultant Aspergillus niger colony in the Positive Control must be 75-125% of the lab averages for this the diameter of this species on that particular nutrient agar. An acceptable Negative Control is defined as no observable growth.
11. Should either of the control plates be outside of the acceptable parameters, dispose of the entire batch. If possible, find the source of the problem and immediately rectify.

11.31. Work Practice #MYCO-16 Culture Media Preparation

Revised: 08/25/04 Printed: 03/05/13

A. AgarAssimilation General

1. Weigh out amount of agar needed in a tared weigh boat.
2. Add the agar to the appropriate amount of dH2O in a 500 ml beaker
3. Cover the beaker with aluminum foil
4. Place beaker and biological indicator test (example: Attest™ by 3M) ampule in autoclave
5. Sterilize it for no more than 15 minutes at 121 degrees C.
6. Remove the beaker and allow to cool for 10 minutes
7. Manipulate pH as necessary and according to manufacturer's directions
8. Pour the media into pre-labeled 100 mm perti dishes and allow to cool at least 20 minutes before use
9. Perform appropriate QA including testing of biological indicator and document results in Sterilizer log book.

A. Malt Extract Agar (MEA) Assimilation

1. Start heating desired volume of dH20 on the hot plate/stirrer turned to high heat.
2. While water is heating tare the balance with a large weigh boat.
3. Weigh out appropriate amount of malt extract agar (33.6 g per liter).
4. Bring water to desired volume using the graduated marks on the side of the beaker then add magnetic stir rod to water.
5. Turn stir knob on stirrer and adjust speed so that the vortex nearly reaches the bottom of the beaker.
6. Slowly add the powdered malt extract making sure to avoid large clumps in the resulting solution.
7. Cover the solution with aluminum foil.
8. Place the solution into the sterilizer and autoclave at 121C for 15 minutes.
9. Upon removal the solution should be clear.
10. Pour the solution into premarked 100 mm plastic petri dishes and allow to cool for at least 20 minutes before moving to the 4 degree C refrigerator for storage.

Hold time is 30 days from assimilation.

B. Potato Dextrose Agar (PDA) Assimilation

1. Start heating desired volume of dH20 on the hot plate/stirrer turned to high heat.
2. While water is heating tare the balance with a large weigh boat.
3. Weigh out appropriate amount of potato dextrose agar (39g per liter).

4. Bring water to desired volume using the graduated marks on the side of the beaker then add magnetic stir rod to water.
5. Turn stir knob on stirrer and adjust speed so that the vortex nearly reaches the bottom of the beaker.
6. Slowly add the powdered potato dextrose agar making sure to avoid large clumps in the resulting solution.
7. Cover the resulting solution with aluminum foil.
8. Place the solution into the sterilizer and autoclave at 121C for 15 minutes.
9. Allow the agar to cool at room temperature until it reaches a temperature of 45-50^{o} C then aseptically add 10% tartaric acid until the pH reaches 3.5.
10. Mix the agar well but do not reheat.
11. Pour the solution into premarked 100 mm plastic petri dishes and allow to cool for at least 20 minutes before moving to the 4 degree C refrigerator for storage.

Hold time is 30 days from assimilation.

C. Corn Meal Agar (CMA) Assimilation

1. Start heating desired volume of dH20 on the hot plate/stirrer turned to high heat.
2. While water is heating tare the balance with a large weigh boat.
3. Weigh out appropriate amount of Corn meal agar (17g per liter).
4. Bring water to desired volume using the graduated marks on the side of the beaker then add magnetic stir rod to water.
5. Turn stir knob on stirrer and adjust speed so that the vortex nearly reaches the bottom of the beaker.
6. Slowly add the powdered corn meal agar making sure to avoid large clumps in the resulting solution.
7. After all agar has been added, the solution will be cloudy.
8. Cover the solution with aluminum foil and place in the autoclave set at 121C for 15 minutes.
9. The solution should be clear upon removal from the autoclave.
10. Pour the solution into premarked 100 mm plastic petri dishes and allow to cool for at least 20 minutes before moving to the 4 degree C refrigerator for storage.

Hold time is 30 days from assimilation.

D. Oatmeal Agar Assimilation

1. Start heating desired volume of dH20 on the hot plate/stirrer turned to high heat.
2. While water is heating tare the balance with a large weigh boat.
3. Weigh out appropriate amount of Oatmeal agar (72.5g per liter).
4. Bring water to desired volume using the graduated marks on the side of the beaker then add magnetic stir rod to water.
5. Turn stir knob on stirrer and adjust speed so that the vortex nearly reaches the bottom of the beaker.
6. Slowly add the powdered malt extract making sure to avoid large clumps in the resulting solution.
7. The resulting solution will be very thick and occluded. Take steps to ensure that the stir bar does not stop spinning in the beaker.
8. Cover the solution with aluminum foil.
9. Place the solution into the sterilizer and autoclave at 121C for 15 minutes.
10. Pour the solution into premarked 100 mm plastic petri dishes and allow to cool for at least 20 minutes before moving to the 4 degree C refrigerator for storage.

Hold time is 30 days from assimilation.

E. Czapek Solution Agar Assimilation

1. Start heating desired volume of dH20 on the hot plate/stirrer turned to high heat.

2. While water is heating tare the balance with a large weigh boat.
3. Weigh out appropriate amount of Czapek solution agar (49g per liter).
4. Bring water to desired volume using the graduated marks on the side of the beaker then add magnetic stir rod to water.
5. Turn stir knob on stirrer and adjust speed so that the vortex nearly reaches the bottom of the beaker.
6. Slowly add the powdered Czapek agar making sure to avoid large clumps in the resulting solution.
7. Cover the solution with aluminum foil.
8. Place the solution into the sterilizer and autoclave at 121C for 15 minutes.
9. Upon removal the solution should be clear.
10. Pour the solution into premarked 100 mm plastic petri dishes and allow to cool for at least 20 minutes before moving to the 4 degree C refrigerator for storage.

Hold time is 30 days from assimilation.

F. Sabouraud Dextrose Agar Assimilation

1. Start heating desired volume of dH20 on the hot plate/stirrer turned to high heat.
2. While water is heating tare the balance with a large weigh boat.
3. Weigh out appropriate amount of Sabouraud dextrose agar (65g per liter).
4. Bring water to desired volume using the graduated marks on the side of the beaker then add magnetic stir rod to water.
5. Turn stir knob on stirrer and adjust speed so that the vortex nearly reaches the bottom of the beaker.
6. Slowly add the powdered Sabouraud dextrose agar making sure to avoid large clumps in the resulting solution.
7. Cover the resulting solution with aluminum foil.
8. Place the solution into the sterilizer and autoclave at 121C for 15 minutes.
9. Pour the solution into premarked 100 mm plastic petri dishes and allow to cool for at least 20 minutes before moving to the 4 degree C refrigerator for storage.

Hold time is 30 days from assimilation.

G. Media other than above

There will, from time to time, be occasions when a client/customer will request a nutrient agar that we have not made before. When such requests are made, we will use the following standard operating procedure:

Determine what type of agar the client/customer is requesting.

Research this type of agar using in-house, and if necessary, outside references. Several of the in-house texts are useful including Medicinally Important Fungi, 3rd ed., Identifying Filamentatious Fungi, A Clinical Laboratory Handbook, Diagnostic Microbiology, 2nd ed., and Standard Methods for Examination of Wastewater 18th ed. There are several other excellent publications to which we can refer if the desired agar is not found in these resources.

1. If not already in stock, procure the necessary reagents from one of our regular vendors (VWR, Fisher Scientific, etc..)
2. Follow manufacturer's directions for assimilating the agar. In the absence of manufacturer's directions, the above-mentioned references will be used in their place.
3. While water is heating tare the balance with a large weigh boat.
4. Weigh out appropriate amount of reagents.
5. Bring water to desired volume using the graduated marks on the side of the beaker then add magnetic stir rod to water.
6. Turn stir knob on stirrer and adjust speed so that the vortex nearly reaches the bottom of the beaker.
7. Slowly add the reagents making sure to avoid large clumps in the resulting solution.
8. Cover the resulting solution with aluminum foil.
9. Place the solution into the sterilizer and autoclave at 121C for 15 minutes.

10. Pour the solution into premarked 100 mm plastic petri dishes and allow to cool for at least 20 minutes before moving to the 4 degree C refrigerator for storage.

Hold time is 30 days from assimilation.

11.32. Work Practice #MYCO-17 Sterilization Techniques

Revised: 12/28/2005 Printed: 03/05/13

Ritter M11 sterilizer

1. This is the larger of the two but it has to be ran twice for 30 minutes to meet the 1-hour sterilization requirement.
2. Look at the water level tube on the left side of the interior of the unit to ensure there is water in the reservoir.
3. Press the on button if the sterilizer is not already turned on.
4. Press the "Packs" button to set the sterilizer for 250 degrees F and 30:00 minutes.
5. Place a piece of biological indicator strip on the outside of the inner bag. Follow manufacturers' directions (e.g., for paper or ampule) Load the sterilizer with double-bagged contents.
6. Close the door making sure the door latch catches.
7. Press the start button.
8. At the end of the first cycle the door must be opened and re-closed. Repeat steps 3 through 6 above.
9. In the logbook on top of the Ritter, note the date, peak pressure, temperature, duration, and the condition of the biological indicator strip. Indicate pass/fail in the log according to the strip manufacturer's instructions.

Tuttnauer Sterilizer

1. This is the smaller of the two.
2. First, turn the lowest of the 3 knobs to the fill position while looking into the chamber. You will see the water level start to rise. When the water line reaches the water line mark in the chamber, turn the knob clockwise to the "Ste" position. If the water level will not rise to the fill line, it is because there is not enough water in the main tank. To refill the main tank, add water into the portal on the top of the unit. The tank should hold about 4L of DISTILLED water. Continue adding water until it just covers the coils seen in the portal.
3. Closer the door and swing the locking mechanism into place and turn the handle clockwise until tight.
4. Turn the top knob, the timer knob, to 60 minutes and the sterilization process will begin.
5. After the sterilization cycle is complete, turn the handle of the locking mechanism counter clockwise to release the door. IF THE HANDLE WILL NOT TURN, IT IS BECAUSE THE PRESSURE AND TEMPERATURE INSIDE THE CHAMBER IS TOO HIGH TO BE RELEASED SAFELY. DO NOT FORCE THE HANDLE!!
6. Once opened, allow the contents to cool and remove.
7. In the logbook on top of the Tuttnauer, note the date, the peak pressure, temperature, duration, and the condition of the autoclave tape.

Some important things to consider:

1. Never fill solution containers to the top and then try to sterilize. This will lead to overflow.
2. Never place screw cap containers in the sterilizers with their lids completely tightened. The pressure will build up in the container and may cause them to burst.
3. Place all non-glass and non-metal items in autoclave bags (located under the sink) and add about 100 mls of water to the bag. Then, LOOSELY cinch the bag and "tie" it with a blue rubber band (also located under the sink).
4. Both autoclaves are already set for 121 degrees Celsius (250 degrees F) as required by our SOPs. Please do not adjust the temperatures from 121 Celsius.
5. Blue autoclave gloves are available and should be used when removing hot items from the sterilizer. They are located next to the Ritter autoclave.
6. When in doubt as to whether an item should be autoclaved-Just do it. It is better to error on the side of safety.

11.33. Work Practice #MYCO-18 Calculation of Bulk Recount (SPB Recount) Acceptance Limits

Revised: 08/25/04 Printed: 03/05/13

1. Copy recounts of interest t(e.g. last years) to the SPBStats table using query SPBStatsMakeTableQry. Must delete the table first.
2. Use the 5 separate queries (SPBStatsClad, SPBStatsPen, SPBStatsAlt, SPBStatsStachy and SPBStatsChaet) to calculate the average RSD for those entries where both analysts reported >5%.
3. Use the 5 averages to estimate a working average for all. Better to be on the low side than high.
4. Go to form <Spore Bulk Re-Analysis> and enter twice the working average as OOC (95% conf range or power of 2)

11.34. Work Practice #PCM-1 PCM Filter Preparation

Revised: 07/13/99 Printed: 03/05/13 For either NIOSH 7400 Rev. 3 Issue 2 Aug. 1994 or OSHA Ref. Method

1. Cassettes will be found in a large bag having its job number and client/customer written on it. The work order will also be present with the bag of samples. Each cassette inside will have its assigned Lab Number written on its label.
2. Place cassettes from one or several jobs in an organized array on the sample prep desk. Turn on hot block mounter.
3. Place new glass slides out, one for each cassette. Place one additional slide out for a prep blank.
4. Mark the appropriate lab number on each glass slide. Referring to the Sample Submittal Form, mark each slide with an A (for 7400A) or an O (for ORM) to designate the method by which the slide is to be counted. Default methods are 7400A for area samples and ORM for personal samples.
5. Mark the blank slide "B<date>", e.g., B 10-5-89. Blanks are always counted using 7400A.
6. If not clean, wipe each marked slide with a clean room wipe and blow off any visible debris.
7. Place a wedge of unused 0.8u MCE 25mm dia. filter from stock on the blank slide. The blank is left out in the open, un-cleared, while the sample slides are being mounted.
8. Move the 1st cassette to be mounted and its slide to in front of the hot block. Check that the lab number on the cassette and the lab number on the slide are the same.
9. Cut a wedge (1/4 of a 25mm dia filter) of filter using the scalpel and forceps.
10. Transfer the wedge of filter to the center of the glass slide sample area. Place the slide on the center of the hot block stage and place the stage in the hot block.
11. Inject acetone into the top of the hot block until the wedge clears.
12. Drop 0.3-0.35 ul triacetin onto middle of cleared filter, being careful not to touch filter with needle of syringe (if needle touches filter, syringe and needle must be cleaned before more mounting).
13. Immediately place clean cover slip (discard any slip with visible debris) onto triacetin drop/cleared filter. Press cover slip down lightly with forceps to facilitate full coverage of the wedge.
14. Repeat steps 8-13 for remaining cassettes, and, finally, the blank.
15. Count blank first. If blank result is too high, samples may have to be remounted under cleaner conditions.

11.35. Work Practice #PCM-2 Counting PCM Samples

Revised: 07/13/99 Printed: 3/5/13 For either NIOSH 7400 Rev. 3 Issue 2 Aug. 1994 or OSHA Ref. Method

1. Perform a qualitative scan – if loading is markedly uneven, do not count, report as uneven loading.
2. Start count from the tip of the filter wedge and progress along a radial line to the outer edge; shift up or down to change directions. Each analysis should cover at least one such radial traverse.
3. Reject a field if particulate obscures more that 1/6 of field.
4. If more than 1/6 of the fields are too highly loaded, reject the entire filter and report as too highly loaded.
5. 7400 rules: count fibers >5um; =>3:1 aspect ratio; stop after observing at least 100 fibers or 100 fields.
6. ORM rules: count fibers =>5 um; =>3:1 aspect ratio; maximum diameter 3um; stop after observing at least 100 fibers or 100 fields.
7. Document the counts and fields on work order.
8. Input counting data into LIMS under “Samples”.
9. Perform recounts when prompted by computer.
10. Perform one manual calculation and compare to computer – if not the same contact LIMS Specialist.
11. Perform report checks (see PCM-3).

11.36. Work Practice #PCM-3 Quality Procedures for PCM Analysts

Revised: 02/24/94 Printed: 3/5/13

I. GENERAL

1. Keep PCM prep area, microscopes and microscope tables clean.

2. Check condenser alignment, field limiting aperture size and phase ring alignment every day before samples, or as needed, and document in the LIMS under "QC" and "PCM".

3. Check phase resolution every month when prompted by computer. Record on Phase Resolution Screen.

II. REFERENCE SAMPLES Once a day, before samples, read one reference slide, report results in the LIMS. If LIMS indicates out of control, recount a different slide until in control.

III. RECOUNTS Samples are to have replicate analyses (recounting of the same slide) performed by either the same analyst or a different analyst. The type of recount is determined by the computer and is listed on the work order. The listing is RS or RD, depending on the type of recount required. Before a job goes out, the RS recounts are completed; RD recounts may be saved until another analyst is counting. As each recount is entered, the LIMS determines whether it is in control. If the recount is out-of-control the control level, then action (usually a third count) is mandatory and the Lab Manager is contacted.

IV. BLANKS Once a day, set out an unused wedge of MCE filter during the prep of a job(s), then mount, count, and record result on the blank recording form. If count is >5.5, then report to Lab Manager or QA Officer.

V. REPORT CHECK The original analyst checks on the computer screen for transcription errors. One non-zero result for each job is calculated to ensure that the correct result (both f/mm2 and f/cc) is calculated by the computer. Then each report is given to a trained PCM analyst other than the one who counted the samples. The second analyst checks for completeness and transcription errors from the original data.

11.37. Work Practice #PLM-1 Quality Procedures for PLM Analysts

Revised: 06/15/99 Printed: 3/5/13

I. General Procedures

1. Check hood temperature (23-27^{o}C) before work.

2. Check microscope condenser alignment, polarizer alignment, and phase contrast alignment each day before or during the first sample and as needed.

3. Sign and date internal sample tracking and customer chain of custody.

II. Duplicate Analyses

1. 1st Analyst analyzes the job.

2. Pass samples, dup sheet and sample submittal sheet to 2nd analyst.

3. The second analyst analyzes the marked samples, entering the job #,lab #, brief results on the Duplicate Sample Analysis Record in the computer PLM QA area..

4. Computer determines whether the two results are in or out of control for positive/negative determination, type of asbestos seen and percentages. A discrepancy exists when one result is positive (>1% asbestos) and the other negative, or when different types of asbestos are reported to be positive, or when the RPD of the two analyses is > 100%.

5. If a discrepancy is found, arrange an immediate conference with the other analyst and hash out a consensus analysis, requesting help from the technical advisor, if necessary. Report the consensus under notes on the Dup Record.

Take samples to disposal bins and document; file duplicate sheet.

Check printed report for errors in data entry, especially a) whether the "positive sample" category matches the fiber type and percentage reported; b) texture is completely filled in; c) fibers reported are consistent with the type of sample; and d) optical characteristics are consistent with the fiber type reported.

III. Blanks

1. When a blank is indicated by the computer, mount a blank (no sample) using the liquid (may be r.i. liquid or solvent) indicated by the computer. Note any contamination on the Routine Blanks form.

11.38. Work Practice #PLM-2 Analysis of Floor Tile and Other Vinyl Matrix Materials using PLM

Revised: 03/10/93 Printed: 3/5/13

See Full SOP with photos at: Larry//C:/SOPs/Individual SOPs in ISO Format/SOP Floor Tile.001.doc

TILE

1. Break tile, using wire cutters if necessary, to get a fresh break (old breaks have contaminant fibers on them).

2. Observe the fresh break at 30x magnification in glancing illumination. White, broom ended fibers sticking out of the plastic are probably chrysotile. Pull some and check in 1.55HD medium.

3. Use stiff forceps to crush or squeeze a forceps-tip-sized portion of vinyl off of the break. Be careful not to include any mastic in the sample. Place pieces on one side of a glass slide. It has been found that floor tiles exist that have two similar layers, the top of which does not have asbestos and the bottom of which has >1 % asbestos. Therefore, at least one pinch from the top of the tile and one from the bottom of the tile should be taken.

4. Place 2 drops of THF (caution: THF is an irritant) on the sub-sample. Put cover slip on immediately (before it evaporates) and push around with nail pusher to dissolve until only a foggy-looking smear remains (all big pieces are dissolved).

5. Observe the THF mount at 400x magnification, phase contrast. All fibers show up as black on white background. Chrysotile fibers will be are very thin, with bundling, broom ends, kink bands, etc. If morphology is not quite clearly chrysotile, there may be some vinyl left on the fibers, so push around again with pusher.

6. If no chrysotile morphology observed, drop to 100x magnification in order to find large fibers, polars crossed, with and without red plate. Look for any fibers (usually cellulose) that show up.

7. If chrysotile morphology observed on THF mount, then pull cover slip and allow to evaporate.

8. When dry, place a drop of 1.55 HD oil on the previously dissolved sub-sample and cover with a clean cover slip. Place another drop at the other end of the slide and cover with the used cover slip. This way, two mounts are obtained. Push with nail pusher to distribute the particles.

9. Identify chrysotile as usual including r.i. Although only small pieces may be present, disp. staining colors can almost always be confirmed.

10. If straight fibers are observed at any time, then mount in 1.605HD or other suitable medium to identify as usual. Watch out for 3:1 aspect ratio non-fibrous tremolite and talc/transitional talc fibers.

8. Call:

- chrysotile is present if seen with proper morphology in either Dynasolve (400x phase contrast) or 1.55HD (400x crossed polars, aperture open) and confirmed by dispersion staining in 1.55HD (400x phase contrast or 100x, #4 phase ring).

- % is determined best from THF or Dynasolve mount, 400x phase contrast.

- if call is not certain, check with other analyst or Lab Manager for a second or third opinion, ashing, SEM or TEM analysis.

MASTIC

1. Both bitumen (black) and synthetic (white or yellow) mastics dissolve well in viscous mount. Bundles of chrysotile are large. Because only one set of optical properties may be reported per sample, chrysotile may be identified by morphology alone (100-400x, either plain light or crossed polars) only if their accompanying tile is positive. If the tile is negative, then all the properties for the chrysotile must be gathered and reported from the fibers in the mastic.

2. Confirming dispersion staining may be obtained in 1.55HD, but the matrix does not dissolve off the fibers well, and the highly colored background makes colors appear off-shade.

3. Any observed straight fibers must be mounted in other appropriate HD media and identified as usual.

11.39. Work Practice #PLM-3 Gravimetric Asbestos Determination – (Chatfield Method)

Revised: 06/140/99 Printed: 03/05/13

1. Turn on muffle furnace (setting ~2) to stabilize at 450° C (must be <500).

2. Turn on small drying oven (setting for 65° C).

3. Weigh porcelain crucible to 0.0001 g.

4. Place .1-.2 g of sample in crucible and weigh to 0.0001 g.

5. Place crucible in muffle furnace overnight (2 hours minimum).

6. Weigh a .8 u 25mm dia filter (preferably PC) to 0.0001 g.

7. Set up bulk sample filter apparatus using the weighed filter.

8. Put ~1N HCl solution in crucible, entrain ash and transfer to mortar. Using Ni spatula, get all of ash out of crucible, washing all into the mortar. In all operations hereafter, do not lose any residue.

9. Add 1 N HCl until about 5 ml is in mortar.

10. Grind sample until powdered and no further evolution of gas. Check that all carbonates are dissolved by adding a small amount of HCl. If no more bubbles, then done. Do not leave in acid for more than 15 minutes, or structure may be changed.

11. Pour mixture into top of filtering apparatus. Wash all remnants from mortar into top of filtering apparatus with distilled water.

12. Apply vacuum until water is filtered. Water must be clear (otherwise filter has a hole + re-do entire analysis).

13. Place filter carefully onto a folded kimwipe. Make sure all residue is on filter, and none adheres to the filter apparatus.

14. Place filter and paper towel into drying oven at 90° C to dry.

15. After 1 hour, weigh filter and residue to 0.0001 g. Filter is brittle and must be handled carefully.

16. Replace filter in oven. Reweigh after 15 min. If weights are nearly the same, use second weight and are done. If weights differ significantly, heat and weigh again until weight is constant.

17. Mount and analyze residue using PLM or TEM. Quantify asbestos using visual estimate or point count.

Calculations:

weight of sample = crucible and sample - crucible alone

weight of residue = filter and residue - filter alone

% asbestos = % estimated in residue x residue weight/sample weight

11.40. Work Practice #PLM-4 Checking PLM Reports

Revised: 06/22/99 Printed: 03/05/13

I. Checks that the Original Analyst makes

1. All samples have been analyzed. If samples are missing or not analyzed for some other reason, put notes on the sample submission (s.s.) form. During analysis, if the sample number on the bag does not match both the coc and our database, fix the problem (usually logged in with a typo, but if the coc does not match the sample bags submitted, then ask the front office to please straighten it out with the submitter.)

2. Number of samples analyzed is correct - usually is wrong because an analyzed sample still has "no" in the analyzed box.

3. All boxes are filled in that should be.

4. Conclusions box is consistent with percentage in fiber i.d. column.

5. Check for inconsistencies in sample results, *e.g.*, all the wall textures are negative except one. In such cases, make some more mounts to be sure that they really are different materials, or to make sure it wasn't just contamination. The client/customer is going to ask the same question and it is better to re-check now than after the client/customer asks.

6. Does each result make sense for the type of material, or have we reported asbestos in a material that never has it, or more asbestos than has ever been seen in a material type.

II. Checks that the Dup Analyst makes

1. Analyze dups, check for discrepancies, resolve discrepancies.

2. Check that conclusion box is filled in is consistent with the % listed in the fiber i.d. column.

3. Quickly check for completeness - any glaring omissions, identity of fiber, # of mounts, , mis-match of identity data to species type, *etc.*

4. Does each result make sense for the type of material (see #8 above).

11.41. Work Practice #PLM-5 Using the Abbe Refractometer

Revised: 03/10/93 Printed: 03/05/13

To be done for each small set of r.i. oils (1.550,1.605,1.680) at the beginning of every month of use.

I. Calibration of Refractometer

To be done once each year (January) or if all r.i. oils checked are off in the same direction.

1. make sure that the laboratory and refractometer are 25° C +/1 2. This ensures that the oils are +/-.001 or .002.

2. check that the glass surfaces of the refractometer and standard are clean; if not, clean with ethanol.

3. place 2 drops of naphthalene bromide on smooth glass surface of the refractometer.

4. place the glass standard (r.i. = 1.5161) on the drops so that no bubbles are formed.

5. keep mirror closed and top block of refractometer open.

6. peer into eyepiece; turn eyepiece until the cross-hairs are sharp.

7. adjust the large knob until the scale reads 1.516.

8. adjust the small knob until the image of the shadow is sharp.

9. adjust the large knob until the shadow image transects the cross-hairs.

10. read r.i. on bottom scale.

11. if the r.i. is not 1.516 +/- 0.001, then use a small screw-driver to turn the screw on the side facing you; the shadow image only will move, so you must re-adjust the large knob and take another reading to know whether the calibration is closer or further from the standard; re-iterate until the reading comes out 1.5161.

II. Measuring the Refractive Index of a R.I. Oil

1. if both glass surfaces of the refractometer are not clean, wipe them with ethanol.

2. place 2 drops of the r.i. oil to be tested on the smooth glass surface; pull down the top block and lock in place with the cam on the left side of the refractometer.

3. keep mirror closed and open the window in the top block.
4. peer into the eyepiece; turn the eyepiece until the cross-hairs are sharp.
5. adjust large knob until the scale reads the nominal r.i. of the oil.
6. focus the image of the shadow using the small knob.
7. adjust the large knob until the shadow transects the cross-hairs.
8. read the r.i. on the bottom scale.
9. the measured r.i. must be within 0.004 of its nominal value; if not, it must be discarded or adjusted by mixing in another r.i.; see the lab manager for action.

11.42. Work Practice #PLM-6 Vermiculite Flotation

Revised: 02/24/2005 Printed: 03/05/13

To be done for each small set of r.i. oils (1.550,1.605,1.680) at the beginning of every month of use.

Vermiculite attic insulation presents analytical problems, in that it is inhomogeneous, contains (usually) a small % of asbestos, and the matrix is almost all silicate. The procedure attempts to float the vermiculite from the heavies. The majority of the asbestos will probably be in the heavy fraction, and the suspended liquid is only examined if nothing is found in the heavies. Document the data using the form: "Annex 5 Gravimetric Analysis of Vermiculite Sample for Asbestos" (C:\MSOffice\Winword\FORMS\Annex 5 Gravimetric Analysis of Vermiculite Sample for Asbestos.doc)

1. Attic insulation is already expanded, and it is beyond our capability to exfoliate safely.
2. The weight of a subsample is to be (at least) 5 gm for particle size <2mm; 10 gm for particle size 2-5mm, and 50gm (about 250ml) for particle size >5mm. Obtain a subsample by the cone and quarter method using Al-foil to hold the sample in one of the larger bulk hoods.
3. The vermiculite must be absolutely dry to float. Dry the subsample at 95° C for 2 hours. Weigh in analytical balance (using a tared 250ml beaker, only if quantitative result are required).
4. Place sub-sample in 1000ml high form beaker of de-ionized water and stir. The idea is to separate the mica flakes but still have them float. Large (up to 1 cm) pieces of non-vermiculite will drop to bottom. Push the vermiculite under water and stir several times.
5. Scoop off the floating fraction + save in a zip-loc bag.
6. Allow to settle 1 hour. Decant off the suspended fraction and save
7. Dry the heavy fraction in the beaker at 65° C . Transfer into a plastic petri dish.
8. Examine the heavy fraction under a stereoscope. Pick out any amphibole or chrysotile pieces and identify. Weigh these separately using a weighing boat, if a quantitative number is required.
9. If asbestos is found in the heavy fraction, identify on the PLM. Any such pieces will far out-weigh anything in the suspended fraction. Therefore, the analysis is over.
10. If asbestos is not found in the heavy fraction, filter and examine the suspension as in Part 2.
11. Calculate as indicated on the form to determine total % asbestos (100*weight asbestos/total weight).

11.43. Work Practice #SEM-1 SEM Analysis of Floor Tiles

Revised: 03/09/93 Printed: 03/05/13

1 Produce a cross-section of the tile 1/2" long by 1/8" wide with a fresh fracture on the long side.

2 Mount all samples to be examined on an SEM peg.

3 Examine the fresh fracture of each sample under the stereoscope at 10-40x and estimate the % sand or filler to % matrix (vinyl).

4 Sputter a thick Au coat on the samples for conductivity.

5 Examine the tiles in the SEM and 1) estimate the % fiber to % vinyl in the matrix part of the sample at 5-20,000x taking a photograph if necessary to get a good estimate, and 2) document the EDXA spectrum of observed fiber types, either by writing down major and minor elements or by hardcopy.

6 Multiply the % matrix from the stereoscope by the % fiber by SEM to yield the overall % fiber for the sample.

7 Results are reported as % fiber, fiber ID.

8 Ranges: 0-5% = +/-40% relative

5-40% = +/- 30% relative

>40% = +/- 20% relative

11.44. Work Practice #SOOT-1 Sample Preparation of Soot Samples

Revised: 07/30/2012 Printed: 03/05/13

The sample suspension prep is performed on the benchtop in the AA lab and the slides are prepared on the benchtop in the Micro lab.

Suspension Prep-swipes

1 Pre-label one 4 ml screw cap vial with the unique laboratory number assigned to the sample.

2 Place an unused swipe in a 4 ml glass vial labeled "Lab Blank" with the date.

3 Remove the client/customer sample swipe from the container in which the client/customer submitted it using a clean pair of forceps.

4 Place the swipe in the pre-labeled vial and fill the vial to its shoulder with either acetone or de-ionized water.

5 Screw the cap securely on the vial and vortex for a minimum of 30 seconds. In the case where multiple suspensions are being prepared at the same time it is permissible to vortex more than one vial at a time. This includes the blank from step 2.

Sample Prep-swipes

1 Turn on the hot plate and set the temperature dial at 300° F. Place the jar of Meltmount on the hotplate to liquefy the contents.

2 Remove the client/customer samples from their bag and lay out on the prep area. Ensure that the sample numbers match those on the chain of custody and that there is the correct number of samples.

3 Lay out the appropriate number of pre-cleaned 1"x3" glass slides and mark them with a unique laboratory identification number preceded by the letter "S" Example: S 12-1234-1.

4 Premark a clean glass slide with "Lab Blank," the date, and the number of preps done while that blank is exposed to the room air.

5 Place the pre-marked glass slide and a cover slip on the hot plate.

6 Take a pipette tip and dip it into the Meltmount and transfer a drop of the Meltmount onto the pre-marked glass slide.

7 Using a 100-ul pipettor, draw out 100 ul of the suspension with the client/customer sample in it.

8 Slowly press the plunger to gradually transfer the suspension to the cover slip allowing it to evaporate. This step is performed slowly so as to not let the suspension run over the edges of the coverslip.

9 Depending on how much debris was on the swipe, it may be necessary to repeat step 11 until the deposit on the cover slip is dense enough that a representative field of view has ≥10% coverage.

10 When sufficient sample has been transferred to the cover slip, use forceps to pick up the cover slip by its corner.

11 Place the cover slip sample-side-down onto the drop of Meltmount on the 1" x 3" glass slide. The Meltmount should spread evenly over the sample deposit.

12 Using the forceps, remove the glass slide from the hot plate and place in the sample prep area to cool for at least one minute before analyzing.

13 Repeat the prep procedure for the lab blank.

Sample Prep-tape lifts

1 Turn on the hot plate and set the temperature dial at 300° F. Place the jar of Meltmount on the hotplate to liquefy the contents.

2 Remove the client/customer samples from their bag and lay out on the prep area. Ensure that the sample numbers match those on the chain of custody and that there is the correct number of samples.

3 Lay out the appropriate number of pre-cleaned 1"x3" glass slides and mark them with a unique laboratory identification number preceded by the letter "S" Example: 12-1234-1.

4 Premark a clean glass slide with "Lab Blank," the date, and the number of preps done while that blank is exposed to the room air.

5 Take the first client/customer sample and the corresponding lab slide. Place the lab slide on the hot plate to warm it.

6 Take a pipette tip and dip it into the Meltmount and transfer a drop of the Meltmount onto the pre-marked glass slide.

7 Remove the adhesive media from the client/customer sample and place it sample-side-down onto the drop of Meltmount on the pre-marked slide.

8 Use finger pressure to spread the Meltmount out underneath the sample media.

9 Remove the sample from the hotplate and set the sample aside to cool for at least one minute before analyzing the sample.

10 Repeat steps 4-8 until all of the samples are prepared.

11 Repeat steps 4-8 for the lab blank.

11.45. Work Practice #TEM-1 JEOL 1200 TEM System Check and Daily Alignment

Revised: 07/08/2002 Printed: 03/05/13

1. Chiller and TEM are on at all times; if not turn start key and wait until ready light comes on.
2. Fill EDS Dewar Mondays and Fridays with liquid nitrogen; fill TEM cold trap if performing EDS work (not needed for routine scanning
3. Place sample holder with sample in TEM, if not already in; push to activate pump; when red light goes out, rotate holder clockwise and push in until seated
4. Turn on accelerating voltage (120kv), stabilizes in about 30 sec at a current of ~70-73
5. Increase gun current to slightly under-saturation to see the filament image
6. Focus filament image with brightness control (condenser), bring image to center with deflectors
7. Use gun tilt to obtain a symmetrical black circle in the undersaturated filament image; stigmate condensers until filament image is sharpest
8. Fully saturate the filament
9. At low mag, center focused beam with deflectors, then de-focus condenser until illumination is ~4cm dia. If illumination does not stay not centered, then align condenser aperture until illumination stays in the middle as condenser knob is rotated
10. In diffraction mode, insert and align objective aperture

11.46. Work Practice #TEM-2 4pi EDS Procedures for Samples

Revised: 02/09/2002 Printed: 03/05/13

System Check & Calibration

1. Power is always on to analyzer and computer
2. With specimen in TEM, location of beam unimportant, goniometer at ~30o tilt, collect a spectrum, check positions of Cu Kα and Lα; if Kα = 8.040 +/- 0.10 and Lα = 0.930 +/- 010, then document that it has been checked on the TEM bench sheet of the sample it was used for. It outside of the above ranges, calibrate the 4pi, as follows:
3. Software Calibration: choose menu item <calibrate> then start collection on either Cu or Mn (choosing the correct element in the setup at the top), start collecting – it hones in automatically, select <calibrate>, then <OK> when as desired.

Normal Use

1. Tilt specimen to 30 degrees. JEOL: crank detector in to the stop.
2. Adjust beam size to 7 on JEOL, or to produce ~2000 cts/sec.
3. Choose EDS or Imaging, depending on use. Click the <collect> icon (eye) to start acquisition. Repeat to stop the acquisition (not for imaging).
4. Save a spectrum by using the menu item <File> <save as>. In the file name, include the lab sample number (which includes the job number), fiber number, the camera length (for diffraction patterns) and your initials (for the EDS check later). Store in the folder <Spectra>, <cc>, etc. as applicable.
5. Print a spectrum by choosing <Display> <export>. Save the file as a .bmp, then start up Ms Word, and <insert> <picture> <from file> to drop the .bmp into the word doc. Save the word doc under the Spectra folder, too, then print the word file.

Quantitation

1. Choose the menu item , <quantify>. This displays the peak counts, %'s etc.
2. View periodic table if not already visible. Click elements of interest until they are green. Then they will calculate. Red elements do not calculate. Yellow calculate if they computer thinks they are there. The background is always subtracted.
3.

11.47. Work Practice #TEM-3 Overview of TEM Sample Handling

Revised: 07/24/02 Printed: 3/5/13

1. Receive samples, package in plastic bag, if necessary
2. Sign and date the customer coc and make copy
3. Give original coc to customer, staple coc copy and any other paperwork to the sample submittal form
4. Log in job and samples in LIM program
5. Label Job # on sample bag; label each cassette with Lab #, either writing or using printed labels
6. Send samples and sample submittal form to lab coordinator
7. Notify the senior analyst of the day that samples have come in; give samples to TEM sample prep
8. Make three grids from each sample, according to sample prep procedures
9. Evaluate grids, if OK, place grids in grid storage, mark grid storage form. If not, re-prep from appropriate spot in procedure
10. Analyze enough grid openings from grids to achieve required analytical sensitivity, splitting analyzed openings between at least two grids. Return grids to grid storage.
11. Make calculations, report, return to lab coordinator.
12. Give report, papers to 2nd analysts for QA.
13. Check completeness, calcs, blanks and other available QC data.
14. Send all to front desk
15. Invoice, contact client/customer, send out or retain report/samples, marking sign-off sheet as appropriate.

11.48. Work Practice #TEM-4 MCE Filter Sample Prep for TEM Analysis

Revised: 07/24/02 Printed: 3/5/13

1. Open cassette bag in clean bench
2. Wet-wipe cassettes using amended water
3. Clean scalpel and forceps
4. Place a very small amount of vacuum grease on a clean 2x3” glass slide as a release agent; cover uniformly, wiping away excess
5. Cut a wedge of unused MCE filter material place on a clean slide as a prep blank. Mark identification and location of wedge on the top of a disposable petri dish. Fix wedge to slide using the "hotshot" acetone vaporizer, or by a drop of Burdett's solution.
6. Clean tools between each sample with a clean room wipe or flush with acetone and air dry.
7. Cut wedges of each sample as above, affix and mark as above.
8. Optional: After samples, cut another wedge of unused MCE as an asher blank and affix to slide and mark
9. Heat acetone-prepped slides for 5 min @65oC, heat Burdett method slides for 30 min. or until wedges are fully flat.
10. Place all slides in dispo-petri dishes and transport to asher
11. Ash MCE on slides for latest calibrated time and power (posted)
12. Return slides to dispo-petri dishes and transport to carbon coater
13. Prepare coater
14. Coat carbon (and Au if desired) on all slides
15. Return slides to dispo-petri dishes and transport back to clean bench
16. Prepare a 1M2P Jaffe Washer and set out small screens. Place 3 TEM grids, shiny side up, on each screen
17. Cut pieces of a wedge and place on grids of one screen
18. Place screen in Jaffe washer, marking lid of washer with identity of sample
19. After 15 min. or when filter pieces appear flat, place screens one at a time in acetone condensation washer for 1/2 hour to clear, or after 1-6 hours or more, pull out filter screens from washers to air dry in the clean bench.
20. Visually evaluate grids for coverage, holes in carbon, filter dissolution; place the worst in the third (not used) slot.

21. If OK, assign to grid storage and place in grid holder, or analyze immediately
22. If grids are unusable, re-prep from appropriate spot in sequence
23. When usable grids are in storage, give cassettes and paperwork to lab coordinator to be passed on to analyst

11.49. Work Practice #TEM-5 Plasma Ashing of MCE Filters for TEM

Revised: 07/24/02 Printed: 3/5/13

Filter sections of samples and blanks are mounted on glass slides. Transport slides from clean bench in disposable petri dishes

A) Plasmod type (March, EMSL, Tegal)

1. Place slide in barrel of asher, within the Cu area, and on glass vial pedestal
2. Turn on power, then pump, and vacuum on making sure door of barrel is closed and sealing.
3. Turn on oxygen main valve at tank and also small knob after regulator; large regulator knob should already be adjusted to deliver 5 lbs pressure
4. allow pump-down and electronic warm up for about 30 seconds
5. Set timer to desired time (current time calibrated to ash 1.5 um of the filter)
6. Make sure RF power knob is all the way counter-clockwise (off), then turn RF power and meter switch on
7. Increase RF power until a plasma forms, then adjust tuning knob so that the power meter is at its minimum. Color of plasma should be dim blue. If it is bright and purple, then it is an air plasma; turn off and allow oxygen flow to wash out remaining air.
8. Turn on timer
9. Continue to adjust tuning and power during etch
10. Just before timer goes off, turn timer to manual, turn RF power all the way counter-clockwise. Push RF switch off. Push pump button off
11. Push vacuum switch off, barrel can be opened in about 1 minute. Close main oxygen valve at tank and small knob after regulator; turn off power and ac to asher after ~5 minutes cool-down.
12. Replace sample slides in dispo-petri dishes for transport

B) Autoglow

1) Place slide in the barrel of asher, using the quartz support
2) Turn vacuum pump on; turn on <ac power> to the Autoglow
3) Turn on oxygen main valve at tank and also small knob after regulator; large regulator knob should already be adjusted to deliver 5 lbs pressure
4) Hold the door against the chamber and turn on <vacuum.
5) Close the door; there is a check that doesn't allow RF power with the door open.
6) Pressure should rapidly come down to 0.5
7) [Optional pre-etch] Set <rf power> to 0. Set <timer> to current calibration setting. Make sure <autotune> is on.
8) [Optional pre-etch] Press <process start> This round is to clean the air out and replace with O2. While it is running, make sure the pressure in the chamber is 1.0-1.2.
9) When done, leave the vacuum on; set the <rfpower> to 125.
10) Press <process start>. This round does the etching.
11) When done, reverse steps above: turn vacuum off (takes about a minute to vent); take out the sample and place it in its petri dish; turn off <ac power>; turn off vacuum pump.

11.50. Work Practice #TEM-6 Carbon Coating of TEM Filter Samples

Revised: 03/09/93 Printed: 3/5/13

1 Samples and blanks are mounted and marked on glass slides or disposable petri dishes, transported to the coater in petri dishes

2 Denton coater is warmed up and pumped down.

3 Vent chamber with auto vent, takes about 2 minutes.

4 Remove bell, check grease condition on bell rubber seal and coater plate, remove and replace hard grease

5 Remove carbon rods from electrodes, sand rear rod flat on sandpaper, sharpen 1/8" dia. rod in sharpener, replace rods so that the spring at the end of the rear rod presses them together. Excess pressure causes rod breakage

6 Place a bent 2mm length of .008"dia Au wire in tungsten basket if Au coating is desired in addition to carbon

7 Place samples on sample stage

8 Replace bell, squish sideways slightly to seat it

9 Push auto pump

10 After diffusion pump gate valve opens automatically (pump lights 2 and 3 are on) and the Pirani gauge on the coater is pegged all the way to the left, turn on the high vacuum gauge, allow several seconds to warm up.

11 Adjust zero on high vac gauge.

12 Turn scale to 10-4 and turn on filament (rocker switch)

13 Choose appropriate scale. With LN, reading should be 3x10-6 or lower, but coating can proceed, in a pinch, at a vacuum anywhere on the 10^{-6} scale.

14 When vacuum is OK, then turn on electrode power and select right (wired backwards) electrodes

15 Bring power up to ~25 for about 30 to out-gas the electrodes.

16 Turn on rotation motor and adjust to fast rate.

17 Using dark glass to view, turn up electrode current until shooting stars come off electrodes, then decrease immediately. Continue for 6-8 of such episodes (narrow part of electrode is ~ gone)

18 If Au is desired, select left electrodes; increase current to preheat basket; then increase melt Au; then increase to evaporate Au, observing with dark glasses

19 When all evaporation is complete, turn off rotation motor, electrode power, and high vac gauge. Allow electrodes to cool (about 1 minute), then press auto vent

20 Compare coating color with standard coatings. If not thick enough, put another bunch on by repeating the above.

21 Return samples to petri dish for transport

27 If through with the coater, use shutdown procedure T-33

<u>For MCE Filters</u>

Carbon rod holder should be all the way down. Heating won't affect the filters.

<u>For PC Filters</u>

Carbon rod holder should be all the way up. Turn power to approx. 60 but with rocker switch off. Press rocker momentarily to give a 1/2 sec burst. Adjust power in between bursts to give a few sparks. Under no circumstances turn the power above 60 or let the thick part of the rods glow. Two pump-downs and rod sharpenings will be required. You can't fully evaporate the first one at <60 setting, but don't try. You will blow it. If the filter edges look curled at all, you've blown it.

11.51. Work Practice #TEM-7 Making and Using a Jaffe Washer

Revised: 02/24/94 Printed: 03/05/13

TO MAKE:

1 Use clean Stender dish, re-grind the ground glass using 30u diamond paste if the fit is loose

2 Place a coarse wire substrate inside the dish

3 Fill the dish with appropriate solvent (1M2P or acetone) until the mesh is awash

TO USE:

1 Place clean grids, shiny side up, on a piece of fine screen.

2 Cut carbon coated filters to produce pieces about 3mm square

3 Place cut filter piece on the correct grid and center. When all three grids for one sample are in position, place fine screen into Jaffe washer (for acetone or chloroform, grids and screens must be placed in the washer first, then each filter

piece is place onto its grid with a swift motion. Use an asymmetrical placement of little screens in the washer, to make sure that the samples are not mixed up if the washer is moved.

4 Top up with solvent if needed -just enough to wet the fine screens. Too much will float the filter pieces off the grids, too little will not dissolve the filters. For chloroform Jaffe wicks, too much solvent may produce cracks

5 Leave for sufficient time to clear grids, or clear each screen individually in the condensation washer after about 15 min. Grids cleared in 1m2p should spend 15-20 minutes in the wick (longer if the 1m2p is not clean); then 15-30 minutes in an acetone condensation washer. Polycarbonate grids cleared in chloroform should spend 3-5 hours in one wick, then be transferred to a fresh wick for >5 minutes

6 Remove screens and let dry in clean bench. If to be left for more than a minute, place Stender cover over the paper to prevent accidental breezes from disturbing the samples

7 When dry, visually evaluate grids for coverage, if OK, place in grid storage, marking grid storage record

11.52. Work Practice #TEM-8 Condensation Washing of TEM Filters

Revised: 07/24/02 Printed: 03/05/13

1 Performed when in a hurry to dissolve filter material from replica

2 Start grids as usual in the Jaffe washer for about 15 min. until filter pieces appear to be flat to adhere filter to grids

3 Pull fine screen from Jaffe washer with a tweezers and transfer to the arm of the condensation washer

4 Make sure washer has an adequate amount of the correct solvent for the filter material (chloroform for PC, acetone for MCE). Current solvent type should be marked on the exterior of the flask

5 Remove rubber stopper from very top of condenser

6 Turn on condenser water

7 Turn on transformer to 120v and set to 48 for either solvent

8 Check washer from time to time, to see that the solvent vapors reach the grids but not much higher, and that the grids have not been displaced

9 After 5-30 minutes, samples are as clean as they will get; pull out arm and retrieve fine screen and transport back to the clean bench; put in next set, if any; turn off transformer if done.

11 Let solvent evaporate from screen in clean bench

12 Visually evaluate grids and store as normal

11.53. Work Practice #TEM-9 Optical Microscope Calibration

Revised: 03/09/93 Printed: 03/05/13

1 Performed once a year or after service or change to the scope

2 Calibration is for the objective + tube only; eyepieces are not calibrated

3 Obtain Optical Microscope Calibration Form from QA Officer

4 Put in eyepiece with 100x0.1mm reticule (usually in the SEMTEC Nikon Optiphot)

5 Insert and focus on the Gradicules Ltd. 100x0.01mm stage micrometer (usually in the SEMTEC scope table drawer)

6 Measure the number of stage units per 100 eyepiece units, and record on the form

7 Perform the calculation indicated on the form

8 File form with QA Officer

9 Indicate calibration magnifications on sticker on microscope.

11.54. Work Practice #TEM-10 Taking Photos on the JEOL 1200

Revised: 08/25/06 Printed: 03/05/13

North Instrument

1. Same procedure used for diffraction patterns as anything else
2. Turn on image collection box, detector will slide into chamber
3. Open 4pi workspace and choose imaging
4. Click the acquire icon to collect image

To obtain a measurement on a diffraction pattern:

1. display the pattern
2. click the <M> button at the top of the 4pi control banner to put it into measurement mode.
3. move the cursor to a point within one layer line that it is desired to measure and click, keeping your finger down.
4. With finger down, move several (eg. 4) spacings over to another convenient layer line and lift the finger. (Measuring multiple spacings will be more accurate than trying to measure just one)
5. the line between the two points will be displayed and a measurement also displayed.
6. Divide said measurement by the number of spacings it was to obtain what a single spacing would have been had you measured it that way.
7. camera length correction: multiply the measurement in step 6 by 80cm/camera length used.
8. Now divide the current cc by that single spacing measurement in 7 to obtain the d-spacing in Å

11.55. Work Practice #TEM-11 Developing TEM Film (obsolete – not currently used)

Revised: 03/09/93 Printed: 03/05/13

1 Pour developer (200 ml HC110 concentrate in 1 gal water) into developing tank

2 Pour fixer (1 bottle concentrate in 1 gal water) into fixing tank

3 Put wash tank in sink and fill with water

4 Set plastic film rack in a convenient spot

5 Turn off white lights, turn on red safe-light, lock doors

6 Obtain TEM cassette box and remove lid

7 Remove one placeholder from cassette, snap out film kit and slide out film

8 Place film in a pile for later

9 Repeat 7 and 8 for remainder of film

10 Take off gloves, load the film into the rack

11 Develop the rack of film with more or less constant agitation for 4 minutes

12 Rinse for 30 seconds in wash water

13 Fix for 2 minutes with more or less constant agitation

14 Wash film in rack for 10-30 minutes with running water in wash tank

15 Dry film while still in rack

11.56. Work Practice #TEM-12 Printing TEM Photos (obsolete – not currently used)

Revised: 03/09/93 Printed: 03/05/13

1 Pour developer (3.2oz conc. in 1 qt water) into white tray

2 Pour fixer (same as film fixer) into red tray

3 Put tan tray in sink and fill with water for wash

4 Turn out white lights and turn on safe-light

5 Put paper, shiny side up (test strip or sheet) on foam of contact printer

6 Place desired negs on top of paper, with notch at the upper portion of the right edge of the neg

7 Set exposure time (approx. 20 sec)

8 Push button of timer to expose

9 Develop in white tray for 1 min with constant rocking of tray as agitation

10 Rinse for 30 sec in tan tray

11 Fix for 1 min in red tray with occasional rocking agitation

12 If images are too dark, then decrease exposure time; if too light, increase exposure time

13 Hang on clips to dry

14 When finished, return used chemicals to their containers and wipe up counter to prevent staining

11.57. Work Practice #TEM-13 TEM Magnification Calibration

Revised: 06/26/98 Printed: 03/05/13

1 Performed once a week, or after instrument has been serviced

2 Obtain TEM Magnification Calibration Form (in cal folder)

3 Perform TEM system check and daily alignment

4 Put in Fullam grating replica standard grid (2160 lines/mm).

5 Adjust the holder so that the specimen is in the eucentric position, place stage at 0o tilt

6 Use 20,000x for JEOL for routine calibration, 19,000x for CM10, or other magnification(s) if desired. Focus the image and the diffraction aperture using the IOS/Diff knob on the JEOL (no diffraction aperture on CM10). If not, calibration may not be valid

7 Put in objective aperture and center. Focus and stigmate image

8 Count the number and fraction of grating images that will fit inside the 100mm (largest) inscribed ring on the screen (should be 10.8 for exactly 20,000)

9 Record the results of 4 such measurements on the form

10 If the average result is not within 19K and 21K, then inform lab supervisor and QA Officer. Do not analyze samples (use the other TEM). The OOC TEM probably needs a service call to correct, since these TEMs do not allow for adjustment of magnification.

11 Replace grating grid in Fullam vial and vial in box, box in standards drawer

12 File completed form in TEM calibrations folder and enter data in computer mag form.

11.58. Work Practice #TEM-14 TEM Camera Constant Calibration (Image)

Revised: 07/22/01 Printed: 03/05/13

1 Performed once a week or when the instrument has been serviced

2 Perform TEM system check and daily alignment

3 Put in Au standard grid (in vial next to mag std), or any other grid with Au deposition

4 Adjust holder so that grid is in the eucentric position, put tilt at 0o

5 Put in the largest diffraction apertures for most accurate focusing (CM10: go to 11 spot size and adjust the illumination to be approximately the field of view on the small screen at 15000x).

6 Focus edge of aperture with IOS/Diff knob on right panel (disregard for CM10)

7 Focus image inside of aperture

10 Switch to diffraction mode, turn down the condenser until you can just barely see the diff rings

11 On small screen, focus central spot (focus knobs)

12 Set exposure for 100 msec (JEOL)

13 Capture image (JEOL)

14 For JEOL, make a digital circle the size of the innermost Au ring and save with diff pattern. Record the mm diameter in the LIMS for later use.

15 On screen measurement: Place standard chrysotile grid into TEM. While observing a strong diffraction pattern of chrysotile, insert the 1st objective aperture. Record the number of layer lines that can fit into the objective aperture, and enter that number into the LIMS form.

11.59. Work Practice #TEM-15 Changing TEM Filaments

Revised: 07/08/200298 Printed: 03/05/13

1 When uA meter gives no rise at any setting of filament current, filament is burned out. Also change if uA is too high at filament saturation

2 Turn off filament current and HV, take out diff and obj apertures

3 JEOL push gun air; then after 1 minute push gun lift lever (gun will actually rise and swing out)

5 Put on gloves

6 Pull Wehnelt assembly off

7 Clean Wehnelt and replace filament (see Work Practice TEM 16)

8. Push on fresh Wehnelt assembly, matching the pin to the notch

9 Take off gloves

10 JEOL 100: push gun air button (it will swing over and pump down automatically.

11 JEOL is ready when ready light turns on. Turn on HV

18 Slowly increase the filament current until you can see some light on the screen

19 Focus filament image with condenser

20 The intensity of the beam will normally increase with increasing filament current. If it starts to decrease before saturation is reached, stop increasing the filament current before the light goes completely, then adjust the gun tilt (back sticks) until the beam intensity is brightest. Then continue to increase filament current, repeating the tilt adjustment as needed, until saturation

21 Perform the system check and daily alignment

11.60. Work Practice #TEM-16 Replacing Filament in Wehnelt Assembly JEOL

Revised: 07/23/02 Printed: 03/05/13

1 Use gloves for handling Wehnelt assembly and filaments

2. Remove Wehnelt assembly from TEM. First, remove cylindrical shield by turning it counterclockwise. Remove the Wehnelt assembly by pulling it downward.

3. Disassemble the Wehnelt assembly as follows: Loosen the three filament securing screws, and remove the burnt-out filament. Put filament pack in box with an X marked on its base. Remove the Wehnelt cap and spring from the filament holder by turning the cap counterclockwise. Use the Wehnelt adjusting tool if necessary.

4. Clean Wehnelt cap with POL polish. Place cap in an acetone-filled beaker and ultrasonicate for 5 minutes. Discard dirty liquid and refill beaker with clean acetone. Ultrasonicate for another 5 minutes and discard dirty liquid. Allow cap to air dry and then blow dust off with a can of compressed air.

5. Reassemble by attaching the spring to the filament holder. Screw the Wehnelt cap onto the holder (1 to 2 turns). Insert a new filament into the holder so that the filament base groove aligns with the holder pin. Secure the filament to the holder with the three filament securing screws. No need to center, as JEOL filaments are pre-centered.

6. Place the assembled Wehnelt on the pedestal of the Wehnelt adjusting tool, then fit the Wehnelt adjusting tool cap over the assembly so that the cap pin aligns with one of the holes in the cap.

7. Screw in the Wehnelt cap by turning the Wehnelt adjusting tool cap clockwise until the tip of the Wehnelt cap is flush with the tip of the filament.

8. Give the Wehnelt adjusting tool cap 1.25 turns in the counterclockwise direction to make the tip of the Wehnelt cap higher than the tip of the filament.

9. Remove the Wehnelt assembly from the tool and mount the assembly in the electron gun socket by aligning the assembly grove with the socket pin, pushing the assembly into the socket as far as it will go. Reinstall the cylindrical shield over the Wehnelt assembly, turn gun lift off and hit column air to re-evacuate the column.

11.61. Work Practice #TEM-17 TEM Filter Count: AHERA

Revised: 07/08/2002 Printed: 03/05/135-Mar-13

1 There are 3 grids in grid storage for each lab number

2 Put one of the grids in the tilting or rotating holder, holder in TEM

3 Turn on 100kV, saturate filament, perform system and alignment check, being sure that the specimen is in the eucentric position

4 Turn on EDS, perform EDS system check and calibration if necessary

5 In scan mode, orient and evaluate grid openings. If uncountable (>50% GO's of coverage blown out, not enough GO's with >95% intact) then try another grid, etc.

6 Find center u marker, orient grid for easy scanning, mark prominent features on grid map

7 Choose a GO to count, mark its designation (e.g., F3) on map and counting chart. Do not choose any of the small grid openings around the u marker to count

8 Scan go at >15,000

9 A structure is a fiber or a combination of fibers with substantially parallel sides and aspect ratio of >5:1

10 Classify the structure as fiber, bundle, cluster or matrix, referring to the drawings in the Fed Reg booklet for reference

11 Measure the length of the structure using the inscribed circles (0.3, 0.5, 2.0 and 5.0 um diameters) and/or the hash marks (0.5 um apart) on the large screen. Classify as either >5um or between .5 and 5um. Fibers less than 0.5 um are ignored

12 Classify morphology as chrys or amph. Photo a fiber image every 10th fiber

13 Observe the ED pattern on small screen and identify as chrysotile, amphibole, non-asbestos or no pattern.

14 ED pattern is chrysotile if 1) rows are 2.2 to the Au ring or aperture circle, 2) odd rows are streaked, 3) three spots in the #2 row just fit into the Au ring, and 4) spacing of spots in the #0 row are slightly less than the layer line spacing (7A vs 5A)

15 ED pattern is amphibole most common zone if 1) all spots are sharp (unless multiple fibers), 2) rows are 2.2 to the Au ring, and 3) four spots in the #2 row (7 if twinned) just fit into the Au ring. Match other observed patterns to the amphibole standards catalog of ED photos

16 ED pattern is non-asbestos if neither of the above.

17 No ED pattern is the observance of no spots or too few to apply the above criteria

18 ED required up to 70 asb str/mm2 (normally, 5 structures per sample); after that, can use EDS without ED

19 Every 10th amphibole identification, tilt to zone axis and photo for confirmation

20 Confirm all likely asbestos fibers using EDS, classifying as chrys, type of amph or type of other fiber (e.g., gypsum)

21 If non-asbestos fibers >70/mm2, then they must be confirmed to be non-asbestos using zone axis photos or EDS

22 Make a final ID of a fiber based on morph, ED and EDS data. ED need not be present for asbestos ID, but there must be a reason for its absence: small fiber, interference, etc.

23 Stopping rules:

a) >50 asb. structures in one GO

b) >50 asb. structures in four GOs (counting whole GOs)

c) after required number of GOs (depends on volume) usually 4 or 5 per grid

d) for blanks, count 7 GOs

24 Repeat the above scanning analysis on one other grid

25 If average str/mm2 > 70, count field blank (if present, lab blank if not)

11.62. Work Practice #TEM-18 TEM Filter Count: Yamate Level I (do not use; use modified AHERA)

Revised: 03/09/93 Printed: 03/05/13

1 There are 3 grids in grid storage for each lab number

2 Put a grid in the holder, holder in TEM

3 Turn on HV, saturate filament, perform TEM system check and daily alignment, be sure that specimen is in the eucentric position

4 Scan mode, low mag. Evaluate replica (holes, cracks, wrinkles). If it can't be counted, try another grid, etc.

5 Scan mode, find the u marker (center of grid), orient grid for easy scanning. Mark prominent features of grid on grid map

6 Choose a GO for scanning. Do not choose one of the small GO's near the u marker. Mark the GO designation (e.g., F3) on the grid map and counting chart

7 Scan at 20,000, SA#16

8 A structure is a fiber of combination of fibers with substantially parallel sides and aspect ratio >3:1

9 Classify a structure as a fiber, bundle, cluster matrix or x (crossing a grid bar)

10 Measure the length and diameter of each structure at 20,000 using the inscribed circles (0.3, 0.5, 2.0 and 5.0 um diameters) and/or the hash marks (0.5 um apart) on the large screen

11 Classify morphology as chrys or morph

12 Observe ED pattern (small scale) on small screen

13 Classify ED pattern as chrysotile if 1) rows are 2.2 to the Au ring, 2) odd rows are streaked, and 3) three spots in the #2 row just fit inside of the Au ring

14 Classify ED pattern as amphibole if it matches one of the patterns in the amphibole standards ED pattern catalog

15 If ED pattern does not fit the above, classify as ambiguous

16 If no spots or too few to apply the above criteria, classify as no pattern

17 To identify a structure as asbestos, both morphology and ED pattern must fit same type of asbestos. Very small fibers of chrysotile may not show ED pattern; if larger fibers of chrysotile have been confirmed by ED, these smaller ones may be identified as chrysotile and counted, but if the small ones are all that are present, it cannot be assumed that they are- they must remain ambiguous

18 Continue count until >100 asb structures have been identified (but count a whole number of go's) or until 10 gos have been scanned. Gos do not have to be split between two grids, but it wouldn't hurt to split the gos on two grids

11.63. Work Practice #TEM-19 TEM Filter Count: Yamate Level II (do not use; use modified AHERA)

Revised: 03/09/93 Printed: 03/05/13

1 There are 3 grids in grid storage for each lab number

2 Put one grid in the tilting or rotating holder, holder in TEM

3 Turn on HV, saturate filament, perform TEM system check and daily alignment, be sure specimen is in the eucentric position

4 Turn on EDS, perform EDS system check, calibration if needed

5 In scan mode, low mag, evaluate replica for excessive holes, cracks, wrinkling, etc. If it can't be counted, one of the other grids

6 Scan mode, find the u mark at the center of the grid, orient grid for easy scanning, mark prominent features of the replica on the grid map

7 Choose a suitable GO, mark its designation (e.g., F3) on the map and the counting chart, and scan at 20,000 (SA mode #16)

8 A structure is a fiber or combination of fibers with substantially parallel sides and aspect ratio > 3:1

9 Classify a structure as a fiber, bundle, cluster, matrix or x (crossing a grid bar)

10 Measure the length and diameter of a structure at 20,000x using the inscribed circles (0.3, 0.5. 2.0 and 5.0 um diameters) and/or the hash marks (0.5 um apart) on the large screen

11 Classify the morphology of a structure as chrysotile or amphibole

12 Observe the ED pattern on the small screen

13 Classify the ED pattern as chrysotile if 1) the rows are 2.2 to the Au ring, 2) the odd rows are streaked and 3) three spots in the #2 row just fit inside of the Au ring. Photo every 10th chrys pattern for documentation

14 Classify the ED pattern as amphibole (most common pattern) if 1) the spots are sharp (except for multiple fiber structures), 2) the rows are 2.2 to the Au ring, and 3) four spots (7 if twinned) in the #2 row just fit inside of the Au ring, or by matching pattern to one in the amphibole standards ED pattern catalog

15 Every 10 structures identified as amphibole, tilt to a zone axis and photo for detailed ED confirmation

16 If ED pattern does not fit the above, classify as ambiguous

17 If no spots or too few to apply the above criteria, classify as no pattern

18 Perform EDS analysis confirmation for first 5 chrysotile fibers, then one of every 10 following

19 Perform EDS analysis confirmation for the first 10 amphibole fibers, then one of every 10 following

20 For final identification of a structure, all data taken must consistently indicate the same type of asbestos (morphology, ED and EDS, if done). Small fibers of chrysotile may not always give ED patterns. They may be counted

as chrysotile if several larger fibers of chrysotile on the same sample do show the correct ED pattern. But if only small, no-pattern fibers are present, they must remain ambiguous, mention in notes section of report

21 Continue scanning until >100 asbestos structures have been identified (count a whole number of GO's), or until 10 GO's have been scanned. It is not required to split the GO's on two different grids, but it would improve the consistency of the analysis to do so

11.64. Work Practice #TEM-20 TEM Filter Count: Yamate Level III (do not use; use modified AHERA)

Revised: 03/09/93 Printed: 03/05/13

1 There are 3 grids in grid storage for each lab number

2 Put a grid in the tilting or rotation holder, the holder in the TEM

3 Turn on HV, saturate filament, perform TEM system check and daily alignment, making sure that the specimen is in the eucentric position

4 Turn on EDS, perform EDS system check, calibration if necessary

5 In scan mode, evaluate replica for excessive holes, cracks, wrinkling, etc. If uncountable, try another grid

6 Find the u marker at the center of the grid, orient the grid for easy scanning, mark prominent features of the replica on the grid map

7 Choose a GO, mark it designation (e.g., F3) on map and counting chart, and scan at 20,000x, SA mode #16. Do not scan the small GO's near the u marker

8 A structure is a fiber or combination of fibers with substantially parallel sides and aspect ratio > 3:1

9 Classify a structure as a fiber, bundle, cluster, matrix or x

10 Measure the dimensions of a structure at 20,000x using the inscribed circles (0.3, 0.5, 2.0 and 5.0 um diameters) and/or the hash marks (0.5 um apart) on the large screen

11 Classify the structure morphology as chrysotile or amphibole

12 Observe the ED pattern of a structure on the small screen

13 The ED pattern is classified as chrysotile if 1) rows are 2.2 to the Au or scribed ring, 2) odd rows are streaked, and 3) three spots in the #2 row just fit inside of the Au ring. Photo one of every ten for confirmation

14 For ED patterns that look like amphibole (rows are 2.2 to the Au ring, sharp spots closely spaced), tilt to a common zone axis and compare to our atlas of amphibole patterns. Photo one of every 10 for confirmation. For court case, photo every amphibole diffraction pattern

15 If ED pattern does not fit the above criteria, classify as ambiguous

16 If no spots or too few to apply the above criteria, classify as no pattern

17 Perform EDS analysis confirmation on every structure, classifying as chrysotile, the appropriate amphibole, or other

18 For final identification, all data must consistently indicate the same type of asbestos. Some small chrysotile fibers may not give ED patterns. If larger chrysotile fibers have given ED patterns in the same sample, it can be assumed that the smaller fibers are chrysotile. If only the small, no pattern fibers are present, they must remain identified as ambiguous

19 Continue count until >100 asbestos structures have been identified (count a whole number of GO's), or until 10 GO's have been scanned. It is not required to split the GO's between two grids, but the consistency of the analysis would be improved if they were

11.65. Work Practice #TEM-21 PC Filter Sample Preparation

Revised: 07/24/02 Printed: 03/05/13

1. Open sample cassette bag (in fume hood, if they look dirty); mark a disposable petri dish with the date of preparation, and the lab numbers and blanks to be mounted and in what order.
2. Wet-wipe cassettes using amended water
3. Cover a 2x3" glass slide with Whatman filter paper; mark which end is the start of samples. Hold down with parallel strips of double-sticky tape on glass slide or dispo-petri dish for holding samples; use a paper filter as a backing material
4. Place PC filter sample on a bench, using another piece of clean filter paper as backing. Cut a strip from a sample; place the strip across the tape on slide to hold and mark the petri dish lid with the sample designation
5. Continue filling up tape with sample strips

6. cut and mount the prep blanks along with samples; also mount the bench blank if air samples
7. Option: Cut and mount another strip of PC filter for a coater blank
8. Close cover of dispo-petri dish or put glass slide containing the samples into a large dispo-petri dish for transport to the coater
9. Carbon coat (and Au if desired), using minimum of carbon, short bursts, and long waits in between bursts. Carbon rods in the high position. Use on/off switch to control burst length while keeping power knob at constant 60 position. Do not go above 60 or allow the large diameter of the carbon to glow.
10. Cover or return slides to dish for transport back to clean bench
11. Place 3 grids, shiny side up, for each sample and blank on fine screens. Place screens in Jaffe washer charged with chloroform (1M2P will often cause the filters to roll up
12. Cut 2mm-sized filter pieces from each sample and blank using a cleaned scalpel and forceps. Place each piece on the appropriate grid in one motion to prevent wrinkling. Leave cover off while doing it to prevent premature wrinkling of filter pieces. Best result is obtained with only a little chloroform present; too much chloroform causes grid openings to break. Do not breathe chloroform vapors and cover washer between each sample to prevent solvent vapors from becoming airborne. Add some more solvent, but too much solvent will float the filter pieces away from their grids and possibly cause cracking, too little solvent will not dissolve back the filter material
13. After 3-5 hours, transfer the screens to a fresh Jaffe wick charged with chloroform & leave for >5 minutes
14. Visually inspect grids to see if carbon has held up. If OK, place grids in grid storage box, mark grid storage record
15. If grids are unusable, re-prep from appropriate place in procedure

11.66. Work Practice #TEM-22 Routine Maintenance of the TEMs

Revised: 02/24/94 Printed: 03/05/13

-DAILY-

1. Check vacuum level, should be near zero later in the day, advise technician if high.
2. Check any o-rings exposed (e.g., specimen holder, film drawers) and lubricate or replace as needed.

-MONTHLY-

1. Clean windows and instrument horizontal surfaces.
2. Check and/or clean film holders and cassettes.

-AS NEEDED-

1. Replace and clean Wehnelt assembly as per T-19 and T-20.
2. Clean adjustable C1,C2 and diffraction apertures when visibly dirty, as per manual E2.1, E2.3 and E2.4. Clean fixed C1 aperture whenever other apertures are being cleaned.
3. Clean specimen holder tips as described in manual E-2.4.

11.67. Work Practice #TEM-23 Grid Opening Measurement

Revised: 03/09/93 Printed: 03/05/13

-Performed for every lot of EM grids received.

1. Obtain 20 EM grids, chosen equally from the lot received, e.g., one from each 100 grid vial.

2. Place grids in a recognizable pattern (so as not to lose place during measurement) on a glass slide.

3. Place slide with grids on a calibrated optical microscope which has a 100x0.1mm reticule in its eyepiece, and preferably a circular stage and x/y travel. Use 400x magnification. A combination of transmitted and reflected light will make the reticule most visible.

4. A grid opening width is measured perpendicular to its sides. Do not measure widths that are near the central u-marker, as they are smaller than normal.

5. Measure 10 randomly selected grid opening widths on one grid, then rotate the grid 90o and measure 10 more. Record the results (in reticule units) on the Grid Opening Measurement Form.

6. Repeat for the other 19 grids.

7. Perform the calculation given at the bottom of the form.

8. File the form in the calibrations binder.

9. When the grids are actually used in sample prep, the calculations (and computer program) must be changed accordingly.

11.68. Work Practice #TEM-24 TEM Beam Dose Check

Revised: 03/09/93 Printed: 3/5/13

Performed by all new analysts until at least a 90% level is achieved, and thereafter once a year by all analysts.

1. Place standard chrysotile reference standard grid in TEM.

2. Obtain Beam Dose Check form.

3. Perform TEM system check and daily alignment.

4. Search out single chrysotile fibrils that are >1u in length.

5. Obtain diffraction pattern as usual (see SOP for suggestions for limiting beam dose)

6. Count seconds until pattern becomes unrecognizable (up to 30 seconds maximum) and record number of seconds on form.

7. Perform timing for 50 fibrils.

8. Calculate % of fibers whose patterns persisted for longer than 15 seconds, and record at bottom of form.

9. File form with QA officer.

11.69. Work Practice #TEM-25 Energy Dispersive Spectrometer Performance Check

Revised: 03/09/93 Printed: 03/05/13

1. Obtain EDS Performance Check Form.

2. Place SRM 2063 standard (mineral glass film) in TEM, gray side up..

3. Perform TEM system check and daily alignment.

4. Tilt to 30o (clockwise)

5. Reduce spot size to about 20 on C1, then spread beam out (defocused).

6. Perform EDS energy calibration check, and calibration, if necessary.

I. K-ratio measurement and Mg/Fe sensitivity check

1. Obtain 5- 300 sec counts on the 2063 standard.

2. For each count, label each element of interest; perform standardless semi-quant (adjusting background windows for a decent fit as shown by low residue); record net counts for each

3. Enter into the k-factor MS Excel spreadsheets for calculations.

4. Repeat with albite (Na,Al vs Si).

II. Resolution Check

1. Put Mn-oxide sample grid in TEM.

2. Perform the TEM system check and daily alignment.

3. Tilt sample to 30o and then reduce beam size to small normal EDS setting.

5. Perform EDS system check and calibration (F7).

6. Collect a spectrum of Mn where the Mn peak is ~2000 cts high; subtract background and delete/adjust the background windows to produce a good background subtraction. Perform peak fit; Emispec will tell the resolution in the properties window. Save the workspace under <spectra>; export the display and save in the same place. Repeat to get 5 of them. Determine the resolution graphically for one of them to check the computer version. If OK, use computer numbers; if not within a few eV, then determine all five graphically. Calculate the average resolution and the standard deviation. Calculate the sum of the average + 2 standard deviations.

7. File the form in the TEM tech file, enter data in computer.

III. MINERAL OBSERVATIONS

1. Observe standard crocidolite, obtain a ~300 sec. spectrum. Obtain the integrated peak and the integrated background by: 1) background subtract (as above, adjusting the background windows to get a good fit); 2) do peak fit; 3) place roi on the Na peak and select the roi, then hit <process><sum>; the intensity will be displayed in the properties window. Perform the calculation: if $(I-I_b) > 3(2I_b)^{1/2}$, then the peak is significant.

2. Observe standard chrysotile, obtain a 300 sec. spectrum from a single fibril. Perform the same tests for significant peaks as in #1.

3. Observe kaersutite amphibole, obtain a 300 sec. Spectrum. Get an analysis, setting backgrounds as above. Must detect >2% of Na,Mg, Ca,Fe.

4. Attach both spectra to Performance Check Form.

11.70. Work Practice #TEM-26 TEM Minimum Beam Diameter Measurement

Revised: 03/09/93 Printed: 03/05/13

1. With or without a sample in TEM, perform condenser aperture alignment and daily alignment.

2. Choose 100,000 magnification, smallest Condenser aperture.

3. Reduce spot size to minimum.

4. Stigmate condensers.

5. When spot is round, take an image on the 4pi measure diameter.

6. Add a line scan across the middle of the spot. Measure the full width at 10% the peak height. Record on EDS Performance form, attach a hard copy and store the electronic copy.

11.71. Work Practice #TEM-27 Quality Procedures for TEM Analysts

Revised: 07/24/02 Printed: 03/05/13

DAILY

Perform TEM system check and daily alignment.

Perform EDS system check and energy calibration and document on EDS check form.

Keep TEM prep area and microscope clean

Photograph ED pattern for each asbestos type for each set of samples containing asbestos.

WEEKLY

Perform and camera constant calibration.

MONTHLY

Perform plasma asher calibration.

Identify qualitative standard.

Perform TEM magnification calibration

EVERY SIX MONTHS

Perform Spectrometer Performance Check (K-ratios and resolution).

Perform Minimum Beam Diameter Calibration.

YEARLY

Count SRM 1876 successfully.

Perform Beam Dose Check.

AS NEEDED

Log TEM samples into TEM log, noting type of QA re-count required.

Originate prep blank while preparing each job.

Make duplicate preps when required by the TEM Log.

Perform replicate counts, duplicate counts and verified counts (same analyst or different analyst as determined by the TEM Log).

Prep or count interlab and proficiency samples.

Perform TEM condenser alignment when indicated by system check.

Perform Grid Opening Measurement and Optical Microscope Calibration.

11.72. Work Practice #TEM-28 Plasma Asher Calibration

Revised: 01/29/09 Printed: 03/05/13

1. Obtain three blank plasma asher calibration forms.
2. Obtain three clean, dry 2x3" glass slides from the dessicator, weigh to 0.00001g, record each weight on its own form.
3. For each slide, cut an unused 25mm dia. Millipore brand MCE filter in quarters. Clear pieces in turn on the slide with the hot block. Place each in asher with the vacuum on for 15 min. to get rid of the acetone from the clearing. If they fit, they can be vacuumed at the same time.
4. Weigh the three cleared filter and slides to 0.00001g, record on their respective forms.
5. Warm up the asher pump and electronics, and ash slide 1 at normal wattage for 2 min, ash slide 2 for 5 min, and ash slide 3 for 10 min.
6. Weigh the three ashed slides to 0.00001g, record on the respective forms.
7. Open a spreadsheet in //Larry\c:\TEM Data Backup\TEM Plasma Asher Calibrations\, for example the file 'TEMPlasmaAsherCalibration01-28-09.xls'. Note that the date of the calibration is in the filename. <Save As> the opened file substituting the date of the current calibration in the filename, so that each calibration is documented with its own spreadsheet. Enter the 9 weights (3 per slide) by <tabbing> around the spreadsheet. Calculations for each slide are automatically performed. When done, the chart will show the curve that fits the current data, and the equation of the curve will be displayed in the chart. Enter the three coefficients for the curve under a, b, and c, respectively. The time to etch 5% will be calculated automatically at the bottom of the spreadsheet. Print a copy of the spreadsheet and staple to the raw data forms.
8. Make a new line in the LIMS Plasma Asher Calibration database, and enter the date and calculated 5% etch time.
9. File the papers in the Plasma Asher Calibrations file in the TEM drawer in the technical file cabinets in Larry's office.

11.73. Work Practice #TEM-29 Turn-on and Turn-off of the Denton D-502A Carbon Coater

Revised: 02/24/94 Printed: 03/05/13

Turn On

1. Turn on air tank main valve
2. Turn on water on wall
3. Turn on coater main power switch
4. Valves on manual and all closed
5. Turn on mechanical pump
6. Wait until foreline vac comes down
7. Open backing valve, wait until foreline vac comes down again
8. Turn on diff pump power. Wait 20 minutes for warm up
9. Close backing valve
10. Turn to auto vent to prepare rods

Turn off

1. Pump down chamber until gate valve is open
2. Go to manual valves, all valves closed
3. Open backing valve
4. Turn off diffusion pump power
5. Wait 15 minutes for diff pump to cool
6. Turn off diff pump water

7. Close backing valve

8. Turn off mechanical pump

9. Turn off main power

10. Turn off air supply at main valve.

11.74. Work Practice #TEM-30 TEM Filter Count: Water Sample

Revised: 02/24/94 Printed: 03/05/13

1 There are 3 or 4 grids in grid storage for each lab number

2 Put one grid in the tilting or rotating holder, holder in TEM

3 Turn on HV, saturate filament, perform TEM system check and daily alignment, be sure specimen is in the eucentric position

4 Turn on EDS, perform EDS system check, calibration if needed

5 In scan mode, low mag, evaluate replica for excessive holes, cracks, wrinkling, etc. If it can't be counted, one of the other grids

6 Scan mode, find the u mark at the center of the grid, orient grid for easy scanning

7 Choose a suitable GO, mark its designation (e.g., F3) on the map and the counting chart, and scan at 10,000-20,000; 10,000 if only fibers > 10um are to be counted (usually)

8 A fiber is a fiber or bundle with substantially parallel sides and aspect ratio > 3:1. Count fibers intersecting the top and left grid edges only, and record as twice the visible length; do not count fibers intersecting the bottom or right edges.

10 Measure the length and diameter of a fiber at 20,000x using the inscribed circles and/or the hash marks (0.5 um apart) on the large screen

11 Classify the morphology of a structure as chrysotile or amphibole

12 Observe the ED pattern on the small screen

13 Classify the ED pattern as chrysotile if 1) the rows are 2.2 to the Au or scribed ring, 2) the odd rows are streaked and 3) three spots in the #2 row just fit inside of the Au ring. Photo every 10th chrys pattern for documentation

14 Classify the ED pattern as amphibole (most common pattern) if 1) the spots are sharp (except for multiple fiber structures), 2) the rows are 2.2 to the Au ring, and 3) four spots (7 if twinned) in the #2 row just fit inside of the Au ring, or by matching pattern to one in the amphibole standards ED pattern catalog

15 Every 10 structures identified as amphibole, tilt to a zone axis and photo for detailed ED confirmation

16 If no spots or too few to apply the above criteria, classify as no pattern

17 Classify final identification according to data: CM (chrysotile by morphology), CD (chrysotile by morphology and diffraction), CQ (chrysotile by morphology, diffraction and EDS), AM, AD, AQ, AZQ (all of above including zone axis), etc. Default identifications: unless marked otherwise, all "ch" identifications are CD and all amphiboles are AQ.

18 Continue scanning until >100 asbestos structures have been identified (count a whole number of GO's), or until an analytical sensitivity of 0.2 mfl has been obtained (nominally 6 gos for 90 ml water on a 47mm filter). Do not count any less than 4 grid openings. Split grid openings among three different grids

19 Report best estimate + confirmed (CD+CQ+AQ+ADQ) fibers >10um long.

11.75. Work Practice #TEM-31 TEM Analysis of Bulk Samples

Revised: 03/04/93 Printed: 03/05/13

I. Qualitative Analysis

Use: For routine confirmation of fiber identity (usually after and as a complement to PLM analysis). Quantitation is by visual estimate on the TEM grid (estimated CV=20-50%, depending on fiber concentration).

1. Grind ~.1 gm sample lightly in mortar and pestle to reduce grain size and to homogenize. "Sample" may be as received or already reduced or concentrated by gravimetry or other means.

2. Lubricate grinding using acetone, ethanol or DI water, depending on sample compatibility with those liquids.

3. Wash sample into new 50 ml vial. Add additional liquid until sample is distinctly but barely cloudy.

4. Clamp a previously carbon-coated TEM grid in a locking forceps.

5. Ultrasonicate sample mixture for 2 min.

6. Immediately after ultrasonication, drop 5 uL mixture onto the TEM grid using the Eppendorf micro-pipetter.

7. Allow to dry (acetone: 5 min.; ethanol: 10 min.; water: 1 hour).

8. Examine grid on TEM at 1000X-20,000X.

9. Identify fiber types using AHERA protocol. Photo-document one diffraction pattern of each type of asbestos observed. Estimate relative % of fiber types.

II. Semi-quantitative Analysis (Chatfield): see Work Practice PLM-3

III. Quantitative Analysis

Use: For extraordinary determination of asbestos percentages in a bulk sample. Quantitation is by weight from the volumes of fibers estimated from their apparent areas.

1. Weigh to 0.0001 gm approximately 0.1 gm sample. "Sample" would normally be already reduced or concentrated by gravimetry (see WP PLM-3).

2. Grind sample under DI water in mortar and pestle to liberate fibers.

3. Wash sample into clean 150ml beaker and bring volume to at 50-100ml.

4. Place 5um pore size MCE backing filter into the 47mm dia filter apparatus reserved for bulk samples. Place a 0.45 pore size MCE filter on top of it, followed by the funnel and clamp.

5. Pour the sample mixture into the funnel, then apply vacuum until mixture has been drawn through. As sample is drawn, periodically wash down the sides of the funnel, but not during the last 10 ml, as this may cause uneven distribution.

6. Dry filter overnight in dessicator or drying oven.

7. Prepare 3 TEM grids from the MCE filter according to AHERA protocol. The grids should be prepared from three widely separated parts of the filter.

8. Examine the grids on the TEM. Particulate loading should be 10-20%. If not, re-prep.

9. Analyze according to Yamate II protocol (length & width of each asbestos fiber, 20 grid openings chosen evenly from the three grids. Photo-document one diffraction pattern from each asbestos type observed.

10. Drop to 1000X and examine 20 grid openings on each grid for large fibers.

11. Calculate volume of each asbestos type observed (if fibers were seen during both high and low mag scans, the calculation should be standardized at one mag, by applying the 3:1 ratio to the other fiber volume).

12. Calculate the weight of each asbestos type observed, assuming chrysotile=2.55gm/cc and amosite=3.43gm/cc (other densities listed in TEM in water method).

13. Calculate weight % = weight during analysis x eff. filter area/(sample weightxanalyzed area).

11.76. Work Practice #TEM-32 Filtering Water Samples for TEM Analysis

1. Revised: 07/24/02 Printed: 03/05/13
2. Check water sample(s), filtration must be completed within 48 hours of sample collection for drinking water law compliance. Place water sample(s) in ultrasonicator, adjust water level as necessary. Sonicate at least 10 minutes.
3. Get water filtration apparatus from drying rack or storage shelf.
4. Attach pump hose to plastic flask. Place glass filter base into flask.
5. Center a 5 micron pore size MCE filter on the frit.
6. Center a 0.1 micron pore size PC filter on the frit. Be careful as filters are usually full of static electricity and will curl up and stick to themselves.
7. Turn pump on. If pump breaks, there is a manual hand pump available.
8. Place the top part of the filter apparatus on the filters.
9. clamp the upper and lower parts of the filtration apparatus together with the blue metal spring clip.
10. A fresh supply of distilled water is necessary each day, as organic stuff grows in water left overnight. Fill clear plastic container with fresh distilled water from tap located at the rear of building.

11. Measure 250ml of distilled water into graduated cylinder and pour into filtration apparatus to make the batch (one per every batch of samples filtered one after another as a group) blank.
12. After all of the water is sucked through the filter, with pump still on, open the spring clamp and remove upper part of filtration apparatus. Next, pull the upper filter off with tweezers and place in a 50mm diameter plastic petri dish. Label with date and volume.
13. Discard MCE filter and let glass frit dry momentarily with the pump running before placing the next MCE filter down.
14. If client/customer water sample is 800ml in a 1000ml container as they are supposed to be, sample is ready to be filtered after 10 minutes. Unfortunately, most samples arrive in full containers requiring additional work for us.
15. After 10 minutes in the ultrasonicator, pull full water sample container out and shake vigorously end to end 30 times. Pour out excess sample so only 800ml remains in container. Ultrasonicate for an additional 10 minutes.
16. After sample is ready, select volume to be filtered. Choosing the correct volume is the key step in preparing a water sample for TEM analysis. If too much volume is used, the filter will be opaque and unreadable. The analyst will have to start all over again by refiltering the sample. If too small a volume is used, the analyst will have to read too many grid openings and spend more time then is necessary. The goal is to filter the largest readable volume.
17. For most water samples, we begin with 90ml. Use disposable centrifuge tubes to measure volume in order to avoid cross-contaminating samples. Volumes greater than 50ml will require two tubes full.
18. Set up filtration apparatus as described above. Shake sample container vigorously end to end 30 times and pour into centrifuge tube. Pour sample into top of filtration apparatus.
19. Water will be slowly filtered. With pump still on, remove clamp and top of filter assembly.
20. Place PC filter in disposable 50mm petri dish. Start over if particulate loading is nonuniform.
21. It is easiest to hold the filter in a petri dish up to the light in the TEM prep hood in order to judge particulate loading. Compare with example filter in petri dish located in TEM prep hood. This example is a filter just at the boundary between being too heavily loaded to count and being barely countable. The ideal is to match the example or to be slightly under that loading. If it is more heavily loaded, then refilter the sample using a smaller volume. Discard filter if it is grossly overloaded. If just slightly overloaded, prepare it along with the other filtrations, as it is not always possible to predict the loading from visual appearance.
22. In all cases, the total volume of fluid to be filtered should be >50ml. Add distilled water to the sample to make up the proper volume. The smallest volume that can be filtered to achieve the desired analytical sensitivity of 0.2 million fibers per liter is 20ml. Use a larger volume if you can. Client/customer samples submitted to us commonly yield proper particulate loading on the filter at 30, 25, or 20ml. If the particulate loading looks perfect at 5 or 10ml, filter one at 20ml anyway, as it still may be possible to read it.
23. Use 50ml centrifuge tubes for samples down to 20ml and use 15ml centrifuge tubes for samples down to 5ml. Smaller volumes will require the use of micropipettes.
24. For small volumes, set up filtration apparatus, fill a beaker full of distilled water, shake sample, and use pipette (with disposable tip attached) to extract a sample. Pour about 50 ml of distilled water into funnel of filtration apparatus, inject sample into water, touch tip of pipette to funnel so drop of sample on tip gets filtered, pour more distilled water into funnel to bring total volume up to at least 100ml. Multiple shots from the pipette will be required if 2 or 3ml of sample is filtered. Pipette can be adjusted to deliver as small as 0.2ml.
25. I the volume needed is smaller than 0.2 ml, serial dilution is recommended. In this case, get an empty one liter plastic bottle (in TEM prep room or on storage shelf near where old samples are stored) and fill about halfway up with distilled water. Using a disposable centrifuge tube, pour 10ml of sample into the new container, add a few drops of concentrated bleach (TEM refrigerator) and enough di water to fill to 1L. This yields a 1:100 dilution factor. Filter the diluted sample like an ordinary sample, but remember to take into account the dilution factor for total volume calculations.
26. Save all filters that have particle loadings anywhere near ideal amounts in disposable 50mm petri dishes marked with sample number and volume (very important!).
27. Remember that there is no going back – the 48 hr window will be gone by the time it will be discovered that the filters are too lightly or too heavily loaded. It is not possible to tell whether a filter is loaded correctly by looking at it. Make multiple filtrations.
28. Place all filtered samples in TEM prep hood. Indicate time in which filtration is completed for each job on work order. Be sure to indicate volume(s) filtered on work order for each sample.

29. If the analytical sensitivity for the analysis will be >7MFL (about 1 ml of filtered volume), then contact the client/customer to see whether they want to pay for the additional gos to be counted to exceed 7 or scratch the analysis or perform as is.

30. client/customer

11.77. Work Practice #TEM-37 TEM Filter Count: ASTM dust

Revised: 10/28/2003 Printed: 03/05/13

1. Check c-o-c to make sure client/customer supplied the surface area vacuumed for each sample.

2 Wet–wipe the exterior of each cassette.

3. Remove the upper plug from the sample cassette and introduce 10ml of a 50/50 mixture particle-free water and alcohol into the cassette using a plastic wash bottle. If the plugged nozzle was left attached, introduce the solution through the tubing, and then remove the tubing, if it is visibly clean.

4. Replace the upper plug and lightly shake the dust suspension by hand for 3 s.

5. Remove the entire cap of the cassette and pour the suspension into a 250ml glass specimen bottle. If large dust bunnies are present, pour the suspension through a 1.0 by 1.0 mm opening screen (you can use our silver mesh grid supports).

6. Rinse all traces of the sample contained in the cassette into the specimen bottle with a plastic wash bottle containing the water-alcohol solution.

7. Repeat the washing procedure two additional times for a total of three washings.

8. Typically, the total amount of the 50/50 mixture of water and alcohol used in the rinse is 50 to 75ml. Bring the volume of solution in the specimen bottle up to the 100 ml mark with particle-free water only.

9. Use our standard TEM water sample filtration apparatus to filter sample.

10. Filter a 50ml blank.

11. Hand shake each capped bottle 3 s, then place in ultrasonic bath and sonicate 3.0 min.

12.Shake each suspension lightly by hand for 3 s, then let it rest for 2.0 min. to allow large particles to settle to the bottom or float to the surface.

13. Filter several volumes. Filter smallest volume first and largest volume last, so glassware doesn't have to be washed between filtrations. Typical volumes filtered may be 1ml, 3ml, and 10ml, although you can filter up to 50ml. Volumes smaller than 1ml require serial dilution (e.g., for 0.1ml, dilute 1ml sample to 50ml total, then dilute 5ml of that solution in 50ml total). Often volumes that take 30 min or more to filter will produce a readable prep.

14. Prep as per our standard PC-filter method.

15. Select prep made from largest suitable volume to read.

16. Read filters using standard AHERA methodology.

17 Calculate asbestos structures/ cm^2 = EFA x 100ml x #STR / GO x GOA x V x SPL; where #STR = number of asbestos structures counted, EFA = effective filter area of the final sampling filter ($962mm^2$), GO = number of grid openings counted, GOA = average grid opening area, mm^2, SPL = surface area sampled, cm^2, and V = volume of sample filtered, representing the actual volume taken form the original 100ml suspension, ml.

18 Read enough grid openings to achieve an analytical sensitivity of 1000 asbestos structures per square centimeter (calculated for the detection of a single asbestos structure).

19. If an analytical sensitivity of 1000 asbestos structures per square centimeter cannot be achieved after analyzing ten grid openings, then stop after the 10^{th} grid opening. A minimum of four grid squares must be analyzed for each sample.

20. The limit of detection for this method is defined as, at a minimum, the counting of four asbestos structures during the TEM analysis. If less than four asbestos structures are counted during the analysis report the analytical result as less than the limit of detection (4). On the final report, this is a situation where a raw analytical result is useful, but the method result is still calculated on the basis of 4 fibers with a < symbol before the result.

21. There are no accepted clearance standards, but according to Jim Millette of MVA, <1000 str/cm^2 is considered clean and >100,000 str/cm^2 is considered to be definitely contaminated. Intermediate values are "gray areas" so each individual client/customer must try to interpret the results.

11.78. Work Practice #TEM-38 Calibrations with the 4pi EDXAs – Resolution, TEM Mag, TEM CC

Note: after use, always keep the detector cranked up to a position of at least 3 to prevent degradation by electrons. Crank it down to the stop (0.8) to analyze. Since the crank is sticky, support the detector during cranking to prevent excessive wobbling during cranking.

Energy calibration and Resolution measurement

- This is a single point calibration that can be done with any grid (using the Cu K alpha peak) or by inserting a Mn-oxide standard (using the Mn K alpha peak).
- Adjust to smallest beam size on a carbon area (for normal grid) or on a Mn-oxide particle (for the Mn-oxide standard)
- Click <analyze><calibrate> (If you hold <alt> down while clicking calibrate, the fit will be shown.)
- At the top, choose the element to be calibrated to.
- Click the camera at the top right of the calibrate window to start the collection.
- The system autocalibrates continually. When the displayed "measured" eV matches the "actual" eV, then click the camera to stop the spectrum, then <OK> to store and close the window. If the spectrum is to be stored, do a screen print to the Windows clipboard (push <Print scrn> button) before clicking <OK>. Import into Photoshop to crop, then save in c:/spectra.
- The measured fwhm resolution (back-calculated to the Mn K alpha peak if necessary) is also displayed in real time (EDS Performance Check, Part II).
- The calibration display is modal (does not allow leaving the window).

Collecting a spectrum

- Make sure detector is cranked in, as above.
- Start Revolution from desktop shortcut.
- Options probably not needing changing are in <Analyze><Setup Detector> and <Analyze><Setup Analysis>.
- Click the camera at the upper left.
- A window opens with the spectrum accumulating.
- Click the "###" button to show the quant numbers. All pertinent elements should already be present, but, if not, select them using the window opened with <Analyze><Edit Elements>. ROI window displays, gross or net are also arranged with this dialogue box, as well as other quant options. Use net ROI counts on NIST SRM 2063 and standard albite for K-factor calculation (EDS Performance Check, Part I). Backgrounds for ROIs (e.g., for EDS Performance Check, Parts III and IV) must be estimated by displaying the ROIs, then estimating the mean background per channel, then multiplying by the number of channels.
- Stop the analysis by clicking the camera again.
- Save the spectrum, e.g.as c:/spectra/ 2007-01201-1 ch doc str 1 LSP 03-12-07.

Images / Magnification Calibration / Camera Constant Calibration

- Turn on Gatan image box and TV. Insert camera and observe the image to be captured on the TV.
- In the Revolution program click <Mode><TEM Image>
- Click the camera icon at the top left to capture an image. It will have a unique photo number, just like film would. Use 1000x for camera constant, use the actual magnification for images, when asked what the mag is.
- Save the image in revolution format, e.g., c:\camera constants\CCD Film #000117 cc 03-15-07.mbd
- Contrast and brightness can be adjusted in the program (right click and choose "adjust levels"
- Click the measurement icon at the top (M with a line), then place the crosshairs at one edge to be measured, click, then stretch the line to the other edge to be measured (for a camera constant, measure the diameter of the first gold ring). The positions of the ends can be dragged to better spots at any time.
- For camera constant, store the diameter in the LIMS.
- Save the image again. If you want to export, save it as a different format, e.g., jpg.

11.79. Work Practice #XRD-1 Routine XRD (Miniflex) Confirmation of Floor Tile Analysis

Revised: 06/29/00 Printed: 03/05/13

To confirm or quantify presence of chrysotile in a floor tile using a direct mount.

1. Remove wax, oil from tile surface by either ultrasonicating in a 1:1 solution of tile stripper for 30 sec., or by sanding on 240 grit wet lap. When tile has matte finish, it is clean.

2. Turn on water to XRD.; the turn on power to XRD, ADC, and XRD HV

3. Make sure ADC parameters are as listed on the XRD top.

4. Place tile in XRD, clean side up, replace cap.

6. With clutch out, adjust angle to 35°.

7. Close top, making sure handle is not loose (which will keep shutter from opening), turn on x-ray.

8. Start the ADC run at the same time you turn on the XRD goniometer

9. Goniometer and ADC will automatically stop. Turn off X-ray and HV. Wait a bit before turning off the water and XRD power.

Interpretation

Consult book of 100 floor tiles for examples of interpretation. Serpentine falls at 12.1 and 24.5. Kaolinite, usually in very large peaks, falls at 12.5 and 25.0. Amphibole falls at 10.5, usually in conjunction with a larger talc peak at 9.5. In the case of talc+amphibole, the material is probably NY talc, which contains both fibrous anthophyllite and non-fibrous tremolite.

Rutile, at exactly 27.5, can usually be used as an internal angle calibration. For instance, if the rutile peak occurs at 27.8, then peaks at 12.4 and 24.8 are serpentine, not kaolinite.

For quantitation of serpentine, estimate the area of the 12.1 peak by multiplying the height of the peak over background by the width of the peak at half its maximum over background. Measure in mm to obtain a mm^2 area. 100 mm^2 peak area = ~12% chrysotile. No quantitation for amphibole yet.

Caveats: XRD cannot tell non-fibrous species from fibrous. The presence of chrysotile, as opposed to antigorite or lizardite, must be confirmed by PLM. XRD cannot tell amphiboles apart in the quantities seen here. Again, the identity of the amphibole must be determined by PLM. Normally the XRD would be done after the PLM analysis, as a cross check, or more objective method of quantitation.

11.80. Work Practice #XRF-1 Survey with RMD LPA-1 Portable X-ray Fluorescence (XRF) Analyzer

1. Written: 12/29/97 Revised: 07/01/02 5:03 PM Printed: 03/05/13
2. Put on exposure badge
3. Use fresh battery for a survey. Insert charged one and substitute spent one on charger.
4. Sign out on utilization log.
5. Verify that the manual shutter lock and key lock are unlocked (usually kept that way)
6. Check that all old data has been down-loaded, then <reset><set> to clear all data.
7. Enter a new unit <new unit><new unit><set>. Write unit # (date and time on data sheet)
8. Select Time Corrected Mode <select mode><select mode> and select 30 sec. Count time <set>
9. Analyze the test block (green mounted on wood) three times, and record their numbers (1, 2, and 3) in the calibration line on the data sheet. All numbers should be 1.0 +/- 0.2. If not, discontinue testing, or return machine to room temperature and re-analyze the test block.
10. Change to Quick Mode <select mode><select mode><set>, make sure abatement level shown during <set> is 1.0, if not, continue pressing <set> until it does, then allow display to power down to store.
11. Make floor-plan of unit, marking which side is A (the street or entrance side) and numbers for each room or room-equivalent area (such as hallway)
12. Take readings, marking the numbers of each measurement (displayed immediately after the analysis) on the data sheets. Take all readings on one substrate at one time; e.g. 4 walls, 1 ceiling on drywall, then 1 baseboard, 1 door, 1 door frame, 1 window jamb, 1 window sill on wood, then any other components. The continuing same substrate type will make computer entry easier at a later time.
13. Mark each reading on the appropriate place on the form, indicating for each A,B,C or D and the relative location on the wall. Write as notes above the diagrams the colors and substrates involved.
14. When done with one room, mark the assay numbers used for that room (e.g. 1-15) on the upper right of the form, and choose a new form for the next room. Store used forms in the slot in the belt-pack.
15. Every 4 hours, do three 30-second calibrations in Time Corrected mode, as above, then return to quick mode.
16. When done for the day, do three 30 sec. Time Corrected Calibrations, as in 8.
17. A single reading, if suspect, may be deleted from having an assay number by pressing <delete><set>. The next assay will be substituted for the suspect one. Use this in cases where a single positive value intrudes into a string of negatives, or a test where the gun moved or was not in position for the entire analysis. Only the last reading may be deleted - all the others are permanent.
18. To review previous readings, let display power down, the hold <delete> for 2 seconds, until display reads "job scan mode" then displays the last reading. Then <delete> goes backwards, and <average> goes forwards.
19. When done, lock up instrument, sign out utilization log.
20. To download data, use download cable in com2 of the workstation
21. Plug in gun.
22. Put in download mode by pressing <set> for 3 secs
23. Start LPA-1 program and click buttons to download
24. Choose job and unit and click areas where tests were taken, using field sheets as a guide - don't forget to change substrate and color when necessary
25. Make up cover page and assemble report.

12. QUALITY ASSURANCE SUMMARIES

Quality assurance procedures performed for each type of analysis on samples are summarized quarterly; some summaries are broken out to summarize monthly (PLM,TEM). The goal of a QA Summary is to provide a concise statement of the procedures performed and the analysts' and lab's performance. The data therein should be used to assess analyst proficiency, to determine, in part, when deficiency training may be required, to point out areas in which the lab excels and areas which need further attention, and to indicate when QA activities may be performed less frequently or need to be performed more frequently. It allows the QA Officer or Lab Manager to see how the lab is doing at a glance.

The summaries follow the same general format: a listing and brief summary of all QA activities supported by exhibits and data such as control charts. Each summary is generated by the LIMS using data entered during the month or after certain QA activities have been performed. The form ensures that all the data is addressed, and the most current charts are automatically printed.

The following are the topics discussed for each:

PCM Summary

1. Equipment Maintenance or Calibration: a line at which to add a comment to the pdf.

2. Blanks: # run during month and average count per blank.

3. Reference Slides: chart of CV vs f/mm2 for each analyst and lab.

4. Recounts: number performed during the month.

5. Interlab Activity: checkbox and attachment, if activity.

6. PAT: chart of most recent comparison for each analyst to reference values and

   chart of most recent long range comparison for each analyst.

7. Training: form field for description.

8. Out-of-Control Instances and Resolutions: check box and five form fields for details.

9. most recent acceptable limits for reference slides charts (2).

10. most recent warning limits for recounts chart.

PLM Summary

1. Equipment Maintenance or Calibration: a line at which to add a comment to the pdf.

2. Blanks: # routine blanks run and reminder to attach monthly material check form.

3. Qualitative Standards: table giving # run in the month, cum. # run, cum. false + % and cum. false - % for the lab and for each analyst.

4. Quantitative Standards: table giving # run in the month, cum. # run, cum. % bias, and cum. % rel std. dev. for the lab and for each analyst, and a chart of average analysis vs. reference analysis for each analyst and for the lab.

5. Inter-Analyst Re-Analysis: a table giving # run this month, cum. # run, cum. false + %, and cum. false - % for each analyst and for the lab, and a chart of average diff/mean vs % asb. for each analyst and for the lab.

6. Interlab: checkbox and a reminder to attach results.

7. Proficiency Samples: the most recent chart comparing the analyst results to the reference results for each analyst.

8. Training: a form field for details.

9. Discrepancies and Out-of-Control Situations and Resolution: 5 form fields for entering details.

TEM Summary

1. Activity: total # samples, # analyzed, # of AHERA, # other air, # water, # 7402.

2. Equipment Maintenance: a line at which to add a comment to the pdf.

3. Calibrations: most recent charts of a) TEM magnification, b) TEM camera constant, c) plasma asher time, d) beam diameter, e) EDS energy resolution, f) EDS K-factors/sensitivity.

4. Blanks: # counted in the month, avg. str/mm2 per month, and cum. avg. str/mm2.

5. Recounts: # done in month and # cumulative and

a table giving # current month, # cum., same gos cum % diff/mean, diff gos cum % diff/mean, new prep cum %diff/mean and all recounts cum % diff/mean for each analyst and for the lab., and

most recent charts of diff/mean vs str/mm2 for same go recounts and the same chart for diff go recounts.

6. ED Screen Call Verification: % correct screen diffraction pattern calls for each analyst and the lab.

7. EDS Screen Call Verification: % correct EDS spectrum calls for each analyst and the lab.

8. Verified Counting: form fields for inputting the number of gos counted for low level and for high level, and

a table giving the cum true pos(# and %), cum false pos (# and %), and cum false neg. (# and %) for each analyst and for the lab.

9. Qualitative Standards: a table giving the # this month, the cum #, and cum. % correct for each analyst and for the lab.

10. Interlab Samples: a form field for details.

11. Proficiency Samples: a form field for details.

12. Changes in procedure, deficiency corrections, training: a form field for details.

13. Out-of Control Incidents, Resulting Actions and Resolutions: five form fields for details.

AA Summary

1. Activity: # samples

2. Equipment Maintenance : a line at which to add a comment to the pdf.

3. Calibrations: no entry - plotted for each run.

4. Blanks: # run and a form field for any above detection limit.

5. Spikes: a table containing for each matrix (5): # samples for the month, cum % yield and std. dev. for each analyst and for the lab, and

latest control charts for each matrix.

6. Duplicate Analyses: a table containing for each matrix (3): cum % diff/mean for each analyst and for the lab, and

latest control charts for each matrix.

7. Replicate Analyses: # run for the month, and cum. CV.

8. Laboratory Control Standards: a table containing for each standard (5): # run in the month, cum % bias, and cum std dev for each analyst and for the lab, and

latest control charts for each matrix.

9. PAT results: most recent comparison of lab results to reference results.

10. ELPAT results: most recent comparisons of analyst results to reference results.

11. Changes to Procedures, deficiency corrections, training: a form field for details.

12. Out-of Control Incidents, Resulting Actions, and Resolutions: five form fields for details.

Microbiological Summary

1. Activity: # samples

2. Equipment Maintenance : a line at which to add a comment to the pdf.

3. Blanks: # run and a form field for any above detection limit.

4. Reference Samples: a table with each sample organized by analyst; latest control charts for each matrix.

5. Recounts: control chart latest control charts for each matrix.

6. Proficiency results: most recent comparison of lab results to reference results.

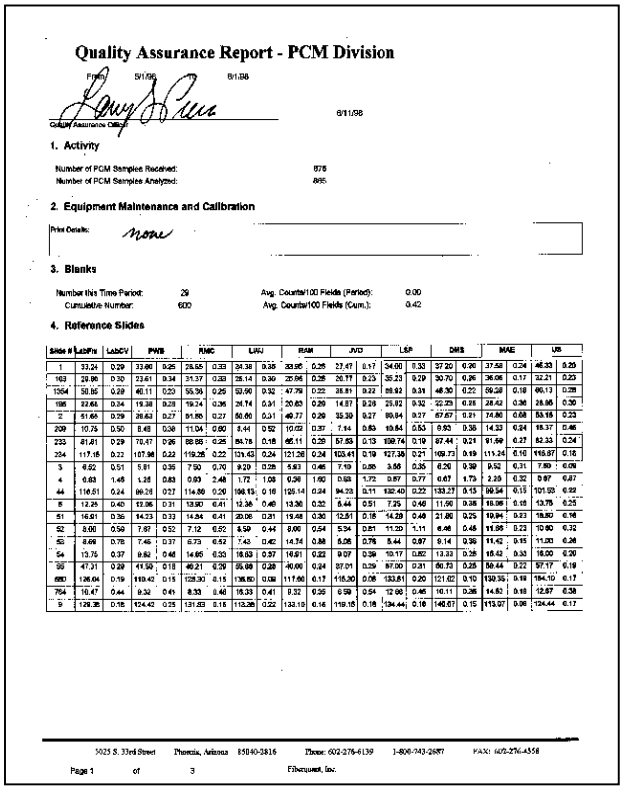
7. Changes to Procedures, deficiency corrections, training: a form field for details.

8. Out-of Control Incidents, Resulting Actions, and Resolutions.

Soot QA Report

1. Activity: # samples
2. Equipment Maintenance : a line at which to add a comment to the pdf.
3. Blanks: # run and a line for comment for any above detection limit.
4. Reference Samples: a table with each sample organized by analyst; latest control charts for each matrix.
5. Recounts: control chart latest control charts for each matrix.
6. Changes to Procedures, deficiency corrections, training: a line for comment.
7. Out-of Control Incidents, Resulting Actions, and Resolutions, pulled from the LIMS.

Below are example summaries.



Quality Assurance Report - PCM Division

From: 5/1/98 To: 6/1/98

6/1/98

1. Activity

Number of PCM Samples Received: 876
Number of PCM Samples Analyzed: 895

2. Equipment Maintenance and Calibration

Print Details: none

3. Blanks

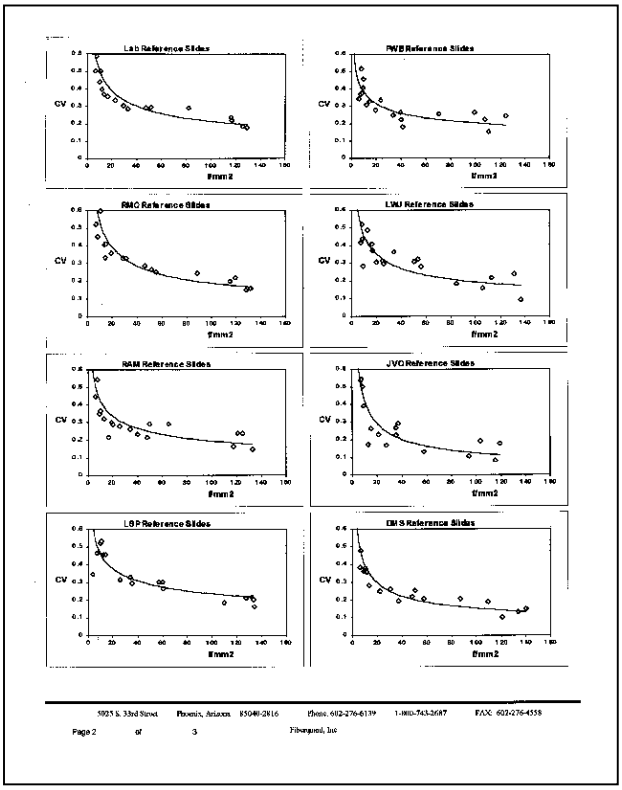
Number this Time Period: 29 Avg. Counts/100 Fields (Period): 0.00
Cumulative Number: 600 Avg. Counts/100 Fields (Cum.): 0.42

4. Reference Slides

Slide #	LabPm	LabCV	PWB		RMC		LWJ		RAM		JVC		LSP		DMS		MAE		US	
1	33.24	0.29	33.66	0.25	29.55	0.33	34.38	0.38	33.95	0.25	27.47	0.17	34.00	0.33	37.20	0.26	37.58	0.24	46.33	0.25
103	29.06	0.30	23.61	0.34	31.37	0.33	26.14	0.30	25.06	0.25	26.77	0.23	35.23	0.29	30.70	0.26	36.06	0.17	32.21	0.23
1354	50.85	0.29	40.11	0.23	55.36	0.25	53.90	0.32	47.79	0.22	36.81	0.22	69.62	0.31	46.30	0.22	59.28	0.18	66.13	0.28
195	22.66	0.24	19.38	0.28	19.24	0.36	24.74	0.31	20.63	0.29	14.87	0.26	25.92	0.32	22.23	0.26	28.42	0.36	28.85	0.30
2	51.66	0.29	39.63	0.27	51.85	0.27	50.66	0.31	40.77	0.29	35.39	0.27	69.84	0.27	47.67	0.21	74.80	0.08	53.16	0.23
209	10.75	0.50	8.45	0.38	11.04	0.60	8.44	0.52	10.02	0.37	7.14	0.83	10.64	0.53	8.93	0.38	14.33	0.24	16.37	0.46
233	81.41	0.29	70.47	0.26	88.85	0.25	84.78	0.18	66.11	0.25	57.83	0.13	108.74	0.19	87.44	0.21	91.89	0.27	82.33	0.24
234	117.16	0.22	107.98	0.22	119.25	0.22	121.43	0.24	121.36	0.24	103.41	0.19	127.39	0.21	109.73	0.19	111.24	0.16	119.87	0.16
3	8.62	0.51	5.81	0.35	7.50	0.70	9.29	0.28	5.63	0.46	7.19	0.86	3.58	0.35	6.20	0.39	9.52	0.31	7.80	0.09
4	0.83	1.48	1.26	0.83	0.00	2.48	1.72	1.08	0.26	1.60	0.88	1.72	0.87	0.77	0.67	1.73	2.28	0.32	0.97	0.67
44	116.51	0.24	99.28	0.27	114.80	0.20	108.13	0.16	125.14	0.24	94.23	0.11	132.40	0.22	133.27	0.13	99.54	0.15	101.93	0.22
5	12.25	0.40	13.06	0.31	13.90	0.41	12.36	0.40	13.36	0.32	8.44	0.51	7.25	0.40	11.90	0.38	16.08	0.18	13.75	0.25
51	16.91	0.36	14.23	0.33	14.84	0.41	20.06	0.21	19.48	0.30	12.51	0.18	14.28	0.40	21.80	0.25	19.94	0.23	18.80	0.16
52	8.00	0.59	7.87	0.52	7.12	0.62	8.59	0.44	8.06	0.54	5.34	0.81	11.20	1.11	6.46	0.45	11.86	0.23	10.60	0.32
53	8.69	0.78	7.46	0.37	6.73	0.52	7.43	0.42	14.74	0.88	5.06	0.76	8.44	0.97	9.14	0.36	11.42	0.15	11.20	0.26
54	13.75	0.37	9.89	0.46	14.66	0.33	16.63	0.57	16.61	0.22	9.97	0.39	19.17	0.62	13.33	0.28	16.42	0.33	16.00	0.20
98	47.31	0.29	41.58	0.18	49.21	0.29	55.99	0.28	40.66	0.24	37.01	0.29	57.00	0.21	50.73	0.25	59.44	0.22	57.17	0.19
660	126.04	0.19	119.42	0.15	128.30	0.15	136.50	0.08	111.66	0.17	115.30	0.08	133.61	0.20	121.02	0.10	130.35	0.16	134.10	0.17
764	10.47	0.44	9.32	0.41	8.33	0.46	16.33	0.41	9.32	0.35	6.59	0.54	12.06	0.46	10.11	0.26	14.82	0.18	12.67	0.38
9	129.38	0.16	124.42	0.25	131.63	0.16	113.26	0.22	133.19	0.16	119.16	0.16	134.44	0.16	140.67	0.15	113.07	0.06	124.44	0.17

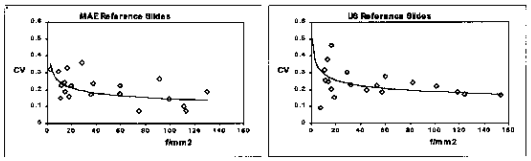
5025 S. 33rd Street Phoenix, Arizona 85040-2816 Phone: 602-276-6139 1-800-743-2687 FAX: 602-276-4558

Page 1 of 3 Fiberquant, Inc.



5025 S. 33rd Street Phoenix, Arizona 85040-2816 Phone: 602-276-6139 1-800-743-2687 FAX: 602-276-4558

Page 2 of 3 Fiberquant, Inc



5. Recounts

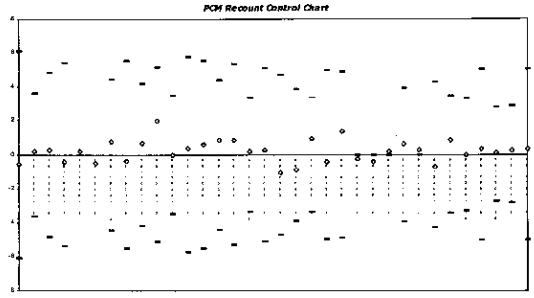
RS: 80 + RD: 15 = 95 Percent = 11.0 (Target = 10%)

LabPer	LabCum	PWB	RMC	LWJ	RAM	JVO	LSP	DMS	MAE	US
96	2261	19	582	31	784	14	159	13	372	1	199	0	93	0	44	17	21	0	20

CVs:

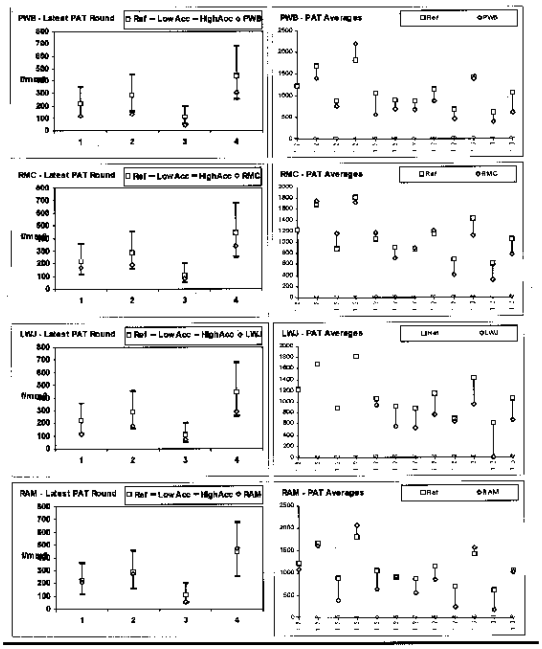
Range	LAB	PWB	RMC	LWJ	RAM	JVO	LSP	DMS	MAE	US
<5.35	1.48	0.59	2.48	1.08	1.02	1.16	0.80	1.06	0.32	0.87
>5.35-25.4	0.48	0.38	0.48	0.39	0.41	0.41	0.39	0.34	0.23	0.26
>25.4-63.5	0.29	0.25	0.29	0.31	0.29	0.23	0.30	0.29	0.23	0.24
>63.5-127	0.23	0.23	0.22	0.18	0.23	0.14	0.19	0.17	0.13	0.21
>127	0.16		0.15	0.15	0.15		0.18	0.14	0.16	0.17

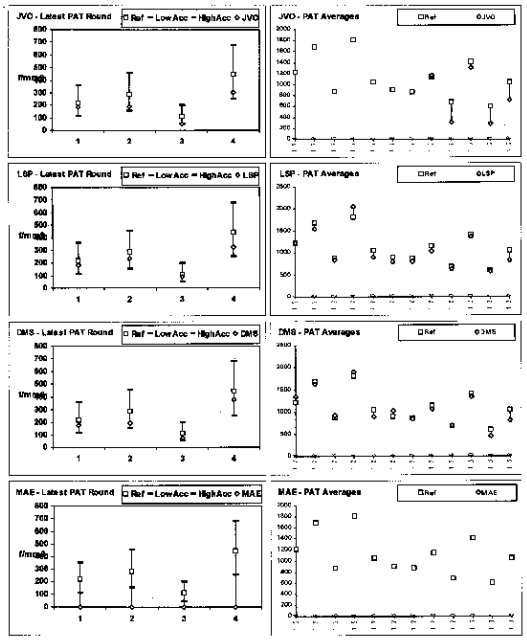
PCH Recount Control Chart

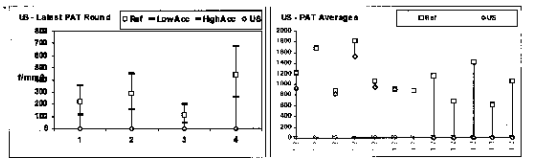


Lab Cum. Diff/Mean: 21.10

6. PAT Samples (most recent PAT results)

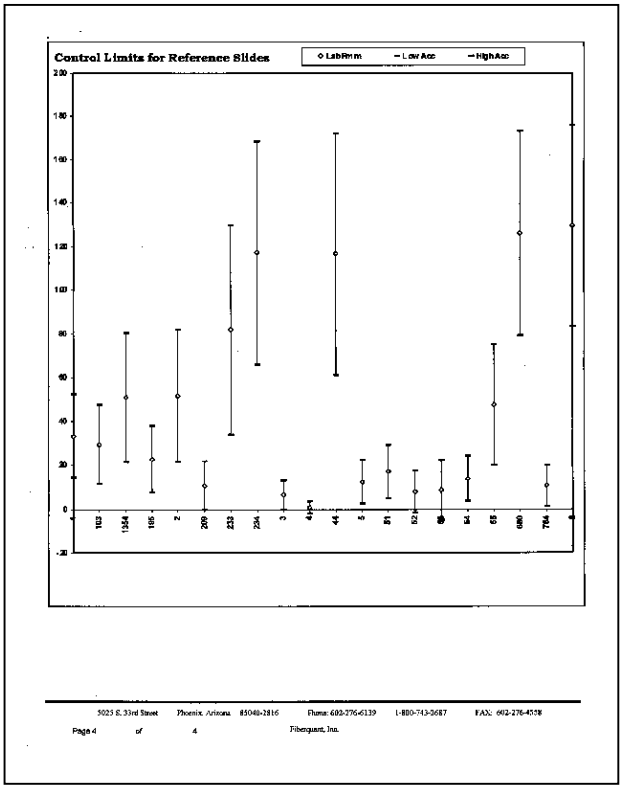


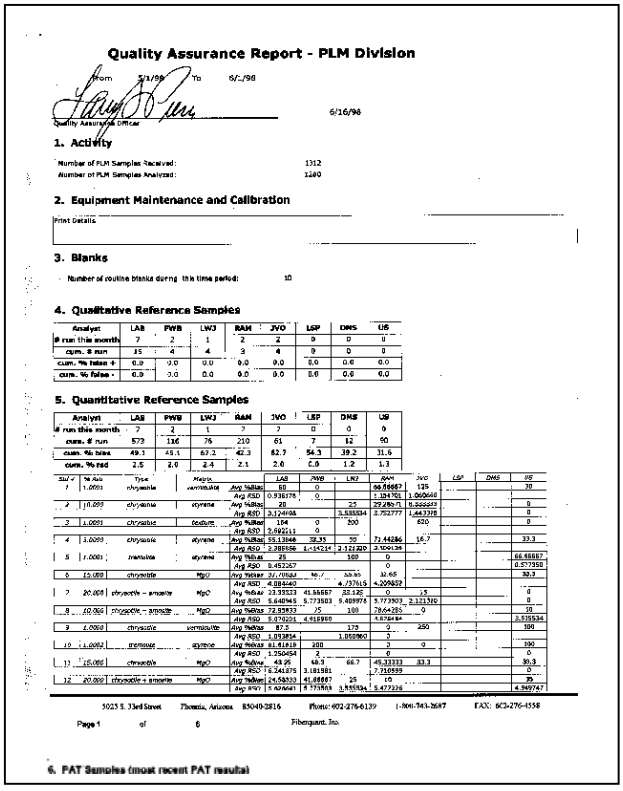




7. Out-of-Control Situations (give summary, actions and results

None





Quality Assurance Report - PLM Division

From 5/1/98 To 6/_/98

6/16/98

Quality Assurance Officer

1. Activity

Number of PLM Samples Received: 1312

Number of PLM Samples Analyzed: 1280

2. Equipment Maintenance and Calibration

Print Details

3. Blanks

Number of routine blanks during this time period: 10

4. Qualitative Reference Samples

Analyst	LAB	PWB	LWJ	RAM	JVO	LSP	DMS	US
# run this month	7	2	1	2	2	0	0	0
cum. # run	15	4	4	3	4	0	0	0
cum. % false +	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
cum. % false -	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

5. Quantitative Reference Samples

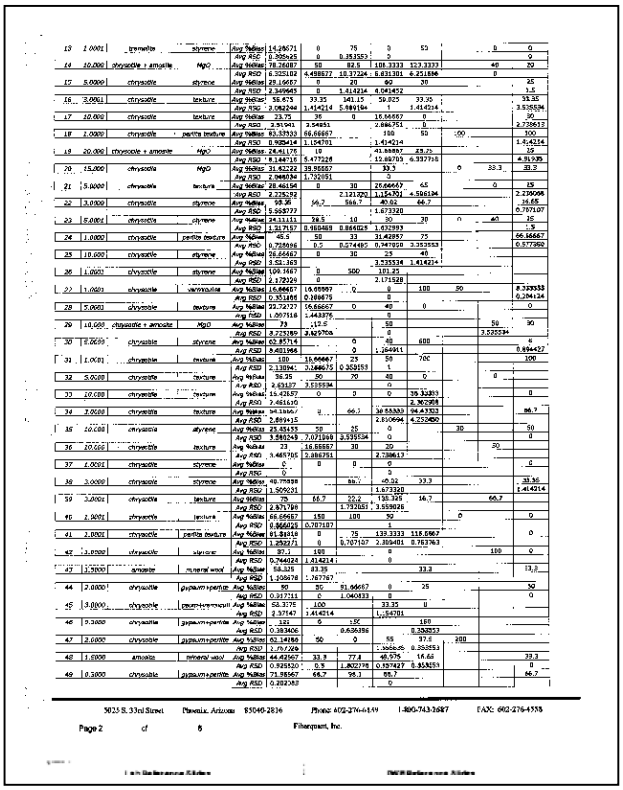
Analyst	LAB	PWB	LWJ	RAM	JVO	LSP	DMS	US
# run this month	7	2	1	2	2	0	0	0
cum. # run	573	116	76	210	61	7	12	60
cum. % bias	49.1	45.1	67.2	42.3	62.7	54.5	39.2	31.6
cum. % rsd	2.5	2.0	2.4	2.1	2.0	2.0	1.2	1.3

SLI #	% Asb	Type	Matrix		LAB	PWB	LWJ	RAM	JVO	LSP	DMS	US
1	1.0000	chrysotile	vermiculite	Avg %Bias	50	0		66.66667	125			20
				Avg RSD	0.936178	0		1.134701	1.060660			0
2	10.000	chrysotile	styrene	Avg %Bias	20		25	29.89475	0.666667			0
				Avg RSD	3.124998		3.535534	2.752777	1.447376			0
3	1.0000	chrysotile	texture	Avg %Bias	164	0	200		620			0
				Avg RSD	3.692111	0	0		0			
4	3.0000	chrysotile	styrene	Avg %Bias	55.13846	32.35	50	71.44286	16.7			33.3
				Avg RSD	2.288556	1.414214	2.121320	3.109635				
5	1.0000	tremolite	styrene	Avg %Bias	25		100	0				66.66667
				Avg RSD	0.452267			0				0.577350
6	15.000	chrysotile	MgO	Avg %Bias	20.77647	50	33.33	30.68				30.3
				Avg RSD	4.884640		4.737615	4.209652				
7	20.000	chrysotile + amosite	MgO	Avg %Bias	23.99333	41.66667	33.125	0	25			0
				Avg RSD	5.640465	5.773503	5.489975	5.773503	2.121320			0
8	10.000	chrysotile + amosite	MgO	Avg %Bias	72.59333	25	100	78.64285	0			10
				Avg RSD	9.676231	4.419949		6.678454				3.535534
9	1.0000	chrysotile	vermiculite	Avg %Bias	87.5		175	0	250			100
				Avg RSD	1.053854		1.060660	0				
10	1.0000	tremolite	styrene	Avg %Bias	81.81818	200		0	0			100
				Avg RSD	1.250454	2		0				0
11	15.000	chrysotile	MgO	Avg %Bias	43.25	50	66.7	46.33333	33.3			30.3
				Avg RSD	12.24175	3.181981		7.310999				0
12	20.000	chrysotile + amosite	MgO	Avg %Bias	24.58333	41.66667	25	10				25
				Avg RSD	5.728483	3.859534	5.477226					4.949747

5025 S. 33rd Street Phoenix, Arizona 85040-2816 Phone: 602-276-6139 1-800-743-3687 FAX: 602-276-4558

Page 1 of 6 Fiberquant, Inc.

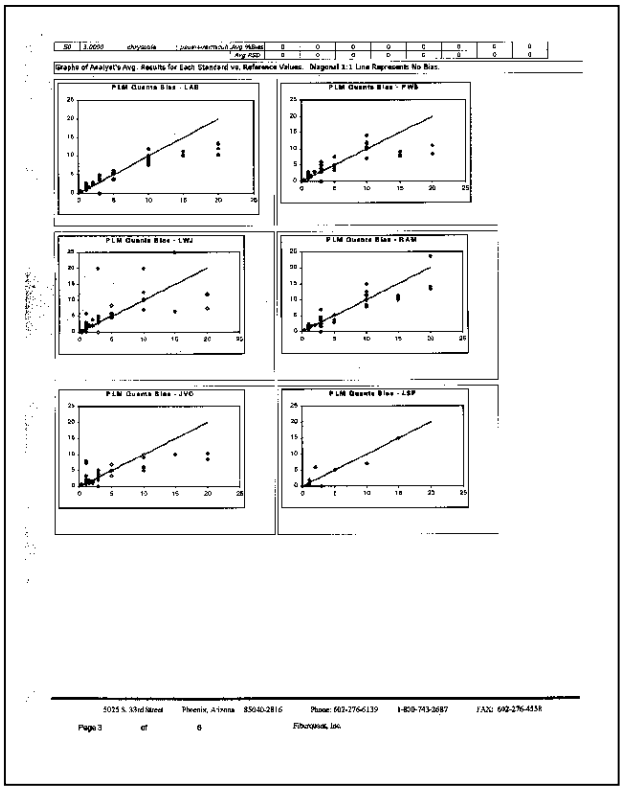
6. PAT Samples (most recent PAT results)



13	1.0001	tremolite	styrene	Avg %Bias	14.28571	0	75	0	50			0	0
				Avg RSD	0.935425	0	0.353553	0					0
14	10.000	chrysotile + amosite	MgO	Avg %Bias	78.36087	60	83.5	108.3333	133.3333		40		20
				Avg RSD	6.325102	4.498827	10.17224	6.631301	4.251856		0		
15	5.0000	chrysotile	styrene	Avg %Bias	27.16667	0	20	60	30				25
				Avg RSD	2.349643	0	1.414214	4.041452					1.5
16	3.0001	chrysotile	texture	Avg %Bias	58.675	33.35	141.15	59.025	33.35				33.35
				Avg RSD	2.062294	1.414214	5.869184	1	1.414214				3.535534
17	10.000	chrysotile	texture	Avg %Bias	23.75	25	0	16.66667	0				50
				Avg RSD	2.50341	3.54651		2.886751	0				2.726613
18	2.0000	chrysotile	perlite texture	Avg %Bias	83.33333	66.66667		100	50		100		100
				Avg RSD	0.925414	1.154701		1.414214					1.414214
19	20.000	chrysotile + amosite	MgO	Avg %Bias	24.41176	10		41.66667	48.75				15
				Avg RSD	8.144716	5.477226		12.69705	6.337716				4.91935
20	15.000	chrysotile	MgO	Avg %Bias	31.62222	39.99667		33.3			0	33.3	33.3
				Avg RSD	2.968134	1.732051		0					
21	5.0001	chrysotile	texture	Avg %Bias	28.46154	0	30	20.66667	65		0		10
				Avg RSD	2.225252		2.121320	1.154701	4.596194				2.236068
22	3.0000	chrysotile	styrene	Avg %Bias	58.38	66.2	166.7	40.62	66.7				16.65
				Avg RSD	5.993777			1.673320					0.707107
23	1.0001	chrysotile	styrene	Avg %Bias	24.33333	99.5	10	30	30		0	40	10
				Avg RSD	1.317157	0.969483	0.866025	1.632993					1.5
24	1.0000	chrysotile	perlite texture	Avg %Bias	45.5	50	33	31.42857	75				66.66667
				Avg RSD	0.788696	0.5	0.574495	0.746709	3.353553				0.577350
25	10.000	chrysotile	styrene	Avg %Bias	26.66667	0	30	33	40				0
				Avg RSD	3.551163			2.533534	1.414214				
26	1.0001	chrysotile	styrene	Avg %Bias	109.1667	0	500	101.25					
				Avg RSD	2.172029	0		2.171529					
27	1.0001	chrysotile	vermiculite	Avg %Bias	16.66667	16.66667	0	0	100	50			8.333333
				Avg RSD	0.353166	0.288675		0					0.204124
28	5.0001	chrysotile	texture	Avg %Bias	22.72727	16.66667	0	40	0				0
				Avg RSD	1.097118	1.443376		0					
29	10.000	chrysotile + amosite	MgO	Avg %Bias	73	12.5		50			50		90
				Avg RSD	8.723189	2.917594		0			3.535534		
30	2.0000	chrysotile	styrene	Avg %Bias	62.85714		0	40	600				0
				Avg RSD	8.401966		0	1.264911					0.894427
31	1.0001	chrysotile	texture	Avg %Bias	100	16.66667	25	50	700				100
				Avg RSD	2.138941	3.686675	0.353553	1					
32	5.0000	chrysotile	texture	Avg %Bias	36.25	50	70	40	0		0		
				Avg RSD	2.43127	2.516534		0					
33	10.000	chrysotile	texture	Avg %Bias	16.42857	0	0	0	33.3333				0
				Avg RSD	2.481416				2.309268				
34	2.0000	chrysotile	texture	Avg %Bias	141.6667	0	66.7	16.66333	66.4333				66.7
				Avg RSD	2.891415			2.859696	4.252488				
35	10.000	chrysotile	styrene	Avg %Bias	21.66153	50	25	0			50		50
				Avg RSD	3.860249	7.071068	3.535534	0					0
36	10.000	chrysotile	texture	Avg %Bias	33	16.66667	30	20			50		
				Avg RSD	3.467705	2.886751		2.738613					
37	1.0001	chrysotile	styrene	Avg %Bias	0	0	0	0					0
				Avg RSD	0			0					
38	3.0000	chrysotile	styrene	Avg %Bias	48.77838		No	40.32	33.3				33.35
				Avg RSD	1.509231			1.673320					1.414214
39	3.0001	chrysotile	texture	Avg %Bias	75	66.7	33.3	130.375	16.7			66.7	
				Avg RSD	2.871796		1.732051	3.559026					
40	2.0001	chrysotile	texture	Avg %Bias	66.66667	150	100	50			0		0
				Avg RSD	0.866025	0.707107		1					
41	2.0001	chrysotile	perlite texture	Avg %Bias	91.25316	0	75	133.3333	116.6667				0
				Avg RSD	1.250271	0	0.707107	2.309401	0.763763				
42	2.0000	chrysotile	styrene	Avg %Bias	87.1	100		0			100		0
				Avg RSD	0.744024	1.414214		0					
43	3.3000	amosite	mineral wool	Avg %Bias	66.328	33.35			33.3				33.3
				Avg RSD	1.208678	1.767767							
44	2.0000	chrysotile	gypsum+perlite	Avg %Bias	90	50	91.66667	0	25				50
				Avg RSD	0.917711	0	1.040833	0					0
45	3.0000	chrysotile	gypsum+vermiculi	Avg %Bias	83.3375	100		33.35	0				
				Avg RSD	2.37547	1.414214		1.154701					
46	3.3000	chrysotile	gypsum+perlite	Avg %Bias	125	0	150		100				
				Avg RSD	0.383406		0.636396		0.288652				
47	2.0000	chrysotile	gypsum+perlite	Avg %Bias	62.14286	50	0	55	37.5		100		
				Avg RSD	2.787269			1.366605	0.353553				
48	1.0000	amosite	mineral wool	Avg %Bias	44.42667	33.3	77.4	46.575	16.66				33.3
				Avg RSD	0.925520	0.5	1.802776	0.957427	0.353553				0
49	0.3000	chrysotile	gypsum+perlite	Avg %Bias	71.25667	66.7	95.1	66.7					66.7
				Avg RSD	0.992582			0					

5025 S. 33rd Street Phoenix, Arizona 85040-2816 Phone: 602-276-6139 1-800-743-3687 FAX: 602-276-4558

Page 2 of 6 Fiberquant, Inc.

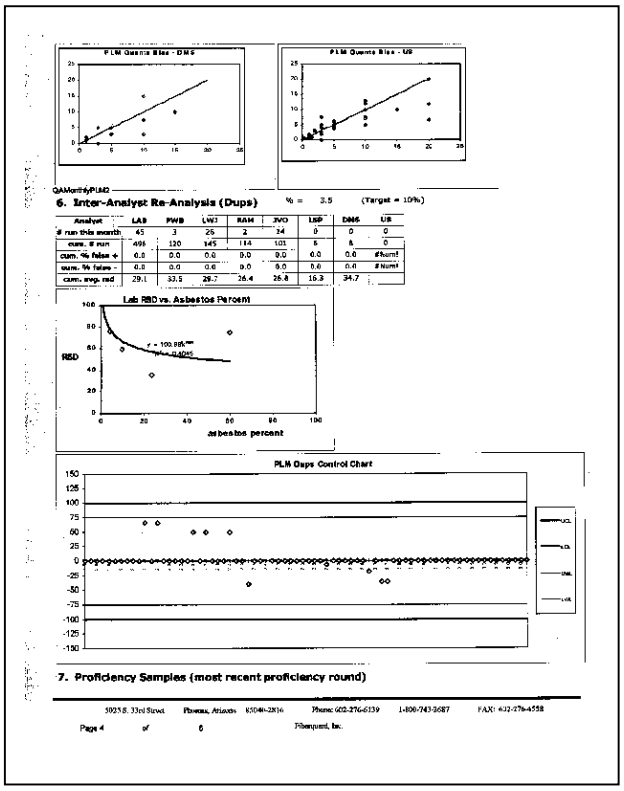


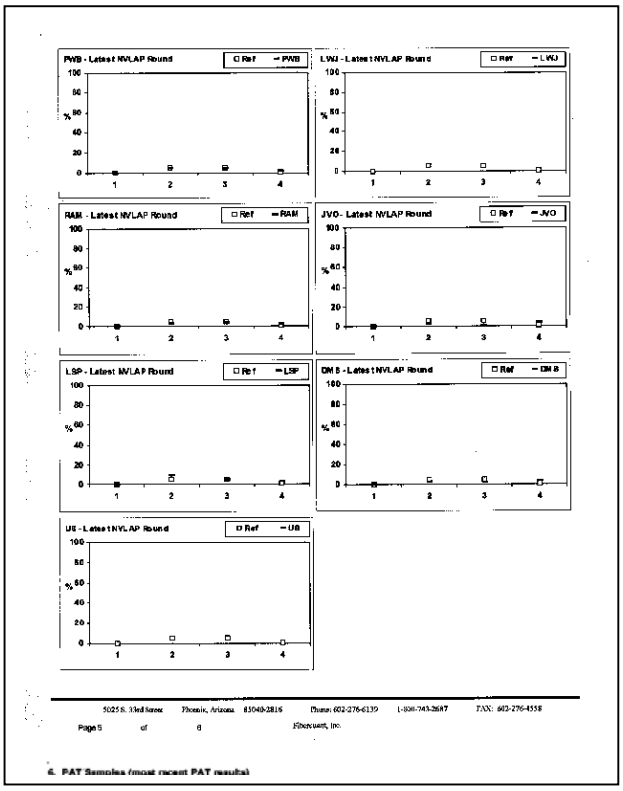
50	3.0000	chrysotile	[illegible]	Avg %Bias	0	0	0	0	0	0	0	0	0
				Avg RSD	0	0	0	0	0	0	0	0	0

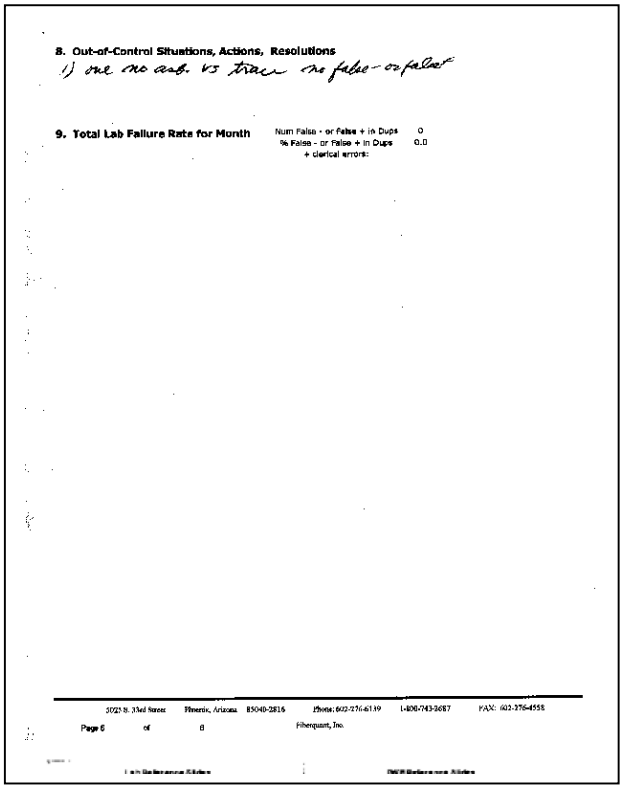
Graphs of Analyst's Avg. Results for Each Standard vs. Reference Values. Diagonal is 1:1 Line Represents No Bias.

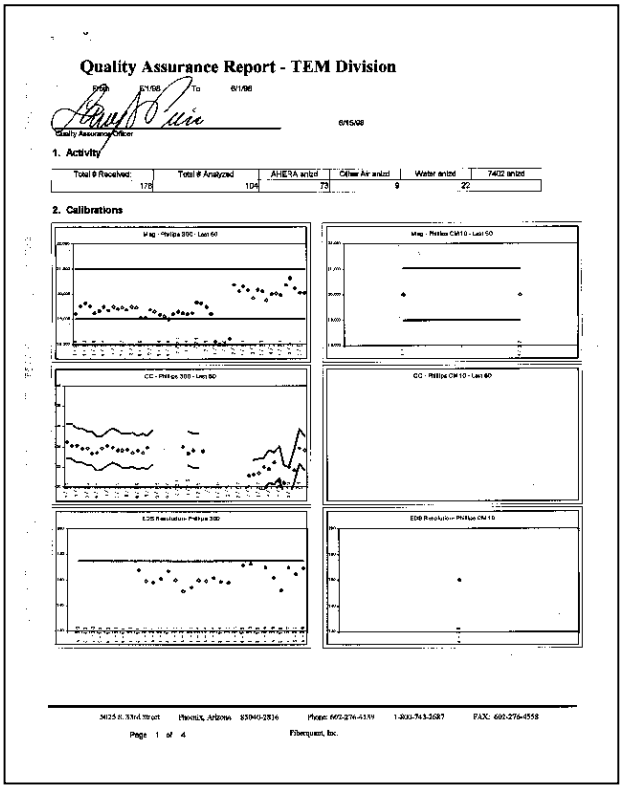
5025 S. 33rd Street Phoenix, Arizona 85040-2816 Phone: 602-276-6139 1-800-743-3687 FAX: 602-276-4558

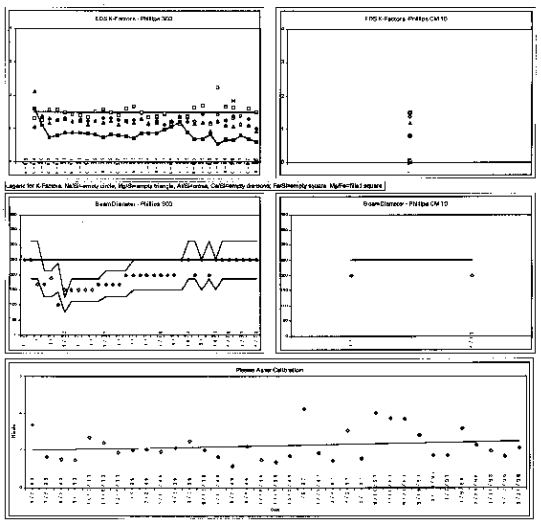
Page 3 of 6 Fiberquant, Inc.


PLM Gravis Bias - DMS
PLM Gravis Bias - US
6. Inter-Analyst Re-Analysis (Dups)
% = 3.5 (Target = 10%)
Lab RBD vs. Asbestos Percent
RBD
asbestos percent
PLM Dups Control Chart
7. Proficiency Samples (most recent proficiency round)


PWB - Latest NVLAP Round
LWJ - Latest NVLAP Round
RAM - Latest NVLAP Round
JVO - Latest NVLAP Round
LSP - Latest NVLAP Round
DM 8 - Latest NVLAP Round
US - Latest NVLAP Round
6. PAT Samples (most recent PAT result)


8. Out-of-Control Situations, Actions, Resolutions
9. Total Lab Failure Rate for Month
Num False - or False + in Dups 0
% False - or False + in Dups 0.0
+ clerical errors:


Quality Assurance Report - TEM Division
1. Activity
Total # Received
Total # Analyzed
AHERA anlzd
Other Air anlzd
Water anlzd
7402 anlzd
2. Calibrations

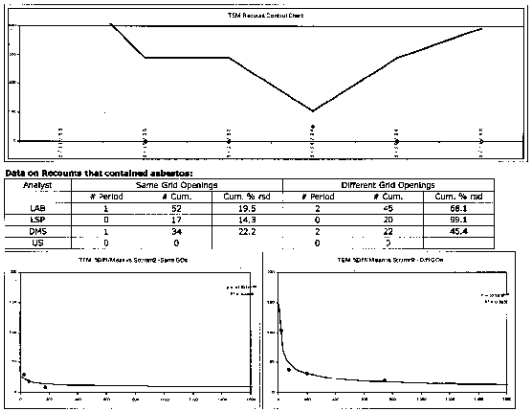


3. Blanks

# this Time Period:	# last 12 months	Percent (last 12 months):	Target Percent:	Cum. # Blanks	Avg. str/mm2 (Cum.):
7	26	2.8	4.0	322	0.12

4. Recounts

Number this Time Period:	Number last 12 months	% (last 12 months)	Target Percent:
8	65	7.0	6.0



Data on Recounts that contained asbestos:

Analyst	Same Grid Openings			Different Grid Openings		
	# Period	# Cum.	Cum. % rsd	# Period	# Cum.	Cum. % rsd
LAB	1	52	19.5	2	<5	68.1
LSP	0	17	14.3	0	20	99.1
DMS	1	34	22.2	2	22	45.4
US	0	0		0	5	

5. Electron Diffraction Screen Call Verification

	# Total	# Correct	% Correct
LAB	515	511	99.2
LSP	178	176	98.9
DMS	337	335	99.4
US	0	0	#Num!

6. EDXA Screen Call Verification

	# Total	# Correct	% Correct
LAB	36	33	91.7
LSP	6	5	83.3
DMS	30	28	93.3
US	0	0	#Num!

7. Verified Counts

Smp GOs Anyzd	846

	# GOs Low	# GOs High	# GOs Total	% (Target 1%)	# Str Cum.	% TP	% FP	% Fil
LAB	8	0	8	0.9	725.5	91.5	1.9	7.0
LSP	8	0	8		734	93.9	1.5	3.2
DMS	8	0	8		665	89.5	1.5	9.5
US					52	84.6	13.5	1.9

8. Qualitative Standards

	Cum. #	% Correct
LAB	51	98.0
LSP	26	96.2
DMS	22	100.0
US	3	100.0

9. Changes in Procedure, Deficiency Corrections, Training

none

10. Out-of-Control Incidents, Resulting Actions, and Resolution

none

QA Report - AA Division - Pb - Part 1

From 4/1/98 to 4/30/98

Quality Assurance Officer 5/21/98

Activity

Numb of AA Samples Received: 880
Numb of AA Samples Analyzed: 871
Numb of Runs: 44

Equipment Maintenance and Calibration

Print Details:

Changes in Procedures, Deficiency Corrections, Training

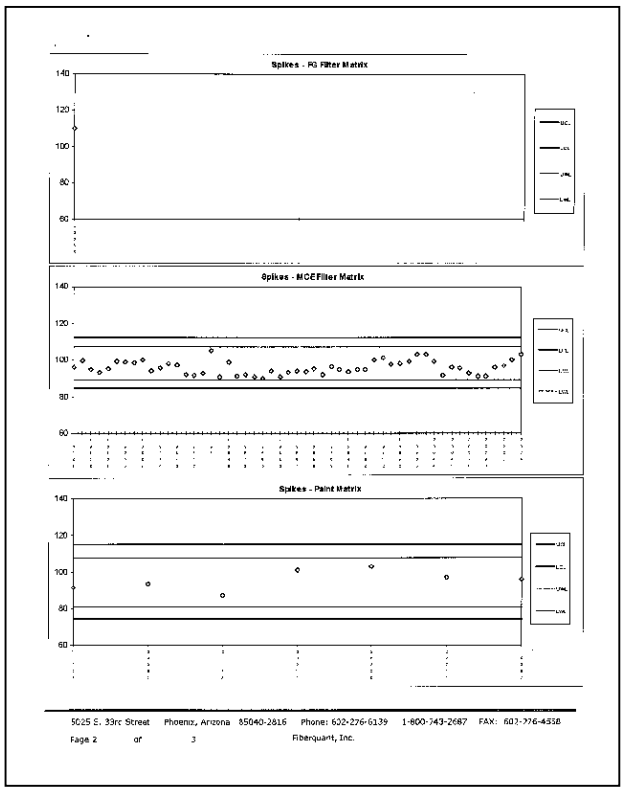
Print Details

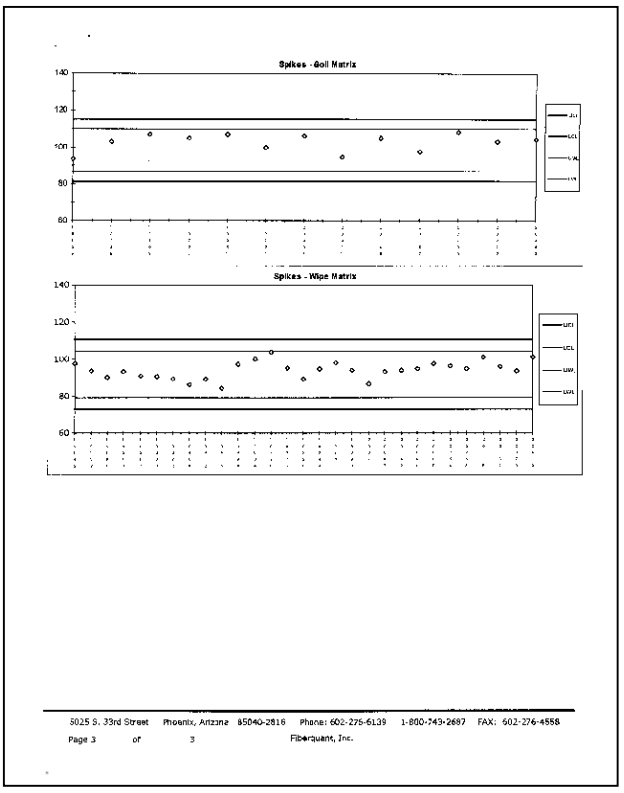
Blanks

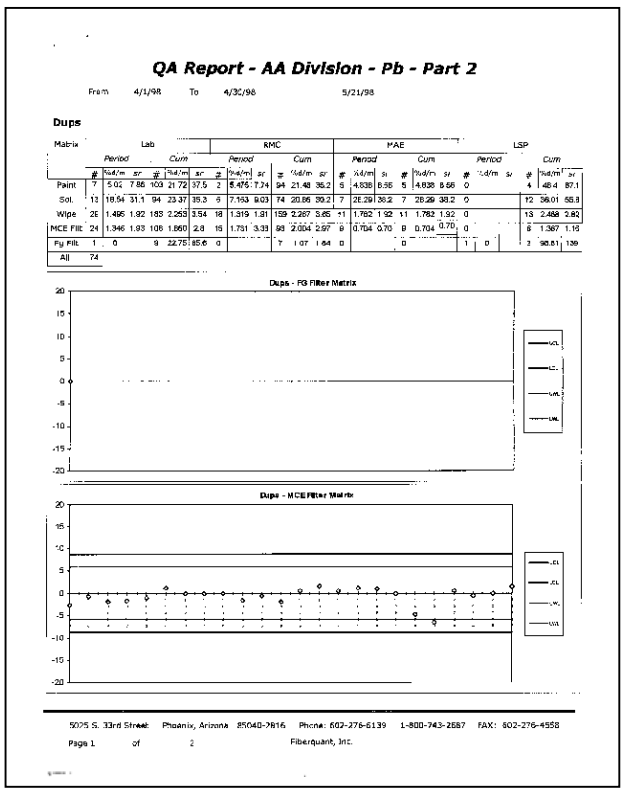
Number this Time Period: 84 Avg. Absorbance (Period): 0.02
Cumulative Number: 564 Avg. Absorbance (Cum.): 0.04

Spikes

Matrix	Lab						RMC				MAE				LSP			
	Period			Cum			Period		Cum		Period		Cum		Period		Cum	
	#	% Yld	Sr	#	% Yld	Sr	#	% Yld	Sr	#	% Yld	Sr	#	% Yld	Sr	#	% Yld	Sr
Paint	7	85.56	5.44	114	92.91	11.3	2	94.8	1.58	105	92.95	11.6	5	95.94	6.57	5	95.94	6.57	0			4	87.9	4.23
Soil	13	102.8	4.76	113	94.78	7.22	6	101.4	5.84	94	94.54	7.15	7	103.6	3.8	7	103.6	3.8	0			12	91.47	5.26
Wipe	29	94.1	4.63	249	89.73	8.19	18	92.69	4.62	217	89.38	8.21	11	96.41	3.77	11	96.41	3.77	0			21	88.89	5.02
MCE Filt	194	101.2	8.78	305	99.81	7.82		96.57	3.36	115	97.51	4.89	170	101.5	8.93	9	102.7	10.1	20	96.53	9.44
Pg Filt	1	110		11	100.5	6.27	0			7	101.9	9.2	0			0			1	110		4	98.15	9.95
All	244																							





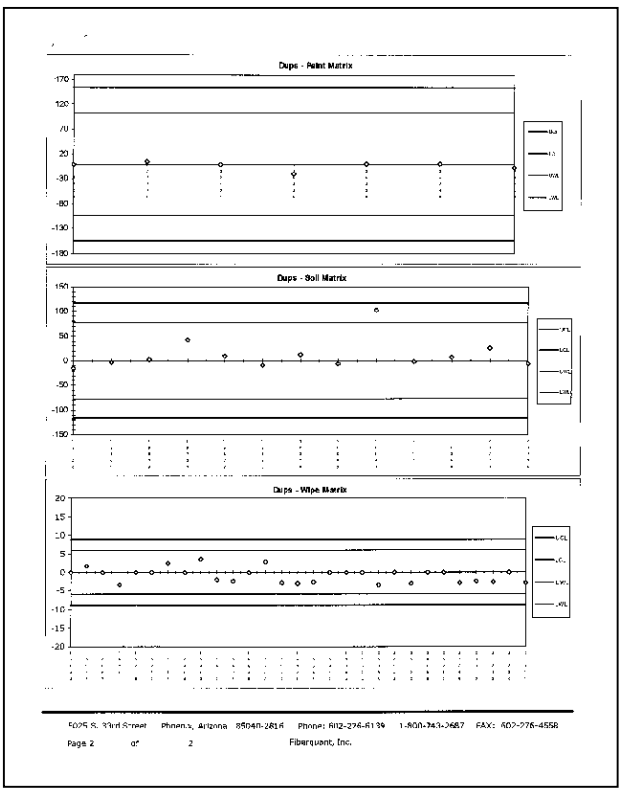


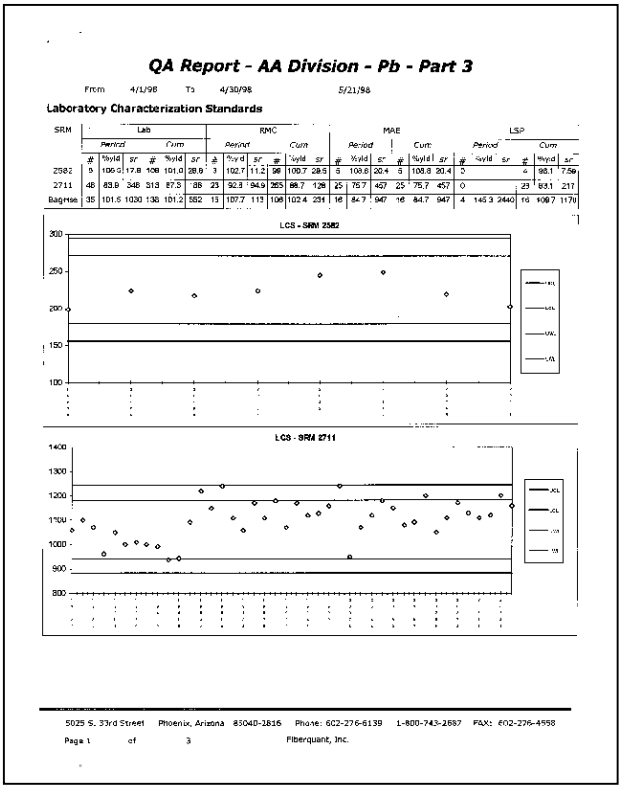
QA Report - AA Division - Pb - Part 2

From 4/1/98 To 4/30/98 5/21/98

Dups

Matrix	Lab				RMC				MAE				LSP	
	Period		Cum		Period		Cum		Period		Cum		Period	Cum
	#	%d/m	#	%d/m	#	%d/m	#	%d/m	#	%d/m	#	%d/m	#	%d/m
Paint	7	5.02	103	21.72	5	5.475	94	21.48	5	4.838	5	4.838	4	48.4
Soil	13	18.54	94	23.37	6	7.153	74	20.86	7	28.29	7	28.29	12	56.01
Wipe	28	1.495	183	2.259	18	1.319	159	2.267	11	1.782	11	1.782	13	2.488
MCE Filt	24	1.346	108	1.860	16	1.731	98	2.004	8	0.704	8	0.704	8	1.387
Fg Filt	1	0	9	22.75	0		7	1.07	0		0		3	98.81
All	74													





QA Report - AA Division - Pb - Part 3

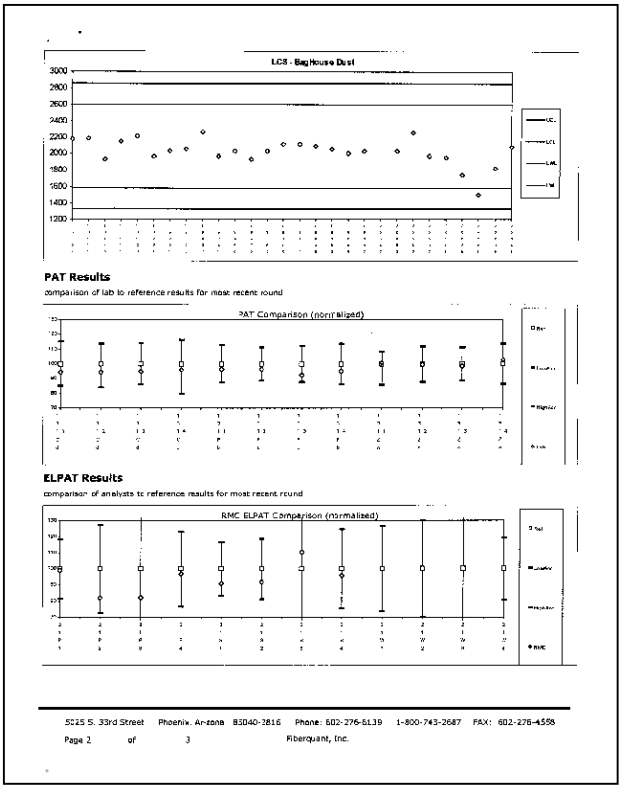
From 4/1/98 To 4/30/98 5/21/98

Laboratory Characterization Standards

SRM	Lab					RMC				MAE				LSP			
	Period			Cum		Period		Cum		Period		Cum		Period		Cum	
	#	%yld	sr	#	%yld	sr	#	%yld	sr	#	%yld	sr	#	%yld	sr	#	%yld	sr
2582	9	109.9	17.8	108	101.0	28.9	3	102.7	11.2	98	100.7	28.5	6	108.8	20.4	6	108.8	20.4	0			4	98.1	7.59
2711	48	89.9	348	513	87.3	88	23	92.8	194.9	265	88.7	128	25	75.7	457	25	75.7	457	0			23	93.1	217
BagHse	35	101.6	1030	138	101.2	552	13	107.7	113	106	102.4	231	16	84.7	947	16	84.7	947	4	145.3	2440	16	109.7	1170

LCS - SRM 2582

LCS - SRM 2711



LCS - BagHouse Dust

PAT Results

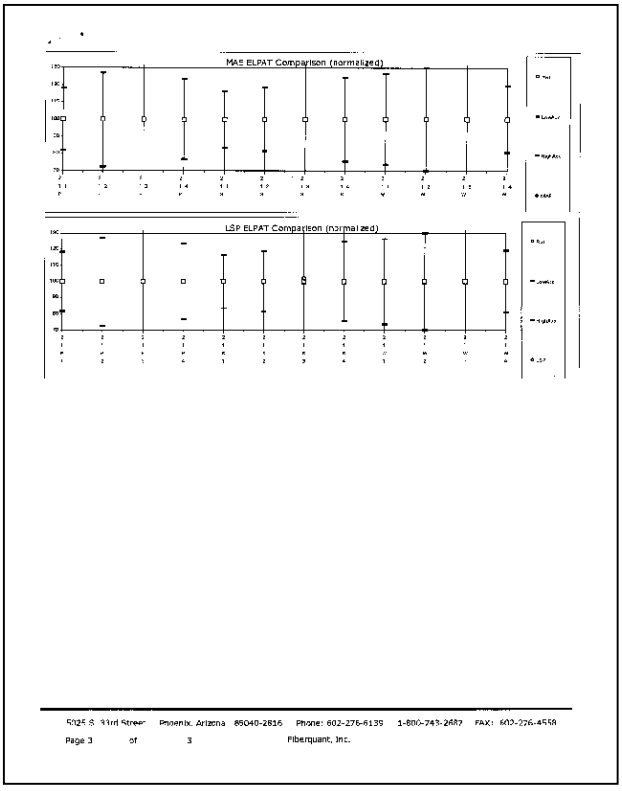
comparison of lab to reference results for most recent round

PAT Comparison (normalized)

ELPAT Results

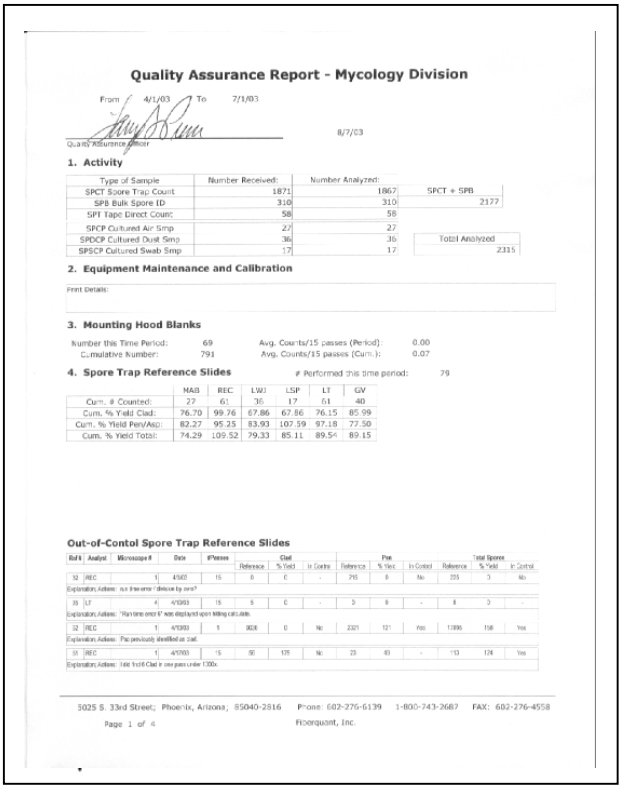
comparison of analysts to reference results for most recent round

RMC ELPAT Comparison (normalized)



MAS ELPAT Comparison (normalized)

LSP ELPAT Comparison (normalized)



Quality Assurance Report - Mycology Division

From 4/1/03 To 7/1/03

8/7/03

Quality Assurance Officer

1. Activity

Type of Sample	Number Received:	Number Analyzed:	
SPCT Spore Trap Count	1871	1867	SPCT + SPB
SPB Bulk Spore ID	310	310	2177
SPT Tape Direct Count	58	58	
SPCP Cultured Air Smp	27	27	
SPDCP Cultured Dust Smp	36	36	Total Analyzed
SPSCP Cultured Swab Smp	17	17	2315

2. Equipment Maintenance and Calibration

Print Details:

3. Mounting Hood Blanks

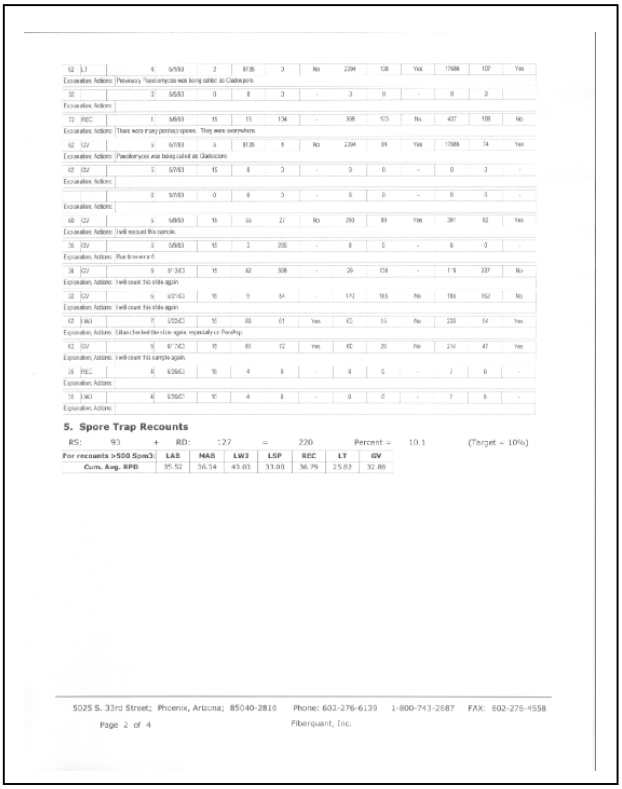
Number this Time Period: 69 Avg. Counts/15 passes (Period): 0.00
Cumulative Number: 791 Avg. Counts/15 passes (Cum.): 0.07

4. Spore Trap Reference Slides # Performed this time period: 79

	MAB	REC	LWJ	LSP	LT	GV
Cum. # Counted:	27	61	36	17	61	40
Cum. % Yield Clad:	76.70	99.76	67.86	67.86	76.15	85.99
Cum. % Yield Per/Aid:	82.27	95.25	83.93	107.59	97.18	77.56
Cum. % Yield Total:	74.29	109.52	79.33	85.11	89.54	89.15

Out-of-Contol Spore Trap Reference Slides

Refd	Analyst	Microscope #	Date	#Passes	Clad			Pre			Total Spores		
					Reference	% Yield	In Contrl	Reference	% Yield	In Control	Reference	% Yield	In Control
32	REC	1	4/3/03	15	8	0	-	295	8	No	355	3	No
Explanation, Actions: not time error / deleve by one?													
35	LT	4	4/7/03	15	9	0	-	9	8	-	8	3	-
Explanation, Actions: "Run time error 6" was displayed upon hitting calc.date.													
32	REC	1	4/7/03	1	308	0	No	2321	121	Yes	1996	158	Yes
Explanation, Actions: Pas previously identified as clad.													
35	REC	1	4/7/03	15	90	135	No	23	83	-	113	124	Yes
Explanation, Actions: 1 slid 1=16 Clad in one pass under 1300x.													

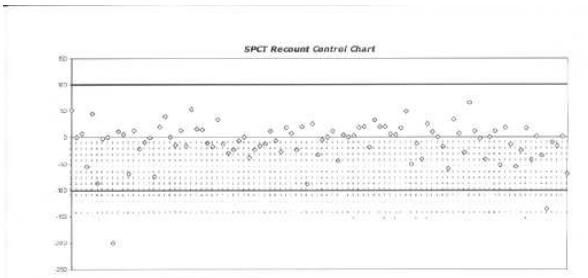


52	LT		4	6/9/03	2	8136	0	No	2294	108	Yes	17686	107	Yes
Excavation; Actions: Pinnularia ? basilomycos was being called as Diatoxpora.														
32			0	5/6/03	0	8	0	-	0	0	-	0	0	-
Excavation; Actions:														
72	REC		1	5/6/03	15	15	136	-	308	103	No	437	108	No
Excavation; Actions: There were many pennate spores. They were overwhelm														
52	GV		3	5/7/03	0	8136	4	No	2294	84	Yes	17686	74	Yes
Excavation; Actions: Pseudomycos was being called as Diatoxpora														
67	GV		5	5/7/03	15	8	0	-	0	0	-	0	0	-
Excavation; Actions:														
			0	5/7/03	0	8	0	-	0	0	-	0	0	-
Excavation; Actions:														
68	GV		3	5/8/03	15	60	27	No	293	89	Yes	391	82	Yes
Excavation; Actions: I will recount this sample.														
78	GV		5	5/8/03	15	0	205	-	0	0	-	6	0	-
Excavation; Actions: Run time error 6														
28	GV		5	5/13/03	15	42	308	-	26	158	-	119	227	No
Excavation; Actions: I will count his slide again														
12	GV		6	5/12/03	15	9	64	-	143	169	No	186	152	No
Excavation; Actions: I will count his slide again														
62	LWJ		7	5/12/03	15	60	61	Yes	65	15	No	220	54	Yes
Excavation; Actions: I Blan checked the slide again especially on PenPop.														
62	GV		5	5/13/03	15	60	72	Yes	65	35	No	214	47	Yes
Excavation; Actions: I will count his sample again.														
18	REC		4	5/26/03	15	4	8	-	0	0	-	7	0	-
Excavation; Actions:														
78	LWJ		4	5/26/03	15	4	8	-	0	0	-	7	0	-
Excavation; Actions:														

5. Spore Trap Recounts

RS: 93 + RD: 127 = 220 Percent = 10.1 (Target = 10%)

For recounts >500 Spm3:	LAB	MAB	LWJ	LSP	REC	LT	GV
Cum. Avg. RPD	95.52	36.34	43.65	33.80	36.79	25.62	32.86



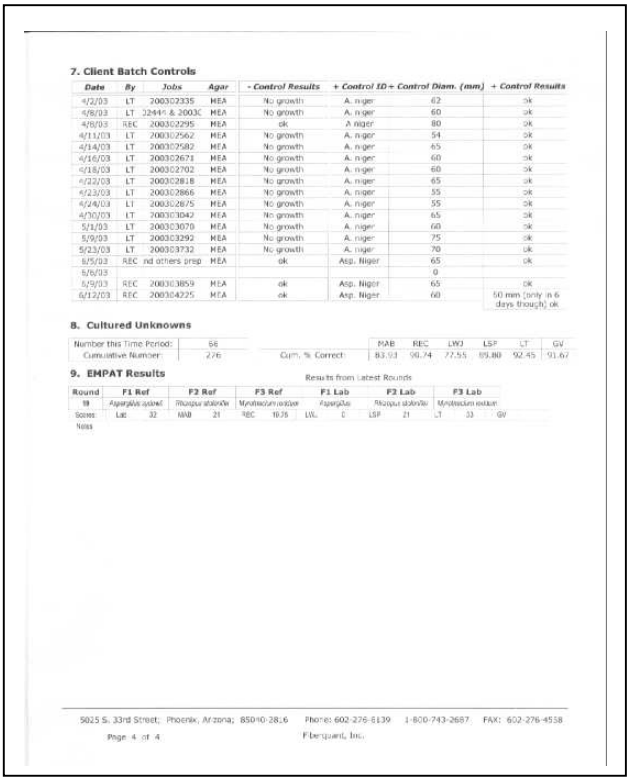
Lab statistics on recounts:					
Raw Avg. Counts per Analysis	<8	8-15	16-30	31-60	61-120	>120
Cum. Avg. RPD	69.69	46.09	44.73	38.47	31.03	29.79
No. of Anayses in Recount Database:	681	127	94	86	64	70

Out-of-Control Spore Trap Recounts

Job #	Analyst 1	Date	Spm3 1	Analyst 2	Date 2	Spm3 2	R-D	Notes, Explanation, Actions
2002-32280-2	LT	4/2/03	65333.3333	REC	4/9/03	31.33333	193	Missed the blurry ridges/rays. Will go back to line. LT showed me the stamp of pennate on 4/7
2002-33901-3	LT	4/15/03	0	REC	4/15/03	14033.33	-200	Pennate spore stamp on a single area
2003-33485-2	REC	5/6/03	80.8363636	REC	5/13/03	349.9003	-125	Small amounts of spores on the 1000 x counts
2002-33486-8	LWJ	5/7/03	48	GV	5/29/03	186.6667	120	Spore concentrations too low for reliable statistics. Net difference of 1 spore across 7 trav, and 2
2002-33476-8	LT	5/7/03	86	MAB	5/13/03	0	-233	Sample lost
2002-33954-3	LT	5/20/03	28	GV	5/29/03	73.33333	-114	Spore concentrations too low for reliable statistics. Net difference of 4 spores total (2 at 1000 x
2003-34298-7	LT	6/5/03	133.333333	GV	6/13/03	840	421	will ask Lalita to look on the overall in the morning. Lalita looked at the slide again and it's fine th
2003-34286-2	REC	6/5/03	48	GV	6/13/03	253.3333	345	gave the result to Rob. performed. 3 new spores or 5/18 per found pre-misidentified spor
2003-34408-8	GV	6/20/03	26.6666667	REC	6/23/03	160	143	Only off by one spore. No need to investigate.
2002-34480-4	REC	6/24/03	333.333333	REC	6/24/03	1733.333	520	Very few spores present. Found on three pieces
2003-34522-10	GV	6/25/03	126.666667	REC	7/2/03	306.6667	142	No GV, do a recount. New worked on one other sample as well in this job and it checked out f

6. Agar Batch Controls

Batch #	Date	By	Expires	Agar	- Control Results	+ Control ID + Control Diam. (mm)	+ Control Result
47	4/1/03	MAB	5/1/03	MEA	No growth	A. niger	65	ok
48	4/14/03	MAB	5/14/03	MEA	No growth	A. niger	65	ok
49	4/16/03	MAB	5/16/03	PDA		A. niger	0	
50	4/23/03	LT	5/23/03	MEA	No growth	A. niger	65	ok
51	4/30/03	LT	5/30/03	MEA	No growth	A. niger	65	ok
52	5/20/03	MAB	6/20/03	MEA		A. niger	0	
53	5/29/03	REC	6/29/03	PDA		A. niger	0	



7. Client Batch Controls

Date	By	Jobs	Agar	- Control Results	+ Control ID + Control Diam. (mm)	+ Control Results
4/2/03	LT	200302335	MEA	No growth	A. niger	62	ok
4/8/03	LT	32444 & 2003C	MEA	No growth	A. niger	60	ok
4/8/03	REC	200302295	MEA	ok	A niger	80	ok
4/11/03	LT	200302562	MEA	No growth	A. niger	54	ok
4/14/03	LT	200302582	MEA	No growth	A. niger	65	ok
4/16/03	LT	200302671	MEA	No growth	A. niger	60	ok
4/18/03	LT	200302702	MEA	No growth	A. niger	60	ok
4/22/03	LT	200302818	MEA	No growth	A. niger	65	ok
4/23/03	LT	200302866	MEA	No growth	A. niger	55	ok
4/24/03	LT	200302875	MEA	No growth	A. niger	55	ok
4/30/03	LT	200303042	MEA	No growth	A. niger	65	ok
5/1/03	LT	200303070	MEA	No growth	A. niger	60	ok
5/9/03	LT	200303292	MEA	No growth	A. niger	75	ok
5/23/03	LT	200303732	MEA	No growth	A. niger	70	ok
5/5/03	REC	nd others prep	MEA	ok	Asp. Niger	65	ok
5/6/03						0	
5/9/03	REC	200303859	MEA	ok	Asp. Niger	65	ok
6/12/03	REC	200304225	MEA	ok	Asp. Niger	60	50 mm (only in 6 days though) ok

8. Cultured Unknowns

Number this Time Period:	58		MAB	REC	LWJ	LSP	LT	GV
Cumulative Number:	276	Cum. % Correct:	83.93	98.74	77.55	89.80	92.45	91.67

9. EMPAT Results

Results from Latest Rounds

Round	F1 Ref		F2 Ref		F3 Ref		F1 Lab		F2 Lab		F3 Lab	
19	Aspergillus oryzae		Rhizopus stolonifer		Myrothecium verrucaria		Aspergillus		Rhizopus stolonifer		Myrothecium verrucaria	
Scores:	Lab	32	MAB	21	REC	19.76	LWJ	0	LSP	21	LT	33	GV
Notes												

13. STANDARD OPERATING PROCEDURES FOR LEAD-BASED-PAINT (LBP) SURVEYS AND RISK ASSESSMENTS

13.1. Qualifications

13.1.1. Lead-Based Paint Inspectors

The XRF and chemicals present a clear hazard to the inspector, so training in safety and hazard avoidance is required. The operation of the portable XRF and taking of physical samples during a lead-in-paint inspection are not overly technical and do not require an extensive technical background. A survey does require on-the-spot decisions based on observations and conclusions; this ability to make sound decisions is not necessarily learned in the classroom, so the choice of inspector is based not only on educational background, but also on less tangible qualities. As a minimum, a high school diploma is required, although college-level chemistry or science would be an advantage.

13.1.2. Risk Assessors

Conducting a risk assessment requires more decision-making and judgement in the field. As a minimum, the EPA requires a bachelor's degree and one year related experience. Fiberquant requires a bachelor's degree in science and one year experience in LBP inspection or equivalent.

13.2. Training (Inspector and Risk Assessor)

13.2.1. Safety Training

The XRF and chemicals present a clear hazard to the inspector, so training in safety and hazard avoidance is mandatory. A one-day course in radiation safety given at Radiation Engineering, Chandler, AZ is attended to learn to work with radiation safely. An inspector cannot operate the XRF before completing this course. For chemical safety, our internal, one-day course in chemical hygiene is attended.

One important aspect of safety is these standard operating procedures, since following the procedures as written will result in safe operation of the equipment.

Safety is of great importance during the use and storage of the XRF. A safety program has been written separately and will not be repeated in total here. The main points are:

1) machine is chained and locked whether at the lab or in transit or stored in the car or at my house (these are the only options; the machine is not to be stored elsewhere).

2) operators wear radiation badges

3) a use log documents where and when the machine was outside the lab.

4) a bill of lading is to be carried with the unit when outside the lab.

5) no non-lab personnel with 5' of the unit during operation.

8) only licensed operators use the unit.

9) swipe test annually to check for source leak.

13.2.2. Procedural Training

Each operator undergoes in-house training to provide familiarization with the controls and menus of the XRF(s). Being a menu-driven system, the operation is relatively straightforward. Each person performing a site survey will be responsible for reading and following these SOPs and any appropriate work practices. The in-house training is documented by the form given in 5.2.2 of this document.

13.3. Portable XRF

13.3.1. Operation

The portable XRF in use is an RMD LPA-1 spectrum analyzer. Its instruction manual is kept in the instrument case. Brief operating instructions follow.

The source and electronics are contained in a gun-like unit There are three modes of operation: standard (not used), time corrected (used for check samples and timed assays) and quick mode, used for normal operation. The quick mode stops the assay as soon as the answer is above or below the action level with 95% confidence, and therefore gives the fastest analysis. The right action level (usually 1 mg/cm2) must be set, though. The operation is controlled via 6 buttons on top of the unit. The instructions for each operation are given in the manual and will not be repeated here.

Up to 4000 tests in any number of rooms or units may be stored before down-loading.

13.3.2. Maintenance

The instrument is kept in a locked room, chained to a shelf unit. The battery is plugged into its charger (on trickle) while it is not being used in the field. This will have no deleterious affect on the wet gel battery.

Care must be taken that the machine is kept in its optimal operation temperature range. The unit can be used from 40 to 130 ◦F, but it is better if the machine stays near 75. If a survey must be conducted at a temperature extreme, then the unit should be equilibrated at 70◦ beforehand to get it to read correctly initially, then monitored via check samples every 20 tests to see what is happening to the values over time.

Approximately once every year, the source must be tested for leakage via a swipe test. This is either performed at the factory during source replacement, or at Radiation Engineers, Chandler, AZ. The results are entered into a LIMS database for tracking purposes.

The source continuously weakens according to its half-life of less than a year. Within about 18 months, a new source will exhaust to the point that tests take significantly longer. Usually, the source is replaced then; this is performed at the factory. Arrangement must be made ahead of time to limit down-time. Shipping is via Federal Express.

Figure 13.3.2 Bill of Lading for XRF

REV 3/96 ATTACHMENT F

MODEL TRANSPORTATION INFORMATION

SHIPPING PAPER

TO: FIBERQUANT, INC.
ADDRESS: 5025 S. 33RD ST., PHOENIX, AZ 85040
FROM: FIBERQUANT, INC.
ADDRESS: 5025 S. 33RD ST., PHOENIX, AZ 85040
IF BEING SHIPPED AND RETURNED TO PLACE OF ORIGIN CHECK HERE: ____

HAZARDOUS MATERIAL
PROPER SHIPPING NAME: RQ, RADIOACTIVE MATERIAL, SPECIAL FORM, N.O.S.
HAZARD CLASS: RADIOACTIVE MATERIAL
IDENTIFICATION NUMBER: UN2974
TRANSPORT LABEL: RADIOACTIVE
TRANSPORT INDEX: 0.5

DEVICE	MODEL	QUANTITY	ISOTOPE	ACTIVITY
SCITEC	MAP3	1	Co 57	25 mC

THIS IS TO CERTIFY THAT THE ABOVE-NAMED MATERIAL(S) ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED, LABELED AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE STATE OF ARIZONA AND U.S. D.O.T.

SIGNED: [signature]
TITLE: LAB DIRECTOR
DATE: 1-30-97

IN CASE OF EMERGENCY, CONTACT ANY OF THE FOLLOWING:

RADIATION SAFETY OFFICER: LARRY S. PIERCE
COMPANY MAIN OFFICE: 5025 S. 33RD ST., PHOENIX, AZ 85040
D.P.S. ____
ARIZONA RADIATION REGULATORY AGENCY: (602) 255-4845
AFTER NORMAL BUSINESS HOURS: (602) 223-2212

The above information shall be available in the cab of any vehicle transporting a nuclear gauge. In case of emergency wherein the driver is rendered unconscious or incapacitated.

A private carrier does not need to sign below.

SIGNED BY: ____
COMPANY: ____ DATE: ____

Signature____ Date____

13.4. On-site Procedures

13.4.1. Preparation

One day prior to an appointment for a LBP survey or Risk Assessment, the following should be checked:

1. Establish who the client/customer is and how to get to the site. For a risk assessment, also establish who the residents are and their ages, if possible.

2. The battery should already be plugged in so that it is fully charged for the trip.

3. Have the following:

   a. at least 20 (or more if a large job) 50 ml centrifuge tubes and caps per unit.

   b. at least 20 ASTM spec lead dust wipes per unit

   c. a sharpened wood chisel

   d. writing pen and "Sharpie" pen

   e. provisions for taking field notes, room floor plan forms and room data forms

   f. the XRF, the bill of lading and your dosimeter badge.

   g. a ladder

   h. plenty of protective gloves

   for a risk assessment, add

   i. a tape measure and 1'x1' template

   j. wipes for cleaning the template between samples

While the XRF is being transported to the site, 1) it is to be in the trunk of a sedan or chained with padlock in the back of a truck, hatchback or SUV, and 2) the XRF on-site package, including a bill of lading, licenses, etc. is to be carried in the front of the vehicle. A copy of the bill of lading is shown in Figure 13.3.2.

13.4.2. Lead-Based Paint Inspection On-site Procedures

Upon arrival at the site, the instrument needs to be checked for proper operation. This is accomplished by running a 30 second time corrected mode analysis on the 1.0 mg/cm2 test sample provided. The standard block is placed on a wood substrate and the gun placed on top of it. The trigger of the gun is opened and the analyzer started. The result can be from 0.7 through 1.2 inclusive. If not, the instrument is not performing correctly and should not be used.

13.4.2.1. Selection of Test Points

Depending upon the client/customer's needs, a survey may be extraordinarily thorough or preliminary. However, the choice of test points is similar.

Test points of a given building component (e.g., door, window trim, wall) should be made semi-randomly within a room. That is, do not test all north-facing walls in a building. Make sure that there is a mix of exterior and interior walls tested, especially in commercial buildings, because interior walls may be build-outs and therefore newer than exterior walls. The height of the test point from the floor should also be semi-random; do not consistently test everything at a height of 4.5 feet from the floor.

Finally, do not ignore varnished items. Clear coatings also contained Pb, although not in the high concentrations that pigmented coatings did.

13.4.2.2. Documentation of Results

In order to eliminate mis-communication of room names, a rough floor plan of the building is made before or as the survey is performed. A typical plan is shown in Figure 13.4.3.

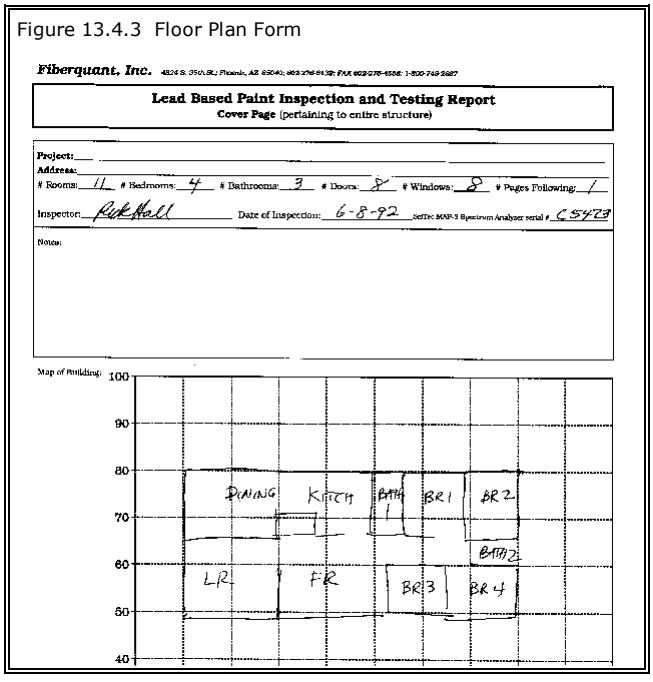
The location of each sample is documented during the survey using diagrammatic forms modified from those supplied by RMD. A sample number is indicated on a floor plan or façade drawing. Doors, windows and specialty items have their own drawings.

The stored results for a survey are downloaded to a desktop computer at the first available time. The LBP-1 program is started and the locations of each sample input.

13.4.2.3. Preliminary-Type Survey

Under certain circumstances, it may be desired to survey building quickly and inexpensively. In these cases, a number of tests or time limit per unit may be negotiated with the client/customer. However, certain minimums must be maintained.

Figure 13.4.3 Floor Plan Form



For a detached house, the ideal preliminary survey would include one of each component/substrate combination for the home. If the home appears to have multiple construction histories, then an attempt will be made to test one of each component/substrate combination in each of the different phases not to exceed 40 measurements. In the event the operator cannot test each component/substrate combination in each construction phase, then concentrate the readings in the oldest part of the home. Most importantly, the operator makes his best effort to locate lead-based paint within these forty measurements so ultimately the decision-making is left up to him on-site.

For multiple unit jobs, such as an apartment complex, a minimum of 10 units should be randomly selected, then a minimum of 1 test per component per unit, 2 is better.

During the negotiations, we must emphasize to the client/customer reluctant to spend the money that certain minimums must be maintained in order for the survey to have validity. Regardless of numbers of tests agreed upon, the report must clearly state that this is a survey not according to HUD Guidelines, and that there are limitations to the conclusions that can be drawn from the data.

13.4.2.4. HUD Guideline Survey

The HUD Guidelines (Lead-Based-Paint: Interim Guidelines for Hazard Identification and Abatement in Public and Indian Housing; 2nd Edition, 2012) give specific directions for performing surveys in multiple unit dwellings and detached dwellings. Only an outline will be presented here. In multiple unit dwellings, a chart gives the percentage of units to be tested (p 29). Within a unit, each building component in each room is to be tested (but each wall in each room), as well as exterior components (each wall, too). This results in 80-120 tests per house given typical Phoenix construction. Houses with much trim, such as turn of the century eastern house, may need up to 400 tests to comply completely.

The unusual point about these guidelines is that they are not mandated, even for HUD-owned housing. However, if we want to claim that a survey is according the HUD guidelines, then the guidelines must be followed to the letter.

13.4.2.5. Taking physical samples

Physical samples should be taken under the following circumstances: 1) when the XRF has given an inconclusive result (between 0.8 and 1.2 on confirm), 2) when a contract calls for a certain number of physical samples side-by-side with XRF (often any positives will be confirmed this way), and 3) when the XRF has indicated an unusual or unexpected result, such as only one positive door trim in an entire house, or inconsistent tests on one component type. Razor blades, a chisel, packing tape and zip-loc bags are kept in the XRF case for this purpose.

The preferable way of taking a physical sample on soft substrates (wood, wallboard) is to 1) put packing tape over the site to be sampled, 2) cut through the tape and paint to form an incised square area of known size (e.g., 1" square), and 3) chisel up the entire area, taking as much substrate as needed to ensure that all paint has been taken. This sample's AA results will be reported by area.

A second way of taking a physical sample which is more useful on hard substrates such as metal is to simply chisel the paint into the sample bag, collecting paint all the way down to the substrate. Care must be taken to get all layers, including the primer, which is the most likely to contain Pb. All layers should be gathered in proportion equal to their occurrence. No substance other than paint should be included in the sample. If the substrate needs to be tested, make a separate sample for it. This type of sample's AA results will be reported by weight percent.

It is especially important to take a physical sample when all sites and components are negative except one. Even though if the XRF gives a conclusive positive, we have shown in the past that there will surely be Pb there, it is good to have the confirmation from the lab to field the questions that will most certainly be raised in such a case.

Fiberquant offers confirmation by Flame AA. If a large enough area can be disturbed, a physical sample should be 1 inch square or more, and specified to the lab to be analyzed by area; in this case, the results will be in mg/cm2 and thus directly comparable to the XRF result. On the other hand, if a physical sample is analyzed by weight, its results will be in weight percent Pb or ppm, and so will not be directly comparable to the mg/cm2 of the XRF(although it may be calculated if the exact thickness of the paint is known). Such physical samples analyzed by weight are considered positive if they contain >0.5% Pb.

13.4.3. Risk Assessment On-site Procedures

1. Present the resident with the interview questionnaire, copy from HUD guidelines, 2012 version, Chapter 5, p.5 to our letterhead.

2. While the resident fills out the questionnaire, draw a floor plan of the structure to be assessed, taking care to label the rooms unambiguously.

3. Document any instances of paint problems:

a. paint failure (chipping, peeling, chalking) and its cause.

b. any settled dust in the structure.

c. any settled paint chips in or around the structure.

If a lead-based paint inspection is to be included with the risk assessment, then document paint problems while the survey is being performed. Instances of failing paint which is negative by XRF need not be documented.

If a full lead-based paint inspection is not to be done, then the paint which is the apparent source of a, b or c above must still be tested with the XRF.

4. Collect two dust wipe samples per each living area, up to ten samples per unit, using the HUD wiping procedure, HUD guidelines, Chapter 5.

5. Collect at least one composited soil sample from the exterior of the structure. A composite consists of up to 10 locations, typically 4. For each garden or play area, take one non-composited soil sample.

6. Label all samples unambiguously, and enter sample number, name, location, date, etc. on a chain of custody form. One chain is to be used for each matrix sampled.

7. Samples must be analyzed by a NLLAP-recognized laboratory (*e.g.*, Fiberquant).

8. Review the complete resident questionnaire. Does information presented indicate that more samples should be taken.

9. Retain all sampling materials (wipe packets, gloves, *etc*.) to be disposed of at Fiberquant. Do not leave these potentially contaminated materials on site.

13.4.4. Clearance testing

1. Determine what the scope of lead activities prior to arriving on-site. This includes bring a floor plan of the structure to be cleared.

2. Visually inspect the work areas and areas adjacent to them and note and dust, debris or paint chips. If any are present inside the work area the clearance is a failure and no sampling is necessary.

3. Inspect the work to verify its completeness. In the case of lead-paint stabilization verify that loose paint was removed prior to repainting. In the case of lead paint or component removal, verify that there are no remaining components with lead-based paint. If there were components to be stripped of paint and were repainted prior to clearance, XRF testing may be necessary to document the removal of the lead-based paint.

4. Once the work areas have passed visual clearance sampling must be done in the case of interior lead activities. Take at least one sample from each of the following: A floor dust wipe sample closest to where the work was done. Take a windowsill dust wipe sample closest to where the work was done. Take a floor dust wipe sample in the non-work area closest to the area where work was completed.

5. In the case of lead activities restricted to exterior work only, soil sampling may be done but is not required. If sampling is done, take a composite soil sample with up to 10 sub-samples from areas adjacent to where the work was done.

6. Label all sample unambiguously and enter the number, name, location, date, etc. on a chain of custody form. One chain of custody is to be used for each matrix analyzed (soil and wipes).

7. Retain all sampling materials (wipe packets, gloves, etc.) to be disposed of at Fiberquant. Do not leave these potentially contaminated materials on site.

8. Samples must be submitted to an NLLAP-recognized laboratory (e.g. Fiberquant) using standard chain-of-custody procedures.

9. Compare the analytical results from the wipe and soils samples (if taken) to the HUD Guidelines, 2nd Edition 2012 to determine if a structure has passed EPA lead dust and soil clearance levels (currently 40 ug/ft2 for floors, 250 ug/ft2 for window sills and 400 ppm for soils).

10. For Clearance testing that meets Tidwewater, Inc.'s requirements, refer to <z:\controlleddocuments\Forms Word\Tidewater clearance testing rules.01.doc>.

13.5. Confirmations

13.5.1. Atomic Absorption Confirmation

Atomic absorption (AA) analysis involved the digestion of a weighed amount of paint and the testing of the extract so obtained. The requirements for sample gathering purposes are approximately 1 gram (1/2 teaspoon) of relatively pure paint. This method is accepted by HUD and has national quality control programs available for lab qualification. The result is the average weight % for the sample. Fiberquant performs Flame AA analysis on lead paint samples.

13.6. Report

Before a report is generated, the results of a survey or risk assessment are reviewed. Review consists of checking, as applicable, that the required procedures have been followed, that the correct numbers of test points were analyzed, the correct number of wipe and soil samples have been taken, that failing lead-based paint was documented, that the questionnaire was completely answered, and that the data is consistent in indicating the sources of lead paint. If certain test points seem anomalous, their spectra and calculated results are checked for accuracy, the calibration of the instrument checked, etc. to determine whether the test result can be trusted. Re-testing may be ordered if the data does not make sense. The results of physical testing will be checked against the results of the XRF.

The report for a lead-based paint inspection consists of a cover letter giving the procedures and conclusions, the site map, and the data pages. The cover letter is kept as a template in the controlled documents forms, and altered to fit the current job when needed. An example is given at the end of this chapter. For HUD, certain other documents are required which are given in the HUD guidelines and will not be repeated here.

The report for a risk assessment will include:

1) The date of the assessment
2) The address of the structure(s), the date of construction and the name of the owner and the owner's phone number
3) The name, signature, and EPA certification number of the risk assessor conducting the assessment
4) Fiberquant's name, address, and telephone number
5) The name of the laboratory conducting the analyses of the samples, namely Fiberquant's
6) The results of the visual inspection for failing paint
7) The testing method used to determine the lead concentration of any failing paint, namely XRF
8) The specific locations of the components tested
9) All XRF data including calibration readings and the serial number of the instrument used
10) All lab results
11) The resident questionnaire (if the unit was occupied)
12) The results of any previous inspections, if available
13) A description of the location, type, cause and severity of identified lead-based paint hazards
14) A description of the interim controls and/or abatement options for each identified lead-based paint hazard with a suggested prioritization and their costs. If encapsulation or enclosure is recommended then the report will also include a recommended maintenance and monitoring schedule for the encapsulated or enclosed hazards.

13.7. After the Survey/Assessment

Store all field notes in the XRF file in Michael's office (eventually archived in the bay). Store all reports electronically on Server//c:/Reports/XRF/… and the appropriate subdirectory.

13.8. Recommendations to Client/customers

Fiberquant does not, in general, give recommendations, such as whether to remove lead paint or not, to client/customers, except as required by a risk assessment. We supply background information, such as the HUD levels of positive and negative for XRF and physical testing, the state of regulations in Arizona, copies of selected pages of HUD or other documents, etc.

Figure 13.7 XRF In-Lab Test Form

Fiberquant Analytical Services

Lead in Paint Assay

Performed at Fiberquant with at least 1" square of paint chip using a Scitec Portable Xray Fluorescence Spectrum Analyzer with concrete as a background. The HUD action level = 1.0 mg/cm².

Fiberquant Job Number: 95-XXXX
Client: MR. CLIENT
Project: GREEN PAINT ON GARAGE

Sample #	Lead Content (mg/cm²) from K-lines
Comments: NIST 3 STD ON WOOD	1.0
GREEN PAINT	1.6
BLANK ON WOOD	0.0

13.9. In-Lab Testing

Occasionally, samples are brought to the lab of chips or wall sections that are large enough to be tested by portable XRF. The minimum size for this kind of testing is 1"x1". The chip or sample must be intact, or else the reading will be anomalously low. The chip or sample is to be supported on a 4x4" wood block or other low density substrate for most accurate testing. A check standard is used beforehand as usual to assure proper instrument operation. In addition, a background is performed (e.g., the wood block with no sample, or the wood block with the NIST blank). All the readings are documented and reported on the form shown in Figure 13.7.

13.10. Quality Assurance Procedures

13.10.1. Check Sample

A painted 1.0 mg/cm2 standard block of wood came with the unit. To check whether the machine is performing correctly at the beginning of a survey, 3 30-second time corrected tests on the block are run. If the result is 0.7 – 1.2, then the machine is considered to be OK for the survey. If not, 3 more tests are run on the block. If all are not within specs, then no quantitative results may be obtained from the machine, and a survey cannot be performed. After the survey, three more tests are recorded.

During a long survey, the check sample should be before and after every unit of a multiple unit job, or before and after the lunch break, if a continuous survey.

13.10.2. NIST Standards

A set of NIST paint standards (SRM 2579) can be used in place of the check sample above. The likely standard to be so used would be the 1.0 mg/cm2 one. Tests on these standards using a 30 second time corrected count should be within the same range expected in the field.

13.10.3. Substrate Corrections

The RMD Performance Characteristic Sheet requires no substrate corrections for quick mode. If the standard mode is used, substrate corrections should be made.

The series of standards is run in test mode on wood, drywall, concrete block and metal. A calibration curve is calculated for each and the y-intercept is the substrate correction. The results are documented as in Figure 13.8.3.

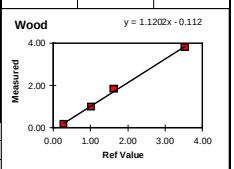
Figure 13.8.3 Substrate Corrections

XRF Substrate Corrections — All K numbers test mode

Corrections are calculated: raw + correction so are the negative of b below

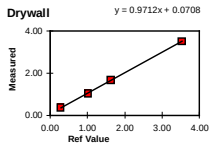
Wood:

Std Level	Test 1	Test 2	Test 3	Avg.	Ref Val
IV	0.30	0.00	0.20	0.17	0.29
III	1.00	0.90	1.10	1.00	1.02
II	1.90	2.00	1.60	1.83	1.63
I	3.90	4.00	3.50	3.80	3.53
Correction	0.1				



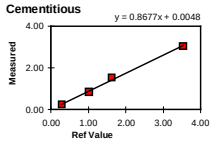
Drywall:

Std Level	Test 1	Test 2	Test 3	Avg.	Ref Val
IV	0.20	0.50	0.40	0.37	0.29
III	1.00	1.10	1.00	1.03	1.02
II	1.60	1.70	1.70	1.67	1.63
I	3.60	3.30	3.60	3.50	3.53
Correction	-0.1				



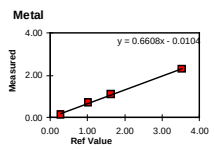
Cementitious:

Std Level	Test 1	Test 2	Test 3	Avg.	Ref Val
IV	0.10	0.30	0.30	0.23	0.29
III	0.80	0.90	0.80	0.83	1.02
II	1.40	1.60	1.60	1.53	1.63
I	3.00	2.90	3.20	3.03	3.53
Correction	0.0				



Metal: (two sheets of galvanized steel)

Std Level	Test 1	Test 2	Test 3	Avg.	Ref Val
IV	0.20	0.20	0.00	0.13	0.29
III	0.70	0.70	0.70	0.70	1.02
II	1.10	1.00	1.20	1.10	1.63
I	2.30	2.20	2.40	2.30	3.53
Correction	0.0				



Until Stds are located, plastic=wood and plaster=drywall

14. STANDARD OPERATING PROCEDURES – METALS ANALYSIS

14.1. Introduction

Flame Atomic Absorption (FLAA) is a technique by which many elements can be analyzed using the same instrumentation, with only changes in source tube and operating parameters. In order to efficiently present SOP data, this chapter will be generalized, and will discuss those aspects of the analysis which are common to any FLAA analysis. Details of sample preparation and analysis parameters for the elements we commonly analyze will be found in Work Practices. Each Work Practice consists of a brief but complete compilation of what has to be done and when it has to be done to accomplish a process or procedure. The Work Practice is designed to assist personnel that have already been trained in a procedure to perform the procedure in a consistent manner. The Lab Summaries do not explain why steps are performed, so it is incumbent upon the analyst to thoroughly read the full SOPs when issued. Work Practices are kept 1) complete in Chapter 11 of this document, 2) complete in a folder near the AA, and 3) as individual summaries taped up or kept near the area where the procedure is performed. They are to be referred to on a daily basis and need to be as handy as possible for this reason.

The AA may be called upon to analyze different elements in different matrices than already established. In this case, the following procedures must be performed before such new-type client/customer samples are analyzed: 1) literature review of available published methods applicable to the analyte or matrix, 2) obtain or produce appropriate standards (matrix LCS, Cal Stds, ICV, spiking material), 3) try out and/or modify existing methods, 4) write SOP for sample prep and analysis, 5) qualify SOP using LCSs and spikes, 6) perform detection limit, accuracy and precision calculations, 7) develop report forms, 8) perform client/customer analyses.

If a new method is to be employed that states specific QA requirements or components, it is the responsibility of the QA Officer to make sure that those components are present in our SOP/QA Manual and performed as required by the method. If the QA of the method is not done, then we are not performing the method.

14.2. Organization and Training of Personnel

The organization of the company is described in 4.1 of this manual. Training of personnel is described in 5.2.2.

14.3. Equipment and Supplies

14.3.1. Major Equipment

AA's:

The instruments require 1) filtered compressed air, supplied by an air compressor with an in-line Balston trap and filter, and 2) AA grade compressed acetylene, supplied by Air Products. Maintenance detailed in section 16.5.3.

1) Two Thermal Elemental M5 AA/AE Flame atomic absorption spectrometers, onemade 2001 and the other in 2008.; technical manual (w/ schematics), instruction manual and analysis manual stored in AA bookshelf.

Balances:

1) Sartorius CP 244S .1 mg Analytical Balance; manual is stored in instructions file cabinet; automatically calibrated whenever turned on; calibration check using a 0.2 weight daily. Back-up is a Sartorius BP 210 D Analytical Balance (0.01mg; manual stored in instructions, file cabinet. Preventative maintenance and calibration performed yearly.

Other:

Hydride Generator Model HGB-001, ser # 080165-13, purchased new from Buck Scientific (Spectra Hardware) (out of service until the SOPs are re-written for the M5 AAs).

Fume Hood: Permalab model H-704 66815 POC455 (6'x3'). The face velocity of the fume hood is tested every 6 months by the senior AA analyst. The four corners and the center are tested with the vanometer. The results are entered into the LIMS under the AA QC menu. The average must be >80 ft/min – otherwise the hood is to be taken out of service until the average can be made to be >80.

Hot Plates: 2- Thermolyne remote control 1'x2' ceramic top

Drying Oven: Precision catalog #51221126

14.3.2. Supplies

Reagents for AA must be ACS grade (AIHA requirement), except where greater purity is required because of analytical sensitivity, in which case Spec grade or equivalent (check the specifications before ordering) should be used. Reagents are generally purchased from Fisher or VWR. A reagents from Fisher has a "date received" blank on the label and a Fisher assigned expiration date, if applicable. When a reagent is received, it should be examined for damage, leakage, etc. that may have affected its concentration. The date received is filled in or added. If it does not already have an expiration date, one is assigned. Generally, concentrated standards are good for three years from date of manufacture. Solid chemicals are generally assigned a 10 year expiration date, unless they are known to be unstable. Solvents and acids are likewise assigned 10 year expiration dates. Unused solid standards that are beyond their expiration date may be assigned a new expiration date if they are re-validated by at least 3 analyses

that show that the material has the same concentration as it did before expiring. Liquid standards are not be used beyond their expiration date regardless of apparent concentrations.

Item (supplier)	Target Stock
volumetric Flasks, Class A 100 ml	24
50 ml	24
25 ml	24
10 ml	24
5 ml	6
centrifuge tubes, 50 ml (VWR or Alameda)	1500
centrifuge tubes, 15 ml (VWR or Alameda)	300
pipettes, 10 ml,5ml,2ml,0.5ml	several each
pipettes, 1 ml	10
adjustable micropipettes, 5-50, 50-200, 200-1000 ul	1 each
Fixed micropipettes, 250, 500 1000 ul	1 each
de-ionized Water	On tap
beakers, 150 ml	160
spatulas, Ni	2
NaBH4, AR	50 g
HCl, conc., AR	1 L
HNO3, conc., spec grade	4 L
H2O2, 30%	3x100 ml
hot plate	1
beaker tongs, stainless steel	2
safety equipment	
filter paper, Whatman #4, 90mm and 65	200
funnels, polyethylene	24
wash bottle, polyethylene	2
bulb for pipettes	1
Pace L415 paint CRM	2
NIST SRM 2704	1
NIST SRM 2582	1
EPA Std AW-13	1
EPA Std AW-14	1
watch glasses, 65 or 75 mm ribbed	24
1000 ppm standards, one manufacturer, e.g. Baker	100 ml each element
1000 ppm standards, another manufacturer for ICV, e.g Alfa Aesar	100 ml each element

14.3.3. Reagent Handling

Since knowing the concentration of standards is at the heart of this analysis, documentation of reagents is especially important to analysis integrity. The reagent handling program consists of 1) reagent quality, 2) reagent make up and log-in, 3) storage and expiration and 4) disposal.

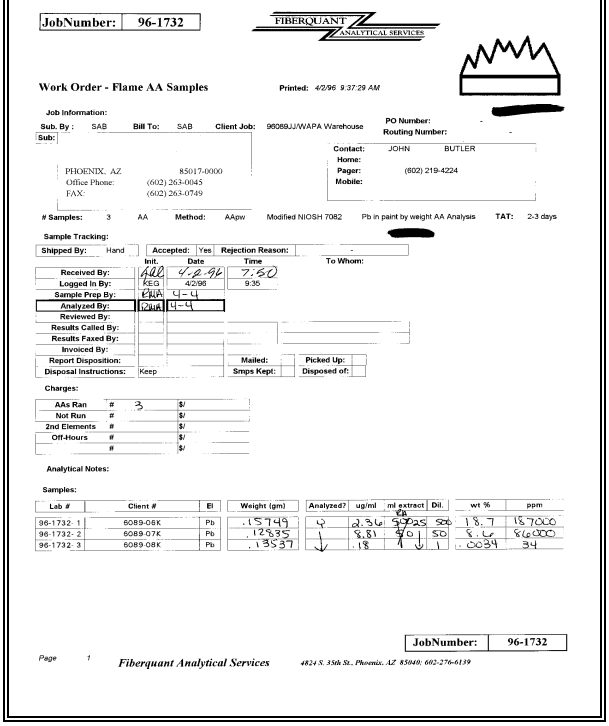
Reagents to be purchased are liquid standards and digesting chemicals. The reagent standards are to be Fisher AA standards or equivalent, which are traceable to NIST. The digesting chemicals are to be AR grade or better ("Tracemetal"). Receipt of these is to be logged into the AA notebook, and their expiration date noted. The standards have an expiration date printed by the manufacturer, which is generally more than 1 year from date of manufacture. ICV stock standard solutions made by us are also logged into the AA book, and assigned a 2 year expiration date. Digestion chemicals are assigned a 3 year expiration date.

Make-up of reagents and standards are documented in the AA log book as to date of make-up, concentration, element, person making it up, and expiration date. In addition, this data is put on the vial or bottle itself. Instructions for making standards are included in Work Practice #AA-4.

Stock standards are stored in the standards cabinet. Working standards are stored at the AA. Digestion chemicals are stored at the hood and acid cabinet. In no case should standards or chemicals be used past their expiration date, as the concentration is unreliable.

When a logged-in standard or chemical has been used, it should be logged out of the AA notebook by making a notation next to the log-in entry. Expired chemicals may have to be disposed of as hazardous, either due to heavy metal or acid content.

Figure 15.4 Example AA Log-in Form



JobNumber: 96-1732

FIBERQUANT ANALYTICAL SERVICES

Work Order - Flame AA Samples Printed: 4/2/96 9:37:29 AM

Job Information:

Sub. By : SAB Bill To: SAB Client Job: 96089JJ/WAPA Warehouse PO Number: - Routing Number: -

Sub:

PHOENIX, AZ 85017-0000
Office Phone: (602) 263-0045
FAX: (602) 263-0749

Contact: JOHN BUTLER
Home:
Pager: (602) 219-4224
Mobile:

Samples: 3 AA Method: AApw Modified NIOSH 7082 Pb in paint by weight AA Analysis TAT: 2-3 days

Sample Tracking:

Shipped By: Hand Accepted: Yes Rejection Reason: - To Whom:

	Init.	Date	Time
Received By:	MB	4-2-96	7:50
Logged In By:	KEG	4/2/96	9:35
Sample Prep By:	EMA	4-4	
Analyzed By:	[illegible]	4-4	
Reviewed By:			
Results Called By:			
Results Faxed By:			
Invoiced By:			

Report Disposition: Mailed: Picked Up:
Disposal Instructions: Keep Smps Kept: Disposed of:

Charges:

AAs Ran	# 3	$/
Not Run	#	$/
2nd Elements	#	$/
Off-Hours	#	$/
	#	$/

Analytical Notes:

Samples:

Lab #	Client #	El	Weight (gm)	Analyzed?	ug/ml	ml extract	Dil.	wt %	ppm
					Ck				
96-1732- 1	6089-08K	Pb	.15749	Y	2.36	5025	50	18.7	187000
96-1732- 2	6089-07K	Pb	.12835		8.8	50	50	8.6	86000
96-1732- 3	6089-08K	Pb	.13537	Y	.18	1	1	.0034	34

JobNumber: 96-1732

Page 1 Fiberquant Analytical Services 4824 S. 35th St., Phoenix, AZ 85040; 602-276-6139

14.4. Sample Log-in and Handling

Log-in of a job and associated samples is accomplished via a custom computer program which is started by typing "log" <enter> on the receiving computer. The program automatically assigns consecutive job numbers for each job and lab numbers for each sample. The job is designated "AA " as to sample type, and job data such as client/customer, contact, phone numbers, etc. Sample data such as client/customer sample designation, type of sample (paint, soil, water, wipe, etc.), and element to analyze for is entered on a separate screen for each sample. Finally, a printed sample submittal form is generated, shown in Figure 15.4. Any accompanying paperwork is stapled to this form.

The samples and their paperwork are placed in the AA holding racks and the AA sample coordinator is informed that samples are in house. The AA sample coordinator arranges for analysis, bearing in mind turn around required, and other samples in house or expected to be in house. A run consists of a series of client/customer samples and QC samples having calibration curve in common. It is cost effective to run as large a number of samples for one element at one time, since standards may have to be made fresh. On the other hand, too many samples cannot be handled in one run without a break in activity. A good compromise is 60-72 samples per run.

After analysis, the samples are placed in storage, to be returned to the client/customer or to be disposed of. The samples to be discarded are hazardous waste. They are placed in a 6 mil bag marked as to content. When a bag has been filled, it is disposed of using a commercial disposal company (see LIMS <Approved Suppliers>. Negative samples may be disposed in normal waste, so should be marked as to content after analysis, rather than being mixed with Pb-containing samples. All samples are retained for at least 30 days, in the event there is a problem or discrepancy that could be resolved by re-testing.

The analyst initiates a run 1) adding a new record to AA Runs in the LIMS. The standard concentrations may be automatically filled in by double-clicking the analyte box. The run make-up page is then accessed by double-clicking the run number. Samples yet to be assigned a run are shown in one table and samples in the current run are shown in another table. Samples are moved from one to the other by double-clicking their lab number. QC samples are added after 20 client/customer samples by clicking the appropriate button above the right table. The run is then printed out (see Figure 15-2). After analysis, the absorbance, extract volume, dilution factor and smp weight (if any) data are input, and the LIMS then calculates the results and QC compliance. The analyst checks that the LIMS calculations are working by hand-calculating one ug/ml and one final result. Before the report is given out, a second analyst checks the data entry and results.

14.5. AA Operation

14.5.1. Overview

The flame AA siphons a liquid sample into an acetylene-air flame, where the metal atoms are suspended in a vapor state. A hollow cathode tube generates wavelengths of light specific to a given metal to be analyzed. The light traverses the length of the ribbon-like flame, during which time, some of the light is absorbed by metal atom

electrons. The more metal atoms present in the flame, the greater the light absorbed. To analyze, standards of known concentration covering the linear range and more are run at the same approximate time as are the sample unknowns to construct a calibration curve.

14.5.2. Routine Operation

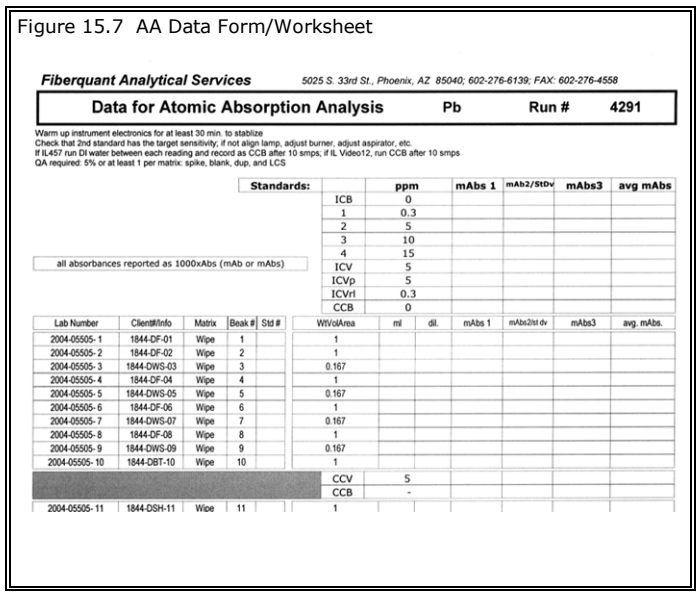
Turn on, turn off, and routine alignment are outlined in Work Practice AA-1, and will not be repeated here.

Detailed explanation of the digital electronics (some of which do not function) is given in the IL Instruction Book, kept in the AA bench.

14.5.3. Maintenance

Maintenance of the burner assembly is kept to a minimum by aspirating plenty of DI water during warm up, between samples or during waits for dilutions, and before shut down. Also, only filtered or clear liquids are to be aspirated. Cloudy liquids or liquids containing particulate may clog the aspiration tube or burner. Instructions for cleaning the burner or replacing parts are given in the IL instruction manual.

Figure 15.7 AA Data Form/Worksheet



Fiberquant Analytical Services 5025 S. 33rd St., Phoenix, AZ 85040; 602-276-6139; FAX: 602-276-4558

Data for Atomic Absorption Analysis Pb Run # 4291

Warm up instrument electronics for at least 30 min. to stablize
Check that 2nd standard has the target sensitivity; if not align lamp, adjust burner, adjust aspirator, etc.
If IL457 run DI water between each reading and record as CCB after 10 smps; if IL Video12, run CCB after 10 smps
QA required: 5% or at least 1 per matrix: spike, blank, dup, and LCS

all absorbances reported as 1000xAbs (mAb or mAbs)

Standards:		ppm	mAbs 1	mAb2/StDv	mAbs3	avg mAbs
	ICB	0				
	1	0.3				
	2	5				
	3	10				
	4	15				
	ICV	5				
	ICVp	5				
	ICVrl	0.3				
	CCB	0				

Lab Number	Client#/Info	Matrix	Beak #	Std #	Wt/vol/Area	ml	dil.	mAbs 1	mAbs2/st dv	mAbs3	avg. mAbs.
2004-05505- 1	1844-DF-01	Wipe	1		1						
2004-05505- 2	1844-DF-02	Wipe	2		1						
2004-05505- 3	1844-DWS-03	Wipe	3		0.167						
2004-05505- 4	1844-DF-04	Wipe	4		1						
2004-05505- 5	1844-DWS-05	Wipe	5		0.167						
2004-05505- 6	1844-DF-06	Wipe	6		1						
2004-05505- 7	1844-DWS-07	Wipe	7		0.167						
2004-05505- 8	1844-DF-08	Wipe	8		1						
2004-05505- 9	1844-DWS-09	Wipe	9		0.167						
2004-05505- 10	1844-DBT-10	Wipe	10		1						
					CCV	5					
					CCB	-					
2004-05505- 11	1844-DSH-11	Wipe	11		1						

Periodic maintenance is as follows:

Weekly:

1) Clean windows inside burner compartment with alcohol on swab.

As needed:

1) Clean burner

2) Replace acetylene tank when pressure is 50 psi.

3) Drain air-line trap and replace filter.

4) Other maintenance as needed when performance not up to expectations, procedures to be found in the IL instruction book (in AA table).

Whenever maintenance of any kind is performed, it is to be recorded in the LIMS by opening the equipment file in the Utilities menu and entering what was done under the appropriate piece of equipment.

14.6. Sample Preparation

Summaries of sample preparation are given in Work Practice AA-2, and will not be repeated here.

14.7. Analysis

The normal sequence of events in an analysis run is:

1) initial calibration blank (ICB)

2) lowest or reporting limit std

3) low ppm std – check sensitivity (see 14.10.2.6; e.g., Pb 2ppm > 0.051 (85% * target 0.060))

4) med ppm std

5) high ppm std

Each of these readings should be approximately proportional to the previous; if not, plot the results to make sure. If the calibration curve is not approximately linear, there is a problem with the standards or the machine.

6) initial calibration verification (ICV, see 16.10.2.4)

7) continuing calibration blank (CCB)

8) samples

9) low ppm (continuing calibration verification, CCV) std every tenth sample (this is already set up in on the data form, so is easy to remember). If the CCV std varies significantly from its previous value, then something has changed on the machine, most likely aspiration rate. The tubing may have to be cleaned. If the CCV varies by more than 10%, then the run must be repeated when the conditions are more stable.

10) CCB every tenth sample (this is already set up on the data form, so is easy to remember).

11) other QA samples as follows (which would have been added during the run makeup on the LIMS):

method blank (16.10.3.2.3)	1/20 or 1/run
lab control sample (16.10.4.1)	1/20 or 1/run
spike (16.10.4.2)	1/20 or 1/run
duplicate (16.10.4.3)	1/20 or 1/run

14.8. Calculations

14.8.1. Manual Calculations

Occasionally, calculations need to be made outside the LIMS. The spreadsheet for AA calibration/calculation is shown for Pb in Figure 15.8.1. Pb is usually calculated by the LIMS at this time, but other elements must be calculated via their own calibration sheet in the same computer file, C:\MSOFFICE\EXCEL\CHARTS\AA_CAL.XLS. Entered into the spreadsheet on the appropriate line must be: matrix type, average of the three absorbance readings, mls of solution, dilution factor, and the sample weight or volume or area. For each matrix, the spreadsheet reminds the analyst what units the weight or volume or area should be in. The calibration curve is automatically plotted when the absorbances of the 3-4 standards are entered into their appropriate lines. The fit is a least squares parabola with the low end fixed at zero. The two calibration constants, one for x2 and one for x, are shown inside the chart borders. These two values *must manually be entered* into the two boxes so marked near the top of the sheet. *If not, incorrect calculations will result*.

Figure 15.8.1 AA Calibration Spreadsheet

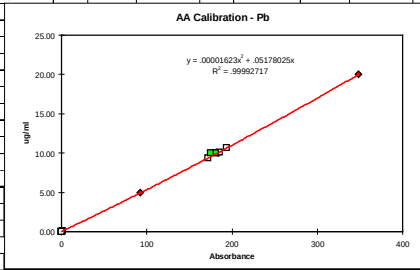
Fiberquant Analytical Services Fiberquant, Inc; 4824 S. 35th St., Phoenix, AZ 85040; 602-2766139

AA Calibration & Calculations - Pb

Analyst: LSP

Place trend-line constants here:

x2	x
.00001623	.05178



Beaker #	Absorbance	Conc	smptype	ml	dilution	smpwtvol		results 1		results 2	
Blank	0	0.00									
5 ppm std	92	5.00									
10 ppm std	184	10.00									
15 ppm std		15.00									
20 ppm std	348	20.00									
ICV 10 ppm	181	10.00									
1	1	0.05	MCE	10.0	1	587	L	<4.43	ug/m3	-	-
2	0	0.00	MCE	10.0	1	114	L	<22.81	ug/m3	-	-
3	0	0.00	MCE	10.0	1	120	L	<21.67	ug/m3	-	-
4	1	0.05	MCE	10.0	1	524	L	<4.96	ug/m3	-	-
5	1	0.05	MCE	10.0	1	688	L	<3.78	ug/m3	-	-
6	1	0.05	MCE	10.0	1	700	L	<3.71	ug/m3	-	-
7	0	0.00	MCE	10.0	1	636	L	<4.09	ug/m3	-	-
8	1	0.05	MCE	10.0	1	1053	L	<2.47	ug/m3	-	-
9	0	0.00	MCE	10.0	1	2065	L	<1.26	ug/m3	-	-
10	0	0.00	BL	10.0	1	1	-	-	-	-	-
CCV 10 ppm	182	10.00									
11	172	9.39	SPK	10.0	1	1	-	93.9	ug	-	-
12	194	10.66	SPK	10.0	1	1	-	106.6	ug	-	-
13	185	10.13	LCS	15.0	1	0.0757	-	2008.2	ppm	-	-
14		0.00			1	1	-	-	-	-	-
15		0.00			1	1	-	-	-	-	-
16		0.00			1	1	-	-	-	-	-
17		0.00			1	1	-	-	-	-	-
18		0.00			1	1	-	-	-	-	-
19		0.00			1	1	-	-	-	-	-
20		0.00			1	1	-	-	-	-	-
CCV 10 ppm	181	10.00									
21		0.00					-	-	-	-	-
22		0.00					-	-	-	-	-
23		0.00					-	-	-	-	-
24		0.00					-	-	-	-	-
25		0.00					-	-	-	-	-
CCV 10 ppm	175	10.00									

The dilution factor, which has not been previously discussed, is simply the ratio of final volume of a dilution to the volume of extract pipetted. For instance, when 1 ml of extract pipetted into a 100 ml volumetric, the dilution factor is 100. When a sample is diluted, the factor is greater than 1. If the original extract is concentrated, which is possible for water, the dilution factor may be a fraction of 1.

The ppm of an element in the sample is given by:

$$ppm = \frac{\mu g / ml \times ExtractVolume \times DilutionFactor}{SampleWeight}$$

% is simply ppm x 0.0001.

For wipe samples, the result is reported in ug/smp, since we do not always know the area wiped. For filter samples, the Sample Volume (either in L or m3) is substituted for Sample Weight in the equation above. For water samples, the ug/ml value obtained from the calibration curve is the ppm value; no further calculation is needed.

These values are filled in on the AA data form. The data and calculated values are also filled in on the sample submittal form, for the use of front desk personnel.

14.8.2. Computer Calculations

The LIMS program, under "run results" will calculate ppm and % from the data ug/ml, extract volume, dilution factor, and sample weight. When these values are input, the computer displays the ppm and % on the screen and prints a hard copy of the run. The LIMS also calculates % yield, %rsd, etc. for QC samples, compares their results to stored control limits and alerts the analyst to any results in the warning or out-of-control areas.

14.9. Report Generation

After the run data have been entered, the analyst goes to each job in the run, inputs analyst, date analyzed and run number, then prints the report. A typical report is shown in Figure 15.9. Reports requiring description or explanation other than in the stock report may be made up special by the analyst on the Works word processor. The report should include laboratory information, equipment information, job information, sample information, results, actual precision and

accuracy data. See pp A5-20-22 in the HUD guidelines for a detailed list of possible report data. The run sheet and each report created from the run are checked according to Lab Summary AAS-6, which lists checks for the original analyst and also checks for a 2nd qualified reviewer.

14.10. Quality Assurance Procedures

14.10.1. General Requirements

The successful analysis of samples by AA depends primarily on fastidiousness in sample preparation, standards preparation, and glassware cleanliness. It is unusual that the machine itself gives rise to poor results, because of the constant standard checks. Quality assurance procedures for AA, then, are designed to check cleanliness, preparation yield, and operator and instrument precision, and fall under the categories: calibrations, contamination control and precision and accuracy checks. If a method is adopted that has additional or different QA checks, Fiberquant will do the method requirements in addition to LQSR requirements.

All out-of-control incidents in the AA area are documented in a database in the LIMS, including run number, problem, possible cause, resolution and actions.

Each matrix has a number of QC checks. A summary is given in Table 14.10.1

Table 14.10.1 **QC Summary for Pb AA Samples**

1) Wipe

Method Blank – Acid, Hydrogen Peroxide

Matrix Blank – Blank Wipe, Acid, Hydrogen Peroxide

Spike – ~0.2g of Soil LCS, Blank Wipe, Acid, Hydrogen Peroxide

LCS – ~0.2g of Soil LCS, Blank Wipe, Acid, Hydrogen Peroxide

RLS – 313ul of 10 ppm Standard, Blank Wipe, Acid, Hydrogen Peroxide

Dup – No physical sample (enter data from second LCS, and mark Spike as sample to compare too)

2) Soil

Method Blank – Acid, Hydrogen Peroxide

Spike – ~0.2g client sample (no weighing), 150 ul – 200ul of 1000 ppm Lead Standard, Acid, Hydrogen Peroxide

Client Dup – ~0.2g client sample, Acid, Hydrogen Peroxide

LCS – ~0.2g of Soil LCS, Blank Soil, Acid, Hydrogen Peroxide

RLS – 313ul of 10 ppm Standard, Blank Soil, Acid, Hydrogen Peroxide

3.) Paint

LCS – ~0.15g Paint LCS, Acid, Hydrogen Peroxide

Method Blank – Acid, Hydrogen Peroxide

Spike – Client sample, 150 ul – 200ul of 1000 ppm Lead Standard, Acid, Hydrogen Peroxide

Paint Dup – 0.15g Client sample, Acid, Hydrogen Peroxide

LCS – ~0.15g Paint LCS, Acid, Hydrogen Peroxide

RLS – 313ul of 10 ppm Standard, Blank Paint, Acid, Hydrogen Peroxide

Dup – No physical sample (enter data from second LCS, and mark 1st LCS as sample to compare too)

4.) MCE Filter

Method Blank – Acid, Hydrogen Peroxide

Matrix Blank – Blank Filter, Acid, Hydrogen Peroxide

Spike – ~0.2g of Soil LCS, Blank Filter, Acid, Hydrogen Peroxide

LCS – ~0.2g of Soil LCS, Blank Filter, Acid, Hydrogen Peroxide

RLS – 125ul of 10 ppm Standard, Blank Wipe, Acid, Hydrogen Peroxide

Dup – No physical sample (enter data from second LCS, and mark Spike as sample to compare too)

14.10.2. Calibrations

14.10.2.1. Analytical Balance Check

Purpose: to ensure that the weighing is accurate.

Figure 15.10.2.1 Analytical Balance Calibration Form

SARTORIUS BALANCE
DAILY CALIBRATION CHECKS

PROCEDURE (REF. QA MANUAL 16.10.2.1): 1) ZERO BALANCE, 2) PLACE 1.0 gm WEIGHT ON PAN USING FORCEPS ONLY TO HANDLE WEIGHT (NO FINGERS) 3) WEIGHT IS RECORDED BELOW 4) OUT OF CONTROL IS < 1.99980 OR > 1.00020 5) TO BE DONE EVERY DAY BALANCE IS USED.

CONTROL	DATE	ANALYST	STD #	WEIGHT
OK	11-15-99	LSP	15	1.00007

Responsible Party: Senior AA Analyst

Timing and Frequency: calibration of the balance is checked daily for Pb weighing using a 1 gm standard weight. For days on which gravimetric filters are weighed, the 20 mg weight is used as a check. Once a year, the balance is cleaned, checked for linearity, calibration, etc. by an accredited calibration.

SOP: zero the balance, and, using forceps only to handle it, weigh the standard.

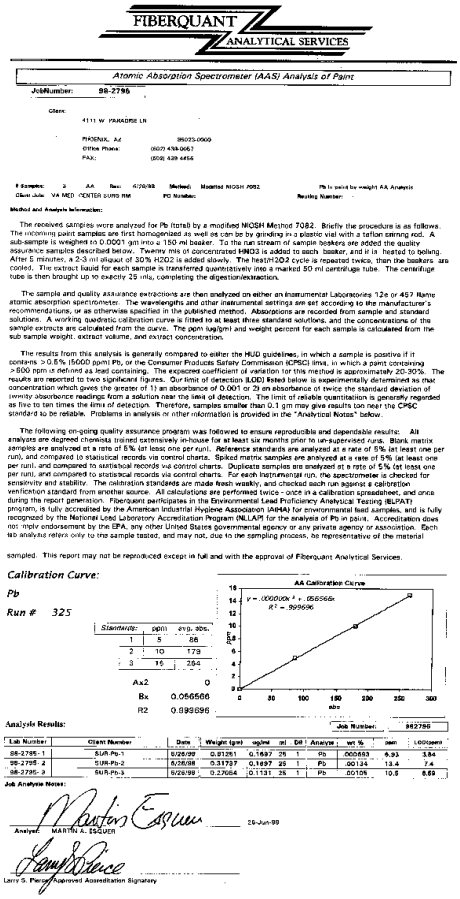
Data Form: Balance Log Book, Figure 15.10.2.1.

Record Storage: Balance Log Book.

Summary & Review: as performed.

Out-of-Control: > 0.00020 from target for 0.1 gm weight, >0.00005 for 20 mg weight.

Figure 15.9 A Typical AA Report



FIBERQUANT ANALYTICAL SERVICES

Atomic Absorption Spectrometer (AAS) Analysis of Paint

Job Number: 98-2795

Client:

4111 W. PARADISE LN

PHOENIX, AZ 85023-0000
Office Phone: (602) 439-0067
FAX: (602) 439-4456

Samples: 3 AA Rec: 6/29/99 Method: Modified NIOSH 7082 Pb in paint by weight AA Analysis
Client Job: VA MED. CENTER BOND RM PO Number: Routing Number:

Method and Analysis Information:

The received samples were analyzed for Pb (total) by a modified NIOSH Method 7082. Briefly the procedure is as follows. The incoming paint samples are first homogenized as well as can be by grinding in a plastic vial with a teflon stirring rod. A sub-sample is weighed to 0.0001 gm into a 150 ml beaker. To the run stream of sample beakers are added the quality assurance samples described below. Twenty mls of concentrated HNO3 is added to each beaker, and it is heated to boiling. After 5 minutes, a 2-3 ml aliquot of 30% H2O2 is added slowly. The heat/H2O2 cycle is repeated twice, then the beakers are cooled. The extract liquid for each sample is transferred quantitatively into a marked 50 ml centrifuge tube. The centrifuge tube is then brought up to exactly 25 mls, completing the digestion/extraction.

The sample and quality assurance extractions are then analyzed on either an Instrumental Laboratories 12e or 457 flame atomic absorption spectrometer. The wavelengths and other instrumental settings are set according to the manufacturer's recommendations, or as otherwise specified in the published method. Absorptions are recorded from sample and standard solutions. A working quadratic calibration curve is fitted to at least three standard solutions, and the concentrations of the sample extracts are calculated from the curve. The ppm (ug/ml) and weight percent for each sample is calculated from the sub sample weight, extract volume, and extract concentration.

The results from this analysis is generally compared to either the HUD guidelines, in which a sample is positive if it contains >0.5% (5000 ppm) Pb, or the Consumer Products Safety Commission (CPSC) limit, in which a paint containing >600 ppm is defined as lead containing. The expected coefficient of variation for this method is approximately 20-30%. The results are reported to two significant figures. Our limit of detection (LOD) listed below is experimentally determined as that concentration which gives the greater of 1) an absorbance of 0.001 or 2) an absorbance of twice the standard deviation of twenty absorbance readings from a solution near the limit of detection. The limit of reliable quantitation is generally regarded as five to ten times the limit of detection. Therefore, samples smaller than 0.1 gm may give results too near the CPSC standard to be reliable. Problems in analysis or other information is provided in the "Analytical Notes" below.

The following on-going quality assurance program was followed to ensure reproducible and dependable results: All analysts are degreed chemists trained extensively in-house for at least six months prior to un-supervised runs. Blank matrix samples are analyzed at a rate of 5% (at least one per run). Reference standards are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. Spiked matrix samples are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. Duplicate samples are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. For each instrumental run, the spectrometer is checked for sensitivity and stability. The calibration standards are made fresh weekly, and checked each run against a calibration verification standard from another source. All calculations are performed twice - once in a calibration spreadsheet, and once during the report generation. Fiberquant participates in the Environmental Lead Proficiency Analytical Testing (ELPAT) program, is fully accredited by the American Industrial Hygiene Association (AIHA) for environmental lead samples, and is fully recognized by the National Lead Laboratory Accreditation Program (NLLAP) for the analysis of Pb in paint. Accreditation does not imply endorsement by the EPA, any other United States governmental agency or any private agency or association. Each lab analysis refers only to the sample tested, and may not, due to the sampling process, be representative of the material sampled. This report may not be reproduced except in full and with the approval of Fiberquant Analytical Services.

Calibration Curve:
Pb
Run # 325

Standards:	ppm	Abs. Abs.
1	5	88
2	10	179
3	15	264

Ax2 0
Bx 0.056566
R2 0.999696

AA Calibration Curve
y = .000006x² + .056566x
R² = .999696

Analysis Results: Job Number: 982795

Lab Number	Client Number	Date	Weight (gm)	wgt/ml	ml	Dil	Analyte	wt %	ppm	ug/Cm²
98-2795-1	SUR-Pb-1	6/28/99	0.81251	0.1627	25	1	Pb	.000583	6.33	3.84
98-2795-2	SUR-Pb-2	6/28/99	0.31737	0.1697	25	1	Pb	.00134	13.4	7.4
98-2795-3	SUR-Pb-3	6/28/99	0.27064	0.1131	25	1	Pb	.00105	10.5	8.69

Job Analysis Notes:

Analyst: MARTIN A. ESSNER 28-Jun-99

Larry S. Pierce, Approved Accreditation Signatory

Responsible Party: Senior AA Analyst.

14.10.2.2. Annual Calibrations: Check Weights, NIST Reference Thermometer Calibration, Pipetters

Purpose: to ensure accuracy and traceability in reference standards and pipetters.

Timing and Frequency: Once per year, when the balance is cleaned and calibrated, except for stage micrometer, which will be calibrated or replaced in 2050. Note: supplier must be able to supply traceability and accreditation documentation.

SOP: 1) call current 17025 accredited supplier of calibrations; 2) make sure that they are still accredited before making arrangements; 3) deliver items or have them pick up; 4) receive items back; 5) examine each certificate for proof of traceability to nist and of 17025 accreditation.

Data Form: for each: certificate of traceability/calibration (must specify the NIST item it is traceable to) and accreditation certificate from the calibration vendor (scope must include 17025 or equivalent).

Record Storage: Equipment paper files: Balance file for weights; thermometer has its own file; pipetter equipment file.

Summary & Review: as performed.

Out-of-Control: as indicated by calibration vendor.

14.10.2.3. Oven Thermometer Check

Purpose: to ensure that digestion oven is correct temperature.

Responsible Party: Senior AA Analyst.

Timing and Frequency: Once per year

SOP: Work Practice GEN-6

Data Form: LIMS

Record Storage: LIMS

Summary & Review: as performed.

Out-of-Control: >+/-2 for 0-120C (after correction).

14.10.2.4. Micro-pipette Check

Purpose: to ensure that pipettes deliver the proper amount of liquid.

Responsible Party: Senior AA Analyst

Timing and Frequency: Once per month.

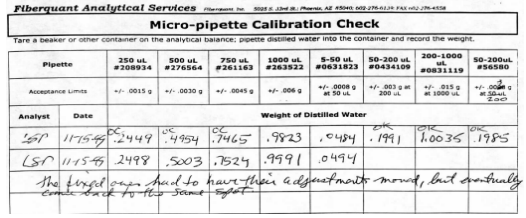
SOP: tare beaker or other receptacle; pipette distilled water into receptacle, and record weight of water. Record data, enter date and analyst in pipette form LIMS<QC><AA><Pipette Check>.

Data Form: Figure 15.10.2.3.

Record Storage: Pipette equipment file.

Summary & Review: as done.

Figure 15.10.2.3 Pipette Calibration Form



Fiberquant Analytical Services

Micro-pipette Calibration Check

Tare a beaker or other container on the analytical balance; pipette distilled water into the container and record the weight.

Pipette	250 uL #208934	500 uL #276564	750 uL #261163	1000 uL #263522	5-50 uL #0631823	50-200 uL #0434109	200-1000 uL #0831119	50-200uL #56580
Acceptance Limits	+/- .0015 g	+/- .0030 g	+/- .0045 g	+/- .006 g	+/- .0008 g at 50 uL	+/- .003 g at 200 uL	+/- .015 g at 1000 uL	+/- .0080 g at 50-uL & 200
Analyst / Date	Weight of Distilled Water							
LSF 11/7/5	.2449 OK	.4954 OK	.7465 OK	.9823	.0484 OK	.1991 OK	1.0035 OK	.1985 OK
LSF 11/7/5	.2498	.5003	.7524	.9991	.0494			

The target range had to have their adjustments moved, but eventually came back to the same spot.

14.10.2.5. Centrifuge Tube Volume Check

Purpose: to ensure accuracy and reliability of the volume markings on centrifuge tubes.

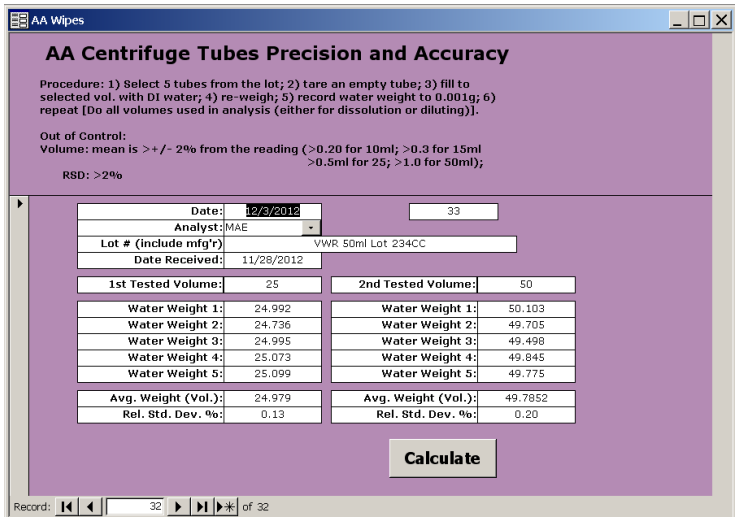
Responsible Party: Senior AA Analyst

Timing and Frequency: Each receipt of a new lot shipment of tubes.

SOP: Semi-randomly select five tubes from the lot, spreading the choice to each case if multiple cases are received. For each tube, label, tare on the balance pan, then fill the tube with distilled water to the currently used volumes for samples (e.g., 25ml for 50ml tubes, 10 and 15ml for 15ml tubes); record the weight on the Volume Check Form.

Data Form: Larry//c:\MSOffice\Winword\FORMS\AA Tube lot cal.01.doc.

Figure 14.10.2.5 P&A Centrifuge Tube Form



AA Wipes

AA Centrifuge Tubes Precision and Accuracy

Procedure: 1) Select 5 tubes from the lot; 2) tare an empty tube; 3) fill to selected vol. with DI water; 4) re-weigh; 5) record water weight to 0.001g; 6) repeat [Do all volumes used in analysis (either for dissolution or diluting)].

Out of Control:
Volume: mean is >+/- 2% from the reading (>0.20 for 10ml; >0.3 for 15ml >0.5ml for 25; >1.0 for 50ml);
RSD: >2%

Date:	12/3/2012		33
Analyst:	MAE		
Lot # (include mfg'r)	VWR 50ml Lot 234CC		
Date Received:	11/28/2012		
1st Tested Volume:	25	2nd Tested Volume:	50
Water Weight 1:	24.992	Water Weight 1:	50.103
Water Weight 2:	24.736	Water Weight 2:	49.705
Water Weight 3:	24.995	Water Weight 3:	49.498
Water Weight 4:	25.073	Water Weight 4:	49.845
Water Weight 5:	25.099	Water Weight 5:	49.775
Avg. Weight (Vol.):	24.979	Avg. Weight (Vol.):	49.7852
Rel. Std. Dev. %:	0.13	Rel. Std. Dev. %:	0.20

Calculate

Record: 32 of 32

Record Storage: AA paper files.

Summary & Review: as done.

Out-of-Control: Precision: Std. Deviation > 2%; Bias: greater than +/- 2% from target value.

14.10.2.6. Sensitivity Check

Purpose: to ensure that the AA is operating the same as when the LOD was determined.

Responsible Party: AA Analyst

Timing and Frequency: Before each run, as calibration standards are read.

SOP: none – merely note value of "low" standard, e.g., Pb 5ppm.

Data Form: Run Data Sheet, Figure 15.7.

Record Storage: with run data.

Summary & Review: as done.

Out-of-Control: < 85% target (listed on AA and in Lab Summary AA-3). If the absorbance is less than the minimum, then the alignment, cleanliness and adjustments of the machine should be checked and the problem found and corrected (usually the siphon tube is blocked).

14.10.2.7. Lowest Standard Check (Pb Matrix Sample at the Reporting Limit)

Purpose: to ensure that the AA is capable of the reproducing a matrix sample at the reporting limit.

Responsible Party: AA Analyst

Timing and Frequency: At least once per day for each day the matrix is analyzed.

SOP: Pb: During run makeup, add a matrix reporting limit QC sample to the run. Upon prep, a matrix blank (for each matrix: paint, soil, wipe and mce filter) is spiked with liquid standard to the reporting level (See WP AAS-4 for amounts)) and cooked/prepared as normal.

Data Form: Run Data Sheet, Figure 15.7.

Record Storage: with run data.

Summary & Review: as done.

Out-of-Control: > +/- 20% from target.

14.10.2.8. AA Calibration Curves

Purpose: to calculate ug/ml from absorbance data.

Responsible Party: AA Analyst

Timing and Frequency: At the beginning of each run.

SOP: The solutions are prepared as per SOP AAS-4. Absorbances of 4 standard solutions of varying concentration are measured during each AA run. For Pb, the four and a blank (0,0 point) are plotted vs. their nominal concentrations by the LIM program, where a quadratic equation is fit to the points. For elements other than Pb, an Excel spreadsheet, AACAL, is used. An Pb calibration curve is shown in Figure 16-3. The curve/spreadsheet is printed along with run results, for every AA run.

Data Form: Run Results Sheet, Figure 15.7.

Record Storage: with run data.

Summary & Review: as done.

Out-of-Control: For Pb 2nd order fit, the x2 coefficient must be <.0004; the correlation coefficient must be >.995; and the intercept (c coefficient) must be < the absolute value of the MDL (historically 0.15 for Pb). For other elements, coefficients should be +/- 15% of the runs that validated our methodology (stored in AA drawer).

14.10.2.9. Linear Response Verification

Purpose: to determine the range over which to make calibration standards.

Responsible Party: Senior AA Analyst

Timing and Frequency: Once a year, nominally January.

SOP: Prepare a series of calibrations standards, encompassing and exceeding by 2x the currently used range (or for new analytes, 2x the published linear range). Run as usual. Plot using Excel spreadsheet. Visually determine break in linearity.

Data Form: Run Data Sheet, Figure 15.7.

Record Storage: File folder, AA drawer.

Summary & Review: as done.

Out-of-Control: none

14.10.2.10. Method Detection Limit (MDL), Method Quantification Limit (MQL) and Reporting Limit (RL)

Purpose: to determine detection limit for reporting purposes.

Responsible Party: Senior AA Analyst

Timing and Frequency: Once a year, nominally January.

SOP: Digest 7 samples consisting of blank medium (for wipes, use ghostwipes or other ASTM D1792-compliant wipes) spiked with an amount of standard (either liquid or solid) to yield a concentration near the lowest standard (but no more the 5x the expected MDL). Run as usual. MDL = 3.143 x std. dev. The MQL is 2x the MDL. The RL may be as low as the MQL (but no lower), and may be chosen higher in order to have the RLs for all matrices the same in ug/ml units (which makes the computer calculations simpler). The RL must be entered for the appropriate element in the LIMS table "AA elements" in order for reports to include the updated RL/MQL. The RL is also the concentration of the lowest standard of the calibration curve.

Data Form: Run Data Sheet, Figure 15.7.

Record Storage: Runs: File folder, AA drawer. MDL calcs: Larry//c:\MSOffice\Excel\AA MDLS\

Summary & Review: as done. Change reporting limit in LIMS as appropriate.

Out-of-Control: The MDL must be < the published LOD for the method, and also <20% of lowest regulatory limit for Pb soils and paints, and <50% of the lowest regulatory limit for Pb wipes. Also, each recovery must be 80-120% of the spiked amount.

14.10.2.11. Initial Calibration Verification (ICV)

Purpose: to check that calibration standard concentrate has not gone bad.

Responsible Party: AA Analyst

Timing and Frequency: Before every run.

SOP: Prepare a second middle concentration calibration standard using a different standard concentration than used to make the calibration standards, at a concentration near the midpoint of the calibration curve. For Pb, a second ICV is made, at the reporting limit, by diluting the first ICV. To produce a 0.3ppm solution from a 5 ppm solution, pipette 3000 ul of the 5ppm into a centrifuge tube and dilute to 50ml.

Data Form: Run Data Sheet, Figure 15.7.

Record Storage: with run data.

Summary & Review: as done.

Out-of-Control: > +/- 10% of middle calibration standard. Typical response to out-of-control: make all new standards.; check linearity of calibration curve.

14.10.2.12. Continuing Calibration Verification (CCV)

Purpose: to check that sensitivity has not changed during a run.

Responsible Party: AA Analyst

Timing and Frequency: During every run.

SOP: Run a calibration standards after every 10 samples. The run sheet automatically adds a line for the CCV.

Data Form: Run Data Sheet, Figure 15.7.

Record Storage: with run data.

Summary & Review: as done.

Out-of-Control: > +/- 10% of corresponding calibration standard. Typical response to out-of-control: clean or blow out siphon tube. If out-of-control, the sensitivity must be restored to previous levels (if it can't, then a new run with a new calibration curve must be constructed). All samples after the last successful CCV must be re-run.

14.10.3. Contamination Control

14.10.3.1. Glassware Handling

The cleanliness of glassware is important to the integrity of AA analysis. General rules to follow regarding glassware are as follows:

1) Disposable items are used whenever practicable, so as to eliminate carryover.

2) Dispo-micropipettes are used to make standards and spikes. Four non-adjustable and a number of adjustable pipetters are used. Two sizes of tips are used. A new tip is to be used for each solution pipetted.

3) For final volumes, disposable centrifuge tubes are used. When bringing the solution up to volume in a centrifuge tube, the volume must be at least half the maximum volume of the tube, and preferably the full maximum volume of the tube, so as to minimize volume errors. Just like volumetrics, the bringing to final volume is done by having the target line at eye level and adding d.i. water via a fine stream from a squeeze bottle, directed against the side of the tube to prevent splash.

4) If glass pipettes are used, they should be dry when used, and used only once before cleaning and drying. If a dry pipette of the correct size is not available, then the pipette must be rinsed three times with the solution to be pipetted.

5) Glass pipettes are cleaned by drawing DI water into them immediately after use (even before continuing with the analysis). Water is drawn all the way past the mark, then blown out. This is done 4 times. Then the pipette is stood on end to drain and dry.

6) If volumetric flasks are used, they need not be dry when used, but must be rinsed with the liquid to be used to bring it up to volume (usually DI water).

7) Glass volumetric flasks are cleaned by rinsing in DI water, then soaking in a Citronox DI water mixture, then rinsing with DI water again. They do not have to be cleaned immediately after use, but if not, should be filled with DI water until cleaning can take place.

8) Beakers and funnels are cleaned by scrubbing in Citronox-DI water with a brush, then rinsing in DI water.

9) No glassware should contain sample more than one day, as evaporation could cause a residue to be deposited.

10) No glassware except beakers are allowed to dry out while containing sample. It may become impossible to clean.

11) Glassware is cleaned the day of the analysis. It is not to be left in the sink.

12) A general rule in transferring liquid quantitatively from one place to another is to rinse and drain completely three times. This applies to digestion beakers, funnels, filters, etc. It does not apply to pipettes, which are calibrated to deliver a certain volume when drained and blown out once.

14.10.3.2. Hood Face Velocity Check

Purpose: to measure the face velocity of the AA prep exhaust hood.

Responsible Party: AA analyst.

Timing & Frequency: six months.

SOP: set hood to normal operating speed; use vaneometer to measure velocity at center, upper left and right, and lower left and right. Record the five readings and average on the equipment page in the LIMS (can be accessed through QC button).

Data Form: LIMS, equipment page

Record Storage: computer

Summary & Review: as performed

Out-of-Control: average <40; if OOC, the contact QC officer.

14.10.3.3. Water Quality and Blanks

A number of different blanks are run; their timing differs according to the type.

14.10.3.3.1. De-ionized Water Conductivity

Purpose: to check the quality of the DI water

Responsible Party: AA analyst.

Timing and Frequency: once per week.

SOP: Immerse the conductivity meter probe into fresh DI water and record reading.

Data Form: LIMS <QC><AA QC><H2O Conductivity>.

Record Storage: same.

Summary & Review: As performed.

Out-of-Control: >0.5. If above 0.5, call Pure Ionics for exchanger service.

14.10.3.3.2. Initial Calibration Blank (ICB)

Purpose: to set the baseline and construct the calibration curve

Responsible Party: Each AA analyst.

Timing and Frequency: once each run at the beginning

SOP: Zero the AA for this liquid. We have found that there is no difference between the absorbance of 10% HNO3 and pure DI water, so the DI water is used.

Data Form: AA Run Data Sheet, Figure 15.7.

Record Storage: AA Run Data Sheet.

Summary & Review: As performed. Zero should be stable before beginning run.

Out-of-Control: none, since instrument is zeroed.

14.10.3.3.3. Continuing Calibration Blank (CCB)

Purpose: to check for analyte carry-over between samples, as shown be the carry-over between the CCV and a blank

Responsible Party: Each AA analyst.

Timing and Frequency: every ten samples, immediately after the CCV

SOP: Record the absorbance. We have found that there is no difference between the absorbance of 10% HNO3 and pure DI water, so the DI water is used.

Data Form: AA Run Data Sheet.

Record Storage: AA Run Data Sheet, Figure 15.7.

Summary & Review: As performed.

Out-of-Control: > +/-0.002.

This is DI water run after each 10 samples (Video 12) or between each data point for each solution tested (457). The absorbance must return to .000 or the machine should be re-zeroed. If the absorbance differs from .000 by more than .002, then all the samples run since the last successful CCB must be re-run. A space is automatically added to the run data sheet by the LIMS to record this data. In addition, for a Pb wipe run, the CCB must be within .003 to be <4ug/ft2.

14.10.3.3.4. Method Blank and Matrix Blank

Purpose: to check for contamination in analysis materials.

Responsible Party: Each AA analyst or technician.

Timing and Frequency: every 20 samples (5%) or a minimum of one per run

SOP: For paint and soil matrix, add method blank (a digestion without any sample or matrix) only. For wipe and MCE filter matrices, add one method blank per run (regardless of number of samples) and also matrix blank (a digestion of blank media) into the run stream after every 20 samples (minimum of one).

Data Form: AA Run Data Sheet.

Record Storage: AA Run Data Sheet, Figure 15.7.

Summary & Review: AA QA monthly summary

Out-of-Control: MDL (for Pb, that's 0.015ug/ml or .002 absorbance). Pb Blanks must also be less than 10% of the lowest regulatory limit. For ghost wipes (in 25 ml) 10% of 40 ug/wipe=4 ug =0.16 ug/ml, eerily the same as the above – so always use 25 ml final volume for wipes.

14.10.3.3.5. Client/customer-supplied Blanks

Client/customers may or may not submit field blanks and/or box blanks with a job. They will be logged in and treated just like any other sample. Since their initial content is expected to be zero, their results will not be used for sample correction.

14.10.3.4. Personnel Contamination Prevention

Since many analytes for this method are hazardous, it is essential that analysts do not become contaminated by the materials they are working with. The AA sample preparer or analyst should always wear a rubber apron, disposable gloves and goggles or glasses while working with samples. Food or drink in the AA prep or analysis areas is prohibited. Hands should be washed at the conclusion of AA activity or before every break from activity, even though gloves were worn.

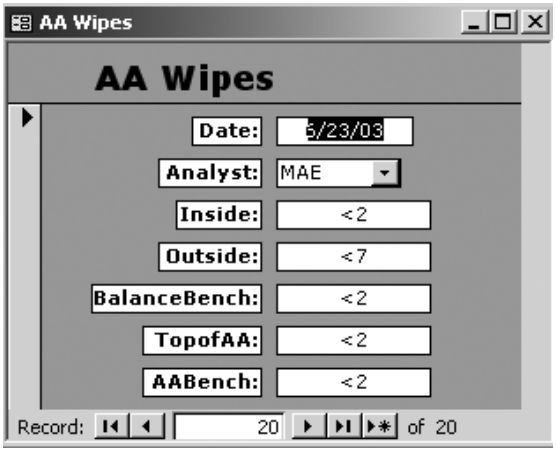
14.10.3.5. Contamination Monitoring

Purpose: to determine whether normal procedures contaminate the lab.

Responsible Party: Senior AA Analyst

Timing and Frequency: once per quarter. The LIMS will remind the analyst during run makeup that wipe tests are due.

Figure 15.10.3.4 Bench Wipe Form



SOP: Take a 1 ft2 wipe sample at 4 locations: 1) inside the hood (horizontal surface), 2) weighing bench, 3) outside of hood, and 4) AA bench. Log in as QA sample and analyze as usual. Wiping procedure: 1) Estimate an area to be wiped nominally 1'x1', but could be a rectangle in tight areas. 2) Remove a 'ghost wipe' from its package; make sure it is wet enough; if not use another. 3) Using an open flat hand with the fingers together, place the wipe on the surface to be sampled. Wipe the selected surface area, side to side, in an overlapping "S" or "Z" pattern while applying pressure to the fingertips. Wipe the surface so that the entire selected surface area is covered. Perform the wiping procedure using the fingers and not the palm of the hand. The front leading edge of the wipe is always pushed forward. 3. Fold the wipe in half with collected dust side folded inward, and repeat the preceding wiping procedure within the selected sampling area using and up and down overlapping "S" or "Z" pattern. 4) Fold the wipe in half again with the collected dust side folded inward, and repeat the wiping procedure one more time. 5) Fold the wipe again with the collected dust side folded inward and insert the folded wipe into a sample container or analysis beaker. 6) Record the area on the bench form.

Data Form: Input results into the LIMS AA Wipe Sample Table; old data on simple hard copy form.

Record Storage: LIMS; old data: file folder AA drawer.

Summary & Review: as done.

Out-of-Control: >40 ug/ft2. Response to OOC: wet wipe lab surfaces (even those not tested), re-sample and re-analyze until <40.

14.10.4. Precision & Accuracy

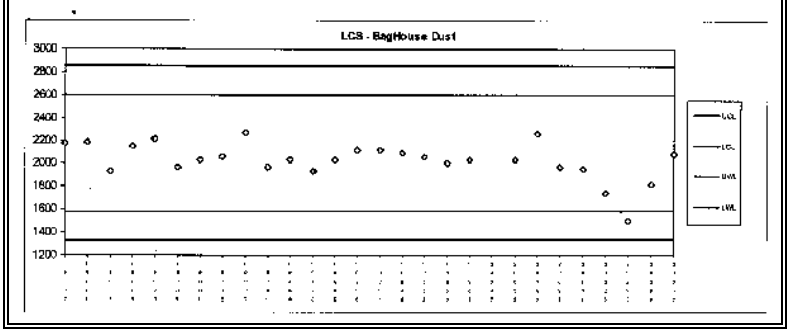
14.10.4.1. Statistical Calculations

For each of the following QA procedures: 1) LCS, 2) Spikes, and 3) Duplicate Analyses, statistically-based control limits are used to determine whether a given run is in or out of control. A quality control chart is generated for each LCS (currently 4), each spike of each matrix (currently 5), and each duplicate analyses of each matrix (currently 5) each month, containing the points for that month. Only detectable amounts (absorbance greater than 0.004) are charted for duplicate analyses. The LIMS used by the QC Officer to calculate an average and standard deviation (σ) for each control chart. Programming tells the Officer how many points have been added to the database since the last control limit up-date (and therefore how many will contribute to the current update). The Officer may wait on some limit updates while up-dating others. Warning limits are +/- 2σ. Control limits are +/- 3σ. Plots exhibiting the warning and control limits are posted in a notebook at the AA bench. Each new data point is plotted on the appropriate chart. Out-of-control for any of these statistically derived limits is defined as two successive points outside of the warning limits or one point only outside of the control limits. For those matrices/analyses which do not have as yet 20 data points to establish statistical limits, the following limits will be used: 1) for LCS, a control limit of +/- 20% of the published reference value, 2) for Spikes, a control limit of +/- 25% of the added analyte, and 3) for Duplicate analyses, a control limit that the difference of the two analyses is less than 25% of the mean of the two analyses.

14.10.4.2. Certified Reference Materials (CRM) & Laboratory Control Samples (LCS)

Purpose: to prove for a given run that a certified analyte content can be reproduced.

Figure 15.10.4.2 LCS Control Chart



Responsible Party: run prep technician and AA Analyst

Timing and Frequency: 1 per 20 samples; minimum of 1 per run. For MCE filter and wipe matrices, two LCS samples are run per 20 samples to produce duplicate pairs. For paint matrix, one extra LCS is used as one half of a duplicate pair(s).

SOP: Weigh CRM into digestion vessel (~0.5gm for paint; ~0.2gm for soil/wipe/mce); add blank matrix for wipe or filter matrix. The CRM to be used for each matrix is listed by the LIMS when adding the LCS to the run. Nominally, 0.1 gm is used for all matrices.

Data Form: Run Data Sheet, Fig. 15.7.

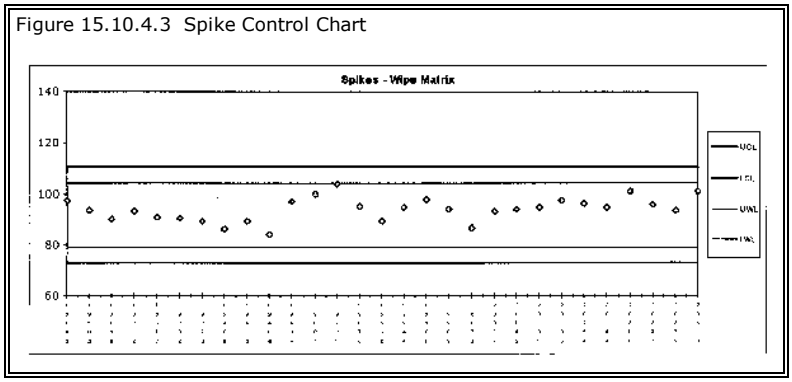
Record Storage: LIMS; data sheet boxes.

Summary & Review: control is determined by the LIMS during each run calculation; control chart (Figure 15.10.4.2) is printed each month in the QA report.

Out-of-Control: If the LIMS indicates OOC or two WARN in a row, then corrective action, such as analyzing two additional LCS samples, or trouble-shooting the problem, is required. If the yield is between 80% and 120%, then data may be reported without flagging or reporting the OOC on the report. Otherwise, the data cannot be reported without a flag or note. Re-analyze if possible.

14.10.4.3. Spiked Samples

Figure 15.10.4.3 Spike Control Chart



Purpose: to determine whether matrix interference has affected the recoveries for the run.

Responsible Party: Prep Technician and Senior AA Analyst

Timing and Frequency: 1 per 20 samples; minimum of 1 per run

SOP: 1) For filter and wipe matrices, weigh ~0.2 g CRM into digestion vessel; add blank matrix (same as an LCS). For these matrices, the spike result is compared to the LCS as a duplicate analysis. 2) For paint and soil matrices, a client/customer sample is chosen, ~0.5 gm (paint) or ~0.2gm (soil), and placed in its numbered beaker. It is not necessary to weigh these because they need to be non-Pb-containing – if they have too much Pb, the spike will be inconclusive. To this sample, add liquid standard (usually 50-200 ul of 1000 ug/ml standard) as indicated on run sheet. Process as normal. Just as with a duplicate, the beaker number duplicated may have to be corrected on the run sheet before calculation. If no client/customer sample in the run has the required low absorption reading, then use blank matrix (and record the method blank beaker number as the duplicated number.

Data Form: AA Run Sheet, Fig. 15.7.

Record Storage: LIMS; run sheet storage.

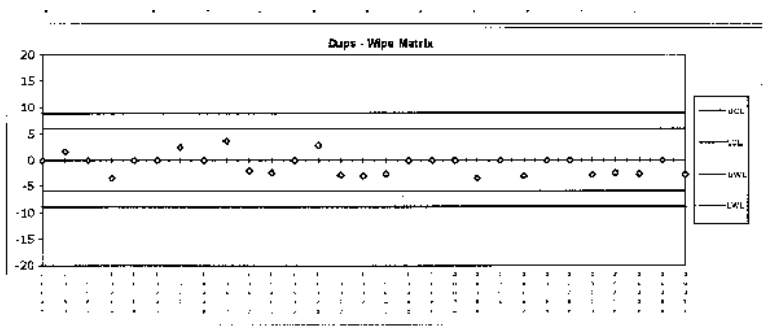
Summary & Review: control is determined by the LIMS during each run calculation; control chart (Figure 15.10.4.3) is printed each month in the QA report.

Out-of-Control: If the LIMS indicates OOC or two WARN in a row, then corrective action, such as analyzing two additional spike samples, or trouble-shooting the problem, is required. First, record the incident in the AA OOC database (under AA QC). If the yield is between 75% and 125%, then data may be reported without flagging or reporting the OOC on the report. Otherwise, the data cannot be reported without a flag or note. Re-analyze if possible. If samples cannot be re-analyzed, the method of standard additions can be used. . A standard addition is the addition of a known amount of element to a sample which already contains that element. In practice, the ideal candidate for standard addition would be a paint extract that needs to be diluted. One dilution is made normally, but a second dilution is made that contains not only 1 ml of sample extract, but also 0.5 ml of 1000ppm Pb standard. However, a known amount of standard could also be added to a measured amount of full strength sample extract. Plot the un-spiked sample at (0,$Abs_{un\text{-}spiked}$) and the spiked sample at (Con_{spike},Abs_{spiked}). A line

drawn through them intersects the x-axis at the concentration of the sample. Report the results of corrective action under the AA OOC incident previously entered into the LIMS.

14.10.4.4. Duplicate Samples

Figure 15.10.4.4 Duplicate Control Chart



Purpose: to determine the consistency of analysis.

Responsible Party: Prep Technician and Senior AA Analyst

Timing and Frequency: 1 per 20 samples; minimum of 1 per run.

SOP: 1) For paint and soil matrices, two sub-samples of a sample are analyzed separately. Which vessel is being duplicated is indicated on the run sheet during run sheet makeup and (usually) amended during the actual run makeup, depending on which samples contain enough material to be duplicated. For paint matrix, the above is referred to as PNT DUP, and duplicate LCS samples are referred to as DUP. 2) For wipe and MCE matrices, duplicate LCS samples are performed, as no field dups are available.

Data Form: AA Run Sheet, Fig. 15.7.

Record Storage: LIMS; run sheet storage.

Summary & Review: control is determined by the LIMS during each run calculation; control chart (Figure 15.10.4.4) is printed each month in the QA report.

Out-of-Control: If the LIMS indicates OOC or two WARN in a row, then corrective action, such as analyzing two additional Dup samples, or trouble-shooting the problem, is required. If the %RSD is < 25%, then data may be reported without flagging or reporting the OOC on the report. Otherwise, the data cannot be reported without a flag or note. Re-analyze if possible.

14.10.4.5. Indirect Yield Check (optional)

To test the completeness of extraction, the decanted or filtered residue (and filter) can be placed back in its beaker and digested again as if it is a new sample. The yield on the original analysis is calculated as the ug observed / the total ug observed in both analyses. This test is performed basically to qualify a preparation protocol, and is not performed routinely. It could be employed to check an out-of-control LCS or spike result for sample prep errors.

14.10.4.6. Uncertainty

For the purposes of reporting to client/customers, the overall uncertainty for AA analysis is defined (for Fiberquant) as the mean relative percent difference for duplicate analyses. This value is calculated for each QA Quarterly Summary.

14.10.4.7. Demonstration of Competency

Purpose: to demonstrate analyst competence in each environmental Pb matrix.

Responsible Party: all AA Analysts

Timing and Frequency: every six months.

SOP: each analyst must, for each matrix, analyze a run, consisting of at least 4 samples and all associated qc. The qc must be within accepted limits. The samples may be client/customer samples. If analyst has performed no client/customer runs during the previous six months, then make up a special run of 4 crms.

Data Form: AA Run Sheet, Fig. 15.7, for normal samples; hand run sheet for others.

Record Storage: LIMS

Summary & Review: as done.

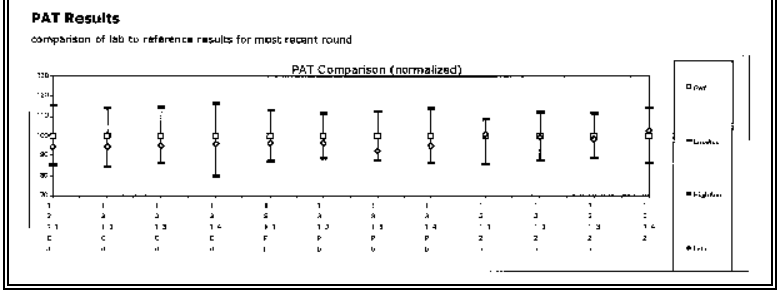
14.10.4.8. Proficiency Testing

Purpose: to demonstrate proficiency.

Responsible Party: Lab Director and all AA Analysts

Timing and Frequency: 1 set of ELPAT air samples (filters) and 1 set of ELPAT paint, soil and wipe samples per quarter. Note: air samples arrive at a different time than the other matrices.

Figure 15.10.4.6a PAT Comparison Summary



SOP: 1) ELPAT Air: analysts alternate analysis in alphabetical order. 2) prepare and analyze samples the same as client/customer samples, 3) do not discuss results with other labs, 4) the result is submitted by www. 5) ELPAT: paint and soil samples (not wipes) are dried before weighing – they are often quite moist. 6) Analysts alternate submittal in alphabetical order. 7) Submittal analyst analyzes all three matrices. 8) All other analysts analyze paint and soil only. 9) Results are compared to eliminate discrepancies, if possible.

Data Form: AA Run Sheet, Fig. 15.7 for submittal analyst; hand run sheet for others.

Record Storage: LIMS; AA file cab.

Summary & Review: provided by AIHA. Comparisons of most recent results are included in the QA monthly summary (Fig. 15.10.4.6a and b).

Out-of-Control: as indicated by the PAT communication.

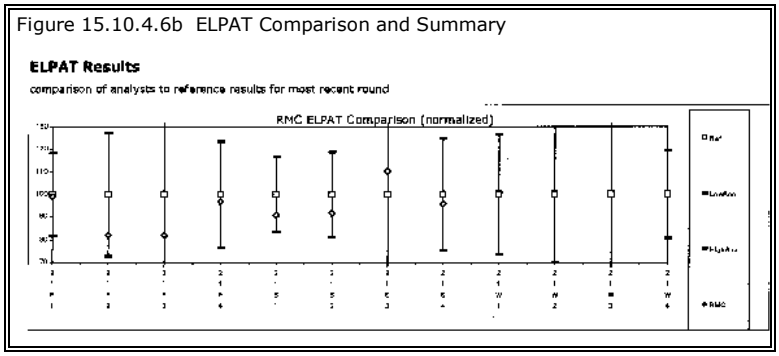
14.10.5. Control, Nonconformity & Corrective Actions

Each QA procedure provides a determination of whether the analysis is in control or not. Each out-of-control situation triggers a response directed at discovering the reason for the problem and correcting it, or at the very least, demonstrating that the problem was a random occurrence and that the system is now back in control.

Blanks

If the CCB differs from 0.000, the machine is re-zeroed before the next reading is taken. If the CCB differs by more than 0.002, then the samples since the last in control CCB must be re-run.

Figure 15.10.4.6b ELPAT Comparison and Summary



If a Method Blank is >0.0044 absorbance, then the glassware or reagents are contaminated. The following steps are taken: 1) the samples of the run are examined. If there are a significant number of negligible absorption readings, then the contamination is a random contamination of a specific beaker(s), and not the reagents. If all samples are non-zero, then the contamination could be either reagents or glassware. 2) two method blanks are run. If zeros, then the contamination was random or glassware contamination; if non-zero, then the contamination is from reagents. 3) glassware is cleaned or reagents dumped, depending on the results of #2. If reagents were dumped, two more method blanks are run using the new reagents to prove that the contamination is in control. 4) Non-zero samples in the affected run are to be re-analyzed, if possible. If not possible, the client/customer must be informed that the samples must be re-taken.

Spikes/Duplicates/LCS

All these checks must be within +/- 3 std. dev. on the appropriate control chart, and also subject to the minimums listed under the individual items. Spike % recovery, duplicate average and CV, and LCS results are calculated for each matrix for each run and documented on the bottom of the work sheet before the results are relayed to the client/customer. If any the % is out-of-control, then 1) The spike/duplicates/LCS is re-analyzed with a new calibration curve. If it is now in control, then the entire run should be repeated with the new calibration. 2) If the spike/duplicates/LCS is still out of control, two more spikes/duplicates/LCS's of the same matrix are run. Many out-of-control duplicates are encountered in paint and soil samples - always with spikes and LCS's in control. For these, the cause of the out-of-control is the inhomogeneity of the sample, and no action on the analysis system is taken. 3) If enough sample is present, several samples can be run as duplicates, to check the conclusion that nothing systematic affected the run. 4) If the two additional spikes/duplicates/LCS's are also out-or-control, then a serious systematic problem exists in the sample preparation/analysis system. All processes in the analysis are checked and the system has to then be qualified by running spikes and LCS's until normal operating results are obtained once

again. In this case, the results of the affected run are void, and samples must be re-analyzed or, if unique, re-taken and analyzed.

Even though the computer program performs the QA calculations and indicates clearly to the analyst whether the data is in control or not, the ELPAT program requires that the data be checked by a different analyst than the analyst. Documentation of the check is made by initialing the lower right hand corner of the data sheet.

All out-of-control instances are reported in the monthly QA summary, along with a description of the steps taken to resolve the situation, changes in procedure, problems, etc.

14.10.6. Quarterly QA Summary

Each quarter, a summary of activity and the results of quality assurance activities will be generated. An example is provided in Chapter 12. The summary includes statistical reduction of QA data. Also included is a history of any out-of-control situations.

14.10.7. Record Keeping

The records system is summarized in the chart below. Records are to be kept for a minimum of 10 years, although some are permanent. Hard copies are made of the spreadsheet and calibration curve for every AA run and stapled to the worksheet. All reports are copied and stored in client/customer files. Hard copies of QA charts are generated once per month for QA reports. All records are chronological unless stated otherwise.

Type of Record	Location
Job Log	LIMS, hardcopy in Log Room
Sample Submittal Form	Office File
Invoice	Office File
Balance Calibrations	Balance Log Book
Reports	Office File
Standards Makeup	AA Standards Log Book
Standards & Reagent Receipt	AA Log Book
Blank Results	LIMS/QA Report
Reference Sample Results	LIMS/QA Report
Spikes	LIMS/QA Report
Standard Additions	LIMS/QA Report
Proficiency Sample Results	Tech File
AA Worksheets/spreadsheets/calibration curves	Current in Lab Binder/Old in File

14.11. Lab Characterization for AA

Based on past performance of quality control samples, the following can be stated about the AA analysis of Pb in the lab:

Element:	Pb		
LOD (ug/ml)	0.094		
Blanks (ug/ml)	<0.1		
Replicate RSD	2.3%		
Duplicate RSD	10%		
Spike:	Mean Recovery	95-102.3%	
	RSD	7.0-10.0%	
LCS:	CRM 8e (paint)	Mean RSD	4.5%
		Cum Bias	-6.5%

	CRM 9a (soil)	Mean RSD	9.5%
		Cum Bias	-1.5%
	CRM 9a (wipe)	Mean RSD	5.5%
		Cum Bias	-2.0%
	CRM-9a (filter)	Mean RSD	7.0%
		Cum Bias	-3.5%
ELPAT	Mean RSD	6.65%	
	Cum Bias	+1.74	
For Cd,CR,Pb and Zn:			
PAT:	Mean RSD	4.64%	
	Cum Bias	-1.79%	

15. STANDARD OPERATING PROCEDURES: MYCOLOGY

15.1. INTRODUCTION

These standard operating procedures are instituted so that a consistent and standard analysis can be performed no matter who in the laboratory is performing it. These procedures have been written to a level of detail fine enough so that someone with only a passing knowledge of the analysis would be able to perform it. Naturally, it is not expected that an analyst would page through a document of this size on a daily basis, for example, to be reminded of the order of certain steps or of counting rules. For daily reference, Work Practices have been written, which are step-by-step but

brief summaries of the procedures detailed here. The Work Practices are kept in a bound notebook or, in some cases, posted in the analysis area, for easy reference.

Fiberquant performs four types of biological analysis: 1) spore trap counting, 2) bulk fungal identification 3) viable fungal spore counting, and 4) viable fungal culture identification. Bacteria are not cultured nor identified at Fiberquant.

15.2. ORGANIZATION OF PERSONNEL AND TRAINING

The job descriptions, prerequisites and organization of personnel at Fiberquant, Inc. are given in Section 4 of the SOP/QA Manual. Training procedures and requirements for personnel are given in Section 9 of the same.

15.3. BIOLOGICAL SAFETY PROCEDURES

Because molds and mold by-products can be a biological hazard, special precautions are taken when handling mycology samples. Fiberquant observes the precautions recommended by the CDC, WHO and AIHA for Biosafety Levels I and II. These generally include: 1) training of laboratory personnel in the hazards of molds, and the procedures for handling them safely, 2) controlling access to those parts of the laboratory which may contain biologically hazardous materials, 3) taking extra precaution when dealing with sharp objects, and 4) performing certain procedures under biosafety level II conditions.

15.3.1. Standard Microbiological Practices

1. micro labs are marked as such on doors; access to these laboratories is restricted to authorized personnel when experiments are in progress
2. personnel wash their hands in anti-bacterial soap after they handle viable materials, and when leaving the micro lab
3. eating, drinking, smoking, handling of contact lenses, and applying makeup are not allowed in the work areas
4. food is stored outside the work area in refrigerators or cabinets designated for food
5. mouth pipetting is prohibited; micropipetters are used instead
6. special practices are instituted for handling of sharp items (see below)
7. limit splash or aerosol creation; agitation of liquids are to be performed in closed containers only, preferably in the biological safety cabinet. Vortexing of swabs is to be in a capped centrifuge tube (swab must be cut).
8. work surfaces are decontaminated at the end of the day or after any spill or splash of viable material
9. all cultures, stocks or other waste contaminated with viable material are decontaminated by autoclave before disposal
10. biohazard signs are posted on all micro lab doors
11. micro lab and return air vent is filtered by sanuvox UV air purifier

15.3.2. Special Microbiological Practices for Infectious Agents

1. all samples and standard cultures are to be treated as infectious unless it is known that they are not
2. needles, syringes and other sharp tools should be used only when no other suitable alternative exists
3. plastic ware should be used rather than glassware when possible
4. sterile loops are used for culture prep rather than syringes
5. needles are disposed of in labeled sharps containers
6. broken glassware is not handled directly, but rather retrieved using tongs, brush, dustpan, etc.
7. cultures, if transported, are transported in a container which prevents leakage
8. spills that result in overt personnel exposure are reported immediately to the lab director, so that appropriate medical surveillance or treatment can be instituted. All such incidents are to be documented in a paper file "Biological Contamination Incidents" in the Mycology file drawer 3-5.
9. Biological safety cabinets (maintained and documented in the LIMS equipment file) are used whenever procedures are performed that have a potential for creating an aerosol. Each Biological safety cabinets must be certified yearly. The procedures that should happen inside include: centrifuging, grinding, blending, vigorous shaking, ultrasonication, opening containers whose pressure may be different than that of the laboratory
10. face protection (goggles or face shield) is used when splash or spray is anticipated

11. protective clothing (lab coats) are worn while working with infectious agents in the lab. The clothing is left in the lab before leaving the area. All coats are disposed of or laundered by the lab – not taken home
12. gloves are worn while working with infectious materials or contaminated surfaces. Gloves are disposed of when contaminated, or before leaving the laboratory or handling clean surfaces, such as phones or computer keyboards. Hands are washed after removing gloves.
13. All cultures and their packaging are sterilized in a autoclave at >120 deg. C for at least 60 minutes prior to disposal as non-hazardous waste.

15.3.3. Other Safety Policies

1. stock cultures are kept in a locked facility
2. prep laboratory must contain: an eyewash station, sink, antibacterial soap, biological safety cabinet
3. bench tops are non-porous and easily decontaminatable
4. lab floor is also non-porous and easily decontaminatable
5. door sweeps and seals are installed on mycology lab
6. negative pressure in mycology lab

15.4. EQUIPMENT, SUPPLIES and STANDARDS

15.4.1. Equipment

The current equipment used for mycological analysis is as follows:

1) Microscopes (9), Nikon Labphot, Laphot II or Optiphot

2) Fume Hood

3) Exhaust hood (normally used for AA) for reagent prep.

4) Biological Safety Cabinet, Baker model B40112 certified for Biosafety Level II

5) Autoclave (2)

6) Incubators (2)

8) pH meter

9) Vortex Type 16700 Mixer

10) Bact-cinerator

11) Inoculating loops

15.4.2. Mycology Culture Collection

A library of known culturable fungal species is maintained in the lockable white cabinet located in the FAA lab. The purpose of maintaining a culture collection is to have available training aids for mold analysts and spore counters.

Fungal strains come from one of three sources: the Canadian Fungal Culture Collection (CFCC), American Type Culture Collection (ATCC), and from proficiency testing administered by the American Industrial Hygiene Association (AIHA). They are documented in a database "Mold Standards", as to name, source, and date of acquisition.

The culture collection is stored in three separate groups. The first is the "Working Stock" which is used in Fiberquant's day-to-day operations. Spore suspensions are made using sterile Tween 20 liquid-filled 4 ml screw cap vials. The vials are labeled with the species and stored in vial files in the white cabinet. The second set of suspensions are also stored in Tween 20 liquid-filled 4 ml screw cap vials in vial files but are marked "Back Up." The purpose of this set of suspensions is so that Fiberquant will have a replacement should one of the Working Stock suspensions be broken, contaminated, or found to be non-cutlurable. The third set of cultures is not suspensions but is stored in 4 ml screw cap vials filled with malt extract agar. There are several species of fungi that do not survive well in liquid suspensions necessitation the need for grown cultures on agar slants. A second function of the agar slants is to make immediately available bulk mounts of fungi if there is a time constraint that prevents cultivation one of the suspensions.

The cultures are reconstituted time to time as part of the Mystery Mold proficiency testing for fungal analysts.

15.4.3. Maintenance

1) Microscopes

The exterior surface of the microscope is cleaned during the normal lab clean-up. The interior of the microscope is cleaned and inspected once per year by a professional microscope maintenance service, Bender Associates,

Tempe, AZ. Other maintenance is of the trouble-shooting type, and is performed as needed by the Lab Manager. Manuals for the optical scopes are kept in the scope tables.

15.4.4. Supplies

The analysis depends in large part on the availability of uncontaminated supplies and so the following list of expendables and target inventories has been compiled to aid in supply maintenance.

ITEM (SOURCE)	TARGET INVENTORY
glass slides, 1x3" (Chem Lab Supply)	50 gross
cover slips, #11/2, 22mm square (Chem Lab Supply)	20 packs
Nail polish, clear	1
clean room wipes, 4x4" DURX 770 (F#06-665-33F)	4 pks.
Kimwipes, large and small (F#06-666A,B)	8 pks.
forceps, jewelers (F#08-953E)	1
Glass stir rod	1
50 ml centrifuge tubes	50
Glycerol (Fisher)	100 ml
Hot plate	1
Lactophenol cotton blue (Fisher)	10 ml
1 ml plastic syringes	100
10 ml plastic syringes	100
Sharps container	2
26 gauge 3/8 in. hypodermic syringes	50
Culture media (various agars depending on client/customer demand)	Various
4 ml screw cap vials	300 ea.
1 μl sterile inoculating loops	1000
10 μl sterile inoculating loops	200
DL Lactic acid (Fisher)	50 ml
Fucshin acid (Fisher)	50 ml
Tartaric acid (Fisher)	50 g
Safety Labels for poison and infectious	50
100 mm dia plastic sterile petri dishes (Fisher)	500

15.5. SAMPLE LOG-IN

The general log-in and sample handling procedures are described in Section 5 of the SOP/QA Manual, and will not be repeated here. Handling of the samples and jobs for mycology is described below.

15.6. HANDLING AND DISPOSAL

15.6.1. Microscope Slides for spore counts or identification

Prepared microscope slides will be held for a minimum of 7 calendar days after analysis. Slides prepared using a phenol-based fixing stain can be disposed of as non-hazardous waste. Slides prepared from non-fixing materials have to be sterilized by autoclave before then disposing of as non-hazardous waste.

15.6.2. Zefon or other Spore Trap Filter Sample Disposal

Cassettes should be analyzed as soon as practical after receipt. Cassettes may be held at room temperature for a maximum of 7 calendar days before analysis. Used and unused cassettes will be disposed of as non-hazardous waste.

15.6.3. Bulk Fungal Samples/Swab Bulk Samples

Bulk fungal samples should be analyzed as soon as possible after receipt. Bulk samples can be held at room temperature after analysis for a maximum of 7 calendar days. Bulk samples must be sterilized by autoclave, then disposed of as non-hazardous waste.

15.6.4. Viable Bulk Samples (Culture Counts)

Viable Swab or Dust Samples to be used for culture counts not prepared within one hour of receipt will be refrigerated in the microbial lab refrigerator until preparation. After cultivation, they can be held at room temperature after analysis for a maximum of 7 calendar days, sterilized by autoclave, then disposed of as non-hazardous waste.

15.6.5. Culture Plates

Culture plates will be held after counting, identification, etc. for a maximum of 2 weeks, sterilized by autoclave, then disposed of as non-hazardous waste.

All autoclaved waste is disposed of with normal lab waste.

15.7. SAMPLE PREPARATION

The steps for spore trap sample preparation are summarized in Work Practice Myco-1.

The steps for bulk in sample preparation are summarized in Work Practice Myco-2.

15.8. Agar Preparation

Agars is prepared according to manufacturers directions. Briefly, a given weight of nutrient agar will be slowly mixed into water on a heat/stir plate and stirred. When required, streptomycin will be added to the agar (1mg/L) to suppress bacterial growth. The agar is autoclaved for 15 minutes at 121 C, after which the agar is poured into premarked petri dishes and refrigerated after cooling for at least 20 minutes. Petri dishes are marked with the date of preparation, the type of agar, and batch number. Materials are kept for corn meal agar (CMA), potato dextrose agar (PDA), malt extract agar (MEA), oatmeal agar (OMA), malt-yeast agar (MYA), potato-carrot agar (PCA), Sabouraud-Dextrose Agar (SDA), and Czapek Agar (CZA). On-hand supplies may change with client/customer demand.

The instructions for preparation are given in Myco Work Practice #16, in Chapter 11.

15.9. MICROSCOPE PREPARATION

Several microscopes are used for mycology – each has been assigned a number in the equipment files for analysis purposes. Alignment is checked before work each day and documented in the LIMS using the microscope's number designation.

1) Eyepiece setup

Remove the eyepiece containing the reticle and, looking at a blank, lit background, turn the focus of the eyepiece until the reticle appears sharp. Make sure that your eye is relaxed (e.g., focus outside of the eyepiece in the distance then bring the eyepiece in front of the eye; the eye should not have to re-focus). Replace the eyepiece and focus on a recognizable object using the microscope focus but looking only through this eyepiece. Finally, turn the eyepiece focus of the non-reticle eyepiece until the recognizable object is sharply focused as well. For eyes that are matching in focus power (e.g., 20/20), both eyepieces should be focused to approximately the same spot relative to the ring showing on the barrel.

2) Condenser alignment and field aperture size adjustment

With a focused slide on the stage, the field aperture (in the base) is dialed down to a small diameter. If the hexagonal shape of the iris is in focus, its edges will appear sharp and have a faint purple color, not red or blue. If the aperture is not in focus, focus it by turning the 1" dia. knob on the left side of the sub-stage assembly If the aperture is not centered, center it using the two 1/2" dia. knobs on the sub-stage assembly. Finally, dial the size of the aperture larger until it falls just outside the field of view.

15.10. ANALYSIS

15.10.1. Spore Trap Analysis

Spore trap analysis is based on ASTM D7391-09, but with the three following options: **1) *SPCT:*** Observation of 15 transverse scans through the deposit at 1000x oil immersion magnification; **2) *SPCT1:*** Observation of entire deposit at 500-600x oil immersion magnification; **3) *SPCT2:*** Observation of entire deposit at 400-600x oil immersion magnification and the observation of 15 transverse scans through the deposit at 1000x oil immersion magnification. The full SOPs including characteristics of spore types are to be found in <z:\controlleddocuments\SOPs\ SOP SPCT-SPCT1-SPCT2.007.doc>. For all three types, data is transcribed to and reports generated by the LIMS. The general form of reports is shown in Figure 15-1.

15.10.2. Bulk Sample Analysis

See Chapter 11 Work Practice MYCO-2.

15.10.3. Viable Bulk Sample Analysis

Not generally done except for proficiency samples. See Chapter 11 Work Practice MYCO-8.

15.10.4. Bulk Culture Plate Analysis

Not generally done except for proficiency samples. See Chapter 11 Work Practice MYCO-8.

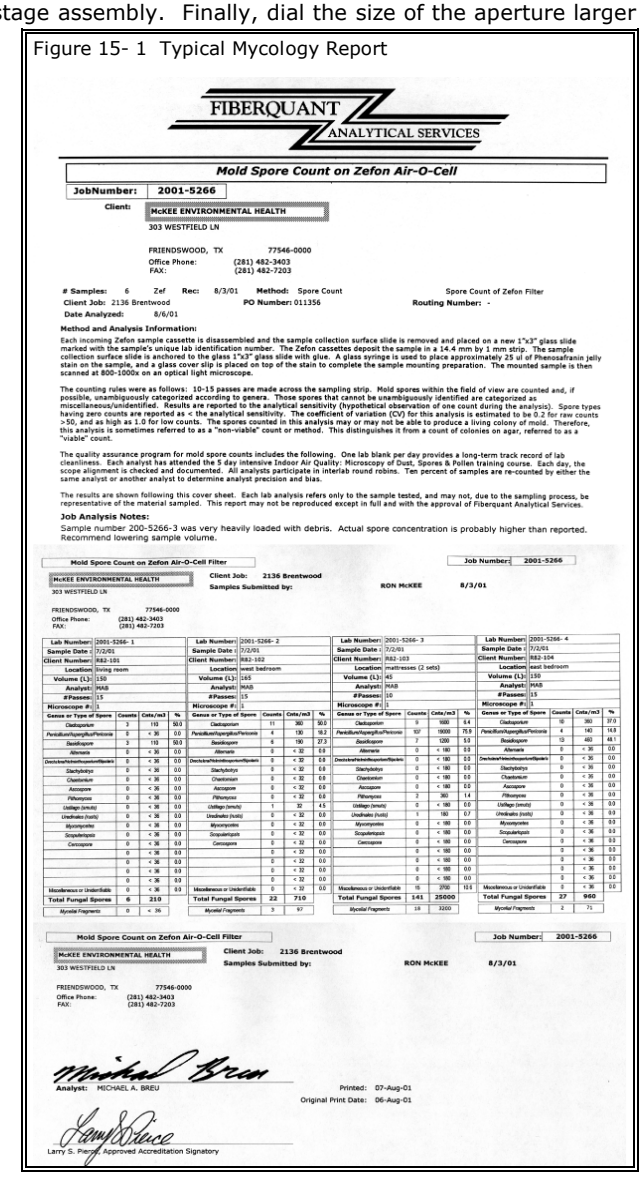
15.11. QUALITY ASSURANCE PROCEDURES

15.11.1. General Requirements

The quality control program consists of three parts: 1) calibrations, 2) contamination control, and 3) precision and accuracy checks. Calibrations ensure that data is not biased due to instrumental errors. Contamination control ensures that the data is not erroneously high due to spores introduced during handling. Precision and accuracy checks ensure that the data is not compromised due to operator bias or error. The details of each of these programs is discussed below:

15.11.2. Calibrations

Figure 15- 1 Typical Mycology Report



FIBERQUANT ANALYTICAL SERVICES

Mold Spore Count on Zefon Air-O-Cell

JobNumber: **2001-5266**

Client: McKEE ENVIRONMENTAL HEALTH
303 WESTFIELD LN

FRIENDSWOOD, TX 77546-0000
Office Phone: (281) 482-3403
FAX: (281) 482-7203

 # Samples: 6 Zef **Rec:** 8/3/01 **Method:** Spore Count Spore Count of Zefon Filter
Client Job: 2136 Brentwood **PO Number:** 011356 **Routing Number:** -
Date Analyzed: 8/6/01

Method and Analysis Information:

Each incoming Zefon sample cassette is disassembled and the sample collection surface slide is removed and placed on a new 1"x3" glass slide marked with the sample's unique lab identification number. The Zefon cassettes deposit the sample in a 14.4 mm by 1 mm strip. The sample collection surface slide is anchored to the glass 1"x3" glass slide with glue. A glass syringe is used to place approximately 25 ul of Phenosafranin jelly stain on the sample, and a glass cover slip is placed on top of the stain to complete the sample mounting preparation. The mounted sample is then scanned at 800-1000x on an optical light microscope.

The counting rules were as follows: 10-15 passes are made across the sampling strip. Mold spores within the field of view are counted and, if possible, unambiguously categorized according to genera. Those spores that cannot be unambiguously identified are categorized as miscellaneous/unidentified. Results are reported to the analytical sensitivity (hypothetical observation of one count during the analysis). Spore types having zero counts are reported as < the analytical sensitivity. The coefficient of variation (CV) for this analysis is estimated to be 0.2 for raw counts >50, and as high as 1.0 for low counts. The spores counted in this analysis may or may not be able to produce a living colony of mold. Therefore, this analysis is sometimes referred to as a "non-viable" count or method. This distinguishes it from a count of colonies on agar, referred to as a "viable" count.

The quality assurance program for mold spore counts includes the following. One lab blank per day provides a long-term track record of lab cleanliness. Each analyst has attended the 5 day intensive Indoor Air Quality: Microscopy of Dust, Spores & Pollen training course. Each day, the scope alignment is checked and documented. All analysts participate in interlab round robins. Ten percent of samples are re-counted by either the same analyst or another analyst to determine analyst precision and bias.

The results are shown following this cover sheet. Each lab analysis refers only to the sample tested, and may not, due to the sampling process, be representative of the material sampled. This report may not be reproduced except in full and with the approval of Fiberquant Analytical Services.

Job Analysis Notes:

Sample number 200-5266-3 was very heavily loaded with debris. Actual spore concentration is probably higher than reported. Recommend lowering sample volume.

Mold Spore Count on Zefon Air-O-Cell Filter **Job Number:** **2001-5266**

McKEE ENVIRONMENTAL HEALTH
303 WESTFIELD LN

FRIENDSWOOD, TX 77546-0000
Office Phone: (281) 482-3403
FAX: (281) 482-7203

Client Job: **2136 Brentwood**
Samples Submitted by: **RON McKEE** **8/3/01**

Lab Number:	2001-5266- 1		
Sample Date :	7/2/01		
Client Number:	R82-101		
Location	living room		
Volume (L):	150		
Analyst:	MAB		
#Passes:	15		
Microscope #:	1		
Genus or Type of Spore	**Counts**	**Cnts/m3**	**%**
Cladosporium	3	110	50.0
Penicillium/Aspergillus/Periconia	0	< 36	0.0
Basidiospore	3	110	50.0
Alternaria	0	< 36	0.0
Drechslera/Helminthosporium/Bipolaris	0	< 36	0.0
Stachybotrys	0	< 36	0.0
Chaetomium	0	< 36	0.0
Ascospore	0	< 36	0.0
Pithomyces	0	< 36	0.0
Ustilago (smuts)	0	< 36	0.0
Uredinales (rusts)	0	< 36	0.0
Myxomycetes	0	< 36	0.0
Scopulariopsis	0	< 36	0.0
Cercospora	0	< 36	0.0
	0	< 36	0.0
	0	< 36	0.0
	0	< 36	0.0
	0	< 36	0.0
Miscellaneous or Unidentifiable	0	< 36	0.0
Total Fungal Spores	**6**	**210**	
Mycelial Fragments	0	< 36	

Lab Number:	2001-5266- 2		
Sample Date :	7/2/01		
Client Number:	R82-102		
Location	west bedroom		
Volume (L):	165		
Analyst:	MAB		
#Passes:	15		
Microscope #:	1		
Genus or Type of Spore	**Counts**	**Cnts/m3**	**%**
Cladosporium	11	360	50.0
Penicillium/Aspergillus/Periconia	4	130	18.2
Basidiospore	6	190	27.3
Alternaria	0	< 32	0.0
Drechslera/Helminthosporium/Bipolaris	0	< 32	0.0
Stachybotrys	0	< 32	0.0
Chaetomium	0	< 32	0.0
Ascospore	0	< 32	0.0
Pithomyces	0	< 32	0.0
Ustilago (smuts)	1	32	4.5
Uredinales (rusts)	0	< 32	0.0
Myxomycetes	0	< 32	0.0
Scopulariopsis	0	< 32	0.0
Cercospora	0	< 32	0.0
	0	< 32	0.0
	0	< 32	0.0
	0	< 32	0.0
	0	< 32	0.0
Miscellaneous or Unidentifiable	0	< 32	0.0
Total Fungal Spores	**22**	**710**	
Mycelial Fragments	3	97	

Lab Number:	2001-5266- 3		
Sample Date :	7/2/01		
Client Number:	R82-103		
Location	mattresses (2 sets)		
Volume (L):	45		
Analyst:	MAB		
#Passes:	10		
Microscope #:	1		
Genus or Type of Spore	**Counts**	**Cnts/m3**	**%**
Cladosporium	9	1600	6.4
Penicillium/Aspergillus/Periconia	107	19000	75.9
Basidiospore	7	1200	5.0
Alternaria	0	< 180	0.0
Drechslera/Helminthosporium/Bipolaris	0	< 180	0.0
Stachybotrys	0	< 180	0.0
Chaetomium	0	< 180	0.0
Ascospore	0	< 180	0.0
Pithomyces	2	360	1.4
Ustilago (smuts)	0	< 180	0.0
Uredinales (rusts)	1	180	0.7
Myxomycetes	0	< 180	0.0
Scopulariopsis	0	< 180	0.0
Cercospora	0	< 180	0.0
	0	< 180	0.0
	0	< 180	0.0
	0	< 180	0.0
	0	< 180	0.0
Miscellaneous or Unidentifiable	15	2700	10.6
Total Fungal Spores	**141**	**25000**	
Mycelial Fragments	18	3200	

Lab Number:	2001-5266- 4		
Sample Date :	7/2/01		
Client Number:	R82-104		
Location	east bedroom		
Volume (L):	150		
Analyst:	MAB		
#Passes:	15		
Microscope #:	1		
Genus or Type of Spore	**Counts**	**Cnts/m3**	**%**
Cladosporium	10	360	37.0
Penicillium/Aspergillus/Periconia	4	140	14.8
Basidiospore	13	460	48.1
Alternaria	0	< 36	0.0
Drechslera/Helminthosporium/Bipolaris	0	< 36	0.0
Stachybotrys	0	< 36	0.0
Chaetomium	0	< 36	0.0
Ascospore	0	< 36	0.0
Pithomyces	0	< 36	0.0
Ustilago (smuts)	0	< 36	0.0
Uredinales (rusts)	0	< 36	0.0
Myxomycetes	0	< 36	0.0
Scopulariopsis	0	< 36	0.0
Cercospora	0	< 36	0.0
	0	< 36	0.0
	0	< 36	0.0
	0	< 36	0.0
	0	< 36	0.0
Miscellaneous or Unidentifiable	0	< 36	0.0
Total Fungal Spores	**27**	**960**	
Mycelial Fragments	2	71	

Mold Spore Count on Zefon Air-O-Cell Filter **Job Number:** **2001-5266**

McKEE ENVIRONMENTAL HEALTH
303 WESTFIELD LN

FRIENDSWOOD, TX 77546-0000
Office Phone: (281) 482-3403
FAX: (281) 482-7203

Client Job: **2136 Brentwood**
Samples Submitted by: **RON McKEE** **8/3/01**

Michael Breu
Analyst: MICHAEL A. BREU

Printed: 07-Aug-01
Original Print Date: 06-Aug-01

Larry S. Pierce
Larry S. Pierce, Approved Accreditation Signatory

15.11.2.1. Microscope Magnification

Purpose: calibration ensures that the correct figure is used in calculations

Responsible Party: Michael A. Breu

Timing & Frequency: at least once per year, after the routine service of the scopes; and after any service or repair.

SOP: TEM-9 (Optical Microscope Calibration)

Data Form: Figure 16.11.2.1

Record Storage: equipment files, with microscope records

Summary & Review: no charts or summaries made.

Figure 15.11.2.1 Optical Microscope Calibration Form

Fiberquant, Inc. 5025 S. 33rd St.; Phoenix, AZ 85040; 602-276-6139; FAX 602-276-4558

Optical Microscope Calibration Bench Sheet

Microscope Calibrated (FQ#):	Location
Stage Micrometer (1mm x 100 units) Used (FQ#):	

I. Walton-Beckett Reticle Area Determination (PCM)

Procedure: View the stage micrometer using 400x phase contrast through the Walton-Beckett reticle (each scope has its own unique Walton-Beckett reticle, they are not to be interchanged). Focus the stage micrometer using the stage "z" control and focus the eyepiece reticle by twisting the eyepiece focus. Report how many stage micrometer units are encompassed by the diameter of the reticle.

Diameter of reticle (to the nearest 0.1 unit) = _____ stage micrometer units

Area of reticle = .000025 * pi * (# of stage micrometer units)^2 = _____ mm^2

II. [a] 10x10 x 1cm Reticle Width Determination (Micro)
[b] 100 units x 1cm Occular (eyepiece) Micrometer Size Check(Micro)

Procedure: View the stage micrometer using 1000x oil through the 10x10x1cm square reticle (each scope keeps its own unique reticle and they are not to be interchanged). Focus the stage micrometer using the stage "z" control and focus the eyepiece reticle by twisting the eyepiece focus. Report how many stage micrometer units are encompassed by the entire width of the reticle. Repeat with occular micrometer instead of the square reticle.

[a] Width of 10x10x1cm reticle (to the nearest 0.1 unit)=_____ stage micrometer units

Width of 10x10x1cm square reticle in microns = (# stage micrometer units) * 10 = _____µ

[b] Length of 100x0.1x1cm occular micrometer (to the nearest 0.1 unit)=_____ stage micrometer units

Each unit of the 100x0.1x1cm occular micrometer = (# stage micrometer units)/100 = _____µ

III. Magnification

Procedure: View the stage micrometer (100 x 0.01 = 1mm) with the eyepiece containing a 100 x 0.1 =1cm reticle, for which the length has just been determined in II, above. Focus the stage micrometer using the stage "z" control and focus the eyepiece reticle by twisting the eyepiece focus. Report how many stage micrometer units are encompassed by the entire 100 eyepiece units.

Magnification 1	Objective:	Eyepiece: 10x (or fill in other _____)
Number of stage micrometer units (to the nearest 0.1 unit, e.g., 25.1) = _____		
Magnification = 10 * Length of eyepiece reticle (line **[a]** above / # stage micrometer units = _____		
Magnification 2	Objective:	Eyepiece: 10x (or fill in other _____)
Number of stage micrometer units (to the nearest 0.1 unit, e.g., 25.1) = _____		
Magnification = 10 * Length of eyepiece reticle (line **[a]** above / # stage micrometer units = _____		

Performed by _____ Date _____

C:\controlleddocuments\Forms Word\OpticalMagnification004.doc Created: 3/1/2013 8:23 AM1/2/13 8:59 AM; Version: 04; Current 3/1/2013 8:23 AM; reviewed by LSP
Page 1 of 1

15.11.2.2. Field of View/Occular Calibration

1) Field of View: The diameter of the field of view is measured with a stage micrometer (1mm x 0.01mm) by counting the micrometer spaces visible across the field. Each unit is 10 um at 1000x.

2) Occular Calibration: For each microscope used for microbiology, one eyepiece contains a 1 cm x 0.01 cm graticule. Using the stage micrometer 1mm x 0.01mm; measure the distance covered by 100 eyepiece units (at 100x this should be exactly 10 stage micrometer units or 0.1 mm). Divide by 100 then multiply by 1000 (or multiply by 10) to get the number of um per eyepiece unit (should be 1 um)

Document both results in the electronic equipment file (can use one entry), under a category of calibration.

15.11.2.3. Resolution Check

Purpose: ensures that microscopes are capable of seeing the required detail

Responsible Party: Michael A. Breu

Timing & Frequency: at least once per year, after the routine service of the scopes; and after any service or repair.

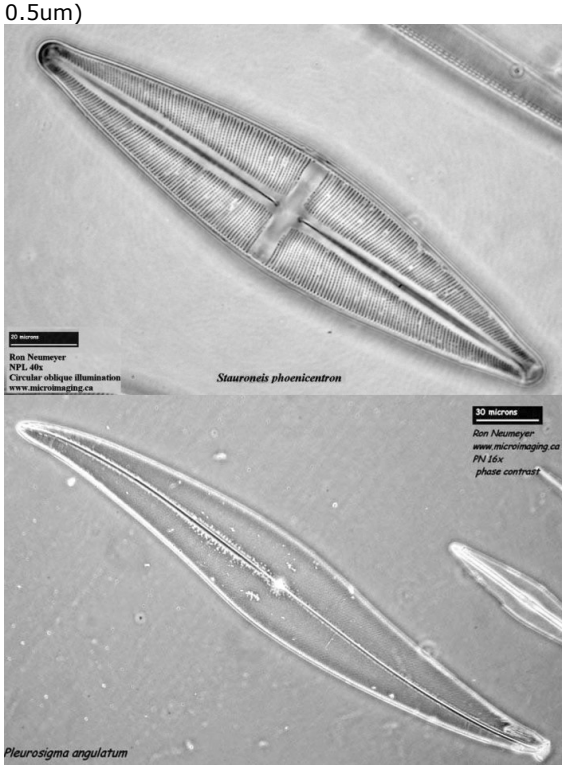
SOP: Two resolutions are to be checked: one for magnification/resolution 1 (50x oil objective) and one for magnification/resolution 2 (100x oil objective). Mag/res 1 must exceed 0.7um resolution and mag/res 2 must exceed 0.5um resolution. Insert Kemp 8-diatom test slide and locate the two diatoms shown at right. The dot spacing for the top one will be visible as dots for mag/res 1 and the dots in the bottom one will be visible as dots for mag/res 2.

Data Form: LIMS <QC><Myco QC><Resolution Check>

Record Storage: LIMS

Summary & Review: no charts or summaries made.

Figure 15.11.2.3 Stauroneis phoenicentron (top, 0.7um) and Pleurosigma angulatum (bottom, 0.5um)



15.11.2.4. Incubator Thermometer Calibration Check

Purpose: to ensure that incubation temperature is correct.

Responsible Party: Senior AA Analyst.

Timing and Frequency: Once per year, tickler brought up by LIMS.

SOP: Work Practice GEN-6

Data Form: LIMS<QC><AA><Thermometer Check>, one page for each thermometer.

Record Storage: LIMS Data Form as above.

Summary & Review: as performed.

Out-of-Control: >+/-2 deg. C with the calculated correction factor at temperature(s) of use.

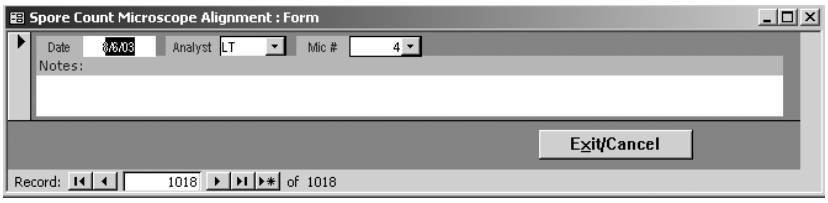
15.11.2.5. Microscope Alignment

Purpose: alignment ensures that the microscope can visualize spores as well as possible

Responsible Party: each analyst

Timing & Frequency: once per day, each scope used.

Figure 16.11.3 Microscope Alignment



SOP: With a focused slide on the stage, the field aperture (in the base) is dialed down to a small diameter. If the hexagonal shape of the iris is in focus, its edges will appear sharp and have a faint purple color, not red or blue. If the aperture is not in focus, focus it by turning the 1" dia. knob on the left side of the sub-stage assembly. A centered aperture would be concentric with the eye-piece reticule circle. If the aperture is not centered, center it using the two 1/2" dia. knobs on the sub-stage assembly. Finally, dial the size of the aperture larger until it falls just outside the field of view.

Data Form: Figure 16.11.2.3

Record Storage: equipment files, with microscope records

Summary & Review: no charts or summaries made.

15.11.3. Contamination and Growth Controls

15.11.3.1. Housekeeping

Once a week, usually over the weekend, the entire laboratory is cleaned and dusted by a cleaning service. If lab areas are noticed to be dusty or weekly, the analyst should wet wipe the offending area. The biological safety cabinet and spore trap mounting hood are sprayed with bleach solution and wet wiped. After cleaning of the mounting hood, the first series of cassettes to be mounted will have a blank run during mounting.

15.11.3.2. Air Monitoring

Purpose: to determine lab concentrations and types of spores.

Responsible Party: M. Breu

Timing & Frequency: quarterly, with LIMS tickler in SPCT2 results form.

SOP: Draw two Spore Trap samples, each at 15L/m for 5min (75L). One is to be either from the mold microscope room (near hood) or from next to the BSC. Alternate these locations. The second is to be taken (immediately after the first) outside the building on the SE corner. Fill out COC; analyze using current recommended spore trap method.

Data Form: LIMS <QC><Air Monitoring> form. Use one line for inside and another for outside.

Record Storage: same. Store COC and paper report in Mycology file drawer in Larry's office.

Summary & Review: by MAB, as done

Out-of-Control: Inside>Outside or different rank order (3 out of top 5 taxa are not the same)

15.11.3.3. Microscope Blanks

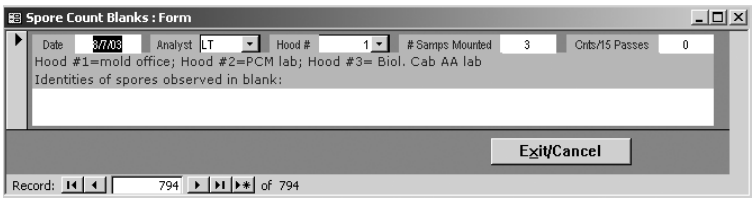
Purpose: to qualify the sample prep area as clean.

Responsible Party: the first person to mount slides each day.

Timing & Frequency: once a day, during the first set of samples mounted.

SOP: A blank prep mount is made by leaving a 1" strip of double sticky tape out during the mounting process for the samples, then staining and mounting the blank the same as a sample. The blank is counted using 15 passes at 1000x, and is performed before the samples for which it is a blank.

16.11.3.2 Blank Form



Data Form: LIMS <SPCT Blanks>

Record Storage: same

Summary & Review: as done

Out-of-Control: 2 spores; if OOC, then mount another and re-analyze. If in control, then report data with note; if still OOC, determine cause of contamination, clean, do not mount further until a 0 count blank can be achieved.

15.11.3.4. Culture Plate Negative Control

Purpose: to qualify the agar preparation and conditions as non-contaminating.

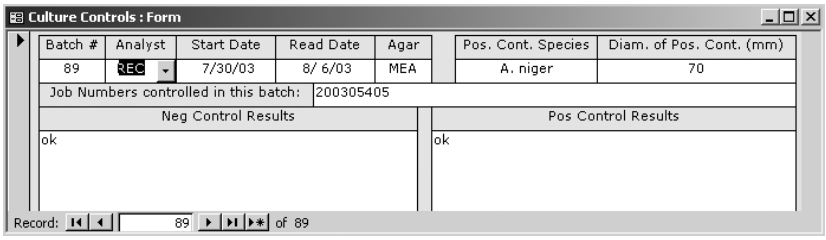
Responsible Party: agar preparer or culture preparer.

Timing & Frequency: each batch of agar prepared; also along with each day client/customer plates are inoculated.

SOP: See Work Practice 11-23.

Data Form: LIMS Figure 16.11.3.3

Figure 16.11.3.3 Positive and Negative Control Documentation



Record Storage: same

Summary & Review: as done

Out-of-Control: any growth; resolution: find source of contamination before any further culturing; repeat samples, if possible; otherwise, flag samples as possibly contaminated with ----.

15.11.3.5. Culture Plate Positive Control

Purpose: to qualify the agar preparation and conditions as capable of supporting growth.

Responsible Party: agar preparer or culture preparer.

Timing & Frequency: each batch of agar prepared; also each day client/customer plates are inoculated.

SOP: See Work Practice 11-23.

Data Form: LIMS Figure 16.11.3.3

Record Storage: same

Summary & Review: as done

Out-of-Control: <25% size of average colony; resolution: determine the cause of slow or no growth

15.11.3.6. Incubator Temperature Check

Purpose: to see if incubators are at correct temperature.

Responsible Party: G. Volkova

Timing & Frequency: 3x per week.

SOP: Record temperatures as indicated on the thermometer of each incubator.

Data Form: Temp notebook beside incubators

Record Storage: same

Summary & Review: as done

Out-of-Control: > +/-2 deg. C from desired temperature. If temperature is off, check incubator power (it may be off), or adjust controls, or, if lab is too warm, adjust AC so that incubators can achieve 25 deg.

15.11.4. Precision and Accuracy Determinations

15.11.4.1. Reference Slides (Direct Examination) and Reference Samples (Culturable)

Purpose: to qualify an analyst for client/customer samples, to obtain precision and accuracy data.

Responsible Party: each analyst.

Timing & Frequency: Direct Examination: once per each day of analysis each technician and analyst; *Culturables:* 2 cultures per every month; all analysts and preferred also all technicians.

SOP for SPCT, SPCT1, SPCT, and SPT Direct Examination: a series of slides, selected from previous samples and/or commercial reference samples, are kept in the microscope lab (reference slides). The loading of the reference slides ranges from about 100 to 10,000 spores per slide. The analyst chooses a slide (going through all of the slides in order so that all are counted an equal number of times), counts it, then enters the data into the LIMS, which calculates in or out of control.

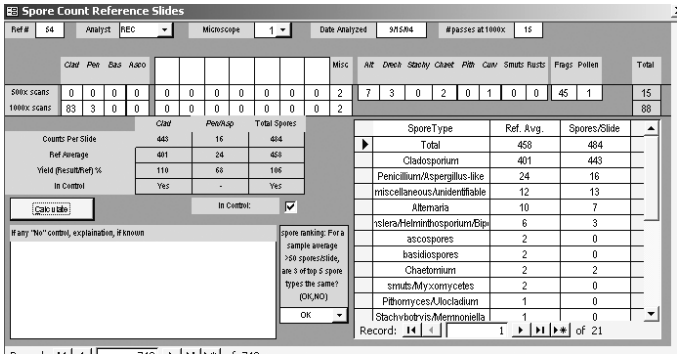
SOP for SPB Direct Examination and Culturable: a culture plate (MEA and/or PDA) is made from one of the culture library standards. Each analyst identifies genus and species, if possible. Results are entered into the LIMS. Correct answers are given and discussed after all analysts have participated.

Data Form: LIMS Figure 16.11.4.1a and b

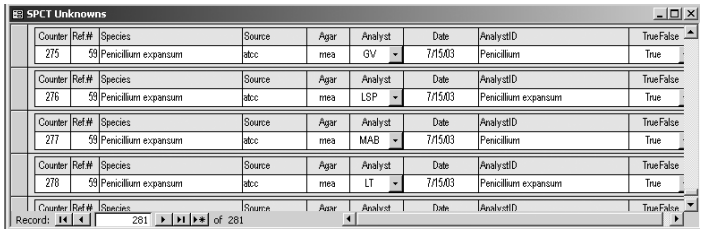
Record Storage: same

Summary & Review: as done

16.11.4.1a Spore Trap "Reference Slide" Results



16.11.4.1b Culture Unknown Form

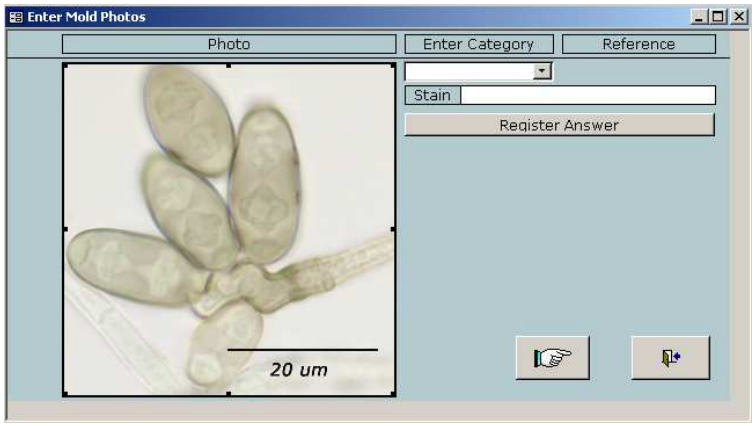


Out-of-Control: Direct Examination: Acceptance limits are +/- 2 times the standard deviation for the categories clad, pen/asp and total spores if >50 spores per slide as calculated on the Micro QA Report; in addition, three of the five most abundant spore types (LIMS calculates spore rankings) must match the lab average abundances. If count is out-of-control, recount the slide or another slide until in control. If ranking is out-of-control, investigate categories which disagree and verify the correct categorization. Acceptance limits will be recalculated quarterly using the recalculate button on the quarterly summary menu in the LIMS. *Bulk Analysis/Culturable Analysis:* incorrect genus is out-of-control; resolution: discussion of answers highlights how to identify; study reference texts on that genus identification. Culturable analysts must maintain >85% correct to analyze client/customer samples.

15.11.4.2. Spore Trap Flash Cards (Direct Examination Air)

Flash cards are photos of spores stored in a computer program. The analyst is shown the photos in random order; their identification is checked versus the known or reference identity. A cumulative % correct is calculated for each analyst and the lab. The analyst is shown the correct answer immediately after registering their identification, for immediate feedback and correction.

Figure 16.11.4.2 Spore Flash Card Program



Purpose: to train the analyst and to document analyst performance

Responsible Party: each analyst

Timing & Frequency: 100 photos per week

SOP: start flash card program, hit <start> button, categorize the spore(s) shown in the photo, hit <register answer>, hit arrow to continue until 100 (program stops); finally hit end.

Data Form: Flash Cards Program

Record Storage: same

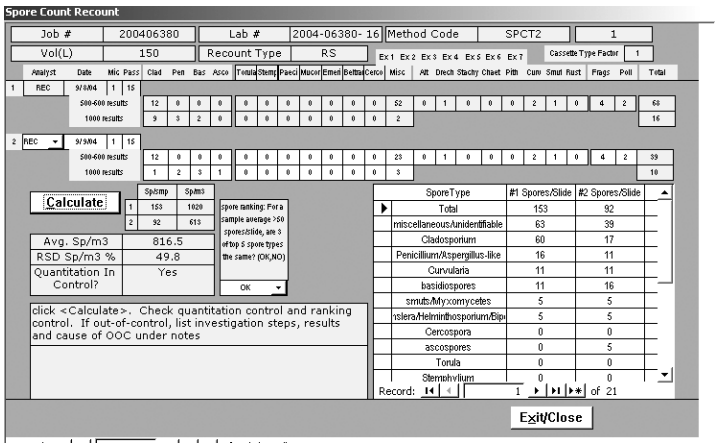
Summary & Review: as done

Out-of Control: <85% correct – resolution: train on flash cards until >85% can be maintained.

15.11.4.3. Re-Analysis (Direct Examination and Cultured)

A re-analysis is a recount of the same mounted spore trap slide, tape mount or bulk sample, or identification and recount of a cultured sample. At Fiberquant, a recount is sometimes (5% of analyses) performed by the same analyst as the original count (RS), and is sometimes (5%) performed by a different analyst than the one who performed the original count (RD). The sample on which to perform the recount and whether the same or different analyst should count is controlled in an arbitrary way: by a counter in the Fiberquant LIM log-in program. As samples are logged-in, certain samples will be designated for RS or RD recount on the sample submittal form. Bulk samples and culture plates are always RD.

16.11.4.3 Spore Trap Recount Form



Purpose: to check analyst identification and quantitation

Responsible Party: each analyst as indicated by the work order

Timing & Frequency: There must be at least one intra-analyst and one inter per month. For spore traps, for which current sample loads produce the required re-analysis per month, the frequency as assigned by log-in and indicated on the count form; timing for RS - immediately following completion of job counts and culture plates; timing for all RDs – immediately, if possible – it must be completed before the job can be marked as "reviewed by" on the main job screen. Until the RD is completed and and the entire QC for the job reviewed, the report will stay "preliminary.

SOP: analyze again as if a client/customer sample.

Data Form: each analysis type has its specific form in the LIMS; Figure 16.11.4.3 is an example for spore trap

Record Storage: same

Summary & Review: as done

Out-of Control: Direct Examination Air (Spore Trap): Numerical acceptance limits are 3 x cumulative average RSD for the lab for total spores as calculated on the Micro QA Report, except for Stachybotrys, for which both analysts must agree to presence or absence; Also, rank and order acceptance requires that at least three of the five categories with the highest spore count be in agreement between the two analyses. Acceptance limits will be recalculated quarterly by the LIMS using the recalculate button on the quarterly summary menu. *Direct Examination Bulk*: >+/- 50% RSD for each observed genera >10%. Acceptance limits for direct bulk will be evaluated and re-assigned if necessary annually, during the annual audit (see Work Practice Myco-18). *Direct Examination Surface:* >+/-25% RSD total spores/slide. Acceptance limits for direct surface will be evaluated and re-assigned if necessary annually, during the annual audit.; *Culturable Air:* >+/- 2 colonies for each colony type for cultures having <50 colonies and colony genera agree; *Culturable Bulk/Surface:* for reading of same plate, same as for Culturable Air,; for reading of 2nd prep plate, >+/- 200% RSD each colony type. Acceptance limits for culturable samples will be evaluated and re-assigned if necessary annually, during the annual audit.

15.11.4.4. Alternative Minimum Re-analysis for SPB and SPT

We do not perform enough of these to guarantee at least one re-analysis for SPB and SPT. Therefore, the LIMS keeps track of the number of re-analyses per 30 day period, and checks every time an analyst fills in their name for an SPCT2 (the analysis we do the most of) results.

Purpose: to ensure that precision data are obtained monthly for SPB and SPT FOTs.

Responsible Party: all mycology analysts.

Timing & Frequency: 30 days.

SOP:

1. When prompted by the LIMS, locate a suitable SPB or SPT (LIMS will say which) sample or prepared slide to re-analyze
2. Log in that sample using FQI as the client/customer, but do not print the work order yet.
3. In the "SPCTSamples" table, change the "-" in the QA column to "RS" or "RD" (half each over time).
4. Now print the work order, which will have a results section for one analysis and a re-count page for a second analysis.
5. In the results screen of LIMS, enter the results of analysis 1.
6. Print the report to the screen, store normally.
7. LIMS will then have added to the recount database this sample.
8. You (RS) or 2nd Analyst (RD) enter the results of analysis 2 in the LIMS Recounts Screen.

Data Form: paper bench sheets and LIMS.

Record Storage: LIMS.

Summary & Review: QA Reports.

Out-of-Control: Statistically set by LIMS.

15.11.4.5. Interlab Samples (Direct Examination Air)

Interlab spore trap mounted slides are the only sample type exchanged at present.

Purpose: compare lab/analyst results to those of other labs; to obtain an interlab CV to be used for calculation of 95% confidence ranges.

Responsible Party: arrangements by Michael Breu. Analysis by all Myco analysts, depending on type of interlab being done.

Timing & Frequency: approximately 2x a year, 4 samples.

SOP: varies - contact labs, generate slides, and count all slides.

Data Form: varies with participating labs. Summary form is an Excel file on Michael//c:/my documents/interlab/

Record Storage: Myco file "interlab".

Summary & Review: calculation of z-score for major spore categories; acceptable is <=3.

Out-of-Control: z-score of >3 for any type and total

15.11.4.6. Proficiency Samples

AIHA proficiency testing is available for cultures and for spore traps (direct read).

Purpose: compare lab/analyst results to those of other labs; to obtain analyst bias.

Responsible Party: Michael Breu; all analysts to analyze all samples.

Timing & Frequency: 3x/year

SOP: **EMPAT Culturable**: 1) One set of plates are cultured (various media) to start and incubated. 2) Depending on results from the first plating, other media and conditions may be used. 3) All analysts independently analyze. 4) When all have completed, answers are compared and discrepancies are resolved, if needed. **EMPAT Direct**: 1) done over internet; 2) all available analysts gather around to share in the identification for training purposes while it is being done. All: To the extent possible, perform analysis the same as a client/customer analysis; do not discuss results with other labs.

Data Form: paper.

Record Storage: Myco files "Prof.".

Summary & Review: synopsis in monthly summaries.

15.11.4.7. Limit of Detection (Direct Examination and Culturable)

Purpose: to calculate the minimum count that is 95% certain to be significantly over background.

Responsible Party: Larry S. Pierce.

Timing & Frequency: reviewed once per year; changed as needed

SOP: if possible: LOD = Student's t value x standard deviation of a data set from a sample averaging near the LOD. For the present, all FOTs use sensitivity (hypothetical observation of one spore or colony) as a LOD.

Data Form: none – just data crunching.

Record Storage: Myco files "LOD"

15.12. QA Report

A report is prepared which summarizes the QA activities and results for the samples received. Since the completion of samples is dependent on backlog, the timing of the QA Report may be irregular. The exact items to be included in the report are listed and discussed fully in Section 12 of the SOP/QA Manual and will not be repeated here.

15.13. Record Keeping

The written records of lab activities are listed in Table 16-1, below. The locations of current records are also given. Records older than one year may be archived. These records are to be held secure and confidential. The original client/customer has full access to data and reports relating to his samples, of course. But if other than the original client/customer asks for information about the samples (e.g., a contractor wants to know whether samples taken by a consultant passed or failed), then the original client/customer is first contacted to obtain approval (verbal is required, written desirable) to release the data. Usually, the client/customer will prefer to release the information himself. All records are chronological unless stated otherwise.

TABLE 16.1

Mycology Lab Records

Record	**Location**
Sample Submittal Form	Office File
Job and Sample Logs	LIMS
Invoice	Office File
Calibrations	LIMS Equip. File
Reports	LIMS
Prep Blank Results	LIMS
Reference Sample Results	LIMS
Recounts (Rep + Dup)	LIMS

Interlab Results	Tech File
Proficiency Sample sults	Tech File
Incubator Temperature Logs	Prep Lab Next to Incubators

16. STANDARD OPERATING PROCEDURES: SOOT

16.1. INTRODUCTION

These standard operating procedures are instituted so that a consistent and standard analysis can be performed no matter who in the laboratory is performing it. These procedures have been written to a level of detail fine enough so that someone with only a passing knowledge of the analysis would be able to perform it. Naturally, it is not expected that an analyst would page through a document of this size on a daily basis, for example, to be reminded of the order of certain steps or of counting rules. For daily reference, Work Practices have been written, which are step-by-step but brief summaries of the procedures detailed here. The Work Practices are kept in a bound notebook or, in some cases, posted in the analysis area, for easy reference.

16.2. ORGANIZATION OF PERSONNEL AND TRAINING

The job descriptions, prerequisites and organization of personnel at Fiberquant, Inc. are given in Section 4 of the SOP/QA Manual. Training procedures and requirements for personnel are given in Section 9 of the same.

16.3. EQUIPMENT AND SUPPLIES

16.3.1. Equipment

The current equipment used for mycological analysis is as follows:

1) Hotplate, Thermolyne Type 2300, or equivalent

2) Microscopes (9), Nikon Labphot, Laphot II or Optiphot

3) 100 µl pipette

4) 4) Vortex mixer

16.3.2. Maintenance

1) Hotplate

Meltmount will occasional be dripped onto the hot plate. Because of the resilience of the Meltmount the only efficient way to clean the hot plate is to turn the rheostat all of the way up and burn it off. This is done on an as needed basis.

2) Microscopes

The exterior surface of the microscope is cleaned during the normal lab clean-up. The interior of the microscope is cleaned and inspected once per year by a professional microscope maintenance service, Bender Associates, Tempe, AZ. Other maintenance is of the trouble-shooting type, and is performed as needed by the Lab Manager. Manuals for the optical scopes are kept in the scope tables.

3) pipettes

cleaning and replacing as needed; calibration is not performed.

4) Vortex mixer

cleaning as needed.

16.3.3. Supplies

The analysis depends in large part on the availability of uncontaminated supplies and so the following list of expendables and target inventories has been compiled to aid in supply maintenance.

ITEM (SOURCE)	TARGET INVENTORY
glass slides, 1x3" (Chem Lab Supply)	50 gross
cover slips, #11/2, 22mm square (Chem Lab Supply)	20 packs
Sanford Sharpie pens	2
pipette tips	200
alcohol swipes	500
forceps, jewelers (F#08-953E or equivalent)	1
Cargill Meltmount, r.i. 1.662	50ml
Acetone (Fisher #A929-4)	4L
vials, 4ml glass with screw caps	200
De-ionized water	-

16.4. SAMPLE LOG-IN AND HANDLING

The general log-in and sample handling procedures are described in Section 5 of the SOP/QA Manual, and will not be repeated here. Handling of the samples and jobs in the PCM lab is described below.

The samples are placed by front office personnel in the sample prep rack in the order received. Rush samples are placed on the prep desk and in this case, the analyst is notified that rush samples are present in the lab. Present with each bag of samples is the partially completed sample submittal form.

The job is mounted and counted usually in turn. Multiple jobs may be mounted before counting, or one person may mount samples while another counts them. When the job is being counted, the concentrations of analytes, percent coverage, microscope number, and whether or not the sample was analyzed are written on the bench sheet. Any same analyst recounts are performed and written at the end of the samples. Then, the job is brought up on the computer, and the data are filled in on the screen for all the samples in the job. The data entry is checked on the screen. If the data entry is OK the data is locked and the report printed and reviewed. When the analyst exits the main data entry field, the recount data entry form appears if a same analyst recount was to be performed. The analyst fills in the data for the recount, and the computer calculates the …… and indicates whether the recount is in control or not. Different analyst recounts are deferred until another analyst is available, up to but not more than 30 days after the original analysis, and the recount results checked in the same manner as same analyst recounts. In this case, the recount data screen is entered through the "QC" button on the job screen. When complete and printed, the job paperwork is returned to the front desk while the samples are either saved or disposed of, according to the directions given in Section 5.7.

16.5. SAMPLE PREPARATION

The steps performed in sample preparation are summarized in SOP Work Practice #SOOT-1 Sample Preparation of Soot Samples.

16.6. MICROSCOPE SET-UP

There is a microscope dedicated to Soot analysis. Since its objective is not moved, nor its apertures or other adjustments moved, they do not frequently need alignment or adjustment. The alignment is nonetheless checked before work each day. Checked are the 1)condenser alignment and field aperture size adjustment and 2) the phase ring centering. Not needed to be checked is the filament centering (the microscopes have only Pseudo-Koeller illumination and their filaments are pre-centered).

1) Eyepiece setup

Remove the eyepiece containing the reticule and, looking at a blank, lit background, turn the focus of the eyepiece until the reticule appears sharp. Make sure that your eye is relaxed (e.g., focus outside of the eyepiece in the distance then bring the eyepiece in front of the eye; the eye should not have to re-focus). Replace the eyepiece and focus on a recognizable object using the microscope focus but looking only through this eyepiece. Finally, turn the eyepiece focus of the non-reticule eyepiece until the recognizable object is sharply focused as well. For eyes that are matching in focus power (e.g., 20/20), both eyepieces should be focused to approximately the same spot relative to the ring showing on the barrel.

2) Condenser alignment and field aperture size adjustment

With a focused slide on the stage, the field aperture (in the base) is dialed down to a small diameter. If the hexagonal shape of the iris is in focus, its edges will appear sharp and have a faint purple color, not red or blue. If the aperture is not in focus, focus it by turning the 1" dia. knob on the left side of the sub-stage assembly. A centered aperture would be concentric with the eye-piece reticule circle. If the aperture is not centered, center it using the two 1/2" dia. knobs on the sub-stage assembly. Finally, dial the size of the aperture larger until it falls just outside the field of view.

3) Phase ring centering

For proper operation of the 40x phase objective used in PCM analysis, a ring in the condenser must be concentric with a ring in the objective. Both rings are visualized by replacing one of the eyepieces with a telescope, kept in the microscope table drawer. The rings are made concentric using the Allen sockets on both sides of the right hand side of the plate on the non-turret condenser of the scope. It is worthwhile noting that ring alignment can be affected by cover slip position. Specifically, if a cover slip is tilted, the phase rings will be out of alignment relative to their position during observation of a parallel slip. Any out-of-alignment condition may be apparent in the image as fuzziness, low contrast or astigmatism. If any of these conditions are noted, the scope should be re-aligned before work continues.

The first analyst to use the scope for the day indicates that the above have been checked by placing their initials in the "blanks/alignment" computer form, shown in Figure Soot.2.

16.7. SAMPLE ANALYSIS

The sample slides are analyzed and the observations are documented in one of 6 categories. Those are soot-like, fungi, pollen, fiber, vegetative char/ash, mineral dust, or unknown miscellaneous **(see Reference ASTM Standard Method D6602-03b)**. The percent coverage of a representative field of view is reported for each of these 6 categories such that the total will always be 100%. In the case of very low concentrations of one or more of these categories, the result is reported as "trace" and that value is not included in the 100%. In addition, the overall coverage of a representative field of view is documented as well as weather or not the sample was analyzed and which microscope was used. PLM is used for determining the presence and concentration of mineral dust at 400 x while 500x oil immersion is used for determining the concentrations of the other analytes.

Soot.1 Sample Results

Job #	201208461	Method Code	SootT	Modified ASTM D6602-03b - Tape		Enter Samples
Analyst	RFV	Date Analyzed	9/5/2012	Locked	Yes	)/5/2012 2:37:36 PI
Microscope#	9					

				Percent								
Lab Number	Client Number	Date	An?	Coverage	soot	fungi	pollen	fiber	veg	mineral	unk/ms	Total
2012-08461- 1	M-8-31-1	8/31/2012	OK	98	2	1	0	0	15	5	77	100.0
	TEM Exam (Conclusions, file#s)											
2012-08461- 2	M-8-31-2	8/31/2012	OK	100	3	1	0	0	10	1	85	100.0
	TEM Exam (Conclusions, file#s)											
2012-08461- 3	M-8-31-3	8/31/2012	OK	98	5	2	-1	0	15	1	77	100.0
	TEM Exam (Conclusions, file#s)											
2012-08461- 4	M-8-31-4	8/31/2012	OK	100	3	1	1	0	15	2	78	100.0
	TEM Exam (Conclusions, file#s)											
2012-08461- 5	M-8-31-5	8/31/2012	OK	97	4	2	1	0	10	1	82	100.0
	TEM Exam (Conclusions, file#s)											

16.7.1. Daily Procedure

1. Blank – See 16.8.2.2
2. Mount Samples – Mounting is SOP Work Instruction SOOT-1
3. Reference Slide – See 16.8.3.1
4. Optical counting – See 16.7.1
5. Recounts – See 16.8.3.2
6. TEM confirmation, if required – See 16.7.3
7. Enter Data, Print & Review

16.7.2. Optical Counting (MAB enter steps here)

blah

16.7.3. TEM Confirmation

The purpose of TEM analysis is to confirm the optical result and, if soot is present in the sample, to document its composition and appearance.

Preparation: steps here.

Examination:

1. Observe at ~5kx a sampling of grid openings that contain particulate.
2. Locate an area containing particulate that resembles soot standards (grape clusters, etc.).
3. At, 20kx, obtain an EDXA spectrum, If the spectrum is consistent with those from soot standards (high carbon, smattering of other elements) save and print the spectrum for documentation.
4. Also photograph, save and print at least one image of the area at a magnification (10kx-50kx) that shows its appearance. Estimate the percentage of similar material in the mount, and compare to the optical result. If the two are in the same ballpark, then done. If the %s are much different (100% off), then find the reason (is there a second opaque material, etc.).
5. If the initial spectrum is not consistent with soot, and the optical examination showed significant soot-like content, move to another area to find the soot, or find a particulate that is a soot look-alike (e.g., TiO2).
6. Put documentation spectrum and image with the work order.

16.8. QUALITY ASSURANCE PROCEDURES

16.8.1. General Requirements

The quality control program consists of three parts: 1) calibrations, 2) contamination control, and 3) precision and accuracy checks. Calibrations ensure that data is not biased due to instrumental errors. Contamination control ensures that the data is not erroneously high due to spores introduced during handling. Precision and accuracy checks ensure that the data is not compromised due to operator bias or error. The details of each of these programs is discussed below:

16.8.2. Contamination Control

16.8.2.1. Housekeeping

Once a week, usually over the weekend, the entire laboratory is cleaned and dusted by a cleaning service. The PCM areas consist of the mounting desk and the two microscope tables. If these areas are noticed to be dusty, the analyst should wet wipe the offending area. After cleaning, the first series of cassettes to be mounted must have a blank out during mounting.

16.8.2.2. Blanks

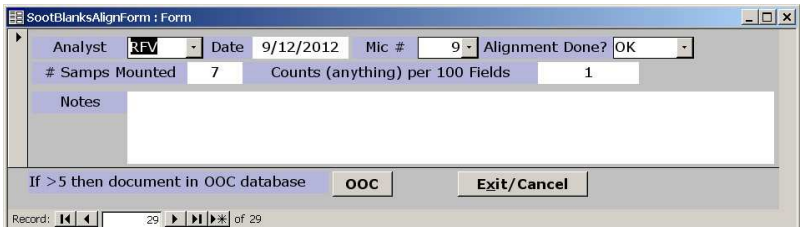
Purpose: to qualify the sample prep area as clean.

Responsible Party: the first person to mount slides each day.

Timing & Frequency: once a day, during the first set of samples mounted.

SOP: A blank prep mount is made by leaving a suspending and unused cotton swipe in the case of SOOTs prep and analysis or an unused slid and coverslip in the case of SOOTt prep and analysis. The blank is counted before the samples for which it is a blank.

Figure Soot.2 Blanks/Alignment Form



Data Form: LIMS <QC><SOOT><Blanks/Alignment>, Figure Soot.1.

Record Storage: LIMS

Summary & Review: as done

Out-of-Control: greater than a few occasional particles or the presence of any visible soot-like particles.

16.8.3. Precision and Accuracy Determinations

16.8.3.1. Reference Slides

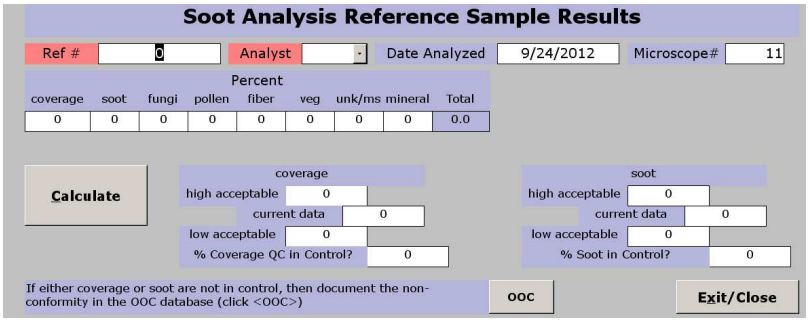
Purpose: to qualify an analyst for client/customer samples, to obtain precision and accuracy data.

Responsible Party: each analyst.

Timing & Frequency: Direct Examination: once per each week of analysis each analyst.

SOP: Direct Examination: a series of slides, selected from previous samples and/or commercial reference samples, are kept in the microscope lab (reference slides). The loading of the reference slides ranges from near LOD to 100% soot. The analyst examines the slide, then enters the data into the LIMS, which calculates in or out of control

Soot.3 Reference Slide Results



Data Form: LIMS, Figure Soot.3

Record Storage: same

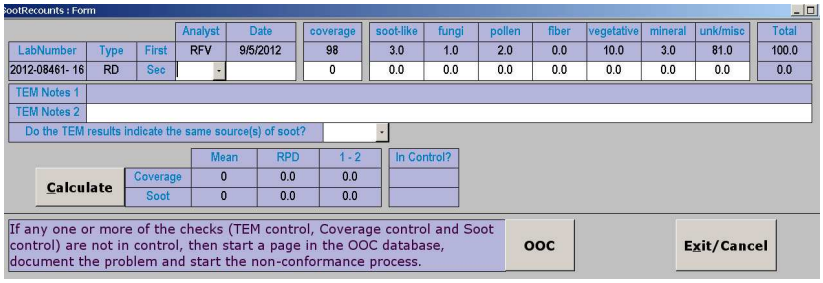
Summary & Review: as done

Out-of-Control: to be determined when data is gathered.

16.8.3.2. Re-Analysis

A re-analysis is a recount of the same mounted sample. At Fiberquant, a recount is sometimes (5% of analyses) performed by the same analyst as the original count (RS), and is sometimes (5%) performed by a different analyst than the one who performed the original count (RD). The sample on which to perform the recount and whether the same or different analyst should count is controlled in an arbitrary way: by a counter in the Fiberquant LIM log-in program. As samples are logged-in, certain samples will be designated for RS or RD recount on the sample submittal form.

Soot.4 Re-Analysis LIMS Form



Purpose: to check analyst identification and quantitation

Responsible Party: each analyst as indicated by the work order

Timing & Frequency: 10% or one per month per analyst (see 16.8.3.3 for SOP for minimum).

SOP: analyze again as if a client/customer sample.

Data Form: LIMS; Figure Soot.4

Record Storage: LIMS

Summary & Review: as done

Out-of Control: to be determined.

16.8.3.3. Alternative Minimum Re-analysis

If too few samples are performed to produce one recount per month, the LIMS keeps track of the number of re-analyses per 30 day period, and checks every time an analyst fills in their name for soot results.

Purpose: to ensure that precision data are obtained monthly.

Responsible Party: all analysts.

Timing & Frequency: at least every month.

SOP:

1) When prompted by the LIMS, locate a suitable prepared slide to re-analyze
2) Log in that sample using FQI as the client/customer, but do not print the work order yet.
3) In the "SootSamples" table, find the line for sample just logged-in, then change the "-" in the QA column to "RS" or "RD" (half each over time).
4) Now print the work order, which will have a results section for one analysis and a re-count page for a second analysis.
5) In the results screen of LIMS, enter the results of analysis 1.
6) Print the report to the screen, store normally. LIMS will then have added to the recount database this sample.
7) You (RS) or 2nd Analyst (RD) re-analyze, then enter the results of analysis 2 in the LIMS Recounts Screen.

Data Form: paper bench sheets and LIMS.

Record Storage: LIMS.

Summary & Review: QA Reports.

Out-of-Control: Statistically set by LIMS.

16.8.3.4. Interlab Samples

Mounted slides are the only sample type exchanged at present.

Purpose: compare lab/analyst results to those of other labs; to obtain an interlab CV to be used for calculation of 95% confidence ranges.

Responsible Party: arrangements by Michael Breu. Analysis by all Soot analysts, depending on type of interlab being done.

Timing & Frequency: approximately 2x a year, 4 samples.

SOP: 1) contact labs to see if interested, 2) generate slides, 3) count all slides, 4) send slides to lab list without results or with results in sealed envelope, 5) put results into a spreadsheet that generates std. deviation, cv, and z-scores.

Data Form: varies with participating labs. Summary form is an Excel file on Michael//c:/my documents/interlab/

Record Storage: Soot file "interlab".

Summary & Review: calculation of z-score for stock categories.

Out-of-Control: abs(z)>3

16.8.3.5. Limit of Detection

Delayed until 30 non-zero samples near the LOD are completed.

Purpose: to calculate the minimum count that is 95% certain to be significantly over background.

Responsible Party: Larry S. Pierce.

Timing & Frequency: reviewed once per year; changed as needed

SOP: if possible: LOD = Student's t value x standard deviation of a data set from a sample averaging near the LOD. For the present, all FOTs use sensitivity (hypothetical observation of one spore or colony) as a LOD.

Data Form: none – just data crunching.

Record Storage: Soot paper files "LOD"

16.8.3.6. Percent Accuracy Training/Documentation

Delayed until the program is completed.

Purpose: to test and train the analysts to accurately estimate percents by eye.

Responsible Party: all analysts.

Timing & Frequency: once per month; changed as needed

SOP: Open and complete the program <Percent Estimation>. The program is a flash-card type that offers random photos or diagrams as unknowns. The analyst estimates what the program asks for, then hits a reveal that gives them instant feedback on their accuracy. Over time, they should become better.

Data Form: done by the program.

Record Storage: Stored in the program.

16.8.4. QA Report

A QA report is prepared quarterly which summarizes the SOOT sample and QA activity for the samples received. . Since the completion of samples is dependent on backlog, the timing of the QA Report may be irregular. The exact items to be included in the report are listed and discussed fully in Section 12 of the SOP/QA Manual and will not be repeated here.

16.9. Record Keeping

The written records of lab activities are listed in Table 16-1, below. The locations of current records are also given. Records older than one year may be archived. These records are to be held secure and confidential. The original client/customer has full access to data and reports relating to his samples, of course. But if other than the original client/customer asks for information about the samples (e.g., a contractor wants to know whether samples taken by a consultant passed or failed), then the original client/customer is first contacted to obtain approval (verbal is required, written desirable) to release the data. Usually, the client/customer will prefer to release the information himself. All records are chronological unless stated otherwise.

TABLE 16.1

Soot Lab Records

Record	Location
Sample Submittal Form	Office File
Job and Sample Logs	LIMS
Invoice	Office File
Calibrations	LIMS Equip. File
Reports	LIMS
Prep Blank Results	LIMS
Reference Sample Results	LIMS
Recounts (Rep + Dup)	LIMS
Interlab Results	Tech File

17. Laboratory Information Management System (LIMS) Description

17.1. General Description

The LIMS consists of two linked MS-Access databases. One database stores the data itself; it resides on the computer named *Server*, file name *c:/access/fqlim/fqdata/fqdata.mdb*. Many other files exist named fqdata.mdb at other locations or on other computers – these are backups or archives. Only the named file on *Server* contains the current data. The other database is file *c:/fqlim/fqlim2000.mdb*. It contains the forms and reports used to access the data in *fqdata.mdb*, and resides on every computer other than *Server*. The master (and latest) version of *fqlim2000.mdb* resides on computer *Larry*. Other computers may have the same version as *Larry*, but may have a previous version depending on need. In order to access the data on *Server*, *Server* must be connected to each computer as *Drive G:/*. To make the connection: double-click <My Network Places> on the desktop of a computer; then double-click <entire network> <entire contents> (if necessary) <Microsoft windows network> <Fiberquant> <Server>; now highlight (single-click) the *c:* drive of *Server*; then choose menu item <File> <Map Network Drive>; in the dialog box, choose G: as the drive letter, then <Finish>. The contents of *Server's c:* will open to prove that the connection is made. [**Troubleshooting tip:** upon starting the LIMS, if an error message states that *g:/access/fqlim/fqdata/fqdata.mdb* is "not a valid pathway", check <My Computer> - if there is no *g:* drive listed, you must re-map as above.]

To start the LIMS, double-click <Shortcut to Fqlim2000> on the desktop. The MS-Access program will open, as will several windows within the Access program. The black title box serves as a last protection against unauthorized use. Click the *Fiberquant Analytical Services* area to close it. There are now three windows open. Two of them are purple in color, and contain various stored values necessary for the remainder of the program to function. They must remain open in the background. Never close a purple window. The main window is the green form called *Job Data Entry*.

17.2. Job Data Entry

All jobs that are currently in the data base can be viewed from *Job Data Entry*. The default is reverse chronological order (the most recent is first). Navigation to other jobs is via 1) the *record* bar at the bottom, 2) six gray buttons at the left bottom, in which small arrows move one job, larger arrows move 30 jobs, the arrows with stops go to the front or back, and *New*, which brings up a new job, and 3) the *Go To* button, which will ask you which job number to display. Most fields in *Job Data Entry* may be edited at any time, but the *Submitted by* and *Bill to* client/customers will be disabled once a job has been invoiced, and will appear gray to indicate they are not editable. In order to change a client/customer once an invoice has been made, you must re-invoice.

Click <New>, and a fresh record will be created. An incremented unique *Job Number* will be created. The number will be of the form *2004XXXXX*. Fields that are critical to job creation are now highlighted in red on *Job Data Entry*. Start entering data at the top and use <Tab> to move to the next field. The *Submitted by* and *Bill to* client/customers are selected from a drop-down list which shows the client/customers in the database. To enter a job from a new client/customer, you must first put that client/customer into the database by clicking the *Client/customers* button, thereby opening the *Client/customers* form, in which the client/customer data is entered. When entering a client/customer *Idcode*, use a convenient abbreviation (Don't worry, you will not be allowed to duplicate another client/customer's *Idcode)*. Now enter the *Contact* (person either bringing in the samples or taking responsibility for them) on *Job Data Entry* using another drop-down list. Like the client/customers, you cannot enter a new contact from the *Job Data Entry* form, but must list the contact for the appropriate company using the form *Client/customers*. Type in the *Client/customer Job* and *Due*. *Rec'd By* is the person who signed the chain of custody (coc). The rec'd by date is automatically filled in as the current date by the computer, but it may be changed to the coc date, if they are not the same. The *Log in By* is you, the person filling in this form, and the log-in date and time are filled in automatically by the computer when you start the form. The *Accepted* box must be checked as documentation that the samples have been accepted. Choose the *Shipping Method* and turnaround time (*T.A.T.*) from their drop-down menus. Type the *P.O.* and *Routing Number*, if known. Match the *Method* from its drop-down list to what is indicated on the coc. At this point, all the red fields should have been turned to green as you entered the data, and the job-specific information has all been entered. Some fields on the form will remain blank for now, to be filled-in automatically by the computer as various parts of the analysis, printing and billing are completed.

Now samples must be logged-in. Click the *Samples* button. For a new job (one with no previously entered samples), a sample entry form will open. The exact form depends on the *Method* entered on *Job Data Entry*. [**Troubleshooting tip**: when a job has samples entered, the computer assumes you want to enter results when you click *Samples*, and so opens a method-specific results form. To enter in or edit the sample log, you must click the *Enter Samples* button on the results form.] As a sample is entered, a unique *Lab Number* will be automatically created, of the form *JobNumber-XXX.* Enter the sample data as prompted, such as *Client/customer Number, Date Sampled, Volume, etc*. The *Condition* field documents any potential sample problems – choose from the drop-down list. When a new sample is created, certain fields from the previous sample are copied to the new line; you may be able to avoid typing a long sample number over and over. [**Troubleshooting tip**: if the automatic copying feature does not work or creates an error message, it is because a certain reference library has not been activated. To check, go to the main Access menu (that lists Tables, Forms, etc. on the left side), click *Modules*, double-click *Initialization*, which opens the Visual Basic Editor. From the menu, choose <Tools><References>. On the giant list of options, six options should be checked at the top. Among them must be *Microsoft DAO 3.6 Object Library*, which is necessary for the automatic copying to function. If it is not, find it down below and check it.]

When the sample data has been entered, close the sample entry form. Click the *Print* button, then, on the sub-form *Print Options*, click the *Work Order* button. A Work Order is simply a paper version of *Job Data Entry*, along with appropriate work sheets for analysts to fill in their results. The Work Order Report is shown in preview; you must click <File><Print> to send it to a printer. Using this menu path allows you to send it to any printer installed on your computer by choosing it from a drop down list. If you print using the printer icon, the work order will go to your computer's default printer. Also previewed is a *Job Label*, which is to be printed to one of the Dymo label printers. For PCM and TEM, individual sample labels are also previewed, which are also to be printed to the Dymo.

17.3. Results

When a job has samples associated with it in the database, *Fqlim* assumes that when you click the button <Samples> that you want to enter results. It will then open a form specific to the type of analysis. Sometimes, data is entered directly into the computerized form as the only data storage type, as for PLM. More often, a paper worksheet, printed with the work order, is used to collect data away from a computer, in which case the computerized form mirrors the paper version to allow the analyst to enter the data in a straightforward manner. In the case of AA, the worksheet cannot be printed until the run is constructed, and therefore printed by an AA analyst/technician.

The analyst who gathered the data enters it into the computer, to minimize transcription errors. After the results have been entered, click <Lock Data> to lock the form. When locked, the values in the fields cannot be changed, either by accident or on purpose. The form is then closed/exited. Click the button <Print> <Report>, enter your password (specific to each analyst) and a preview of the report will appear (sometimes after several minutes for large jobs). The report may be in two parts (micro) or just one. A fax cover sheet will be previewed as a separate report. Finally, for PLM, a dup worksheet will be generated, if needed, for the job. All previewed items should be printed on paper. In addition, all final reports are to be printed to the Adobe Distiller or PDF Printer (depends on which computer) as a .pdf file and stored electronically in Server//c:/reports/… A number of directories exist for different job types, to make it easier to find a particular report. Store to the appropriate directory.

After a job's data has been locked, it may be changed. Click the <Unlock Data> button. A dialog box will open, asking whether data has been sent to the client/customer. "Data sent to client/customer" means a final report in final form. Verbal results or preliminary faxed data do not count as a final report. If the <Data sent to Client/customer> button is clicked, Fqlim increments a stored value called *report version*. If the report version is anything but 1 (meaning data has been changed after it went to a client/customer), then the report will print, including a subtitle: *Amended Report*, and the date of the original report and of the amended report will be listed on the report. After changing the data, the fact that a report has been amended must be documented in <Utilities><Amend Report>.

17.4. Employees

The button <Employees> on *Job Data Entry* opens the *Employees* form, which gives access to Employee data. Since Fqlim uses drop-down lists of employees for each entry of initials (the code for an employee), an employee must be in this database and also must be marked as active (must enter into the table itself, not this form) to show up in *Fqlim*. Employees no longer working for the company are retained in the database (otherwise one could not generate one of their old reports) and marked as inactive. The employee form has several tabs of data. The tabs may not be visible when the form is first viewed, but they can be seen by scrolling up.

The first tab is general data, such as name, address, etc. Two important entries must be made here, though. One is the employee number for equipment authorization. Each employee must have a unique number. This entry works in conjunction with the equipment database to indicate when, if ever, a given employee has been authorized to use a given piece of equipment. The second important entry is at the bottom, where an employee may be authorized on a certain date to perform a type of analysis. Unless authorized here for an analysis, the employees initials will not appear in the drop-down list of analysts for that analysis type, the employee will not be able to enter their initials, and therefore will be prevented from performing that analysis type.

The second tab is *Vita*, which was to be a scanned vita for the employee. It has been abandoned due to the memory involved in storing scanned documents.

The third tab is *Accuracy and Precision*. On this page will be found a large number of tables showing current accuracy and precision data for each type of analysis and each analyst. Since all analysts are shown, you must search through for the one of interest. These tables are updated every time a *QA Summary* is printed.

The fourth tab is *Continuing Education*. As employees take classes or participate in a conference, an entry is made in this database.

The fifth tab is *Deficiency Corrections*. This table will show any deficiency corrections on record for the given analyst.

The sixth tab is where the electronic signatures for the analysts are stored. They are used by *Fqlim* to sign reports electronically.

17.5. Quality Assurance

In addition to storing original data and observations necessary to produce a report, *Fqlim* also stores QA and QC data, such as blank results, reference sample identifications and quantifications, re-analysis data, proficiency tests, *etc*. Almost every QA/QC task listed in our SOPs is tracked by *Fqlim*. In some cases, forms will automatically be opened to

receive such data, for example, PCM recounts by the same analyst. It is expected that these will be performed immediately, so the recount form opens when the results form closes. All QA/QC data may be entered or accessed from the <QC> button on *Job Data Entry*. When clicked, this button presents the form *QC Options*, a choice of analysis type buttons. Click any of these and yet another menu of QA/QC tasks will be presented. Clicking any of the buttons on it will open a form to be used to enter that type of QA data. As the analyst will soon discover, it is important to enter QA data in a timely manner, since failure to do so may lock the analyst out of entering client/customer results. Before or as *Fqlim* locks anyone out, a pop-up message will indicate the type of QA/QC task, the data from which must be entered before being allowed to continue.

17.6. Invoicing and Payments

Fqlim allows jobs to be invoiced, an invoice printed, and payment to be received. First, display the job to which the invoice or payment refers by navigating in *Job Data Entry*, then click either the <Invoice> or <Payment> button. The activity is stored in the *jobs* database as an invoice amount, invoice date, payment amount, and/or payment date. It is stored in a second database, *Transactions*, as a positive or negative amount along with other data. The two databases are periodically compared in order to catch errors before they get to client/customers.

The invoicing programming allows invoices to be changed (amounts or client/customers). However, because of the complexity of changing invoices, as many as four transactions will be generated, and the entire process may not come off as expected. It is best when changing invoices to check both *Jobs* and *Transactions* using a calculator to make sure all the totals are as they should be.

The <Invoice> button is for changing or making invoices only. To merely print an invoice, click <Print> <Invoice>.

17.7. Utilities

The <Utilities> button on *Job Data Entry* opens a form with many buttons, each of which does some miscellaneous function for the database. <Products> allows one to alter or add an analysis type/turnaround/price combination that will be used as a line item on an invoice. <Date/Time> is a shortcut to correct the computer's internal clock. <Amend Report> is a database which explains for each amended report, what has been changed and why. <Custody Errors> is a database which documents when samples have been mis-identified on paperwork, or switched during analysis. Custody errors may be our fault (primarily logged in wrong) or the client/customer's fault (incorrect coc), and are marked in the database as such. <Client/customer Communication> documents any technical conversations that has taken place with a client/customer. Such a conversation may be about sampling, how to store, analytical techniques, problems, *etc*. <Memos> is an incomplete record of memos distributed by management. <Methods> allows the details of a report method name or description (including the long explanation to be printed on each report) to be viewed or changed. Each change of the description is stored as a separate record, which, when combined with a stored description date for a report, allows an old report to be printed exactly the way it was originally, even though the description of the method or the method itself has changed in the meantime. <Grid Openings> changes the default area of TEM grid openings. <QA Assignments> prints the expected QA tasks for TEM for a given time period, to be used as a worksheet to perform those tasks. <Archive> starts a lengthy procedure which removes jobs and/or samples from their normal databases and places them in archive databases. This button is password protected, and it is imperative to make a backup copy of the entire database before archiving, and to archive when the database is not being used. Only the LIMS Specialist should be archiving anything, since other steps are involved besides merely pressing the button. This button is password protected to prevent unauthorized archiving. <Equipment> opens the *Equipment* form, which stores information about each piece of equipment at Fiberquant; maintenance records are stored as a sub-form. It is important to keep maintenance records up-to-date, since *Fqlim* checks this database to see if microscopes, hoods and pipetters have been calibrated. <Master Doc List> opens the database of controlled documents. <Supplies Qual> is a database of previously qualified suppliers for each material or reagent used in the lab. <Reagent Log> is the database which documents the receipt, log #, *etc*. of reagents received.

17.8. Summaries

The <Summaries> button on *Job Data Entry* opens another menu having numerous buttons that cause summarizing reports to be calculated or printed. <Job Log> prints the jobs received for a given time period. <Client/customer Statement> is a report for a given client/customer which shows the jobs invoiced and jobs paid during a given period. <Unpaid Invoices> will show all outstanding invoices for a client/customer. <FQ Business (Long)> will print a summary of jobs, samples received, invoices, payments made, accounts receivable and ageing information for each client/customer owing more than $500. <Project Revenues> attempts to guess what FQ Business will be. The remaining buttons, all marked <*** Summary> produce the QA Summaries for all the types of analysis. Some are printed monthly (PLM and TEM) while the remainder are printed quarterly. These summaries contain quality control charts, accuracy, precision and bias information, proficiency data, *etc*. The <Recalculate AA Control Limits> button starts a procedure that allows one to view current AA control limits for Pb and how many data points have occurred since the last recalculation, then recalculate; one can keep the recalculation or keep the old limits.

17.9. AA Runs

AA samples are unique at Fiberquant, in that they are not analyzed by job, but rather are analyzed by run. A run is defined as a group of data points which share the same calibration curve. Calibration data is stored in its own table (*AA Runs*) separate from *Jobs*. Clicking the <AA Runs> button opens form showing the *AA Runs* database. To make a new

run, use the new record navigation button, or click into the blank line at the bottom. Enter an analyst for the run, and an analyte. Double-clicking the analyte will fill in default values for the standard concentrations. When done, double-click the run number, and two forms will open: one (*AA Sample Select*) shows all samples in house not currently assigned to a run, and the other (*AA Run Makeup*), shows the samples in the current run being constructed (it will be empty to start). If a sample is double-clicked on *AA Sample Select*, it is assigned to the current run, disappearing from *AA Sample Select*, and appearing on *AA Run Makeup*. When a QC sample is required, it is added to *AA Run Makeup* by clicking the appropriate button on that form, and filling in the information requested. When the run is done being constructed, clicking <Print> creates a worksheet onto which the data will be written.

After data is collected, <AA Runs> is again clicked to show the runs in the database. This time, double-click any of the calibration curve coefficients in the same line as the desired run number to open the form *AA Run Calculations*. Fill in the observed absorptions for each of the calibration liquids, choose a 1^{st} or 2^{nd} order fit for the curve (the two buttons at the left). The calibration coefficients will be displayed on the chart of the calibration curve. Check that the curve is almost linear- if not, there may be a problem. Type in the coefficients and the R2 fit coefficient. Lock the data by clicking the button with the lock on it, the click <Exit>, which closes this form and opens the form *AA Run Results*. Enter into this form weights or volumes (if applicable) and the absorption for each sample. Clicking <Recalculate> should cause all the QA results to be calculated and stored in the proper places, although sometimes it may have to be clicked twice in a row, or a sticky line might have to be re-entered. <Print> produces a hard-copy of the form, to be stored in the AA files.

For each job to be printed, its page in *Job Data Entry* must be visited, and <Samples> clicked, just like every other job type. In this case, however, only the analyst, analysis date and run number need be entered, since the rest of the data is already in the computer.

17.10. Structure of the Programming

Many of the normal mathematical functions are included in MS Access as native functions. However, some functions in *Fqlim* are *user-defined functions*, written in the Visual Basic programming language. There are also *procedures*, some of which are quite lengthy, which are also written in Visual Basic. Many of these user-defined functions and procedures may be found by clicking <modules> in the main Access program window. There are two modules in *Fqlim*. One, *Initialization*, sets up the names of some variables and constants used in *Fqlim*, but contains no functions or procedures. The other, *LIM Procedures*, contains the functions and procedures, which may be viewed by opening the module. The module is viewed via the Visual Basic Editor, a separate program from *Access* which starts automatically when a module is opened, but which must be closed or ended independently of *Access*. With *LIM Procedures* open, a specific function or procedure may be viewed by choosing its name from the drop-down list at the right top of the window. It is beyond the scope of this description to explain *Visual Basic*, or what to do with the procedure being viewed.

In addition to the module *LIM Procedures*, programming may also occur within each form or report. To see this programming, highlight the specific form or report in the main Access window, then click <design>. The form will open in design view, which enables one to move fields around, or to add or subtract fields. Each object in the design, including the form itself, every field, and every section (*e.g.*, form header, detail) has a list of some 10-40 properties. The properties may be viewed by clicking an icon in the form of a hand holding a sheet of paper. The properties may designate, for example, the color of a field, whether it is locked to data, or what happens when you click it. For reports, the programming runs as the report is opened. For forms, some programming may run when as it opens, but often the programming within a form is activated when one of its fields is clicked. To see what programming will run when a field is clicked, highlight that field, then view its properties. Near the bottom of the properties table is the property *on click*. If there is an entry *[Event Procedure]* listed for the on click property, then programming is attached to that field. Put the cursor in the *on click* line, and then click the icon having three dots – you will be taken directly to the programming specific for that field. Each form may have numerous fields for which programming has been written, in addition to programming which runs when the form is opened, when it is displayed (*on current*), or when it closes. You may see all the programming for a form by clicking an icon that is a square with three colored jewels on it at the top of the design screen, or by scrolling up or down once you have opened the *Visual Basic Editor* by looking at one field's programming. Again, it is beyond the scope of this description to explain what to do with the programming.

17.11. QA Status

Since most, if not all, the quality assurance checks for a given type of analysis are stored in *Fqlim*, it can show the state of quality assurance activities.

On *Job Data Entry*, a button marked *QA Status* opens a form *QA Status*. This form has a general part at the top and six tabs below, each specific to a type of analysis, e.g., AA, PCM, etc. When the form first opens, the tabs are not visible; one must use the navigation bar at the right to go to the top of the tab sheet to see them. On the general portion, and on each page, are listed a number of QA objectives, the last time they were performed and when they are due. Most should be colored green, while ones overdue or coming up to be due will be colored red. The form is used to keep on top of QA objectives. A red colored item which indicates that an item is overdue requires action to correct it, while, if nearly due, requires watching. Often, a particular objective will be accomplished at the last minute, but never becomes overdue, since another part of the program will have not allowed an analyst to do anything until that objective has been met.

17.12. On-the-fly QA Checks

For the same reason as in #11, *Fqlim* can check the status of quality assurance objectives on-the-fly.

Fqlim may check whether equipment is usable. For example, a PLM analyst must enter the hood number they are using to analyze a sample. At the moment they enter its number, *Fqlim* checks 1) that the microscope at that hood has been aligned today, 2) that the microscope at that hood has been cleaned/had maintenance within the last year, 3) that the refractive index liquids at that hood have been calibrated within the last 90 days, 4) that the refractometer (used to calibrate refractive index liquids) has been calibrated within the last year, and 5) that a blank has been performed within the last 3 days.

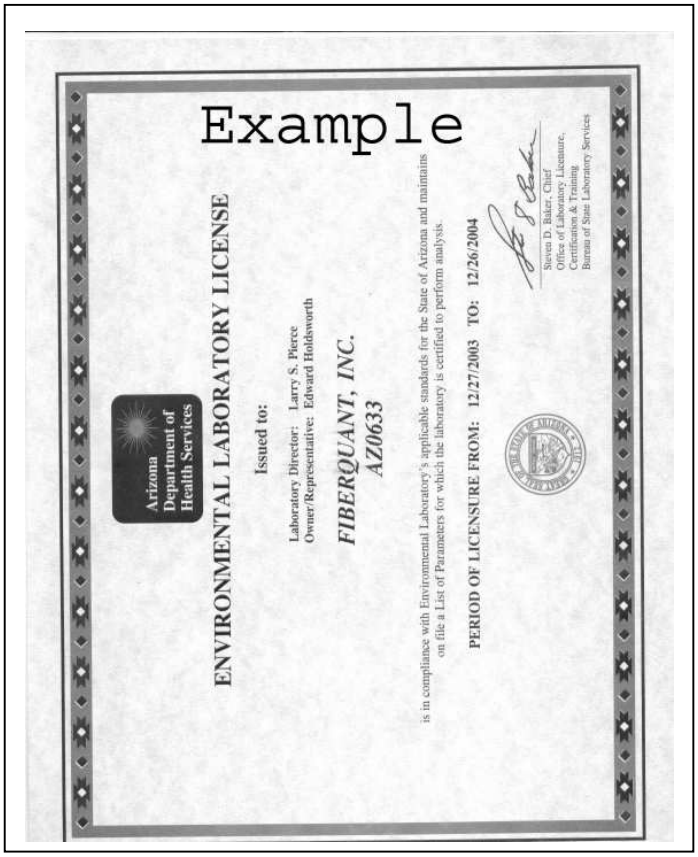
Likewise, Fqlim may check QA objectives specific to a person. For example, a spore trap analyst must enter their initials for each sample analyzed. At the moment they enter the initials, *Fqlim* checks 1) that they have identified >100 flash card images (a computerized internal proficiency test) within the last week, 2) have analyzed a reference slide today, and 3) whether they have any recounts past the grace period (1 day for same analyst, 3 days for different analyst).

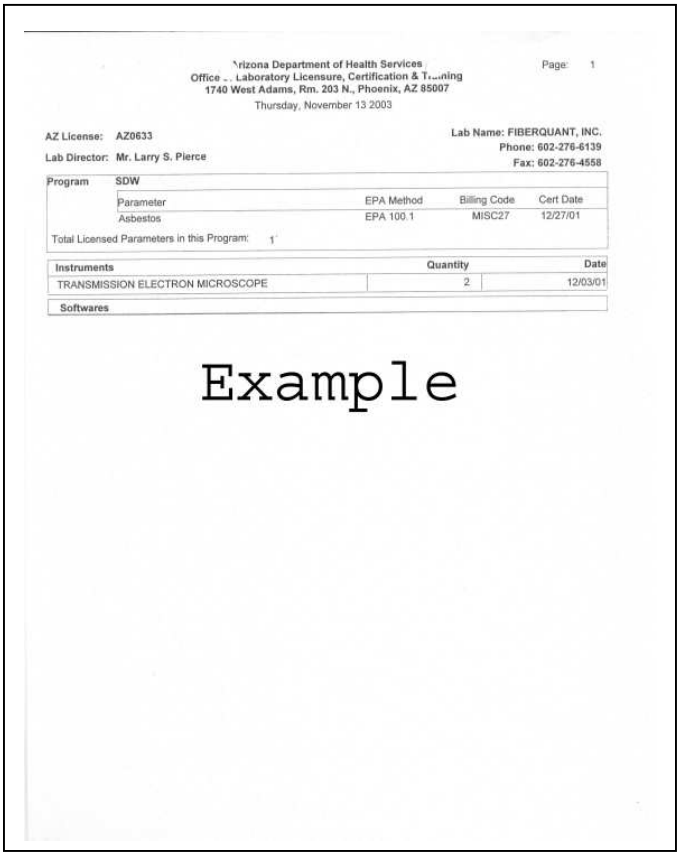
If any of the QA objectives that *Fqlim* checks for have not been met or are out of compliance, a pop-up message alerts the analyst that they have yet to perform that QA task. In cases where the QA task may take some time to perform, for instance, a TEM Energy Dispersive Performance Check (which may take several days to complete), a grace period is allowed, during which time the analyst can merely close the message box and continue with their analysis. For short tasks, and when the grace period has expired, the analyst may close the message box only to find that their entry (*e.g.*, initials or hood number) has been erased – they must perform the task before being allowed to enter their results. [**Trouble-shooting tip**: How to deal with a misbehaving QA check. First, you must find what *Fqlim* wants. Open the offending form in design mode, highlight the field that gave the message, open its properties, scroll down to the bottom of properties and you should see *Event Procedure* under the *After Update* property. Click the button with the three dots, and the Visual Basic Editor will open to the programming specific to the after update of that field. At this point, you must find the specific test giving the problem (they are named by comments, but you can also recognize the *message box* statement there that is the same as the one you saw on the screen). Read the test statement (it's only one line) to see which database it is checking. Then go to the main *Access* window where you can open that table by double-clicking its name under the *Tables* tab. Check this table manually to see if a proper entry is present. Many times, the date you thought you entered was a different year or different century than you thought, or the entry is flawed in some other way. In this case, close the table, VB Editor, and design form, try to re-enter the data correctly, and see if that fixes the problem. If the problem persists, there may be a glich in your program – copy the master *Fqlim* from Larry's computer. If the problem is still present, try entering a line directly into the table. If that does not work, or you are prevented from entering directly into the table, then the database has been corrupted. The LIMS Specialist must fix it.]

The goal of *Fqlim* is to remind and eventually force responsible parties to perform their QA tasks in a timely manner. Thus, *Fqlim* assures >95% (usually 100%) compliance with its QA objectives.

Addendum:

Example AZ Licenses





United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 101031-0

Fiberquant, Inc.

Phoenix, AZ

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

BULK ASBESTOS FIBER ANALYSIS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2013-07-01 through 2014-06-30

Effective dates

DEPARTMENT OF COMMERCE * UNITED STATES OF AMERICA *

For the National Institute of Standards and Technology

NVLAP-01C (REV. 2009-01-28)

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 101031-0

Fiberquant, Inc.
Phoenix, AZ

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

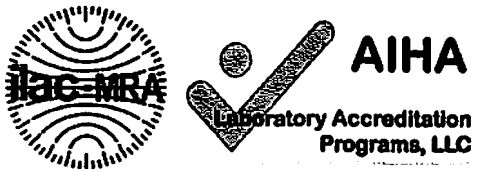
AIRBORNE ASBESTOS FIBER ANALYSIS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2013-07-01 through 2014-06-30
Effective dates

For the National Institute of Standards and Technology

NVLAP-01C (REV. 2009-01-28)



AIHA Laboratory Accreditation Programs, LLC

acknowledges that

Fiberquant Analytical Services

5025 S. 33rd Street, Phoenix, AZ 85040

Laboratory ID: 101593

along with all premises from which key activities are performed, as listed above, has fulfilled the requirements of the AIHA Laboratory Accreditation Programs (AIHA-LAP), LLC accreditation to the ISO/IEC 17025:2005 international standard, *General Requirements for the Competence of Testing and Calibration Laboratories in t*he following:

LABORATORY ACCREDITATION PROGRAMS

✓	**INDUSTRIAL HYGIENE**	Accreditation Expires: 03/01/2015
✓	**ENVIRONMENTAL LEAD**	Accreditation Expires: 03/01/2015
✓	**ENVIRONMENTAL MICROBIOLOGY**	Accreditation Expires: 03/01/2015
☐	**FOOD**	Accreditation Expires:
☐	**UNIQUE SCOPES**	Accreditation Expires:

Specific Field(s) of Testing (FoT)/Method(s) within each Accreditation Program for which the above named laboratory maintains accreditation is outlined on the attached **Scope of Accreditation**. Continued accreditation is contingent upon successful on-going compliance with ISO/IEC 17025:2005 and AIHA-LAP, LLC requirements. This certificate is not valid without the attached **Scope of Accreditation**. Please review the AIHA-LAP, LLC website (www.aihaaccreditedlabs.org) for the most current Scope.

Larry S. Pierce
Chairperson, Analytical Accreditation Board

Cheryl O. Morton
Managing Director, AIHA Laboratory Accreditation Programs, LLC

Revision 13: 03/12/2013

Date Issued: 03/29/2013

AIHA Laboratory Accreditation Programs, LLC
SCOPE OF ACCREDITATION

Fiberquant Analytical Services
5025 S. 33rd Street, Phoenix, AZ 85040

Laboratory ID: **101593**
Issue Date: 03/29/2013

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or withdrawal of accreditation.

Industrial Hygiene Laboratory Accreditation Program (IHLAP)

Initial Accreditation Date: 07/01/1991

IHLAP Scope Category	Field of Testing (FoT)	Technology sub-type/ Detector	Published Reference Method/Title of In-house Method	Method Description or Analyte *(for internal methods only)*
Asbestos/Fiber Microscopy Core	Polarized Light Microscopy (PLM)		EPA 600/R-93/116	
			EPA/600/M4-82-020	
	Phase Contrast Microscopy (PCM)		NIOSH 7400	
			OSHA Reference Method – 29 CFR 1926.1101 App A	

A complete listing of currently accredited Industrial Hygiene laboratories is available on the AIHA-LAP, LLC website at: http://www.aihaaccreditedlabs.org

AIHA
Laboratory Accreditation Programs, LLC

AIHA Laboratory Accreditation Programs, LLC
SCOPE OF ACCREDITATION

Fiberquant Analytical Services
5025 S. 33rd Street, Phoenix, AZ 85040

Laboratory ID: **101593**
Issue Date: 03/29/2013

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or withdrawal of accreditation.

The EPA recognizes the AIHA-LAP, LLC ELLAP program as meeting the requirements of the National Lead Laboratory Accreditation Program (NLLAP) established under Title X of the Residential Lead-Based Paint Hazard Reduction Act of 1992 and includes paint, soil and dust wipe analysis. Air analysis is not included as part of the NLLAP.

Environmental Lead Laboratory Accreditation Program (ELLAP)

Initial Accreditation Date: 01/18/1995

Field of Testing (FoT)	Method	Method Description *(for internal methods only)*
Paint	EPA SW-846 3050B	
	EPA SW-846 7420	
Soil	EPA SW-846 3050B	
	EPA SW-846 7420	
Settled Dust by Wipe	NIOSH 7082 Modified	
Airborne Dust	NIOSH 7082	

A complete listing of currently accredited Environmental Lead laboratories is available on the AIHA-LAP, LLC website at: http://www.aihaaccreditedlabs.org

AIHA
Laboratory Accreditation Programs, LLC

AIHA Laboratory Accreditation Programs, LLC
SCOPE OF ACCREDITATION

Fiberquant Analytical Services
5025 S. 33rd Street, Phoenix, AZ 85040

Laboratory ID: **101593**
Issue Date: 03/29/2013

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or withdrawal of accreditation.

Environmental Microbiology Laboratory Accreditation Program (EMLAP)

Initial Accreditation Date: 06/01/2003

EMLAP Category	Field of Testing (FoT)	Method	Method Description *(for internal methods only)*
Fungal	Air - Direct Examination	ASTM D7391	SPCT
		ASTM D7391	SPCT1
		Modified ASTM D7391-09	SPCT2
	Bulk - Direct Examination	In house: WP MYCO-4 Analysis of Bulk Samples	SPB
	Surface - Direct Examination	In house: WP MYCO-5 Analysis of Direct Count Samples	SPT

A complete listing of currently accredited Environmental Microbiology laboratories is available on the AIHA-LAP, LLC website at: http://www.aihaaccreditedlabs.org

Arizona Department of Health Services

ENVIRONMENTAL LABORATORY LICENSE

Issued to:

Laboratory Director: **Larry S. Pierce**
Owner/Representative: **Michael A. Breu**

Fiberquant Analytical Services
AZ0633

is in compliance with Environmental Laboratory's applicable standards for the State of Arizona and maintains on file a List of Parameters for which the laboratory is certified to perform analysis.

PERIOD OF LICENSURE FROM: 12/27/2012 TO: 12/26/2013

Steven D. Baker, Chief
Office of Laboratory Licensure & Certification
Bureau of State Laboratory Services

Arizona Department of Health Services
Office of Laboratory Licensure, Certification & Training
250 North 17th Avenue, Phoenix, AZ 85007

Wednesday, September 13 2006

AZ License: AZ0633

Lab Director: Mr. Larry S. Pierce

Lab Name: Fiberquant, Inc.
Phone: (602) 276-6139
Fax: (602) 276-4558

Program SDW

Parameter	EPA Method	Billing Code	Cert Date
Asbestos	EPA 100.1	MISC27	12/27/01

Total Licensed Parameters in this Program: 1

Instruments	Quantity	Date
TRANSMISSION ELECTRON MICROSCOPE	2	12/03/01

Softwares

TEXAS DEPARTMENT OF STATE HEALTH SERVICES

FIBERQUANT INC DBA
FIBERQUANT ANALYTICAL SERVICES

is certified to perform as a

Asbestos Laboratory
PCM, PLM, TEM

in the State of Texas within the purview of Texas Occupations Code, chapter 1954, so long as this license is not suspended or revoked and is renewed according to the rules adopted by the Texas Board of Health.

DAVID LAKEY, M.D.
COMMISSIONER OF HEALTH

License Number: 300395

Expiration Date: 12/28/2013

Control Number: 95788

(Void After Expiration Date)

VOID IF ALTERED NON-TRANSFERABLE

United States Environmental Protection Agency

This is to certify that

Fiberquant Analytical Services

has fulfilled the requirements of the Toxics Substance Control Act (TSCA) Section 402, and has received certification to conduct lead–based paint activities pursuant to 40 CFR Part 745.226

In the Jurisdiction of:

Arizona

This certification is valid from the date of issuance and expires **February 11, 2015**

AZ-2033-3

FEBRUARY 12, 2012
Issued On

Adrienne Priselac, Manager, Toxics Office

Communities and Ecosystems Division

United States Environmental Protection Agency

This is to certify that

Fiberquant Analytical Services

has fulfilled the requirements of the Toxics Substance Control Act (TSCA) Section 402, and has received certification to conduct lead–based paint activities pursuant to 40 CFR Part 745.226

In the Jurisdiction of:

Region 9 Tribal Lands

This certification is valid from the date of issuance and expires **February 11, 2015**

T9-2033-4

FEBRUARY 12, 2012
Issued On

Adrienne Priselac, Manager, Toxics Office

Communities and Ecosystems Division

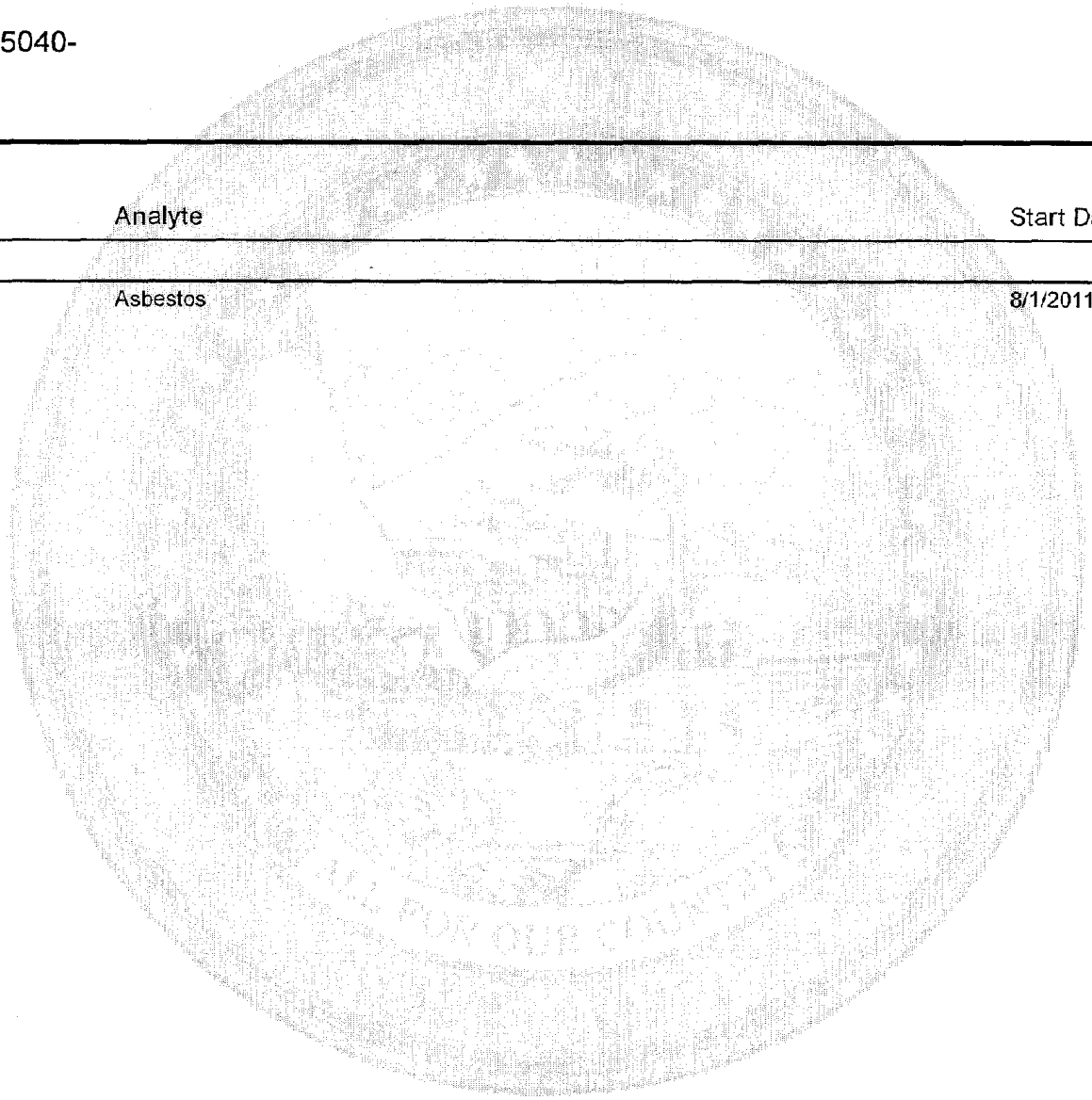
State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: *AZ00063* **Attachment to Certificate Number: AZ000632011-1** **Expiration Date: 7/31/2012**

Fiberquant Analytical
5025 S. 33rd St. Phoenix, AZ 85040-

Matrix: ***SDWA (Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
Discipline Chemistry				
EPA 100.1	Asbestos	8/1/2011	7/31/2012	Certified



Disclaimer: A laboratory that is certified or approved has established that they have the ability to implement a quality control program in accordance with the appropriate Federal or State regulations or statutes. It is the certified laboratory's responsibility to provide their client the most current certified parameter list. Contact LCP to verify certification status.

STATE OF NEVADA
Department of Conservation & Natural Resources
DIVISION OF ENVIRONMENTAL PROTECTION
Brian Sandoval, Governor
Leo M. Drozdoff, P.E., Director
Colleen Cripps, Ph.D., Administrator

July 26, 2012

Fiberquant Analytical
5025 S. 33rd St.
Phoenix, AZ 85040-

RE: Nevada Environmental Laboratory Certification 2-month Extension.

Dear Sir or Madam:

Since our application was not available in a timely manner, the State of Nevada is extending your laboratory's 2011-2012 Nevada scope until September 30, 2012. We have received your application. Once you have been invoiced and we receive your fees, we will issue either a 1 year extension or your 2012-2013 scope.

This will serve as official notice to you and your clients.

Be advised this letter is only valid as long as your laboratory maintains compliance with State of Nevada regulation NAC 445A.0552 to .067, NAC 445A.542 to .54296 and/or NAC 459.96902 to .9699.

Failure to do so will result in invalidation of any data submitted to the Nevada Department of Environmental Protection.

If you or your clients have any questions please contact Donald LaFara at 775-687-9491.

Sincerely,

Don LaFara

Donald LaFara, Laboratory Certification Officer
Program Manager, Laboratory Certification Program
State of Nevada Division of Environmental Protection

State of California—Health and Human Services Agency
California Department of Public Health

RON CHAPMAN, MD, MPH
Director & State Health Officer

EDMUND G. BROWN JR.
Governor

March 22, 2012

Larry S. Pierce
Fiberquant Analytical Services
5025 South 33rd Street
Phoenix, AZ 85040

Dear Larry S. Pierce: Certificate No. 2801

This is to advise you that the laboratory named above has been granted an interim certificate pursuant to California Health and Safety Code (HSC), Division 101, Part 1, Chapter 4, Section 100850(d).

The Fields of Testing for which this laboratory has been granted interim certification is shown in the enclosed "Fields of Testing". The Interim certificate shall remain in effect until **March 31, 2013** or until a certificate pursuant to HSC 100825(a) is issued.

Your laboratory is required to participate in the appropriate performance evaluation studies and to perform acceptably in such studies as stated in HSC 100870 and Title 22 of the California Code of Regulations Section 64809. Continued compliance with the Environmental Laboratory Accreditation Program Branch statutes and regulations is required for maintaining the interim certification status.

Any changes in laboratory location or structural alterations, which may adversely affect the quality of analysis in the fields of testing for which the laboratory has been granted certification, require prior notification. Notification is also required for changes in ownership or laboratory director within 30 days after the change (HSC 100845(b) and (d)).

If you have any questions, please contact Bill Walker at (818) 551-2012.

Sincerely,

Fred Chosbe for

George C. Kulasingam, Ph.D., Chief
Environmental Laboratory Accreditation Program Branch

Enclosure

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM
Accredited Fields of Testing

Fiberquant Analytical Services
5025 South 33rd Street
Phoenix, AZ 85040
Phone: (602) 276-6139

Certificate No.: 2801
Renew Date: 3/31/2013
INTERIM

Field of Testing: 121 - Bulk Asbestos Analysis of Hazardous Waste

121.010	001	Bulk Asbestos	EPA 600/M4-82-020	Interim

As of 3/22/2012 , this list supersedes *all* previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

SilverState
Analytical Laboratories

Statement of Qualifications

EnviroTech
Quality Environmental Products
Exclusive Nevada Dealer

4587 Longley Lane, No. 2
Reno, NV 89502

3638 E. Sunset Road, Suite 100
Las Vegas, NV 89120

Table of Contents

Company Profile

Company History and Description

Mission Statement:

To provide the best value for high quality analytical data, environmental field equipment, and customized client service.

Silver State Analytical Laboratories (SSAL) is a full-service analytical testing laboratory dedicated to providing our clients with unsurpassed customer service and real world solutions. We want you to see us as an extension of yourself, supporting you and dedicated to your company's mission - doing everything possible to meet your service needs in a high quality, timely, and cost-effective manner. SSAL maintains full time laboratory facilities in Las Vegas and Reno, Nevada and has partnership service providers such that we can support projects throughout Nevada and all adjoining states.

Silver State Analytical Labs offers you:

- Environmental testing for water, wastewater, soil, and air under SDWA, CWA, RCRA, UST, OSHA and other programs.
- Soil and construction material chemical testing following ASTM, AASHTO, AWWA, DOT, Caltrans and other standards. Building Permit compliance reports.
- Microbiological testing for health departments, food processing, commercial, resort, and residential needs.

- Minerals, process industries, and manufacturing analytical services.
- Field equipment, supplies and services for complete project support.

Established in 1997, SSAL's track record of service and solutions for our clients allowed us to celebrate 15 years as a professionally managed company in 2012.

From our beginnings as a local Las Vegas lab analyzing samples for leaking petroleum products, we expanded to support municipal water and wastewater programs and other regional needs, and

now we provide a full complement of analytical and field support services to many industries in the regions near our two service hubs of Las Vegas and Reno.

During this time, SSAL has taken steps and acquired additional assets to provide our clients with the best possible support.

- In 2005, our Reno Laboratory was opened to provide services locally to the Northern Nevada and Lake Tahoe area.
- In 2008, our Las Vegas Laboratory moved to larger facilities, including additional equipment capabilities.
- In 2011, SSAL purchased assets from Atlas Consultants. Atlas was a 30-year Las Vegas materials chemistry lab which ceased operations.
- In 2011, SSAL also procured the only commercially owned Dionex 5000 ICS Ion Chromatograph in Nevada. This advanced instrument allows ultra-low detection limits for anions, hexavalent chromium, perchlorate and other compounds of emerging concern.

- In 2012 our Reno laboratory moved to a new and larger location to better serve our clients and house our Enviro-Tech equipment sales and rentals. As an exclusive dealer for Enviro-Tech field equipment and supplies (www.envirotechonline.com), we now offer one-stop solutions for field sampling and testing, sample collection, analytical testing and certified reporting.

SSAL takes pride in our ability to listen to our clients and to develop services and programs to meet those identified needs. In the time ahead, we plan to continue to develop our capabilities and enhance our services to clients in our never ending quest for excellence and value.

SSAL routinely completes projects in Nevada and the adjacent states of California, Arizona, and Utah. We have long-term contracts in Washington State, and have successfully completed multiple projects in Idaho, Texas, New Mexico and Hawaii.

Benefits of Using Silver State Analytical Laboratories/Enviro-Tech

SSAL operates Nevada Division of Environmental Protection (NDEP) certified laboratories, equipment sales and rental centers, and full time customer service facilities in Las Vegas and Reno, Nevada.

SSAL works with a partnership of network laboratories throughout the country to perform a complete complement of testing services for the most demanding projects as well as routine sampling and compliance monitoring work. We offer expanded laboratory capabilities with the attention to customer service and responsiveness only a small, locally focused laboratory can provide.

Silver State Analytical Laboratories offers:

- Local – State and EPA Certified Laboratories - NV-00905 (Las Vegas) and NV-00931 (Reno)
- Certification from Clark County, NV Building Department with a rare certificate in soil chemistry testing
- Full analytical services – recently upgraded test instruments – largest commercial lab in Southern Nevada
- Customized sampling & testing programs – free consultations
- Free pick-up and delivery services (in metro areas) – no out-of-area shipping
- 5 Day standard turnaround times – rush services available
- Exclusive Nevada dealer of Enviro-Tech; field equipment sales/rental
- Project research, support and test method development services
- Redundant test equipment and cross-trained staff offers extreme program dependability, including 6 day per week service schedules
- Federal Registration on CCR as a small business (DUNS No. 11-799-7002)

Clients like using Silver State Labs and Enviro-Tech because we provide:

- One-stop service for field equipment, sampling, courier service and analytical testing which streamlines project coordination and makes their operation more efficient.
- Service locations in Las Vegas and Reno.
- A unique willingness to support projects in rural Nevada, and adjacent States, provides support for our clients' projects anywhere in the region.
- Robust in-house testing capabilities, combined with a thorough and reliable group of specialty partnership labs which means clients do not need to source and contract multiple labs, split samples, or worry about chasing down analytical reports from multiple labs.

- Willingness to review and consult on project analytical details and requirements. Defining project needs ahead of time helps ensure that project needs, test methods, reporting limits and other details are correct and acceptable the first time out.
- Specialized reporting formats and delivery services to provide a professional, efficient and customized program that is reliable and worry free while making clients look professional and impressive to their stakeholders.
- Standard and reliable turnaround times and a willingness to expedite services to ensure that the client can reliably get data when they need it.
- Convenience of being a local equipment supplier that will work with them on specific project applications.
- Stock of field testing equipment and supplies, and the ability to special order items individually for each client's project. This saves time in sourcing, costs of rentals and shipping.
- SSAL's registration as a small business in the Federal CCR allows our clients to meet contracting goals and opens many more doors to projects they would not otherwise be able to pursue. Clients receive preference points and consideration on government contracts by using SSAL – for credit in using small businesses and possibly for contract set asides for only small businesses.

Laboratory Services and Capabilities

Introduction

Silver State Analytical Laboratories offers a full line of in-house testing services supporting multiple industries. While environmental testing and compliance is SSAL's primary focus, we provide analytical tests for QA/QC, process control, and product specification to many industries using advanced testing methods and equipment.

We have EPA/NDEP assigned laboratory numbers of NV-00905 (Las Vegas) and NV-00931 (Reno) and a rare certificate in soil chemistry testing from Clark County, NV Building Department.

SSAL follows EPA, NDEP, NELAP, ASTM, AASHTO, OSHA, AWWA, WEF, AHPA, NSF, and other standards issuing association protocols.

We take pride in providing unsurpassed customer service by providing a single point of contact for each client's project. This supports the client by providing assistance in compiling data for complex suites of certified analytical testing involving multiple specialty labs. Using our internal and external resources, SSAL provides data in a quality, timely, and cost-effective manner.

Our capabilities include analytical support and third-party QA/QC for a variety of process, mineral, energy and manufacturing industries. We typically use ASTM or industry specific test methods specific to our analytical instruments to provide customized testing and reporting services.

Additionally, our line of environmental products, field test equipment and safety gear available through our Enviro-Tech dealership allows us to provide one-stop support for your field project and laboratory testing.

Value Added Services

- Customized sampling, testing and reporting protocols. EDD available.
- Free bottle kits, local pick-up and delivery.
- Method development – consultations with regulators.
- One-stop shopping for field equipment and analytical services
- Expert advice from analytical chemists, environmental specialists and former industry and utility executives.
- NO WORRY sample scheduling, test results, and regulatory submittals. (24/7 support available)

Industry Support Services

Environmental - Engineering, Geology, and Environmental Services

- Site investigations
- Water and mineral resources explorations
- Research and development
- Permit applications and monitoring tests
- Waste disposal tests
- Remediation performance testing and compliance

Engineering Design and Construction

- Water quality and waste characterization studies
- Soil chemistry - sulfates, solubility, resistivity etc…
- Agronomy and soil fertility testing
- Cement, aggregate, stucco, concrete reactivity and related chemistry
- Potable water line bacteria and chlorination testing
- VOC testing – tanks, pipes, miscellaneous coatings, etc…

Municipal Water, Wastewater and Storm Water

- Discharge permit testing and compliance
- Drinking water quality testing
- Industrial pre-treatment program testing
- Storm water monitoring programs
- Process control and improvement studies
- Corrosion and odor control support testing

Minerals, Mining, Process and Energy Industries

- Waste discharge permit testing
- Environmental permitting and compliance testing – meteoric water mobility
- Third-party product or process QA/QC data
- Specialized chemical analyses for process control
- Product specification testing
- Fracking and geothermal water and residue testing

Food Processing and Manufacturing Industries

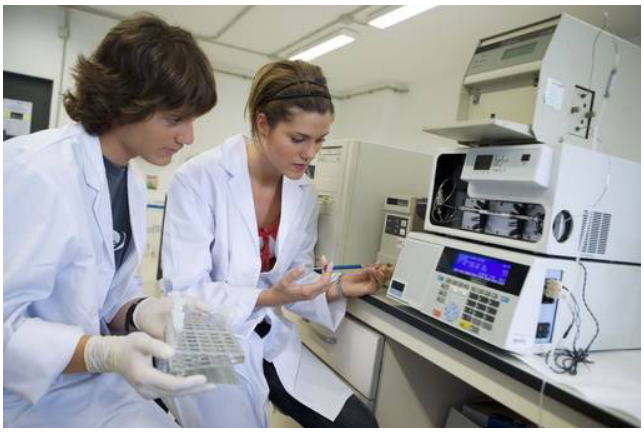
- Prep-table sanitizing tests – microbiological
- Product purity tests
- Chemical characterizations
- Industrial hygiene and safety support services

Commercial, Resort and Residential

- Pool water chemistry, purity - including advanced microbiological testing
- Well water quality test suites – health department submittals
- Waste discharge permits

- Solid waste disposal support services
- Internal plumbing and process line quality testing
- Lake water quality tests for golf course and resort lakes and ponds

Analytical Capabilities



Silver State Analytical Laboratories offers a full array of in-house testing capabilities following industry protocols and certified test methods. We are continuously adding to our capabilities with new methods, certifications, and equipment to meet the needs of our clients.

In addition to the specific test groups listed below, which are performed in-house, SSAL maintains a network of national partner laboratories for specialized testing in a wide variety of analytical testing fields. These partnerships include favorable pricing and turnaround times for: radiochemistry, dioxin, specialty pesticides/herbicides, algae speciation, insect identification, virus density counts, x-ray fluorescence, mineral fire assays, asbestos, air toxics using summa canisters, and other specialized testing needs.

Environmental – Water, Wastewater, Air, and Soil

SSAL is equipped and proficient in conducting analytical chemistry tests for chemical constituents in water, soil, sludge, products and air. This typically is for compliance with regulations related to the Clean Water Act – CWA, Safe Drinking Water Act – SDWA, Resource Conservation and Recovery Act – RCRA, Underground Storage Tanks – (UST) and related environmental programs. We also support construction, manufacturing, industrial, food, and mining businesses. While most of our tests reference EPA methods and protocols, we are also proficient in tests adopted by ASTM, AASHTO, DOT, Caltrans, Standard Methods, IAS, and others.

Typical analyses performed in-house include:

- Biological Oxygen Demand
- Chemical Oxygen Demand
- Coliform bacteria
- Nitrogen – all forms
- Phosphorous
- General minerals
- General physical
- Solids – Total, Suspended, Dissolved
- Anions and Cations
- Metals - by ICP
- Volatile Organic Compounds
- Semi Volatile Organic Compounds

- Total Petroleum Hydrocarbons (GRO, DRO, ORO)
- BTEX/MTBE
- Chrome 6 – colorimetric or low level on our new DIONEX - ICS 5000
- Perchlorate – low level on our new DIONEX - ICS 5000
- Mercury
- Cyanide
- Flash Point
- Phenols
- Oil and Grease including SGT process
- Dissolved Sulfides
- Other tests

Microbiological

SSAL has a dedicated microbiological lab and is capable of performing a host of microbiological tests in support of health, environmental, food safety or product quality requirements.

- Total, Fecal, and E. coli coliform bacteria
- HPC
- Legionella
- Listeria
- Pseudomonous
- Staph
- Iron and sulfide reducing bacteria
- Chlorophyll content
- Other tests

Soil Chemistry, Materials and Agronomy Tests

We have dedicated lab space for soil and material (concrete, aggregate, other) chemical tests with fast turnaround times for maximum support of time critical projects. Our Las Vegas soil laboratory is also certified by the Clark County Building Department. Capabilities include:

- Water soluble sodium, sulfate and sodium sulfate salts.
- Total solubility
- Chlorides
- pH
- Reduction – Oxidation Potential
- Resistivity tests following NDOT, AASHTO and Caltrans
- Corrosivity test suites
- Concrete reactivity tests
- Cement content tests
- Gypsum test suites
- Meteoric water mobility procedure tests
- Trace metal content – by ICP
- Agronomy and soil fertility test suites with recommendation reports

Major Equipment

- Gas Chromatograph Ovens – HP 5890 II (5)
- Mass Spectrometers – HP 5971/5972 (4)
- Auto Samplers – HP and Orion Archon (6)
- Concentrators – Tekmar 2000 (2)
- SRI 8610C GC System complete (1)
- Flame Ionization Detection System (1)
- ICP – Perkin Elmer (1)
- Leeman – Mercury Analyzer – CVAA (1)
- Flame AA unit (1)
- Flame Photometer (1)
- Flash Point tester (1)
- Horizon 7000/7050 Extractors (8)
- Ion Chromatograph – Dionex DX 120 (1)
- Ion Chromatograph – Dionex ICS 5000 – NEW (1)
- Spectrometer – Gynesis II (2)
- TKN testing equipment
- Cyanide test equipment
- Titration equipment, reagents etc…
- Fume hoods (4)
- Scales and balances (6)
- Drying ovens (4)
- High temperature muffle furnaces (2)
- Incubators and BOD system (3)
- pH and ion specific electrodes and meters (8)
- Miller Box resistivity meters and boxes (3)
- Computer hardware and software
- Air compressors
- Vacuum pumps
- Field composite samplers (5)
- Field sampling and test equipment
- Miscellaneous field and lab equipment
- Service Trucks – 3 total

Facilities

Silver State Analytical Laboratories, Inc. operates from two professional laboratory, equipment stocking, and customer service complexes. From these facilities our fleet of vehicles and other strategic business partners are able to provide excellent service throughout Nevada and the adjacent states.

3638 E. Sunset Road, Suite 100, Las Vegas, NV 89120

Conveniently located just east of McCarran International Airport, this location is approximately 3500 square feet of office and laboratory space and is specifically designed for commercial laboratory work. Additional power and ventilation equipment provides a reliable and safe environment for quality and efficient processing of samples. Separate lab spaces for microbiology, metals, VOC's, SVOC's, TPH, soil chemistry, Enviro-Tech product storage, and general office space creates efficient work flow and minimizes any chances of cross contamination.

4587 Longley Lane, No. 2, Reno, NV 89502

This facility is 2000 square feet of space specifically set up for environmental laboratory services. It also serves as our local sales and customer service office and the service location for the Enviro-Tech Services Company product line. Silver State Analytical moved into this space from a smaller Reno location in 2012 with the goal of expanding services to the local market.

Enviro-Tech Equipment and Supplies

Introduction

Beginning in 2012 SSAL began to offer quality environmental products from Enviro-Tech Services Company through our Reno and Las Vegas facilities. We are the exclusive Nevada dealer for the full line of Enviro-Tech products including groundwater sampling pumps, water quality test instruments, water level meters, interface meters, air monitoring equipment, PID's, soil and sediment sampling tools, and geological equipment. We also offer a full line of industry leading health and safety supplies.

Our equipment manufacturers include industry leaders such as Solinst, Heron, Grundfos, Proactive Pumps, QED Pumps, GeoTech, Rae Systems, Sensidyne air monitors, GasTech, LandTech, Oakton, Myron Meters, La Motte, Horiba, YSI, AMS, Honeywell, Ryan Herco, and many others.

SSAL continues to expand our product offerings based on customer requests. With our exclusive manufacturer and reseller agreements, you are assured our prices are at or below manufacturer direct prices. We maintain stocking, sales, rental, and service locations with trained representatives in Reno and Las Vegas, Nevada. We also provide service throughout the entire state of Nevada.

Environmental, Geotechnical, and Geological Equipment

Water Sampling Equipment

SSAL/Enviro-Tech maintains a large inventory and selection of bailers, filters, pumps, surface water samplers, and accessories for groundwater and surface water sampling applications. We stock bladders and grab plates for bladder type pumps and all required hoses, tubing and fittings, 12 Volt battery packs, adapters or generators as needed.

Water Quality Instruments

We have a full line and large selection of water quality test instruments including single and multiple parameter meters with or without flow through cells by industry leading manufacturers. Test samples in the field for pH, temp, DO, TDS, ORP, chlorine, turbidity, salinity, and many other parameters.

Soil Sampling Equipment

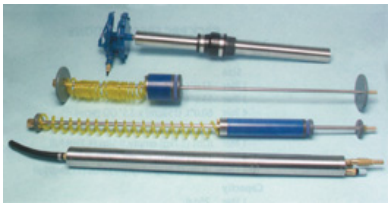
Our stock of soil sampling equipment includes Mini, Basic, and Environmental Soil Sampling Kits; Mini Core Sampling Kits and Stainless Steel Core Sampling Mini Kits; Flighted Augur Kits and Hollow Stem Auger Kits; Gas Vapor Probe Systems and Retract-A-Tip Gas Vapor Probes; Soil Augers and Soil Probes; Standard, Split and Multi-Stage Core Samplers; Sludge and Discrete Sludge Samplers; Cross Handles and Extensions; Plastic and Stainless Steel Scoops; Soil Sample Liners; and Soil Sampling Accessories.

Air Monitoring Equipment

PID's – photo ionization detectors for VOC's, photoionization w/multi-gas, single and dual gas monitors. Multi-gas monitors for confined space safety and other monitoring needs. Gas detection pumps and tubes, particulate monitors, landfill gas monitors, anemometers, calibration gases, regulators, tedlar sampling bags, and instrument carrying cases. Popular models include QRae, MultiRae, MiniRae and others.

Remediation Products

Supplies for remediation work in wells: product skimmers, passive hydrogen recovery, and purging and sampling pumps, and other remediation products.



Geology Field Equipment

We support the geology profession with specialized products: hand lenses, specialized compasses, sample bags, colored flagging tape, rock and soil charts, log books, field desks, acid bottles, picks, rock hammers and other accessories.

General Field and Safety Supplies

Accessories for a complete and successful field operation: tyvek coveralls, respirators, hard hats, earplugs, safety monitors, confined space entry equipment, safety glasses, traffic safety, gloves of all types and sizes, PVC well casings and screens, PVC fittings, surge blocks, well plugs, locks, monitoring well caps and collars, drums, soil sample liners, generators and miscellaneous tools.

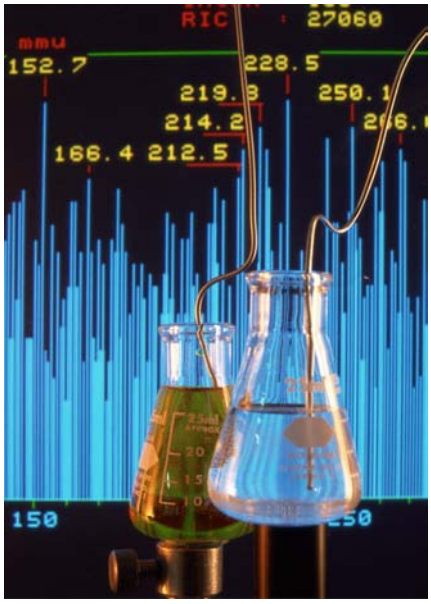
Rentals

We maintain extensive rental fleets in Reno and Las Vegas for local delivery or out of area shipment. Each rental includes fresh batteries, calibration, carrying cases, and pre-rental checkout.

Quality Management System

Overview

Silver State Analytical Laboratories has developed an effective Quality Management System (QMS) that exceeds the requirements of the Nevada Division of Environmental Protection (NDEP) requirements promulgated from the USEPA. Our QMS also exceeds the Clark County (NV) Building Department and other agency and industry standards. Our QMS is a systematic approach combining rigid written procedures, staff training, a proactive testing and audit program and a closed loop corrective action program geared towards continuous improvement.



We have developed and published a Quality Assurance Program (QAP) manual that has been reviewed and approved by accreditation agencies. By providing staff with extensive training in the QAP's application and utilizing a proactive approach to self-audits and improvements, we offer high quality data that meets or exceeds industry quality standards.

Our QMS and QAP are designed to meet the needs of our clients while fulfilling accreditation agencies and licensing requirements. Our policy is to implement practices and procedures that lead to the generation of high quality data, on-time, with maximum customer responsiveness while meeting regulatory compliance.

It is SSAL's policy to:

- Generate data that are scientifically sound and legally defensible.
- Comply with National Environmental Laboratory Accreditation Conference (NELAC) standards, and specific State standards as required.
- Provide high quality testing services in compliance with federal, state, local agency and industry regulatory requirements.

Some specific elements of SSAL's quality program include:

- Method validations – Each new method is tested and validated for proper implementation, quality, use, and repeatability.
- Standard Operating Procedures (SOPs) - Procedures are developed for each test method and updated at least annually.
- Initial demonstrations of competency – Each analyst is trained and required to pass competency tests on each test method. This process is documented and reviewed.
- Self-audits – Periodic self-audits are conducted by chemists to check and validate data

quality. Internal corrective actions are taken to address any system weaknesses.

- Method detection level studies – Chemists complete MDL studies that are reviewed and adopted for use by the Laboratory Director.
- Periodic ethics training – Each analyst and chemist is required to take initial and refresher training on environmental laboratory ethics. Silver State Labs is superior in its implementation of this ethics program, as suggested by NDEP.
- Continued training and education – Analysts receive periodic training on analytical methods and techniques.
- Performance Testing Programs – Each analyst participates directly in the Performance Testing program.

Quality Commitment

It cannot be overstated how SSAL is committed to high quality data that meets or exceeds all regulatory requirements. We are members of The NELAC Institute (TNI) and follow NELAC standards and guidelines. We practice continual monitoring, proactive corrective action, and improvements in our methods and processes. We take our role and responsibility of providing quality data that is legally defensible seriously. We know our clients are depending on us.

SSAL management regularly participates in the Quality Management System process. Managers may directly review data for quality and consistency and follow up directly with staff and clients to ensure quality and reliable data. Additionally, managers at SSAL will conduct self-audits of our internal processes by checking analyst performance, log books and calculation sheets. Such self-audits are documented with action items for implementation by the staff. Managers are in regular contact with clients and seek feedback from them on the quality of data and quality reporting requirements.

As appropriate, managers at SSAL will direct process and method changes to be made in the approach, method or reporting format to ensure a high level of quality data reporting. Managers will also recommend and implement, as needed, additional training for staff, equipment procurement or other steps to ensure all data quality requirements are being met. SSAL is committed to generating quality data and our employees and managers are empowered to make it happen.

Performance Testing Programs

SSAL utilizes performance testing samples to ensure that analyses meet industry standards. Each analyst performing compliance tests in the laboratory participates in the Performance Testing (PT) program. SSAL uses an independent third-party PT program supply firm, as approved by NDEP, to administer the testing program.

Test results from each round of blind testing are reviewed by the Laboratory Director, submitted to accreditation agencies in electronic format, and monitored for ongoing compliance. Performance testing protocols and programs follow requirements of NELAC and NDEP.

Certifications and Associations

State and Local Certifications

Silver State Analytical Laboratories is certified by the State of Nevada Division of Environmental Protection (NDEP) as a testing laboratory. Details of our certifications are available upon request.

SSAL is also certified by the Clark County Department of Development Services - Building Division for soil chemistry quality assurance testing. Through partnership laboratories with certifications in all 50 States, SSAL will manage projects and provide full compliance reporting for just about any project location.

Additionally, SSAL is on the list of approved laboratories by the following local agencies:

- City of Henderson, NV
- Southern Nevada Health District, NV
- Washoe County Health District, NV
- Clark County, NV
- Others

Certification in California as an Environmental Testing Laboratory lapsed in 2006 but is in the process of reinstatement as of 2012. Currently our California projects are completed through our partnership laboratories.

SSAL has its corporate domicile in the State of Nevada as a C-corporation and maintains full state and local business licenses for its operations. We maintain full coverage for general, automobile, and professional liability insurance and have full workers compensation insurance coverage. We are certified in the Federal Central Contractor Registration system as a small business. SSAL maintains status as an “Accredited Business” by the Better Business Bureau.

Professional Associations

SSAL and Enviro-Tech, Nevada are proud members or sponsorship supporters of the following organizations:

- Air & Waste Management Association
- American Chemical Society
- American Council of Engineering Companies
- American Public Works Association
- American Society of Civil Engineers

- American Water Works Association
- Association of Environmental and Engineering Geologists
- Better Business Bureau
- Building Jobs Coalition of Nevada
- Geological Society of Nevada
- Nevada Mining Association
- Nevada Water and Environment Association
- Nevada Water Resources Association
- Northwest Mining Association
- Retail Association of Nevada – RAN
- The NELAC Institute
- Western Petroleum Marketers Association
- Water Environment Federation

Corporate Responsibility

Silver State Analytical Laboratories is committed to our responsibilities as a trusted service provider and complying with all legal and ethical requirements in support of our clients, our regulatory agencies, our employees and our public world as a whole. We are committed to providing high quality services and products at fair prices in an ethical and sustainable manner.

Compliance

It is our company policy to comply with all applicable laws as they apply to our business, our employees, our clients, our regulatory agencies, our projects, our subcontractors, and our business practices. Each employee of SSAL receives basic compliance training and is expected to comply with requirements and report any deviations to senior management at the company.

Health and Safety & Environment

It is our company policy to carry out our business mission in a safe and effective manner that protects employees and clients from any health or safety hazards and to comply with applicable health, safety and environmental compliance requirements. We strive to carry out our daily work in a safe manner and in a way that minimizes impacts to the environment and promotes a safe and sustainable environment for prosperity for future generations in all regards.

Confidentiality and Ethics

We take our obligations to our clients and regulatory agencies seriously. This includes maintaining confidentiality of identity, projects, site locations, and specific data as required by project specifications and legal parameters. We do not disclose proprietary information or data without our client's approval in advance or other legal requirement.

Our company requires all staff to complete an Environmental Laboratory Ethics Training Course, pass a test and take annual refreshers. These topics include data integrity, project and client confidentiality, conflicts of interest, quality control issues, chain of custody matters and other aspects to make sure that the data and services we provide are legitimate, high quality and legally defensible.

Management and Professional Staff

Silver State Analytical Laboratories and EnviroTech believe that quality analytical and environmental service begins with quality professional management, effective professional staff, and a well managed plan. Value is enhanced by deploying and managing properly trained staff to complete project assignments in a focused, efficient, repeatable, and high quality manner. We work hard every day to plan our work and work our plan to meet our clients' needs.

Our management personnel have worked in a variety of settings ranging from large multi-national corporations to small companies. They have worked on multiple sides of the analytical, environmental, regulatory and health businesses and hold degrees in technical fields as well as business management.

We use a combination of full and part-time professionals, on-call experts, and professional partners to provide superior testing and support services in an efficient and effective manner. We believe in recruiting properly educated staff, and training and developing them to be the best in the industry. We continuously monitor and improve our processes and encourage life-long learning for all our professionals.

Professional staff and analysts hold bachelors degrees as a minimum and many hold advanced degrees with real world application experience and we have recently added Dr. Adam Moore to our staff.

Our technical staff have Associate Degrees or advanced specialized training. Additionally, we maintain access to experts in analytical chemistry, environmental, and geosciences through on-call contracts with multiple Ph.D. level consultants.

We strive to implement the "best-of-the-best" practices from this real world experience into SSAL and we seek ongoing customer feedback to modify and improve our systems. We have instilled a unique culture of client service and excellence through our professional management and professional staff.

Key Personnel

David Frohnen, PE – President
Mr. Frohnen has over 25 years of experience in environmental testing, regulation and engineering. He is a former water & sewer utility executive with laboratory and compliance responsibility and served as an Environmental Project Manager in heavy industry, and a principal for an international engineering consulting firm. He holds degrees in environmental engineering and an MBA with specialized training in business operations and customer service systems. He is a licensed

professional engineer in 5 western states and is a Past President of the American Council of Engineering Companies of Nevada.

John Sloan - Laboratory Director
Mr. Sloan has over 10 years of experience in analytical chemistry with focus on EPA and ASTM methods. He holds a BS in Chemistry and has completed master's level course work.

Adam L. Moore, Ph.D. - Chemist
Dr. Moore completed doctorate and post doctorate research in analytical chemistry with environmental and industrial applications. In addition to his Ph.D. in chemistry, he has 5 years of commercial and research laboratory experience as an analyst, QA/QC representative and project manager.

Deborah Clark - Senior Chemist
Ms. Clark has 6 years work experience and a BS in Biochemistry/Biology. She serves as quality assurance/quality control (QA/QC) lead, supervising staff chemists and analytical technicians.

Jody Gascon - Senior Chemist
Mr. Gascon has over 20 years of work experience in laboratories under rigorous QA/QC requirements. He has a BS in Biochemistry and AA Environmental Science.

Steve West - Senior Technician
Mr. West has over 9 years of direct industry experience in field sampling protocols and laboratory analytical tests. He is a Project Manager for sampling, schedules, and customer services. He has specialized training in support of Enviro-Tech products sales and service for pumps, samplers, test equipment, PID's, supplies and related products. He is our key point of contact for Enviro-Tech services in Las Vegas.

Melissa Vega – Office Manager – Customer Service
Ms. Vega has 20 years of experience in order processing, tracking, dispatch, customer service, project management and accounting.

Tim Sweeney - Reno/Northern Nevada Branch Manager
Mr. Sweeney has over 25 years of experience in environmental service businesses including petroleum and propane systems. He is experienced in field and lab work and is knowledgeable in regulatory compliance issues. He has specialized training in the Enviro-Tech product line and is the key contact for services from our Reno facility. He is also a past president of several trade organizations in the Northern Nevada region.

Frederick Ousey, PG – Enviro-Tech
Mr. Ousey has over 25 years of experience as a professional geologist, practicing in environmental and geo-sciences and is the owner of Enviro-Tech Services Company. Through Silver State Analytical Labs exclusive dealership agreement with Enviro-Tech, Mr. Ousey provides specialized consulting for equipment applications, selection, specifications, protocols, and field supplies in support of client projects.

Company Contact Information

LAS VEGAS

3638 East Sunset Road
Suite 100
Las Vegas, NV 89120

Phone: 702.873.4478
Fax: 702.873.7967

RENO

4587 Longley Lane, No. 2
Reno, NV 89502

Phone: 775.825.1127
Fax: 775.825.1167

WEBSITES: www.ssalabs.com or
www.envirotechonline.com

Key Contacts:

Executive Management, New Programs, Client Services
David J. Frohnen, PE – President 702.873-4478
dfrohnen@ssalabs.com

Laboratory Director, Analytical Management, Quality Control
John Sloan – Laboratory Director 702.873-4478
jsloan@ssalabs.com

General Customer Service, Scheduling, Accounting
Melissa Vega – Office Manager 702.873-4478
mvega@ssalabs.com

Enviro-Tech Products Sales and Service, Las Vegas
Steve West – Senior Technician 702.873-4478
swest@ssalabs.com

Reno Branch Manager–Northern Nevada (Laboratory and Enviro-Tech Products)
Tim Sweeney – Branch Manager 775.825.1127
tsweeney@ssalabs.com

SilverState
Analytical Laboratories

QUALITY ASSURANCE PLAN

Laboratory Director/Quality Assurance Officer: John Sloan (702) 873-4478

Organizations covered by this Manual:

Las Vegas Laboratory (NV-00905)
Silver State Analytical Laboratories, Inc.
3638 E. Sunset Road, Suite 100
Las Vegas, NV 89120
Phone: (702) 873-4478
Fax: (702) 873-7967

Reno Laboratory (NV-00931)
Silver State Analytical Laboratories, Inc.
4587 Longley Lane, No. 2
Reno, NV 89502
Phone: (775) 825-1127
Fax: (775) 825-1167

www.ssalabs.com

Control Number: QAP-2012-12.6
Effective Date: June 18, 2012

TABLE OF CONTENTS

1 QUALITY POLICY SUMMARY

1.1 Purpose

Silver State Analytical Laboratories is a private environmental, analytical laboratory certified by the State of Nevada. The objective of Silver State Analytical Laboratories (SSAL) is to provide its clients with quality analytical data which meets all regulatory requirements. The objective of this QAP is to provide a procedural basis that establishes laboratory requirements that enable and ensure the production of reliable and accurate analytical data by Silver State Analytical Laboratories.

1.1.1 To meet this goal, the staff of Silver State Analytical Laboratories commits to

1. Promote client discussions to establish the scope and objective of a project, along with the suitability of analytical procedures and methods.

2. Require application of analytical procedures and methods previously determined suitable for a project.

3. Appoint a regime of laboratory QA procedures that maintain the precision and accuracy of data produced by SSAL personnel.

4. Use of a rigorous quality control program to further verify the performance of the laboratory on a whole.

1.1.2 These commitments are implemented through the laboratory's quality system. This quality system is designed to meet the standards set forth by Nevada Department of Environmental Protection (NDEP). These protocols are included within this Quality Assurance Plan (QAP) and associated Standard Operating Procedures (SOPs).

1.1.3 The purpose of this QAP is to establish protocols to ensure that the analytical data provided to SSAL clients is accurate and reliable. Such protocols include:

A. QA procedure requirements for laboratory practices and procedures including sample collection, handling and analysis.
B. A description of the methods used to implement the QA procedures and requirements.
C. Client contact and communication

1.1.4 It is SSAL policy that all laboratory personnel follow all aspects of this Quality Assurance Plan (QAP). It is the responsibility of the Quality Assurance Officer (QAO) to ensure that all personnel of SSAL follow its QAP. The QAO is responsible for the supervision and policing of the laboratory personnel to assure the proper implementation this plan. The QAO reports directly to the President on all matters concerning laboratory quality assurance and control.

1.2 Goals

The goal of SSAL is to ensure that all measured data generated is scientifically and legally defensible. Additionally, the data must be of known and acceptable quality per the data quality objectives. This data must be documented to provide sound support for environmental decisions and comply with contractual requirements and environmental regulations established by local, state, and federal authorities.

Our specific goals are:

1.2.1 To provide a uniform framework for physical and chemical data generation.
1.2.2 To operate under a comprehensive, effective, and ongoing quality assurance program.
1.2.3 To instill a commitment to quality and excellence at all levels of operation and staffing.
1.2.4 To detect anomalies and nonconformance that would adversely affect data quality and integrity.
1.2.5 To monitor the QA/QC system for data accuracy, representativeness, comparability, completeness, and detectability through proven methodologies.
1.2.6 To enable personnel responsible for the production of data to identify and implement corrective actions necessary to ensure data integrity.
1.2.7 To establish a stringent system of QA/QC that is applied to all analytical procedures and data handling procedures as well as sample login and runs.
1.2.8 To have adequate document control.
1.2.9 To have good laboratory and measurement practices
1.2.10 To have good automated laboratory practices, and good standard operating procedures.
1.2.11 To have sufficient flexibility for customized QA procedures to meet customers' specific requirements for data quality.

In order to reflect better technologies and ever-changing regulatory requirements, this QAP will be reviewed and revised semi-annually or at the discretion of the QAO and Laboratory Director.

This QAP contains information that is considered confidential and proprietary in nature. It is intended for use only by the clients and staff of SSAL. Unauthorized reproduction or distribution of this document is strictly prohibited.

2.0 ORGANIZATION AND MANAGEMENT STRUCTURE

2.1. Business Organization

2.1.1. Legal Organization: Silver State Analytical Laboratories, Inc. is a Nevada C-corporation. The stock shares are privately owned.

2.1.2. The current organizational chart of the laboratory is included in Appendix 1.

2.1.3. The laboratory may assign the duties of more than one position described below to a single individual.

2.2. Management Responsibilities

2.2.1. It is the responsibility of Laboratory Director to ensure that laboratory personnel carry out environmental sampling and analysis activities to meet the requirements of the Nevada Department of Environmental Protection (NDEP) and to satisfy the needs of the laboratory's clients.

2.2.2. To meet these responsibilities, Laboratory Director will

- ensure that sufficient resources are provided to the laboratory to meet the requirements of the applicable quality standards.
- be responsible for the quality of data produced by the laboratory, including the implementation of data integrity procedures, and for documenting all analytical and operational activities of the laboratory.
- ensure the proper supervision of all personnel employed by the laboratory.
- nominate deputies in the absence of the Laboratory Director.
- be responsible for establishing the minimum level of personnel qualifications and experience.
- be responsible for keeping training of personnel up to date on laboratory quality documents, procedures, techniques, and operation of instrumentation.
- be responsible for training personnel in ethical and legal responsibilities.
- be responsible for documenting personnel training and performance.
- ensure that laboratory personnel are free of undue commercial, financial or other pressures and influences that may adversely affect the quality of their work.
- ensure that acceptable document control procedures are in place and are followed.
- implement procedures to protect client confidentiality
- support implementation of the quality system.
- develop and implement policies and procedures to avoid involvement in any activities that would diminish confidence in its competence, impartiality, judgment or operational integrity.
- ensure participation by the laboratory in a proficiency testing program.

2.3. Job Descriptions and Personnel Qualifications

2.3.1. Laboratory Director

2.3.1.1. Responsibilities– The person holding this position is responsible for administrative oversight and overall operation of the laboratory as defined by NELAC (Chapter 5). The Laboratory Director is responsible for the technical supervision of personnel, including coordination of work assignments. The Laboratory Director will define minimum qualifications, experience, and skills necessary for all technical employees. The Laboratory Director will ensure through an annual competency check that each technical employee demonstrates initial and ongoing proficiency for the tests the technical employee performs. The Laboratory Director will supervise and be responsible for the production and quality of all results reported by the certified laboratory. The Laboratory Director will assume responsibility for compliant sample handling, analysis, reporting, and chemical hygiene.

2.3.1.2. Qualifications

2.3.1.2.1. Laboratory Director: The educational and work history requirements and responsibilities of this position are listed in the NELAC (chapter 4). In general, the Laboratory Director must have a bachelor's degree in the biological, chemical, or physical science, with at least 24 college semester hours in chemistry, 4 college semester hours in General Microbiology, plus four years experience in a certified laboratory or a laboratory with equivalent requirements. A masters or doctoral degree in one of the above disciplines may be substituted for one year of experience.

2.3.2. Quality Assurance Officer (QAO)

2.3.2.1. Responsibilities. The QAO will

2.3.2.1.1. serve as the focal point for QA/QC and be responsible for the oversight and/or review of quality control data;

2.3.2.1.2. be responsible for the laboratory's quality assurance program and its implementation;

2.3.2.1.3. maintain the laboratory's quality documents, including this Quality Assurance Plan;
2.3.2.1.4. review laboratory quality control data;
2.3.2.1.5. conduct or arrange for annual internal laboratory audits;
2.3.2.1.6. notify laboratory management of deficiencies in the quality system;
2.3.2.1.7. ensure any corrective actions arising from internal audits are implemented in a timely manner.

2.3.2.2. Qualifications

2.3.2.2.1. The QAO must be free from internal and external influences when evaluating data and conducting audits.
2.3.2.2.2. The QAO must have documented training and experience in QA/QC procedures and must be knowledgeable of the approved analytical methods and quality assurance program requirements.
2.3.2.2.3. The QAO must have functions independent from the operations for which they have quality assurance oversight and be able to evaluate data without outside influence.

2.3.3. Chemist/Technician

The chemists and technicians are responsible for routine analysis of all microbiology and wet chemical analyses following the laboratory SOP for each analysis. They follow all quality control procedures. They record analytical and Quality Control results as defined in the Standard Operating Procedures and this QAP. They operate and maintain analytical equipment. If there is a problem with precision or accuracy of an analysis, they will immediately investigate, troubleshoot and correct it. When appropriate, they will review these procedures with the Laboratory Director and corrective action will be taken. The chemists and technicians report to the Laboratory Director.

2.3.4. Branch Manager

The Branch Manager is responsible for customer service and overall operations of a Company Branch facility. Typically, this includes customer service scheduling, commercial terms, and allocation of resources to meet requirements for services (testing and environmental supplies) to clients of Silver State Analytical Laboratories, Inc. Unless

the Branch Manager has specific analytical chemistry education and training; technical management and testing procedures are supervised and directed by the Laboratory Director, Quality Assurance Officer and Chemist/Technicians on site at the Branch Location in coordination and under the supervision of the main Las Vegas Laboratory Director and President. Laboratory Reports from Branch facilities are reviewed and signed and issued from the Main Laboratory following QC procedures contained in this manual. Reference Appendix 1- Organizational Structure.

2.4. Assignment of Deputies

2.4.1. In the event of brief (<15 calendar days) expected or unexpected absences of the Laboratory Director, the senior person holding the highest level position in the lab will fill in for them as required.

2.4.2. In the event of an absence from the laboratory of 15 calendar days or longer, the Laboratory Director will assign a deputy who meets all of the qualification requirements for the position.

2.5. Identification of Approved Signatories

The following individuals are authorized to sign laboratory reports:

- The Laboratory Director
- The Quality Assurance Officer
- Laboratory Chemists
- President

3.0 PROCEDURES FOR DOCUMENT CONTROL

This section describes procedures for document management, which includes controlling, distributing, and accepting modifications for all documents that make up the quality system. These include this Quality Assurance Plan (QAP) and related Standard Operating Procedures (SOPs), Laboratory Method SOPs, instrument manuals and any other documents that provide instruction to analytical personnel. All documents that affect the quality of laboratory data are managed appropriate to the scope and depth required.

3.1 Document Issue and Approval

3.1.1 The laboratory will keep a master list of documents written by the laboratory that are part of its quality system. This list will include the title of the document, the revision, effective date, and distribution locations.

The Quality Assurance Plan, as well as all administrative and method SOPs will be included on this master list. The Laboratory Director is responsible to maintain the master list. The list must be revised each time a document is added or revised, as well as each time the distribution of a document changes.

3.1.2 Documents not written by the laboratory, such as instrument manuals prepared by the instrument manufacturer, will not be included on the master list. These documents will be kept on shelves that are accessible to laboratory personnel.

3.1.3 Distribution of quality system documents will be performed in a manner that ensures that only approved documents are in use in the laboratory and so that a historical record of instructions is maintained.

3.1.3.1 The Laboratory Director/QA Officer prior to implementation must approve new documents and major revisions of older documents. The LD/QAO will carefully review the document prior to implementation, making any necessary changes before implementation of the document.

3.1.3.1.1 When the new document is ready for implementation, the document will be saved to the appropriate drive on the computer network and a hardcopy will be placed in the SOP Binder.

3.1.3.1.2 The author of the document and the Laboratory Director or designee must sign and date the document. If an additional reviewer is used, they may also sign the document but it is not required.

3.1.3.2 Authorized editions of the QAP and related administrative SOPs will be kept on the laboratory's computer server. These are the master copies.

3.1.3.3 Authorized editions of Laboratory Method SOPs will be kept on the laboratory's computer server. These are the master copies.

3.1.3.4 Any other copies of these documents must be labeled as being "uncontrolled" or "draft" or some similar label so that it is clear that they are not to be relied on for current instruction.

3.1.3.5 Whenever a new revision of a document is approved, the old version of the document will be removed from the "Current SOPs"

Binder, the cover sheet of the old document will be edited to include the retirement date, and the old version will be filed in an archive folder.

3.1.3.6 When a document is retired without a replacement, it will be edited to include the retirement date and will be filed in an archive folder.

3.1.3.7 All quality system documents prepared by the laboratory must be reviewed at least once per year. If no changes are required, the reviewer will date and initial the master list to indicate that the review has been performed and no changes are required. If changes are required, the document will be checked out, labeled as "Draft" or some similar label, and the revision process will be performed starting with that copy.

3.2 Document Identification

All documents will be uniquely identified in the header in the upper right hand corner of each page of the document. The identifier consists of an abbreviated version of the title of the document (*e.g.*, "QA Plan", "pH", etc.) combined with the revision number, which will be incremented for each new revision. The header must also include the effective date of the revision and the number of pages in the format of "Page X of Y" where Y is the total number of pages in the document.

3.3 Changes to Documents

3.3.1 Changes to documents must be made in a deliberate and controlled manner.

3.3.2 Minor changes to a document may be made to make editorial corrections, add clarification or correct minor errors in text. Make a minor change by checking the document out, making the correction, and checking the document back in.

3.3.2.1 Changes to correct minor typographical errors that have no impact to the performance of the procedure (e.g. 'smaple' instead of 'sample') and insignificant modifications (e.g. a reagent vendor reference) may be made without Laboratory Director approval in the master copy. These changes are documented to ensure that they can be tracked throughout the life of the document.

3.3.2.2 Changes to correct typographical errors (e.g. 0.5 g instead of 0.05 g) that may potentially impact performance of the procedure shall be considered major revisions and require Laboratory Director

approval and a new revision number (see major changes below).

3.3.3 Major changes to a document require that the document receive a new revision number and go through the full review process.

3.4 Standard Operating Procedures

STANDARD OPERATING PROCEDURES (SOPs) are used to ensure consistency of application of common procedures, are written procedures that describe in detail how to accurately reproduce laboratory processes, and are of two types, 1) test method SOPs, which have specifically required details, and 2) general use SOPs which document the more general organizational procedures. Copies of all SOPs are accessible to all personnel. Each SOP indicates the effective date, the revision number, and contains the signature(s) of the Laboratory Director/QAO.

3.4.1 Analytical Method SOPs

3.4.1.1 The laboratory has SOPs for all test methods within its scope, and for procedures that are part of the Quality System that accurately reflect how the process is performed.

3.4.1.2 All analytical method SOPs must contain all of the information required by NDEP. The SOPs must be definitive in their procedural descriptions, defining the specific procedures and equipment the laboratory has chosen to use to implement the analytical method.

3.4.1.3 The laboratory maintains a standard format for analytical method SOPs as follows. Each heading listed below is a required primary heading in an analytical method SOP. Any required section may reference another laboratory SOP or the Quality Assurance Plan. The headings are listed as they should appear in the SOP.

3.4.1.4 Format for Analytical Method SOPs

1. TITLE

This Section includes the EPA or Standard Methods numbers and the analyte name (*e.g.*, BOD, Chloride, etc.). It is listed on the title page. The title is listed on the title page. See Section 3.5 for stylistic considerations for more information.

2. SCOPE AND APPLICATION

This section includes the basic objective of the method, the matrices that can be analyzed (*e.g.*, surface waters, drinking waters, sludges, etc.), and the practical range of the method, where applicable.

3. SUMMARY

This section is a brief outline of the method, written in paragraph form, excluding technical information.

4. DEVIATIONS FROM THE METHOD

This section lists all changes that have been made by the laboratory to an approved method. Examples of changes that could be made include chemicals, general supplies, or technical refinements.

- Any change in the chemistry of the method is not allowed. In some cases, changes of sample sizes may be allowed as long as all reagent amounts are changed proportionally.
- For each deviation or modification, list the specific requirement in the method, the deviation or modification implemented by the laboratory, and the justification for the deviation.
- For each choice made, the SOP will state the general area in which the choice is made and the particular choice selected by the laboratory.

5. DEFINITIONS

This section references a listing of definitions that will explain terminology used in SOPs and throughout the Laboratory.

6. INTERFERENCES

This section includes a list of known interferences extracted from Standard Methods, EPA Methods for Chemical Analysis of Water and Wastes, 40 CFR, or Method for Microbiological Analyses of Sewage Sludges, as well as any interferences noted during the laboratory's history.

7. SAFETY

This section includes a list of protective equipment analysts should wear when performing the procedure and specific warnings about any particularly hazardous materials used in the procedure.

8. EQUIPMENT AND SUPPLIES

This section includes a list of all apparatus used, from instruments to beakers and pipettes, and all supplies used, such as filters and disposable items.

9. REAGENTS AND STANDARDS

This section includes a list of all reagents and standards used, purchased or prepared for use in the method. For each prepared reagent, the listing will include preparation instructions unless the reagent is a common stock reagent such as water or a standard concentration acid.

10. SAMPLE COLLECTION, PRESERVATION AND STORAGE

This section includes temperature and chemical preservation requirements, container requirements, storage and holding time requirements.

11. QUALITY CONTROL

This section lists all of the batch and instrument quality control that must be performed with this method, including but not limited to standardization, interference checks, instrument performance checks, spiked samples and blanks. Preparation instructions for each QC type are included.

12. INITIAL DEMONSTRATION OF PERFORMANCE

This section references the current rules governing the performance of an initial demonstration or method required parameters. When the method is not amenable to spiking and requires a unique demonstration of capability, it must be described in this section

13. METHOD DETECTION LIMIT

This section includes a reference to the method used to determine the method detection limit, the approximate MDL expected, and the location of documentation of the laboratory MDL

14. CALIBRATION AND STANDARDIZATION

This section describes the standardization procedures of the method, including any required instrument performance checks. Limits used to evaluate the calibration may be included in this section or in section 16, or both at the analyst's discretion.

15. PROCEDURE

This section describes the procedure of the analysis in a step-by-step fashion. It is important for this section to be written describing how the analysts in the laboratory perform this method, as opposed to simply copying the method text into the SOP. Include descriptions of techniques and helpful hints for performing the analysis, determining proper performance, and for streamlining implementation of the procedure. It is extremely helpful to capture the analyst's knowledge of the procedure in this section.

16. DATA ANALYSIS AND CALCULATIONS

This section describes how results are calculated. All of the information and equations required will be listed or referenced here, unless they are already listed in a master QA document.

17. METHOD PERFORMANCE, DATA REVIEW AND ACCEPTANCE CRITERIA

This section lists the quality control limits that must be used to evaluate the batch quality control samples and instrument calibration standards. The section will also contain additional information on corrective actions and contingencies for handling out of control or unacceptable data.

18. REFERENCES

This section includes a list of all documentation reviewed to derive the method/procedure, including the primary published method.

19. TABLES

This section includes any tables or diagrams that may be helpful in understanding the procedure. This section may be left blank.

20. WORKSHEETS

This section contains an example of any laboratory work sheets. The examples are not controlled so that modifications may be made to the worksheets to aid the analysts without generating a revision to the SOP. The example should be updated during the annual SOP review.

3.4.3 Administrative SOPs

3.4.3.1 Administrative SOPs are formatted as is convenient for the procedure being described. Certain elements are required in all of the SOPs, but the document is formatted at the discretion of the writer. Each SOP will be clearly organized and written so that any member of the laboratory staff may use and understand it. Required sections include the following items.

TITLE
The title is listed on the title page.

PURPOSE
A brief paragraph stating the purpose of the SOP is included here.

APPLICABILITY
This section will list the procedures, systems, and personnel that are governed by the document.

SUMMARY
This section is a brief outline of the procedure or system, written in paragraph form, excluding technical information.

PROCEDURE
This section may be labeled in any logical fashion and is developed to guide the reader through the procedure in a logical fashion

Any other necessary sections.
These may include definitions, QA/QC considerations, logbook descriptions, special safety or waste handling procedures, flow charts, tables, diagrams, etc. Forms included in the SOP shall be regarded as examples unless the SOP states that the form must be controlled with the SOP. Forms may be modified without formal revision of the SOP. Forms with required formats must be modified only with formal revision of the SOP.

3.5. Stylistic Considerations

Standard Operating Procedures will be written in a consistent document style and font.

3.5.1.1. SOPs shall be written using fonts approved by the Laboratory Director, typically Arial or Times New Roman. Documents must be easily readable by all personnel.

3.5.1.2. Paragraphs will be numbered with an additional number after the digit of the main heading, as in this section.

3.5.1.3. Secondary headings will be indented one tab for each additional digit in the numbering system.

3.5.1.4. There are no required footers. Footnotes may be used for references to copyrighted materials.

3.5.1.5. A title and signature page will be placed on top of every SOP.

3.5.1.5.1. The title page will include the name of the laboratory, the words “Standard Operating Procedure”, and the title of the SOP.

3.5.1.5.2. The title page will include the approval signature of the Laboratory Director and date approved.These signatures will document the approval by these

individuals of the document for use in the laboratory.

4.0 Procurement, Supplies and Equipment

The Laboratory Director is responsible for purchasing all laboratory supplies, equipment and subcontract services. The Laboratory Director is responsible for approving technical and quality requirements of each item and service purchased.

4.1 General Supplies

All supplies are purchased through "known quality" chemical suppliers i.e. VWR, Restek, Fisher, etc. Each item is purchased using a laboratory PO number.

4.2 Chemicals & Solvents

All chemicals used at Silver State Analytical Laboratories are ACS Reagent Grade, Spectrophotometric Grade, or HPLC Grade depending on method requirements. All chemicals are NIST traceable and/or traceable to the manufacturer. When chemicals are received, each one logged with the receiving date, source, lot number, expiration date, unique laboratory ID number and person whom received the compound into the corresponding logbook. Each chemical is marked with the date it is opened to ensure freshness. Certificate of analysis for chemicals are bound into a book for permanent storage. Whenever possible the each standard is validated against the previous standard. A solvent blank is run on each lot number of a new solvent to ensure quality. The solvent can only be used after it has been shown to have no contamination higher than the method detection limit for that analysis. Material Safety Data Sheets (MSDS) for each compound are kept in a separate loose-leaf notebook.

4.3 Glassware

All glassware is ACS Class A. All glassware is washed individually with brushes in phosphate-free 2% Liquinox detergent. Soap is removed by rinsing the glassware in tap water ten times followed by rinsing in reagent water ten times. Glass ware is then allowed to air dry on the dish rack. When appropriate glassware is washed in an acid bath before the final rinsing.

4.4 Water Type

a) Las Vegas Laboratory:

Tap water is provided by the Las Vegas Valley Water district and is used during the preparation of glassware cleaning solutions and during the initial rinsing of glassware. Reagent Water is provided through the use of a Nanopure ultrapure water system model 4741. The Nanopure water system is designed to produce Type I Reagent Grade Water equal to or exceeding standards established by ASTM, CAP, and NCCLS with bacterial endotoxin levels below 0.005 EU/ml. This reagent grade water is used for all analytical methods as well as the final rinse of all glassware cleansing. Reagent water is tested monthly to ensure that it possess conductivity levels less than 2.0 micromhos/cm at 25°C, Total Chlorine Residual <0.1 mg/L and Heterotrophic Plate Count <500 CFU/ml. Reagent water is annually tested to ensure the metals Pb, Cd, Cr, Cu, Ni, Zn are not greater than 0.05 mg/L per contaminant or collectively at 0.1 mg/L.

b) Reno Laboratory:

Tap water is provided by the Truckee Meadows Water Authority through the City of Reno and is used during the preparation of glassware cleaning solutions and during the initial rinsing of glassware. Reagent Water is provided through the use of purchased distilled water from a major brand manufacturer. Purchased distilled water is designed to provide Type I Reagent Grade Water equal to or exceeding standards established by ASTM, CAP, and NCCLS with bacterial endotoxin levels below 0.005 EU/ml. This reagent grade water is used for all analytical methods as well as the final rinse of all glassware cleansing. Reagent water is tested monthly to ensure that it possess conductivity levels less than 2.0 micromhos/cm at 25°C, Total Chlorine Residual <0.1 mg/L and Heterotrophic Plate Count <500 CFU/ml. Reagent water is annually tested to ensure the metals Pb, Cd, Cr, Cu, Ni, Zn are not greater than 0.05 mg/L per contaminant or collectively at 0.1 mg/L.

4.5 Balances

Balances are calibrated annually by the National Calibration Inc. Calibration records are maintained in a loose-leaf binder maintained by the QA Officer. Balance calibration is verified daily through the use of ASTM Class I certified weights purchased through Mettler Toledo. These are certified every year through an accredited source. Documentation of this daily verification is maintained in a loose-leaf binder maintained by the QA Officer. Balances are recalibrated when this calibration verification fails protocol set forth in the SOP.

4.6 Thermometers

Thermometers are calibrated once a year through comparison to a NIST certified reference thermometer used only for thermometer calibration. The All thermometers used in refrigerators, freezers, incubators, and drying ovens are checked annually by the comparison to the reference thermometer. Any variance is recorded on the thermometer and discrepancies greater than 1°C results in the thermometer being discarded and replaced.

4.7 High Pressure Gases

High pressure gas cylinders used in the laboratory are purchased through Airgas. The cylinders are securely chained to the wall at all times. The following gases and corresponding instruments are in use in the laboratory.

Argon-ICP

Helium- IC, GC-MS, GC-FID

Nitrogen- Cold Vapor Mercury Analyzer, GC-FID, Oil & Grease Extraction system.

Hydrogen- GC-FID

Air- GC-FID

4.8 Refrigerators and Freezers.

Refrigerators and Freezers are designated for either samples only or for standards and chemicals only. Refrigerators are kept at a constant temperature of 4°C ±2 using a calibrated thermometer and recorded each working day in a loose-leaf notebook maintained by the QA Officer. Freezers are kept at a constant temperature of 25°C ±2 using a calibrated thermometer and recorded each working day in a loose-leaf notebook maintained by the QA Officer

4.9 Incubators

The coliform incubator is kept at 35° ±0.5 and is verified twice a day at least four hours apart using a calibrated thermometer and recorded each working day in a loose-leaf notebook maintained by the QA Officer. The BOD incubator is kept at 20° ±1.0 and is verified each day of use using a calibrated thermometer and recorded each working day in a loose-leaf notebook maintained by the QA Officer

4.10 Disposal

Chemicals are disposed of in accordance with state and federal regulations when either its expiration date is exceeded or it is determined that analytical results and performance is deemed inadequate using that reagent.

5.0 SERVICES TO CLIENTS

5.1 General

5.1.1 This laboratory primarily serves Nevada and adjoining states based clients both public and private.

5.1.2 Many of the procedures described in this section require some sort of documentation. Documentation of client information will be contained in e-mails or a telephone log.

5.2 Review of Requests, Tenders, and Contracts

5.2.1 In general, the laboratory's workload is routine and static but unique unscheduled projects do occur occasionally. If the laboratory decides to change its scope significantly, the following items will be taken into consideration.

5.2.1.1 The laboratory will verify that the proper accreditations are in place to perform the methods requested. If new methods are required, they will be implemented as a planned activity in accordance with this QAP.

5.2.1.2 The laboratory will verify that the volume of work will not negatively impact the laboratory's ability to perform the new work and work previously contracted.

5.3 Subcontracting

5.3.1 In the event that Silver State Analytical Laboratories is unable to meet a client's requirements the sample may be subcontracted upon client approval. The subcontracted lab must be approved to meet the client's requirements. Instructions will be sent with a COC to the subcontracted

lab. The final report will clearly state that the work was completed by the subcontractor and not Silver State Analytical Laboratories.

5.4 Client Complaints

5.4.1 Complaints and/or input may be received from clients. Complaints will be documented using the e-mail system. The person receiving the complaint records the name of complainant, the date, contact number, problem, analysis involved, and who received the complaint.

5.4.2 The Laboratory Director or designee will evaluate all complaints. If it is determined that the complaint is without merit, it will be documented, the client will be contacted and the process will end.

5.4.3 If it is determined that the complaint has merit, the complaint will be documented (whether or not it is considered a quality system failure) using the Corrective Action Report and following the steps of the corrective action system. See the Corrective Action section of this QAP (Section 6.1) for more information.

5.5 Control of Nonconforming Work

5.5.1 Non-conforming work is defined as work in which quality control outliers or quality system failures are identified. When discovered, the laboratory will investigate the situation and take action appropriate to the significance of the non-conformance using the corrective action system.

5.5.1.1 The Laboratory Director (LD), Quality Assurance Officer (QAO), or designee will make an evaluation of the significance of the non-conformance.

5.5.1.2 The laboratory will ensure that any corrective actions are taken immediately and documented appropriately using the laboratory's corrective action system.

5.5.1.3 If necessary, the LD or QAO will direct the laboratory to stop work until the non-conformance is corrected.

5.5.1.4 If it is determined that reported data was affected, the client will be notified in writing.

5.5.1.5 If work has been halted, the LD or QAO will determine and document when work may be resumed.

5.5.1.6 The laboratory will follow its corrective action procedures to ensure that the problem will not recur and that the laboratory is operating in compliance with its policies and procedures.

5.6 Client Confidentiality

It is the laboratory's policy to protect client confidentiality. Information regarding these analyses shall not be disclosed to any other outside entity without specific permission from the client.

6.0 CORRECTIVE AND PREVENTATIVE ACTION

6.0 Corrective Action

6.1.1 The laboratory must have a process for performing a root cause analysis and taking corrective action when departures from policies, procedures, and QC requirements or when other types of exceptions occur.

6.1.1 The laboratory has defined processes to address two types of exceptions: quality control sample outliers and quality system failures.

6.1.2 A quality control sample outlier is the type of exception that occurs during an analysis or procedure where a quality control sample result, such as a QC spike recovery, does not conform to requirements. Procedures for required actions are included in the associated technical SOP. Note that a consistent pattern of quality control sample outliers is indicative of a quality system failure and shall be addressed as described below.

6.1.3 A quality system failure is the type of exception where an event within the overall quality system is not compliant with the NDEP standard or internal quality policies or procedures. Examples include, but are not limited to: findings from internal audits or NDEP assessments, Proficiency Testing sample failures, and deviations from the SOP. Quality system failures are remedied through the corrective action process and are documented using a Corrective Action Form.

6.1.4 The corrective action process must include the following elements:

6.1.4.1 Definition of the problem, concern or failure

6.1.4.1.1 The Laboratory Director, Quality Assurance Officer or Analytical Personnel may initiate the Corrective Action Process whenever quality system failures occur. The Laboratory Director or Quality Assurance Officer will

make the assignments or appoint responsibilities described in this section.

6.1.4.1.2 The issue shall be defined with adequate detail to allow further investigation. Typically, the important elements to include are:

- what event(s) occurred
- in what process did the event(s) occur
- who witnessed the event(s) or performed the process
- when (date/time) did the event(s) occur
- where did the event(s) occur
- what other processes were or may be impacted.

6.1.4.2 Investigation of the cause(s), including Root Cause Analysis

6.1.4.2.1 Root Cause Analysis seeks to identify the origin of a problem. It assumes that systems and events are interrelated. One event leads to another, which leads to another. By tracing back these actions, you can discover the original source of the problem.[1]

6.1.4.2.2 Root causes are specific underlying causes that can be reasonably identified management has control to fix and effective recommendations for preventing occurrences can be generated.[2]

6.1.4.2.3 Adequate data must be collected to allow effective Root Cause Analysis.

6.1.4.3 Identification of possible solutions

6.1.4.3.1 If possible, generate several potential solutions to the root cause of the problem.

6.1.4.4 Selection of one or more of the proposed solutions appropriate to

[1] ***"Root Cause Analysis: Tracing a Problem to Its Origins" http://www.mindtools.com/pages/article/newTMC_80.htm***

[2] *"Root Cause Analysis for Beginners", Rooney and Vanden Heuvel, Quality Progress, July, 2004*

the magnitude and risk of the failure

6.1.4.4.1 Rank the potential solutions according to their likelihood of eliminating the problem, preventing its recurrence, the cost vs. benefit, and the risk of unintended negative impacts.

6.1.4.4.2 Select one or more actions appropriate to the magnitude of the problem and the risk of recurrence.

6.1.4.4.3 Assign personnel responsible for implementation.

6.1.4.4.4 Assign a completion date for implementation.

6.1.4.5 Implementation of the solution(s) within the specified time-frame

6.1.4.5.1 Date of the implementation must be documented.

6.1.4.5.2 Solutions that require major modifications to equipment, procedures or methods may require formal revisions to laboratory policies or procedures, formal validation processes and/or notification of the accrediting authority.

6.1.4.6 Follow up to verify the effectiveness of the change.

6.1.4.6.1 The QAO will define what will be checked, assign a party responsible for following up, and ensure follow up occurred within a timely manner.

6.1.5 It is often beneficial to include as many laboratory personnel as possible in the corrective action process to facilitate generation of ideas.

6.1.6 The corrective action process shall be documented on the Corrective Action form and shall be filed in the Corrective Action Binder. Occasionally, during the investigation, Root Cause Analysis, implementation and/or follow up, supplemental data will be generated which will be maintained in an appropriate format for five years.

6.2 Preventive Action

6.2.1 The laboratory will be aware of possible preventive actions that may be taken. Preventive actions are proactive actions taken to eliminate possible quality control sample failures or quality system failures before they

occur.

6.2.2 Performing appropriate preventive action requires a mindset of looking at laboratory operations with an eye toward seeing what could go wrong. Often, this will be based on what types of problems have been solved in the past. Preventive actions may come as a result of the management review process.

6.2.3 The preventive action process is as follows

- Identify the needed preventive action
- Develop an action plan to implement the action
- Implement the action, with changes as necessary
- Monitor to the results of the action to verify that the action taken is achieving the desired results and has not caused unanticipated negative impacts

Preventive actions should be documented. The corrective action system may be used to document the preventive action or another means may be used.

7.0 CONTROL OF RECORDS

7.1 General Considerations

The laboratory must retain all records required to demonstrate compliance to the NDEP standard and any other applicable regulations. The laboratory will retain all original observations, calculations and derived data, calibration records and a copy of the bench sheet for a minimum of five years from the date of the last entry into the record.

7.1.1 The procedures that follow in this section describe how the laboratory will maintain all necessary quality and technical records.

7.1.2 In general, working records are stored on shelves or in filing cabinets in the laboratory area or an offsite storage facility. Reasonable efforts are made to protect records from fire, theft, loss, environmental deterioration, and vermin. Only authorized personnel have access to this area.

7.1.3 Analytical data is stored as written documents and/or electronically in the laboratory area or an offsite storage facility. Data entered into electronic systems is stored on computer drives that are routinely backed up or the records may be printed and filed with paper documents. Data entered into paper systems is stored in folders or binders in the laboratory. Alternately,

paper data may be scanned into the computer system and then stored as electronic data.

7.1.4 A signature log is required. This log will include the name of each temporary or permanent employee, their signature and their initials. This is designed to allow the signatures and initials in the documentation to be easily traced to the personnel of the laboratory.

7.2 The Record Keeping System

7.2.1 The record keeping system is designed to allow historical reconstruction of all laboratory activities that produced the analytical data. The history of the sample is to be understood solely through the documentation. To meet this goal, the following procedures are implemented.

7.2.2 Each record includes the identity of personnel involved in the process recorded. All bench sheets, log books, and notebooks are designed to include the signature or initials of the personnel performing steps.

7.2.3 Each step has a documentation process designed for it, including activities such as sampling, sample receiving, analysis, data review and reporting as well as information relating to the laboratory facilities and equipment.

7.2.4 The record-keeping system is designed to contain sufficient information to facilitate identification of factors affecting the uncertainty and to enable the environmental test to be repeated under conditions as close as possible to the original.

7.2.5 Records are kept in a logical manner to facilitate retrieval.

7.2.6 Access to electronic records is controlled by username and password requirements for the computer drive(s) on which the files are stored.

7.2.7 All data recorded by hand must be recorded directly, promptly, and legibly in permanent ink on the permanent record for that data.

7.2.8 Entries made in records must not be obliterated by methods such as erasures, overwriting or markings. All corrections must be made using a single line strike out of the error. The individual making the correction must sign (or initial) and date the correction. If the reason for the correction is not readily apparent, a reason for the change shall be included. Other than typographical errors, corrections made to comment fields in electronic records will be appended to the existing record and the inaccurate portion of the record will be clearly identified.

7.2.9 Analysts must keep records of unusual occurrences in analysis or departures, intentional of inadvertent, from written procedures. When such events occur, the analyst must document on the appropriate bench sheet or log a description of the unusual situation or departure all actions taken to address it, and the results of those actions.

7.2.10 The laboratory will retain records of all original observations, derived data, and sufficient information to establish an audit trail, calibration records, staff records and a copy of each analytical report issued for a minimum of five years.

7.3 Analytical Records

7.3.1 Each manual analysis performed in the laboratory has a bench sheet that is designed to track critical information required by the standard. Each bench sheet contains the following information.

7.3.1.1 The following information must be recorded in a traceable manner. It is typically part of the bench sheet template, but some items may be recorded in logbooks in such a way that the analysis can be accurately reconstructed.

- Identification of any instruments used.
- The date of analysis, and when required, the time of analysis. The time is required if the holding time is 72 hours or less or when time critical steps are included in the analysis such as color development or incubations.
- All manually calculated results (may be on a separate calculation sheet)
- The initials or signature of the analyst
- Sample preparation information including, as applicable, ID codes, volumes, weights, meter readings, calculations, reagents, temperatures, etc.
- Sample analysis information
- Standard and reagent identifications
- Calibration information
- Quality control sample information and results
- The initials or signature of the data reviewer

7.3.2 Additional required information is contained in the reports generated by the laboratory, including the following items.

- Data interpretation, assessment and reporting conventions

- Quality control assessment

7.4 Records Management and Storage

7.4.1 All records (including those pertaining to laboratory instruments and support equipment) and reports are to be safely stored, held secure and in confidence to the client. Additionally, all records required to demonstrate compliance with the NDEP standard and any other applicable regulations must be made available to the accrediting authority during routine business hours of the laboratory.

7.4.2 The laboratory has a system for managing all notebooks, logbooks, and records of data including data reduction, validation, storage and reporting.

7.4.2.1 Standard and reagent logbooks are maintained in the laboratory area. Reagent Certificates of Analysis (C of A) may be maintained in hardcopy form in files in the laboratory area, or in electronic form either as a scanned document, downloaded document or a web link within a manufacturer's website.

7.4.2.2 All records of sample preparation, analysis, calibration, raw data, data reduction and validation are collected on bench sheets or in logbooks customized for each analysis. Bench sheets are maintained in folders and filed with the completed reports in the laboratory area. At approximately the end of each year these data are placed in files in the laboratory area or boxed and placed in the archive.

7.4.2.2.1 Analytical data for wet chemistry and microbiological methods are stored on bench sheets sorted by method/analyte and filed chronologically.

7.4.2.2.2 Supporting data for wet chemistry and microbiological methods (*e.g.*, balance checks, temperature records, etc.) are stored separately from the analytical data in notebooks or files in the laboratory areas.

7.4.2.2.3 Chain of Custody records are stored with the completed report in the designated area.

7.4.2.3 The long-term storage area considered an archive area. Data stored here is protected from fire, theft, loss, environmental deterioration, vermin and magnetic sources. All data removed from this area, even for a short time, must be logged in the archive

access log.

7.4.2.4 After five years, records may be destroyed or, returned to the client.

7.4.3 In the event that the laboratory ceases to do business, Silver State Analytical Laboratories will maintain laboratory data for a minimum of five years. Any clients having data stored at the laboratory will be notified. The laboratory will transfer records to the clients who requested the analysis. Any data that the client cannot or will not take will be held in storage the required five years, and then will be discarded.

7.5 Other Requirements

7.5.1 Other documentation and records required by the standard, such as training documentation, sample receipt documentation, standard and reagent documentation, are discussed in the pertinent sections of the quality system.

8.0 INTERNAL AUDITS AND MANAGEMENT REVIEWS

8.1 Internal Audits

The QAO is responsible for organizing a complete review of all laboratory systems on at least an annual basis. The QAO or their designee may perform this review as long as the reviewer is independent of the function being reviewed.

8.1.1 The review must be performed by Laboratory Director or QAO.

8.1.2 Checklists are used to assist the audit procedure. This ensures that there is documentation of what items were checked and the corresponding results.

8.1.3 Deficiencies discovered during the auditing process are rectified and documented using the corrective action process. Minor deficiencies that can be immediately fixed may be noted in the audit report as being completed at the time of the audit and are not required to be documented with a formal corrective action.

8.1.4 If audit findings cast doubt on the correctness or validity of calibrations or analytical results, immediate corrective action must be taken.

8.1.5 Specific parts of the review are detailed below.

8.1.5.1 Quality Systems review. The overall quality system is reviewed

using a checklist developed for this purpose. A checklist may be derived from the NELAC laboratory audit checklist or other reliable source. It may be modified as needed to meet the situation of the laboratory. Checklists are not controlled documents, but tools to remind the auditor of items to check and to provide a mechanism for documenting the items reviewed.

8.1.5.2 Quality Assurance Plan Review. The Quality Assurance Plan is reviewed at least annually. The review is designed to ensure that laboratory personnel are complying with its policies and procedures. At a minimum, the review will consist of reading the manual on an annual basis, deleting, updating and modifying the contents of the manual, and conducting refresher training for the laboratory personnel on the updates and changes of the manual.

8.1.5.3 Training files. Training files must be reviewed to ensure that the training for all of the methods each analyst is using is up to date and appropriately documented.

8.1.5.4 Proficiency Testing records. PT sample records are reviewed to verify that all required elements have been addressed. Additionally, the Laboratory Director or QAO will track all PT results to ensure that there are PT results for all certified parameters at the required twice-annual frequency.

8.1.5.5 Review of records—a selection of records, which may include data, sample receiving, thermometer calibration, balance and weight calibrations, etc., will be reviewed. The record review will be documented on the checklist. The review will consist of ensuring the records meet the requirements listed in laboratory procedures and policies.

8.1.5.6 Review of purchasing of certified standards. The laboratory QAO will review the electronic system that tracks certificates of purchased certified or reagents. The review will also consist of reviewing the standard preparation logbooks for completeness and adherence to laboratory policy and procedure. The review will be documented on the checklist.

8.1.5.7 Review of quality control schemes is performed when the laboratory QAO reviews the methodology performed by the laboratory personnel as stated in Section 4.1.3.

8.1.6 Laboratory Method Standard Operating Procedures–The Laboratory

Coordinator, QAO or designee will compare the laboratory SOP for each certified method to the actual laboratory practice at least once every two years.

8.1.6.1 The comparison to the method is performed by taking each section of the method and comparing it to the laboratory's SOP. If anything has changed, for example a new instrument has been introduced to the method, or if errors are discovered, the laboratory SOP will be revised. The laboratory may develop a checklist to aid in this comparison.

8.1.6.2 The comparison of the SOP to laboratory practice is accomplished by interviewing and/or observing the laboratory personnel performing the method. The laboratory may develop a checklist to aid in this comparison. The review may be documented using a form or by writing directly on an uncontrolled copy of the SOP.

8.1.7 Review of Quality Control Data. Quality Control Data is reviewed on an on-going basis at the time data is reported. Reviewer will take appropriate action if trends are identified that would negatively impact data quality.

8.2 Management Review

8.2.1 The Laboratory Management is responsible for performing an annual management review of the laboratory. The review is performed by the Laboratory Director's supervisor. The focus of the management review is on the sufficiency of the Quality Assurance Plan and system to meet the standards set by NDEP.

8.2.2 The review will include but is not limited to the following items:

8.2.2.1 The suitability of policies and procedures, including data integrity procedures
8.2.2.2 Results of the annual assessment
8.2.2.3 Results of proficiency testing samples
8.2.2.4 Corrective and preventive actions
8.2.2.5 Results of any external assessments, *e.g.*, certification assessments
8.2.2.6 Any changes in the volume or type of work, particularly anticipated changes
8.2.2.7 Review of client complaints or other client feedback
8.2.2.8 Any other relevant factors, such as quality control activities, resources, and staff training.

8.2.3 A record of the discussions included in the review will be kept on file in

the laboratory.

8.2.4 Any deficiencies identified during the management review will be rectified using the corrective action system described in the QAP. Documentation will be kept (using the corrective action system) to verify that the actions are completed within the time frame agreed upon during the management review.

Any preventive actions identified will be dealt with as described in the Preventive Action section of this QAP. Preventive actions must also be documented.

9.0 PERSONNEL TRAINING

9.1 General

9.1.1 The laboratory is required to ensure the competence of all personnel who operate equipment, perform environmental tests, evaluate results and sign reports. Personnel in training must be directly supervised until they have demonstrated capability for the task being performed. Personnel performing specific tasks must be qualified based on appropriate education, training, experience and/or demonstrated skill, as required.

9.1.2 The laboratory must have sufficient personnel with sufficient education, training, technical knowledge and experience to perform the activities of the laboratory.

9.1.3 All personnel are required to understand and comply with all quality assurance and quality control requirements that pertain to their job. The combination of training and experience must allow personnel to have a specific knowledge of their particular function as well as a general knowledge of laboratory operations, test methods, QA/QC procedures and records management.

9.1.4 In the event contract personnel are used in the laboratory, they must be properly supervised and meet all training requirements for the position they hold. This compliance must be documented.

9.1.5 The laboratory must maintain current job descriptions of all personnel in the laboratory.

9.2 Specific Requirements

9.2.1 Each analyst must demonstrate capability for each test method used in the laboratory initially, prior to reporting samples using the method, and on an

annual basis thereafter. The training must be documented. Specific requirements and procedures are detailed in the "Training" SOP.

9.2.2 Each analyst must read, understand, and agree to abide by all sections of the quality system that apply to their position. This must be performed and documented as described in the "Training" SOP.

9.3 Data Integrity Training

The laboratory is required to have in place a program to detect and prevent improper, unethical, or illegal actions. The program in place in the laboratory includes the following elements

- Data integrity training
- Documentation signed by each employee
- In-depth, periodic monitoring of data integrity
- Documentation of data integrity procedures.

9.3.1 Data integrity training is required as a part of the initial new employee orientation and annually thereafter. The following requirements will be met in the training

9.3.2 All topics must be documented in writing and provided to all trainees.

9.3.3 Topics must include the following items

- The relationship of the laboratory mission to the critical need for honesty and full disclosure in all data reporting
- The importance of proper narration where collected data may be useful, but are in one sense or another partially deficient
- Definitions and examples of improper, unethical, or illegal actions
- A description of the program for prevention and detection of these types of actions
- Defined consequences for violating the data integrity policy.
- How and when to report data integrity issues
- Record keeping requirements.

At the conclusion of each data integrity training session, laboratory personnel will be required to sign a statement that they understand and agree to abide by the data integrity provisions in the laboratory.

9.4 Ethics Training

9.4.1 All employees involved in the handling process of samples will undergo an ethics training program. In the absence of a formal NDEP program for ethics Silver State Analytical labs has chosen to use the New York Association of Approved Environmental Laboratories (NYAAEL) program. All employees involved in the sample handling process will undergo the initial NYAAEL initial ethics program course shortly after initial hire. In addition all employees involved in the sample handling process are also required to complete the ethics refresher course each year offered by NYAAEL. Certification that this training has been completed will be stored in the Employees permanent training file.

10.0 ACCOMODATION AND ENVIRONMENTAL CONDITIONS

10.1 General Considerations

10.1.1 The laboratory must ensure that all of the laboratory facilities, including but not limited to the physical space and layout, energy sources, lighting and environmental conditions are such that they allow correct performance of the environmental tests.

10.1.2 The laboratory must also ensure that environmental conditions do not invalidate the tests being performed. This is true in the laboratory as well as for testing performed away from the laboratory.

10.1.3 Access to the laboratory is controlled. Only authorized laboratory personnel are allowed past the office area into the areas of the laboratory where analyses are performed. In the event that a person must enter the laboratory they will sign the visitor's log and be supervised by a laboratory employee for the extent of their time in the laboratory.

10.2 Laboratory Description

10.2.1 The Las Vegas laboratory is located at 3638 E. Sunset Rd. Suite 100, Las Vegas, NV 89120 and has sufficient workspace for conducting all laboratory activities. The Reno Laboratory is located at 4587 Longley Lane, No. 2, Reno, NV 89502 and has sufficient work space for conducting all laboratory activities per the NDEP scoping letter.

10.2.2 The laboratories have adequate storage space to contain and store all needed supplies, reagents, and equipment.

10.2.3 The laboratories have adequate lighting and ventilation for the work performed. Temperature and humidity are maintained with instrument and

analytical considerations in mind.

10.3 Environmental Conditions

10.3.1 The laboratory monitors and controls all environmental conditions that affect the test methods used in the laboratory, including all those that are required by a specific test method.

10.3.2 The ambient temperature of the laboratory is maintained appropriately for performing pH measurements and measuring DO in the BOD test. The laboratory is generally maintained between 68 – 76 ^{o}F. Laboratory ambient temperature will be adjusted if samples are consistently outside the desired range.

10.4 Housekeeping

10.4.1 Laboratory personnel should keep unused glassware put away except during use to minimize clutter in the work areas.

10.4.2 Laboratory benches are kept clean appropriate to the tests being run.

10.4.3 Work spaces, walkways, laboratory benches and other work areas are kept clear and uncluttered.

10.4.4 No other specific procedures are required to prevent cross contamination from one procedure to another.

11.0 ENVIRONMENTAL TEST METHODS AND METHOD VALIDATION

11.1 Test Methods

11.1.1 The laboratory uses only methods from recognized methods compendia such as *Standard Methods for the Examination of Water and Wastewater*, Annual Book of ASTM Standards and methods published by the Environmental Protection Agency. If the laboratory ever needs to use methods that are not from a recognized source, they will be fully validated as described in NELAC Chapter 5. Since it is unlikely that such methods will ever be required, the validation process is not included in the written quality system of the laboratory.

11.1.2 When choosing methods to apply to client samples, the laboratory ensures that all analyses for which the results are to be submitted for regulatory purposes are performed using methods certified by the accrediting body.

11.1.3 The laboratory uses appropriate methods for all other laboratory operations, including sampling, transport, sample receipt, sample handling, storage and preparation of samples and, where appropriate, for the estimation of measurement uncertainty and statistical evaluation of data.

11.1.4 The laboratory maintains instructions for all processes where the absence of such instructions could jeopardize the results of its analyses. All such instructions are kept up to date and are readily available to laboratory personnel.

11.1.4.1 The instrument manuals provided by the manufacturer are the instructions used for instrument operation.

11.1.4.2 Instructions for laboratory processes that are not analytical methods are contained in this QAP or in related SOPs.

11.1.4.3 SOPs for analytical methods in this QAP

11.1.5 The laboratory maintains a list of all methods for which accreditation is sought.

11.1.6 All methods used by the laboratory are fully documented in Standard Operating Procedures. The format to be used when writing SOPs is specified in Section 3 of this QAP.

11.2 Validation

11.2.1 Prior to implementation in the laboratory, each method must be demonstrated to be functional in the laboratory with a Demonstration of Capability. The DOC must be performed at the implementation of a method and again every time there is significant change in equipment, personnel, or method. Since the DOC is required for every analyst prior to method performance, no additional method DOC is required. Details on performing the DOC are located in the SOP.

12.0 UNCERTAINTY OF MEASUREMENT

12.1 Uncertainty of Measurement

12.1.1 It is required that the laboratory have a process for estimating the uncertainty of measurement for each reported parameter, if applicable. These values will be reported whenever they are requested by a client. It

is unlikely that a client of the laboratory will ever request the uncertainty associated with any values reported by this laboratory. Nevertheless, the laboratory has a procedure for developing uncertainty values.

12.1.2 If uncertainty values are requested by the client, the laboratory will attempt to make a determination as to whether the client is interested in obtaining the uncertainty values associated with the laboratory performance or with the entire measurement process.

12.1.2.1 If the client is interested only in the laboratory uncertainty, this can be determined by developing control charts of LCS determinations.

12.1.2.1.1 Chart the LCS values for at least 20 analyses. For pH analyses, use the second source standard values.

12.1.2.1.2 Determine the 95% confidence limits for the charted values. Determine the standard deviation of the values and express it as a percent of the LCS target value. Multiply the standard deviation (in percent) by a factor of two. This value will provide the confidence interval in the uncertainty expression.

12.1.2.1.3 Determine the average of the LCS recovery data. Express it as a percent of the target value. This will provide a measure of the systematic bias of the laboratory measurement.

12.1.2.1.4 The client data can then be reported with an uncertainty interval for either a single value or an average of more than one value. To determine the uncertainty interval, multiply the value or average value, whichever is desired, by the 2SD value (in percent, expressed as a decimal) determined above. Determine the upper limit by adding the result to the reported value or average value. Determine the lower limit by subtracting the result from the reported value or average value. The result of this calculation is the uncertainty interval expressed in the same units as the result.

12.1.2.2 Correct the uncertainty interval for the systematic bias determined above by dividing the values obtained for the upper and lower limits of the uncertainty interval by the bias determined above (in percent, expressed as a decimal).

12.1.3 Determination of total uncertainty including sampling and matrix effects is beyond the scope of this QAP.

13.0 CONTROL OF DATA

13.1 Data Collection

13.1.1 Calculations and data transfers must be verified in an appropriate and systematic manner.

13.1.2 All analyses in the laboratory have a bench sheet designed for them that guides the analyst to record all of the information required.

13.1.3 Data is recorded on the bench sheets promptly at the time of the analysis. Proper documentation procedures must be used as described in Section 7 of this QAP. Analysts review the QC information at the time of analysis.

13.1.4 The analyst signs or initials and dates the bench sheet to indicate that they have performed the steps indicated and that the analysis meets acceptance criteria or has exceptions that are noted in the comments section of the bench sheet.

13.1.5 When the analyst has finished the analysis, another person in the laboratory checks the bench sheet for the following items.

- All required information has been recorded on the bench sheet.
- QC criteria have been met or exceptions are documented in the comments section of the bench sheet.
- Manual calculations are spot checked to verify accuracy.
- Data that was originally captured manually is correctly transferred to the electronic version of the bench sheet.

13.1.6 When these checks have been completed, the reviewer signs or initials and dates the bench sheet to document that the review has been performed.

13.1.7 The data from the bench sheet is then entered into an Excel spreadsheet.

13.2 Automated calculations

13.2.1 Some analyses in the laboratory have spreadsheets that have been designed to perform the calculations necessary to generate the reportable results. All spreadsheets created for the laboratory will be validated for

use prior to implementation.

13.2.2 This validation will typically consist of a manual confirmation of the calculations performed by the spreadsheet. This verification will be kept on file in the laboratory.

13.3 Software Validation

13.3.1 Instrument software provided by the instrument vendor or by a recognized third-party vendor is considered to be validated by the vendor.

13.3.2 Office software applications such as Word and Excel are considered to be validated by the vendor.

13.3.3 Any software applications designed in the laboratory must be validated by the laboratory. See the section above for a description of the validation procedure for spreadsheets. This same process is followed if any other types of applications are designed in the laboratory.

13.4 Data Integrity

13.4.1 All records shall be maintained in a manner that facilitates documentation tracking and allows historical reconstruction of all analytical events and ancillary procedures that produced the resultant sample analytical data. The system shall link all documentation through the final analytical result. This may be accomplished through either direct or cross-references to specific documentation. The system shall be straightforward and shall facilitate the retrieval of all working files and archived records for inspection and verification purposes. Final reports, data summaries, or other condensed versions of data that have been prepared by external parties shall be linked to internal records by an unequivocal cross-referencing mechanism (laboratory ID numbers).

13.4.2 Entries into all records must be written legibly and must be made with waterproof ink. All documentation entries shall be signed or initialed by responsible staff. Entries in records shall not be obliterated by erasures or markings (whiteout products are not to be used).

13.4.3 All corrections to record-keeping errors shall be made by one line marked through the error. The individual making the correction shall sign (or initial) and date the correction.

13.4.4 When a sample collection, preservation or handling anomaly is noted, the report and corrective action will be verified by a second sample receipt technician.

13.4.5 The chemistry technician checks the final reports against the original COC when the final report is generated. The data entry for results is

checked within the analytical units and validated by the laboratory Director.

13.4.6 Hard copies of final reports are kept in folders and filed using the following guidelines: by year, by assigned lab number

13.4.7 Lab numbers are filed in descending order. All COCs are kept in the file with the reduced data. All final reports can be linked to internal records via lab number. Results may be accessed by the data user via computer after analysis is completed and approved.

Any software applications designed in the laboratory must be validated by the laboratory. See the section above for a description of the validation procedure for spreadsheets. This same process is followed if any other types of applications are designed in the laboratory

14.0 EQUIPMENT

14.1 General

14.1.1 The laboratory furnishes all of the equipment necessary to perform the analyses for which certification is sought.

14.1.2 Equipment and the software associated with it, if applicable, is capable of achieving the accuracy required by the specific analytical methods.

14.1.3 All equipment having an effect on the accuracy or validity of analytical results must be calibrated or verified prior to being put into service and on a continuing basis.

14.1.4 Prior to use each working day, all balances, ovens, refrigerators, freezers, and incubators are checked with NIST-traceable references in the expected working range.

14.1.5 Acceptability for use is based on the needs of the analysis or application for which it is used.

14.1.6 All equipment, including both hardware and software, must be safeguarded from adjustments which would invalidate the test results.

14.2 Calibration of Analytical Instruments

14.2.1 General Considerations

14.2.1.1 Calibration procedures are described in detail in the analytical method SOP.

14.2.1.2 Sufficient raw data records must be retained to permit reconstruction of the instrument calibration. Data must include the

14.2.1.2.1 calibration date
14.2.1.2.2 test method
14.2.1.2.3 instrument
14.2.1.2.4 analysis date
14.2.1.2.5 analyte name
14.2.1.2.6 analyst's initials or signature
14.2.1.2.7 concentration and response
14.2.1.2.8 the equation or other mathematical terms used to reduce instrument responses to concentration. Records of the mathematical equations used by on-board software are not required.

14.2.1.3 Samples must be quantitated using the initial calibration.

14.2.2 Initial Calibration

14.2.2.1 All initial instrument calibrations must be verified with a standard obtained from another source, such as another manufacturer or a second, independent lot from the same manufacturer. Traceability must be to a national standard when one is available.

14.2.2.2 Criteria for acceptance of the initial calibration must be established and included in the method SOP.

14.2.2.3 The lowest calibration standard is the lowest concentration for which quantitative data are reported. Any data reported below the lower quantitation limit must be qualified on the final report as having a greater uncertainty.

14.2.2.4 The highest calibration standard defines the upper limit of the calibrated range of the instrument. Any data reported from concentrations above the upper standard must be qualified on the final report as having a greater uncertainty.

14.2.2.5 If initial calibration results do not meet the acceptance criteria defined in the method or method SOP, corrective actions must be performed and all associated samples reanalyzed. If this is not possible, the data must be reported with appropriate qualification.

14.2.2.6 If the reference method does not specify the number of

calibration standards required, the minimum number is two, one of which must be at the limit of quantitation, not including blanks or zero standards.

14.2.3 Continuing Calibration Verification

14.2.3.1 When an initial calibration is not performed on the day of analysis, the validity of the initial calibration must be verified prior to sample analysis using the continuing calibration verification process.

14.2.3.2 Calibration must be verified for each compound, element, or other discrete chemical species, except for multicomponent analytes where a representative chemical related substance or mixture can be used. In some analytical procedures, the same solution preparation may meet the requirements to be both the CCV and the LCS. In this case, the requirements of both may be met by a single analysis of the solution.

14.2.3.3 Instrument calibration verification must be performed:

- at the beginning and end of each analytical batch
- whenever it is expected that the analytical system may be out of calibration or might not meet the verification acceptance criteria
- if the time period for the most previous calibration verification has expired
- for analytical systems that contain a calibration verification requirement
- at the rate defined within the referenced method

14.2.3.4 In addition to other data requirements noted above, the records must explicitly connect the continuing calibration verification data to the initial instrument calibration.

14.2.3.5 Acceptance criteria for the continuing calibration verification must be established in the laboratory method SOPs. If the CCV does not pass the criteria, corrective action must be performed.

14.2.3.5.1 Routine preventative maintenance may be performed and a second CCV analyzed immediately. If the second CCV passes, sample analysis may be resumed.

14.2.3.5.2 If the second CCV does not pass, the laboratory may perform additional maintenance. If this option is chosen, the laboratory must demonstrate acceptable performance with analysis of two consecutive acceptable CCVs prior to re-starting analysis.

14.2.3.5.3 If the laboratory cannot demonstrate acceptable performance with the CCVs, a new initial calibration must be analyzed and verified before proceeding with sample analysis.

14.2.3.6 There are two special circumstances in which data may be reported from an analysis where the CCV was not acceptable.

- If the acceptance criteria were exceeded high (*i.e.*, there is a high bias) and the associated samples show the analyte as non-detected, those samples may be reported.
- If the acceptance criteria are exceeded low and the results exceed a regulatory maximum or decision level, those results may be reported.

14.3 Preventive Maintenance and Instrument Documentation

14.3.1 All equipment must be properly maintained, inspected and cleaned. Maintenance procedures must be documented.

14.3.2 Each piece of analytical equipment that requires calibration or monitoring must be uniquely identified. This is accomplished in the laboratory by using the manufacturer and model number of each piece of equipment. In the event that duplicate pieces of equipment are present in the laboratory, a different unique identifier will be added to the description.

14.3.3 The laboratory maintains a log book for each instrument that includes the following information

- The identity of the item and non-integral software, if applicable
- The manufacturer, model number, and serial number
- The current location of the instrument
- A record of all maintenance carried out to date, including all routine, non-routine, and third-party vendor maintenance
- A record of any malfunctions, modifications, or repairs
- The date received and the date placed in service, if known

- The condition when received (*e.g.*, new, used, reconditioned), if known

14.3.4 The laboratory keeps copies of the instrument manuals as instructions for use. The copies are kept in or near the laboratory for easy reference.

14.3.5 The laboratory keeps all instrument calibration data.

14.3.6 Equipment that has been subjected to overloading or mishandling, gives suspect results, or has been shown to be defective or outside specified limits must be taken out of service. It shall be isolated or clearly labeled or marked to be out of service until it has been repaired and shown by calibration or test to perform correctly. Additionally, the laboratory must examine the effect of the problem on previous environmental tests and shall institute the "Control of non-conforming work" procedure, if necessary.

If the laboratory ever uses equipment that is outside the control of the laboratory, or if the laboratory's equipment ever goes outside the direct control of the laboratory, the laboratory must take responsibility for checking to ensure that the equipment still functions correctly prior to returning the equipment to service in the laboratory.

15.0 MEASUREMENT TRACEABILITY

15.1 Measurements

15.1.1 The laboratory maintains a program of measurement traceability that is detailed in various places in the quality system. All equipment must be calibrated before being put into use.

15.1.1.1 Analytical instrumentation is calibrated in accordance with the Section "Equipment" of this QAP and with the analytical method SOP.

15.1.1.2 Support equipment is calibrated in accordance with Section "Equipment" of this QAP.

15.1.2 Laboratory equipment is demonstrated to provide the uncertainty of measurement needed through passing initial demonstrations of capability for specific methods. Support equipment is traceable to national standards through NIST-traceable thermometers and class 1 weights.

15.1.3 Analytical standards are traceable to reference materials and are routinely verified through the analysis of second-source standards and participation

in Proficiency Testing programs.

15.1.4 Reference Standards and Traceability. The laboratory maintains a program of calibration for its reference standards to ensure traceability in SI units of measurement to international standards.

15.1.4.1 Reference Thermometer

15.1.4.1.1 A NIST-traceable thermometer will only be used to check the working thermometers. The calibration of this thermometer will be verified by an outside calibration vendor every five years.

15.1.4.1.2 The vendor providing the thermometer calibration check will provide a certificate stating the specific metrological specification used to evaluate the thermometer. This certificate will be kept on file by the laboratory.

15.1.4.1.3 The NIST-traceable thermometer is stored in a protective case and is protected from shock or extreme temperature that could disrupt the mercury column.

15.1.4.2 Reference Weights

15.1.4.2.1 Class 1 weights are used to check the balance calibration on a daily basis and are used for no other purposes. The Class 1 weights will be verified every five years by an outside calibration vendor and will be calibrated if necessary.

15.1.4.2.2 The vendor will provide a certificate of calibration stating the specific metrological specification used to evaluate the weights. This certificate will be kept on file by the laboratory.

15.1.4.2.3 The Class 1 weights are stored in a protective case and handled with forceps specifically for that purpose. They are handled carefully to avoid dropping them or contaminating them by touching them with anything but the forceps. Alternatively, they may be handled directly using a fresh pair of clean, non-talc gloves.

15.1.5 Reference Materials (Standards) and Reagent Traceability

15.1.5.1 Analytical Standards

15.1.5.1.1 Analytical standards are purchased with certificates of analysis showing them to be valid reference materials.

15.1.5.1.2 Procedures for preparing working standards are designed to ensure traceability to the primary analytical standard. The procedures are described in Section 16 of this QAP.

15.1.5.1.3 Standards are stored in accordance with label instructions in order to preserve the integrity of the standard.

15.1.5.2 Documentation and Labeling of Standards, Reagents, and Reference Materials

15.1.5.2.1 The laboratory maintains documented procedures for the purchase, reception and storage of consumable materials used for the technical operations of the laboratory.

15.1.5.2.2 The laboratory retains records for standards, reagents and reference materials, including the following information:

- The Manufacturer or Vendor
- The manufacturer's Certificate of Analysis or purity (if supplied)
- The date of receipt
- Recommended storage conditions
- An expiration date after which the material will not be used unless its reliability is verified by the laboratory

15.1.5.2.3 The laboratory will not use prepared reagents, standards, or purchased chemicals outside the expiration date of the material.

15.1.5.2.4 Original containers are labeled with an expiration date.

15.1.5.2.5 Records are maintained on the preparation of standards

and reference materials. The records include information to show traceability to purchased stocks or neat compounds and include the following information.

- Reference to the method of preparation
- Date of preparation
- Expiration date
- Preparer's signature or initials

15.1.5.2.6 All containers of prepared standards and reference materials are labeled with a unique identifier and expiration date. The identifier is linked to the preparation records.

15.1.5.2.7 Reagents are prepared from reagent grade chemicals, at a minimum, unless a lesser grade of chemical is specifically listed in the reference method. Quality control checks of the method demonstrate that the reagents meet the requirements of the methods.

15.1.5.2.8 All containers of prepared reagents are labeled with a unique identifier, which includes the preparation date, and an expiration date.

16.0 SAMPLING

16.1 Silver State Analytical Laboratories offers sampling services to clients. These procedures are described in detail in the SOP *Sample Management*. Since sampling is an integral part of the service offered by the laboratory, it is important that laboratory personnel include this SOP and the procedures it describes as part of their training.

16.2 Where sampling (as in obtaining sample aliquots from a submitted sample) is carried out as part of the test method, instructions are given in the laboratory method SOP on how to obtain a representative subsample.

16.3 If a client requests deviations, additions, or exclusions from the procedure described in the SOP *Sample Management*, these will be recorded in detail with the appropriate sampling data and will be included in all documents containing the resulting test data. These deviations must be communicated to the appropriate personnel.

16.4 Laboratory Technicians working for the laboratory are required to keep records of the sampling procedure used, the identification of the sample, and any other records

necessary to identify the sampling site.

17.0 HANDLING OF SAMPLES

17.1 The laboratory maintains a system to identify each sample unambiguously for the life of the sample in the laboratory. This system is described in detail in the SOP *Sample Receipt and Login*.

17.2 Any samples or sample preparations determined to be hazardous are returned to the client for proper disposal or collected and sent to a hazardous waste disposal facility.

18.0 QUALITY CONTROL

18.1 General

18.1.1 The laboratory is required to have quality control (QC) procedures in place to monitor the analyses performed by the laboratory. QC data must be recorded and must be subject to planned reviews. In addition to review of QC data, the following procedures are used to demonstrate continuing compliance of laboratory operations.

- Regular use of reference materials and secondary reference materials
- Participation in a twice-annual proficiency testing program
- Replicate testing of spiked and unspiked samples

Each of these types of quality control checks are described elsewhere in this QAP.

18.2 Essential Quality Control Procedures

The laboratory maintains a quality control program designed to be compliant with the NDEP standards and with accepted laboratory practices.

18.2.1 The laboratory has in place the following quality controls.

- Spiked samples and blanks to be used as positive controls
- Blank samples to be used as negative controls
- Duplicate samples to be used to define variability or repeatability
- Calibrations, use of reference materials and proficiency test samples to assure accuracy
- Defined mathematical procedures to be used to generate final results from raw data
- Use of standards and reagents of appropriate quality
- Initial demonstrations of method capability to assure the selectivity

of each analytical method
- Use of Method Detection Limits to demonstrate adequate sensitivity and annual LOD/LOQ verification.
- Documented procedures in each laboratory method SOP for defining and monitoring required test conditions

18.2.2 Instruments are calibrated as described in Section 14.2 of this QAP and detailed in the laboratory method SOPs.

18.2.3 Batch QC samples are prepared with each preparation batch prepared in the laboratory. A preparation batch is a batch of samples of the same quality system matrix not to exceed a total of 20 field samples. QC samples are not counted as part of the twenty.

18.2.3.1 Each batch must contain, where applicable, a Laboratory Control Sample, a Method Blank, a Matrix Spike sample and a Matrix Spike Duplicate or Matrix Duplicate sample.

18.2.3.1.1 There is no appropriate Method Blank for pH analyses.

18.2.3.1.2 Matrix Spike/Matrix Spike Duplicates are not required for analyses where no certified spiking solution is available (e.g. pH, BOD, Solids analyses).

18.2.3.2 The preparation and evaluation of each of these QC samples is detailed in the laboratory method SOPs.

18.2.4 All quality control measures must be assessed and evaluated while analyses are on-going. Laboratory personnel use bench sheets to record all raw data. QC data is used to determine the usability of sample data as described later in this section.

18.2.5 Detection Limits and Reporting Limits

18.2.5.1 The laboratory uses Reporting Limits rather than the Method Detection Limit (MDL) procedure described in 40 CFR 136, Appendix B to convey sensitivity for each analysis performed in the laboratory.

18.2.5.2 Reporting limits are set using the low standard of the analysis. The laboratory strives to set the reporting limit either at a level approximately 3-5 times the approximate MDL or at a level such that the range of the analysis encompasses any significant regulatory levels.

18.2.5.2.1 Reporting limits must be verified annually using the following procedure.

18.2.5.2.1.1 A QC sample is prepared at a concentration 1-2 times the reporting limit.

18.2.5.2.1.2 The sample is analyzed by the test method.

18.2.5.2.1.3 The result must be within the accuracy limits of the method or within the client-specified accuracy limits.

18.2.5.2.2 Reporting limit verification is not required for analyses where no certified spiking solutions are available (e.g. pH, BOD, TSS)

18.2.6 All quality control protocols specified in the laboratory method SOPs must be followed. These protocols must be based on the NDEP standards.

18.3 Calculations

18.3.1 Matrix spike recoveries are calculated using the following equation unless otherwise specified in the laboratory method SOP.

$$\%R = [(SSR-SR)/SA] * 100$$

Where
SSR = Spiked Sample Result
SR = Sample Result (Unspiked)
SA = Spike Added

18.3.2 Laboratory control sample recoveries are calculated using the following equation.

$$\%R = (\text{CONCENTRATION FOUND} \div \text{TRUE CONCENTRATION}) * 100$$

18.3.3 Duplicate precision is calculated using the following equations for Relative Percent Difference (%RPD) as is appropriate.

$$\%RPD = [|V1 - V2| \div ((V1 + V2) \div 2)] * 100$$

Where
V1 = Sample1 Value or % Recovery
V2 = Sample1 Duplicate Value or % Recovery

19.0 REPORTING OF RESULTS

19.1 General Considerations

19.1.1 The result of each environmental test must be reported accurately, clearly, unambiguously and objectively as well as in accordance with any specific instructions included in the test method.

19.2 Report Elements:

19.2.1 All of the following information must either be included in the report or retained and available in the laboratory.

- The name and address of the laboratory, the phone number, and the name of the contact person to address questions.
- A unique identification of the test report. This identification must be placed so that every page is recognizable as part of the test report. This laboratory uses the laboratory identification number of the sample being reported. The laboratory identification number is printed on every page of the test report.
- The name and address of the client, and the project name if applicable.
- Identification of the method used for analysis.
- A description of, condition of, and unambiguous identification of the sample(s) including the client identification code.
- The date of receipt of the samples, the date and time of sample collection and the date of analysis.
- Reference to the sampling plan and procedures used by the laboratory where these are relevant or applicable to the results.
- The environmental test result, including units of measurement such as mg/L, identification of any failures, and, where applicable, identification as to whether results are reported on a dry weight or wet weight basis.
- The name of the person authorizing the test result and the date of issue.

19.2.2 In addition to the items listed above, the laboratory will include the following where it is necessary for interpretation of the results.

- Deviations from the method, including failed quality control

parameters, information on specific test conditions, any other non-standard conditions and definitions of any data qualifiers.

- Identification of any test results that did not meet all NDEP sample acceptance requirements or laboratory quality system requirements.
- Where applicable or requested by the client, a statement on the estimated uncertainty of the measurement.
- Qualification of numerical results with values outside the working range.

19.2.3 When the laboratory performed the sampling, the following information must be retained.

- The date of sampling.
- Unambiguous identification of the substance sampled.
- The location of the sampling. This may include diagrams, sketches or photographs if necessary, but it is not required.
- Reference to the sampling plan and procedures used.
- Details of any environmental conditions during sampling that may have affected the interpretation of the test result.
- Any standard or other specification for the sampling method or procedure and any deviations, exclusions, or additions from the specification. In this laboratory the sampling procedure is provided in the SOP Sampling and no additional information is usually required.

19.2.4 Results obtained from subcontractors must be clearly identified, including the subcontractor's name or applicable certification number. Subcontractors report results to the laboratory in writing and this report is kept for reference.

19.3 Prior to reporting of results, batch quality control data shall be reviewed by the Laboratory Director or designee.

19.4 A copy of each report must be kept by the laboratory.

19.5 If results are reported to the client by e-mail, telephone, FAX or other electronic means, the requirements above must be met and all reasonable steps must be taken to ensure client confidentiality.

19.6 If an amendment is required to a report, the following requirements will be met.

- The amended report will meet all requirements of this section.
- If a completely new report is required, it will be uniquely identified and make reference to the original report that it replaces.

20.0 PROFICIENCY TESTING

20.1 The laboratory will participate in Proficiency Testing studies twice per year for each analyte/matrix for which the laboratory is requesting certification.

20.1.1 The studies must be approximately six months apart as determined by the closing date of the study. The closing dates may be no closer than five months and no longer than seven months apart without express permission from NDEP.

20.1.2 Additional studies, if required, may start no more than 15 days after the close of the previous study.

20.1.3 All PT study results, regular or remedial, must be returned to the PT provider within 45 calendar days of opening of the study. For regular studies, this date is listed by the PT provider. For remedial studies, this date is the shipping date from the provider.

20.1.4 Remedial PT studies must be obtained from an accredited provider and must be from a study lot that has not previously been provided to the laboratory.

20.1.5 The laboratory must not subcontract the analysis of PT samples, must not communicate with any other laboratory about the contents of PT samples prior to the closing date of the study, and must not knowingly analyze PT samples for any other laboratory.

20.2 PT studies must be performed for each certified parameter in each of the NDEP defined matrices. Generally, for this laboratory, this only includes non-potable water, but could potentially also include potable water or solid/chemical waste.

20.2.1 PT samples must be analyzed in the same manner as client samples.

20.2.1.1 PT samples received as ampules are diluted according the providers instructions. The diluted sample becomes the routine samples and is added to a routine analytical batch.

20.2.1.2 PT samples are prepared in the same manner as routine environmental samples except as otherwise instructed by the PT provider.

20.2.1.3 PT samples will not be analyzed multiple times unless routine samples are analyzed multiple times. Results will be calculated in the same manner that results of routine samples are calculated. Multiple dilutions may be analyzed as necessary in

order to achieve results within the calibrated range of the method.

20.2.1.4 As much as possible, the type, composition, concentration, and frequency of QC samples analyzed with the PT sample must be the same as is analyzed with routine environmental samples.

20.2.1.5 Initial and continuing calibrations are analyzed at the same frequency and in the same manner as with routine environmental samples.

20.2.2 All raw data generated in the analysis of PT samples will be documented in the same manner as with routine samples. Copies will be kept on file for easy access if requested by the Accrediting Body.

20.3 PT results must be reported to the provider as required by the provider. The Laboratory Director or other signatory for the laboratory must sign the attestation statement provided with the PT samples. Copies of all report documents must be kept by the laboratory.

20.4 If the laboratory PT result is rated "Not Acceptable" by the PT provider, the laboratory must take corrective action using the corrective action system in the laboratory.

20.4.1 Corrective actions must be reported to NDEP.

20.4.2 The laboratory may, in the course of the corrective action, use QC samples provided by a PT provider. These samples may be used to help troubleshoot the analytical system, but they may not be analyzed in the same analytical batch as a PT sample.

20.4.3 The laboratory may use remedial PT samples to demonstrate successful corrective action and to meet PT requirements for each certified parameter.

21.0 DATA INTEGRITY PROCEDURES

21.1 The laboratory is required to have in place a program to detect and prevent improper, unethical, or illegal actions. The program in place in the laboratory includes the following elements.

- Data Integrity Training
- Documentation signed by each employee
- In-depth, periodic monitoring of data integrity
- Documentation of data integrity procedures

21.2 Laboratory management shall review the Data Integrity Procedures annually in conjunction with the annual management review.

21.3 Data integrity training is required as a part of the initial new employee orientation and annually thereafter. The following requirements will be met in the training:

21.3.1 All topics must be documented in writing and provided to all trainees.

21.3.2 Topics must include the following items:

- The relationship of the laboratory mission to the critical need for honesty and full disclosure in all data reporting.
- The importance of proper narration where collected data may be useful, but are in one sense or another partially deficient.
- Definitions and examples of improper, unethical, or illegal actions.
- A description of the program for prevention and detection of these types of actions.
- Defined consequences for violating the data integrity policy.
- How and when to report data integrity issues.
- Record keeping requirements.

21.3.3 At the conclusion of each data integrity training session, laboratory personnel will be required to sign a statement that they understand and agree to abide by the data integrity provisions in the laboratory.

21.4 Prevention of improper, unethical, or illegal actions.

21.4.1 Prevention of improper, unethical, or illegal actions begins with a zero-tolerance philosophy established by the laboratory management. Laboratory management will uphold the spirit of the laboratory's data integrity procedures and will work to effectively implement the requirements of these procedures.

21.4.2 The laboratory also maintains a no-fault reporting policy for data integrity issues.

21.4.2.1 The no fault policy is intended to encourage personnel to report suspected violations of the data integrity policy.

21.4.2.2 Personnel may report suspected violations of this policy confidentially. Investigations that may be required will be carried out in a confidential manner as long as possible.

21.4.2.3 If any laboratory personnel observe behavior that they believe is improper, unethical, or illegal, they should report that behavior to the Laboratory Director

21.4.2.4 The laboratory management will assure that personnel will not be punished for reporting their observation of improper, unethical, or illegal activities to supervisory personnel.

21.4.3 Gross deviations from specified procedures should be investigated for potential improper, unethical, or illegal actions. Findings of fraud should be prosecuted to the fullest extent of the law.

21.4.4 The program begins with a presentation of the data integrity policy to all new hires during their initial city orientation.

21.4.5 Annual refresher training is provided to all laboratory personnel.

21.4.6 Internal audits include in-depth data monitoring in every analytical section.

21.4.7 Proficiency Testing samples are analyzed twice yearly. Assignments are rotated among analysts to verify competency.

21.5 Investigations

21.5.1 If a report is received of a potential violation of the laboratory's data integrity procedures, further review is required.

21.5.2 Management must ensure that the person reporting the possible violation is encouraged to give a complete reporting and that no negative actions are taken against the employee because they have reported the possible violation.

21.5.3 If the laboratory's auditing program reveals evidence of inappropriate actions or vulnerabilities related to data integrity, further review is required.

21.5.4 A review may indicate that the possible problem is not of concern and may be closed. If the review indicates potential issues of concern, a thorough investigation will be conducted.

21.5.4.1 All investigations will be handled in a confidential manner until such time as a follow up evaluation, full investigation, or other appropriate actions have been completed and the issues

clarified.

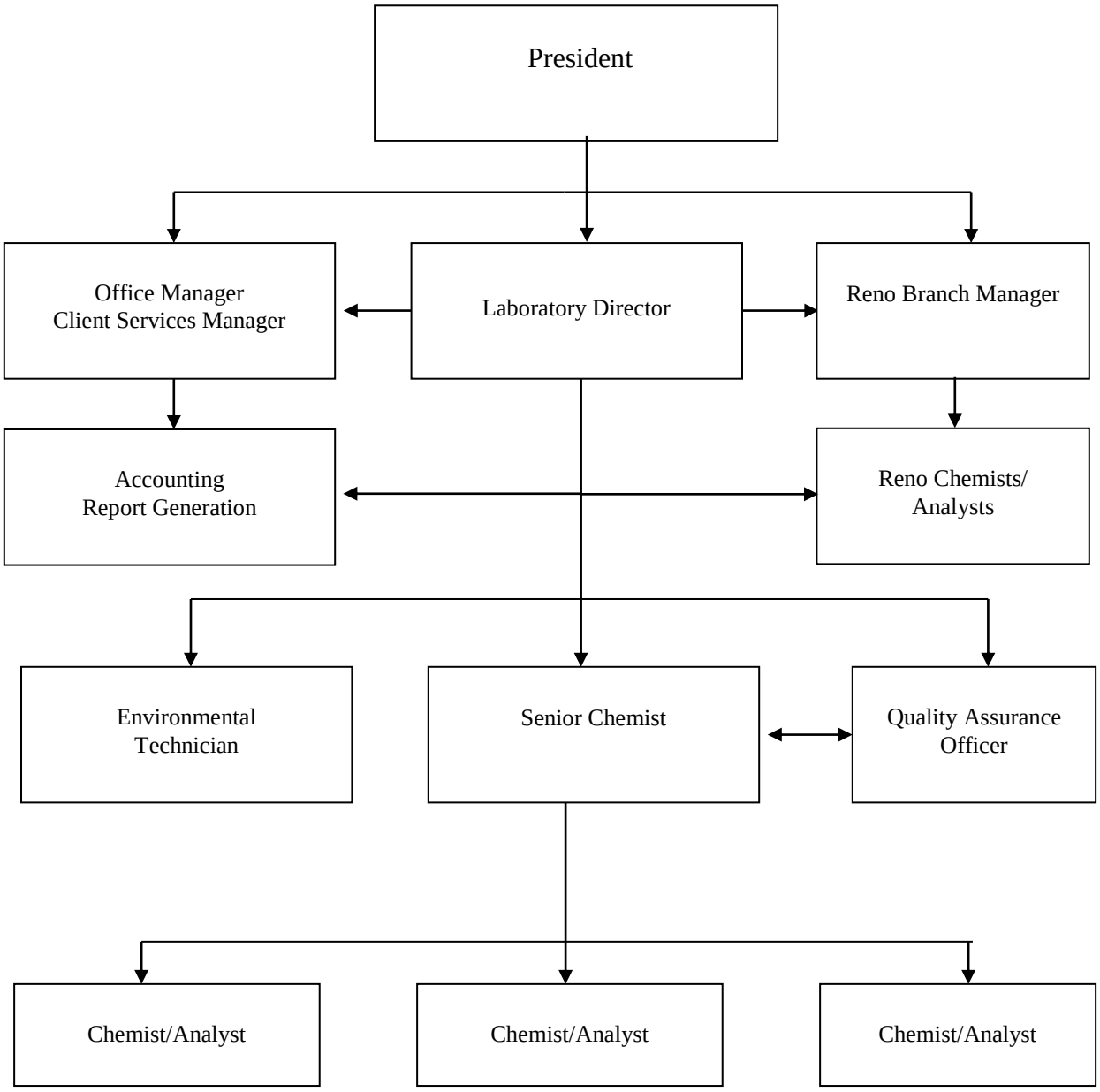
21.5.4.2 All investigations that result in finding of inappropriate activity must be documented and the documentation must include any disciplinary actions involved, corrective actions taken, and all notifications of clients. All documentation must be kept for at least five years.

Appendix 1
Organizational Chart

ORGANIZATIONAL STRUCTURE

Silver State Analytical Laboratories, Inc.

Corporate/Laboratory Organizational Chart



Appendix 2
Certified Method List

Methods				
	Method ID	**Analyte**	**Las Vegas**	**Reno**
SDWA (potable)	9223B – Colilert (21st) P/A	Total Coliform and E. coli, p/a	X	Pending
	IDEXX Quanti-Tray (21st)	Total Coliform and E. coli, mpn	X	Pending
	SM 300.0	Chloride	X	Non-reg
	SM 300.0	Fluoride	X	Non-reg
	SM 300.0	Nitrite	X	Non-reg
	SM 300.0	Nitrate	X	Non-reg
	SM 300.0	Sulfate	X	Non-reg
	SM 300.0	Nitrite – Nitrate	X	Non-reg
	SM 2510 B (21st)	Conductivity	NR	Pending
	SM 2550 B (21st)	Temperature	NR	Pending
	SM 4500 (H+) B (21st)	pH	NR	Pending
	SM 4500 (CL-) D (21st)	Chloride	NR	Pending
CWA (non-potable) Methods	EPA 1664A	Hexane Extractable Material (HEM)	X	
	EPA 200.7	Aluminum	X	
	EPA 200.7	Antimony	X	
	EPA 200.7	Arsenic	X	
	EPA 200.7	Barium	X	
	EPA 200.7	Beryllium	X	
	EPA 200.7	Boron	X	
	EPA 200.7	Cadmium	X	
	EPA 200.7	Calcium	X	
	EPA 200.7	Chromium	X	
	EPA 200.7	Cobalt	X	
	EPA 200.7	Copper	X	
	EPA 200.7	Iron	X	
	EPA 200.7	Lead	X	
	EPA 200.7	Magnesium	X	
	EPA 200.7	Manganese	X	
	EPA 200.7	Molybdenum	X	
	EPA 200.7	Nickel	X	
	EPA 200.7	Potassium	X	
	EPA 200.7	Selenium	X	
	EPA 200.7	Silver	X	
	EPA 200.7	Sodium	X	
	EPA 200.7	Strontium	X	
	EPA 200.7	Thallium	X	
	EPA 200.7	Vanadium	X	
	EPA 200.7	Zinc	X	
	EPA 200.7	Titanium	Non-Reg	

	EPA2130B	Turbidity	X	
	EPA 245.2	Mercury	X	
	EPA 300.0	Chloride	X	
	EPA 300.0	Fluoride	X	
	EPA 300.0	Nitrate-N	X	
	EPA 300.0	Nitrite-N	X	
	EPA 300.0	Sulfate	X	
	EPA 335.2	Cyanide, Total	X	
	EPA 420.1	Phenol	X	
	EPA 5220B	Chemical Oxygen Demand	X	
	EPA 624	1,1,1 -Trichloroethane	X	
		1,1 ,2,2-Tetrachloroethane	X	
		1 ,1 ,2-Trichloroethane	X	
		1,1-Dichloroethane	X	
	EPA 624	1,1 -Dichloroethene (1,1 -DCE)	X	
	EPA 200.7	Vanadium	X	
	EPA 624	1 ,2-Dichlorobenzene	X	
	EPA 624	1 ,2-Dichloroethane	X	
	EPA 624	1 ,2-Dichloropropane	X	
	EPA 624	1 ,3-Dichlorobenzene	X	
	EPA 624	1 ,4-Dichlorobenzene	X	
	EPA 624	2-Chloroethyl vinyl ether	X	
	EPA 624	Benzene	X	
	EPA 624	Bromodichloromethane	X	
	EPA 624	Bromoform	X	
	EPA 624	Bromomethane (Methyl bromide)	X	
	EPA 624	Carbon tetrachloride	X	
	EPA 624	Chlorobenzene	X	
	EPA 624	Chlorodibromomethane(Dibromochloromethane)	X	
	EPA 624	Chloroethane	X	
	EPA 624	Chloroform	X	
	EPA 624	Chloromethane (Methyl chloride)	X	
	EPA 624	cis-l,3-Dichloropropene	X	
	EPA 624	Ethylbenzene	X	
	EPA 624	Methylene chloride (Dichloromethane)	X	
	EPA 624	Tetrachloroethene (Perchloroethene, PCE)	X	
	EPA 624	Trichloroethene	X	
	EPA 624	Trichlorofluoromethane (Freon 11)	X	
	EPA 624	Vinyl Chloride	X	
	EPA 624**	Dichlorodifluoromethane	X	
	EPA 624**	Ethanol	X	
	EPA 624**	Isopropyl ether (DIPE)	X	
	EPA 624**	Methyl t-butyl ether (MTBE)	X	
	EPA 624**	t-Amyl methyl ether (TAME)	X	

	SM 2320B 18th, 19th & 20th	Alkalinity as CaCO3	X	
	SM 2340B	Hardness (calculation)	X	
	SM2540B 18th, 19th & 20th	Residue Total	X	
	SM2540C 18th, 19th & 20th	Residue Filterable (TDS)	X	
	SM 2540D 18th, 19th & 20th	Residue Non-filterable (TSS)	X	
	SM 2510 B (21st)	Conductivity	Pending	Pending
	SM 2550 B (21st)	Temperature	Pending	Pending
	SM 4500-(C1-) B 18th, 19th & 20th	Chloride	X	
	SM 4500-(Cl-) D (21st)	Chloride		Pending
	SM 4500-C1 G 18th, 19th & 20th	Total Residual Chlorine	X	
	SM 4500-F C 18th, 19th & 20th	Fluoride	X	
	SM 4500-H+ B 18th, 19th & 20th, 21st.	pH (Hydrogen ion)	X	Pending
	SM 4500-N Org B	Kjeldahl Nitrogen Total	X	
	SM 4500-NH3 D 19th & 20th	Ammonia as N	X	
	SM 4500-NO2 B 18th, 19th & 20th	Nitrite-N	X	
	SM 4500-P E	Ortho-phosphate as P	X	
	SM 4500-P E	Phosphorus, Total	X	
	SM5210B 18th, 19th & 20th	Biological Oxygen Demand (BOD)	X	
	SM5210B 18th, 19th & 20th	Carbonaceous Biochemical Oxygen Demand	X	
	EPA 9223B – Colilert (21st) P/A	Total Coliform and E. coli, p/a	Pending	Pending
	EPA 9223B Colilert – Quanti-tray	Total Coliform and E. coli, mpn	X	Pending
RCRA (Solids & Hazardous Materials) / (Soils) Method	EPA 6010B	Aluminum	X	
	EPA 6010B	Antimony	X	
	EPA 6010B	Arsenic	X	
	EPA 6010B	Beryllium	X	
	EPA 6010B	Boron	X	
	EPA 6010B	Cadmium	X	
	EPA 6010B	Chromium	X	
	EPA 6010B	Cobalt	X	
	EPA 6010B	Copper	X	
	EPA 6010B	Iron	X	
	EPA 6010B	Lead	X	
	EPA 6010B	Manganese	X	
	EPA 6010B	Molybdenum	X	
	EPA 6010B	Nickel	X	
	EPA 6010B	Potassium	X	
	EPA 6010B	Selenium	X	
	EPA 6010B	Silver	X	
	EPA 6010B	Sodium	X	
	EPA 6010B	Strontium	X	
	EPA 6010B	Thallium	X	
	EPA 6010B	Titanium	X	
	EPA 6010B	Vanadium	X	
	EPA 6010B	Zinc	X	
	EPA 7470A	Mercury	X	

	EPA 8015B	Diesel Range Organics (DRO, Extract able Petroleum Hydrocarbons, EPH)	X	
	EPA 8015M	Gasoline Range Organics (GRO, Volatile Petroleum Hydrocarbons, VPH)	X	
	EPA 8260B	1,1,1,2-Tetrachloroethane	X	
	EPA 8260B	1,1,1 -Trichloroethane	X	
	EPA 8260B	1,1,2,2-Tetrachloroethane	X	
	EPA 8260B	1,1,2-Trichloroethane	X	
	EPA 8260B	1,1-Dichloroethane	X	
	EPA 8260B	1,1 -Dichloroethene (1,1 -DCE)	X	
	EPA 8260B	1,2,3-Trichloropropane (TCP)	X	
	EPA 8260B	1,2,4-Trimethylbenzene	X	
	EPA 8260B	1,2-Dibromo-3-chloropropane (DBCP)	X	
	EPA 8260B	1,2-Dibromoethane (EDB, Ethylene Dibromide)	X	
	EPA 8260B	1,2-Dichlorobenzene	X	
	EPA 8260B	1,2-Dichloroethane	X	
	EPA 8260B	1,2-Dichloropropane	X	
	EPA 8260B	1,3,5-Trimethylbenzene	X	
	EPA 8260B	1,3-Dichlorobenzene	X	
	EPA 8260B	1,4-Dichlorobenzene	X	
	EPA 8260B	2-Butanone (Methyl ethyl ketone, MEK)	X	
	EPA 8260B	2-Chloroethyl vinyl ether	X	
	EPA 8260B	Acetone	X	
	EPA 8260B	Acetonitrile	X	
	EPA 9045 D	pH		Pending
	SM 2550 B (21st)	Temperature		Pending
RCRA (non-potable Water) Method	EPA 8260B	Acrolein (Propenal)	X	
	EPA 8260B	Acrylonitrile	X	
	EPA 8260B	Benzene	X	
	EPA 8260B	Bromodichloromethane	X	
	EPA 8260B	Bromoform	X	
	EPA 8260B	Bromomethane (Methyl bromide)	X	
	EPA 8260B	Carbon disulfide	X	
	EPA 8260B	Carbon tetrachloride	X	
	EPA 8260B	Chlorobenzene	X	
	EPA 8260B	Chlorodibromomethane (Dibromochloromethane)	X	
	EPA 8260B	Chloroethane	X	
	EPA 8260B	Chloroform	X	
	EPA 8260B	Chloromethane (Methyl chloride)	X	
	EPA 8260B	cis-l,2-Dichloroethene	X	
	EPA 8260B	cis-l,3-Dichloropropene	X	
	EPA 8260B	Dichlorodifluoromethane	X	
	EPA 8260B	Ethylbenzene	X	
	EPA 8260B	Methyl isobutyl ketone (4-Methyl-2-	X	

		pentanone, MIBK)		
	EPA 8260B	Methyl t-butyl ether (MTBE)	X	
	EPA 8260B	Methylene chloride (Dichloromethane)	X	
	EPA 8260B	Naphthalene	X	
	EPA 8260B	Styrene	X	
	EPA 8260B	Tetrachloroethene (Perchloroethene, PCE)	X	
	EPA 8260B	Toluene	X	
	EPA 8260B	Total xylenes	X	
	EPA 8260B	trans-1,2-Dichloroethene	X	
	EPA 8260B	trans-1,3-Dichloropropene	X	
	EPA 8260B	Trichloroethene	X	
	EPA 8260B	Trichlorofluoromethane (Freon 11)	X	
	EPA 8260B	Vinyl Acetate	X	
	EPA 8260B	Vinyl Chloride	X	
	EPA 8260B	Xylene, m +p	X	
	EPA 8260B	Xylene, o	X	
	EPA 8260B	Xylene, p	X	
	EPA 9040 C	pH		Pending
	EPA 9050 A	Conductivity		Pending
	SM 2550 B (21st)	Temperature		Pending

Appendix 3
Reporting Limits

Data Processing in Reporting

The following table illustrates the estimated reporting limits used during reporting of analytical results by our laboratory:

Inorganic Analytes

Parameters	Analytical Methods	Estimated Reporting Limits*		Duplicate Precision (RPD)	LCS Accuracy (% recovery)
		Aqueous (mg/L)	Solid (mg/kg)		
Acidity	305.1	N/A	N/A	N/A	N/A
Alkalinity (high/low)	SM2320B	10	N/A	20	100 ± 10
Aluminum	200.7	0.05	2.5	20	100 ± 10
Aluminum	6010	0.05	2.5	20	100 ± 10
Antimony	200.7	0.05	2.5	20	100 ± 10
Antimony	6010	0.05	2.5	20	100 ± 10
Arsenic	200.7	0.05	1.0	20	100 ± 10
Arsenic	6010	0.05	1.0	20	100 ± 10
Arsenic	TCLP-1311	1.0	N/A	20	100 ± 10
Barium	200.7	0.01	0.5	20	100 ± 10
Barium	6010	0.01	0.5	20	100 ± 10
Barium	TCLP-1311	1.0	N/A	20	100 ± 10
Beryllium	200.7	0.01	0.5	20	100 ± 10
Beryllium	6010	0.01	0..5	20	100 ± 10
Biological Oxygen Demand	SM5210B	2	N/A	20	100 ± 10
Boron	200.7	0.50	2.5	20	100 ± 10
Cadmium	200.7	0.01	0.5	20	100 ± 10
Cadmium	6010	0.01	0.5	20	100 ± 10
Cadmium	TCLP-1311	0.	N/A	20	100 ± 10
Calcium	200.7	5.0	25	20	100 ± 10
Calcium	6010	5.0	25	20	100 ± 10
Chemical Oxygen Demand	SM5220D	5.0	N/A	20	100 ± 10
Chloride	300.0	0.5	0.5	20	100 ± 10
Chloride	SM4500ClB	0.5	0.5	20	100 ± 10
Chlorine, Total Residual	SM4500ClG	0.10	N/A	20	100 ± 10
Chromium-Total	200.7	0.01	0.50	20	100 ± 10
Chromium-Total	6010	0.01	0.5	20	100 ± 10
Chromium-Total	TCLP-1311	1.0	N/A	20	100 ± 10
Chromium (VI)	SM3500CrD	0.01	0.01	20	100 ± 10
Color	110.2	N/A	N/A	N/A	N/A
Copper	200.7	0.01	0.50	20	100 ± 10

Parameters	Analytical Methods	Estimated Reporting Limits*		Duplicate Precision (RPD)	LCS Accuracy (% recovery)
		Aqueous (mg/L)	Solid (mg/kg)		
Copper	6010	0.01	0.50	20	100 ± 10
Cyanide, Amenable	335.1	0.01	1.0	20	100 ± 10
Cyanide, Total	SM4500CNE	0.01	1.0	20	100 ± 10
Dissolved Oxygen	360.1	N/A	N/A	N/A	N/A
Electrical Conductivity	SM 2510	N/A	N/A	N/A	N/A
Fluoride	300.0	0.5	0.5	20	100 ± 10
Fluoride	340.2	0.5	0.5	20	100 ± 10
Hydrogen Ion (pH)	SM4500H^+B	0.10	0.10	20	100 ± 10
Ignitability	1010	N/A	N/A	20	N/A
Iron	200.7	0.01	0.5	20	100 ± 10
Iron	6010	0.01	0.5	20	100 ± 10
Lead	200.7	0.01	2.5	20	100 ± 10
Lead	6010	0.01	2.5	20	100 ± 10
Lead	TCLP-1311	1.00	N/A	20	100 ± 10
Magnesium	200.7	5.0	5.0	20	100 ± 10
Magnesium	6010	5.0	5.0	20	100 ± 10
Manganese	200.7	0.01	0.50	20	100 ± 10
Manganese	6010	0.01	0.50	20	100 ± 10
Mercury	245.1	0.001	0.05	20	100 ± 10
Mercury	TCLP-1311	0.02	N/A	20	100 ± 10
Molybdenum	200.7	0.05	2.5	20	100 ± 10
Molybdenum	6010	0.05	2.5	20	100 ± 10
Nickel	200.7	0.01	0.5	20	100 ± 10
Nickel	6010	0.01	0.5	20	100 ± 10
Nitrogen, Ammonia	SM4500NH_3D	0.10	1.0	20	100 ± 10
Nitrogen, Inorganic	350.2	0.10	1.0	20	100 ± 10
Nitrogen, Kjeldahl	SM4500N_{org}C	1.0	1.0	20	100 ± 10
Nitrogen, Nitrate as	300.0	0.1	0.1	20	100 ± 10
Nitrogen, Nitrate as	352.1	0.10	0.1	20	100 ± 10
Nitrogen, Nitrite as	300.0	0.1	0.1	20	100 ± 10
Nitrogen, Nitrite as	353.3	0.1	0.1	20	100 ± 10
Nitrogen, Organic	351.3-350.2	1.0	1.0	20	100 ± 10
Oil and Grease	1664A	10	10	20	100 ± 10
Ortho Phosphorus	300.0	0.05	0.05	20	100 ± 10
Ortho Phosphorus	SM4500PE	0.05	0.05	20	100 ± 10
Phenolics	420.3/9067	0.05	0.1	20	100 ± 10
Potassium	200.7	5.0	5.0	20	100 ± 10
Selenium	200.7	0.05	2.5	20	100 ± 10
Selenium	6010	0.05	2.5	20	100 ± 10
Selenium	TCLP-1311	1.0	N/A	20	100 ± 10
Silica	200.7	1.0	1.0	20	100 ± 10
Silica	SM4500SiF	0.05	0.05	20	100 ± 10
Silver	200.7	0.05	1.0	20	100 ± 10

Parameters	Analytical Methods	Estimated Reporting Limits*		Duplicate Precision (RPD)	LCS Accuracy (% recovery)
		Aqueous (mg/L)	Solid (mg/kg)		
Silver	6010	0.05	1.0	20	100 ± 10
Silver	TCLP-1311	1.0	N/A	20	100 ± 10
Sodium	200.7	5.0	5.0	20	100 ± 10
Sulfate	300.0	0.5	0.5	20	100 ± 10
Sulfate	375.4	0.5	0.5	20	100 ± 10
Sulfide	376.1	2.0	10.0	20	100 ± 10
Surfactants (MBAS)	425.1	0.10	1.0	20	100 ± 10
TDS	SM2540C	10.0	N/A	20	100 ± 10
Temperature	170.1	0.10	0.1	20	N/A
Thallium	200.7	0.05	2.5	20	100 ± 10
Thallium	6010	0.05	2.5	20	100 ± 10
Tin	200.7	0.20	5.0	20	100 ± 10
Tin	6010	0.20	5.0	20	100 ± 10
Titanium	200.7	0.01	0.5	20	100 ± 10
Titanium	6010	0.01	0.5	20	100 ± 10
Total Phosphorus	365.2	0.05	0.05	20	100 ± 10
TPH-DRO	8015 M	5.0	10	20	100 ± 10
TPH-GRO	8015 M	1.0	10	20	100 ± 10
TPH-Oil Range	8015 M	25.0	50	20	100 ± 10
TRPH	1664A	10	50	20	100 ± 10
TSS	SM2540D	10.0	N/A	20	100 ± 10
Turbidity	180.1	1.0	N/A	20	100 ± 10
Vanadium	200.7	0.05	2.5	20	100 ± 10
Vanadium	6010	0.05	2.5	20	100 ± 10
Zinc	200.7	0.05	2.5	20	100 ± 10
Zinc	6010	0.05	2.5	20	100 ± 10

NOTE: *: Estimated Reporting Limits are derived from the MDL by a multiplier that gives the analyst a level of certainty that the value is above the noise/background level. Also, the above table is for reference only, specific QA/QC criteria may be found in detail in other sections of this QAP or SOPs.

VOC Compounds

Parameters	Analytical Methods	Estimated Reporting Limits*		Duplicate Precision (RPD)	LCS Accuracy (% recovery)
		Aqueous (mg/L)	Solid (mg/kg)		
Benzene	8260/624	0.005	0.010	20	100 ± 30
Bromobenzene	8260/624	0.005	0.010	20	100 ± 30
Bromochloromethane	8260/624	0.005	0.010	20	100 ± 30
Bromodichloromethane	8260/624	0.005	0.010	20	100 ± 30
Bromoform	8260/624	0.005	0.010	20	100 ± 30
Bromomethane	8260/624	0.005	0.010	20	100 ± 30
Acetone	8260/624	0.010	0.010	20	100 ± 30
Acrolein	8260/624	0.050	0.050	20	100 ± 30
n-Butylbenzene	8260/624	0.005	0.010	20	100 ± 30
sec-Butylbenzene	8260/624	0.005	0.010	20	100 ± 30
tert-Butylbenzene	8260/624	0.005	0.010	20	100 ± 30
Carbon tetrachloride	8260/624	0.005	0.010	20	100 ± 30
Chlorobenzene	8260/624	0.005	0.010	20	100 ± 30
Chloroethane	8260/624	0.005	0.010	20	100 ± 30
2-Choroethyl vinylether	8260/624	0.020	0.010	20	100 ± 30
Chloroform	8260/624	0.005	0.010	20	100 ± 30
Chloromethane	8260/624	0.005	0.010	20	100 ± 30
2-Chlorotoluene	8260/624	0.005	0.010	20	100 ± 30
4-Chlorotoluene	8260/624	0.005	0.010	20	100 ± 30
Dibromochloromethane	8260/624	0.005	0.010	20	100 ± 30
Dichlorodifluoromethane	8260/624	0.005	0.010	20	100 ± 30
1,2-Dibromo-3-chloropropane	8260/624	0.005	0.010	20	100 ± 30
1,2-Dibromoethane	8260/624	0.005	0.010	20	100 ± 30
Dibromomethane	8260/624	0.005	0.010	20	100 ± 30
1,2-Dichlorobenzene	8260/624	0.005	0.010	20	100 ± 30
1,3-Dichlorobenzene	8260/624	0.005	0.010	20	100 ± 30
1,4-Dichlorobenzene	8260/624	0.005	0.010	20	100 ± 30
1,1-Dichloroethane	8260/624	0.005	0.010	20	100 ± 30
1,2-Dichloroethane	8260/624	0.005	0.010	20	100 ± 30
1,1-Dichloroethene	8260/624	0.005	0.010	20	100 ± 30
cis-1,2-Dichloroethene	8260/624	0.005	0.010	20	100 ± 30
trans-1,2-Dichloroethene	8260/624	0.005	0.010	20	100 ± 30
1,2-Dichloropropane	8260/624	0.005	0.010	20	100 ± 30
1,3-Dichloropropane	8260/624	0.005	0.010	20	100 ± 30
2,2-Dichloropropane	8260/624	0.005	0.010	20	100 ± 30
1,2-Dichloropropene	8260/624	0.005	0.010	20	100 ± 30
cis-1,3-Dichloropropene	8260/624	0.005	0.010	20	100 ± 30

Parameters	Analytical Methods	Estimated Reporting Limits*		Duplicate Precision (RPD)	LCS Accuracy (% recovery)
		Aqueous (mg/L)	Solid (mg/kg)		
trans-1,3-Dichloropropene	8260/624	0.005	0.010	20	100 ± 30
Ethylbenzene	8260/624	0.005	0.010	20	100 ± 30
Hexachlorobutadiene	8260/624	0.005	0.010	20	100 ± 30
Isopropylbenzene	8260/624	0.005	0.010	20	100 ± 30
p-Isopropyltoluene	8260/624	0.005	0.010	20	100 ± 30
Methylene chloride	8260/624	0.005	0.010	20	100 ± 30
Naphthalene	8260/624	0.005	0.010	20	100 ± 30
n-Propylbenzene	8260/624	0.005	0.010	20	100 ± 30
Styrene	8260/624	0.005	0.010	20	100 ± 30
1,1,1,2-Tetrachloroethane	8260/624	0.005	0.010	20	100 ± 30
1,1,2,2-Tetrachloroethane	8260/624	0.005	0.010	20	100 ± 30
Tetrachloroethylene	8260/624	0.005	0.010	20	100 ± 30
Toluene	8260/624	0.005	0.010	20	100 ± 30
Trichlorofluoromethane	8260/624	0.005	0.010	20	100 ± 30
1,2,3-Trichlorobenzene	8260/624	0.005	0.010	20	100 ± 30
1,2,4-Trichlorobenzene	8260/624	0.005	0.010	20	100 ± 30
1,1,1-Trichloroethane	8260/624	0.005	0.010	20	100 ± 30
1,1,2-Trichloroethane	8260/624	0.005	0.010	20	100 ± 30
Trichloroethene	8260/624	0.005	0.010	20	100 ± 30
1,2,3-Trichloropropane	8260/624	0.005	0.010	20	100 ± 30
1,2,4-Trimethylbenzene	8260/624	0.005	0.010	20	100 ± 30
1,3,5-Trimethylbenzene	8260/624	0.005	0.010	20	100 ± 30
Vinyl Chloride	8260/624	0.005	0.010	20	100 ± 30
Vinyl Acetate	8260/624	0.010	0.010	20	100 ± 30
Xylenes	8260/624	0.005	0.010	20	100 ± 30
MTBE	8260/624	0.005	0.010	20	100 ± 30

*: The above table is for reference only. Methods EPA 624, 625, 8270, 8080/8081, 8021 may have different windows of acceptance for the LCS than Stated above and should be reviewed in specific SOPs.

Appendix 4

Major Equipment List

Laboratory Equipment/Instrumentation

HP 5890 Series II GC x2
HP 5971 Series Mass Selective Detector x2
Tekmar LSC 2000 Concentrator x2
Archon Automated Sampler
Tekmar ALS 2016 Auto sampler x2
GC 5890 Series II GC/FID
HP 7673 Tabletop Auto sampler x2
HP 5972 Series Mass Selective Detector
SRI 8610C GC/FID
Perkin Elmer Optima 3000DV ICP
Neslabs CFT33 Refrigerated Recirculator
Perkin Elmer AS90 Auto sampler
Perkin Elmer AS91 Controller
US General US660V Air Compressor
Dionex DX-120 IC
Dionex AS40 Automated Sampler
Dionex LCS 5000 with Automate Sampler
Hydra AA Automated Cold Vapor Mercury Analysis System
HF Scientific Micro100 Turbidimeter
Horizon Technologies Oil & Grease 1000XL Extractor
Horizon Technologies SpeDex 3000 Controller
Horizon Technologies Speedvap III
Hach COD Reactor Incubator
MIDI Cyanide Distillation Apparatus
Buchi K314 Distillation Unit
Genesys 20 Spectrophotometer
Nanopure Ultrapure Water System model 4741
VWR Symphony SB80PI desktop meter
Orion 420A desktop meter x2
IEC Clinical Centrifuge
Thermolyn type 1400 Furnace
Tyler Sieve Shaker model RX-24
Binder Model BD53UL incubator
IDEXX Quanti-Tray Sealer 2X
VWR model 2026 Incubator
VWR 1300U Drying Oven
VWR 1320U Drying Oven
Blue M OV-12A Drying Oven
Orion 850A Dissolved Oxygen Bench Top Meter
Denver Instrument Co. AA250 Analytical Balance
Sartorius GMBH Analytical Balance

Sargent Welch SW210
Appendix 5
Definitions

Accuracy: the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

Analyst: the designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

Assessment: the evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of NDEP.)

Assessment Criteria: The measures established by NDEP and applied in establishing the extent to which an applicant is in conformance with NDEP requirements.

Assessor: one who performs on-site assessments of accrediting authorities and laboratories' capability and capacity for meeting NDEP requirements by examining the records and other physical evidence for each one of the tests for which accreditation has been requested.

Audit: a systematic evaluation to determine the conformance to quantitative and qualitative specification for some operational function or activity.

Batch: environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same NDEP-defined matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples.

Blank: a sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. Blanks include:

> Equipment blank: a sample of analyte-free media that has been used to rinse common sampling equipment to check effectiveness of decontamination procedures.

Field blank: blank prepared in the field by filling a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken.

Instrument blank: a clean sample (e.g. distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination.

Method blank: a sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

Blind Sample: a sub-sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process.

Calibration: to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter, instrument, or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements.

Calibration blank: a zero standard, one that has not been subject to any of the sample preparation process. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct the routine analytical results where stated by the analytical method.

Calibration Curve: the graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response.

Calibration Method: a defined technical procedure for performing a calibration.

Calibration Standard: a substance or reference material used to calibrate an instrument.

Certified Reference Material (CRM): a reference material one or more of whose property values are certified by a technical valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body.

Chain of Custody Form (COC): record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; collector; time of collection; preservation; and requested analyses.

Chronic toxicity: a description of the state that occurs when the survival, growth, or reproduction for either test species exposed to a dilution of sixty nine (69) percent effluent (or lower) is

significantly less (at the 95 percent confidence level) than the survival, growth or reproduction of the control specimens.

Composite sample: a sample collected over a 24-hour period by either an automated or manual mechanical means.

Conformance: an affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements.

Continuing Calibration Verification (CCV): a standard used to demonstrate continuing compliance with calibration criteria of an instrument. The CCV is typically a mid-range standard and is analyzed periodically during and at the end of an analytical sequence. Under NDEP requirements, the concentration of the CCV must be varied over time.

Contract: any agreement regarding analysis (written or verbal) between the client and the laboratory.

Corrective Action: the action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence.

Data Audit: a qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality (i.e., that they meet specified acceptance criteria).

Data Reduction: the process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form.

Deficiency: an unauthorized deviation from acceptable procedures or practices, or a defect in an item.

Demonstration of Capability (DOC): a procedure to establish the ability of the analyst to generate results of acceptable accuracy and precision.

Detection Limit: the lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. See Method Detection Limit.

Federal Water Pollution Control Act (Clean Water Act, CWA): the enabling legislation under 33 U.S.C 1251 et seq., Public Law 92-50086 Stat. 816, that empowers EPA to set discharge limitations, write discharge permits, monitor, and bring enforcement action for non-compliance.

Finding: an assessment or audit conclusion that identifies a condition having a significant effect on an item or activity. An assessment finding is normally a deficiency and is normally

accompanied by specific examples of the observed condition.

Governmental Laboratory: as used in these standards, a laboratory owned by a federal, state, or tribal government; includes government-owned contractor-operated laboratories.

Grab sample: for monitoring requirements, a grab sample is defined as a single "dip and take" sample collected at a representative point in the discharge stream.

Holding Times (Maximum Allowable Holding Times): the maximum times that samples may be held prior to analysis and still be considered valid or not compromised. (40 CFR Part 136 or other applicable regulations).

Inspection: an activity such as measuring, examining, testing, or gauging one or more characteristics of an entity and comparing the results with specified requirements in order to establish whether conformance is achieved for each characteristic.

Laboratory: a body that calibrates and/or tests.

Laboratory Control Sample (LCS): a QC sample of similar matrix to the analytical samples, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

Laboratory Duplicate: (also called Matrix Duplicate) aliquots of a sample taken from the same container under laboratory condition and processed and analyzed independently.

Legal Chain of Custody Protocols: Procedures employed to record the possession of samples from the time of sampling until analysis and are performed at the special request of the client. These protocols include the use of a Chain of Custody Form that documents the collection, transport, and receipt of compliance samples by the laboratory. In addition, these protocols document all handling of the samples within the laboratory.

Matrix: the substrate of a test sample. In this laboratory, all samples are of the aqueous/non-potable water matrix

> Aqueous (for batch and quality control use) or Non-Potable water (for fields of accreditation use): any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.
>
> Drinking Water: any aqueous sample that has been designated a potable or potential water source.

Matrix Duplicate: (also called Laboratory Duplicate) aliquots of a sample taken from the same container under laboratory condition and processed and analyzed independently.

Matrix Spike (MS): a QC sample prepared by adding a known mass of target analyte to a specified amount of field sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate (MSD): a second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery of each analyte.

May: denotes a permitted, but not required action.

Method Detection Limit (MDL): the minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136, Appendix B or applicable test methods.)

Must: denotes a required action or result.

National Institute of Standards and Technology (NIST): an agency of the US Department of Commerce's Technology Administration that is working with EPA, State, NELAC, and other public and commercial entities to establish a system under which private sector companies and interested States can be accredited by NIST to provide NIST-traceable proficiency testing (PT) to those laboratories testing drinking water and wastewater.

National Environmental Laboratory Accreditation Conference (NELAC): formerly a voluntary organization of State and Federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting environmental laboratories. A subset of NELAP. This organization has been replaced by The Nelac Institute (TNI).

National Environmental Laboratory Accreditation Program (NELAP): the overall National Environmental Laboratory Accreditation Program of which NELAC is a part.

National Pollution and Discharge Elimination System (NPDES): the guidelines governing the discharge of wastes into streams, rivers, lakes, holding ponds, and wetlands.

National Voluntary Laboratory Accreditation Program (NVLAP): a program administered by NIST that is used by providers of proficiency testing to gain accreditation for all compounds/matrices for which NVLAP accreditation is available, and for which the provider intends to provide NELAP PT samples.

Negative Control: measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results.

NELAC Standards: accreditation standards promulgated by NELAC, currently used by NELAP. It contains procedures for consistently evaluating and documenting the ability of laboratories performing environmental measurements to meet nationally defined standards established by National Environmental laboratory Accreditation Conference (NELAC).

Performance Audit: the routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory.

Performance Based Measurement System (PBMS): a set of processes wherein the data quality needs, mandates or limitation of a program or project are specified and serve as criteria for selecting measurement processes which will meet those needs in a cost-effective manner.

Positive Control: measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects.

Precision: the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision may be expressed as standard deviation, relative standard deviation, variance, range, percent difference or relative percent difference. This laboratory typically uses relative percent difference.

Preservation: refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample.

Primary Accrediting Body: the agency or department designated at the Territory, State or Federal level as the recognized authority with responsibility and accountability for granting NELAC accreditation for a specified field of testing.

Proficiency Testing (PT): a means of evaluating a laboratory's performance under controlled conditions relative to a set of criteria through analysis of unknown samples provided by an external source.

Proficiency Testing Study Provider: any person, private party, or government entity that meets stringent criteria to produce and distribute NDEP PT samples, evaluate study results against published performance criteria and report the results to the laboratories, primary accrediting authorities and NDEP.

Proficiency Test Sample (PT): a sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria.

Protocol: a detailed written procedure for field and/or laboratory operation (e.g. sampling,

analysis) which must be strictly followed.

Quality Assurance: an integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.

Quality Assurance Plan: a document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.

Quality Assurance Project Plan (QAPP): a formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved.

Quality Control: the overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users.

Quality Control Sample: an uncontaminated sample matrix spiked with known amounts of analytes from a source independent from the calibration standards. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

Quality System: a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC.

Quantitation Limits: levels, concentrations, or quantities of target of a target variable (e.g. target analyte) that can be reported at a specified degree of confidence.

Range: the difference between the minimum and the maximum of a set of values.

Raw Data: any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g. tapes which have been transcribed verbatim, data and verified accurate by signature), the exact copy or exact transcript may be submitted.

Recognition: previously known as reciprocity. The mutual agreement of two or more parties (i.e., States) to accept each other's finding regarding the ability of environmental testing

laboratories in meeting NELAC standards.

Reference Material: a material or substance having one or more properties which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

Reference Method: a method of known and documented accuracy and precision issued by an organization recognized as competent to do so.

Reference Standards: a standard, generally of the highest metrological quality available at a given location, from which measurements made at the location are derived.

Replicate Analyses: the measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval.

Requirement: denotes a mandatory specification; often designated by the term "shall" or "must".

Resource Conservation and Recovery Act (RCRA): the enabling legislation under 42 USC 321 et seq. (1976), that gives EPA the authority to control hazardous waste from the "cradle-to-grave", including its generation, transportation, treatment, storage, and disposal.

Safe Drinking Water Act (SDWA): the enabling legislation, 42 USC 300f et seq. (1974), Public Law 93-523), that requires EPA to protect the quality of drinking water in the U.S. by setting maximum allowable contaminant levels, monitoring, and enforcing violations.

Sample Management: (also called Sample Tracking) procedures employed to record the possession of the samples from the time of sampling until analysis, reporting, and archiving. These procedures include the use of a Chain of Custody Form that documents the collection, transport, and receipt of compliance samples to the laboratory. In addition, access to the laboratory is limited and controlled to protect the integrity of the samples.

Selectivity: (Analytical chemistry) the capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances.

Sensitivity: the capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest.

Shall: denotes an action or result that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation.

Should: denotes a guideline or recommendation whenever noncompliance with the specification is permissible.

Spike: a known mass of target analyte added to a blank sample or sub-sample; used to determine

recovery efficiency or for other quality control purposes.

Standard Operating Procedure (SOP): a written document which details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks.

Standardized Reference Material (SRM): a certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method.

Statistical Minimum Significant Difference (SMSD): the minimum difference between the control and a test concentration that is statistically significant; a measure of test sensitivity or power. The power of a test depends in part on the number of replicates per concentration, the significance level selected, e.g., 0.05, and the type of statistical analysis. If the variability remains constant, the sensitivity of the test increases as the number of replicates is increased.

Supervisor: the individual designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control.

Surface water: all water which is open to the atmosphere, and subject to surface runoff.

Laboratory Coordinator: individual who has overall responsibility for the technical operation of the environmental testing laboratory.

Technology: a specific arrangement of analytical instruments, detection systems, and/or preparation techniques.

Test: a technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate.

Test Method: an adoption of a scientific technique for a specific measurement problem, as documented in a laboratory SOP or published by a recognized authority.

Testing Laboratory: a laboratory that performs tests.

Test Sensitivity/Power: the minimum significant difference between the control and test concentration that is statistically significant. It is dependent on the number of replicates per concentration, the selected significance level, and the type of statistical analysis.

The Nelac Institute: a voluntary organization of State and Federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting

environmental laboratories. A subset of NELAP. This organization has replaced the National Environmental Laboratory Accreditation Conference (NELAC).

Traceability: the property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons.

Validation: the process of substantiating specified performance criteria.

Verification: confirmation by examination and provision of evidence that specified requirements have been met.

Water Pollution audit (WP): a blind audit sample purchased by the laboratory, which checks the laboratory efficiency and accuracy in analyzing ground water and wastewater samples.

Water Survey audit (WS): a blind audit sample purchased by the laboratory, which checks the laboratory efficiency and accuracy in analyzing drinking water samples.

Work Cell: a well-defined group of analysts that together perform the method analysis. The members of the group and their specific functions within the work cell must be fully documented.

Appendix 6
Sample Storage, Preservation Guide and Hold Times

Parameter	Analytical Method	Container	Storage & preservation	Minimum Sample Volume	Maximum Holding Times
Acidity	305.1	Plastic/Glass	4°C	100ml	14 day
Alkalinity	SM2320B	Plastic/Glass	4°C	100ml	14 days
Ammonia-N	350.1	Plastic/Glass	H_2SO_4	400 ml	28 days
Bromide	300.0	Plastic/Glass	None	50ml	28 days
COD	410.4	Plastic/Glass	4°C/H_2SO_4	50ml	28 days
Chloride	300.0/325.3/9251	Plastic/Glass	None	50ml	28 days
Cyanide (total & amenable)	335.2/9010/3500 CN-C&E	Plastic/Glass/ Teflon	NaOH $C_6H_8O_6$	500ml	14 days
TDS	2540C/160.1	Plastic/Glass	4°C	100ml	7 days
Fluoride	340.2/300.0	Plastic/Glass	4°C	300ml	28 days
TSS	160.2	Plastic/Glass	4°C	100ml	7 days
pH	150.1	Plastic/Glass	4°C	40ml	Immediate
TKN	351.2	Plastic/Glass	4°C/H_2SO_4	500ml	28 days
Nitrate-N	300.0/353.2	Plastic/Glass	4°C	100ml	48 hours
Nitrite-N	300.0/351.2	Plastic/Glass	4°C	100ml	48 hours
Nitrate + Nitrite-N	300.0/353.2	Plastic/Glass	4°C/H_2SO_4	100ml	28 days
Ortho-PO_4	365.2/300.0	Plastic/Glass	Filter/4°C	50ml	48 hours
Phenolics (total)	420.1	Glass	4°C/$CuSO_4$/ H_2SO_4	1000ml	24 hours
PO_4-Total	365.2	Plastic/Glass	4°C/H_2SO_4	250ml	28 days
Conductance	120.1/2510	Plastic/Glass	4°C	100ml	28 days
Total Hardness ($CaCO_3$)	130.2/2340B	Plastic/Glass	4°C/HNO_3	100ml	180 days
TOC	SSSA/ASTM 2579A/9060/415. 1/5310C	Plastic/Glass/ Teflon	4°C/HCL/ H_2SO_4	500ml/250g	28 days (soil/water)
Turbidity	180.1	Plastic/Glass	4°C	100ml	48 hours
Metals-all	200.7/200.8/6010/ 6020/7000 series	Plastic/Glass/ Teflon	4°C/HNO_3	500ml	180 days
Metals-Mercury	245.1/7470A/ 7471A	Plastic/Glass/ Teflon	4°C/HNO_3	500ml	28 days in glass/14 days in plastic
Metals-Cr	7196A	Plastic/Glass/ Teflon	4°C	500ml	24 hours from sampling
TRPH	418.1	Glass/Teflon	4°C/H_2SO_4	1000ml	28 days
Oil/Grease	413.1	Glass/Teflon	4°C/H_2SO_4	1000ml	28 days
TPH-GRO	8015M	Glass	4°C/$Na_2S_2O_3$/ HCL	1000ml	14 days
TPH-GRO	8015M P&T	Glass	4°C/$Na_2S_2O_3$/ HCL	1000ml	14 days
TPH-DRO	8015M	Glass	None	1000ml	7 days to extraction 40 days after

					extraction

Parameter	Analytical Method	Container	Storage & preservation	Minimum Sample Volume	Maximum Holding Times
Aromatic Volatile Org.	8020	Glass	4°C/ $Na_2S_2O_3$/ HCL	3x40ml	14 days
Purgeable Halocarbons	8010B	Glass	4°C/$Na_2S_2O_3$/ HCL	3x40ml	14 days
VOC	624/8260	Glass	4°C/$Na_2S_2O_3$; HCL	3x40ml VOA vials	14 days preserved 7 days un-pres.
SVOC	625/8270	Glass	4°C/$Na_2S_2O_3$/ HCL	1000ml	7/14 days for extraction; 40 days to analysis
Chlorinated Herbicides	8150B	Glass	4°C pH 5-9	1000ml	7/14 days for extraction; 40 days to analysis
Pest./PCBs	8080A/8140	Glass	4°C pH 5-9	1000ml	7 days to extraction for water 14 days to extraction for soils
Polycyclic Aromatic Hydrocarbons (PAHs)	8310	Glass	4°C/$Na_2S_2O_3$	1000ml	7/14 days to extraction; 40 days to analysis
TCLP	1311	Glass-Teflon lined	4°C	1000ml 500 grams	180 days to extraction-metals; 14 days for VOAs extraction and 40 days to analysis; 28 days to Hg extraction and analysis

Appendix 7

Resumes

The following resumes are attached as representative of the Technical Staff at Silver State Analytical Laboratories, Inc. but not an exhaustive list of staff members.

- John Sloan, Laboratory Director
- Deborah Clark – Chemist
- Steve West – Senior Technician
- Edward Tullman, III – Chemist
- Jody Gascon – Senior Chemist
- Tim Sweeney – Reno Branch Manager
- Amy Nygren – Chemist
- Brian Wadsworth – Technician
- David Frohnen - President

John Sloan
9490 Thunder Sky #102
Las Vegas, NV 89178

Education

University of Nevada-Reno
Bachelor of Science, Biochemistry
Spring 2003

Work Experience

August 2010 - Present
Silver State Analytical Laboratories
Las Vegas, Nevada

Laboratory Director

Some of the responsibilities of Laboratory Director are:

- Coordinating and overseeing all operations of the laboratory, including budgeting, supply requisitions, new equipment purchasing, and general management.
- Overseeing the development and implementation of strict quality assurance and control programs.
- Developing and maintaining client relationships, including the supervision of all projects and new client development.
- Supervising all laboratory testing, analyses, performance evaluations, and reporting to ensure compliance with client, local, state and federal standards.
- Supervising the training and continuing education of all management and laboratory staff.
- Providing technical support for management and laboratory personnel.
- Overseeing laboratory staffing and the maintenance of laboratory equipment and facilities.
- Performing special analytical testing and method development as needed.

2006- 2010
Silver State Analytical Laboratories
Las Vegas, Nevada

Analytical Chemist

Some of the responsibilities of Analytical Chemist included:

- Conducting laboratory testing and analyses in the inorganic laboratory in accordance with the Safe Drinking Water Act (SDWA), Clean Water Act (CWA), and Resource Conservation and Recovery Act (RCRA).
- Analyzing samples by Ion Chromatography, Spectroscopy, Colorimetry, Gravimetric methods and various other Wet Chemistry methods.
- Writing, editing, and coordinating laboratory results in a written report for clients.
- Maintaining knowledge of testing and analytical policies and procedures to ensure compliance with client, local, state and federal standards..
- Performing laboratory testing with due diligence to ensure quality of work and safety in the workplace.
- Maintaining appropriate record keeping for quality assurance and control standards.
- Receiving and recording samples for testing.
- Assisting laboratory supervisors with projects as needed.

Deborah Clark
3305 E. Rome Blvd. # 2066
North Las Vegas, NV 89086

Education

New Mexico State University
Bachelor of Science, Biochemistry/Biology
May 2005

Work Experience

December 2009 - Present
Silver State Analytical Laboratories
Las Vegas, Nevada

Laboratory Chemist

Some of the responsibilities of Laboratory Chemist are:

- Maintain sample control and chain of custody procedures.
- Prepare laboratory reagents, calibrate equipment and complete laboratory log books.
- Prepare samples for analysis using sieves, digestion and extraction procedures following NDEP, EPA and other SOP's.
- Conducting analyses using analytical chemistry and microbiological techniques and procedures. All in accordance with NDEP or NELAC approved methods.
- Analyzing samples by Ion Chromatography, Spectroscopy, Colorimetric, Gravimetric methods and various other Wet Chemistry methods.
- Routine tests include Ammonia, Nitrate, Nitrite, TKN, Cyanide, BOD, Sulfate, Chloride, ICP-metals and Mercury.
- Maintain qa/qc data and calculate final numerical results with accuracy.
- Set-up, run and troubleshoot advance analytical instruments.
- Review final data, perform peer reviews, and input raw data into usable report formats using computerized systems.
- Assist with other laboratory and customer service function as needed.

2009 - 2009
Genetic Testing Laboratory
Las Cruces, New Mexico

Quality Assurance Technician

- Proofread and correct paternity reports.
- Provide feedback to colleagues in order to improve written products.
- Review legal documentation to ensure completeness.
- Maintain and update an Excel based inventory system. Organize and file documents.

2006 –2009
Walgreens Pharmacy
Las Cruces, New Mexico

Pharmacy Technician

- Provided friendly and efficient customer service in a fast paced pharmacy environment.
- Input and retrieval of patient/insurance information into computerized data base.
- Maintain automated equipment and fill prescriptions.
- Handle customer questions in person and over the telephone.
- Worked with insurance carriers on proper billing of prescriptions.
- Responsible for safety and security of controlled substances.
- Performed pharmacy staff orientation and training.

2004 – 2004
University of New Mexico Cancer Research and Treatment Center
Albuquerque, New Mexico

Intern

- Utilized techniques in Polymarase Chain Reaction (PCR), restriction digests, ligations and bacterial transformations to help construct two receptors for further use by the laboratory.

2001-2004
New Mexico State University
Las Cruces, New Mexico

Laboratory Assistant – Research Assistant

- Assisted laboratory personnel with research.
- Performed research project under own supervision.
- Used biochemical techniques and computer software.
- Care of invertebrates and general laboratory upkeep.

Stephen A. West

Experience

2011-Present Silver State Analytical Laboratories Las Vegas, NV

- **Senior Technician**

Bottle preparation/preservation and delivery
Composite and grab sampling of waste streams
Monitors and records refrigerator temperature and balance calibrations
Prepares soils for analysis
Miscellaneous sample preparation under Chemist direction
Sample log-in and tracking
Test equipment calibration, maintenance and service.

2003-2011 Silver State Analytical Laboratories Las Vegas, NV

- **Technician II**

Field sampling of soil and aqueous material.
Bottle preparation/preservation and delivery
Composite and grab sampling of waste streams
Monitors and records refrigerator temperature and balance calibrations
Prepares soils for analysis
Sample log-in and tracking

- **Education**

2000-2003 Snow College Manti, UT
Pursuing a Bachelor of Science degree in Environmental Studies

- 1996-2000 Park City High School Park City, UT
High School Diploma

Edward J. Tullman III

2128 Club Meadows Dr.
Henderson, NV 89074
Cell: (702) 553-9953
Email: spaghed@gmail.com

EMPLOYMENT OBJECTIVE

A Laboratory Technician position that will utilize my education in the fields of biology and chemistry, and previous two years of experience as an intern at the Las Vegas Valley Water District (LVVWD)

TECHNIQUES (Biology)

- Prepared media plates for growing bacterial cultures at LVVWD and University of Nevada Las Vegas (UNLV)
- Completed microbiology lecture and lab courses at UNLV
- Assisted in viral extractions from water samples at LVVWD
- Used glassware dishwashers, autoclaves and vacuum filtration systems at LVVWD and UNLV

TECHNIQUES (Chemistry)

- Experienced with sample preparations required for treating water samples and associated chemicals in accordance with EPA guidelines at LVVWD
- Performed organic extractions on Haloacetic Acids (HAA) at LVVWD
- General skills: Conductivity, pH, titration, centrifugation, melting point determination, eudiometry, calorimetric, absorption spectrometry (for testing of chlorine, zinc, and iron samples), specific gravity and turbidity measurements

EDUCATION

2005-2010 UNLV: B.S. degree in Biology with a minor in Chemistry, GPA: 3.2

2001-2005 Coronado High School: Advanced Diploma, GPA: 3.6

EMPLOYMENT

9/2011-Pres. Chemist, Silver State Analytical Laboratories, Inc.:

- Prepared samples for analysis and conducted analyses of phosphate, sulfates, sodium, phenols, nitrogen and other parameter following SOP's.

- Prepared reagents and solutions for the chemistry laboratory

- Entered sample data into Laboratory Computer system

- Keep log books of sample check in, equipment calibrations, temperatures and other qa/qc data.

4/2011-9/2011 Environmental Technician, Silver State Analytical Laboratories, Inc.:

- Collected field samples and logged in same following Chain of Custody and other procedures.

- Prepared sample bottles and preservatives per EPA protocols.

- Prepared reagents and solutions for the chemistry laboratory

- Entered sample data into Laboratory Computer system
- Keep log books of sample check in, equipment calibrations, temperatures and other qa/qc data.

2007-2009 Chemistry Intern III, LVVWD:
- Prepared samples for analysis of phosphate, total organic carbon, dissolved organic carbon, trihalomethane and HAA
- Prepared reagents and solutions for the chemistry laboratory
- Entered sample data into Laboratory Information Management Systems (LIMS) for phosphate digestion, bulk ferric chloride, and bulk zinc ortho-phosphate samples
- Neutralized and disposed of organic/inorganic hazardous waste
- Performed media and sample preparations for the microbiology laboratory
- Collected and tested water from reagent water systems for free and total chlorine to ensure no chlorine contamination existed
- Performed calibrations on various laboratory instrumentation

AWARDS AND SKILLS
- Nevada State Millennium Scholarship, awarded in 2005
- Completed calculus I, II, III, differential equations and calculus-based physics beyond college degree requirements
- Software: LIMS, Microsoft Office Suite, Sigmaplot and Minitab

Jody L. Gascon

Cell 585.957.1342 • jgkm0129@yahoo.com

Laboratory Technician with outstanding skills in scientific, academic, commercial, and medical environments. Continuously improves the quality of lab analysis and engages in team productivity, cost savings, and customer satisfaction. Highly skilled in cell culture and microscopy. Successful in Histological processes and protocols. Possess many other talents and skills that would complement any work situation.

CORE COMPETENCIES & STRENGTHS

Cell culture	Molecular Biology Principles & Techniques	PCR techniques
DNA isolation	Microscope Slide Imagery	qPCR techniques
RNA isolation	Research & Innovation	Tissue harvesting
Animal Colony Supervision	Protocol Development & Implementation	Project Management
Problem Solving	Equipment Troubleshooting	Process Improvement
Multitasking	Staff Training & Development	Articulate Communicator

KEY EXPERIENCE

University of Rochester Medical Center - Rochester, New York **2008 - Present**

Team Leader / Laboratory Technician III - Center for Pediatric Biomedical Research

Lead a team focused on genetic testing of human and mouse cellular samples to obtain genetic results. Specific study is the onset of COPD in the lung development of neonates. Center specializes in genetic-level pediatric disease prevention and treatment.

Highlights

- As team leader, engages the staff in decision-making; provides them with opportunities for leadership roles, building on their strengths, and enhancing their professional skill sets; and fosters teamwork by maintaining open communication as the standard.
- Manages the project in research on the SOX5 gene to determine when in lung development SOX5 is activated.
- Co-Authored “SOX5 Is a Candidate Gene for COPD Susceptibility and Is Necessary for Lung Development” which appears in the *American Journal of Respiratory and Clinical Care Medicine.*
- As laboratory safety officer, consistently maintains the highest OSHA standards for a safe work environment. Passed every audit conducted.
- Performs tissue harvests for an array of different uses including: Histology; DNA isolation; and RNA isolation.

- Expert in lung inflations with agarose for structural studies through Histological processes.
- Customized a lab instrument that aids in the delivery of pressurized agarose.
- Organized the entire lab layout, increasing efficiency, productivity, safety, and employee satisfaction.
- Maintains a well-stocked, cost-effective inventory. Negotiated a $5,000 savings in a major purchase of lab equipment.

Strong Health / Highland Hospital - Rochester, New York **2005 - 2011**

Laboratory Assistant - Pathology Department **2006 - 2011**

In this newly-created position, supported physicians and their medical diagnostic processes. Prepared and stained slides presenting patients' tissue biopsies, collected fluids from patients for cytology studies, and preserved these slides and studies in the laboratory archives.

Highlights

- Developed the processes and procedures needed to ensure this newly-created position provided physicians with high quality tissue biopsy and cytology study support, eliminated the need for outsourcing these functions.
- Consistently earned excellent feedback from physicians and lab personnel on outstanding work quality. Always met or exceeded daily goals for quality, throughput, and turnaround.
- Improved lab analysis quality and productivity by serving as the lead person and problem-solver for specimen collection and preservation methods, quality control logs for staining processes, temperatures of coolers in which specimens are stored, slide photography, and information technology and office equipment technical support.
- Developed a reputation for dedication to quality; professional, positive attitude; built excellent relationships with all levels of healthcare professionals within the hospital; teamwork skills; and contributed to hospital staff morale.
- Volunteered to serve as the Pathology Department's safety officer. In this role, improved lab safety by identifying and resolving issues related to ergonomics, air quality, chemical waste, and MSDSs for all chemicals.

Laboratory Assistant - Specimen Management Department **2005 - 2006**

Ensured information on requisitions for laboratory tests of patients' fluids was accurate and in compliance with state and federal regulations.

Highlights

- Organized employee workstations department-wide. Led to improved accuracy of test data, increased employee productivity, and virtual elimination of misplaced test requisitions. This contributed significantly to employee and customer satisfaction.
- Achieved excellent results on state and federal compliance audits.
- Implemented the new On-Base documentation imaging system throughout the department. This new

system computerized and stored hundreds of thousands of laboratory test requisitions, making this data quickly
accessible to healthcare professionals.

(From 2004 to 2005, was on the hospitality services staff at Aaron Manor, Penfield, NY. From 2003 to 2004, was a die cutter at Bristol ID Technologies, Lima, NY.)

Ward's Natural Science Establishment - Henrietta, New York **1993 - 2003**
Protozoologist - Protist Laboratory **1996 - 2003**
Maintained stocks of living unicellular organisms used for scientific research studies and for educational purposes in universities, colleges, and schools.

Highlights
- Formulated a new growth medium that improved organism health and led to a 200% savings in medium costs.
- Gained valuable experience in sterile lab techniques, staining, medium techniques, slide making, organism dissection prototypes, and animal husbandry.
- Developed innovative lab kits that were well-received by customers.
- Researched and recommended organisms to be added to Ward's product portfolio.
- Systemized the Protist Lab, increasing lab user-friendliness, productivity, and safety.
- Created and presented "Protists in the Classroom" and "Cultural and Observational Techniques for Protozoa" at conferences for science educators.
- Developed and presented "Pond Water" to Rochester Museum & Science Center attendees.
- Created illustrations of various organisms for educational literature and text books supplied to customers.

Drosophila Technician - Drosophila Laboratory **1993 - 1996**
Maintained fruit fly stocks for genetic studies conducted by Ward's and its customers.

Highlights
- Gained solid knowledge of genetic hybridization.
- Increased fly stocks and lab productivity by re-organizing the lab.
- Created lab kits for sale to customers.

Training
OSHA Required Laboratory Safety Training, Shipping Biological Materials, Micro Isolator Technique in Animal Handling, OSHA Hazardous Materials Handling, Confined Space Entry, Respirator, and Decontamination.

Degree Programs
Bachelor of Science in Biology
Empire State College Rochester, New York

Associate in Science in Liberal Arts
Monroe Community College - Rochester, New York

Associate in Applied Science in Environmental Sciences
Finger Lakes Community College - Canandaigua, New York

Computer Skills
Word, Excel, PowerPoint, and Photoshop. Quick Basic, HBOC, IDX, On-Base, Soft, and SoftPath.

Affiliations
MENSA, ResearchGate.

Certifications
DISC Leadership Certificate, Shipping Biological Materials, New York State EMT-Basic. Volunteer EMT, Penfield Volunteer Ambulance, Penfield, NY.

Timothy M. Sweeney
6280 Stone Valley Dr.
Reno, NV 89523
(H) 775-747-2538
(C) 775-376-0776
timmkt4u@yahoo.com

PROFESSIONAL HISTORY

2011-Present	Branch Manager, Silver State Analytical Labs
2006 - 2011	Terminal Operations Supervisor, AmeriGas
1997 - 2006	Special Projects Manager, Pezonella Associates, Inc.
1992 - 1997	Marketing & Public Relations, Broadbent & Associates, Inc.
1983 - 1992	Vice President, Norris Fuel & Supply Co., Inc.

SUMMARY

Currently I am Branch Manager for Silver State Analytical Labs in Reno, Nevada. The scope of my duties include the management of a soil, water and air analytical laboratory and sales and rental of environmental sampling equipment.

PROFESSIONAL EXPERIENCE

2006 - Present Branch Manager, Silver State Analytical Labs, Reno, NV,

- Assured safe and efficient operation of the Office and Laboratory Facility.
- Ensured proper documentation, reporting, and quality control in accordance to the Quality Assurance Control guidelines.
- Oversaw Standard Operations Procedures and were followed to guarantee quality defensibility was not questioned.

2006 - 2011 Terminal Supervisor, AmeriGas Terminal, Reno, NV,

- Assured safe and efficient operation of the shipping storage facility.
- Ensured proper documentation, reporting, of all incidents and accidents.
- Maintenance of compressors, pumps and other equipment at the Terminal.
- Managed inventory and performed calculations to ensure slippage was less than 2% (averaged .5%)
- Monitored and tested propane for specification variations and odorization.
- Instructed and monitored drivers and their equipment to ensure our loading procedures were followed.
- Drove down costs by adhering to budget that I helped in establishing and ensure minimization of utilities.
- Contributed in the development of the Operations Safety Manuel and Process Safety Management for the existing and expansion.

1997 - 2006 Special Projects Manager, Pezonella Associates, Inc., Reno, NV, I performed the following:

- Negotiated of acceptable budget and terms.
- Created numerous proposals and Requests for Qualifications.
- Worked closely with regulators for our clients.
- Interpreted construction schedules and structural blueprints.

- Designed and utilized the pumping system for monitoring groundwater.
- Coordinated all marketing brochures, signs and promotional items for direct marketing.
- Assisted staff in the efforts to keep the Statement of Qualifications current.

1992 - 1997 Marketing & Public Relations, Broadbent & Associates, Inc., Reno & Las Vegas, NV,

- Communicated with contractors, environmental consultants, insurance companies, and regulators.
- Created numerous proposals and Requests for Qualifications.
- Coordinated all marketing brochures, signs, banners and promotional items.
- Assisted staff in the ongoing efforts to keep the Statement of Qualifications current.
- Assisted in the development of a marketing plan.
- Established a more cost effective way to keep track of future Requests for Proposal.
- Developed procedures to improve communication with potential and existing clients.
- Developed marketing lists for a quarterly mailing.

1967 - 1992 Vice President of Operations, Norris Fuel & Supply Companies, Inc., Sparks, NV. *Prior to reaching the position of Vice President began served as an hourly employee in every aspect of the company.*

- Oversaw the fleet was maintained cost effectively by Norris's own or out sourced shop.
- Developed a Safety program including quarterly safety meetings for the drivers.
- Supervised a staff of fifty employees of various job descriptions.
- Directed the acquisitions of petroleum products from major and independent oil companies.
- Determined the petroleum price to be sold to customers and verified through billing invoicing.
- Developed and administered a budget for an operation with gross sales of twelve million dollars per year.
- Directed efforts to develop new markets through management of a sales force.

COMPUTER EXPERIENCE

IBM compatible Microsoft including MS-DOS and Windows, Timberline and Platinum software. MS Project, EXCEL, Word, Claris MacDraw, Filemaker, Now Up To Date, Now Contact, PowerPoint, and Territory Manager.

PROFESSIONAL COURSES AND SEMINARS

2008 CTEP Training Basic Principles and Practices
2008 CTEP Training Transfer System Operations
2008 AmeriGas Rail Terminal Training
2007 TARGA Propane Safety Seminar
2000 Marketing/ Goal Setting Seminar, Reno, NV
1991 Financial Analysis, Valley Bank of Nevada, Reno, NV
1989 Human Resource Management Techniques, Reno, NV
1988 Credit Management Workshop, T.B.Edlick, Inc., Sacramento, CA
1976 two semesters University of Nevada, Reno, NV., General Studies

PROFESSIONAL AFFILIATIONS

- Scout Master for Troop 152 of Boy Scouts of America
- Chairman of the City of Reno Environmental Committee
- Member of the Western Petroleum Marketers Assoc.
- Member of the California Independent Oil Marketers Assoc.
- Member of the Nevada Mining Assoc. (NMA),
- Member of the Nevada Mining Assoc. (NMA), Environmental Committee

- Member of the Nevada Mining Assoc. (NMA), Miner's Pick supplier organization
- Past Secretary of the City of Reno Environmental Committee
- Past President of the City of Reno Environmental Committee
- Past member of the Board of Directors of the Nevada Motor Transport Assoc.
- Past member of the Board of Directors of the Western Petroleum Marketers Assoc.
- Past President and Treasurer of the Oil Heat Institute of Northern Nevada
- Past Sec/Treas. of the Board of Directors of Norris Fuel Co., Inc.
- Past Sec/Treas. of the Board of Directors of Norris Supply Co., Inc.

REFERENCES
Excellent references available on request

Amy Aurora Nygren
1155 Ernst Dr.
Fallon, NV 89406
775-342-8253
anygren77@gmail.com

♦Objective
To obtain a position as a Chemist in a laboratory setting in order to gain experience in a chemistry research environment and expand upon my chemistry capabilities

♦Education
Graduated with High Distinction from University of Nevada, Reno - May 2011
B.S. in Chemistry with a Theater minor, GPA - 3.814
Placed on the Dean's List for College of Science 5 semesters
Delta Epsilon Iota Honor Society
Areas of Study – General, Analytical, Physical, Organic, and Inorganic Chemistries, Differential Equations, Physics, Biochemistry, Anatomy and Physiology
Co-Valedictorian at Churchill County High School - June 2007
Honor Society Treasurer, Perfect Attendance for 12 years, Best Actress, International Thespian Society President, Dance Team

♦Laboratory and Computer Skills
8 semester courses of lab work in chemistry, physics, and biology
Experience with the following lab processes – Organic Synthesis, Refluxing/Distillations, Vacuum Filtration, Melting Point, Electrochemistry/Redox Reactions, Buffers, Spectroscopy (Electronic, Vibrational, IR and NMR), Combustion, Calorimetry, Chromatography (Gas, Thin Layer, and Column), Mass Spectrometry, Titrations
Programs – Microsoft Word, Excel, and PowerPoint, Photoshop
Extensive knowledge of general laboratory and safety procedures
Laser Safety Certification

♦Work Experience
Silver State Analytical Laboratories, Inc., Reno - January 2011 – Present.
Chemist/Analyst
Perform laboratory tests on water and soil for environmental parameters following approved methods and SOP's. Keep lab qa/qc data.

Banner Churchill Community Hospital- Summer and Winter 2007, Summer 2010
Medical Secretary / Office Assistant for Dr. Tim Hockenberry
Scheduled appointments, answered phone calls, checked in patients, filed records, faxed prescriptions to pharmacies, provided medical records

Fallon Theatres - March 2005 to June 2009
Assistant Manager / Concession Stand Attendant
Projectionist, ticket sales, custodial services, concession stand, trained new employees, provided friendly service to customers

Fleischmann Planetarium and Science Center - August 2007 to August 2010
Birthday Party Coordinator / Cash Register Attendant
Planned children's birthdays, taught children crafts and showed them science exhibits, decorated and cleaned party room, sold tickets and merchandise

Gold Canyon Steakhouse – periodically for holidays and special events since 2006
Waitress / Kitchen Assistant / Hostess

♦Volunteer Work
Senior Citizen Center – decorated for holidays and organized social activities
Sierra Service Project - built houses in Arizona
Homework Club and 2nd Grade Teacher Assistant - tutored students
Republican campaigning during elections
Cowboy's Rest Summer Camp – counselor and recreation leader
Fallon Daily Bread - serve the homeless meals
Big Brother Big Sister Organization – matched with a child for one year
Stillwater Wildlife Refuge wood duck project –trapping ducks, recording data, checking nests

♦Extracurricular Activities
UNR theater department, musical theater in the community, and directing experience
Fallon City Ballet for five years - performed lead roles
UNR Dance Department - advanced ballet and jazz courses, Spring and Fall Dance Festivals
American Chemical Society – attended presentations and helped judged science fair
Miss UNR Pageant 2010
Member of Living Stones Church and Parkside Bible Fellowship

♦References
Mr. and Mrs. Bob Erickson – Owners of Fallon Theaters
(775) 423-6210
movies@phonewave.net

Dr. and Mrs. Timothy Hockenberry - Family Practitioner / Office Manager
(775) 423-3174
abcm@phonewave.net

Mrs. Paula Parrish – Teacher and Mentor
(775) 423-4333
pwp911@phonewave.net

Brian Wadsworth

347 Paiute Road
P.O. Box 185
Nixon, NV 89424
(775) 335-6773
Bwadsworth@ssalabs.com

Education:

The University of Nevada, Reno *Graduation Date: May 2010*
Degree: Bachelors of Science in International Business

Experience:

Silver State Analytical Laboratories *September 2011 - Present*
Technician

- Complete basic laboratory tests on water/ww samples following SOP's.
- Stock reagents and calibrate instruments.
- Log samples in and follow chain of custody procedures.
- Go out in the field and collect samples per EPA standards
- Prepare sample bottle kits and sub contract analyses per procedures.

Silver State Analytical Laboratories *July 2009-August 2011*
Business Development Manager

- Responsible for management of satellite office in Reno, and to work closely with the Laboratory Director and President in the Las Vegas office
- Creation of various documents utilizing Microsoft Office suite
- Responsible for attracting new clients, and maintaining professional relationships with existing clients
- Participation in various professional organizations, and attendance at conventions throughout the Western United States
- Perform market research on the Northern Nevada and Northern California areas
- Go out in the field and collect samples per EPA standards

Western Environmental Testing Laboratory *August 2007-July 2009*
Client Service Representative

- Maintained organization of front office, and general office duties
- Data entry into a Laboratory Information Management Systems (LIMS)
- Interacted with walk-in clients, and answered incoming phone calls
- Called clients with past due invoices, and faxed or e-mailed sensitive documents with the use of QuickBooks
- Prepared bottle kits for clients
- Assisted laboratory technicians with analytical testing

Organizations:

- Founding member of Tau Kappa Epsilon fraternity, Lambda Iota Chapter of Florida State University
- Nevada Mining Association
  - Supplier's Committee
  - Environmental Committee
- Northwest Mining Association

- Lake Tahoe Interagency Monitoring Program
- Air & Waste Management Association (Eastern Sierra Chapter)

David J. Frohnen
11 Isleworth Drive
Henderson, NV 89052
dfrohnen@ssalabs.com

Phone (702) 348-8375
E-mail:

TECHNICAL/SCIENTIFIC MANAGEMENT – ENVIRONMETNAL COMPLIANCE

• Certified Laboratory Management
• Water/WW Operations
• Customer Service and Business Operations
• Environmental Quality Compliance
• Environmental Engineer
• Utility Planning, Construction & Operations

- Accomplished leader with repeated success in diverse industries. Experience in environmental quality compliance including laboratory methods and supervision. Proficient in regulation development and compliance.
- M.B.A. - Management; B.S. - Civil Engineering. P.E. in AZ, CA, OR, WA, and NV. Real Estate Licensee.

EXPERIENCE

2010 – Present, **Silver State Analytical Laboratories, Inc.,** Las Vegas, NV
President

Supervise day-to-day operations and executive functions of a Nevada Certified Environmental Testing Laboratory with operations in Las Vegas and Reno, Nevada. Establish overall Quality program, procurement of analytical instruments, staffing and customer service functions of lab providing quality services in SDWA, CWA, RCRA, materials, food safety and general chemistry in support of industry and the environment. Staff of 10.

2002 – 2010, **Stanley Consultants, Inc.,** Las Vegas, NV

Vice–President and Manager, Las Vegas Office

International Engineering, Environmental, and Construction Management firm providing services to governments, private/commercial developers, utilities, public agencies and various industrial, healthcare and education entities.

Directed two office locations with 100 members (total) in engineering, surveying and construction services - selling to clients involved in land development/home building, commercial real estate, transportation, and water/wastewater infrastructure projects and master plans. Billings in excess of $10 million per year.

- Re-focused office with poor history of profitability to profitable sales, management, and fiscal accountability. Recruited staff for critical skill set needs and grew staff from 20 members in 2002 to 100 in 2006 through organic growth. Implemented many programs for training to improve financial performance, quality, and service.
- Established, staffed and grew a start-up office in Kingman, Arizona to service the Northwest Arizona area.
- As Group Manager and PM, led completion of infrastructure for 1900-acre master planned community in North Las Vegas. Expedited schedules, completed designs and coordinated with multiple stakeholders and agencies.
- Applied expertise in environmental engineering, regulatory compliance and water treatment to assist

varied clients in planning, designing, constructing and operating infrastructure projects including chemical process engineering and laboratory protocols. Insuring environmental compliance and quality operations.

1997 – 2001, **United Metal Technologies,** Las Vegas, NV.

President – Chief Operating Officer

$20 million, multi-state manufacturer servicing OEM's in electronics, telecom, medical, semiconductor, and gaming.

- Responsibility for all operations, including sales, estimating, engineering, production, quality, and customer service. Oversaw 200 personnel through 8 direct reports. Reported to Chairman of Parent Company.
- Grew company from 1 location, 20-persons, $1.8 million in sales to 7 locations, 200 personnel and $20 million sales. Implemented aggressive LBO program, acquiring/integrating 6 companies in CA and NV.
- Grew internally through expanding service offerings, introducing turnkey assembly services, powder coating, chrome plating, and enhanced engineering design services. Put systems/procedures in place for large multi-state operation. Responsible for environmental compliance and implemented quality programs.

1990 – 1997, **American Water Works Company (formerly Citizens Utilities Company),** Stamford, CT.
$1 billion Company, with $100 million in revenues providing water services, $30 million of which is in Arizona.

Director–Operations/Assistant General Manager, Phoenix, AZ. 1992 – 1997

Promoted from California subsidiary to high-growth Arizona market with responsibility of business and technical operations of 7 distinct investor-owned water utilities. Activities included daily service and facility maintenance of $100+ million in plant assets, construction projects, environmental compliance, long-range planning, staff development, and marketing. Oversaw 60 personnel through 6 direct reports. Served on several corporate teams.

- Led $30 million statewide organization in providing high-quality, cost-effective water and wastewater service.
- Grew business through winning unregulated service contracts, making acquisitions, plus constructing new facilities. Emphasis on quality service and environmental compliance, major nutrient removal upgrade project.
- Served as expert witness before State Board, providing testimony that resulted in rate increases and greater revenues.
- Researched state law and developed effective water resource plans in arid southwest. Participated in development of regulations that minimized negative impacts to our industry. Participated in regional and national water policy.

Manager, Engineering and Construction, Sacramento, CA. 1990 - 1992

Planned, designed, and managed construction of all water facilities for 7 operating companies serving 250,000 people in Northern California. Oversaw 6 engineers, technicians and inspection personnel, plus multiple contractors.

- Performed system master planning and strategic business plans. Managed annual capital budget of $15 million.
- Marketed services to land developers, wrote proposals, and negotiated/implemented development contracts.

- Streamlined design processes and fast tracked water project constructions.
  - Designed water improvement project, completed competitive application, and won $3 million in state funding.
- Directed effective responses to floods and earthquakes, minimizing service interruption and damage to facilities.
  - Rebuilt water systems plus negotiated contested insurance claim, winning $600,000 award.
- Served as expert witness in rate proceedings. Filed written testimony, conducted public forums on water quality, environmental compliance and other subjects. Stood trial.
- Directed water quality and conservation programs. Integrated new regulations into long range planning.

1989 – 1990, **Nolte and Associates,** Sacramento, CA.

Associate Engineer – Project Manager (Consulting Engineer)

Performed civil and environmental engineering services for industrial clients, land developers, and government. Grew firm's revenues via marketing activities, preparing proposals, contracting services, as well as through prospecting.

- Completed studies, designs, project/construction management, and operations on various water/waste projects.
- Served as regulatory and public relations liaison. Dealt with public agencies during entitlement/enforcement work.
- Developed solutions for master planned communities, land developers, food processors, manufacturers, utilities, government, and institutional facilities.

1983-1989

ALCOA (formerly Reynolds Metals Company), Longview, WA.

Project Engineer/Project Manager

Planned, designed, and constructed projects for modernizing aluminum smelting, manufacturing, and chemical processing plants, expanding facilities and achieving environmental compliance. Performed process, manufacturing, and facilities engineering within large self-contained complex. Projects included a deep water port, 20 mgd water system, advanced technology wastewater plants, buildings, casting pits, and other facilities to support an aluminum and chemical processing plant covering 700 acres and employing 1200 personnel.

- Directed all research, design, and construction of advanced technology industrial waste treatment plant. Served as general contractor saving more than $500,000 in capital and $250,000 in first year's O&M (1987 dollars).

EDUCATION

M.B.A., University of Portland, Portland, Oregon.
Concentration in policy/strategic planning, general management, and finance.

B.S.C.E., University of Idaho, Moscow, Idaho.
4.0 GPA within civil/environmental engineering major while 4-year starter on Division I football team.

MEMBERSHIPS, TRAINING, & LICENSES

Member – ACEC – NV President, ASCE, AWWA, NAIOP, NDA, Air & Waste Mgmt., AEG, WEF, NRWA, NMA.
The Business of Engineering Consulting, American Council of Engineering Companies, October 2006.
Commercial Real Estate, University of Nevada Las Vegas, 9-month Certificate Program – completed in 2004.
Residential Land Development, American Society of Civil Engineers Continued Education Course – 2003.

Center for Creative Leadership – Leadership Development Program, a high-level professional curriculum for developing senior executives in six-day retreat/workshop/observation environment.

Leadership Breakthrough Training. Intensive leadership development program offered by Rapport Leadership Institute.

Public Utilities Reports. Comprehensive correspondence course for utility managers.

Utility Finance and Accounting. Completion of intensive workshop offered by Financial Accounting Institute, with focus on utility finance/accounting issues as well as deregulation.

Malcolm Baldrige National Quality Award. Completion of comprehensive training and application of concepts used for TQM programs based on the National Award Criteria. Member of corporate review team.

Registered Professional Engineer – Civil, states of Arizona, California, Oregon, Washington, and Nevada.

Certified Water/Wastewater Operator, highest level possible –states of Arizona and California (lapsed).

Licensed Real Estate Sales Agent, State of California (lapsed).

PUBLICATIONS, PRESENTATIONS & AWARDS

"Plan, Deploy, Review - A Business Planning Process Empowering Associates for Superior Results" presented and published June 1996 at the American Water Works Association Annual Conference and Exposition, Toronto, Ontario, Canada.

"Replacing Water Meters for Optimal Economic Value" presented May 1996 at Arizona Water and Pollution Control Association Annual Conference, Tucson, AZ. Presented and published June 1996 at the American Water Works Association Annual Conference and Exposition, Toronto, Ontario, Canada.

"Deep Well Injection of High Salinity Food Processing Wastewater" presented and published in February 1991 at the 18th annual CWPCA Industrial and Hazardous Waste Conference and Exhibition sponsored by California Water Pollution Control Association and WEF.

Tau Beta Pi, Phi Kappa Phi, and Silver Lance Honorary Societies.

Appendix 8
Sample Chain of Custody Form (See following page)

SilverState Analytical Laboratories

www.ssalabs.com

❑ 3638 E. Sunset Rd., Ste. 100, Las Vegas NV 89120
Phone: (702) 873-4478 Fax: (702) 873-7967

❑ 4600 Kietzke Lane, Ste. D-130, Reno, NV 89502
Phone: (775) 825-1127 Fax: (775) 825-1167

CHAIN-OF-CUSTODY RECORD

Page _____ of _____

Project/Job #:	Payment Method/PO #:	REPORT RESULTS TO: (INDICATE METHOD)	Name:
SEND INVOICE TO: Name:			Company:
Company:			Mailing Address:
Mailing Address:			City, State, Zip:
City, State, Zip:			Phone: Fax: Email:

Sampled By:

Report Attention:

On-Site pH/Temperature:

Turnaround Time (Specify Below with an X):

Standard 10 Business Days ☐

1 Day	2 Day	3 Day	Other

NOTE: A surcharge is applied for rush samples

Other Pertinent Info:

ANALYSES REQUESTED

Circle Applicable Program:
SDWA CWA RCRA Other Non-Reg

Reporting requirements:
RL MDL PQL

Report Level:
I II III IV

NOTE: Surcharges apply to Level III and IV reports

Date Sampled	Time Sampled	Sample Location/ Sample ID	Silver State Lab ID	Comp/ Grab	Matrix*	Preservative	Number/Type of Containers**											
																		*Metals:

Tampering with sample name, date, time, and location may constitute fraud

Relinquished by Signature/Print:	Time/Date:	Received by Signature/Print:	Time/Date:
Relinquished by Signature/Print:	Time/Date:	Received by Signature/Print:	Time/Date:

Authorized by: _____ Date: _____

Authorization is required to process samples. This obligates your organization for fee pertaining to services rendered. If collections or legal services are required to recover said fees, your organization will be responsible for all fees and cost in addition to service fees.

Method of Delivery: Receiving Laboratory:

Special Instructions:

Note: Samples are discarded 30 days after results are reported. Samples deemed hazardous are returned to the client upon completion of analysis.

* Key: AQ – Aqueous S – Soil W – Waste OT – Other

** Key: P – Plastic G – Glass V – VOA Vial OT - Other

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00930*** **Attachment to Certificate Number:** **NV009302013-1** **Expiration Date:** **7/31/2013**

Silver State Analytical Labs - Las Vegas
3638 E. Sunset Rd. Suite 100 Las Vegas, NV 89120-

Matrix: ***CWA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
Discipline Chemistry				
By Calculation	Alkalinity, Bicarbonate (as CaCO3)	8/1/2012	7/31/2013	Nevada Approved
EPA 1664	Oil & Grease	8/1/2012	7/31/2013	Certified
EPA 1664A	n-Hexane Extractable Material (O&G)	8/1/2012	7/31/2013	Certified
EPA 1664A (SGT-HEM)	n-Hexane Extractable Material (O&G)	8/1/2012	7/31/2013	Certified
EPA 200.7	Aluminum	8/1/2012	7/31/2013	Certified
EPA 200.7	Antimony	8/1/2012	7/31/2013	Certified
EPA 200.7	Arsenic	8/1/2012	7/31/2013	Certified
EPA 200.7	Barium	8/1/2012	7/31/2013	Certified
EPA 200.7	Beryllium	8/1/2012	7/31/2013	Certified
EPA 200.7	Boron	8/1/2012	7/31/2013	Certified
EPA 200.7	Cadmium	8/1/2012	7/31/2013	Certified
EPA 200.7	Calcium	8/1/2012	7/31/2013	Certified
EPA 200.7	Calcium hardness as CaCO3	8/1/2012	7/31/2013	Certified
EPA 200.7	Chromium	8/1/2012	7/31/2013	Certified
EPA 200.7	Cobalt	8/1/2012	7/31/2013	Certified
EPA 200.7	Copper	8/1/2012	7/31/2013	Certified
EPA 200.7	Hardness by calculation	8/1/2012	7/31/2013	Certified
EPA 200.7	Iron	8/1/2012	7/31/2013	Certified
EPA 200.7	Lead	8/1/2012	7/31/2013	Certified
EPA 200.7	Magnesium	8/1/2012	7/31/2013	Certified
EPA 200.7	Manganese	8/1/2012	7/31/2013	Certified
EPA 200.7	Molybdenum	8/1/2012	7/31/2013	Certified
EPA 200.7	Nickel	8/1/2012	7/31/2013	Certified
EPA 200.7	Potassium	8/1/2012	7/31/2013	Certified
EPA 200.7	Selenium	8/1/2012	7/31/2013	Certified
EPA 200.7	Silver	8/1/2012	7/31/2013	Certified
EPA 200.7	Sodium	8/1/2012	7/31/2013	Certified
EPA 200.7	Strontium	8/1/2012	7/31/2013	Certified
EPA 200.7	Thallium	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00930*** **Attachment to Certificate Number:** **NV009302013-1** **Expiration Date:** **7/31/2013**

Silver State Analytical Labs - Las Vegas
3638 E. Sunset Rd. Suite 100 Las Vegas, NV 89120-

Matrix: ***CWA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 200.7	Titanium	8/1/2012	7/31/2013	Certified
EPA 200.7	Total hardness as CaCO3	8/1/2012	7/31/2013	Certified
EPA 200.7	Vanadium	8/1/2012	7/31/2013	Certified
EPA 200.7	Zinc	8/1/2012	7/31/2013	Certified
EPA 218.6	Chromium VI	8/1/2012	7/31/2013	Certified
EPA 245.2	Mercury	8/1/2012	7/31/2013	Certified
EPA 300.0	Chloride	8/1/2012	7/31/2013	Certified
EPA 300.0	Fluoride	8/1/2012	7/31/2013	Certified
EPA 300.0	Nitrate as N	8/1/2012	7/31/2013	Certified
EPA 300.0	Nitrate-nitrite	8/1/2012	7/31/2013	Certified
EPA 300.0	Nitrite as N	8/1/2012	7/31/2013	Certified
EPA 300.0	Sulfate	8/1/2012	7/31/2013	Certified
EPA 314.0	Perchlorate	8/1/2012	7/31/2013	Certified
EPA 420.1	Phenol	8/1/2012	7/31/2013	Interim
EPA 624	1,1,1-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 624	1,1,2-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 624	1,1-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 624	1,1-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 624	1,2-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 624	1,2-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 624	1,2-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 624	1,3-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 624	1,4-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 624	Benzene	8/1/2012	7/31/2013	Certified
EPA 624	Bromodichloromethane	8/1/2012	7/31/2013	Certified
EPA 624	Bromoform	8/1/2012	7/31/2013	Certified
EPA 624	Carbon tetrachloride	8/1/2012	7/31/2013	Certified
EPA 624	Chlorobenzene	8/1/2012	7/31/2013	Certified
EPA 624	Chlorodibromomethane (Dibromochloromethane)	8/1/2012	7/31/2013	Certified
EPA 624	Chloroethane (Ethyl chloride)	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00930*** **Attachment to Certificate Number:** **NV009302013-1** **Expiration Date:** **7/31/2013**

Silver State Analytical Labs - Las Vegas
3638 E. Sunset Rd. Suite 100 Las Vegas, NV 89120-

Matrix: ***CWA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 624	Chloroform	8/1/2012	7/31/2013	Certified
EPA 624	cis-1,3-Dichloropropene (cis-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 624	Dichlorodifluoromethane (Freon-12)	8/1/2012	7/31/2013	Certified
EPA 624	Ethylbenzene	8/1/2012	7/31/2013	Certified
EPA 624	Methyl bromide (Bromomethane)	8/1/2012	7/31/2013	Certified
EPA 624	Methyl chloride (Chloromethane)	8/1/2012	7/31/2013	Certified
EPA 624	Methyl tert-butyl ether (MTBE)	8/1/2012	7/31/2013	Certified
EPA 624	Methylene chloride (Dichloromethane)	8/1/2012	7/31/2013	Certified
EPA 624	Tetrachloroethylene (Perchloroethylene)	8/1/2012	7/31/2013	Certified
EPA 624	Toluene	8/1/2012	7/31/2013	Certified
EPA 624	trans-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 624	trans-1,3-Dichloropropene (trans-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 624	Trichloroethene (Trichloroethylene)	8/1/2012	7/31/2013	Certified
EPA 624	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	8/1/2012	7/31/2013	Certified
EPA 624	Vinyl chloride	8/1/2012	7/31/2013	Certified
SM 2130 B [21st]	Turbidity	8/1/2012	7/31/2013	Certified
SM 2320 B [21st]	Alkalinity as CaCO3	8/1/2012	7/31/2013	Certified
SM 2340 B [21st]	Calcium hardness as CaCO3	8/1/2012	7/31/2013	Nevada Approved
SM 2340 B [21st]	Hardness by calculation	8/1/2012	7/31/2013	Nevada Approved
SM 2510 B [21st]	Conductivity	8/1/2012	7/31/2013	Certified
SM 2540 B [20th]	Residue-total	8/1/2012	7/31/2013	Certified
SM 2540 C [21st]	Residue-filterable (TDS)	8/1/2012	7/31/2013	Certified
SM 2540 D [21st]	Residue-nonfilterable (TSS)	8/1/2012	7/31/2013	Certified
SM 2550 B [21st]	Temperature, deg. C	8/1/2012	7/31/2013	Certified
SM 3500-Cr B [21st]	Chromium VI	8/1/2012	7/31/2013	Certified
SM 4500-Cl G [21st]	Total residual chlorine	8/1/2012	7/31/2013	Certified
SM 4500-CN^- E [21st]	Cyanide	8/1/2012	7/31/2013	Certified
SM 4500-CN^- I [21st]	Cyanide, WAD	3/21/2013	7/31/2013	Nevada Approved
SM 4500-H+ B [21st]	pH	8/1/2012	7/31/2013	Certified
SM 4500-NH3 D [21st]	Ammonia as N	8/1/2012	7/31/2013	Certified

Disclaimer: A laboratory that is certified or approved has established that they have the ability to implement a quality control program in accordance with the appropriate Federal or State regulations or statutes. It is the certified laboratory's responsibility to provide their client the most current certified parameter list. Contact LCP to verify certification status.

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00930*** **Attachment to Certificate Number:** **NV009302013-1** **Expiration Date:** **7/31/2013**

Silver State Analytical Labs - Las Vegas
3638 E. Sunset Rd. Suite 100 Las Vegas, NV 89120-

Matrix: ***CWA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
SM 4500-O G [21st]	Oxygen, dissolved	8/1/2012	7/31/2013	Certified
SM 4500-P E [21st]	Orthophosphate as P	8/1/2012	7/31/2013	Certified
SM 4500-P E [21st]	Phosphorus, total	8/1/2012	7/31/2013	Certified
SM 5210 B [21st]	Biochemical oxygen demand	8/1/2012	7/31/2013	Certified
SM 5210 B [21st]	Carbonaceous BOD, CBOD	8/1/2012	7/31/2013	Certified
SM 5220 D [21st]	Chemical oxygen demand	8/1/2012	7/31/2013	Certified
Discipline Microbiology				
IDEXX Quanti-Tray® using Colilert®-18Hr®	Fecal coliforms	12/21/2012	7/31/2013	Interim

Disclaimer: A laboratory that is certified or approved has established that they have the ability to implement a quality control program in accordance with the appropriate Federal or State regulations or statutes. It is the certified laboratory's responsibility to provide their client the most current certified parameter list. Contact LCP to verify certification status.

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00930*** **Attachment to Certificate Number:** **NV009302013-1** **Expiration Date:** **7/31/2013**

Silver State Analytical Labs - Las Vegas
3638 E. Sunset Rd. Suite 100 Las Vegas, NV 89120-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
Discipline Chemistry				
EPA 6010B	Aluminum	8/1/2012	7/31/2013	Certified
EPA 6010B	Antimony	8/1/2012	7/31/2013	Certified
EPA 6010B	Arsenic	8/1/2012	7/31/2013	Certified
EPA 6010B	Barium	8/1/2012	7/31/2013	Certified
EPA 6010B	Beryllium	8/1/2012	7/31/2013	Certified
EPA 6010B	Boron	8/1/2012	7/31/2013	Certified
EPA 6010B	Cadmium	8/1/2012	7/31/2013	Certified
EPA 6010B	Calcium	8/1/2012	7/31/2013	Certified
EPA 6010B	Chromium	8/1/2012	7/31/2013	Certified
EPA 6010B	Cobalt	8/1/2012	7/31/2013	Certified
EPA 6010B	Copper	8/1/2012	7/31/2013	Certified
EPA 6010B	Iron	8/1/2012	7/31/2013	Certified
EPA 6010B	Lead	8/1/2012	7/31/2013	Certified
EPA 6010B	Magnesium	8/1/2012	7/31/2013	Certified
EPA 6010B	Manganese	8/1/2012	7/31/2013	Certified
EPA 6010B	Molybdenum	8/1/2012	7/31/2013	Certified
EPA 6010B	Nickel	8/1/2012	7/31/2013	Certified
EPA 6010B	Potassium	8/1/2012	7/31/2013	Certified
EPA 6010B	Selenium	8/1/2012	7/31/2013	Certified
EPA 6010B	Silver	8/1/2012	7/31/2013	Certified
EPA 6010B	Sodium	8/1/2012	7/31/2013	Certified
EPA 6010B	Strontium	8/1/2012	7/31/2013	Certified
EPA 6010B	Thallium	8/1/2012	7/31/2013	Certified
EPA 6010B	Titanium	8/1/2012	7/31/2013	Certified
EPA 6010B	Vanadium	8/1/2012	7/31/2013	Certified
EPA 6010B	Zinc	8/1/2012	7/31/2013	Certified
EPA 7470A	Mercury	8/1/2012	7/31/2013	Certified
EPA 8015B	Diesel range organics (DRO)	8/1/2012	7/31/2013	Certified
EPA 8015M	Gasoline range organics (GRO)	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00930*** **Attachment to Certificate Number:** **NV009302013-1** **Expiration Date:** **7/31/2013**

Silver State Analytical Labs - Las Vegas
3638 E. Sunset Rd. Suite 100 Las Vegas, NV 89120-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260B	1,1,1,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,1-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,2,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,2-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2,3-Trichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2,4-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2,4-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dibromoethane (EDB, Ethylene dibromide)	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,3,5-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,3-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,4-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	2-Butanone (Methyl ethyl ketone, MEK)	8/1/2012	7/31/2013	Certified
EPA 8260B	2-Hexanone	8/1/2012	7/31/2013	Certified
EPA 8260B	4-Methyl-2-pentanone (MIBK)	8/1/2012	7/31/2013	Certified
EPA 8260B	Acetone	8/1/2012	7/31/2013	Certified
EPA 8260B	Acrolein (Propenal)	8/1/2012	7/31/2013	Certified
EPA 8260B	Acrylonitrile	8/1/2012	7/31/2013	Certified
EPA 8260B	Benzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Bromodichloromethane	8/1/2012	7/31/2013	Certified
EPA 8260B	Bromoform	8/1/2012	7/31/2013	Certified
EPA 8260B	Carbon disulfide	8/1/2012	7/31/2013	Certified
EPA 8260B	Carbon tetrachloride	8/1/2012	7/31/2013	Certified
EPA 8260B	Chlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Chlorodibromomethane (Dibromochloromethane)	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00930*** **Attachment to Certificate Number:** **NV009302013-1** **Expiration Date:** **7/31/2013**

Silver State Analytical Labs - Las Vegas
3638 E. Sunset Rd. Suite 100 Las Vegas, NV 89120-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260B	Chloroethane (Ethyl chloride)	8/1/2012	7/31/2013	Certified
EPA 8260B	Chloroform	8/1/2012	7/31/2013	Certified
EPA 8260B	cis-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260B	cis-1,3-Dichloropropene (cis-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	Dibromomethane (Methylene bromide)	8/1/2012	7/31/2013	Certified
EPA 8260B	Dichlorodifluoromethane (Freon-12)	8/1/2012	7/31/2013	Certified
EPA 8260B	Ethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	m+p-xylene	8/1/2012	7/31/2013	Certified
EPA 8260B	Methyl bromide (Bromomethane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Methyl chloride (Chloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Methyl tert-butyl ether (MTBE)	8/1/2012	7/31/2013	Certified
EPA 8260B	Methylene chloride (Dichloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 8260B	o-Xylene	8/1/2012	7/31/2013	Certified
EPA 8260B	Styrene	8/1/2012	7/31/2013	Certified
EPA 8260B	Tetrachloroethylene (Perchloroethylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	Toluene	8/1/2012	7/31/2013	Certified
EPA 8260B	trans-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260B	trans-1,3-Dichloropropene (trans-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	Trichloroethene (Trichloroethylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	8/1/2012	7/31/2013	Certified
EPA 8260B	Vinyl chloride	8/1/2012	7/31/2013	Certified
EPA 8260B	Xylene (total)	8/1/2012	7/31/2013	Certified
EPA 9040C	Corrosivity	8/1/2012	7/31/2013	Nevada Approved
EPA 9050A	Conductivity	8/1/2012	7/31/2013	Nevada Approved
EPA 9056A	Chloride	8/1/2012	7/31/2013	Nevada Approved
EPA 9056A	Fluoride	8/1/2012	7/31/2013	Nevada Approved
EPA 9056A	Nitrate as N	8/1/2012	7/31/2013	Nevada Approved
EPA 9056A	Nitrite as N	8/1/2012	7/31/2013	Nevada Approved
EPA 9056A	Sulfate	8/1/2012	7/31/2013	Nevada Approved

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00930*** **Attachment to Certificate Number:** **NV009302013-1** **Expiration Date:** **7/31/2013**

Silver State Analytical Labs - Las Vegas
3638 E. Sunset Rd. Suite 100 Las Vegas, NV 89120-

Matrix: ***RCRA (Non Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
EPA 9058	Perchlorate	8/1/2012	7/31/2013	Certified
EPA 9070A	n-Hexane Extractable Material (O&G)	8/1/2012	7/31/2013	Nevada Approved
EPA 9070A	Oil & Grease	8/1/2012	7/31/2013	Certified
EPA 9081	Cation exchange capacity	8/1/2012	7/31/2013	Nevada Approved
EPA 9095B	Paint Filter Liquids Test	8/1/2012	7/31/2013	Nevada Approved
SM 2540 C [21st]	Residue-filterable (TDS)	8/1/2012	7/31/2013	Certified
SM 2550 B [21st]	Temperature, deg. C	8/1/2012	7/31/2013	Certified
SM 4500-Cl G [21st]	Total residual chlorine	8/1/2012	7/31/2013	Certified
SM 4500-CN^- E [21st]	Cyanide	8/1/2012	7/31/2013	Certified
SM 4500-CN^- I [21st]	Cyanide, WAD	3/21/2013	7/31/2013	Nevada Approved

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00930*** **Attachment to Certificate Number:** **NV009302013-1** **Expiration Date:** **7/31/2013**

Silver State Analytical Labs - Las Vegas
3638 E. Sunset Rd. Suite 100 Las Vegas, NV 89120-

Matrix: ***RCRA (Solid & Hazardous Material)***

Method	Analyte	Start Date	Date Expires	Status
Discipline Chemistry				
EPA 6010B	Aluminum	8/1/2012	7/31/2013	Certified
EPA 6010B	Antimony	8/1/2012	7/31/2013	Certified
EPA 6010B	Arsenic	8/1/2012	7/31/2013	Certified
EPA 6010B	Barium	8/1/2012	7/31/2013	Certified
EPA 6010B	Beryllium	8/1/2012	7/31/2013	Certified
EPA 6010B	Boron	8/1/2012	7/31/2013	Certified
EPA 6010B	Cadmium	8/1/2012	7/31/2013	Certified
EPA 6010B	Calcium	8/1/2012	7/31/2013	Certified
EPA 6010B	Chromium	8/1/2012	7/31/2013	Certified
EPA 6010B	Cobalt	8/1/2012	7/31/2013	Certified
EPA 6010B	Copper	8/1/2012	7/31/2013	Certified
EPA 6010B	Iron	8/1/2012	7/31/2013	Certified
EPA 6010B	Lead	8/1/2012	7/31/2013	Certified
EPA 6010B	Magnesium	8/1/2012	7/31/2013	Certified
EPA 6010B	Manganese	8/1/2012	7/31/2013	Certified
EPA 6010B	Molybdenum	8/1/2012	7/31/2013	Certified
EPA 6010B	Nickel	8/1/2012	7/31/2013	Certified
EPA 6010B	Potassium	8/1/2012	7/31/2013	Certified
EPA 6010B	Selenium	8/1/2012	7/31/2013	Certified
EPA 6010B	Silver	8/1/2012	7/31/2013	Certified
EPA 6010B	Sodium	8/1/2012	7/31/2013	Certified
EPA 6010B	Strontium	8/1/2012	7/31/2013	Certified
EPA 6010B	Thallium	8/1/2012	7/31/2013	Certified
EPA 6010B	Titanium	8/1/2012	7/31/2013	Certified
EPA 6010B	Vanadium	8/1/2012	7/31/2013	Certified
EPA 6010B	Zinc	8/1/2012	7/31/2013	Certified
EPA 7471A	Mercury	8/1/2012	7/31/2013	Certified
EPA 8015B	Diesel range organics (DRO)	8/1/2012	7/31/2013	Certified
EPA 8015M	Gasoline range organics (GRO)	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00930*** **Attachment to Certificate Number:** **NV009302013-1** **Expiration Date:** **7/31/2013**

Silver State Analytical Labs - Las Vegas
3638 E. Sunset Rd. Suite 100 Las Vegas, NV 89120-

Matrix: ***RCRA (Solid & Hazardous Material)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260B	1,1,1,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,1-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,2,2-Tetrachloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1,2-Trichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,1-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2,3-Trichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2,4-Trichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2,4-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dibromoethane (EDB, Ethylene dibromide)	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dichloroethane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,2-Dichloropropane	8/1/2012	7/31/2013	Certified
EPA 8260B	1,3,5-Trimethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,3-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	1,4-Dichlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	2-Butanone (Methyl ethyl ketone, MEK)	8/1/2012	7/31/2013	Certified
EPA 8260B	2-Chloroethyl vinyl ether	8/1/2012	7/31/2013	Certified
EPA 8260B	2-Hexanone	8/1/2012	7/31/2013	Certified
EPA 8260B	4-Methyl-2-pentanone (MIBK)	8/1/2012	7/31/2013	Certified
EPA 8260B	Acetone	8/1/2012	7/31/2013	Certified
EPA 8260B	Acetonitrile	8/1/2012	7/31/2013	Certified
EPA 8260B	Acrolein (Propenal)	8/1/2012	7/31/2013	Certified
EPA 8260B	Benzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Bromobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Bromodichloromethane	8/1/2012	7/31/2013	Certified
EPA 8260B	Bromoform	8/1/2012	7/31/2013	Certified
EPA 8260B	Carbon disulfide	8/1/2012	7/31/2013	Certified
EPA 8260B	Carbon tetrachloride	8/1/2012	7/31/2013	Certified

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00930*** **Attachment to Certificate Number:** **NV009302013-1** **Expiration Date:** **7/31/2013**

Silver State Analytical Labs - Las Vegas
3638 E. Sunset Rd. Suite 100 Las Vegas, NV 89120-

Matrix: ***RCRA (Solid & Hazardous Material)***

Method	Analyte	Start Date	Date Expires	Status
EPA 8260B	Chlorobenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	Chlorodibromomethane (Dibromochloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Chloroethane (Ethyl chloride)	8/1/2012	7/31/2013	Certified
EPA 8260B	Chloroform	8/1/2012	7/31/2013	Certified
EPA 8260B	cis-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260B	cis-1,3-Dichloropropene (cis-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	Dichlorodifluoromethane (Freon-12)	8/1/2012	7/31/2013	Certified
EPA 8260B	Ethylbenzene	8/1/2012	7/31/2013	Certified
EPA 8260B	m+p-xylene	8/1/2012	7/31/2013	Certified
EPA 8260B	Methyl bromide (Bromomethane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Methyl chloride (Chloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Methyl tert-butyl ether (MTBE)	8/1/2012	7/31/2013	Certified
EPA 8260B	Methylene chloride (Dichloromethane)	8/1/2012	7/31/2013	Certified
EPA 8260B	Naphthalene	8/1/2012	7/31/2013	Certified
EPA 8260B	o-Xylene	8/1/2012	7/31/2013	Certified
EPA 8260B	Styrene	8/1/2012	7/31/2013	Certified
EPA 8260B	Tetrachloroethylene (Perchloroethylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	Toluene	8/1/2012	7/31/2013	Certified
EPA 8260B	trans-1,2-Dichloroethylene	8/1/2012	7/31/2013	Certified
EPA 8260B	trans-1,3-Dichloropropene (trans-1,3-Dichloropropylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	Trichloroethene (Trichloroethylene)	8/1/2012	7/31/2013	Certified
EPA 8260B	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	8/1/2012	7/31/2013	Certified
EPA 8260B	Vinyl chloride	8/1/2012	7/31/2013	Certified
EPA 8260B	Xylene (total)	8/1/2012	7/31/2013	Certified
EPA 9045D	Corrosivity (pH)	8/1/2012	7/31/2013	Nevada Approved
EPA 9081	Cation exchange capacity	8/1/2012	7/31/2013	Nevada Approved
EPA 9095B	Paint Filter Liquids Test	8/1/2012	7/31/2013	Nevada Approved
SM 2550 B [21st]	Temperature, deg. C	8/1/2012	7/31/2013	Certified
SM 4500-CN⁻ E [21st]	Cyanide	8/1/2012	7/31/2013	Nevada Approved
SM 4500-CN⁻ I [21st]	Cyanide, WAD	3/21/2013	7/31/2013	Nevada Approved

Disclaimer: A laboratory that is certified or approved has established that they have the ability to implement a quality control program in accordance with the appropriate Federal or State regulations or statutes. It is the certified laboratory's responsibility to provide their client the most current certified parameter list. Contact LCP to verify certification status.

State of Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
Laboratory Scope of Accreditation

EPA Number: ***NV00930*** **Attachment to Certificate Number:** **NV009302013-1** **Expiration Date:** **7/31/2013**

Silver State Analytical Labs - Las Vegas
3638 E. Sunset Rd. Suite 100 Las Vegas, NV 89120-

Matrix: ***SDWA (Potable Water)***

Method	Analyte	Start Date	Date Expires	Status
Discipline Chemistry				
EPA 218.6	Chromium VI	8/1/2012	7/31/2013	Certified
EPA 300.0	Chloride	8/1/2012	7/31/2013	Certified
EPA 300.0	Fluoride	8/1/2012	7/31/2013	Certified
EPA 300.0	Nitrate as N	8/1/2012	7/31/2013	Certified
EPA 300.0	Nitrite as N	8/1/2012	7/31/2013	Certified
EPA 300.0	Sulfate	8/1/2012	7/31/2013	Certified
EPA 314.0	Perchlorate	8/1/2012	7/31/2013	Certified
SM 2540 C [21st]	Residue-filterable (TDS)	8/1/2012	7/31/2013	Certified
SM 2540 D [21st]	Residue-nonfilterable (TSS)	8/1/2012	7/31/2013	Certified
SM 2550 B [21st]	Temperature, deg. C	8/1/2012	7/31/2013	Certified
SM 4500-H+ B [21st]	pH	8/1/2012	7/31/2013	Certified
Discipline Microbiology				
IDEXX Colilert® [21st]	Escherichia coli	8/1/2012	7/31/2013	Certified
IDEXX Colilert® [21st]	Total coliforms	8/1/2012	7/31/2013	Certified

STATE OF NEVADA
Department of Conservation & Natural Resources
DIVISION OF ENVIRONMENTAL PROTECTION
Brian Sandoval, Governor
Leo M. Drozdoff, P.E., Director
Colleen Cripps, Ph.D., Administrator

July 26, 2013

Silver State Analytical Labs - Las Vegas
3638 E. Sunset Rd. Suite 100
Las Vegas, NV 89120-

RE: Nevada Environmental Laboratory Certification 1 Year Extension.

Dear Sir or Madam:

Your laboratory's 2012-2013 Nevada scope has been extended until July 31, 2014 or until you receive the updated 2013-2014 scope.

This will serve as official notice to you and your clients.

Be advised this letter is only valid as long as your laboratory maintains compliance with State of Nevada regulation NAC 445A.0552 to .067, NAC 445A.542 to .54296 and/or NAC 459.96902 to .9699.

Failure to do so will result in invalidation of any data submitted to the Nevada Department of Environmental Protection.

If you or your clients have any questions, please contact Donald LaFara at 775-687-9491.

Sincerely,

Don LaFara

Donald LaFara, Laboratory Certification Officer
Program Manager, Laboratory Certification Program
State of Nevada Division of Environmental Protection

Appendix E

Field Boring Logs

LOG OF BORING NO. SB-1

Project: Coaldale Junction Phase II — Job No.:

Elevation Top of Hole: — Datum: — Prepared By: — Date: 4-15-13

Type / Size of Boring: HSA 8" — Rig Type: Diedrich — Driller: Eagle — Reviewed By: — Date:

DEPTH, FEET	PENETRATION RESISTANCE BLOW / FOOT C	PENETRATION RESISTANCE BLOW / FOOT N/R	SAMPLE TYPE	DRY DENSITY, PCF	WATER CONTENT, %	SOIL CLASSIFICATION	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	MAXIMUM SIZE	PARTICLE SIZE DISTRIBUTION, % BOULDERS / COBBLES	GRAVEL	SAND	SILT & CLAY	GRADATION WELL	GRADATION MEDIUM	GRADATION POOR	GRAIN SHAPE ANGULAR	GRAIN SHAPE SUBANGLAR	GRAIN SHAPE SUBROUNDED	GRAIN SHAPE ROUNDED	RELATIVE DENSITY LOOSE	RELATIVE DENSITY MED. DENSE	RELATIVE DENSITY DENSE	RELATIVE DENSITY VERY DENSE	PLASTICITY NONE	PLASTICITY LOW	PLASTICITY MEDIUM	PLASTICITY HIGH	CONSISTENCY SOFT	CONSISTENCY FIRM	CONSISTENCY STIFF	CONSISTENCY VERY STIFF	CONSISTENCY HARD	CEMENTATION NONE	CEMENTATION LIGHT	CEMENTATION MODERATE	CEMENTATION HEAVY
1							PID																														
2																																					
3																																					
4																																					
5	11	12	C				0 ppm Sandy + Silts 0735																																
6																																					
7																																					
8																																					
9																																					
10	11	13	C				0 ppm some gravels																																
1																																					
2																																					
3																																					
4																																					
15	11	11	C				0 ppm																														
6																																					
7																																					
8																																					
9																																					
20	13	17	19	C			0 ppm																														
1																																					
2																																					
3																																					
4																																					
25	72	44-50/2	C				0 ppm clays																														
6																																					
7																																					
8																																					
9																																					
30	50	5"	C				0 ppm dense clays																																

GRADATION — GRAIN SHAPE — RELATIVE DENSITY — PLASTICITY — CONSISTENCY — CEMENTATION

GROUNDWATER CONDITIONS

Date _____ No Groundwater Encountered _____

Date _____ Time _____ Depth _____

Date _____ Time _____ Depth _____

Location: adjacent to well

Coordinates: 38° 1.631' N 117° 53.007' W

LOG OF BORING NO. SB-1

Project Coaldale Phase II — Job No. _____

Elevation Top of Hole _____ Datum _____ Prepared By _____ Date 4-15-13

Type / Size of Boring HSA 8" Rig Type Diedrich Driller Eagle Reviewed By _____ Date _____

DEPTH, FEET	PENETRATION RESISTANCE BLOW/FOOT C	N/R	SAMPLE TYPE	DRY DENSITY, PCF	WATER CONTENT, %	SOIL CLASSIFICATION	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	MAXIMUM SIZE	PARTICLE SIZE DISTRIBUTION, % BOULDERS / COBBLES	GRAVEL	SAND	SILT & CLAY	GRADATION WELL	MEDIUM	POOR	GRAIN SHAPE ANGULAR	SUBANGLAR	SUBROUNDED	ROUNDED	RELATIVE DENSITY LOOSE	MED. DENSE	DENSE	VERY DENSE	PLASTICITY NONE	LOW	MEDIUM	HIGH	CONSISTENCY SOFT	FIRM	STIFF	VERY STIFF	HARD	CEMENTATION NONE	LIGHT	MODERATE	HEAVY
1							PID																													
2																																				
3																																				
4																																				
35	36	50/4"					Ø ppm																													
6																																				
7																																				
8																																				
9																																				
40	50/5"						Ø ppm																													
1																																				
2																																				
3																																				
4																																				
45	50/5"						Ø ppm																													
6																																				
7																																				
8																																				
9																																				
50	50/4"						Ø ppm																													
1																																				
2																																				
3																																				
4																																				
55	50/3"						Ø ppm																													
6																																				
7																																				
8																																				
9																																				
60	50/5"						Ø ppm																													

GRADATION — GRAIN SHAPE — RELATIVE DENSITY — PLASTICITY — CONSISTENCY — CEMENTATION

GROUNDWATER CONDITIONS

Date _____ No Groundwater Encountered _____

Date _____ Time _____ Depth _____

Date _____ Time _____ Depth _____

LOG OF BORING NO. SB-1

Project Coaldale Phase II — Job No. _____

Elevation Top of Hole _____ Datum _____ Prepared By I Date 4-15-13

Type / Size of Boring HSA 8" Rig Type Diedrich Driller Eagle Reviewed By _____ Date _____

DEPTH, FEET	PENETRATION RESISTANCE BLOW / FOOT C	N/R	SAMPLE TYPE	DRY DENSITY, PCF	WATER CONTENT, %	SOIL CLASSIFICATION	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	MAXIMUM SIZE	PARTICLE SIZE DISTRIBUTION, % BOULDERS / COBBLES	GRAVEL	SAND	SILT & CLAY	GRADATION WELL	MEDIUM	POOR	GRAIN SHAPE ANGULAR	SUBANGLAR	SUBROUNDED	ROUNDED	RELATIVE DENSITY LOOSE	MED. DENSE	DENSE	VERY DENSE	PLASTICITY NONE	LOW	MEDIUM	HIGH	CONSISTENCY SOFT	FIRM	STIFF	VERY STIFF	HARD	CEMENTATION NONE	LIGHT	MODERATE	HEAVY
1							PID																													
2																																				
3																																				
4																																				
5	50/5"						0 ppm																													
6																																				
7							Sandy gravels														R															
8																					E															
9																					L															
70	NR						—									G					A			P			C			C					
1													G			R					T			L			O			E					
2													R			A					I			A			N			M					
3													A			I					V			S			S			E					
4													D			N					E			T			I			N					
75	NR						—						A											I			S			T					
6													T			S					D			C			T			A					
7													I			H					E			I			E			T					
8													O			A					N			T			N			I					
9													N			P					S			Y			C			O					
80																E					I						Y			N					
1							straight to 100' 11:00 am														T																
2							minimal sample recovery in shoe.														Y																
3																																				
4							NO GW encountered																													
5																																				
6																																				
7																																				
8																																				
9																																				
0																																				

Sandy gravels.

GROUNDWATER CONDITIONS

Date _____ No Groundwater Encountered ✓

Date _____ Time _____ Depth _____

Date _____ Time _____ Depth _____

LOG OF BORING NO. SB-2

Project: Coaldale Junction Phase II — Job No.:

Elevation Top of Hole: — Datum: — Prepared By: — Date: 4-15-13

Type / Size of Boring: HSA 8" — Rig Type: Diedrich — Driller: Eagle — Reviewed By: — Date:

DEPTH, FEET	PENETRATION RESISTANCE BLOW/FOOT C	PENETRATION RESISTANCE BLOW/FOOT N/R	SAMPLE TYPE	DRY DENSITY, PCF	WATER CONTENT, %	SOIL CLASSIFICATION	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	MAXIMUM SIZE	PARTICLE SIZE DISTRIBUTION, % BOULDERS / COBBLES	GRAVEL	SAND	SILT & CLAY
1							PID					
2							Fill Material					
3							12:15pm					
4							0-10'					
5												
6												
7												
8												
9												
10	13-13-20	C					0 ppm					
1												
2												
3												
4												
5												
6												
7												
8												
9												
20	17-13-14						0 ppm 12:55pm					
1												
2												
3												
4												
5												
6												
7							No GW encountered					
8												
9												
0												

GRADATION	GRAIN SHAPE	RELATIVE DENSITY	PLASTICITY	CONSISTENCY	CEMENTATION
WELL	ANGULAR	LOOSE	NONE	SOFT	NONE
MEDIUM	SUBANGLAR	MED. DENSE	LOW	FIRM	LIGHT
POOR	SUBROUNDED	DENSE	MEDIUM	STIFF	MODERATE
	ROUNDED	VERY DENSE	HIGH	VERY STIFF	HEAVY
				HARD	

GRADATION — GRAIN SHAPE — RELATIVE DENSITY — PLASTICITY — CONSISTENCY — CEMENTATION

GROUNDWATER CONDITIONS

Date _____ No Groundwater Encountered ✓

Date _____ Time _____ Depth _____

Date _____ Time _____ Depth _____

Location: Former UST Pit

Coordinates: 38°1.617'N 117°52.975'W

LOG OF BORING NO. SB-3

Project Waldale Junction Phase II — Job No. _____

Elevation Top of Hole _____ Datum _____ Prepared By _____ Date 4-15-13

Type / Size of Boring HSA Rig Type _____ Driller Eagle Reviewed By _____ Date _____

DEPTH, FEET	PENETRATION RESISTANCE BLOW/FOOT C	N/R	SAMPLE TYPE	DRY DENSITY, PCF	WATER CONTENT, %	SOIL CLASSIFICATION	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)
1							PID
2	10-12-16		C				174 ppm 13:17 pm
3							
4							
5	13-12-14		C				156 ppm
6							
7							
8							
9							
0	15-18-12		C				1.8 ppm
1							
2							
3							
4							
5	13-17-18		C				0 ppm
6							
7							
8							
9							
0	1718-18		C				0 ppm 2:22 pm
1							
2							
3							
4							
5							
6							No GW encountered
7							
8							
9							
0							

MAXIMUM SIZE	PARTICLE SIZE DISTRIBUTION, % BOULDERS / COBBLES	GRAVEL	SAND	SILT & CLAY	GRADATION WELL	MEDIUM	POOR	GRAIN SHAPE ANGULAR	SUBANGLAR	SUBROUNDED	ROUNDED	RELATIVE DENSITY LOOSE	MED. DENSE	DENSE	VERY DENSE	PLASTICITY NONE	LOW	MEDIUM	HIGH	CONSISTENCY SOFT	FIRM	STIFF	VERY STIFF	HARD	CEMENTATION NONE	LIGHT	MODERATE	HEAVY

GRADATION — GRAIN SHAPE — RELATIVE DENSITY — PLASTICITY — CONSISTENCY — CEMENTATION

GROUNDWATER CONDITIONS

Date _____ No Groundwater Encountered ✓

Date _____ Time _____ Depth _____

Date _____ Time _____ Depth _____

Location: beneath product piping

Coordinates: 38°1.607'N 117°52.961'W

LOG OF BORING NO. SB-4

Project Coaldale Junction Phase II — Job No.

Elevation Top of Hole — Datum — Prepared By — Date 4-15-13

Type / Size of Boring 8" HSA — Rig Type diedrich — Driller Eagle — Reviewed By — Date

DEPTH, FEET	PENETRATION RESISTANCE BLOW / FOOT C	N/R	SAMPLE TYPE	DRY DENSITY, PCF	WATER CONTENT, %	SOIL CLASSIFICATION	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	MAXIMUM SIZE	PARTICLE SIZE DISTRIBUTION, % BOULDERS / COBBLES	GRAVEL	SAND	SILT & CLAY	GRADATION WELL	MEDIUM	POOR	GRAIN SHAPE ANGULAR	SUBANGULAR	SUBROUNDED	ROUNDED	RELATIVE DENSITY LOOSE	MED. DENSE	DENSE	VERY DENSE	PLASTICITY NONE	LOW	MEDIUM	HIGH	CONSISTENCY SOFT	FIRM	STIFF	VERY STIFF	HARD	CEMENTATION NONE	LIGHT	MODERATE	HEAVY
1							PID																													
2																																			
3																																			
4																																			
5	11-10-9		C				3 ppm																												
6																																			
7																					R														
8																					E														
9																					L														
10	10-15-12		C				0 ppm										G				A				P				C				C		
11																	R				T				L				O				E		
12																	A				I				A				N				M		
13																	D				N				S				S				E		
14																	A				E				T				I				N		
15	12-11-15		C				0 ppm										T								I				S				T		
16																	I				D				C				T				A		
17																	O				E				I				E				T		
18																	N				N				T				N				I		
19																					S				Y				C				O		
20																					I								Y				N		
21																					T														
22																					Y														
23																																			
24																																			
25																																			
26																																			
27																																			
28																																			
29																																			
30							No GW encountered																														

GROUNDWATER CONDITIONS

Date ____ No Groundwater Encountered ✓

Date ____ Time ____ Depth ____

Date ____ Time ____ Depth ____

Coordinates: 38°1.603'N 117°52.923'W

LOG OF BORING NO. SB-5

Project Coaldale Junction Phase II — Job No. _____

Elevation Top of Hole _____ Datum _____ Prepared By _____ Date 4-16-13

Type / Size of Boring 8" HSA Rig Type _____ Driller _____ Reviewed By _____ Date _____

DEPTH, FEET	PENETRATION RESISTANCE BLOW / FOOT C	PENETRATION RESISTANCE BLOW / FOOT N/R	SAMPLE TYPE	DRY DENSITY, PCF	WATER CONTENT, %	SOIL CLASSIFICATION	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	MAXIMUM SIZE	PARTICLE SIZE DISTRIBUTION, % BOULDERS / COBBLES	GRAVEL	SAND	SILT & CLAY
1							PID Concrete deck 7:16am					
2												
3												
4												
5	8-14-10		C				48 ppm grey + heavy TPH odor	½		50	10	40
6												
7												
8												
9												
10	11-11-18		C				97 ppm grey + heavy TPH odor	¼		20	50	30
11												
12												
13												
14												
15	14-20-25		C				136 ppm grey + heavy TPH odor	¼		15	35	50
16												
17												
18												
19												
20	16-22-30		C				81 ppm grey + heavy TPH odor	–	–	30	70	
21												
22												
23												
24												
25	27-32-34		C				42 ppm light grey stained	–			30	70
26												
27												
28												
29												
30	32-27-33		C				37 ppm light grey stained	–			30	70

GRADATION: WELL / MEDIUM / POOR

GRAIN SHAPE: ANGULAR / SUBANGLAR / SUBROUNDED / ROUNDED

RELATIVE DENSITY: LOOSE / MED. DENSE / DENSE / VERY DENSE

PLASTICITY: NONE / LOW / MEDIUM / HIGH

CONSISTENCY: SOFT / FIRM / STIFF / VERY STIFF / HARD

CEMENTATION: NONE / LIGHT / MODERATE / HEAVY

GROUNDWATER CONDITIONS

Date _____ No Groundwater Encountered _____

Date _____ Time _____ Depth _____

Date _____ Time _____ Depth _____

Location - Diesel pump Island

Coordinates: 38° 1.626' N 117° 52.957' W

LOG OF BORING NO. SB-5

Project Coaldale Phase II Job No.

Elevation Top of Hole Datum Prepared By Date 4-16-13

Type / Size of Boring 8" HSA Rig Type Diedrich Driller Eagle Reviewed By Date

DEPTH, FEET	PENETRATION RESISTANCE BLOW / FOOT C	N/R	SAMPLE TYPE	DRY DENSITY, PCF	WATER CONTENT, %	SOIL CLASSIFICATION	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	MAXIMUM SIZE	PARTICLE SIZE DISTRIBUTION, % BOULDERS / COBBLES	GRAVEL	SAND	SILT & CLAY	GRADATION WELL	MEDIUM	POOR	GRAIN SHAPE ANGULAR	SUBANGLAR	SUBROUNDED	ROUNDED	RELATIVE DENSITY LOOSE	MED. DENSE	DENSE	VERY DENSE	PLASTICITY NONE	LOW	MEDIUM	HIGH	CONSISTENCY SOFT	FIRM	STIFF	VERY STIFF	HARD	CEMENTATION NONE	LIGHT	MODERATE	HEAVY
1							PID																													
2																																				
3																																				
4																																				
35	14-24-37		C				8 ppm Grey Stained																															
6																																				
7																																				
8																																				
9																																				
40	45 50/2"		C				98 ppm Grey Stained																															
1																																				
2																																				
3																																				
4																																				
45	56 50/3"		C				84 ppm Grey stained																															
6																																				
7																																				
8																																				
9																																				
50	58 50/2"		C				17 ppm Grey Stained																															
1																																				
2																																				
3																																				
4																																				
55	56 50/6"		C				7 ppm Grey Stained																															
6																																				
7																																				
8																																				
9																																				
600	50 / 4"		C				19 ppm Grey Stained																															

GRADATION

GRAIN SHAPE

RELATIVE DENSITY

PLASTICITY

CONSISTENCY

CEMENTATION

GROUNDWATER CONDITIONS

Date _____ No Groundwater Encountered _____

Date _____ Time _____ Depth _____

Date _____ Time _____ Depth _____

LOG OF BORING NO. SB-5

Project: Coaldale Junction Phase II — Job No.:

Elevation Top of Hole: — Datum: — Prepared By: — Date: 4-16-13

Type / Size of Boring: 8" HSA — Rig Type: diedrich — Driller: Eagle — Reviewed By: — Date:

DEPTH, FEET	PENETRATION RESISTANCE BLOW / FOOT C	PENETRATION RESISTANCE BLOW / FOOT N/R	SAMPLE TYPE	DRY DENSITY, PCF	WATER CONTENT, %	SOIL CLASSIFICATION	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	MAXIMUM SIZE	PARTICLE SIZE DISTRIBUTION, %	GRADATION	GRAIN SHAPE	RELATIVE DENSITY	PLASTICITY	CONSISTENCY	CEMENTATION
									BOULDERS / COBBLES; GRAVEL; SAND; SILT & CLAY	WELL; MEDIUM; POOR	ANGULAR; SUBANGLAR; SUBROUNDED; ROUNDED	LOOSE; MED. DENSE; DENSE; VERY DENSE	NONE; LOW; MEDIUM; HIGH	SOFT; FIRM; STIFF; VERY STIFF; HARD	NONE; LIGHT; MODERATE; HEAVY
1							PID								
2															
3															
4															
5	NR						no recovery								
6															
7															
8															
9															
70	50	50	C				56 ppm impacted grey Stained								
1															
2															
3															
4															
75							Stopped sampling at 80'								
6															
7															
8							drilled to 100'								
9															
80	50	50/6"	C				78 ppm								
1															
2															
3															
4															
5															
6															
7															
8															
9															
0							ND GW encountered. 100'								

GRADATION — GRAIN SHAPE — RELATIVE DENSITY — PLASTICITY — CONSISTENCY — CEMENTATION

GROUNDWATER CONDITIONS

Date _____ No Groundwater Encountered ✓

Date _____ Time _____ Depth _____

Date _____ Time _____ Depth _____

LOG OF BORING NO. SB-6

Project: Coaldale Phase II — Job No.:

Elevation Top of Hole: — Datum: — Prepared By: — Date: 4-16-13

Type / Size of Boring: 8" HSA — Rig Type: D12 — Driller: Eagle — Reviewed By: — Date:

DEPTH, FEET	PENETRATION RESISTANCE BLOW/FOOT C	PENETRATION RESISTANCE BLOW/FOOT N/R	SAMPLE TYPE	DRY DENSITY, PCF	WATER CONTENT, %	SOIL CLASSIFICATION	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)	MAXIMUM SIZE
1							PID 1325 ppm	
2								
3								
4								
5	10 20 16	C					0 ppm No Visual or odor Impact	
6								
7								
8								
9								
10	12 12 15	C					0 ppm "	
11								
12								
13								
14								
15	18 21 27	C					0 ppm "	
16								
17								
18								
19								
20	16 23 33	C					0 ppm "	
21								
22								
23							Terminated boring at 20' bgs	
24								
25								
26								
27								
28								
29								
30							NO GW encountered	

PARTICLE SIZE DISTRIBUTION, %				GRADATION	GRAIN SHAPE	RELATIVE DENSITY	PLASTICITY	CONSISTENCY	CEMENTATION
BOULDERS / COBBLES	GRAVEL	SAND	SILT & CLAY	WELL, MEDIUM, POOR	ANGULAR, SUBANGLAR, SUBROUNDED, ROUNDED	LOOSE, MED. DENSE, DENSE, VERY DENSE	NONE, LOW, MEDIUM, HIGH	SOFT, FIRM, STIFF, VERY STIFF, HARD	NONE, LIGHT, MODERATE, HEAVY

GRADATION — GRAIN SHAPE — RELATIVE DENSITY — PLASTICITY — CONSISTENCY — CEMENTATION

GROUNDWATER CONDITIONS

Date _____ No Groundwater Encountered ✓

Date _____ Time _____ Depth _____

Date _____ Time _____ Depth _____

Location: Gas dispenser Island

Coordinates: 38° 1.637' N 117° 52.974' W

LOG OF BORING NO. SB-7

Project Coaldale Phase II — Job No.

Elevation Top of Hole — Datum — Prepared By — Date 4-16-13

Type / Size of Boring 8" HSA — Rig Type D12 — Driller Eagle — Reviewed By — Date

DEPTH, FEET	PENETRATION RESISTANCE BLOW/FOOT C	PENETRATION RESISTANCE BLOW/FOOT N/R	SAMPLE TYPE	DRY DENSITY, PCF	WATER CONTENT, %	SOIL CLASSIFICATION	SOIL TYPE DESCRIPTION (Modifier, Color, Density, Moisture, etc.)
1							PID
2							
3							
4							
5							— Drilled to 15' bgs
6							
7							
8							
9							
10							— Collected 1st sample
11							at 15' bgs
12							
13							
14							
15	12-17-22	C					0ppm
16							
17							
18							
19							
20	14-32-31	C					0ppm
21							
22							
23							
24							
25	16-18-21	C					0ppm
26							
27							
28							
29							
30							Terminated at 25'

MAXIMUM SIZE	PARTICLE SIZE DISTRIBUTION, % BOULDERS / COBBLES	GRAVEL	SAND	SILT & CLAY	GRADATION WELL	GRADATION MEDIUM	GRADATION POOR	GRAIN SHAPE ANGULAR	GRAIN SHAPE SUBANGULAR	GRAIN SHAPE SUBROUNDED	GRAIN SHAPE ROUNDED	RELATIVE DENSITY LOOSE	RELATIVE DENSITY MED. DENSE	RELATIVE DENSITY DENSE	RELATIVE DENSITY VERY DENSE	PLASTICITY NONE	PLASTICITY LOW	PLASTICITY MEDIUM	PLASTICITY HIGH	CONSISTENCY SOFT	CONSISTENCY FIRM	CONSISTENCY STIFF	CONSISTENCY VERY STIFF	CONSISTENCY HARD	CEMENTATION NONE	CEMENTATION LIGHT	CEMENTATION MODERATE	CEMENTATION HEAVY

GRADATION — GRAIN SHAPE — RELATIVE DENSITY — PLASTICITY — CONSISTENCY — CEMENTATION

GROUNDWATER CONDITIONS

Date _____ No Groundwater Encountered ✓

Date _____ Time _____ Depth _____

Date _____ Time _____ Depth _____

NO GW encountered

Location: between burn pits (N side)

Coordinates: 38° 1.411' N 117° 52.965' W

Appendix F

Soil Laboratory Analytical Data Reports

April 29, 2013

Brian Loffman
BEC Environmental, Inc.
7660 W. Sahara Ave., Ste. 150
Las Vegas, NV 89117

TEL: (702) 304-9830
FAX: (702) 304-9839

CA-ELAP No.: 2676
NV Cert. No.: NV-009222007A

Workorder No.: N010064

RE: Coaldale Junction, 804-11-TZE

Attention: Brian Loffman

Enclosed are the results for sample(s) received on April 19, 2013 by Advanced Technology Laboratories, Inc. . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

I hereby certify that all laboratory analysis requested were performed by Nevada Division of Environmental Protection-certified laboratory for the parameters and matrices reported herein.

Thank you for the opportunity to service the needs of your company.Please feel free to call me at (702) 307-2659 if I can be of further assistance to your company.

Sincerely,

Jose Tenorio Jr.
Laboratory Director

CLIENT: BEC Environmental, Inc.
Project: Coaldale Junction, 804-11-TZE
Lab Order: N010064

CASE NARRATIVE

SAMPLE RECEIVING/GENERAL COMMENTS:

Samples were received intact with proper chain of custody documentation.

Cooler temperature and sample preservation were verified upon receipt of samples if applicable.

Information on sample receipt conditions including discrepancies can be found in attached Sample Receipt Checklist Form.

Samples were analyzed within method holding time.

Analytical Comments for EPA 6010B:

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) are outside recovery criteria for Arsenic, Selenium and Lead possibly due to matrix interference. The associated Laboratory Control Sample (LCS) recovery was acceptable.

CLIENT: BEC Environmental, Inc.
Lab Order: N010064
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010064-001

Client Sample ID: BP2-S / Burn Pit
Collection Date: 4/17/2013 8:56:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
EPA 3550B / **EPA 8015B**							
RunID: **GC1_130422B** QC Batch: **42749** PrepDate: **4/22/2013** Analyst: **MDM**							
DRO	ND	2.2	10		mg/Kg	1	4/22/2013 10:42 PM
ORO	16	1.1	10		mg/Kg	1	4/22/2013 10:42 PM
Surr: p-Terphenyl	106	0	52-175		%REC	1	4/22/2013 10:42 PM
MERCURY BY COLD VAPOR TECHNIQUE							
EPA 7471 / **EPA 7471A**							
RunID: **AA1_130424B** QC Batch: **42761** PrepDate: **4/22/2013** Analyst: **LCC**							
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
EPA 3050B / **EPA 6010B**							
RunID: **ICP2_130424D** QC Batch: **42753** PrepDate: **4/22/2013** Analyst: **CEI**							
Arsenic	8.9	0.15	1.0		mg/Kg	1	4/25/2013 03:41 AM
Barium	200	0.16	1.0		mg/Kg	1	4/25/2013 03:41 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 03:41 AM
Chromium	16	0.17	1.0		mg/Kg	1	4/25/2013 03:41 AM
Lead	18	0.14	1.0		mg/Kg	1	4/25/2013 03:41 AM
Selenium	3.1	0.28	1.0		mg/Kg	1	4/25/2013 03:41 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 03:41 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010064
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010064-002

Client Sample ID: BP2-N / Burn Pit
Collection Date: 4/17/2013 8:51:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC1_130422B**	QC Batch: **42749**			PrepDate:	**4/22/2013**		Analyst: **MDM**
DRO	15	2.2	10		mg/Kg	1	4/22/2013 11:08 PM
ORO	31	1.1	10		mg/Kg	1	4/22/2013 11:08 PM
Surr: p-Terphenyl	99.7	0	52-175		%REC	1	4/22/2013 11:08 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424B**	QC Batch: **42761**			PrepDate:	**4/22/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42753**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	9.4	0.15	1.0		mg/Kg	1	4/25/2013 03:47 AM
Barium	85	0.16	1.0		mg/Kg	1	4/25/2013 03:47 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 03:47 AM
Chromium	13	0.16	1.0		mg/Kg	1	4/25/2013 03:47 AM
Lead	22	0.14	1.0		mg/Kg	1	4/25/2013 03:47 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 03:47 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 03:47 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010064
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010064-003

Client Sample ID: BP1-N / Burn Pit
Collection Date: 4/17/2013 9:02:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B				**EPA 8015B**		
RunID: **GC1_130422B**	QC Batch: **42749**				PrepDate: **4/22/2013**		Analyst: **MDM**
DRO	260	2.2	10		mg/Kg	1	4/22/2013 11:33 PM
ORO	330	1.1	10		mg/Kg	1	4/22/2013 11:33 PM
Surr: p-Terphenyl	113	0	52-175		%REC	1	4/22/2013 11:33 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471				**EPA 7471A**		
RunID: **AA1_130424B**	QC Batch: **42761**				PrepDate: **4/22/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B				**EPA 6010B**		
RunID: **ICP2_130424D**	QC Batch: **42753**				PrepDate: **4/22/2013**		Analyst: **CEI**
Arsenic	7.1	0.15	1.0		mg/Kg	1	4/25/2013 03:53 AM
Barium	94	0.16	1.0		mg/Kg	1	4/25/2013 03:53 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 03:53 AM
Chromium	8.0	0.16	1.0		mg/Kg	1	4/25/2013 03:53 AM
Lead	8.5	0.14	1.0		mg/Kg	1	4/25/2013 03:53 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 03:53 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 03:53 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010064
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010064-004

Client Sample ID: BP1-S / Burn Pit
Collection Date: 4/17/2013 9:09:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B				**EPA 8015B**		
RunID: **GC1_130422B**	QC Batch: **42749**				PrepDate: **4/22/2013**		Analyst: **MDM**
DRO	ND	2.2	10		mg/Kg	1	4/22/2013 11:59 PM
ORO	ND	1.1	10		mg/Kg	1	4/22/2013 11:59 PM
Surr: p-Terphenyl	103	0	52-175		%REC	1	4/22/2013 11:59 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471				**EPA 7471A**		
RunID: **AA1_130424B**	QC Batch: **42761**				PrepDate: **4/22/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B				**EPA 6010B**		
RunID: **ICP2_130424D**	QC Batch: **42753**				PrepDate: **4/22/2013**		Analyst: **CEI**
Arsenic	11	0.15	1.0		mg/Kg	1	4/25/2013 03:59 AM
Barium	96	0.16	1.0		mg/Kg	1	4/25/2013 03:59 AM
Cadmium	1.5	0.16	1.0		mg/Kg	1	4/25/2013 03:59 AM
Chromium	17	0.17	1.0		mg/Kg	1	4/25/2013 03:59 AM
Lead	140	0.14	1.0		mg/Kg	1	4/25/2013 03:59 AM
Selenium	2.2	0.28	1.0		mg/Kg	1	4/25/2013 03:59 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 03:59 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010064
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010064-005

Client Sample ID: BGS / SWC
Collection Date: 4/17/2013 9:11:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424B**	QC Batch: **42761**			PrepDate:	**4/22/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42753**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	9.5	0.15	1.0		mg/Kg	1	4/25/2013 04:26 AM
Barium	130	0.16	1.0		mg/Kg	1	4/25/2013 04:26 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 04:26 AM
Chromium	9.4	0.16	1.0		mg/Kg	1	4/25/2013 04:26 AM
Lead	6.0	0.14	1.0		mg/Kg	1	4/25/2013 04:26 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 04:26 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 04:26 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Work Order: N010064
Project: Coaldale Junction, 804-11-TZE

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **MB-42753**	SampType: **MBLK**	TestCode: **6010_S**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88583**
Client ID: **PBS**	Batch ID: **42753**	TestNo: **EPA 6010B**	**EPA 3050B**	Analysis Date: **4/25/2013**	SeqNo: **1562970**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	ND	1.0									
Barium	ND	1.0									
Cadmium	ND	1.0									
Chromium	ND	1.0									
Lead	ND	1.0									
Selenium	ND	1.0									
Silver	ND	1.0									

Sample ID: **LCS-42753**	SampType: **LCS**	TestCode: **6010_S**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88583**
Client ID: **LCSS**	Batch ID: **42753**	TestNo: **EPA 6010B**	**EPA 3050B**	Analysis Date: **4/25/2013**	SeqNo: **1562971**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	49.848	1.0	50.20	0	99.3	80	120				
Barium	49.984	1.0	50.20	0	99.6	80	120				
Cadmium	49.893	1.0	50.20	0	99.4	80	120				
Chromium	49.956	1.0	50.20	0	99.5	80	120				
Lead	49.775	1.0	50.20	0	99.2	80	120				
Selenium	50.052	1.0	50.20	0	99.7	80	120				
Silver	50.251	1.0	50.20	0	100	80	120				

Sample ID: **N010063-001A-MS**	SampType: **MS**	TestCode: **6010_S**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88583**
Client ID: **ZZZZZZ**	Batch ID: **42753**	TestNo: **EPA 6010B**	**EPA 3050B**	Analysis Date: **4/25/2013**	SeqNo: **1562975**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	49.001	1.0	49.88	10.49	77.2	75	125				
Barium	119.790	1.0	49.88	65.37	109	75	125				
Cadmium	38.194	1.0	49.88	0	76.6	75	125				
Chromium	48.241	1.0	49.88	5.659	85.4	75	125				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Work Order: N010064
Project: Coaldale Junction, 804-11-TZE

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **N010063-001A-MS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **4/22/2013** RunNo: **88583**
Client ID: **ZZZZZZ** Batch ID: **42753** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **4/25/2013** SeqNo: **1562975**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	41.466	1.0	49.88	5.700	71.7	75	125				S
Selenium	37.100	1.0	49.88	0	74.4	75	125				S
Silver	39.759	1.0	49.88	0	79.7	75	125				

Sample ID: **N010063-001A-MSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **4/22/2013** RunNo: **88583**
Client ID: **ZZZZZZ** Batch ID: **42753** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **4/25/2013** SeqNo: **1562976**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	47.930	1.0	49.95	10.49	75.0	75	125	49.00	2.21	20	S
Barium	119.181	1.0	49.95	65.37	108	75	125	119.8	0.510	20	
Cadmium	38.210	1.0	49.95	0	76.5	75	125	38.19	0.0427	20	
Chromium	48.733	1.0	49.95	5.659	86.2	75	125	48.24	1.01	20	
Lead	41.806	1.0	49.95	5.700	72.3	75	125	41.47	0.816	20	S
Selenium	36.703	1.0	49.95	0	73.5	75	125	37.10	1.08	20	S
Silver	39.805	1.0	49.95	0	79.7	75	125	39.76	0.118	20	

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Work Order: N010064
Project: Coaldale Junction, 804-11-TZE

ANALYTICAL QC SUMMARY REPORT

TestCode: 7471_S

Sample ID: **LCS-42761**	SampType: **LCS**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88587**
Client ID: **LCSS**	Batch ID: **42761**	TestNo: **EPA 7471A**	**EPA 7471**	Analysis Date: **4/24/2013**	SeqNo: **1563192**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.409	0.10	0.4167	0	98.2	80	120				

Sample ID: **MB-42761**	SampType: **MBLK**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88587**
Client ID: **PBS**	Batch ID: **42761**	TestNo: **EPA 7471A**	**EPA 7471**	Analysis Date: **4/24/2013**	SeqNo: **1563193**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.10									

Sample ID: **N010063-001A-MS**	SampType: **MS**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88587**
Client ID: **ZZZZZZ**	Batch ID: **42761**	TestNo: **EPA 7471A**	**EPA 7471**	Analysis Date: **4/24/2013**	SeqNo: **1563197**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.420	0.10	0.4160	0	101	75	125				

Sample ID: **N010063-001A-MSD**	SampType: **MSD**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88587**
Client ID: **ZZZZZZ**	Batch ID: **42761**	TestNo: **EPA 7471A**	**EPA 7471**	Analysis Date: **4/24/2013**	SeqNo: **1563198**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.431	0.10	0.4153	0	104	75	125	0.4199	2.61	20	

Qualifiers:

- B Analyte detected in the associated Method Blank
- ND Not Detected at the Reporting Limit
- DO Surrogate Diluted Out
- E Value above quantitation range
- R RPD outside accepted recovery limits

Calculations are based on raw values

- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Work Order: N010064
Project: Coaldale Junction, 804-11-TZE

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015DM_SBEC

Sample ID: **LCS-42749**	SampType: **LCS**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88547**
Client ID: **LCSS**	Batch ID: **42749**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/22/2013**	SeqNo: **1561786**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	1028.404	10	1000	0	103	52	126				
Surr: p-Terphenyl	93.152		80.00		116	52	175				

Sample ID: **MB-42749**	SampType: **MBLK**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88547**
Client ID: **PBS**	Batch ID: **42749**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/22/2013**	SeqNo: **1561787**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	2.565	10									
ORO	1.854	10									
Surr: p-Terphenyl	84.337		80.00		105	52	175				

Sample ID: **N010061-001B-MS**	SampType: **MS**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88547**
Client ID: **ZZZZZZ**	Batch ID: **42749**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/23/2013**	SeqNo: **1561806**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	1313.030	10	1000	5.810	131	39	131				
Surr: p-Terphenyl	110.550		80.00		138	52	175				

Sample ID: **N010061-001B-MSD**	SampType: **MSD**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88547**
Client ID: **ZZZZZZ**	Batch ID: **42749**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/23/2013**	SeqNo: **1561807**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	1282.187	9.9	992.1	5.810	129	39	131	1313	2.38	20	
Surr: p-Terphenyl	104.343		79.37		131	52	175		0		

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CHAIN OF CUSTODY RECORD

Pg 1 of 1

Advanced Technology Laboratories, Inc.
3151-3153 W. Post Rd.
Las Vegas, NV 89118
Tel: (702) 307-2659 • Fax: (702) 307-2691

FOR LABORATORY USE ONLY:

P.O.#: _____
Logged By: MSC Date: 4/22/13 (19)

Method of Transport: Client ☑ ATL ☐ CA OverN ☐ FEDEX ☐ Other: _____

Sample Condition Upon Receipt
1. CHILLED 1.8°C Y☐ N☐ 4. SEALED Y☐ N☐
ICE IR#2
2. HEADSPACE (VOA) Y☐ N☐ 5. # OF SPLS MATCH COC Y☐ N☐
3. CONTAINER INTACT Y☐ N☐ 6. PRESERVED Y☐ N☐

Client: BEC
Attn: Brian Loffman
Address: 7660 W. Sahara Ave #150
City LV State NV Zip Code 89117
TEL: (702) 304-9830
FAX: ( )

Project Name: Coaldale Junction Project #: 804.11.T2E
Sampler: I attest to the validity and authenticity of this sample, I am aware that tampering with or intentionally mislabeling the sample location, date or time of collection is considered fraud and may be grounds for legal action. (Printed Name) Brian Loffman (Signature)

Relinquished by: (Signature and Printed Name) Brian Loffman	Date: 4/19/13	Time: 1503	Received by: (Signature and Printed Name)	Date: 4/19/13	Time: 1503
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter:
Brian Loffman 4/19/13
Print Name Date
Signature

Send Report To:
Attn: Brian Loffman
Co: BEC
Address 7660 W. Sahara
City LV State NV Zip 89117

Bill To:
Attn: _____
Co: Same
Address _____
City _____ State _____ Zip _____

Special Instructions/Comments:
email reports to:
brian@becnv.com

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	8260B (VOC)	8260B (BTEX), (MTBE)	8015B (GRO)	8015B (DRO), (Motor Oil/ORO)	RCRA8 (6010B/7000)	SOIL	WATER	GROUND WATER	WASTEWATER	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
1	N010004-1	BP2-S / Burn Pit	4/17	856			X	X		X				E	2	JG	C	
2	-2	BP2-N / Burn Pit	4/17	851			X	X		X				E	2	JG	C	
3	-3	BP1-N / Burn Pit	4/17	902			X	X		X				E	2	JG	C	
4	-4	BP1-S / Burn Pit	4/17	909			X	X		X				G	2	JG	C	
5	-5	BGS / SWC	4/17	911			X	X		X				E	1	JG	C	

Circle or Add Analysis(es) Requested
SPECIFY APPROPRIATE MATRIX
Container(s)

QA/QC
RTNE ☐
CT ☐
SWRCB ☐ Logcode ____
OTHER ____

- TAT starts 8 a.m. following day if samples received after 3 p.m.

TAT: ☐ A= Overnight ≤ 24 hr ☐ B= Emergency Next workday ☐ C= Critical 2 Workdays ☐ D= Urgent 3 Workdays ☐ E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives:
H=HCl N=HNO_3 S=H_2SO_4 C=4°C
Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: **White** with report, **Yellow** to folder, **Pink** to submitter.

Advanced Technology Laboratories, Inc.

Please review the checklist below. Any NO signifies non-compliance. Any non-compliance will be noted and must be understood as having an impact on the quality of the data. All tests will be performed as requested regardless of any compliance issues.

If you have any questions or further instruction, please contact our Project Coordinator at (702) 307-2659.

Cooler Received/Opened On:	4/19/2013	Workorder:	N010064
Rep sample Temp (Deg C):	1.8	IR Gun ID:	2
Temp Blank:	☐ Yes ☑ No		
Carrier name:	Client		
Last 4 digits of Tracking No.:	NA	Packing Material Used:	None
Cooling process:	☑ Ice ☐ Ice Pack ☐ Dry Ice ☐ Other ☐ None		

Sample Receipt Checklist

1. Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
2. Custody seals intact, signed, dated on shippping container/cooler?	Yes ☐	No ☐	Not Present ☑
3. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
4. Chain of custody present?	Yes ☑	No ☐	
5. Sampler's name present in COC?	Yes ☑	No ☐	
6. Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
7. Chain of custody agrees with sample labels?	Yes ☑	No ☐	
8. Samples in proper container/bottle?	Yes ☑	No ☐	
9. Sample containers intact?	Yes ☑	No ☐	
10. Sufficient sample volume for indicated test?	Yes ☑	No ☐	
11. All samples received within holding time?	Yes ☑	No ☐	
12. Temperature of rep sample or Temp Blank within acceptable limit?	Yes ☑	No ☐	NA ☐
13. Water - VOA vials have zero headspace?	Yes ☐	No ☐	NA ☑
14. Water - pH acceptable upon receipt? Example: pH > 12 for (CN,S); pH<2 for Metals	Yes ☐	No ☐	NA ☑
15. Did the bottle labels indicate correct preservatives used?	Yes ☐	No ☐	NA ☑
16. Were there Non-Conformance issues at login?	Yes ☐	No ☐	NA ☑
Was Client notified?	Yes ☐	No ☐	NA ☑

Comments:

Checklist Completed B MBC mbc 4/22/13

Reviewed By: pjd

April 26, 2013

Brian Loffman
BEC Environmental, Inc.
7660 W. Sahara Ave., Ste. 150
Las Vegas, NV 89117

TEL: (702) 304-9830
FAX: (702) 304-9839

CA-ELAP No.: 2676
NV Cert. No.: NV-009222007A

Workorder No.: N010063

RE: Coaldale Junction, 804-11-TZE

Attention: Brian Loffman

Enclosed are the results for sample(s) received on April 19, 2013 by Advanced Technology Laboratories, Inc. . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

I hereby certify that all laboratory analysis requested were performed by Nevada Division of Environmental Protection-certified laboratory for the parameters and matrices reported herein.

Thank you for the opportunity to service the needs of your company.Please feel free to call me at (702) 307-2659 if I can be of further assistance to your company.

Sincerely,

Jose Tenorio Jr.
Laboratory Director

CLIENT: BEC Environmental, Inc.
Project: Coaldale Junction, 804-11-TZE
Lab Order: N010063

CASE NARRATIVE

SAMPLE RECEIVING/GENERAL COMMENTS:

Samples were received intact with proper chain of custody documentation.

Cooler temperature and sample preservation were verified upon receipt of samples if applicable.

Information on sample receipt conditions including discrepancies can be found in attached Sample Receipt Checklist Form.

Samples were analyzed within method holding time.

Analytical Comments for EPA 6010B:

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) are outside recovery criteria for Arsenic, Selenium and Lead possibly due to matrix interference. The associated Laboratory Control Sample (LCS) recovery was acceptable.

Analytical Comments for EPA 6010B:

RPD for Matrix Spike (MS)/Matrix Spike Duplicate (MSD) is outside criteria; however, the analytical batch was validated by the Laboratory Control Sample (LCS).

CLIENT: BEC Environmental, Inc.
Lab Order: N010063
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010063-001

Client Sample ID: SB1-5
Collection Date: 4/15/2013 7:44:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC3_130424B**	QC Batch: **42791**			PrepDate:	**4/24/2013**		Analyst: **MDM**
DRO	ND	2.2	9.9		mg/Kg	1	4/24/2013 06:50 PM
ORO	ND	1.0	9.9		mg/Kg	1	4/24/2013 06:50 PM
Surr: p-Terphenyl	132	0	52-175		%REC	1	4/24/2013 06:50 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424B**	QC Batch: **42761**			PrepDate:	**4/22/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42753**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	10	0.15	1.0		mg/Kg	1	4/25/2013 02:14 AM
Barium	65	0.16	1.0		mg/Kg	1	4/25/2013 02:14 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 02:14 AM
Chromium	5.7	0.16	1.0		mg/Kg	1	4/25/2013 02:14 AM
Lead	5.7	0.14	1.0		mg/Kg	1	4/25/2013 02:14 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 02:14 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 02:14 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010063
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010063-002

Client Sample ID: SB1-15
Collection Date: 4/15/2013 8:02:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC3_130424B**	QC Batch: **42791**			PrepDate:	**4/24/2013**		Analyst: **MDM**
DRO	ND	2.2	10		mg/Kg	1	4/24/2013 07:17 PM
ORO	ND	1.1	10		mg/Kg	1	4/24/2013 07:17 PM
Surr: p-Terphenyl	115	0	52-175		%REC	1	4/24/2013 07:17 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424B**	QC Batch: **42761**			PrepDate:	**4/22/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.099		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42753**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	33	0.15	1.0		mg/Kg	1	4/25/2013 02:41 AM
Barium	120	0.16	1.0		mg/Kg	1	4/25/2013 02:41 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 02:41 AM
Chromium	9.9	0.16	1.0		mg/Kg	1	4/25/2013 02:41 AM
Lead	4.3	0.14	1.0		mg/Kg	1	4/25/2013 02:41 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 02:41 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 02:41 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010063
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010063-003

Client Sample ID: SB1-25
Collection Date: 4/15/2013 8:17:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC3_130424B**	QC Batch: **42791**			PrepDate:	**4/24/2013**		Analyst: **MDM**
DRO	ND	2.2	10		mg/Kg	1	4/24/2013 07:43 PM
ORO	ND	1.1	10		mg/Kg	1	4/24/2013 07:43 PM
Surr: p-Terphenyl	125	0	52-175		%REC	1	4/24/2013 07:43 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424B**	QC Batch: **42761**			PrepDate:	**4/22/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.099		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42753**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	14	0.15	1.0		mg/Kg	1	4/25/2013 02:47 AM
Barium	230	0.16	1.0		mg/Kg	1	4/25/2013 02:47 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 02:47 AM
Chromium	11	0.17	1.0		mg/Kg	1	4/25/2013 02:47 AM
Lead	3.6	0.14	1.0		mg/Kg	1	4/25/2013 02:47 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 02:47 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 02:47 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010063
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010063-004

Client Sample ID: SB1-35
Collection Date: 4/15/2013 8:40:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
EPA 3550B / **EPA 8015B**							
RunID: **GC3_130424B** QC Batch: **42791** PrepDate: **4/24/2013** Analyst: **MDM**							
DRO	ND	2.2	10		mg/Kg	1	4/24/2013 08:10 PM
ORO	ND	1.1	10		mg/Kg	1	4/24/2013 08:10 PM
Surr: p-Terphenyl	131	0	52-175		%REC	1	4/24/2013 08:10 PM
MERCURY BY COLD VAPOR TECHNIQUE							
EPA 7471 / **EPA 7471A**							
RunID: **AA1_130424B** QC Batch: **42761** PrepDate: **4/22/2013** Analyst: **LCC**							
Mercury	ND	0.029	0.099		mg/Kg	1	4/24/2013
ICP METALS							
EPA 3050B / **EPA 6010B**							
RunID: **ICP2_130424D** QC Batch: **42753** PrepDate: **4/22/2013** Analyst: **CEI**							
Arsenic	11	0.15	1.0		mg/Kg	1	4/25/2013 02:52 AM
Barium	16	0.16	1.0		mg/Kg	1	4/25/2013 02:52 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 02:52 AM
Chromium	12	0.16	1.0		mg/Kg	1	4/25/2013 02:52 AM
Lead	3.8	0.14	1.0		mg/Kg	1	4/25/2013 02:52 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 02:52 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 02:52 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010063
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010063-005

Client Sample ID: SB1-40
Collection Date: 4/15/2013 8:50:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B				**EPA 8015B**		
RunID: **GC3_130424B**	QC Batch: **42791**				PrepDate: **4/24/2013**		Analyst: **MDM**
DRO	ND	2.2	10		mg/Kg	1	4/24/2013 08:36 PM
ORO	ND	1.1	10		mg/Kg	1	4/24/2013 08:36 PM
Surr: p-Terphenyl	165	0	52-175		%REC	1	4/24/2013 08:36 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471				**EPA 7471A**		
RunID: **AA1_130424B**	QC Batch: **42761**				PrepDate: **4/22/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B				**EPA 6010B**		
RunID: **ICP2_130424D**	QC Batch: **42753**				PrepDate: **4/22/2013**		Analyst: **CEI**
Arsenic	30	0.15	1.0		mg/Kg	1	4/25/2013 03:08 AM
Barium	880	0.16	1.0		mg/Kg	1	4/25/2013 03:08 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 03:08 AM
Chromium	9.3	0.17	1.0		mg/Kg	1	4/25/2013 03:08 AM
Lead	5.3	0.14	1.0		mg/Kg	1	4/25/2013 03:08 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 03:08 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 03:08 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010063
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010063-006

Client Sample ID: SB1-45
Collection Date: 4/15/2013 9:12:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
EPA 3550B / **EPA 8015B**							
RunID: **GC3_130424B** QC Batch: **42791** PrepDate: **4/24/2013** Analyst: **MDM**							
DRO	ND	2.2	10		mg/Kg	1	4/24/2013 09:02 PM
ORO	ND	1.1	10		mg/Kg	1	4/24/2013 09:02 PM
Surr: p-Terphenyl	137	0	52-175		%REC	1	4/24/2013 09:02 PM
MERCURY BY COLD VAPOR TECHNIQUE							
EPA 7471 / **EPA 7471A**							
RunID: **AA1_130424B** QC Batch: **42761** PrepDate: **4/22/2013** Analyst: **LCC**							
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
EPA 3050B / **EPA 6010B**							
RunID: **ICP2_130424D** QC Batch: **42753** PrepDate: **4/22/2013** Analyst: **CEI**							
Arsenic	54	0.15	1.0		mg/Kg	1	4/25/2013 03:13 AM
Barium	73	0.16	1.0		mg/Kg	1	4/25/2013 03:13 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 03:13 AM
Chromium	3.4	0.16	1.0		mg/Kg	1	4/25/2013 03:13 AM
Lead	8.9	0.14	1.0		mg/Kg	1	4/25/2013 03:13 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 03:13 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 03:13 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010063
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010063-007

Client Sample ID: SB1-50
Collection Date: 4/15/2013 9:27:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
EPA 3550B / **EPA 8015B**							
RunID: **GC3_130424B** QC Batch: **42791** PrepDate: **4/24/2013** Analyst: **MDM**							
DRO	32	2.2	10		mg/Kg	1	4/24/2013 09:29 PM
ORO	41	1.1	10		mg/Kg	1	4/24/2013 09:29 PM
Surr: p-Terphenyl	113	0	52-175		%REC	1	4/24/2013 09:29 PM
MERCURY BY COLD VAPOR TECHNIQUE							
EPA 7471 / **EPA 7471A**							
RunID: **AA1_130424B** QC Batch: **42761** PrepDate: **4/22/2013** Analyst: **LCC**							
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
EPA 3050B / **EPA 6010B**							
RunID: **ICP2_130424D** QC Batch: **42753** PrepDate: **4/22/2013** Analyst: **CEI**							
Arsenic	20	0.15	1.0		mg/Kg	1	4/25/2013 03:19 AM
Barium	74	0.16	1.0		mg/Kg	1	4/25/2013 03:19 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 03:19 AM
Chromium	5.2	0.17	1.0		mg/Kg	1	4/25/2013 03:19 AM
Lead	20	0.14	1.0		mg/Kg	1	4/25/2013 03:19 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 03:19 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 03:19 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010063
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010063-008

Client Sample ID: SB1-55
Collection Date: 4/15/2013 9:42:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC3_130424B**	QC Batch: **42791**			PrepDate:	**4/24/2013**		Analyst: **MDM**
DRO	11	2.2	9.9		mg/Kg	1	4/24/2013 09:55 PM
ORO	11	1.0	9.9		mg/Kg	1	4/24/2013 09:55 PM
Surr: p-Terphenyl	124	0	52-175		%REC	1	4/24/2013 09:55 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424B**	QC Batch: **42761**			PrepDate:	**4/22/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42753**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	2.3	0.15	1.0		mg/Kg	1	4/25/2013 03:25 AM
Barium	58	0.16	1.0		mg/Kg	1	4/25/2013 03:25 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 03:25 AM
Chromium	2.5	0.17	1.0		mg/Kg	1	4/25/2013 03:25 AM
Lead	8.1	0.14	1.0		mg/Kg	1	4/25/2013 03:25 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 03:25 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 03:25 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

CLIENT: BEC Environmental, Inc.
Lab Order: N010063
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010063-009

Client Sample ID: SB1-60
Collection Date: 4/15/2013 9:55:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B				**EPA 8015B**		
RunID: **GC3_130424B**	QC Batch: **42791**				PrepDate: **4/24/2013**		Analyst: **MDM**
DRO	ND	2.2	10		mg/Kg	1	4/24/2013 10:22 PM
ORO	10	1.0	10		mg/Kg	1	4/24/2013 10:22 PM
Surr: p-Terphenyl	135	0	52-175		%REC	1	4/24/2013 10:22 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471				**EPA 7471A**		
RunID: **AA1_130424B**	QC Batch: **42761**				PrepDate: **4/22/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B				**EPA 6010B**		
RunID: **ICP2_130424D**	QC Batch: **42753**				PrepDate: **4/22/2013**		Analyst: **CEI**
Arsenic	2.8	0.15	1.0		mg/Kg	1	4/25/2013 03:31 AM
Barium	48	0.16	1.0		mg/Kg	1	4/25/2013 03:31 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 03:31 AM
Chromium	4.6	0.16	1.0		mg/Kg	1	4/25/2013 03:31 AM
Lead	7.5	0.14	1.0		mg/Kg	1	4/25/2013 03:31 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 03:31 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 03:31 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010063
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010063-010

Client Sample ID: SB1-65
Collection Date: 4/15/2013 10:10:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
EPA 3550B / **EPA 8015B**							
RunID: **GC3_130424B** QC Batch: **42791** PrepDate: **4/24/2013** Analyst: **MDM**							
DRO	ND	2.2	10		mg/Kg	1	4/24/2013 10:48 PM
ORO	ND	1.1	10		mg/Kg	1	4/24/2013 10:48 PM
Surr: p-Terphenyl	129	0	52-175		%REC	1	4/24/2013 10:48 PM
MERCURY BY COLD VAPOR TECHNIQUE							
EPA 7471 / **EPA 7471A**							
RunID: **AA1_130424B** QC Batch: **42761** PrepDate: **4/22/2013** Analyst: **LCC**							
Mercury	ND	0.029	0.099		mg/Kg	1	4/24/2013
ICP METALS							
EPA 3050B / **EPA 6010B**							
RunID: **ICP2_130424D** QC Batch: **42753** PrepDate: **4/22/2013** Analyst: **CEI**							
Arsenic	5.9	0.15	1.0		mg/Kg	1	4/25/2013 03:35 AM
Barium	57	0.16	1.0		mg/Kg	1	4/25/2013 03:35 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 03:35 AM
Chromium	1.8	0.17	1.0		mg/Kg	1	4/25/2013 03:35 AM
Lead	12	0.14	1.0		mg/Kg	1	4/25/2013 03:35 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 03:35 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 03:35 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Work Order: N010063
Project: Coaldale Junction, 804-11-TZE

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **MB-42753** SampType: **MBLK** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **4/22/2013** RunNo: **88583**
Client ID: **PBS** Batch ID: **42753** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **4/25/2013** SeqNo: **1562970**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	ND	1.0									
Barium	ND	1.0									
Cadmium	ND	1.0									
Chromium	ND	1.0									
Lead	ND	1.0									
Selenium	ND	1.0									
Silver	ND	1.0									

Sample ID: **LCS-42753** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **4/22/2013** RunNo: **88583**
Client ID: **LCSS** Batch ID: **42753** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **4/25/2013** SeqNo: **1562971**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	49.848	1.0	50.20	0	99.3	80	120				
Barium	49.984	1.0	50.20	0	99.6	80	120				
Cadmium	49.893	1.0	50.20	0	99.4	80	120				
Chromium	49.956	1.0	50.20	0	99.5	80	120				
Lead	49.775	1.0	50.20	0	99.2	80	120				
Selenium	50.052	1.0	50.20	0	99.7	80	120				
Silver	50.251	1.0	50.20	0	100	80	120				

Sample ID: **N010063-001A-MS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **4/22/2013** RunNo: **88583**
Client ID: **ZZZZZZ** Batch ID: **42753** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **4/25/2013** SeqNo: **1562975**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	49.001	1.0	49.88	10.49	77.2	75	125				
Barium	119.790	1.0	49.88	65.37	109	75	125				
Cadmium	38.194	1.0	49.88	0	76.6	75	125				
Chromium	48.241	1.0	49.88	5.659	85.4	75	125				

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

CLIENT: BEC Environmental, Inc.
Work Order: N010063
Project: Coaldale Junction, 804-11-TZE

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **N010063-001A-MS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **4/22/2013** RunNo: **88583**
Client ID: **ZZZZZZ** Batch ID: **42753** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **4/25/2013** SeqNo: **1562975**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	41.466	1.0	49.88	5.700	71.7	75	125				S
Selenium	37.100	1.0	49.88	0	74.4	75	125				S
Silver	39.759	1.0	49.88	0	79.7	75	125				

Sample ID: **N010063-001A-MSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **4/22/2013** RunNo: **88583**
Client ID: **ZZZZZZ** Batch ID: **42753** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **4/25/2013** SeqNo: **1562976**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	47.930	1.0	49.95	10.49	75.0	75	125	49.00	2.21	20	S
Barium	119.181	1.0	49.95	65.37	108	75	125	119.8	0.510	20	
Cadmium	38.210	1.0	49.95	0	76.5	75	125	38.19	0.0427	20	
Chromium	48.733	1.0	49.95	5.659	86.2	75	125	48.24	1.01	20	
Lead	41.806	1.0	49.95	5.700	72.3	75	125	41.47	0.816	20	S
Selenium	36.703	1.0	49.95	0	73.5	75	125	37.10	1.08	20	S
Silver	39.805	1.0	49.95	0	79.7	75	125	39.76	0.118	20	

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Work Order: N010063
Project: Coaldale Junction, 804-11-TZE

ANALYTICAL QC SUMMARY REPORT

TestCode: 7471_S

Sample ID: **LCS-42761**	SampType: **LCS**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88587**
Client ID: **LCSS**	Batch ID: **42761**	TestNo: **EPA 7471A**	**EPA 7471**	Analysis Date: **4/24/2013**	SeqNo: **1563192**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.409	0.10	0.4167	0	98.2	80	120				

Sample ID: **MB-42761**	SampType: **MBLK**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88587**
Client ID: **PBS**	Batch ID: **42761**	TestNo: **EPA 7471A**	**EPA 7471**	Analysis Date: **4/24/2013**	SeqNo: **1563193**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.10									

Sample ID: **N010063-001A-MS**	SampType: **MS**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88587**
Client ID: **ZZZZZZ**	Batch ID: **42761**	TestNo: **EPA 7471A**	**EPA 7471**	Analysis Date: **4/24/2013**	SeqNo: **1563197**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.420	0.10	0.4160	0	101	75	125				

Sample ID: **N010063-001A-MSD**	SampType: **MSD**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88587**
Client ID: **ZZZZZZ**	Batch ID: **42761**	TestNo: **EPA 7471A**	**EPA 7471**	Analysis Date: **4/24/2013**	SeqNo: **1563198**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.431	0.10	0.4153	0	104	75	125	0.4199	2.61	20	

Qualifiers:

- B Analyte detected in the associated Method Blank
- ND Not Detected at the Reporting Limit
- DO Surrogate Diluted Out
- E Value above quantitation range
- R RPD outside accepted recovery limits

Calculations are based on raw values

- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Work Order: N010063
Project: Coaldale Junction, 804-11-TZE

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015DM_SBEC

Sample ID: **LCS-42791**	SampType: **LCS**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/24/2013**	RunNo: **88574**
Client ID: **LCSS**	Batch ID: **42791**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/24/2013**	SeqNo: **1562699**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	1031.416	10	1000	0	103	52	126				
Surr: p-Terphenyl	86.461		80.00		108	52	175				

Sample ID: **MB-42791**	SampType: **MBLK**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/24/2013**	RunNo: **88574**
Client ID: **PBS**	Batch ID: **42791**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/24/2013**	SeqNo: **1562700**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	6.042	10									
ORO	4.705	10									
Surr: p-Terphenyl	83.717		80.00		105	52	175				

Sample ID: **N010109-001B-MS**	SampType: **MS**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/24/2013**	RunNo: **88574**
Client ID: **ZZZZZZ**	Batch ID: **42791**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/24/2013**	SeqNo: **1562712**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	773.687	10	1003	6.904	76.4	39	131				
Surr: p-Terphenyl	107.787		80.24		134	52	175				

Sample ID: **N010109-001B-MSD**	SampType: **MSD**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/24/2013**	RunNo: **88574**
Client ID: **ZZZZZZ**	Batch ID: **42791**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/24/2013**	SeqNo: **1562713**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	1268.864	10	1000	6.904	126	39	131	773.7	48.5	20	R
Surr: p-Terphenyl	101.451		80.00		127	52	175		0		

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CHAIN OF CUSTODY RECORD

Pg 1 of 1

Advanced Technology Laboratories, Inc.
3151-3153 W. Post Rd.
Las Vegas, NV 89118
Tel: (702) 307-2659 • Fax: (702) 307-2691

FOR LABORATORY USE ONLY:

P.O.#: _____
Logged By: MSC Date: 4/19/13

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FEDEX ☐ Other: _____

Sample Condition Upon Receipt: 1.8°C
1. CHILLED ICE IN ☑ Y☐ N☐ 4. SEALED Y☐ N☐
2. HEADSPACE (VOA) Y☑ N☐ 5. # OF SPLS MATCH COC Y☐ N☐
3. CONTAINER INTACT Y☐ N☐ 6. PRESERVED Y☑ N☐

Client: BEC
Attn: Brian Loffman
Address: 7660 W. Sahara Ave #150
City LV State NV Zip Code 89117
TEL: (702) 304-9830
FAX: ( )

Project Name: Coaldale Junction Project #: 804.11.TZE
Sampler: I attest to the validity and authenticity of this sample, I am aware that tampering with or intentionally mislabeling the sample location, date or time of collection is considered fraud and may be grounds for legal action. (Printed Name) Brian Loffman (Signature) [signature]

Relinquished by: (Signature and Printed Name) Brian Loffman	Date: 4/19/13	Time: 1503	Received by: (Signature and Printed Name) MSC [signature]	Date: 4/19/13	Time: 1503
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter:
Brian Loffman _____
Print Name Date
[signature]
Signature

Send Report To:
Attn: Brian Loffman
Co: BEC
Address 7660 W. Sahara
City LV State NV Zip 89117

Bill To:
Attn: _____
Co: Same
Address _____
City _____ State _____ Zip _____

Special Instructions/Comments:
email reports to:
brian@becnv.com

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

Circle or Add Analysis(es) Requested

SPECIFY APPROPRIATE MATRIX

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	8260B (VOC)	8260B (BTEX), (MTBE)	8015B (GRO)	8015B (DRO), (Motor Oil/ORO)	RCRA8 (6010B/7000)	SOIL	WATER	GROUND WATER	WASTEWATER	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
1	NO10063-1	SB1-5	4/15	744			X	X		X				E	1	J G	C	
2	-2	SB1-15	4/15	802			X	X		X				E	1	J G	C	
3	-3	SB1-25	4/15	817			X	X		X				E	1	J G	C	
4	-4	SB1-35	4/15	840			X	X		X				E	1	J G	C	
5	-5	SB1-40	4/15	850			X	X		X				E	1	J G	C	
6	-6	SB1-45	4/15	912			X	X		X				E	1	J G	C	
7	-7	SB1-50	4/15	927			X	X		X				E	1	J G	C	
8	-8	SB1-55	4/15	942			X	X		X				E	1	J G	C	
9	-9	SB1-60	4/15	955			X	X		X				E	1	J G	C	
10	-10	SB1-65	4/15	1010			X	X		X				E	1	J G	C	

Coaldale Junction

QA/QC: RTNE ☐ CT ☐ SWRCB ☐ Logcode ____ OTHER ____

- TAT starts 8 a.m. following day if samples received after 3 p.m.

TAT: ☐ A= Overnight ≤ 24 hr ☐ B= Emergency Next workday ☐ C= Critical 2 Workdays ☐ D= Urgent 3 Workdays ☑ E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=Hcl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: **White** with report, **Yellow** to folder, **Pink** to submitter.

Advanced Technology Laboratories, Inc.

Please review the checklist below. Any NO signifies non-compliance. Any non-compliance will be noted and must be understood as having an impact on the quality of the data. All tests will be performed as requested regardless of any compliance issues.

If you have any questions or further instruction, please contact our Project Coordinator at (702) 307-2659.

Cooler Received/Opened On:	4/19/2013	Workorder:	N010063
Rep sample Temp (Deg C):	1.8	IR Gun ID:	1
Temp Blank:	☐ Yes ☑ No		
Carrier name:	Client		
Last 4 digits of Tracking No.:	NA	Packing Material Used:	None
Cooling process:	☑ Ice ☐ Ice Pack ☐ Dry Ice ☐ Other ☐ None		

Sample Receipt Checklist

1. Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
2. Custody seals intact, signed, dated on shippping container/cooler?	Yes ☐	No ☐	Not Present ☑
3. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
4. Chain of custody present?	Yes ☑	No ☐	
5. Sampler's name present in COC?	Yes ☑	No ☐	
6. Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
7. Chain of custody agrees with sample labels?	Yes ☑	No ☐	
8. Samples in proper container/bottle?	Yes ☑	No ☐	
9. Sample containers intact?	Yes ☑	No ☐	
10. Sufficient sample volume for indicated test?	Yes ☑	No ☐	
11. All samples received within holding time?	Yes ☑	No ☐	
12. Temperature of rep sample or Temp Blank within acceptable limit?	Yes ☑	No ☐	NA ☐
13. Water - VOA vials have zero headspace?	Yes ☐	No ☐	NA ☑
14. Water - pH acceptable upon receipt? Example: pH > 12 for (CN,S); pH<2 for Metals	Yes ☐	No ☐	NA ☑
15. Did the bottle labels indicate correct preservatives used?	Yes ☐	No ☐	NA ☑
16. Were there Non-Conformance issues at login?	Yes ☐	No ☐	NA ☑
Was Client notified?	Yes ☐	No ☐	NA ☑

Comments:

Checklist Completed B MBC MBC 4/22/13

Reviewed By: pjd

April 26, 2013

Brian Loffman
BEC Environmental, Inc.
7660 W. Sahara Ave., Ste. 150
Las Vegas, NV 89117

TEL: (702) 304-9830
FAX: (702) 304-9839

CA-ELAP No.: 2676
NV Cert. No.: NV-009222007A

Workorder No.: N010061

RE: Coaldale Junction, 804-11-TZE

Attention: Brian Loffman

Enclosed are the results for sample(s) received on April 19, 2013 by Advanced Technology Laboratories, Inc. . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

I hereby certify that all laboratory analysis requested were performed by Nevada Division of Environmental Protection-certified laboratory for the parameters and matrices reported herein.

Thank you for the opportunity to service the needs of your company.Please feel free to call me at (702) 307-2659 if I can be of further assistance to your company.

Sincerely,

Jose Tenorio Jr.
Laboratory Director

CLIENT: BEC Environmental, Inc.
Project: Coaldale Junction, 804-11-TZE
Lab Order: N010061

CASE NARRATIVE

SAMPLE RECEIVING/GENERAL COMMENTS:

Samples were received intact with proper chain of custody documentation.

Cooler temperature and sample preservation were verified upon receipt of samples if applicable.

Information on sample receipt conditions including discrepancies can be found in attached Sample Receipt Checklist Form.

Samples were analyzed within method holding time.

Analytical Comments for EPA 6010B:

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) are outside recovery criteria for Arsenic and Lead possibly due to matrix interference. The associated Laboratory Control Sample (LCS) recovery was acceptable.

CLIENT: BEC Environmental, Inc.
Lab Order: N010061
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010061-001

Client Sample ID: SB2-10
Collection Date: 4/15/2013 12:44:00 PM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B				**EPA 8015B**		
RunID: **GC1_130422B**	QC Batch: **42749**				PrepDate: **4/22/2013**		Analyst: **MDM**
DRO	ND	2.2	10		mg/Kg	1	4/22/2013 04:17 PM
ORO	ND	1.1	10		mg/Kg	1	4/22/2013 04:17 PM
Surr: p-Terphenyl	131	0	52-175		%REC	1	4/22/2013 04:17 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471				**EPA 7471A**		
RunID: **AA1_130424A**	QC Batch: **42760**				PrepDate: **4/23/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B				**EPA 6010B**		
RunID: **ICP2_130424D**	QC Batch: **42752**				PrepDate: **4/22/2013**		Analyst: **CEI**
Arsenic	18	0.15	1.0		mg/Kg	1	4/24/2013 11:47 PM
Barium	79	0.16	1.0		mg/Kg	1	4/24/2013 11:47 PM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/24/2013 11:47 PM
Chromium	8.3	0.17	1.0		mg/Kg	1	4/24/2013 11:47 PM
Lead	5.6	0.14	1.0		mg/Kg	1	4/24/2013 11:47 PM
Selenium	ND	0.28	1.0		mg/Kg	1	4/24/2013 11:47 PM
Silver	ND	0.15	1.0		mg/Kg	1	4/24/2013 11:47 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010061
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010061-002

Client Sample ID: SB2-15
Collection Date: 4/15/2013 12:52:00 PM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC1_130422B**	QC Batch: **42749**			PrepDate:	**4/22/2013**		Analyst: **MDM**
DRO	ND	2.2	10		mg/Kg	1	4/22/2013 04:43 PM
ORO	ND	1.1	10		mg/Kg	1	4/22/2013 04:43 PM
Surr: p-Terphenyl	129	0	52-175		%REC	1	4/22/2013 04:43 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424A**	QC Batch: **42760**			PrepDate:	**4/23/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42752**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	13	0.15	1.0		mg/Kg	1	4/25/2013 12:14 AM
Barium	200	0.16	1.0		mg/Kg	1	4/25/2013 12:14 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 12:14 AM
Chromium	7.0	0.17	1.0		mg/Kg	1	4/25/2013 12:14 AM
Lead	4.3	0.14	1.0		mg/Kg	1	4/25/2013 12:14 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 12:14 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 12:14 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010061
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010061-003

Client Sample ID: SB2-20
Collection Date: 4/15/2013 1:00:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC1_130422B**	QC Batch: **42749**			PrepDate:	**4/22/2013**		Analyst: **MDM**
DRO	71	2.2	10		mg/Kg	1	4/22/2013 05:08 PM
ORO	77	1.1	10		mg/Kg	1	4/22/2013 05:08 PM
Surr: p-Terphenyl	125	0	52-175		%REC	1	4/22/2013 05:08 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424A**	QC Batch: **42760**			PrepDate:	**4/23/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42752**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	7.1	0.15	1.0		mg/Kg	1	4/25/2013 12:20 AM
Barium	540	0.16	1.0		mg/Kg	1	4/25/2013 12:20 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 12:20 AM
Chromium	3.4	0.16	1.0		mg/Kg	1	4/25/2013 12:20 AM
Lead	44	0.14	1.0		mg/Kg	1	4/25/2013 12:20 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 12:20 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 12:20 AM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

CLIENT: BEC Environmental, Inc.
Lab Order: N010061
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010061-004

Client Sample ID: SB7-15
Collection Date: 4/16/2013 3:11:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC1_130422B**	QC Batch: **42749**			PrepDate:	**4/22/2013**		Analyst: **MDM**
DRO	ND	2.2	10		mg/Kg	1	4/22/2013 05:34 PM
ORO	ND	1.0	10		mg/Kg	1	4/22/2013 05:34 PM
Surr: p-Terphenyl	111	0	52-175		%REC	1	4/22/2013 05:34 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424A**	QC Batch: **42760**			PrepDate:	**4/23/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42752**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	11	0.15	1.0		mg/Kg	1	4/25/2013 12:26 AM
Barium	210	0.16	1.0		mg/Kg	1	4/25/2013 12:26 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 12:26 AM
Chromium	7.2	0.17	1.0		mg/Kg	1	4/25/2013 12:26 AM
Lead	9.7	0.14	1.0		mg/Kg	1	4/25/2013 12:26 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 12:26 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 12:26 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010061
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010061-005

Client Sample ID: SB7-20
Collection Date: 4/16/2013 3:22:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC1_130422B**	QC Batch: **42749**			PrepDate:	**4/22/2013**		Analyst: **MDM**
DRO	ND	2.2	9.9		mg/Kg	1	4/22/2013 06:00 PM
ORO	ND	1.0	9.9		mg/Kg	1	4/22/2013 06:00 PM
Surr: p-Terphenyl	107	0	52-175		%REC	1	4/22/2013 06:00 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424A**	QC Batch: **42760**			PrepDate:	**4/23/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42752**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	6.5	0.15	1.0		mg/Kg	1	4/25/2013 12:42 AM
Barium	410	0.16	1.0		mg/Kg	1	4/25/2013 12:42 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 12:42 AM
Chromium	7.4	0.17	1.0		mg/Kg	1	4/25/2013 12:42 AM
Lead	7.3	0.14	1.0		mg/Kg	1	4/25/2013 12:42 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 12:42 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 12:42 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010061
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010061-006

Client Sample ID: SB7-25
Collection Date: 4/16/2013 3:32:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC1_130422B**	QC Batch: **42749**			PrepDate:	**4/22/2013**		Analyst: **MDM**
DRO	ND	2.2	9.9		mg/Kg	1	4/22/2013 06:25 PM
ORO	ND	1.0	9.9		mg/Kg	1	4/22/2013 06:25 PM
Surr: p-Terphenyl	113	0	52-175		%REC	1	4/22/2013 06:25 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424A**	QC Batch: **42760**			PrepDate:	**4/23/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42752**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	9.1	0.15	1.0		mg/Kg	1	4/25/2013 12:48 AM
Barium	160	0.16	1.0		mg/Kg	1	4/25/2013 12:48 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 12:48 AM
Chromium	8.2	0.16	1.0		mg/Kg	1	4/25/2013 12:48 AM
Lead	11	0.14	1.0		mg/Kg	1	4/25/2013 12:48 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 12:48 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 12:48 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Work Order: N010061
Project: Coaldale Junction, 804-11-TZE

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **MB-42752** SampType: **MBLK** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **4/22/2013** RunNo: **88583**
Client ID: **PBS** Batch ID: **42752** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **4/24/2013** SeqNo: **1562945**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	ND	1.0									
Barium	ND	1.0									
Cadmium	ND	1.0									
Chromium	ND	1.0									
Lead	ND	1.0									
Selenium	ND	1.0									
Silver	ND	1.0									

Sample ID: **LCS-42752** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **4/22/2013** RunNo: **88583**
Client ID: **LCSS** Batch ID: **42752** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **4/24/2013** SeqNo: **1562946**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	50.212	1.0	50.10	0	100	80	120				
Barium	50.145	1.0	50.10	0	100	80	120				
Cadmium	50.585	1.0	50.10	0	101	80	120				
Chromium	50.135	1.0	50.10	0	100	80	120				
Lead	50.122	1.0	50.10	0	100	80	120				
Selenium	50.581	1.0	50.10	0	101	80	120				
Silver	50.402	1.0	50.10	0	101	80	120				

Sample ID: **N010061-001A-MS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **4/22/2013** RunNo: **88583**
Client ID: **ZZZZZZ** Batch ID: **42752** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **4/25/2013** SeqNo: **1562949**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	54.453	1.0	50.03	17.71	73.5	75	125				S
Barium	123.004	1.0	50.03	78.83	88.3	75	125				
Cadmium	39.309	1.0	50.03	0	78.6	75	125				
Chromium	46.675	1.0	50.03	8.311	76.7	75	125				

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Work Order: N010061
Project: Coaldale Junction, 804-11-TZE

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **N010061-001A-MS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **4/22/2013** RunNo: **88583**
Client ID: **ZZZZZZ** Batch ID: **42752** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **4/25/2013** SeqNo: **1562949**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	42.598	1.0	50.03	5.581	74.0	75	125				S
Selenium	38.228	1.0	50.03	0	76.4	75	125				
Silver	40.749	1.0	50.03	0	81.5	75	125				

Sample ID: **N010061-001A-MSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **4/22/2013** RunNo: **88583**
Client ID: **ZZZZZZ** Batch ID: **42752** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **4/25/2013** SeqNo: **1562950**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	52.516	1.0	50.20	17.71	69.3	75	125	54.45	3.62	20	S
Barium	118.411	1.0	50.20	78.83	78.8	75	125	123.0	3.81	20	
Cadmium	38.149	1.0	50.20	0	76.0	75	125	39.31	2.99	20	
Chromium	48.342	1.0	50.20	8.311	79.7	75	125	46.68	3.51	20	
Lead	42.622	1.0	50.20	5.581	73.8	75	125	42.60	0.0562	20	S
Selenium	38.252	1.0	50.20	0	76.2	75	125	38.23	0.0624	20	
Silver	40.562	1.0	50.20	0	80.8	75	125	40.75	0.460	20	

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Work Order: N010061
Project: Coaldale Junction, 804-11-TZE

ANALYTICAL QC SUMMARY REPORT

TestCode: 7471_S

Sample ID: **LCS-42760**	SampType: **LCS**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **4/23/2013**	RunNo: **88560**
Client ID: **LCSS**	Batch ID: **42760**	TestNo: **EPA 7471A**	**EPA 7471**	Analysis Date: **4/24/2013**	SeqNo: **1562298**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.447	0.10	0.4167	0	107	80	120				

Sample ID: **MB-42760**	SampType: **MBLK**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **4/23/2013**	RunNo: **88560**
Client ID: **PBS**	Batch ID: **42760**	TestNo: **EPA 7471A**	**EPA 7471**	Analysis Date: **4/24/2013**	SeqNo: **1562299**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.10									

Sample ID: **N010061-001A-MS**	SampType: **MS**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **4/23/2013**	RunNo: **88560**
Client ID: **ZZZZZZ**	Batch ID: **42760**	TestNo: **EPA 7471A**	**EPA 7471**	Analysis Date: **4/24/2013**	SeqNo: **1562303**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.471	0.10	0.4167	0	113	75	125				

Sample ID: **N010061-001A-MSD**	SampType: **MSD**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **4/23/2013**	RunNo: **88560**
Client ID: **ZZZZZZ**	Batch ID: **42760**	TestNo: **EPA 7471A**	**EPA 7471**	Analysis Date: **4/24/2013**	SeqNo: **1562304**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.475	0.10	0.4167	0	114	75	125	0.4710	0.891	20	

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Work Order: N010061
Project: Coaldale Junction, 804-11-TZE

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015DM_SBEC

Sample ID: **LCS-42749**	SampType: **LCS**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88547**
Client ID: **LCSS**	Batch ID: **42749**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/22/2013**	SeqNo: **1561786**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	1028.404	10	1000	0	103	52	126				
Surr: p-Terphenyl	93.152		80.00		116	52	175				

Sample ID: **MB-42749**	SampType: **MBLK**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88547**
Client ID: **PBS**	Batch ID: **42749**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/22/2013**	SeqNo: **1561787**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	2.565	10									
ORO	1.854	10									
Surr: p-Terphenyl	84.337		80.00		105	52	175				

Sample ID: **N010061-001B-MS**	SampType: **MS**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88547**
Client ID: **ZZZZZZ**	Batch ID: **42749**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/23/2013**	SeqNo: **1561806**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	1313.030	10	1000	5.810	131	39	131				
Surr: p-Terphenyl	110.550		80.00		138	52	175				

Sample ID: **N010061-001B-MSD**	SampType: **MSD**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88547**
Client ID: **ZZZZZZ**	Batch ID: **42749**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/23/2013**	SeqNo: **1561807**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	1282.187	9.9	992.1	5.810	129	39	131	1313	2.38	20	
Surr: p-Terphenyl	104.343		79.37		131	52	175		0		

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CHAIN OF CUSTODY RECORD

Pg 1 of 1

Advanced Technology Laboratories, Inc.
3151-3153 W. Post Rd.
Las Vegas, NV 89118
Tel: (702) 307-2659 • Fax: (702) 307-2691

FOR LABORATORY USE ONLY:

P.O.#: _____
Logged By: NBC Date: 4/19/13

Method of Transport: Client ☑ ATL ☐ CA OverN ☐ FEDEX ☐ Other: _____

Sample Condition Upon Receipt
1. CHILLED 1.0°C ICE IR#2 Y☑ N☐ 4. SEALED Y☑ N☐
2. HEADSPACE (VOA) Y☐ N☐ 5. # OF SPLS MATCH COC Y☑ N☐
3. CONTAINER INTACT Y☑ N☐ 6. PRESERVED Y☑ N☐

Client: BEC
Attn: Brian Loffman
Address: 7660 W. Sahara Ave #150
City LV State NV Zip Code 89117
TEL: (702) 304-9830
FAX: ( )

Project Name: Coaldale Junction Project #: 804.11.TZE
Sampler: I attest to the validity and authenticity of this sample, I am aware that tampering with or intentionally mislabeling the sample location, date or time of collection is considered fraud and may be grounds for legal action. (Printed Name) Brian Loffman (Signature) Brian

Relinquished by: (Signature and Printed Name) Brian Loffman	Date: 4/19/13	Time: 1503	Received by: (Signature and Printed Name) MRCAHN	Date: 4/19/13	Time: 1503
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter:
Brian Loffman 4/19/13
Print Name Date
Signature

Send Report To:
Attn: Brian Loffman
Co: BEC
Address 7660 W. Sahara
City LV State NV Zip 89117

Bill To:
Attn: _____
Co: Same
Address _____
City _____ State _____ Zip _____

Special Instructions/Comments:
email reports to:
brian@becnv.com

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	8260B (VOC)	8260B (BTEX), (MTBE)	8015B (GRO)	8015B (DRO), (Motor Oil/ORO)	RCRA8 (6010B/7000)	SOIL	WATER	GROUND WATER	WASTEWATER	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
1	N0100061-1	SB2-10	4/15	1247			X	X						E	2	JC	C	
2	-2	SB2-15	4/15	1252			X	X						E	2	JG	C	
3	-3	SB2-20	4/15	1:00			X	X						E	1	JG	C	
4	-4	SB7-15	4/16	311			X	X						E	1	JG	C	
5	-5	SB7-20	4/16	322			X	X						E	1	JG	C	
6	-6	SB7-25	4/16	332			X	X						E	1	JC	C	

Circle or Add Analysis(es) Requested
SPECIFY APPROPRIATE MATRIX
Container(s)

QA/QC: RTNE ☐ CT ☐ SWRCB ☐ Logcode ____ OTHER ____

• TAT starts 8 a.m. following day if samples received after 3 p.m.

TAT: ☐ A= Overnight ≤ 24 hr ☐ B= Emergency Next workday ☐ C= Critical 2 Workdays ☐ D= Urgent 3 Workdays ☑ E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=Zn(AC)$_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: White with report, Yellow to folder, Pink to submitter.

Advanced Technology Laboratories, Inc.

Please review the checklist below. Any NO signifies non-compliance. Any non-compliance will be noted and must be understood as having an impact on the quality of the data. All tests will be performed as requested regardless of any compliance issues.

If you have any questions or further instruction, please contact our Project Coordinator at (702) 307-2659.

Cooler Received/Opened On:	4/19/2013	Workorder:	N010061
Rep sample Temp (Deg C):	1.8	IR Gun ID:	2
Temp Blank:	☐ Yes ☑ No		
Carrier name:	Client		
Last 4 digits of Tracking No.:	NA	Packing Material Used:	None
Cooling process:	☑ Ice ☐ Ice Pack ☐ Dry Ice ☐ Other ☐ None		

Sample Receipt Checklist

1. Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
2. Custody seals intact, signed, dated on shippping container/cooler?	Yes ☐	No ☐	Not Present ☑
3. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
4. Chain of custody present?	Yes ☑	No ☐	
5. Sampler's name present in COC?	Yes ☑	No ☐	
6. Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
7. Chain of custody agrees with sample labels?	Yes ☑	No ☐	
8. Samples in proper container/bottle?	Yes ☑	No ☐	
9. Sample containers intact?	Yes ☑	No ☐	
10. Sufficient sample volume for indicated test?	Yes ☑	No ☐	
11. All samples received within holding time?	Yes ☑	No ☐	
12. Temperature of rep sample or Temp Blank within acceptable limit?	Yes ☑	No ☐	NA ☐
13. Water - VOA vials have zero headspace?	Yes ☐	No ☐	NA ☑
14. Water - pH acceptable upon receipt? Example: pH > 12 for (CN,S); pH<2 for Metals	Yes ☐	No ☐	NA ☑
15. Did the bottle labels indicate correct preservatives used?	Yes ☐	No ☐	NA ☑
16. Were there Non-Conformance issues at login?	Yes ☐	No ☐	NA ☑
Was Client notified?	Yes ☐	No ☐	NA ☑

Comments:

Checklist Completed B MBC MBC 4/22/13 Reviewed By:

April 26, 2013

Brian Loffman
BEC Environmental, Inc.
7660 W. Sahara Ave., Ste. 150
Las Vegas, NV 89117

TEL: (702) 304-9830
FAX: (702) 304-9839

CA-ELAP No.: 2676
NV Cert. No.: NV-009222007A

Workorder No.: N010062

RE: Coaldale Junction, 804-11-TZE

Attention: Brian Loffman

Enclosed are the results for sample(s) received on April 19, 2013 by Advanced Technology Laboratories, Inc. . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

I hereby certify that all laboratory analysis requested were performed by Nevada Division of Environmental Protection-certified laboratory for the parameters and matrices reported herein.

Thank you for the opportunity to service the needs of your company.Please feel free to call me at (702) 307-2659 if I can be of further assistance to your company.

Sincerely,

Jose Tenorio Jr.
Laboratory Director

CLIENT: BEC Environmental, Inc.
Project: Coaldale Junction, 804-11-TZE
Lab Order: N010062

CASE NARRATIVE

SAMPLE RECEIVING/GENERAL COMMENTS:

Samples were received intact with proper chain of custody documentation.

Cooler temperature and sample preservation were verified upon receipt of samples if applicable.

Information on sample receipt conditions including discrepancies can be found in attached Sample Receipt Checklist Form.

Samples were analyzed within method holding time.

Analytical Comments for EPA 6010B:

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) are outside recovery criteria for Arsenic and Lead possibly due to matrix interference. The associated Laboratory Control Sample (LCS) recovery was acceptable.

CLIENT: BEC Environmental, Inc.
Lab Order: N010062
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010062-001

Client Sample ID: SB3-2
Collection Date: 4/15/2013 1:46:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC1_130422B**	QC Batch: **42749**			PrepDate:	**4/22/2013**		Analyst: **MDM**
DRO	1500	2.2	10		mg/Kg	1	4/22/2013 07:17 PM
ORO	650	1.1	10		mg/Kg	1	4/22/2013 07:17 PM
Surr: p-Terphenyl	127	0	52-175		%REC	1	4/22/2013 07:17 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424A**	QC Batch: **42760**			PrepDate:	**4/23/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42752**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	9.6	0.15	1.0		mg/Kg	1	4/25/2013 12:54 AM
Barium	200	0.16	1.0		mg/Kg	1	4/25/2013 12:54 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 12:54 AM
Chromium	12	0.17	1.0		mg/Kg	1	4/25/2013 12:54 AM
Lead	5.3	0.14	1.0		mg/Kg	1	4/25/2013 12:54 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 12:54 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 12:54 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010062
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010062-002

Client Sample ID: SB3-5
Collection Date: 4/15/2013 1:51:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B				**EPA 8015B**		
RunID: **GC1_130422B**	QC Batch: **42749**				PrepDate: **4/22/2013**		Analyst: **MDM**
DRO	1300	2.2	10		mg/Kg	1	4/22/2013 07:42 PM
ORO	780	1.1	10		mg/Kg	1	4/22/2013 07:42 PM
Surr: p-Terphenyl	125	0	52-175		%REC	1	4/22/2013 07:42 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471				**EPA 7471A**		
RunID: **AA1_130424A**	QC Batch: **42760**				PrepDate: **4/23/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B				**EPA 6010B**		
RunID: **ICP2_130424D**	QC Batch: **42752**				PrepDate: **4/22/2013**		Analyst: **CEI**
Arsenic	13	0.15	1.0		mg/Kg	1	4/25/2013 01:00 AM
Barium	69	0.16	1.0		mg/Kg	1	4/25/2013 01:00 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 01:00 AM
Chromium	8.8	0.17	1.0		mg/Kg	1	4/25/2013 01:00 AM
Lead	5.7	0.14	1.0		mg/Kg	1	4/25/2013 01:00 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 01:00 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 01:00 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010062
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010062-003

Client Sample ID: SB3-10
Collection Date: 4/15/2013 2:03:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC1_130422B**	QC Batch: **42749**			PrepDate:	**4/22/2013**		Analyst: **MDM**
DRO	ND	2.2	10		mg/Kg	1	4/22/2013 08:08 PM
ORO	ND	1.1	10		mg/Kg	1	4/22/2013 08:08 PM
Surr: p-Terphenyl	130	0	52-175		%REC	1	4/22/2013 08:08 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424A**	QC Batch: **42760**			PrepDate:	**4/23/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42752**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	8.7	0.15	1.0		mg/Kg	1	4/25/2013 01:06 AM
Barium	79	0.16	1.0		mg/Kg	1	4/25/2013 01:06 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 01:06 AM
Chromium	8.4	0.17	1.0		mg/Kg	1	4/25/2013 01:06 AM
Lead	4.0	0.14	1.0		mg/Kg	1	4/25/2013 01:06 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 01:06 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 01:06 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

CLIENT: BEC Environmental, Inc.
Lab Order: N010062
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010062-004

Client Sample ID: SB3-15
Collection Date: 4/15/2013 2:11:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B				**EPA 8015B**		
RunID: **GC1_130422B**	QC Batch: **42749**				PrepDate: **4/22/2013**		Analyst: **MDM**
DRO	ND	2.2	10		mg/Kg	1	4/22/2013 08:34 PM
ORO	ND	1.1	10		mg/Kg	1	4/22/2013 08:34 PM
Surr: p-Terphenyl	109	0	52-175		%REC	1	4/22/2013 08:34 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471				**EPA 7471A**		
RunID: **AA1_130424A**	QC Batch: **42760**				PrepDate: **4/23/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B				**EPA 6010B**		
RunID: **ICP2_130424D**	QC Batch: **42752**				PrepDate: **4/22/2013**		Analyst: **CEI**
Arsenic	16	0.15	1.0		mg/Kg	1	4/25/2013 01:12 AM
Barium	110	0.16	1.0		mg/Kg	1	4/25/2013 01:12 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 01:12 AM
Chromium	8.1	0.17	1.0		mg/Kg	1	4/25/2013 01:12 AM
Lead	4.0	0.14	1.0		mg/Kg	1	4/25/2013 01:12 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 01:12 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 01:12 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010062
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010062-005

Client Sample ID: SB3-20
Collection Date: 4/15/2013 2:18:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B				**EPA 8015B**		
RunID: **GC1_130422B**	QC Batch: **42749**				PrepDate: **4/22/2013**		Analyst: **MDM**
DRO	ND	2.2	10		mg/Kg	1	4/22/2013 08:59 PM
ORO	ND	1.1	10		mg/Kg	1	4/22/2013 08:59 PM
Surr: p-Terphenyl	130	0	52-175		%REC	1	4/22/2013 08:59 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471				**EPA 7471A**		
RunID: **AA1_130424A**	QC Batch: **42760**				PrepDate: **4/23/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B				**EPA 6010B**		
RunID: **ICP2_130424D**	QC Batch: **42752**				PrepDate: **4/22/2013**		Analyst: **CEI**
Arsenic	11	0.15	1.0		mg/Kg	1	4/25/2013 01:17 AM
Barium	220	0.16	1.0		mg/Kg	1	4/25/2013 01:17 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 01:17 AM
Chromium	13	0.17	1.0		mg/Kg	1	4/25/2013 01:17 AM
Lead	7.8	0.14	1.0		mg/Kg	1	4/25/2013 01:17 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 01:17 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 01:17 AM

Qualifiers:

B	Analyte detected in the associated Method Blank
E	Value above quantitation range
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference
	Results are wet unless otherwise specified
DO	Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010062
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010062-006

Client Sample ID: SB4-5
Collection Date: 4/15/2013 2:51:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B				**EPA 8015B**		
RunID: **GC1_130422B**	QC Batch: **42749**				PrepDate: **4/22/2013**		Analyst: **MDM**
DRO	170	2.2	10		mg/Kg	1	4/22/2013 09:25 PM
ORO	150	1.1	10		mg/Kg	1	4/22/2013 09:25 PM
Surr: p-Terphenyl	138	0	52-175		%REC	1	4/22/2013 09:25 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471				**EPA 7471A**		
RunID: **AA1_130424A**	QC Batch: **42760**				PrepDate: **4/23/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B				**EPA 6010B**		
RunID: **ICP2_130424D**	QC Batch: **42752**				PrepDate: **4/22/2013**		Analyst: **CEI**
Arsenic	11	0.15	1.0		mg/Kg	1	4/25/2013 01:23 AM
Barium	110	0.16	1.0		mg/Kg	1	4/25/2013 01:23 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 01:23 AM
Chromium	7.5	0.16	1.0		mg/Kg	1	4/25/2013 01:23 AM
Lead	4.4	0.14	1.0		mg/Kg	1	4/25/2013 01:23 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 01:23 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 01:23 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

CLIENT: BEC Environmental, Inc.
Lab Order: N010062
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010062-007

Client Sample ID: SB4-10
Collection Date: 4/15/2013 2:57:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC1_130422B**	QC Batch: **42749**			PrepDate:	**4/22/2013**		Analyst: **MDM**
DRO	ND	2.2	9.9		mg/Kg	1	4/22/2013 09:50 PM
ORO	ND	1.0	9.9		mg/Kg	1	4/22/2013 09:50 PM
Surr: p-Terphenyl	131	0	52-175		%REC	1	4/22/2013 09:50 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424A**	QC Batch: **42760**			PrepDate:	**4/23/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42752**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	15	0.15	1.0		mg/Kg	1	4/25/2013 01:29 AM
Barium	67	0.16	1.0		mg/Kg	1	4/25/2013 01:29 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 01:29 AM
Chromium	10	0.16	1.0		mg/Kg	1	4/25/2013 01:29 AM
Lead	6.5	0.14	1.0		mg/Kg	1	4/25/2013 01:29 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 01:29 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 01:29 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

CLIENT: BEC Environmental, Inc.
Lab Order: N010062
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010062-008

Client Sample ID: SB4-15
Collection Date: 4/15/2013 3:08:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B				**EPA 8015B**		
RunID: **GC1_130422B**	QC Batch: **42749**				PrepDate: **4/22/2013**		Analyst: **MDM**
DRO	ND	2.2	10		mg/Kg	1	4/22/2013 10:16 PM
ORO	ND	1.1	10		mg/Kg	1	4/22/2013 10:16 PM
Surr: p-Terphenyl	107	0	52-175		%REC	1	4/22/2013 10:16 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471				**EPA 7471A**		
RunID: **AA1_130424A**	QC Batch: **42760**				PrepDate: **4/23/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B				**EPA 6010B**		
RunID: **ICP2_130424D**	QC Batch: **42752**				PrepDate: **4/22/2013**		Analyst: **CEI**
Arsenic	35	0.15	1.0		mg/Kg	1	4/25/2013 01:35 AM
Barium	110	0.16	1.0		mg/Kg	1	4/25/2013 01:35 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 01:35 AM
Chromium	8.2	0.17	1.0		mg/Kg	1	4/25/2013 01:35 AM
Lead	6.5	0.14	1.0		mg/Kg	1	4/25/2013 01:35 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 01:35 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 01:35 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Work Order: N010062
Project: Coaldale Junction, 804-11-TZE

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **MB-42752** SampType: **MBLK** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **4/22/2013** RunNo: **88583**
Client ID: **PBS** Batch ID: **42752** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **4/24/2013** SeqNo: **1562945**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	ND	1.0									
Barium	ND	1.0									
Cadmium	ND	1.0									
Chromium	ND	1.0									
Lead	ND	1.0									
Selenium	ND	1.0									
Silver	ND	1.0									

Sample ID: **LCS-42752** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **4/22/2013** RunNo: **88583**
Client ID: **LCSS** Batch ID: **42752** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **4/24/2013** SeqNo: **1562946**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	50.212	1.0	50.10	0	100	80	120				
Barium	50.145	1.0	50.10	0	100	80	120				
Cadmium	50.585	1.0	50.10	0	101	80	120				
Chromium	50.135	1.0	50.10	0	100	80	120				
Lead	50.122	1.0	50.10	0	100	80	120				
Selenium	50.581	1.0	50.10	0	101	80	120				
Silver	50.402	1.0	50.10	0	101	80	120				

Sample ID: **N010061-001A-MS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **4/22/2013** RunNo: **88583**
Client ID: **ZZZZZZ** Batch ID: **42752** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **4/25/2013** SeqNo: **1562949**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	54.453	1.0	50.03	17.71	73.5	75	125				S
Barium	123.004	1.0	50.03	78.83	88.3	75	125				
Cadmium	39.309	1.0	50.03	0	78.6	75	125				
Chromium	46.675	1.0	50.03	8.311	76.7	75	125				

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Work Order: N010062
Project: Coaldale Junction, 804-11-TZE

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **N010061-001A-MS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **4/22/2013** RunNo: **88583**
Client ID: **ZZZZZZ** Batch ID: **42752** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **4/25/2013** SeqNo: **1562949**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	42.598	1.0	50.03	5.581	74.0	75	125				S
Selenium	38.228	1.0	50.03	0	76.4	75	125				
Silver	40.749	1.0	50.03	0	81.5	75	125				

Sample ID: **N010061-001A-MSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **4/22/2013** RunNo: **88583**
Client ID: **ZZZZZZ** Batch ID: **42752** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **4/25/2013** SeqNo: **1562950**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	52.516	1.0	50.20	17.71	69.3	75	125	54.45	3.62	20	S
Barium	118.411	1.0	50.20	78.83	78.8	75	125	123.0	3.81	20	
Cadmium	38.149	1.0	50.20	0	76.0	75	125	39.31	2.99	20	
Chromium	48.342	1.0	50.20	8.311	79.7	75	125	46.68	3.51	20	
Lead	42.622	1.0	50.20	5.581	73.8	75	125	42.60	0.0562	20	S
Selenium	38.252	1.0	50.20	0	76.2	75	125	38.23	0.0624	20	
Silver	40.562	1.0	50.20	0	80.8	75	125	40.75	0.460	20	

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Work Order: N010062
Project: Coaldale Junction, 804-11-TZE

ANALYTICAL QC SUMMARY REPORT

TestCode: 7471_S

Sample ID: **LCS-42760**	SampType: **LCS**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **4/23/2013**	RunNo: **88560**
Client ID: **LCSS**	Batch ID: **42760**	TestNo: **EPA 7471A**	**EPA 7471**	Analysis Date: **4/24/2013**	SeqNo: **1562298**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.447	0.10	0.4167	0	107	80	120				

Sample ID: **MB-42760**	SampType: **MBLK**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **4/23/2013**	RunNo: **88560**
Client ID: **PBS**	Batch ID: **42760**	TestNo: **EPA 7471A**	**EPA 7471**	Analysis Date: **4/24/2013**	SeqNo: **1562299**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.10									

Sample ID: **N010061-001A-MS**	SampType: **MS**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **4/23/2013**	RunNo: **88560**
Client ID: **ZZZZZZ**	Batch ID: **42760**	TestNo: **EPA 7471A**	**EPA 7471**	Analysis Date: **4/24/2013**	SeqNo: **1562303**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.471	0.10	0.4167	0	113	75	125				

Sample ID: **N010061-001A-MSD**	SampType: **MSD**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **4/23/2013**	RunNo: **88560**
Client ID: **ZZZZZZ**	Batch ID: **42760**	TestNo: **EPA 7471A**	**EPA 7471**	Analysis Date: **4/24/2013**	SeqNo: **1562304**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.475	0.10	0.4167	0	114	75	125	0.4710	0.891	20	

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Work Order: N010062
Project: Coaldale Junction, 804-11-TZE

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015DM_SBEC

Sample ID: **LCS-42749**	SampType: **LCS**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88547**
Client ID: **LCSS**	Batch ID: **42749**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/22/2013**	SeqNo: **1561786**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	1028.404	10	1000	0	103	52	126				
Surr: p-Terphenyl	93.152		80.00		116	52	175				

Sample ID: **MB-42749**	SampType: **MBLK**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88547**
Client ID: **PBS**	Batch ID: **42749**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/22/2013**	SeqNo: **1561787**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	2.565	10									
ORO	1.854	10									
Surr: p-Terphenyl	84.337		80.00		105	52	175				

Sample ID: **N010061-001B-MS**	SampType: **MS**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88547**
Client ID: **ZZZZZZ**	Batch ID: **42749**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/23/2013**	SeqNo: **1561806**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	1313.030	10	1000	5.810	131	39	131				
Surr: p-Terphenyl	110.550		80.00		138	52	175				

Sample ID: **N010061-001B-MSD**	SampType: **MSD**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88547**
Client ID: **ZZZZZZ**	Batch ID: **42749**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/23/2013**	SeqNo: **1561807**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	1282.187	9.9	992.1	5.810	129	39	131	1313	2.38	20	
Surr: p-Terphenyl	104.343		79.37		131	52	175		0		

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CHAIN OF CUSTODY RECORD

Pg 1 of 1

Advanced Technology Laboratories, Inc.
3151-3153 W. Post Rd.
Las Vegas, NV 89118
Tel: (702) 307-2659 • Fax: (702) 307-2691

FOR LABORATORY USE ONLY:

P.O.#: _____

Logged By: MRC Date: 4/19/13

Method of Transport: Client ☑ ATL ☐ CA OverN ☐ FEDEX ☐ Other: _____

Sample Condition Upon Receipt
1. CHILLED 1.8°C ICE IR#1 Y☐ N☐ 4. SEALED Y☐ N☐
2. HEADSPACE (VOA) Y☐ N☐ 5. # OF SPLS MATCH COC Y☐ N☐
3. CONTAINER INTACT Y☐ N☐ 6. PRESERVED Y☐ N☐

Client: BEC
Attn: Brian Loffman
Address: 7660 W. Sahara Ave #150
City LV State NV Zip Code 89117
TEL: (702) 304-9830
FAX: ( )

Project Name: Cockle Junction Project #: 804.11.T2E
Sampler: I attest to the validity and authenticity of this sample. I am aware that tampering with or intentionally mislabeling the sample location, date or time of collection is considered fraud and may be grounds for legal action. (Printed Name) Brian Loffman (Signature)

Relinquished by: (Signature and Printed Name) Brian Loffman	Date: 4/19/13	Time: 1503	Received by: (Signature and Printed Name) Inception	Date: 4/19/13	Time: 1503
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: Brian Loffman (Print Name) 4/19/13 (Date) (Signature)

Send Report To:
Attn: Brian Loffman
Co: BEC
Address 7660 W. Sahara
City LV State NV Zip 89117

Bill To:
Attn: Same
Co: _____
Address _____
City _____ State _____ Zip _____

Special Instructions/Comments:
email reports to:
brian@becnv.com

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

Circle or Add Analysis(es) Requested

SPECIFY APPROPRIATE MATRIX

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	8260B (VOC)	8260B (BTEX), (MTBE)	8015B (GRO)	8015B (DRO), (Motor Oil/ORO)	RCRA8 (6010B/7000)	SOIL	WATER	GROUND WATER	WASTEWATER	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
1	N010062-1	SB3-2	4/15	146			X	X		X				E	2	J	C	
2	-2	SB3-5	4/15	151			X	X		X				E	2	J	C	
3	-3	SB3-10	4/15	203			X	X		X				E	2	J	C	
4	-4	SB3-15	4/15	211			X	X		X				E	2	J	C	
5	-5	SB3-20	4/15	218			X	X		X				E	2	J	C	
6	-6	SB4-5	4/15	251			X	X		X				E	2	J	C	
7	-7	SB4-10	4/15	257			X	X		X				E	2	J	C	
8	-8	SB4-15	4/15	308			X	X		X				E	2	J	C	

QA/QC: RTNE ☐ CT ☐ SWRCB ☐ Logcode ____ OTHER ____

- TAT starts 8 a.m. following day if samples received after 3 p.m.

TAT: ☐ A= Overnight ≤ 24 hr ☐ B= Emergency Next workday ☐ C= Critical 2 Workdays ☐ D= Urgent 3 Workdays ☐ E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=Hcl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: **White** with report, **Yellow** to folder, **Pink** to submitter.

Advanced Technology Laboratories, Inc.

Please review the checklist below. Any NO signifies non-compliance. Any non-compliance will be noted and must be understood as having an impact on the quality of the data. All tests will be performed as requested regardless of any compliance issues.

If you have any questions or further instruction, please contact our Project Coordinator at (702) 307-2659.

Cooler Received/Opened On:	4/19/2013	Workorder:	N010062
Rep sample Temp (Deg C):	1.8	IR Gun ID:	1
Temp Blank:	☐ Yes ☑ No		
Carrier name:	Client		
Last 4 digits of Tracking No.:	NA	Packing Material Used:	None
Cooling process:	☑ Ice ☐ Ice Pack ☐ Dry Ice ☐ Other ☐ None		

Sample Receipt Checklist

1. Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
2. Custody seals intact, signed, dated on shippping container/cooler?	Yes ☐	No ☐	Not Present ☑
3. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
4. Chain of custody present?	Yes ☑	No ☐	
5. Sampler's name present in COC?	Yes ☑	No ☐	
6. Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
7. Chain of custody agrees with sample labels?	Yes ☑	No ☐	
8. Samples in proper container/bottle?	Yes ☑	No ☐	
9. Sample containers intact?	Yes ☑	No ☐	
10. Sufficient sample volume for indicated test?	Yes ☑	No ☐	
11. All samples received within holding time?	Yes ☑	No ☐	
12. Temperature of rep sample or Temp Blank within acceptable limit?	Yes ☑	No ☐	NA ☐
13. Water - VOA vials have zero headspace?	Yes ☐	No ☐	NA ☑
14. Water - pH acceptable upon receipt? Example: pH > 12 for (CN,S); pH<2 for Metals	Yes ☐	No ☐	NA ☑
15. Did the bottle labels indicate correct preservatives used?	Yes ☐	No ☐	NA ☑
16. Were there Non-Conformance issues at login?	Yes ☐	No ☐	NA ☑
Was Client notified?	Yes ☐	No ☐	NA ☑

Comments:

Checklist Completed B MBC MBC 4/22/13

Reviewed By:

April 29, 2013

Brian Loffman
BEC Environmental, Inc.
7660 W. Sahara Ave., Ste. 150
Las Vegas, NV 89117

TEL: (702) 304-9830
FAX: (702) 304-9839

CA-ELAP No.: 2676
NV Cert. No.: NV-009222007A

Workorder No.: N010065

RE: Coaldale Junction, 804-11-TZE

Attention: Brian Loffman

Enclosed are the results for sample(s) received on April 19, 2013 by Advanced Technology Laboratories, Inc. . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

I hereby certify that all laboratory analysis requested were performed by Nevada Division of Environmental Protection-certified laboratory for the parameters and matrices reported herein.

Thank you for the opportunity to service the needs of your company.Please feel free to call me at (702) 307-2659 if I can be of further assistance to your company.

Sincerely,

Jose Tenorio Jr.
Laboratory Director

CLIENT: BEC Environmental, Inc.
Project: Coaldale Junction, 804-11-TZE
Lab Order: N010065

CASE NARRATIVE

SAMPLE RECEIVING/GENERAL COMMENTS:

Samples were received intact with proper chain of custody documentation.

Cooler temperature and sample preservation were verified upon receipt of samples if applicable.

Information on sample receipt conditions including discrepancies can be found in attached Sample Receipt Checklist Form.

Samples were analyzed within method holding time.

Analytical Comments for EPA 6010B:

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) are outside recovery criteria for Arsenic, Cadmium, Chromium, Selenium and Lead possibly due to matrix interference. The associated Laboratory Control Sample (LCS) recovery was acceptable.

Analytical Comments for EPA 8015B DRO/ORO:

Matrix Spike Duplicate (MSD) is outside recovery criteria possibly due to non-homogeneity of sample. The associated Laboratory Control Sample (LCS) recovery was acceptable.

RPD for Matrix Spike (MS)/Matrix Spike Duplicate (MSD) is outside criteria possibly due to non-homogeneity of sample ; however, the analytical batch was validated by the Laboratory Control Sample (LCS).

Advanced Technology Laboratories, Inc. *3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691*

CLIENT: BEC Environmental, Inc.
Lab Order: N010065
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010065-001

Client Sample ID: SB5-5
Collection Date: 4/16/2013 7:35:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B				**EPA 8015B**		
RunID: **GC3_130425A**	QC Batch: **42803**				PrepDate:	**4/25/2013**	Analyst: **MDM**
DRO	3500	2.2	10		mg/Kg	1	4/25/2013 11:53 AM
ORO	1500	1.1	10		mg/Kg	1	4/25/2013 11:53 AM
Surr: p-Terphenyl	137	0	52-175		%REC	1	4/25/2013 11:53 AM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471				**EPA 7471A**		
RunID: **AA1_130424D**	QC Batch: **42793**				PrepDate:	**4/24/2013**	Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B				**EPA 6010B**		
RunID: **ICP2_130424D**	QC Batch: **42754**				PrepDate:	**4/22/2013**	Analyst: **CEI**
Arsenic	8.1	0.15	1.0		mg/Kg	1	4/25/2013 04:42 AM
Barium	84	0.16	1.0		mg/Kg	1	4/25/2013 04:42 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 04:42 AM
Chromium	8.9	0.16	1.0		mg/Kg	1	4/25/2013 04:42 AM
Lead	3.9	0.14	1.0		mg/Kg	1	4/25/2013 04:42 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 04:42 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 04:42 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010065
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010065-002

Client Sample ID: SB5-10
Collection Date: 4/16/2013 7:47:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC3_130423B**	QC Batch: **42768**			PrepDate:	**4/23/2013**		Analyst: **MDM**
DRO	6000	22	100		mg/Kg	10	4/25/2013 10:26 AM
ORO	2400	1.1	10		mg/Kg	1	4/23/2013 08:32 PM
Surr: p-Terphenyl	166	0	52-175		%REC	1	4/23/2013 08:32 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424D**	QC Batch: **42793**			PrepDate:	**4/24/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42754**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	9.0	0.15	1.0		mg/Kg	1	4/25/2013 05:10 AM
Barium	76	0.16	1.0		mg/Kg	1	4/25/2013 05:10 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 05:10 AM
Chromium	6.1	0.17	1.0		mg/Kg	1	4/25/2013 05:10 AM
Lead	3.1	0.14	1.0		mg/Kg	1	4/25/2013 05:10 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 05:10 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 05:10 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010065
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010065-003

Client Sample ID: SB5-15
Collection Date: 4/16/2013 7:57:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC3_130423B**	QC Batch: **42768**			PrepDate:	**4/23/2013**		Analyst: **MDM**
DRO	3200	2.2	9.9		mg/Kg	1	4/23/2013 08:58 PM
ORO	1300	1.0	9.9		mg/Kg	1	4/23/2013 08:58 PM
Surr: p-Terphenyl	130	0	52-175		%REC	1	4/23/2013 08:58 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424D**	QC Batch: **42793**			PrepDate:	**4/24/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42754**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	2.6	0.15	1.0		mg/Kg	1	4/25/2013 05:16 AM
Barium	86	0.16	1.0		mg/Kg	1	4/25/2013 05:16 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 05:16 AM
Chromium	14	0.16	1.0		mg/Kg	1	4/25/2013 05:16 AM
Lead	6.6	0.14	1.0		mg/Kg	1	4/25/2013 05:16 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 05:16 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 05:16 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

CLIENT: BEC Environmental, Inc.
Lab Order: N010065
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010065-004

Client Sample ID: SB5-20
Collection Date: 4/16/2013 8:05:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC3_130423B**	QC Batch: **42768**			PrepDate:	**4/23/2013**		Analyst: **MDM**
DRO	2400	2.2	10		mg/Kg	1	4/23/2013 09:24 PM
ORO	970	1.0	10		mg/Kg	1	4/23/2013 09:24 PM
Surr: p-Terphenyl	121	0	52-175		%REC	1	4/23/2013 09:24 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424D**	QC Batch: **42793**			PrepDate:	**4/24/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42754**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	2.2	0.15	1.0		mg/Kg	1	4/25/2013 05:32 AM
Barium	63	0.16	1.0		mg/Kg	1	4/25/2013 05:32 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 05:32 AM
Chromium	14	0.17	1.0		mg/Kg	1	4/25/2013 05:32 AM
Lead	7.4	0.14	1.0		mg/Kg	1	4/25/2013 05:32 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 05:32 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 05:32 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010065
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010065-005

Client Sample ID: SB5-25
Collection Date: 4/16/2013 8:22:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC3_130423B**	QC Batch: **42768**			PrepDate:	**4/23/2013**		Analyst: **MDM**
DRO	260	2.2	10		mg/Kg	1	4/23/2013 09:51 PM
ORO	120	1.1	10		mg/Kg	1	4/23/2013 09:51 PM
Surr: p-Terphenyl	108	0	52-175		%REC	1	4/23/2013 09:51 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424D**	QC Batch: **42793**			PrepDate:	**4/24/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42754**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	2.4	0.15	1.0		mg/Kg	1	4/25/2013 05:38 AM
Barium	130	0.16	1.0		mg/Kg	1	4/25/2013 05:38 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 05:38 AM
Chromium	12	0.17	1.0		mg/Kg	1	4/25/2013 05:38 AM
Lead	8.9	0.14	1.0		mg/Kg	1	4/25/2013 05:38 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 05:38 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 05:38 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010065
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010065-006

Client Sample ID: SB5-30
Collection Date: 4/16/2013 8:34:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC3_130423B**	QC Batch: **42768**			PrepDate:	**4/23/2013**		Analyst: **MDM**
DRO	220	2.2	10		mg/Kg	1	4/23/2013 10:17 PM
ORO	100	1.1	10		mg/Kg	1	4/23/2013 10:17 PM
Surr: p-Terphenyl	116	0	52-175		%REC	1	4/23/2013 10:17 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424D**	QC Batch: **42793**			PrepDate:	**4/24/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42754**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	2.9	0.15	1.0		mg/Kg	1	4/25/2013 05:43 AM
Barium	34	0.16	1.0		mg/Kg	1	4/25/2013 05:43 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 05:43 AM
Chromium	11	0.16	1.0		mg/Kg	1	4/25/2013 05:43 AM
Lead	11	0.14	1.0		mg/Kg	1	4/25/2013 05:43 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 05:43 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 05:43 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010065
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010065-007

Client Sample ID: SB5-35
Collection Date: 4/16/2013 8:50:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC3_130423B**	QC Batch: **42768**			PrepDate:	**4/23/2013**		Analyst: **MDM**
DRO	ND	2.2	10		mg/Kg	1	4/23/2013 10:44 PM
ORO	ND	1.1	10		mg/Kg	1	4/23/2013 10:44 PM
Surr: p-Terphenyl	106	0	52-175		%REC	1	4/23/2013 10:44 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424D**	QC Batch: **42793**			PrepDate:	**4/24/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42754**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	3.8	0.15	1.0		mg/Kg	1	4/25/2013 05:48 AM
Barium	110	0.16	1.0		mg/Kg	1	4/25/2013 05:48 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 05:48 AM
Chromium	8.7	0.16	1.0		mg/Kg	1	4/25/2013 05:48 AM
Lead	9.6	0.14	1.0		mg/Kg	1	4/25/2013 05:48 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 05:48 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 05:48 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010065
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010065-008

Client Sample ID: SB5-40
Collection Date: 4/16/2013 9:03:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC3_130423B**	QC Batch: **42768**			PrepDate:	**4/23/2013**		Analyst: **MDM**
DRO	11	2.2	10		mg/Kg	1	4/23/2013 11:10 PM
ORO	ND	1.0	10		mg/Kg	1	4/23/2013 11:10 PM
Surr: p-Terphenyl	101	0	52-175		%REC	1	4/23/2013 11:10 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424D**	QC Batch: **42793**			PrepDate:	**4/24/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42754**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	2.8	0.15	1.0		mg/Kg	1	4/25/2013 05:54 AM
Barium	34	0.16	1.0		mg/Kg	1	4/25/2013 05:54 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 05:54 AM
Chromium	10	0.16	1.0		mg/Kg	1	4/25/2013 05:54 AM
Lead	8.9	0.14	1.0		mg/Kg	1	4/25/2013 05:54 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 05:54 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 05:54 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010065
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010065-009

Client Sample ID: SB5-45
Collection Date: 4/16/2013 9:18:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B				**EPA 8015B**		
RunID: **GC3_130423B**	QC Batch: **42768**				PrepDate: **4/23/2013**		Analyst: **MDM**
DRO	3700	2.2	10		mg/Kg	1	4/23/2013 11:36 PM
ORO	1400	1.1	10		mg/Kg	1	4/23/2013 11:36 PM
Surr: p-Terphenyl	157	0	52-175		%REC	1	4/23/2013 11:36 PM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471				**EPA 7471A**		
RunID: **AA1_130424D**	QC Batch: **42793**				PrepDate: **4/24/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B				**EPA 6010B**		
RunID: **ICP2_130424D**	QC Batch: **42754**				PrepDate: **4/22/2013**		Analyst: **CEI**
Arsenic	11	0.15	1.0		mg/Kg	1	4/25/2013 05:59 AM
Barium	220	0.16	1.0		mg/Kg	1	4/25/2013 05:59 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 05:59 AM
Chromium	12	0.16	1.0		mg/Kg	1	4/25/2013 05:59 AM
Lead	7.4	0.14	1.0		mg/Kg	1	4/25/2013 05:59 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 05:59 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 05:59 AM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

CLIENT: BEC Environmental, Inc.
Lab Order: N010065
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010065-010

Client Sample ID: SB5-50
Collection Date: 4/16/2013 9:40:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC3_130423B**	QC Batch: **42768**			PrepDate:	**4/23/2013**		Analyst: **MDM**
DRO	ND	2.2	9.9		mg/Kg	1	4/24/2013 12:02 AM
ORO	ND	1.0	9.9		mg/Kg	1	4/24/2013 12:02 AM
Surr: p-Terphenyl	100	0	52-175		%REC	1	4/24/2013 12:02 AM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424D**	QC Batch: **42793**			PrepDate:	**4/24/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42754**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	9.7	0.15	1.0		mg/Kg	1	4/25/2013 06:05 AM
Barium	31	0.16	1.0		mg/Kg	1	4/25/2013 06:05 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 06:05 AM
Chromium	11	0.17	1.0		mg/Kg	1	4/25/2013 06:05 AM
Lead	12	0.14	1.0		mg/Kg	1	4/25/2013 06:05 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 06:05 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 06:05 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010065
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010065-011

Client Sample ID: SB5-55
Collection Date: 4/16/2013 9:54:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC3_130423B**	QC Batch: **42768**			PrepDate:	**4/23/2013**		Analyst: **MDM**
DRO	860	2.2	10		mg/Kg	1	4/24/2013 12:29 AM
ORO	330	1.1	10		mg/Kg	1	4/24/2013 12:29 AM
Surr: p-Terphenyl	103	0	52-175		%REC	1	4/24/2013 12:29 AM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424D**	QC Batch: **42793**			PrepDate:	**4/24/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42754**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	3.1	0.15	1.0		mg/Kg	1	4/25/2013 06:10 AM
Barium	38	0.16	1.0		mg/Kg	1	4/25/2013 06:10 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 06:10 AM
Chromium	8.3	0.17	1.0		mg/Kg	1	4/25/2013 06:10 AM
Lead	10	0.14	1.0		mg/Kg	1	4/25/2013 06:10 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 06:10 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 06:10 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010065
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010065-012

Client Sample ID: SB5-60
Collection Date: 4/16/2013 10:14:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
EPA 3550B / **EPA 8015B**							
RunID: **GC3_130423B** QC Batch: **42768** PrepDate: **4/23/2013** Analyst: **MDM**							
DRO	260	2.2	10		mg/Kg	1	4/24/2013 12:55 AM
ORO	100	1.1	10		mg/Kg	1	4/24/2013 12:55 AM
Surr: p-Terphenyl	125	0	52-175		%REC	1	4/24/2013 12:55 AM
MERCURY BY COLD VAPOR TECHNIQUE							
EPA 7471 / **EPA 7471A**							
RunID: **AA1_130424D** QC Batch: **42793** PrepDate: **4/24/2013** Analyst: **LCC**							
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
EPA 3050B / **EPA 6010B**							
RunID: **ICP2_130424D** QC Batch: **42754** PrepDate: **4/22/2013** Analyst: **CEI**							
Arsenic	12	0.15	1.0		mg/Kg	1	4/25/2013 06:15 AM
Barium	78	0.16	1.0		mg/Kg	1	4/25/2013 06:15 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 06:15 AM
Chromium	2.7	0.16	1.0		mg/Kg	1	4/25/2013 06:15 AM
Lead	16	0.14	1.0		mg/Kg	1	4/25/2013 06:15 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 06:15 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 06:15 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010065
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010065-013

Client Sample ID: SB5-70
Collection Date: 4/16/2013 10:43:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
EPA 3550B / **EPA 8015B**							
RunID: **GC3_130423B** QC Batch: **42768** PrepDate: **4/23/2013** Analyst: **MDM**							
DRO	24	2.2	10		mg/Kg	1	4/24/2013 01:21 AM
ORO	13	1.0	10		mg/Kg	1	4/24/2013 01:21 AM
Surr: p-Terphenyl	121	0	52-175		%REC	1	4/24/2013 01:21 AM
MERCURY BY COLD VAPOR TECHNIQUE							
EPA 7471 / **EPA 7471A**							
RunID: **AA1_130424D** QC Batch: **42793** PrepDate: **4/24/2013** Analyst: **LCC**							
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
EPA 3050B / **EPA 6010B**							
RunID: **ICP2_130424D** QC Batch: **42754** PrepDate: **4/22/2013** Analyst: **CEI**							
Arsenic	27	0.15	1.0		mg/Kg	1	4/25/2013 06:21 AM
Barium	33	0.16	1.0		mg/Kg	1	4/25/2013 06:21 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 06:21 AM
Chromium	9.6	0.17	1.0		mg/Kg	1	4/25/2013 06:21 AM
Lead	12	0.14	1.0		mg/Kg	1	4/25/2013 06:21 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 06:21 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 06:21 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010065
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010065-014

Client Sample ID: SB5-80
Collection Date: 4/16/2013 11:10:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC3_130423B**	QC Batch: **42768**			PrepDate:	**4/23/2013**		Analyst: **MDM**
DRO	560	2.2	10		mg/Kg	1	4/24/2013 01:47 AM
ORO	190	1.1	10		mg/Kg	1	4/24/2013 01:47 AM
Surr: p-Terphenyl	115	0	52-175		%REC	1	4/24/2013 01:47 AM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130424D**	QC Batch: **42793**			PrepDate:	**4/24/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42754**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	2.8	0.15	1.0		mg/Kg	1	4/25/2013 06:47 AM
Barium	29	0.16	1.0		mg/Kg	1	4/25/2013 06:47 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 06:47 AM
Chromium	7.5	0.16	1.0		mg/Kg	1	4/25/2013 06:47 AM
Lead	11	0.14	1.0		mg/Kg	1	4/25/2013 06:47 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 06:47 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 06:47 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010065
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010065-015

Client Sample ID: SB5-100
Collection Date: 4/16/2013 12:00:00 PM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B				**EPA 8015B**		
RunID: **GC3_130423B**	QC Batch: **42768**				PrepDate: **4/23/2013**		Analyst: **MDM**
DRO	ND	2.2	10		mg/Kg	1	4/24/2013 02:14 AM
ORO	ND	1.0	10		mg/Kg	1	4/24/2013 02:14 AM
Surr: p-Terphenyl	120	0	52-175		%REC	1	4/24/2013 02:14 AM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471				**EPA 7471A**		
RunID: **AA1_130424D**	QC Batch: **42793**				PrepDate: **4/24/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/24/2013
ICP METALS							
	EPA 3050B				**EPA 6010B**		
RunID: **ICP2_130424D**	QC Batch: **42754**				PrepDate: **4/22/2013**		Analyst: **CEI**
Arsenic	3.4	0.15	1.0		mg/Kg	1	4/25/2013 06:52 AM
Barium	23	0.16	1.0		mg/Kg	1	4/25/2013 06:52 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 06:52 AM
Chromium	6.2	0.17	1.0		mg/Kg	1	4/25/2013 06:52 AM
Lead	7.3	0.14	1.0		mg/Kg	1	4/25/2013 06:52 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 06:52 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 06:52 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010065
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010065-016

Client Sample ID: SB6-5
Collection Date: 4/16/2013 1:47:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC3_130423B**	QC Batch: **42768**			PrepDate:	**4/23/2013**		Analyst: **MDM**
DRO	ND	2.2	9.9		mg/Kg	1	4/24/2013 02:40 AM
ORO	ND	1.0	9.9		mg/Kg	1	4/24/2013 02:40 AM
Surr: p-Terphenyl	146	0	52-175		%REC	1	4/24/2013 02:40 AM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130425D**	QC Batch: **42793**			PrepDate:	**4/24/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/25/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42754**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	8.2	0.15	1.0		mg/Kg	1	4/25/2013 06:57 AM
Barium	82	0.16	1.0		mg/Kg	1	4/25/2013 06:57 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 06:57 AM
Chromium	11	0.17	1.0		mg/Kg	1	4/25/2013 06:57 AM
Lead	3.4	0.14	1.0		mg/Kg	1	4/25/2013 06:57 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 06:57 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 06:57 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010065
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010065-017

Client Sample ID: SB6-10
Collection Date: 4/16/2013 2:00:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC3_130423B**	QC Batch: **42768**			PrepDate:	**4/23/2013**		Analyst: **MDM**
DRO	ND	2.2	10		mg/Kg	1	4/24/2013 03:06 AM
ORO	ND	1.1	10		mg/Kg	1	4/24/2013 03:06 AM
Surr: p-Terphenyl	105	0	52-175		%REC	1	4/24/2013 03:06 AM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130425D**	QC Batch: **42793**			PrepDate:	**4/24/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/25/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42754**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	14	0.15	1.0		mg/Kg	1	4/25/2013 07:03 AM
Barium	61	0.16	1.0		mg/Kg	1	4/25/2013 07:03 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 07:03 AM
Chromium	6.6	0.17	1.0		mg/Kg	1	4/25/2013 07:03 AM
Lead	3.7	0.14	1.0		mg/Kg	1	4/25/2013 07:03 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 07:03 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 07:03 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010065
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010065-018

Client Sample ID: SB6-15
Collection Date: 4/16/2013 2:12:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC3_130423B**	QC Batch: **42768**			PrepDate:	**4/23/2013**		Analyst: **MDM**
DRO	ND	2.2	9.9		mg/Kg	1	4/24/2013 03:33 AM
ORO	ND	1.0	9.9		mg/Kg	1	4/24/2013 03:33 AM
Surr: p-Terphenyl	130	0	52-175		%REC	1	4/24/2013 03:33 AM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130425D**	QC Batch: **42793**			PrepDate:	**4/24/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/25/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42754**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	19	0.15	1.0		mg/Kg	1	4/25/2013 07:09 AM
Barium	120	0.16	1.0		mg/Kg	1	4/25/2013 07:09 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 07:09 AM
Chromium	8.0	0.17	1.0		mg/Kg	1	4/25/2013 07:09 AM
Lead	4.1	0.14	1.0		mg/Kg	1	4/25/2013 07:09 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 07:09 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 07:09 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Lab Order: N010065
Project: Coaldale Junction, 804-11-TZE
Lab ID: N010065-019

Client Sample ID: SB6-20
Collection Date: 4/16/2013 2:27:00 AM
Matrix: SOIL

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID							
	EPA 3550B			**EPA 8015B**			
RunID: **GC3_130423B**	QC Batch: **42768**			PrepDate:	**4/23/2013**		Analyst: **MDM**
DRO	ND	2.2	10		mg/Kg	1	4/24/2013 04:25 AM
ORO	ND	1.1	10		mg/Kg	1	4/24/2013 04:25 AM
Surr: p-Terphenyl	111	0	52-175		%REC	1	4/24/2013 04:25 AM
MERCURY BY COLD VAPOR TECHNIQUE							
	EPA 7471			**EPA 7471A**			
RunID: **AA1_130425D**	QC Batch: **42793**			PrepDate:	**4/24/2013**		Analyst: **LCC**
Mercury	ND	0.029	0.10		mg/Kg	1	4/25/2013
ICP METALS							
	EPA 3050B			**EPA 6010B**			
RunID: **ICP2_130424D**	QC Batch: **42754**			PrepDate:	**4/22/2013**		Analyst: **CEI**
Arsenic	11	0.15	1.0		mg/Kg	1	4/25/2013 07:14 AM
Barium	290	0.16	1.0		mg/Kg	1	4/25/2013 07:14 AM
Cadmium	ND	0.16	1.0		mg/Kg	1	4/25/2013 07:14 AM
Chromium	7.6	0.16	1.0		mg/Kg	1	4/25/2013 07:14 AM
Lead	1.9	0.14	1.0		mg/Kg	1	4/25/2013 07:14 AM
Selenium	ND	0.28	1.0		mg/Kg	1	4/25/2013 07:14 AM
Silver	ND	0.15	1.0		mg/Kg	1	4/25/2013 07:14 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

CLIENT: BEC Environmental, Inc.
Work Order: N010065
Project: Coaldale Junction, 804-11-TZE

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **MB-42754**	SampType: **MBLK**	TestCode: **6010_S**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88583**
Client ID: **PBS**	Batch ID: **42754**	TestNo: **EPA 6010B**	**EPA 3050B**	Analysis Date: **4/25/2013**	SeqNo: **1562997**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	ND	1.0									
Barium	ND	1.0									
Cadmium	ND	1.0									
Chromium	ND	1.0									
Lead	ND	1.0									
Selenium	ND	1.0									
Silver	ND	1.0									

Sample ID: **LCS-42754**	SampType: **LCS**	TestCode: **6010_S**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88583**
Client ID: **LCSS**	Batch ID: **42754**	TestNo: **EPA 6010B**	**EPA 3050B**	Analysis Date: **4/25/2013**	SeqNo: **1562998**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	48.146	1.0	50.18	0	96.0	80	120				
Barium	49.355	1.0	50.18	0	98.4	80	120				
Cadmium	48.594	1.0	50.18	0	96.8	80	120				
Chromium	49.161	1.0	50.18	0	98.0	80	120				
Lead	48.583	1.0	50.18	0	96.8	80	120				
Selenium	48.758	1.0	50.18	0	97.2	80	120				
Silver	49.888	1.0	50.18	0	99.4	80	120				

Sample ID: **N010065-001A-MS**	SampType: **MS**	TestCode: **6010_S**	Units: **mg/Kg**	Prep Date: **4/22/2013**	RunNo: **88583**
Client ID: **ZZZZZZ**	Batch ID: **42754**	TestNo: **EPA 6010B**	**EPA 3050B**	Analysis Date: **4/25/2013**	SeqNo: **1563002**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	43.792	1.0	50.00	8.060	71.5	75	125				S
Barium	134.011	1.0	50.00	83.62	101	75	125				
Cadmium	36.582	1.0	50.00	0	73.2	75	125				S
Chromium	45.503	1.0	50.00	8.856	73.3	75	125				S

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Work Order: N010065
Project: Coaldale Junction, 804-11-TZE

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **N010065-001A-MS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **4/22/2013** RunNo: **88583**
Client ID: **ZZZZZZ** Batch ID: **42754** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **4/25/2013** SeqNo: **1563002**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	39.674	1.0	50.00	3.905	71.5	75	125				S
Selenium	35.215	1.0	50.00	0	70.4	75	125				S
Silver	38.409	1.0	50.00	0	76.8	75	125				

Sample ID: **N010065-001A-MSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **4/22/2013** RunNo: **88583**
Client ID: **ZZZZZZ** Batch ID: **42754** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **4/25/2013** SeqNo: **1563032**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	44.436	1.0	49.90	8.060	72.9	75	125	43.79	1.46	20	S
Barium	135.727	1.0	49.90	83.62	104	75	125	134.0	1.27	20	
Cadmium	38.319	1.0	49.90	0	76.8	75	125	36.58	4.64	20	
Chromium	45.988	1.0	49.90	8.856	74.4	75	125	45.50	1.06	20	S
Lead	40.566	1.0	49.90	3.905	73.5	75	125	39.67	2.22	20	S
Selenium	36.569	1.0	49.90	0	73.3	75	125	35.21	3.77	20	S
Silver	39.115	1.0	49.90	0	78.4	75	125	38.41	1.82	20	

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Work Order: N010065
Project: Coaldale Junction, 804-11-TZE

ANALYTICAL QC SUMMARY REPORT

TestCode: 7471_S

Sample ID: **LCS-42793**	SampType: **LCS**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **4/24/2013**	RunNo: **88589**
Client ID: **LCSS**	Batch ID: **42793**	TestNo: **EPA 7471A**	**EPA 7471**	Analysis Date: **4/24/2013**	SeqNo: **1563275**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.418	0.10	0.4167	0	100	80	120				

Sample ID: **MB-42793**	SampType: **MBLK**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **4/24/2013**	RunNo: **88589**
Client ID: **PBS**	Batch ID: **42793**	TestNo: **EPA 7471A**	**EPA 7471**	Analysis Date: **4/24/2013**	SeqNo: **1563276**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.10									

Sample ID: **N010065-001A-MS**	SampType: **MS**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **4/24/2013**	RunNo: **88589**
Client ID: **ZZZZZZ**	Batch ID: **42793**	TestNo: **EPA 7471A**	**EPA 7471**	Analysis Date: **4/24/2013**	SeqNo: **1563279**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.417	0.10	0.4167	0	100	75	125				

Sample ID: **N010065-001A-MSD**	SampType: **MSD**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **4/24/2013**	RunNo: **88589**
Client ID: **ZZZZZZ**	Batch ID: **42793**	TestNo: **EPA 7471A**	**EPA 7471**	Analysis Date: **4/24/2013**	SeqNo: **1563280**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.409	0.10	0.4167	0	98.2	75	125	0.4174	1.99	20	

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Work Order: N010065
Project: Coaldale Junction, 804-11-TZE

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015DM_SBEC

Sample ID: **LCS-42768**	SampType: **LCS**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/23/2013**	RunNo: **88576**
Client ID: **LCSS**	Batch ID: **42768**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/23/2013**	SeqNo: **1562750**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	839.433	10	1000	0	83.9	52	126				
Surr: p-Terphenyl	87.771		80.00		110	52	175				

Sample ID: **MB-42768**	SampType: **MBLK**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/23/2013**	RunNo: **88576**
Client ID: **PBS**	Batch ID: **42768**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/24/2013**	SeqNo: **1562769**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	9.077	10									
ORO	9.891	10									
Surr: p-Terphenyl	86.982		80.00		109	52	175				

Sample ID: **N010065-001B-MS**	SampType: **MS**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/23/2013**	RunNo: **88576**
Client ID: **ZZZZZZ**	Batch ID: **42768**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/24/2013**	SeqNo: **1562771**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	4902.501	10	1000	4002	90.0	39	131				
Surr: p-Terphenyl	106.767		80.00		133	52	175				

Sample ID: **N010065-001B-MSD**	SampType: **MSD**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/23/2013**	RunNo: **88576**
Client ID: **ZZZZZZ**	Batch ID: **42768**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/24/2013**	SeqNo: **1562772**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: p-Terphenyl	115.760		79.29		146	52	175		0		

Sample ID: **N010065-001B-MSD**	SampType: **MSD**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/23/2013**	RunNo: **88576**
Client ID: **ZZZZZZ**	Batch ID: **42768**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/25/2013**	SeqNo: **1564041**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	6188.503	99	991.1	4002	221	39	131	4903	23.2	20	SR

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Work Order: N010065
Project: Coaldale Junction, 804-11-TZE

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015DM_SBEC

Sample ID: **LCS-42803**	SampType: **LCS**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/25/2013**	RunNo: **88604**
Client ID: **LCSS**	Batch ID: **42803**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/25/2013**	SeqNo: **1564035**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	839.101	10	1000	0	83.9	52	126				
Surr: p-Terphenyl	79.312		80.00		99.1	52	175				

Sample ID: **MB-42803**	SampType: **MBLK**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/25/2013**	RunNo: **88604**
Client ID: **PBS**	Batch ID: **42803**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/25/2013**	SeqNo: **1564036**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	8.642	10									
ORO	5.884	10									
Surr: p-Terphenyl	76.912		80.00		96.1	52	175				

Sample ID: **N010073-001B-MS**	SampType: **MS**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/25/2013**	RunNo: **88604**
Client ID: **ZZZZZZ**	Batch ID: **42803**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/25/2013**	SeqNo: **1564039**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	1048.526	10	1005	12.71	103	39	131				
Surr: p-Terphenyl	100.898		80.40		125	52	175				

Sample ID: **N010073-001B-MSD**	SampType: **MSD**	TestCode: **8015DM_SBE**	Units: **mg/Kg**	Prep Date: **4/25/2013**	RunNo: **88604**
Client ID: **ZZZZZZ**	Batch ID: **42803**	TestNo: **EPA 8015B**	**EPA 3550B**	Analysis Date: **4/25/2013**	SeqNo: **1564040**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	918.412	10	1008	12.71	89.8	39	131	1049	13.2	20	
Surr: p-Terphenyl	129.763		80.65		161	52	175		0		

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CHAIN OF CUSTODY RECORD

Pg 1 of 2

Advanced Technology Laboratories, Inc.
3151-3153 W. Post Rd.
Las Vegas, NV 89118
Tel: (702) 307-2659 • Fax: (702) 307-2691

FOR LABORATORY USE ONLY:

P.O.#: _____

Logged By: _____ Date: 4/19/13

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FEDEX ☐ Other: _____

Sample Condition Upon Receipt: 1.8°C
1. CHILLED Y☐ N☐ 4. SEALED Y☑ N☐
2. HEADSPACE (VOA) Y☐ N☐ 5. # OF SPLS MATCH COC Y☑ N☐
3. CONTAINER INTACT Y☑ N☐ 6. PRESERVED Y☐ N☑

Client: BEC
Attn: Brian Loffman
Address: 7660 W. Sahara Ave #150
City LV State NV Zip Code 89117
TEL: (702) 304-9830
FAX: ( )

Project Name: Cooldale Junction Project #: 804.11.T2E
Sampler: I attest to the validity and authenticity of this sample, I am aware that tampering with or intentionally mislabeling the sample location, date or time of collection is considered fraud and may be grounds for legal action. (Printed Name) Brian Loffman (Signature)

Relinquished by: (Signature and Printed Name) Brian Loffman	Date: 4/19/13	Time: 1503	Received by: (Signature and Printed Name) MEGARON	Date: 4/19/13	Time: 1503
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: Brian Loffman 4/19/13
Print Name Date
Signature

Send Report To:
Attn: Brian Loffman
Co: BEC
Address 7660 W. Sahara
City LV State NV Zip 89117

Bill To:
Attn: Same
Co: _____
Address _____
City _____ State _____ Zip _____

Special Instructions/Comments:
email results to:
brian@becnv.com

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

Circle or Add Analysis(es) Requested

ITEM	LAB USE ONLY: Batch # / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	8260B (VOC)	8260B (BTEX), (MTBE)	8015B (GRO)	8015B (DRO), (Motor Oil/ORO)	RCRA8 (6010B/7000)	SOIL	WATER	GROUND WATER	WASTEWATER	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
1	NO10065-1	SB5-5	4/16	735			X	X		X				E	2	JG	C	
2	-2	SB5-10	4/16	747			X	X		X				E	2	JG	C	
3	-3	SB5-15	4/16	757			X	X		X				E	2	JG	C	
4	-4	SB5-20	4/16	805			X	X		X				E	2	JG	C	
5	-5	SB5-25	4/16	822			X	X		X				E	2	JG	C	
6	-6	SB5-30	4/16	831			X	X		X				E	2	JG	C	
7	-7	SB5-35	4/16	850			X	X		X				E	2	JG	C	
8	-8	SB5-40	4/16	903			X	X		X				E	2	JG	C	
9	-9	SB5-45	4/16	918			X	X		X				E	2	JG	C	
10	-10	SB5-50	4/16	940			X	X		X				E	2	JG	C	

Q A / Q C
RTNE ☐
CT ☐
SWRCB ☐ Logcode ____
OTHER ____

- TAT starts 8 a.m. following day if samples received after 3 p.m.

TAT: ☐ A= Overnight ≤ 24 hr ☐ B= Emergency Next workday ☐ C= Critical 2 Workdays ☐ D= Urgent 3 Workdays ☐ E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=Hcl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: **White** with report, **Yellow** to folder, **Pink** to submitter.

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories, Inc.
3151-3153 W. Post Rd.
Las Vegas, NV 89118
Tel: (702) 307-2659 • Fax: (702) 307-2691

FOR LABORATORY USE ONLY:

P.O.#:

Logged By: MRC Date: 4/22/13 (19)

Method of Transport: Client ☑ ATL ☐ CA OverN ☐ FEDEX ☐ Other:

Sample Condition Upon Receipt: 1. CHILLED 1.8°C ICE IR#2 Y☐ N☐ | 2. HEADSPACE (VOA) Y☐ N☐ | 3. CONTAINER INTACT Y☐ N☐ | 4. SEALED Y☐ N☐ | 5. # OF SPLS MATCH COC Y☐ N☐ | 6. PRESERVED Y☐ N☐

Client: BEC
Attn: Brian Loffman
Address: 7660 W. Sahara Ave #150
City LV State NV Zip Code 89117
TEL: (702) 304-9830
FAX: ( )

Project Name: Coaldale Junction Project #: 804.11.TRE

Sampler: I attest to the validity and authenticity of this sample. I am aware that tampering with or intentionally mislabeling the sample location, date or time of collection is considered fraud and may be grounds for legal action. (Printed Name) Brian Loffman (Signature)

Relinquished by: (Signature and Printed Name) Brian Loffman	Date: 4/19/13	Time: 15:03	Received by: (Signature and Printed Name) MRC ATL	Date: 4/19/13	Time: 1505
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:
Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: Brian Loffman (Print Name) 4/19/13 (Date) (Signature)

Send Report To:
Attn: Brian Loffman
Co: BEC
Address 7660 W. Sahara
City LV State NV Zip 89117

Bill To:
Attn:
Co: Same
Address
City State Zip

Special Instructions/Comments:
email reports to:
brian@becnv.com

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	8260B (VOC)	8260B (BTEX), (MTBE)	8015B (GRO)	8015B (DRO), (Motor Oil/ORO)	RCRAB (6010B/7000)	SOIL	WATER	GROUND WATER	WASTEWATER	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
11	N0100065-11	SB5-55	4/16	954			X	X		X				E	2	J G	C	
12	-12	SB5-60	4/16	1014			X	X		X				E	2	J G	C	
13	-13	SB5-70	4/16	1043			X	X		X				E	2	J G	C	
14	-14	SB5-80	4/16	1110			X	X		X				E	2	J G	C	
15	-15	SB5-100	4/16	1210			X	X		X				E	2	J G	C	
16	-16	SB6-5	4/16	147			X	X		X				E	2	J G	C	
17	-17	SB6-10	4/16	200			X	X		X				E	2	J G	C	
18	-18	SB6-15	4/16	212			X	X		X				E	2	J G	C	
19	-19	SB6-20	4/16	227			X	X		X				E	2	J G	C	

Circle or Add Analysis(es) Requested

SPECIFY APPROPRIATE MATRIX

Container(s)

QA/QC: RTNE ☐ CT ☐ SWRCB ☐ Logcode ___ OTHER ___

- TAT starts 8 a.m. following day if samples received after 3 p.m.

TAT: ☐ A= Overnight ≤ 24 hr ☐ B= Emergency Next workday ☐ C= Critical 2 Workdays ☐ D= Urgent 3 Workdays ☐ E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: **White** with report, **Yellow** to folder, **Pink** to submitter.

Advanced Technology Laboratories, Inc.

Please review the checklist below. Any NO signifies non-compliance. Any non-compliance will be noted and must be understood as having an impact on the quality of the data. All tests will be performed as requested regardless of any compliance issues.

If you have any questions or further instruction, please contact our Project Coordinator at (702) 307-2659.

Cooler Received/Opened On:	4/19/2013	Workorder:	N010065
Rep sample Temp (Deg C):	1.8	IR Gun ID:	2
Temp Blank:	☐ Yes ☑ No		
Carrier name:	Client		
Last 4 digits of Tracking No.:	NA	Packing Material Used:	None
Cooling process:	☑ Ice ☐ Ice Pack ☐ Dry Ice ☐ Other ☐ None		

Sample Receipt Checklist

1. Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
2. Custody seals intact, signed, dated on shippping container/cooler?	Yes ☐	No ☐	Not Present ☑
3. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
4. Chain of custody present?	Yes ☑	No ☐	
5. Sampler's name present in COC?	Yes ☑	No ☐	
6. Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
7. Chain of custody agrees with sample labels?	Yes ☑	No ☐	
8. Samples in proper container/bottle?	Yes ☑	No ☐	
9. Sample containers intact?	Yes ☑	No ☐	
10. Sufficient sample volume for indicated test?	Yes ☑	No ☐	
11. All samples received within holding time?	Yes ☑	No ☐	
12. Temperature of rep sample or Temp Blank within acceptable limit?	Yes ☑	No ☐	NA ☐
13. Water - VOA vials have zero headspace?	Yes ☐	No ☐	NA ☑
14. Water - pH acceptable upon receipt? Example: pH > 12 for (CN,S); pH<2 for Metals	Yes ☐	No ☐	NA ☑
15. Did the bottle labels indicate correct preservatives used?	Yes ☐	No ☐	NA ☑
16. Were there Non-Conformance issues at login?	Yes ☐	No ☐	NA ☑
Was Client notified?	Yes ☐	No ☐	NA ☑

Comments:

Checklist Completed B MBC MBC 4/22/13

Reviewed By: pjd

Appendix G

Groundwater Laboratory Analytical Data Reports

July 10, 2013

Brian Loffman
BEC Environmental, Inc.
7660 W. Sahara Ave., Ste. 150
Las Vegas, NV 89117

TEL: (702) 304-9830
FAX: (702) 304-9839

CA-ELAP No.:2676
NV Cert. No.:NV-009222007A

Workorder No.: N010485

RE: Coaldale, 804.11.001

Attention: Brian Loffman

Enclosed are the results for sample(s) received on June 28, 2013 by Advanced Technology Laboratories, Inc. . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

I hereby certify that all laboratory analysis requested were performed by Nevada Division of Environmental Protection-certified laboratory for the parameters and matrices reported herein.

Thank you for the opportunity to service the needs of your company.Please feel free to call me at (702) 307-2659 if I can be of further assistance to your company.

Sincerely,

Jose Tenorio Jr.
Laboratory Director

CLIENT: BEC Environmental, Inc.
Project: Coaldale, 804.11.001
Lab Order: N010485

CASE NARRATIVE

SAMPLE RECEIVING/GENERAL COMMENTS:

Samples were received intact with proper chain of custody documentation.

Cooler temperature and sample preservation were verified upon receipt of samples if applicable.

Information on sample receipt conditions including discrepancies can be found in attached Sample Receipt Checklist Form.

Samples were analyzed within method holding time.

Analytical Comments for EPA 8260B:

Dilution was necessary due to soapy nature of matrix. Samples form bubbles when purged.

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

Advanced Technology Laboratories, Inc.

Date: *10-Jul-13*

CLIENT: BEC Environmental, Inc.
Project: Coaldale, 804.11.001
Lab Order: N010485
Contract No:

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Matrix	Collection Date	Date Received	Date Reported
N010485-001A	SB1	Water	6/28/2013 8:55:00 AM	6/28/2013	7/10/2013
N010485-002A	SB2	Water	6/25/2013 8:06:00 AM	6/28/2013	7/10/2013
N010485-003A	SB3	Water	6/26/2013 7:53:00 AM	6/28/2013	7/10/2013

CLIENT: BEC Environmental, Inc.
Lab Order: N010485
Project: Coaldale, 804.11.001
Lab ID: N010485-001

Client Sample ID: SB1
Collection Date: 6/28/2013 8:55:00 AM
Matrix: WATER

VOLATILE ORGANIC COMPOUNDS BY GC/MS

EPA 8260B

RunID: MS5_130708A QC Batch: P13VW106 PrepDate: Analyst: **QBM**

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
1,1,1,2-Tetrachloroethane	ND	10		µg/L	20	7/8/2013 04:16 PM
1,1,1-Trichloroethane	ND	10		µg/L	20	7/8/2013 04:16 PM
1,1,2,2-Tetrachloroethane	ND	10		µg/L	20	7/8/2013 04:16 PM
1,1,2-Trichloroethane	ND	10		µg/L	20	7/8/2013 04:16 PM
1,1-Dichloroethane	ND	10		µg/L	20	7/8/2013 04:16 PM
1,1-Dichloroethene	ND	10		µg/L	20	7/8/2013 04:16 PM
1,1-Dichloropropene	ND	10		µg/L	20	7/8/2013 04:16 PM
1,2,3-Trichlorobenzene	ND	10		µg/L	20	7/8/2013 04:16 PM
1,2,3-Trichloropropane	ND	10		µg/L	20	7/8/2013 04:16 PM
1,2,4-Trichlorobenzene	ND	10		µg/L	20	7/8/2013 04:16 PM
1,2,4-Trimethylbenzene	ND	10		µg/L	20	7/8/2013 04:16 PM
1,2-Dibromo-3-chloropropane	ND	20		µg/L	20	7/8/2013 04:16 PM
1,2-Dibromoethane	ND	10		µg/L	20	7/8/2013 04:16 PM
1,2-Dichlorobenzene	ND	10		µg/L	20	7/8/2013 04:16 PM
1,2-Dichloroethane	ND	10		µg/L	20	7/8/2013 04:16 PM
1,2-Dichloropropane	ND	10		µg/L	20	7/8/2013 04:16 PM
1,3,5-Trimethylbenzene	ND	10		µg/L	20	7/8/2013 04:16 PM
1,3-Dichlorobenzene	ND	10		µg/L	20	7/8/2013 04:16 PM
1,3-Dichloropropane	ND	10		µg/L	20	7/8/2013 04:16 PM
1,4-Dichlorobenzene	ND	10		µg/L	20	7/8/2013 04:16 PM
2,2-Dichloropropane	ND	10		µg/L	20	7/8/2013 04:16 PM
2-Chlorotoluene	ND	10		µg/L	20	7/8/2013 04:16 PM
4-Chlorotoluene	ND	10		µg/L	20	7/8/2013 04:16 PM
4-Isopropyltoluene	ND	10		µg/L	20	7/8/2013 04:16 PM
Benzene	ND	10		µg/L	20	7/8/2013 04:16 PM
Bromobenzene	ND	10		µg/L	20	7/8/2013 04:16 PM
Bromodichloromethane	ND	10		µg/L	20	7/8/2013 04:16 PM
Bromoform	ND	10		µg/L	20	7/8/2013 04:16 PM
Bromomethane	ND	20		µg/L	20	7/8/2013 04:16 PM
Carbon tetrachloride	ND	10		µg/L	20	7/8/2013 04:16 PM
Chlorobenzene	ND	10		µg/L	20	7/8/2013 04:16 PM
Chloroethane	ND	20		µg/L	20	7/8/2013 04:16 PM
Chloroform	ND	10		µg/L	20	7/8/2013 04:16 PM
Chloromethane	ND	10		µg/L	20	7/8/2013 04:16 PM
cis-1,2-Dichloroethene	ND	10		µg/L	20	7/8/2013 04:16 PM
cis-1,3-Dichloropropene	ND	10		µg/L	20	7/8/2013 04:16 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories, Inc.

ANALYTICAL RESULTS

Print Date: *10-Jul-13*

CLIENT: BEC Environmental, Inc.
Lab Order: N010485
Project: Coaldale, 804.11.001
Lab ID: N010485-001

Client Sample ID: SB1
Collection Date: 6/28/2013 8:55:00 AM
Matrix: WATER

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
			EPA 8260B			
RunID: MS5_130708A	QC Batch: P13VW106			PrepDate:		Analyst: **QBM**
Dibromochloromethane	ND	10		µg/L	20	7/8/2013 04:16 PM
Dibromomethane	ND	10		µg/L	20	7/8/2013 04:16 PM
Dichlorodifluoromethane	ND	10		µg/L	20	7/8/2013 04:16 PM
Ethylbenzene	ND	10		µg/L	20	7/8/2013 04:16 PM
Hexachlorobutadiene	ND	10		µg/L	20	7/8/2013 04:16 PM
Isopropylbenzene	ND	10		µg/L	20	7/8/2013 04:16 PM
m,p-Xylene	ND	20		µg/L	20	7/8/2013 04:16 PM
Methylene chloride	ND	40		µg/L	20	7/8/2013 04:16 PM
MTBE	ND	10		µg/L	20	7/8/2013 04:16 PM
n-Butylbenzene	ND	10		µg/L	20	7/8/2013 04:16 PM
n-Propylbenzene	ND	10		µg/L	20	7/8/2013 04:16 PM
Naphthalene	ND	10		µg/L	20	7/8/2013 04:16 PM
o-Xylene	ND	10		µg/L	20	7/8/2013 04:16 PM
sec-Butylbenzene	ND	10		µg/L	20	7/8/2013 04:16 PM
Styrene	ND	10		µg/L	20	7/8/2013 04:16 PM
tert-Butylbenzene	ND	10		µg/L	20	7/8/2013 04:16 PM
Tetrachloroethene	ND	10		µg/L	20	7/8/2013 04:16 PM
Toluene	ND	10		µg/L	20	7/8/2013 04:16 PM
trans-1,2-Dichloroethene	ND	10		µg/L	20	7/8/2013 04:16 PM
Trichloroethene	ND	10		µg/L	20	7/8/2013 04:16 PM
Trichlorofluoromethane	ND	10		µg/L	20	7/8/2013 04:16 PM
Vinyl chloride	ND	10		µg/L	20	7/8/2013 04:16 PM
Surr: 1,2-Dichloroethane-d4	110	70-127		%REC	20	7/8/2013 04:16 PM
Surr: 4-Bromofluorobenzene	100	80-120		%REC	20	7/8/2013 04:16 PM
Surr: Dibromofluoromethane	113	73-128		%REC	20	7/8/2013 04:16 PM
Surr: Toluene-d8	104	80-120		%REC	20	7/8/2013 04:16 PM
GASOLINE RANGE ORGANICS BY GC/FID						
			EPA 8015B			
RunID: GC4_130703A	QC Batch: E13VW038			PrepDate:		Analyst: **QBM**
GRO	ND	0.050		mg/L	1	7/3/2013 04:57 PM
Surr: Chlorobenzene - d5	111	74-126		%REC	1	7/3/2013 04:57 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Lab Order: N010485
Project: Coaldale, 804.11.001
Lab ID: N010485-002

Client Sample ID: SB2
Collection Date: 6/25/2013 8:06:00 AM
Matrix: WATER

VOLATILE ORGANIC COMPOUNDS BY GC/MS

EPA 8260B

RunID: MS5_130708A | QC Batch: P13VW106 | PrepDate: | Analyst: **QBM**

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
1,1,1,2-Tetrachloroethane	ND	10		µg/L	20	7/8/2013 04:44 PM
1,1,1-Trichloroethane	ND	10		µg/L	20	7/8/2013 04:44 PM
1,1,2,2-Tetrachloroethane	ND	10		µg/L	20	7/8/2013 04:44 PM
1,1,2-Trichloroethane	ND	10		µg/L	20	7/8/2013 04:44 PM
1,1-Dichloroethane	ND	10		µg/L	20	7/8/2013 04:44 PM
1,1-Dichloroethene	ND	10		µg/L	20	7/8/2013 04:44 PM
1,1-Dichloropropene	ND	10		µg/L	20	7/8/2013 04:44 PM
1,2,3-Trichlorobenzene	ND	10		µg/L	20	7/8/2013 04:44 PM
1,2,3-Trichloropropane	ND	10		µg/L	20	7/8/2013 04:44 PM
1,2,4-Trichlorobenzene	ND	10		µg/L	20	7/8/2013 04:44 PM
1,2,4-Trimethylbenzene	ND	10		µg/L	20	7/8/2013 04:44 PM
1,2-Dibromo-3-chloropropane	ND	20		µg/L	20	7/8/2013 04:44 PM
1,2-Dibromoethane	ND	10		µg/L	20	7/8/2013 04:44 PM
1,2-Dichlorobenzene	ND	10		µg/L	20	7/8/2013 04:44 PM
1,2-Dichloroethane	ND	10		µg/L	20	7/8/2013 04:44 PM
1,2-Dichloropropane	ND	10		µg/L	20	7/8/2013 04:44 PM
1,3,5-Trimethylbenzene	ND	10		µg/L	20	7/8/2013 04:44 PM
1,3-Dichlorobenzene	ND	10		µg/L	20	7/8/2013 04:44 PM
1,3-Dichloropropane	ND	10		µg/L	20	7/8/2013 04:44 PM
1,4-Dichlorobenzene	ND	10		µg/L	20	7/8/2013 04:44 PM
2,2-Dichloropropane	ND	10		µg/L	20	7/8/2013 04:44 PM
2-Chlorotoluene	ND	10		µg/L	20	7/8/2013 04:44 PM
4-Chlorotoluene	ND	10		µg/L	20	7/8/2013 04:44 PM
4-Isopropyltoluene	ND	10		µg/L	20	7/8/2013 04:44 PM
Benzene	ND	10		µg/L	20	7/8/2013 04:44 PM
Bromobenzene	ND	10		µg/L	20	7/8/2013 04:44 PM
Bromodichloromethane	ND	10		µg/L	20	7/8/2013 04:44 PM
Bromoform	ND	10		µg/L	20	7/8/2013 04:44 PM
Bromomethane	ND	20		µg/L	20	7/8/2013 04:44 PM
Carbon tetrachloride	ND	10		µg/L	20	7/8/2013 04:44 PM
Chlorobenzene	ND	10		µg/L	20	7/8/2013 04:44 PM
Chloroethane	ND	20		µg/L	20	7/8/2013 04:44 PM
Chloroform	ND	10		µg/L	20	7/8/2013 04:44 PM
Chloromethane	ND	10		µg/L	20	7/8/2013 04:44 PM
cis-1,2-Dichloroethene	ND	10		µg/L	20	7/8/2013 04:44 PM
cis-1,3-Dichloropropene	ND	10		µg/L	20	7/8/2013 04:44 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories, Inc.

ANALYTICAL RESULTS

Print Date: *10-Jul-13*

CLIENT: BEC Environmental, Inc.
Lab Order: N010485
Project: Coaldale, 804.11.001
Lab ID: N010485-002

Client Sample ID: SB2
Collection Date: 6/25/2013 8:06:00 AM
Matrix: WATER

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
EPA 8260B						
RunID: MS5_130708A	QC Batch: P13VW106			PrepDate:		Analyst: **QBM**
Dibromochloromethane	ND	10		µg/L	20	7/8/2013 04:44 PM
Dibromomethane	ND	10		µg/L	20	7/8/2013 04:44 PM
Dichlorodifluoromethane	ND	10		µg/L	20	7/8/2013 04:44 PM
Ethylbenzene	ND	10		µg/L	20	7/8/2013 04:44 PM
Hexachlorobutadiene	ND	10		µg/L	20	7/8/2013 04:44 PM
Isopropylbenzene	ND	10		µg/L	20	7/8/2013 04:44 PM
m,p-Xylene	ND	20		µg/L	20	7/8/2013 04:44 PM
Methylene chloride	ND	40		µg/L	20	7/8/2013 04:44 PM
MTBE	ND	10		µg/L	20	7/8/2013 04:44 PM
n-Butylbenzene	ND	10		µg/L	20	7/8/2013 04:44 PM
n-Propylbenzene	ND	10		µg/L	20	7/8/2013 04:44 PM
Naphthalene	ND	10		µg/L	20	7/8/2013 04:44 PM
o-Xylene	ND	10		µg/L	20	7/8/2013 04:44 PM
sec-Butylbenzene	ND	10		µg/L	20	7/8/2013 04:44 PM
Styrene	ND	10		µg/L	20	7/8/2013 04:44 PM
tert-Butylbenzene	ND	10		µg/L	20	7/8/2013 04:44 PM
Tetrachloroethene	ND	10		µg/L	20	7/8/2013 04:44 PM
Toluene	ND	10		µg/L	20	7/8/2013 04:44 PM
trans-1,2-Dichloroethene	ND	10		µg/L	20	7/8/2013 04:44 PM
Trichloroethene	ND	10		µg/L	20	7/8/2013 04:44 PM
Trichlorofluoromethane	ND	10		µg/L	20	7/8/2013 04:44 PM
Vinyl chloride	ND	10		µg/L	20	7/8/2013 04:44 PM
Surr: 1,2-Dichloroethane-d4	114	70-127		%REC	20	7/8/2013 04:44 PM
Surr: 4-Bromofluorobenzene	102	80-120		%REC	20	7/8/2013 04:44 PM
Surr: Dibromofluoromethane	114	73-128		%REC	20	7/8/2013 04:44 PM
Surr: Toluene-d8	104	80-120		%REC	20	7/8/2013 04:44 PM
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B						
RunID: GC4_130703A	QC Batch: E13VW038			PrepDate:		Analyst: **QBM**
GRO	ND	0.050		mg/L	1	7/3/2013 05:28 PM
Surr: Chlorobenzene - d5	106	74-126		%REC	1	7/3/2013 05:28 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Lab Order: N010485
Project: Coaldale, 804.11.001
Lab ID: N010485-003

Client Sample ID: SB3
Collection Date: 6/26/2013 7:53:00 AM
Matrix: WATER

VOLATILE ORGANIC COMPOUNDS BY GC/MS

EPA 8260B

RunID: MS5_130708A QC Batch: P13VW106 PrepDate: Analyst: **QBM**

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
1,1,1,2-Tetrachloroethane	ND	10		µg/L	20	7/8/2013 05:11 PM
1,1,1-Trichloroethane	ND	10		µg/L	20	7/8/2013 05:11 PM
1,1,2,2-Tetrachloroethane	ND	10		µg/L	20	7/8/2013 05:11 PM
1,1,2-Trichloroethane	ND	10		µg/L	20	7/8/2013 05:11 PM
1,1-Dichloroethane	ND	10		µg/L	20	7/8/2013 05:11 PM
1,1-Dichloroethene	ND	10		µg/L	20	7/8/2013 05:11 PM
1,1-Dichloropropene	ND	10		µg/L	20	7/8/2013 05:11 PM
1,2,3-Trichlorobenzene	ND	10		µg/L	20	7/8/2013 05:11 PM
1,2,3-Trichloropropane	ND	10		µg/L	20	7/8/2013 05:11 PM
1,2,4-Trichlorobenzene	ND	10		µg/L	20	7/8/2013 05:11 PM
1,2,4-Trimethylbenzene	ND	10		µg/L	20	7/8/2013 05:11 PM
1,2-Dibromo-3-chloropropane	ND	20		µg/L	20	7/8/2013 05:11 PM
1,2-Dibromoethane	ND	10		µg/L	20	7/8/2013 05:11 PM
1,2-Dichlorobenzene	ND	10		µg/L	20	7/8/2013 05:11 PM
1,2-Dichloroethane	ND	10		µg/L	20	7/8/2013 05:11 PM
1,2-Dichloropropane	ND	10		µg/L	20	7/8/2013 05:11 PM
1,3,5-Trimethylbenzene	ND	10		µg/L	20	7/8/2013 05:11 PM
1,3-Dichlorobenzene	ND	10		µg/L	20	7/8/2013 05:11 PM
1,3-Dichloropropane	ND	10		µg/L	20	7/8/2013 05:11 PM
1,4-Dichlorobenzene	ND	10		µg/L	20	7/8/2013 05:11 PM
2,2-Dichloropropane	ND	10		µg/L	20	7/8/2013 05:11 PM
2-Chlorotoluene	ND	10		µg/L	20	7/8/2013 05:11 PM
4-Chlorotoluene	ND	10		µg/L	20	7/8/2013 05:11 PM
4-Isopropyltoluene	ND	10		µg/L	20	7/8/2013 05:11 PM
Benzene	18	10		µg/L	20	7/8/2013 05:11 PM
Bromobenzene	ND	10		µg/L	20	7/8/2013 05:11 PM
Bromodichloromethane	ND	10		µg/L	20	7/8/2013 05:11 PM
Bromoform	ND	10		µg/L	20	7/8/2013 05:11 PM
Bromomethane	ND	20		µg/L	20	7/8/2013 05:11 PM
Carbon tetrachloride	ND	10		µg/L	20	7/8/2013 05:11 PM
Chlorobenzene	ND	10		µg/L	20	7/8/2013 05:11 PM
Chloroethane	ND	20		µg/L	20	7/8/2013 05:11 PM
Chloroform	ND	10		µg/L	20	7/8/2013 05:11 PM
Chloromethane	ND	10		µg/L	20	7/8/2013 05:11 PM
cis-1,2-Dichloroethene	ND	10		µg/L	20	7/8/2013 05:11 PM
cis-1,3-Dichloropropene	ND	10		µg/L	20	7/8/2013 05:11 PM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- S Spike/Surrogate outside of limits due to matrix interference
- Results are wet unless otherwise specified
- DO Surrogate Diluted Out

Advanced Technology Laboratories, Inc.

ANALYTICAL RESULTS

Print Date: *10-Jul-13*

CLIENT: BEC Environmental, Inc.
Lab Order: N010485
Project: Coaldale, 804.11.001
Lab ID: N010485-003

Client Sample ID: SB3
Collection Date: 6/26/2013 7:53:00 AM
Matrix: WATER

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
			EPA 8260B			
RunID: MS5_130708A	QC Batch: P13VW106			PrepDate:		Analyst: **QBM**
Dibromochloromethane	ND	10		µg/L	20	7/8/2013 05:11 PM
Dibromomethane	ND	10		µg/L	20	7/8/2013 05:11 PM
Dichlorodifluoromethane	ND	10		µg/L	20	7/8/2013 05:11 PM
Ethylbenzene	ND	10		µg/L	20	7/8/2013 05:11 PM
Hexachlorobutadiene	ND	10		µg/L	20	7/8/2013 05:11 PM
Isopropylbenzene	ND	10		µg/L	20	7/8/2013 05:11 PM
m,p-Xylene	ND	20		µg/L	20	7/8/2013 05:11 PM
Methylene chloride	ND	40		µg/L	20	7/8/2013 05:11 PM
MTBE	14	10		µg/L	20	7/8/2013 05:11 PM
n-Butylbenzene	ND	10		µg/L	20	7/8/2013 05:11 PM
n-Propylbenzene	ND	10		µg/L	20	7/8/2013 05:11 PM
Naphthalene	85	10		µg/L	20	7/8/2013 05:11 PM
o-Xylene	ND	10		µg/L	20	7/8/2013 05:11 PM
sec-Butylbenzene	ND	10		µg/L	20	7/8/2013 05:11 PM
Styrene	ND	10		µg/L	20	7/8/2013 05:11 PM
tert-Butylbenzene	ND	10		µg/L	20	7/8/2013 05:11 PM
Tetrachloroethene	ND	10		µg/L	20	7/8/2013 05:11 PM
Toluene	ND	10		µg/L	20	7/8/2013 05:11 PM
trans-1,2-Dichloroethene	ND	10		µg/L	20	7/8/2013 05:11 PM
Trichloroethene	ND	10		µg/L	20	7/8/2013 05:11 PM
Trichlorofluoromethane	ND	10		µg/L	20	7/8/2013 05:11 PM
Vinyl chloride	ND	10		µg/L	20	7/8/2013 05:11 PM
Surr: 1,2-Dichloroethane-d4	107	70-127		%REC	20	7/8/2013 05:11 PM
Surr: 4-Bromofluorobenzene	99.0	80-120		%REC	20	7/8/2013 05:11 PM
Surr: Dibromofluoromethane	109	73-128		%REC	20	7/8/2013 05:11 PM
Surr: Toluene-d8	101	80-120		%REC	20	7/8/2013 05:11 PM
GASOLINE RANGE ORGANICS BY GC/FID						
			EPA 8015B			
RunID: GC4_130703A	QC Batch: E13VW038			PrepDate:		Analyst: **QBM**
GRO	0.31	0.050		mg/L	1	7/3/2013 05:58 PM
Surr: Chlorobenzene - d5	96.4	74-126		%REC	1	7/3/2013 05:58 PM

Qualifiers:

B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out
E	Value above quantitation range
ND	Not Detected at the Reporting Limit
	Results are wet unless otherwise specified

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Work Order: N010485
Project: Coaldale, 804.11.001

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015GAS_WP

Sample ID: **E130703LCS** SampType: **LCS** TestCode: **8015GAS_WP** Units: **mg/L** Prep Date: RunNo: **89450**
Client ID: **LCSW** Batch ID: **E13VW038** TestNo: **EPA 8015B** Analysis Date: **7/3/2013** SeqNo: **1603568**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	0.947	0.050	1.000	0	94.7	70	130				
Surr: Chlorobenzene - d5	47.964		50.00		95.9	74	126				

Sample ID: **E130703MB1** SampType: **MBLK** TestCode: **8015GAS_WP** Units: **mg/L** Prep Date: RunNo: **89450**
Client ID: **PBW** Batch ID: **E13VW038** TestNo: **EPA 8015B** Analysis Date: **7/3/2013** SeqNo: **1603569**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	0.050									
Surr: Chlorobenzene - d5	51.213		50.00		102	74	126				

Sample ID: **N010479-021ADUP** SampType: **DUP** TestCode: **8015GAS_WP** Units: **mg/L** Prep Date: RunNo: **89450**
Client ID: **ZZZZZZ** Batch ID: **E13VW038** TestNo: **EPA 8015B** Analysis Date: **7/3/2013** SeqNo: **1603571**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	0.050						0	0	20	
Surr: Chlorobenzene - d5	56.020		50.00		112	74	126		0		

Sample ID: **N010510-001BMS** SampType: **MS** TestCode: **8015GAS_WP** Units: **mg/L** Prep Date: RunNo: **89450**
Client ID: **ZZZZZZ** Batch ID: **E13VW038** TestNo: **EPA 8015B** Analysis Date: **7/3/2013** SeqNo: **1603575**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	0.918	0.050	1.000	0	91.8	39	153				
Surr: Chlorobenzene - d5	51.966		50.00		104	74	126				

Sample ID: **N010510-001BMSD** SampType: **MSD** TestCode: **8015GAS_WP** Units: **mg/L** Prep Date: RunNo: **89450**
Client ID: **ZZZZZZ** Batch ID: **E13VW038** TestNo: **EPA 8015B** Analysis Date: **7/3/2013** SeqNo: **1603576**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Qualifiers:

- B Analyte detected in the associated Method Blank
- ND Not Detected at the Reporting Limit
- DO Surrogate Diluted Out
- E Value above quantitation range
- R RPD outside accepted recovery limits

Calculations are based on raw values

- H Holding times for preparation or analysis exceeded
- S Spike/Surrogate outside of limits due to matrix interference

CLIENT: BEC Environmental, Inc.
Work Order: N010485
Project: Coaldale, 804.11.001

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015GAS_WP

Sample ID: **N010510-001BMSD** SampType: **MSD** TestCode: **8015GAS_WP** Units: **mg/L** Prep Date: RunNo: **89450**
Client ID: **ZZZZZZ** Batch ID: **E13VW038** TestNo: **EPA 8015B** Analysis Date: **7/3/2013** SeqNo: **1603576**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	0.770	0.050	1.000	0	77.0	39	153	0.9180	17.5	30	
Surr: Chlorobenzene - d5	50.433		50.00		101	74	126		0		

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Work Order: N010485
Project: Coaldale, 804.11.001

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260WATERP

Sample ID: **P130708LCS** SampType: **LCS** TestCode: **8260WATERP** Units: **µg/L** Prep Date: RunNo: **89495**
Client ID: **LCSW** Batch ID: **P13VW106** TestNo: **EPA 8260B** Analysis Date: **7/8/2013** SeqNo: **1607137**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,1,1,2-Tetrachloroethane	21.520	0.50	20.00	0	108	77	127				
1,1,1-Trichloroethane	19.730	0.50	20.00	0	98.6	74	122				
1,1,2,2-Tetrachloroethane	20.710	0.50	20.00	0	104	70	128				
1,1,2-Trichloroethane	19.600	0.50	20.00	0	98.0	73	120				
1,1-Dichloroethane	19.630	0.50	20.00	0	98.2	72	120				
1,1-Dichloroethene	20.090	0.50	20.00	0	100	69	125				
1,1-Dichloropropene	19.600	0.50	20.00	0	98.0	80	120				
1,2,3-Trichlorobenzene	20.210	0.50	20.00	0	101	80	126				
1,2,3-Trichloropropane	19.540	0.50	20.00	0	97.7	68	126				
1,2,4-Trichlorobenzene	20.660	0.50	20.00	0	103	80	125				
1,2,4-Trimethylbenzene	19.840	0.50	20.00	0	99.2	80	124				
1,2-Dibromo-3-chloropropane	21.870	1.0	20.00	0	109	66	129				
1,2-Dibromoethane	19.850	0.50	20.00	0	99.2	78	120				
1,2-Dichlorobenzene	20.320	0.50	20.00	0	102	80	120				
1,2-Dichloroethane	19.470	0.50	20.00	0	97.4	79	120				
1,2-Dichloropropane	20.030	0.50	20.00	0	100	75	120				
1,3,5-Trimethylbenzene	19.900	0.50	20.00	0	99.5	80	122				
1,3-Dichlorobenzene	20.270	0.50	20.00	0	101	80	120				
1,3-Dichloropropane	20.020	0.50	20.00	0	100	80	120				
1,4-Dichlorobenzene	19.960	0.50	20.00	0	99.8	80	120				
2,2-Dichloropropane	21.570	0.50	20.00	0	108	61	151				
2-Chlorotoluene	20.010	0.50	20.00	0	100	80	120				
4-Chlorotoluene	20.020	0.50	20.00	0	100	80	120				
4-Isopropyltoluene	20.220	0.50	20.00	0	101	80	122				
Benzene	19.850	0.50	20.00	0	99.2	80	120				
Bromobenzene	20.470	0.50	20.00	0	102	80	120				
Bromodichloromethane	21.130	0.50	20.00	0	106	79	123				
Bromoform	23.520	0.50	20.00	0	118	65	141				
Bromomethane	21.040	1.0	20.00	0	105	13	175				
Carbon tetrachloride	21.620	0.50	20.00	0	108	71	136				

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Work Order: N010485
Project: Coaldale, 804.11.001

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260WATERP

Sample ID: **P130708LCS** SampType: **LCS** TestCode: **8260WATERP** Units: **µg/L** Prep Date: RunNo: **89495**
Client ID: **LCSW** Batch ID: **P13VW106** TestNo: **EPA 8260B** Analysis Date: **7/8/2013** SeqNo: **1607137**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chlorobenzene	20.040	0.50	20.00	0	100	80	120				
Chloroethane	21.870	1.0	20.00	0	109	63	137				
Chloroform	19.320	0.50	20.00	0	96.6	71	120				
Chloromethane	22.120	0.50	20.00	0	111	35	145				
cis-1,2-Dichloroethene	19.610	0.50	20.00	0	98.0	74	120				
cis-1,3-Dichloropropene	20.700	0.50	20.00	0	104	80	120				
Dibromochloromethane	22.680	0.50	20.00	0	113	74	127				
Dibromomethane	20.410	0.50	20.00	0	102	80	120				
Dichlorodifluoromethane	20.500	0.50	20.00	0	103	67	123				
Ethylbenzene	19.810	0.50	20.00	0	99.0	80	120				
Hexachlorobutadiene	20.370	0.50	20.00	0	102	80	120				
Isopropylbenzene	20.160	0.50	20.00	0	101	80	120				
m,p-Xylene	39.350	1.0	40.00	0	98.4	80	120				
Methylene chloride	19.710	2.0	20.00	0	98.6	63	126				
MTBE	18.290	0.50	20.00	0	91.4	68	119				
n-Butylbenzene	20.290	0.50	20.00	0	101	80	121				
n-Propylbenzene	20.150	0.50	20.00	0	101	80	120				
Naphthalene	20.110	0.50	20.00	0	101	74	131				
o-Xylene	20.020	0.50	20.00	0	100	80	120				
sec-Butylbenzene	20.030	0.50	20.00	0	100	80	120				
Styrene	20.260	0.50	20.00	0	101	80	120				
tert-Butylbenzene	19.840	0.50	20.00	0	99.2	80	120				
Tetrachloroethene	19.650	0.50	20.00	0	98.2	80	120				
Toluene	19.890	0.50	20.00	0	99.4	80	120				
trans-1,2-Dichloroethene	19.500	0.50	20.00	0	97.5	74	120				
Trichloroethene	19.750	0.50	20.00	0	98.8	80	120				
Trichlorofluoromethane	21.410	0.50	20.00	0	107	67	135				
Vinyl chloride	19.720	0.50	20.00	0	98.6	72	120				
Surr: 1,2-Dichloroethane-d4	24.410		25.00		97.6	70	127				
Surr: 4-Bromofluorobenzene	25.190		25.00		101	80	120				

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Work Order: N010485
Project: Coaldale, 804.11.001

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260WATERP

Sample ID: **P130708LCS** SampType: **LCS** TestCode: **8260WATERP** Units: **µg/L** Prep Date: RunNo: **89495**
Client ID: **LCSW** Batch ID: **P13VW106** TestNo: **EPA 8260B** Analysis Date: **7/8/2013** SeqNo: **1607137**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Dibromofluoromethane	25.470		25.00		102	73	128				
Surr: Toluene-d8	25.460		25.00		102	80	120				

Sample ID: **P130708LCSD** SampType: **LCSD** TestCode: **8260WATERP** Units: **µg/L** Prep Date: RunNo: **89495**
Client ID: **LCSS02** Batch ID: **P13VW106** TestNo: **EPA 8260B** Analysis Date: **7/8/2013** SeqNo: **1607138**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,1,1,2-Tetrachloroethane	21.590	0.50	20.00	0	108	77	127	21.52	0.325	20	
1,1,1-Trichloroethane	19.700	0.50	20.00	0	98.5	74	122	19.73	0.152	20	
1,1,2,2-Tetrachloroethane	21.490	0.50	20.00	0	107	70	128	20.71	3.70	20	
1,1,2-Trichloroethane	19.810	0.50	20.00	0	99.0	73	120	19.60	1.07	20	
1,1-Dichloroethane	19.940	0.50	20.00	0	99.7	72	120	19.63	1.57	20	
1,1-Dichloroethene	20.480	0.50	20.00	0	102	69	125	20.09	1.92	20	
1,1-Dichloropropene	19.840	0.50	20.00	0	99.2	80	120	19.60	1.22	20	
1,2,3-Trichlorobenzene	20.470	0.50	20.00	0	102	80	126	20.21	1.28	20	
1,2,3-Trichloropropane	20.240	0.50	20.00	0	101	68	126	19.54	3.52	20	
1,2,4-Trichlorobenzene	20.880	0.50	20.00	0	104	80	125	20.66	1.06	20	
1,2,4-Trimethylbenzene	20.250	0.50	20.00	0	101	80	124	19.84	2.05	20	
1,2-Dibromo-3-chloropropane	22.870	1.0	20.00	0	114	66	129	21.87	4.47	20	
1,2-Dibromoethane	20.070	0.50	20.00	0	100	78	120	19.85	1.10	20	
1,2-Dichlorobenzene	20.680	0.50	20.00	0	103	80	120	20.32	1.76	20	
1,2-Dichloroethane	19.630	0.50	20.00	0	98.2	79	120	19.47	0.818	20	
1,2-Dichloropropane	19.920	0.50	20.00	0	99.6	75	120	20.03	0.551	20	
1,3,5-Trimethylbenzene	20.150	0.50	20.00	0	101	80	122	19.90	1.25	20	
1,3-Dichlorobenzene	20.400	0.50	20.00	0	102	80	120	20.27	0.639	20	
1,3-Dichloropropane	20.260	0.50	20.00	0	101	80	120	20.02	1.19	20	
1,4-Dichlorobenzene	19.980	0.50	20.00	0	99.9	80	120	19.96	0.100	20	
2,2-Dichloropropane	21.340	0.50	20.00	0	107	61	151	21.57	1.07	20	
2-Chlorotoluene	20.290	0.50	20.00	0	101	80	120	20.01	1.39	20	
4-Chlorotoluene	20.350	0.50	20.00	0	102	80	120	20.02	1.63	20	

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Work Order: N010485
Project: Coaldale, 804.11.001

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260WATERP

Sample ID: **P130708LCSD** SampType: **LCSD** TestCode: **8260WATERP** Units: **µg/L** Prep Date: RunNo: **89495**
Client ID: **LCSS02** Batch ID: **P13VW106** TestNo: **EPA 8260B** Analysis Date: **7/8/2013** SeqNo: **1607138**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4-Isopropyltoluene	20.470	0.50	20.00	0	102	80	122	20.22	1.23	20	
Benzene	19.880	0.50	20.00	0	99.4	80	120	19.85	0.151	20	
Bromobenzene	20.780	0.50	20.00	0	104	80	120	20.47	1.50	20	
Bromodichloromethane	21.350	0.50	20.00	0	107	79	123	21.13	1.04	20	
Bromoform	23.700	0.50	20.00	0	118	65	141	23.52	0.762	20	
Bromomethane	21.630	1.0	20.00	0	108	13	175	21.04	2.77	20	
Carbon tetrachloride	21.470	0.50	20.00	0	107	71	136	21.62	0.696	20	
Chlorobenzene	20.180	0.50	20.00	0	101	80	120	20.04	0.696	20	
Chloroethane	21.830	1.0	20.00	0	109	63	137	21.87	0.183	20	
Chloroform	19.820	0.50	20.00	0	99.1	71	120	19.32	2.55	20	
Chloromethane	22.250	0.50	20.00	0	111	35	145	22.12	0.586	20	
cis-1,2-Dichloroethene	19.550	0.50	20.00	0	97.8	74	120	19.61	0.306	20	
cis-1,3-Dichloropropene	20.700	0.50	20.00	0	104	80	120	20.70	0	20	
Dibromochloromethane	22.630	0.50	20.00	0	113	74	127	22.68	0.221	20	
Dibromomethane	20.670	0.50	20.00	0	103	80	120	20.41	1.27	20	
Dichlorodifluoromethane	20.500	0.50	20.00	0	103	67	123	20.50	0	20	
Ethylbenzene	19.960	0.50	20.00	0	99.8	80	120	19.81	0.754	20	
Hexachlorobutadiene	20.490	0.50	20.00	0	102	80	120	20.37	0.587	20	
Isopropylbenzene	20.600	0.50	20.00	0	103	80	120	20.16	2.16	20	
m,p-Xylene	39.680	1.0	40.00	0	99.2	80	120	39.35	0.835	20	
Methylene chloride	19.790	2.0	20.00	0	99.0	63	126	19.71	0.405	20	
MTBE	18.680	0.50	20.00	0	93.4	68	119	18.29	2.11	20	
n-Butylbenzene	20.680	0.50	20.00	0	103	80	121	20.29	1.90	20	
n-Propylbenzene	20.390	0.50	20.00	0	102	80	120	20.15	1.18	20	
Naphthalene	20.900	0.50	20.00	0	104	74	131	20.11	3.85	20	
o-Xylene	19.880	0.50	20.00	0	99.4	80	120	20.02	0.702	20	
sec-Butylbenzene	20.340	0.50	20.00	0	102	80	120	20.03	1.54	20	
Styrene	20.200	0.50	20.00	0	101	80	120	20.26	0.297	20	
tert-Butylbenzene	20.210	0.50	20.00	0	101	80	120	19.84	1.85	20	
Tetrachloroethene	19.530	0.50	20.00	0	97.6	80	120	19.65	0.613	20	

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Work Order: N010485
Project: Coaldale, 804.11.001

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260WATERP

Sample ID: **P130708LCSD** SampType: **LCSD** TestCode: **8260WATERP** Units: **µg/L** Prep Date: RunNo: **89495**
Client ID: **LCSS02** Batch ID: **P13VW106** TestNo: **EPA 8260B** Analysis Date: **7/8/2013** SeqNo: **1607138**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Toluene	20.070	0.50	20.00	0	100	80	120	19.89	0.901	20	
trans-1,2-Dichloroethene	19.690	0.50	20.00	0	98.4	74	120	19.50	0.970	20	
Trichloroethene	19.640	0.50	20.00	0	98.2	80	120	19.75	0.559	20	
Trichlorofluoromethane	21.420	0.50	20.00	0	107	67	135	21.41	0.0467	20	
Vinyl chloride	20.260	0.50	20.00	0	101	72	120	19.72	2.70	20	
Surr: 1,2-Dichloroethane-d4	25.170		25.00		101	70	127		0	20	
Surr: 4-Bromofluorobenzene	25.720		25.00		103	80	120		0	20	
Surr: Dibromofluoromethane	25.870		25.00		103	73	128		0	20	
Surr: Toluene-d8	25.830		25.00		103	80	120		0	20	

Sample ID: **P130708MB2** SampType: **MBLK** TestCode: **8260WATERP** Units: **µg/L** Prep Date: RunNo: **89495**
Client ID: **PBW** Batch ID: **P13VW106** TestNo: **EPA 8260B** Analysis Date: **7/8/2013** SeqNo: **1607139**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,1,1,2-Tetrachloroethane	ND	0.50									
1,1,1-Trichloroethane	ND	0.50									
1,1,2,2-Tetrachloroethane	ND	0.50									
1,1,2-Trichloroethane	ND	0.50									
1,1-Dichloroethane	ND	0.50									
1,1-Dichloroethene	ND	0.50									
1,1-Dichloropropene	ND	0.50									
1,2,3-Trichlorobenzene	ND	0.50									
1,2,3-Trichloropropane	ND	0.50									
1,2,4-Trichlorobenzene	ND	0.50									
1,2,4-Trimethylbenzene	ND	0.50									
1,2-Dibromo-3-chloropropane	ND	1.0									
1,2-Dibromoethane	ND	0.50									
1,2-Dichlorobenzene	ND	0.50									
1,2-Dichloroethane	ND	0.50									
1,2-Dichloropropane	ND	0.50									

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Work Order: N010485
Project: Coaldale, 804.11.001

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260WATERP

Sample ID: **P130708MB2** SampType: **MBLK** TestCode: **8260WATERP** Units: **µg/L** Prep Date: RunNo: **89495**
Client ID: **PBW** Batch ID: **P13VW106** TestNo: **EPA 8260B** Analysis Date: **7/8/2013** SeqNo: **1607139**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,3,5-Trimethylbenzene	ND	0.50									
1,3-Dichlorobenzene	ND	0.50									
1,3-Dichloropropane	ND	0.50									
1,4-Dichlorobenzene	ND	0.50									
2,2-Dichloropropane	ND	0.50									
2-Chlorotoluene	ND	0.50									
4-Chlorotoluene	ND	0.50									
4-Isopropyltoluene	ND	0.50									
Benzene	ND	0.50									
Bromobenzene	ND	0.50									
Bromodichloromethane	ND	0.50									
Bromoform	ND	0.50									
Bromomethane	ND	1.0									
Carbon tetrachloride	ND	0.50									
Chlorobenzene	ND	0.50									
Chloroethane	ND	1.0									
Chloroform	ND	0.50									
Chloromethane	ND	0.50									
cis-1,2-Dichloroethene	ND	0.50									
cis-1,3-Dichloropropene	ND	0.50									
Dibromochloromethane	ND	0.50									
Dibromomethane	ND	0.50									
Dichlorodifluoromethane	ND	0.50									
Ethylbenzene	ND	0.50									
Hexachlorobutadiene	ND	0.50									
Isopropylbenzene	ND	0.50									
m,p-Xylene	ND	1.0									
Methylene chloride	ND	2.0									
MTBE	ND	0.50									
n-Butylbenzene	ND	0.50									

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CLIENT: BEC Environmental, Inc.
Work Order: N010485
Project: Coaldale, 804.11.001

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260WATERP

Sample ID: **P130708MB2** SampType: **MBLK** TestCode: **8260WATERP** Units: **µg/L** Prep Date: RunNo: **89495**
Client ID: **PBW** Batch ID: **P13VW106** TestNo: **EPA 8260B** Analysis Date: **7/8/2013** SeqNo: **1607139**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
n-Propylbenzene	ND	0.50									
Naphthalene	ND	0.50									
o-Xylene	ND	0.50									
sec-Butylbenzene	ND	0.50									
Styrene	ND	0.50									
tert-Butylbenzene	ND	0.50									
Tetrachloroethene	ND	0.50									
Toluene	ND	0.50									
trans-1,2-Dichloroethene	ND	0.50									
Trichloroethene	ND	0.50									
Trichlorofluoromethane	ND	0.50									
Vinyl chloride	ND	0.50									
Surr: 1,2-Dichloroethane-d4	26.310		25.00		105	70	127				
Surr: 4-Bromofluorobenzene	25.140		25.00		101	80	120				
Surr: Dibromofluoromethane	26.250		25.00		105	73	128				
Surr: Toluene-d8	25.360		25.00		101	80	120				

Qualifiers:

B Analyte detected in the associated Method Blank
ND Not Detected at the Reporting Limit
DO Surrogate Diluted Out
E Value above quantitation range
R RPD outside accepted recovery limits
Calculations are based on raw values
H Holding times for preparation or analysis exceeded
S Spike/Surrogate outside of limits due to matrix interference

Advanced Technology Laboratories, Inc.
3151 W. Post Rd Las Vegas, NV 89118 Tel: 702-307-2659 Fax: 702-307-2691

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories, Inc.
3151-3153 W. Post Rd.
Las Vegas, NV 89118
Tel: (702) 307-2659 • Fax: (702) 307-2691

FOR LABORATORY USE ONLY:

P.O.#: _____

Logged By: _____ Date: _____

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FEDEX ☐ Other: _____

Sample Condition Upon Receipt: 6.0°C
1. CHILLED ICE ICE/N Y☐ N☐ 4. SEALED Y☐ N☐
2. HEADSPACE (VOA) Y☐ N☐ 5. # OF SPLS MATCH COC Y☐ N☐
3. CONTAINER INTACT Y☐ N☐ 6. PRESERVED Y☐ N☐

Client: BEC Environmental Inc
Attn: Brian Loffman
Address: 7660 W. Sahara Ave #150
City: Las Vegas State: NV Zip Code: 89117
TEL: (702) 304-9830
FAX: (702) 304-9839

Project Name: Coaldale Project #: 804.11.001

Sampler: I attest to the validity and authenticity of this sample. I am aware that tampering with or intentionally mislabeling the sample location, date or time of collection is considered fraud and may be grounds for legal action. (Printed Name) Brian Loffman (Signature)

Relinquished by: (Signature and Printed Name)	John Yuen	Date: 6/28/13	Time: 1601	Received by: (Signature and Printed Name)	Brian Loffman	Date: 6/28/13	Time: 1601
Relinquished by: (Signature and Printed Name)	Brian Loffman	Date: 6/28/13	Time: 1700	Received by: (Signature and Printed Name)	[illegible]	Date: 6/28/13	Time: 1700
Relinquished by: (Signature and Printed Name)		Date:	Time:	Received by: (Signature and Printed Name)		Date:	Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter:
Brian Loffman 6/28/13
Print Name Date
Signature

Send Report To:
Attn: Brian Loffman
Co: BEC Environmental
Address: 7660 W. Sahara #150
City: LV State: NV Zip: 89117

Bill To:
Attn: Brian Loffman
Co: BEC
Address: 7660 W. Sahara
City: LV State: NV Zip: 89117

Special Instructions/Comments:

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample : $2.00 / sample / mo (after 45 days)
- Records : $1.00 / ATL workorder / mo (after 1 year)

Circle or Add Analysis(es) Requested: 8260B (VOC); 8260B (BTEX); (MTBE); 8015B (GRO); 8015B (DRO), (Motor Oil)(ORO); RCRA8 (6010B/7000)

SPECIFY APPROPRIATE MATRIX: SOIL; WATER; GROUND WATER; WASTEWATER

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample I.D. / Location	Date	Time	TAT	Container(s): #	Type	PRESERVATION	REMARKS
1	NO1N4KX5-1	SB1 Soil boring 1	6/26	0855	E	7	VG	C	
2	2	SB2 Soil boring 2	6/25	0906	E	5	VG	C	
3	3	SB3 Soil boring 3	6/26	0753	E	7	VG	C	

Q A / Q C: RTNE ☐ CT ☐ SWRCB ☐ Logcode ____ OTHER ____

• TAT starts 8 a.m. following day if samples received after 3 p.m.

TAT: ☐ A= Overnight ≤ 24 hr ☐ B= Emergency Next workday ☐ C= Critical 2 Workdays ☐ D= Urgent 3 Workdays ☐ E= Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

DISTRIBUTION: White with report, Yellow to folder, Pink to submitter.

Advanced Technology Laboratories, Inc.

Please review the checklist below. Any NO signifies non-compliance. Any non-compliance will be noted and must be understood as having an impact on the quality of the data. All tests will be performed as requested regardless of any compliance issues.

If you have any questions or further instruction, please contact our Project Coordinator at (702) 307-2659.

Cooler Received/Opened On:	6/28/2013	Workorder:	N010485
Rep sample Temp (Deg C):	6.0	IR Gun ID:	1
Temp Blank:	☐ Yes ☑ No		
Carrier name:	ATL		
Last 4 digits of Tracking No.:	NA	Packing Material Used:	None
Cooling process:	☑ Ice ☐ Ice Pack ☐ Dry Ice ☐ Other ☐ None		

Sample Receipt Checklist

1. Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
2. Custody seals intact, signed, dated on shippping container/cooler?	Yes ☐	No ☐	Not Present ☑
3. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
4. Chain of custody present?	Yes ☑	No ☐	
5. Sampler's name present in COC?	Yes ☑	No ☐	
6. Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
7. Chain of custody agrees with sample labels?	Yes ☑	No ☐	
8. Samples in proper container/bottle?	Yes ☑	No ☐	
9. Sample containers intact?	Yes ☑	No ☐	
10. Sufficient sample volume for indicated test?	Yes ☑	No ☐	
11. All samples received within holding time?	Yes ☑	No ☐	
12. Temperature of rep sample or Temp Blank within acceptable limit?	Yes ☑	No ☐	NA ☐
13. Water - VOA vials have zero headspace?	Yes ☑	No ☐	NA ☐
14. Water - pH acceptable upon receipt? Example: pH > 12 for (CN,S); pH<2 for Metals	Yes ☐	No ☐	NA ☑
15. Did the bottle labels indicate correct preservatives used?	Yes ☑	No ☐	NA ☐
16. Were there Non-Conformance issues at login?	Yes ☐	No ☐	NA ☑
Was Client notified?	Yes ☐	No ☐	NA ☑

Comments:

Checklist Completed B MBC for: HSG 9/1/13

Reviewed By:

Marlon Cartin

From: Brian Loffman [Brian@becnv.com]
Sent: Monday, July 01, 2013 11:27 AM
To: marlon@atl-labs.com
Subject: additional analysis

Marlon,
Per our telephone conversation this morning, please include gas range TPH analysis to the 3 groundwater samples submitted last Friday.
thanks

Brian Loffman, CEM
Project Manager

BEC Environmental, Inc.
7660 W. Sahara Ave., Suite 150
Las Vegas, NV 89117

Phone: 702.304.9830
Fax: 702.304.9839
Email: Brian@becnv.com

Appendix H

Asbestos Laboratory Analytical Data Reports

FIBERQUANT ANALYTICAL SERVICES

Polarized Light Microscope (PLM) Analysis for Asbestos in Bulk Sample

JobNumber:	**201306714**

Client: **BEC ENVIRONMENTAL INC**

7660 W SAHARA AVE #150

LAS VEGAS, NV 89117-0000

Office Phone: (702) 304-9830
FAX: (702) 304-9839

 # Samples: 37 PLM **Rec:** 7/23/2013 **Method:** EPA 600/R-93/116 The "New" Method; see below

Client Job: 804.11.T2E **PO Number:**

Report Date: 7/26/2013 **Date Analyzed:** 7/26/2013 **Routing Number:** -

Method and Analysis Information: **Fiberquant Internal SOP:** PLMn

Each bulk sample is first dissected under a 7-30x magnification stereo-microscope. This examination is used to determine the general type of sample, how many and what type of layers it has, and initial estimates of fiber types and quantities. Second, liquid media mounts are made of each layer - such mounts may be of selected fibers (used solely for identification purposes) or may be representative of the layer as a whole (used for quantitation purposes). The mounts may be made in a synthetic Canadian balsam, one of several solvents, or in refractive index oils (media of known refractive index). Generally, a variety of different mounts are made: some optimized for fiber visibility, some optimized for fiber identification, and some optimized for fiber quantitation. The mounted slides are then examined at 50-400x magnification on a Nikon Labphot-pol microscope. Optical characteristics are used to identify each observed fiber type; the optical data are contained for each sample on its detail analysis sheet, attached.

Current EPA and NESHAP regulations designate a result of <=1 % asbestos as "negative" and >1 % asbestos as "positive". Samples containing layers that have been determined to be "positive" may have to be handled differently during a renovation or demolition than samples whose layers have been determined to be "negative."

The method of fiber identification and quantitation is the "Standard Operating Procedures for the Analysis of Asbestos in Bulk Samples using Polarized Light Microscopy", Chapter 7 of the Quality Assurance and Management Manual. This SOP and its associated reporting have been designed to satisfy all requirements in both EPA Method 600/M4-82-020 (The Interim Method) and EPA Method 600/R-93/116 (The New Method). The Interim Method is the required method for AHERA (US EPA 40 CFR Pt. 763), but this method calls for the reporting of composited results of multi-layered samples that is no longer an acceptable reporting practice in most circumstances. Current EPA rules, such as NESHAP (US EPA 40CFT Pt. 61), as well as NVLAP accreditation policies, call for separate reporting for each layer of multi-layered samples. The New Method contains the same procedures for identification and quantification of asbestos as does the Interim Method, except that multi-layered samples are reported to comply with the latest US EPA rule. Fiberquant not only reports the asbestos content of each layer of multi-layered samples separately (satisfying current EPA and NVLAP reporting requirements), but Fiberquant also reports what percentage of the sample each layer comprises. Therefore, the results may be arithmetically composited to satisfy the reporting requirements of the Interim Method. The method of fiber quantitation is an estimation technique in which the analysts quantitation is routinely calibrated by reference quantitation standards, and which has been shown to be equivalent in precision and accuracy to point counting. Friability is estimated for the purposes of deciding when to point count. Friabilities determined in the field take precedence over those determined in the laboratory. Those sample layers which are friable and estimated by the analyst to contain <= 1% asbestos are point counted using 400 points. Such point counting is required by NESHAP (National Emission Standards for Hazardous Air Polutants, Nov. 1990) in order to rely on analytical results that are <= 1%. The coefficient of variation for the estimation quantitation technique is 100% in the range 0-5%. This means that PLM analysis is not capable of conclusively determining whether a layer containing close to 1% asbestos is actually "positive" or "negative". For this reason, Fiberquant refers to results where asbestos was detected but <= 1% as "borderline negative", and results where asbestos was >1 % but <= 2% as "borderline positive" to indicate the uncertainty in assigning a "positive" or "negative" label. In the sample summary, "ND" means that no asbestos was detected during the analysis. A "Tr" or "Trace" of asbestos reported is defined for our purposes as the detection of several asbestos fibers during the analysis; this level would be right at the limit of detection for the method. Trace is only reported on the analysis detail - in the summary a trace would be reported as <=1%. The limit of detection (the smallest % of asbestos that can be detected) varies greatly depending on the matrix in which the asbestos is found. As little as 0.001% asbestos can be detected in favorable samples, while detection in unfavorable samples may approach the detection limit of 1% stated in the method. During the analysis, the analyst, for Fiberquant identification purposes only, determines the "apparent sample type" and "apparent layer types." It must be emphasized that these types are only what is apparent. Often, different materials appear similar or identical after sampling, so the analyst may assign a type other than what was sampled.

Floor tiles present a special problem for PLM asbestos analysis. Floor tile can contain chrysotile fibers so thin that they cannot be resolved by optical methods. In such a case, we may observe a percentage of asbestos which is lower than the actual percentage, or not observe asbestos at all when some is present. For this reason, floor tiles reported as negative should be confirmed to be negative using transmission electron microscope (TEM) analysis. Likewise, vermiculite insulation materials containing traces of asbestiform asbestos present a problem for routine PLM analysis - the amphiboles are sometimes present in trace amounts inhomogeneously distributed. For this reason, loose vermiculite samples reported as negative should be confirmed to contain no amphibole using hydroseparation techniques.

The samples were analyzed under the following ongoing quality assurance program: Blank samples are routinely analyzed to maintain contamination-free materials. Each analyst has at least a bachelor's degree in physical science, and has also completed extensive training specific to asbestos analysis for 1-3 months before being allowed to analyze client samples. Qualitative reference samples are routinely analyzed to assure that

analysts can identify asbestos and asbestos-look-alike fibers. Quantitative reference samples are routinely analyzed to calibrate and characterize the estimation procedure. Microscope alignment is checked each day. Refractive index oils are calibrated at least quarterly. At least 10% of client samples are re-analyzed from scratch by a different analyst than the original, and any discrepancies are resolved for the sample and similar sample types before the results are reported. All quality checks performed for these samples were in control except as detailed in the "Analytical Notes" below. All analysts participate in interlab round robins and proficiency testing to assure competence. Fiberquant is accredited by NVLAP (Lab #101031) for the analysis of bulk samples for asbestos using PLM. Accreditation does not imply endorsement by the EPA, any other United States governmental agency or any private agency or association. Each lab analysis refers only to the sample tested, and may not, due to the sampling process, be representative of the material sampled. This report may not be reproduced except in full, without the approval of Fiberquant Analytical Services.

Some results may have been calculated using client supplied data, such as volume or area sampled, for which Fiberquant assumes no liability for accuracy.

Job Analysis Notes:

PLM Analysis Summary: **Job Number: 201306714** 804.11.T2E

Sample Number / Layer	Color	Apparent Layer Type *	Lab Number / Asbestos Results	Apparent Sample Type *	Positive Layer Yes or No
Sample # **Bldg 1-N**			2013-06714- 1	Wall System	Positive Layer? No
Layer # 1	tan	paper/cardboard	*no asbestos detected*		
Layer # 2	white	drywall core	*no asbestos detected*		
Sample # **Bldg 1-S**			2013-06714- 2	Wall System	Positive Layer? No
Layer # 1	tan	paper/cardboard	*no asbestos detected*		
Layer # 2	white	drywall core	*no asbestos detected*		
Sample # **Bldg 1-E**			2013-06714- 3	Wall System	Positive Layer? No
Layer # 1	tan	paper/cardboard	*no asbestos detected*		
Layer # 2	white	drywall core	*no asbestos detected*		
Sample # **Bldg 1-W**			2013-06714- 4	Wall System	Positive Layer? No
Layer # 1	tan	paper/cardboard	*no asbestos detected*		
Layer # 2	white	drywall core	*no asbestos detected*		
Sample # **Bldg 3-N**			2013-06714- 5	Roofing	Positive Layer? No
Layer # 1	black	roofing roll/shingle	*no asbestos detected*		
Sample # **Bldg 3-S**			2013-06714- 6	Roofing	Positive Layer? No
Layer # 1	black	roofing roll/shingle	*no asbestos detected*		
Sample # **Bldg 5-INS**			2013-06714- 7	Insulation	Positive Layer? No
Layer # 1	white	insulation	*no asbestos detected*		
Sample # **Bldg 5-VT1**			2013-06714- 8	Flooring	Positive Layer? Yes
Layer # 1	gray	floor tile	*5-10% chrysotile asbestos*		
Layer # 2	black	mastic	*5-10% chrysotile asbestos*		
Layer # 3	brown	bitumen-paper	*no asbestos detected*		
Layer # 4	brown	mastic	*no asbestos detected*		
Sample # **Bldg 5-VT2**			2013-06714- 9	Flooring	Positive Layer? Yes
Layer # 1	green	sheet flooring surface	*no asbestos detected*		
Layer # 2	black	sheet flooring backing	*no asbestos detected*		
Layer # 3	tan	mastic	*>1-2% chrysotile asbestos*		
Layer # 4	black	bitumen-paper	*no asbestos detected*		
Sample # **Bldg 5-TSI**			2013-06714- 10	Insulation	Positive Layer? Yes
Layer # 1	tan	insulation wrap	*no asbestos detected*		
Layer # 2	white	insulation	*5-10% amosite (grunerite) asbestos*	*5-10% chrysotile asbestos*	
Sample # **Bldg 5-TE**			2013-06714- 11	Cementitious	Positive Layer? Yes
Layer # 1	off-white	paint	*no asbestos detected*		
Layer # 2	gray	cem/asb board	*5-10% chrysotile asbestos*		
Sample # **Bldg 5-RS**			2013-06714- 12	Roofing	Positive Layer? No
Layer # 1	black	roofing roll/shingle	*no asbestos detected*		
Layer # 2	black	roof ply	*no asbestos detected*		
Sample # **Bldg 5-I W**			2013-06714- 13	Wall System	Positive Layer? No
Layer # 1	pink	paint	*no asbestos detected*		
Layer # 2	tan	paper/cardboard	*no asbestos detected*		
Layer # 3	white	drywall core	*no asbestos detected*		
Sample # **Bldg 6-5 VT**			2013-06714- 14	Flooring	Positive Layer? Yes
Layer # 1	tan	floor tile	*10-20% chrysotile asbestos*		
Layer # 2	black	mastic	*no asbestos detected*		
Sample # **Bldg 6-4 VT**			2013-06714- 15	Flooring	Positive Layer? Yes
Layer # 1	off-white	powder	*no asbestos detected*		
Layer # 2	off-white	floor tile	*>1-2% chrysotile asbestos*		
Layer # 3	black	mastic	*no asbestos detected*		
Sample # **Bldg 6-5 IW**			2013-06714- 16	Wall System	Positive Layer? No
Layer # 1	off-white	paint	*no asbestos detected*		
Layer # 2	tan	paper/cardboard	*no asbestos detected*		
Layer # 3	white	drywall core	*no asbestos detected*		

Sample #	**Bldg 6-6 EW**		2013-06714- 17	Wall System	Positive Layer?	No
Layer # 1	green	paint	*no asbestos detected*			
Layer # 2	black	bitumen-paper	*no asbestos detected*			
Layer # 3	tan	paper/cardboard	*no asbestos detected*			
Layer # 4	white	drywall core	*no asbestos detected*			
Sample #	**Bldg 6-3**		2013-06714- 18	Miscellaneous	Positive Layer?	No
Layer # 1	clear	surface	*no asbestos detected*			
Layer # 2	off-white	paint	*no asbestos detected*			
Layer # 3	black	bitumen-paper	*no asbestos detected*			
Sample #	**Bldg 6-RS**		2013-06714- 19	Roofing	Positive Layer?	No
Layer # 1	black	bitumen	*no asbestos detected*			
Layer # 2	black	roof ply/bitumen	*no asbestos detected*			
Sample #	**Bldg 6-2 ES**		2013-06714- 20	Miscellaneous	Positive Layer?	No
Layer # 1	off-white	paint	*no asbestos detected*			
Layer # 2	black	bitumen-paper	*no asbestos detected*			
Sample #	**Bldg 6-1 ES**		2013-06714- 21	Miscellaneous	Positive Layer?	No
Layer # 1	black	bitumen-paper	*no asbestos detected*			
Sample #	**Bldg 6-3 IW**		2013-06714- 22	Wall System	Positive Layer?	No
Layer # 1	white	paint	*no asbestos detected*			
Layer # 2	tan	paper/cardboard	*no asbestos detected*			
Layer # 3	white	drywall core	*no asbestos detected*			
Sample #	**Bldg 7 IW**		2013-06714- 23	Wall System	Positive Layer?	No
Layer # 1	tan	paint	*no asbestos detected*			
Layer # 2	white	texture/joint compound	*no asbestos detected*			
Layer # 3	off-white	paper/cardboard	*no asbestos detected*			
Layer # 4	white	texture/joint compound	*no asbestos detected*			
Layer # 5	tan	paper/cardboard	*no asbestos detected*			
Layer # 6	white	drywall core	*no asbestos detected*			
Sample #	**Bldg 7 EW**		2013-06714- 24	Wall System	Positive Layer?	No
Layer # 1	tan	paint	*no asbestos detected*			
Layer # 2	white	plaster	*no asbestos detected*			
Sample #	**Bldg 7 RS**		2013-06714- 25	Roofing	Positive Layer?	No
Layer # 1	black	roofing roll/shingle	*no asbestos detected*			
Layer # 2	black	roofing roll/shingle	*no asbestos detected*			
Sample #	**Bldg 8 VT1**		2013-06714- 26	Flooring	Positive Layer?	Yes
Layer # 1	off-white	floor tile	*>1-2% chrysotile asbestos*			
Layer # 2	black	mastic	*no asbestos detected*			
Sample #	**Bldg 8 VT2**		2013-06714- 27	Flooring	Positive Layer?	No
Layer # 1	tan	sheet flooring surface	*no asbestos detected*			
Layer # 2	tan	sheet flooring backing	*no asbestos detected*			
Sample #	**Bldg 8 VT3**		2013-06714- 28	Flooring	Positive Layer?	Yes
Layer # 1	off-white	floor tile	*>1-2% chrysotile asbestos*			
Layer # 2	black	mastic	*no asbestos detected*			
Sample #	**Bldg 8 MISC**		2013-06714- 29	Miscellaneous	Positive Layer?	No
Layer # 1	off-white	surface	*no asbestos detected*			
Layer # 2	brown	bitumen-paper	*no asbestos detected*			
Layer # 3	tan	mastic	*no asbestos detected*			
Sample #	**Bldg 9 VT**		2013-06714- 30	Flooring	Positive Layer?	No
Layer # 1	tan	floor tile	*no asbestos detected*			
Layer # 2	tan	mastic	*no asbestos detected*			
Sample #	**Bldg 9 RS**		2013-06714- 31	Roofing	Positive Layer?	No
Layer # 1	black	bitumen	*no asbestos detected*			
Layer # 2	black	roof ply	*no asbestos detected*			
Layer # 3	black	roof ply	*no asbestos detected*			
Layer # 4	black	roof ply	*no asbestos detected*			
Sample #	**Bldg 9 IW**		2013-06714- 32	Wall System	Positive Layer?	No
Layer # 1	tan	paper/cardboard	*no asbestos detected*			
Layer # 2	white	drywall core	*no asbestos detected*			
Sample #	**Bldg 10 ESM**		2013-06714- 33	Miscellaneous	Positive Layer?	No
Layer # 1	off-white	surface	*no asbestos detected*			
Layer # 2	black	bitumen-paper	*no asbestos detected*			
Layer # 3	green	backing	*no asbestos detected*			
Sample #	**Bldg 10 RS**		2013-06714- 34	Roofing	Positive Layer?	No
Layer # 1	black	roofing roll/shingle	*no asbestos detected*			
Sample #	**Bldg 10 IW**		2013-06714- 35	Wall System	Positive Layer?	No
Layer # 1	white	texture/joint compound	*no asbestos detected*			
Layer # 2	tan	paper/cardboard	*no asbestos detected*			
Layer # 3	white	drywall core	*no asbestos detected*			
Sample #	**Bldg 10 EW**		2013-06714- 36	Cementitious	Positive Layer?	Yes
Layer # 1	tan	paint	*no asbestos detected*			
Layer # 2	gray	cem/asb board	*5-10% chrysotile asbestos*			
Sample #	**Bldg 10 VT**		2013-06714- 37	Flooring	Positive Layer?	No
Layer # 1	off-white	floor tile	*no asbestos detected*			
Layer # 2	tan	mastic	*no asbestos detected*			

* Apparent Sample Types and Apparent Layer Types are as they appeared to the analyst. Since many types of materials appear similar after sampling damage, the apparent type of material may not be the actual type of material.

Sample Bldg 1-N **Lab Number** 2013-06714- 1 **Sampled:** **Condition:** acceptable
Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Wall System Fibrous Solid
Homogeneous No **# Layers** 2 **Pos Layer?** No **# Sub-Samples** 5
Non-Fibrous Components (in approx. decreasing order): powder, ,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber: Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	paper/cardboard	15	tan	2	90-100%	-	-	-	-	-
2	drywall core	85	white	3	<=1%	-	-	-	-	-
	Total %	100		**Overall %**	10-20%	-	-	-	-	-
				Fiber Identification:	cellulose fiber					

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations: Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2													
3													
4													
5													
6													

Sample Analytical Note
Procedure: tweased apart using forceps.

Sample Bldg 1-S **Lab Number** 2013-06714- 2 **Sampled:** **Condition:** acceptable
Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Wall System Fibrous Solid
Homogeneous No **# Layers** 2 **Pos Layer?** No **# Sub-Samples** 5
Non-Fibrous Components (in approx. decreasing order): powder, ,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber: Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	paper/cardboard	25	tan	2	90-100%	-	-	-	-	-
2	drywall core	75	white	3	<=1%	-	-	-	-	-
	Total %	100		**Overall %**	20-30%	-	-	-	-	-
				Fiber Identification:	cellulose fiber					

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations: Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2													
3													
4													
5													
6													

Sample Analytical Note
Procedure: tweased apart using forceps.

Sample Bldg 1-E **Lab Number** 2013-06714- 3 **Sampled:** **Condition:** acceptable
Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Wall System Fibrous Solid
Homogeneous No **# Layers** 2 **Pos Layer?** No **# Sub-Samples** 5
Non-Fibrous Components (in approx. decreasing order): powder, ,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber: Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	paper/cardboard	10	tan	2	90-100%	-	-	-	-	-
2	drywall core	90	white	3	<=1%	-	-	-	-	-
	Total %	100		**Overall %**	10-20%	-	-	-	-	-
				Fiber Identification:	cellulose fiber					

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations: Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2													
3													
4													
5													
6													

Sample Analytical Note
Procedure: tweased apart using forceps.

Sample Bldg 1-W **Lab Number** 2013-06714- 4 **Sampled:** **Condition:** acceptable
Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Wall System Fibrous Solid
Homogeneous No **# Layers** 2 **Pos Layer?** No **# Sub-Samples** 5
Non-Fibrous Components (in approx. decreasing order): powder, ,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber: Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	paper/cardboard	5	tan	2	90-100%	-	-	-	-	-
2	drywall core	95	white	3	<=1%	-	-	-	-	-
	Total %	100		**Overall %**	5-10%	-	-	-	-	-
				Fiber Identification:	cellulose fiber					

Fibers		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations: Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2													
3													
4													
5													
6													

Sample Analytical Note
Procedure: tweased apart using forceps.

Sample Bldg 3-N **Lab Number** 2013-06714- 5 **Sampled:** **Condition:** acceptable
Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Roofing Fibrous Solid
Homogeneous Yes **# Layers** 1 **Pos Layer?** No **# Sub-Samples** 3
Non-Fibrous Components (in approx. decreasing order): bitumen, rock,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber: Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	roofing roll/shingle	100	black	1	10-20%	-	-	-	-	-
	Total %	100		**Overall %**	10-20%	-	-	-	-	-
				Fiber Identification:	glass fiber					

Fibers		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations: Oil	Col Par	Col Per	RI Par	RI Per
1	glass fiber	CL	D	Y									
2													
3													
4													
5													
6													

Sample Analytical Note
Procedure: tweased apart using forceps. Procedure: dissolution of matrix using solvent.

Sample Bldg 3-S **Lab Number** 2013-06714- 6 **Sampled:** **Condition:** acceptable
Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Roofing Fibrous Solid
Homogeneous Yes **# Layers** 1 **Pos Layer?** No **# Sub-Samples** 3
Non-Fibrous Components (in approx. decreasing order): bitumen, rock,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber: Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	roofing roll/shingle	100	black	1	10-20%	-	-	-	-	-
	Total %	100		**Overall %**	10-20%	-	-	-	-	-
				Fiber Identification:	glass fiber					

Fibers		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations: Oil	Col Par	Col Per	RI Par	RI Per
1	glass fiber	CL	D	Y									
2													
3													
4													
5													
6													

Sample Analytical Note
Procedure: tweased apart using forceps. Procedure: dissolution of matrix using solvent.

Sample Bldg 5-INS **Lab Number** 2013-06714- 7 **Sampled:** **Condition:** acceptable

Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Insulation Fibrous Mat

Homogeneous Yes **# Layers** 1 **Pos Layer?** No **# Sub-Samples** 3

Non-Fibrous Components (in approx. decreasing order): binder, ,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber					
					Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	insulation	100	white	4	90-100%	-	-	-	-	-
	Total %	100		**Overall %**	90-100%	-	-	-	-	-
				Fiber Identification:	glass fiber					

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations				
									Oil	Col Par	Col Per	RI Par	RI Per
1	glass fiber	CL	D	Y									
2													
3													
4													
5													
6													

Sample Analytical Note

Procedure: tweased apart using forceps. Procedure: dissolution of matrix using solvent.

Sample Bldg 5-VT1 **Lab Number** 2013-06714- 8 **Sampled:** **Condition:** acceptable

Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Flooring Fibrous Solid

Homogeneous No **# Layers** 4 **Pos Layer?** Yes **# Sub-Samples** 10

Non-Fibrous Components (in approx. decreasing order): polymer, filler, bitumen

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber					
					Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	floor tile	40	gray	1	5-10%	n.d.	-	-	-	-
2	mastic	1	black	1	5-10%	n.d.	-	-	-	-
3	bitumen-paper	57	brown	1	n.d.	70-80%	-	-	-	-
4	mastic	2	brown	1	n.d.	2-5%	-	-	-	-
	Total %	100		**Overall %**	2-5%	40-50%	-	-	-	-
				Fiber Identification:	chrysotile asbestos	cellulose fiber				

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations				
									Oil	Col Par	Col Per	RI Par	RI Per
1	chrysotile asbestos	W	A	N	N	L	+	P	1.550	db/ly	sb/o	1.561	1.553
2	cellulose fiber	W	F	N	N	H	+	U					
3													
4													
5													
6													

Sample Analytical Note

Procedure: tweased apart using forceps. Procedure: dissolution of floor tile matrix and mastic using solvent.

Sample Bldg 5-VT2 **Lab Number** 2013-06714- 9 **Sampled:** **Condition:** acceptable

Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Flooring Fibrous Solid

Homogeneous No **# Layers** 4 **Pos Layer?** Yes **# Sub-Samples** 10

Non-Fibrous Components (in approx. decreasing order): polymer, bitumen,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber					
					Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	sheet flooring surface	15	green	1	n.d.	n.d.	n.d.	-	-	-
2	sheet flooring backing	38	black	3	60-70%	2-5%	n.d.	-	-	-
3	mastic	2	tan	1	n.d.	n.d.	>1-2%	-	-	-
4	bitumen-paper	45	black	1	60-70%	n.d.	n.d.	-	-	-
	Total %	100		**Overall %**	50-60%	>1-2%	<=1%	-	-	-
				Fiber Identification:	cellulose fiber	synthetic fiber (extr	chrysotile asbestos			

Fibers		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations				
									Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2	synthetic fiber (extruded)	W	E	N	N	H	+	P					
3	chrysotile asbestos	W	A	N	N	L	+	P	1.550	db/ly	sb/o	1.561	1.553
4													
5													
6													

Sample Analytical Note

Procedure: tweased apart using forceps. Procedure: dissolution of floor tile matrix and mastic using solvent.

Sample Bldg 5-TSI **Lab Number** 2013-06714- 10 **Sampled:** **Condition:** acceptable

Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Insulation Fibrous Solid

Homogeneous No **# Layers** 2 **Pos Layer?** Yes **# Sub-Samples** 5

Non-Fibrous Components (in approx. decreasing order): powder, binder,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber					
					Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	insulation wrap	45	tan	2	90-100%	n.d.	n.d.	-	-	-
2	insulation	55	white	3	n.d.	5-10%	5-10%	-	-	-
	Total %	100		**Overall %**	40-50%	2-5%	2-5%	-	-	-
				Fiber Identification:	cellulose fiber	amosite (grunerite)	chrysotile asbestos			

Fibers		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations				
									Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2	amosite (grunerite) asbestos	W	B	N	N	M	+	P	1.680	vb/g	pb/r	1.689	1.678
3	chrysotile asbestos	W	A	N	N	L	+	P	1.550	vb/g	pb/r	1.556	1.549
4													
5													
6													

Sample Analytical Note

Procedure: tweased apart using forceps. Procedure: dissolution of matrix using dilute HCl acid.

Sample Bldg 5-TE **Lab Number** 2013-06714- 11 **Sampled:** **Condition:** acceptable
Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Cementitious Fibrous Solid
Homogeneous No **# Layers** 2 **Pos Layer?** Yes **# Sub-Samples** 5
Non-Fibrous Components (in approx. decreasing order): powder, polymer, filler

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber: Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	paint	2	off-white	1	n.d.	-	-	-	-	-
2	cem/asb board	98	gray	2	5-10%	-	-	-	-	-
	Total %	100		**Overall %**	5-10%	-	-	-	-	-
				Fiber Identification:	chrysotile asbestos					

Fibers		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations: Oil	Col Par	Col Per	RI Par	RI Per
1	chrysotile asbestos	W	A	N	N	L	+	P	1.550	vb/g	pb/r	1.556	1.549
2													
3													
4													
5													
6													

Sample Analytical Note
Procedure: tweased apart using forceps. Procedure: dissolution of matrix using dilute HCl acid. Procedure: dissolution of matrix using solvent.

Sample Bldg 5-RS **Lab Number** 2013-06714- 12 **Sampled:** **Condition:** acceptable
Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Roofing Fibrous Solid
Homogeneous No **# Layers** 2 **Pos Layer?** No **# Sub-Samples** 4
Non-Fibrous Components (in approx. decreasing order): bitumen, rock,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber: Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	roofing roll/shingle	80	black	1	50-60%	-	-	-	-	-
2	roof ply	20	black	1	60-70%	-	-	-	-	-
	Total %	100		**Overall %**	50-60%	-	-	-	-	-
				Fiber Identification:	cellulose fiber					

Fibers		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations: Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2													
3													
4													
5													
6													

Sample Analytical Note
Procedure: tweased apart using forceps. Procedure: dissolution of bitumen matrix using solvent.

Sample Bldg 5-I W **Lab Number** 2013-06714- 13 **Sampled:** **Condition:** acceptable

Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Wall System Fibrous Solid

Homogeneous No **# Layers** 3 **Pos Layer?** No **# Sub-Samples** 8

Non-Fibrous Components (in approx. decreasing order): powder, polymer,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber					
					Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	paint	4	pink	1	n.d.	-	-	-	-	-
2	paper/cardboard	11	tan	2	90-100%	-	-	-	-	-
3	drywall core	85	white	3	<=1%	-	-	-	-	-
	Total %	100		**Overall %**	10-20%	-	-	-	-	-
				Fiber Identification:	cellulose fiber					

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations				
									Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2													
3													
4													
5													
6													

Sample Analytical Note

Procedure: tweased apart using forceps. Procedure: dissolution of matrix using solvent. Note: no texture layer observed.

Sample Bldg 6-5 VT **Lab Number** 2013-06714- 14 **Sampled:** **Condition:** acceptable

Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Flooring Fibrous Solid

Homogeneous No **# Layers** 2 **Pos Layer?** Yes **# Sub-Samples** 5

Non-Fibrous Components (in approx. decreasing order): polymer, filler,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber					
					Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	floor tile	99	tan	1	10-20%	n.d.	-	-	-	-
2	mastic	1	black	1	n.d.	<=1%	-	-	-	-
	Total %	100		**Overall %**	10-20%	<=1%	-	-	-	-
				Fiber Identification:	chrysotile asbestos	cellulose fiber				

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations				
									Oil	Col Par	Col Per	RI Par	RI Per
1	chrysotile asbestos	W	A	N	N	L	+	P	1.550	db/ly	sb/o	1.561	1.553
2	cellulose fiber	W	F	N	N	H	+	U					
3													
4													
5													
6													

Sample Analytical Note

Procedure: tweased apart using forceps. Procedure: dissolution of floor tile matrix and mastic using solvent.

Sample Bldg 6-4 VT **Lab Number** 2013-06714- 15 **Sampled:** **Condition:** acceptable

Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Flooring Fibrous Solid

Homogeneous No **# Layers** 3 **Pos Layer?** Yes **# Sub-Samples** 7

Non-Fibrous Components (in approx. decreasing order): polymer, filler,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber					
					Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	powder	2	off-white	4	n.d.	n.d.	-	-	-	-
2	floor tile	96	off-white	1	>1-2%	n.d.	-	-	-	-
3	mastic	2	black	1	n.d.	2-5%	-	-	-	-
	Total %	100		**Overall %**	>1-2%	<=1%	-	-	-	-
				Fiber Identification:	chrysotile asbestos	cellulose fiber				

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations				
									Oil	Col Par	Col Per	RI Par	RI Per
1	chrysotile asbestos	W	A	N	N	L	+	P	1.550	db/ly	sb/o	1.561	1.553
2	cellulose fiber	W	F	N	N	H	+	U					
3													
4													
5													
6													

Sample Analytical Note

Procedure: tweased apart using forceps. Procedure: dissolution of floor tile matrix and mastic using solvent. Procedure: dissolution of matrix using dilute HCl acid.

Sample Bldg 6-5 IW **Lab Number** 2013-06714- 16 **Sampled:** **Condition:** acceptable

Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Wall System Fibrous Solid

Homogeneous No **# Layers** 3 **Pos Layer?** No **# Sub-Samples** 8

Non-Fibrous Components (in approx. decreasing order): powder, polymer,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber					
					Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	paint	2	off-white	1	n.d.	-	-	-	-	-
2	paper/cardboard	23	tan	2	90-100%	-	-	-	-	-
3	drywall core	75	white	3	<=1%	-	-	-	-	-
	Total %	100		**Overall %**	20-30%	-	-	-	-	-
				Fiber Identification:	cellulose fiber					

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations				
									Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2													
3													
4													
5													
6													

Sample Analytical Note

Procedure: tweased apart using forceps. Procedure: dissolution of matrix using solvent. Note: no texture layer observed.

Sample Bldg 6-6 EW **Lab Number** 2013-06714- 17 **Sampled:** **Condition:** acceptable
Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Wall System Fibrous Solid
Homogeneous No **# Layers** 4 **Pos Layer?** No **# Sub-Samples** 10
Non-Fibrous Components (in approx. decreasing order): powder, bitumen, polymer

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber					
					Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	paint	2	green	1	n.d.	n.d.	-	-	-	-
2	bitumen-paper	45	black	1	70-80%	n.d.	-	-	-	-
3	paper/cardboard	4	tan	2	90-100%	n.d.	-	-	-	-
4	drywall core	49	white	3	<=1%	<=1%	-	-	-	-
	Total %	100		**Overall %**	30-40%	<=1%	-	-	-	-
				Fiber Identification:	cellulose fiber	glass fiber				

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations				
									Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2	glass fiber	CL	D	Y									
3													
4													
5													
6													

Sample Analytical Note
Procedure: tweased apart using forceps. Procedure: dissolution of matrix using solvent.

Sample Bldg 6-3 **Lab Number** 2013-06714- 18 **Sampled:** **Condition:** acceptable
Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Miscellaneous Fibrous Solid
Homogeneous No **# Layers** 3 **Pos Layer?** No **# Sub-Samples** 8
Non-Fibrous Components (in approx. decreasing order): polymer, bitumen,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber					
					Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	surface	15	clear	1	n.d.	n.d.	-	-	-	-
2	paint	10	off-white	1	n.d.	n.d.	-	-	-	-
3	bitumen-paper	75	black	1	60-70%	>1-2%	-	-	-	-
	Total %	100		**Overall %**	40-50%	>1-2%	-	-	-	-
				Fiber Identification:	cellulose fiber	synthetic fiber (extr				

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations				
									Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2	synthetic fiber (extruded)	W	E	N	N	H	+	P					
3													
4													
5													
6													

Sample Analytical Note
Procedure: tweased apart using forceps. Procedure: dissolution of matrix using solvent.

Sample Bldg 6-RS **Lab Number** 2013-06714- 19 **Sampled:** **Condition:** acceptable
Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Roofing Fibrous Solid
Homogeneous No **# Layers** 2 **Pos Layer?** No **# Sub-Samples** 4
Non-Fibrous Components (in approx. decreasing order): bitumen, ,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber: Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	bitumen	30	black	1	n.d.	-	-	-	-	-
2	roof ply/bitumen	70	black	1	50-60%	-	-	-	-	-
	Total %	100		**Overall %**	40-50%	-	-	-	-	-
				Fiber Identification:	cellulose fiber					

Fibers		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations: Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2													
3													
4													
5													
6													

Sample Analytical Note
Procedure: tweased apart using forceps. Procedure: dissolution of matrix using solvent.

Sample Bldg 6-2 ES **Lab Number** 2013-06714- 20 **Sampled:** **Condition:** acceptable
Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Miscellaneous Fibrous Solid
Homogeneous No **# Layers** 2 **Pos Layer?** No **# Sub-Samples** 5
Non-Fibrous Components (in approx. decreasing order): bitumen, polymer,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber: Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	paint	12	off-white	1	n.d.	-	-	-	-	-
2	bitumen-paper	88	black	1	60-70%	-	-	-	-	-
	Total %	100		**Overall %**	50-60%	-	-	-	-	-
				Fiber Identification:	cellulose fiber					

Fibers		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations: Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2													
3													
4													
5													
6													

Sample Analytical Note
Procedure: tweased apart using forceps. Procedure: dissolution of matrix using solvent.

Sample Bldg 6-1 ES **Lab Number** 2013-06714- 21 **Sampled:** **Condition:** acceptable
Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Miscellaneous Fibrous Solid
Homogeneous Yes **# Layers** 1 **Pos Layer?** No **# Sub-Samples** 3
Non-Fibrous Components (in approx. decreasing order): bitumen, ,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber: Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	bitumen-paper	100	black	1	60-70%	-	-	-	-	-
	Total %	100		**Overall %**	60-70%	-	-	-	-	-
				Fiber Identification:	cellulose fiber					

Fibers		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations: Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2													
3													
4													
5													
6													

Sample Analytical Note
Procedure: tweased apart using forceps. Procedure: dissolution of matrix using solvent.

Sample Bldg 6-3 IW **Lab Number** 2013-06714- 22 **Sampled:** **Condition:** acceptable

Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Wall System Fibrous Solid

Homogeneous No **# Layers** 3 **Pos Layer?** No **# Sub-Samples** 8

Non-Fibrous Components (in approx. decreasing order): powder, polymer,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber: Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	paint	15	white	1	n.d.	-	-	-	-	-
2	paper/cardboard	20	tan	2	90-100%	-	-	-	-	-
3	drywall core	65	white	3	<=1%	-	-	-	-	-
	Total %	100		**Overall %**	10-20%	-	-	-	-	-
				Fiber Identification:	cellulose fiber					

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations: Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2													
3													
4													
5													
6													

Sample Analytical Note

Procedure: tweased apart using forceps. Procedure: dissolution of matrix using solvent. Note: no texture layer observed.

Sample Bldg 7 IW **Lab Number** 2013-06714- 23 **Sampled:** **Condition:** acceptable

Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Wall System Fibrous Solid

Homogeneous No **# Layers** 6 **Pos Layer?** No **# Sub-Samples** 16

Non-Fibrous Components (in approx. decreasing order): powder, polymer,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber: Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	paint	3	tan	1	n.d.	-	-	-	-	-
2	texture/joint compound	4	white	3	n.d.	-	-	-	-	-
3	paper/cardboard	25	off-white	2	90-100%	-	-	-	-	-
4	texture/joint compound	5	white	3	n.d.	-	-	-	-	-
5	paper/cardboard	13	tan	2	90-100%	-	-	-	-	-
6	drywall core	50	white	3	<=1%	-	-	-	-	-
	Total %	100		**Overall %**	30-40%	-	-	-	-	-
				Fiber Identification:	cellulose fiber					

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations: Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2													
3													
4													
5													
6													

Sample Analytical Note

Procedure: tweased apart using forceps. Procedure: dissolution of paint matrix using solvent. Procedure: dissolution of joint compound/texture matrix using acid.

Sample Bldg 7 EW **Lab Number** 2013-06714- 24 **Sampled:** **Condition:** acceptable
Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Wall System Non-fibrous Solid
Homogeneous No **# Layers** 2 **Pos Layer?** No **# Sub-Samples** 5
Non-Fibrous Components (in approx. decreasing order): powder, perlite, polymer

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber: Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	paint	4	tan	1	n.d.	-	-	-	-	-
2	plaster	96	white	2	n.d.	-	-	-	-	-
	Total %	100		**Overall %**	n.d.	-	-	-	-	-
				Fiber Identification:	none					

Fibers		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations: Oil	Col Par	Col Per	RI Par	RI Per
1	none												
2													
3													
4													
5													
6													

Sample Analytical Note
Procedure: tweased apart using forceps. Procedure: dissolution of paint matrix using solvent. Procedure: dissolution of plaster matrix using acid.

Sample Bldg 7 RS **Lab Number** 2013-06714- 25 **Sampled:** **Condition:** acceptable
Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Roofing Fibrous Solid
Homogeneous No **# Layers** 2 **Pos Layer?** No **# Sub-Samples** 4
Non-Fibrous Components (in approx. decreasing order): bitumen, rock,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber: Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	roofing roll/shingle	35	black	1	10-20%	-	-	-	-	-
2	roofing roll/shingle	65	black	1	10-20%	-	-	-	-	-
	Total %	100		**Overall %**	10-20%	-	-	-	-	-
				Fiber Identification:	glass fiber					

Fibers		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations: Oil	Col Par	Col Per	RI Par	RI Per
1	glass fiber	CL	D	Y									
2													
3													
4													
5													
6													

Sample Analytical Note
Procedure: tweased apart using forceps. Procedure: dissolution of matrix using solvent.

Sample Bldg 8 VT1 **Lab Number** 2013-06714- 26 **Sampled:** **Condition:** acceptable
Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Flooring Non-fibrous Solid
Homogeneous No **# Layers** 2 **Pos Layer?** Yes **# Sub-Samples** 5
Non-Fibrous Components (in approx. decreasing order): polymer, filler,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber: Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	floor tile	99	off-white	1	>1-2%	n.d.	-	-	-	-
2	mastic	1	black	1	n.d.	2-5%	-	-	-	-
	Total %	100		**Overall %**	>1-2%	<=1%	-	-	-	-
				Fiber Identification:	chrysotile asbestos	cellulose fiber				

Fibers		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations: Oil	Col Par	Col Per	RI Par	RI Per
1	chrysotile asbestos	W	A	N	N	L	+	P	1.550	db/ly	sb/o	1.561	1.553
2	cellulose fiber	W	F	N	N	H	+	U					
3													
4													
5													
6													

Sample Analytical Note
Procedure: tweased apart using forceps. Procedure: dissolution of floor tile matrix and mastic using solvent.

Sample Bldg 8 VT2 **Lab Number** 2013-06714- 27 **Sampled:** **Condition:** acceptable

Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Flooring Fibrous Solid

Homogeneous No **# Layers** 2 **Pos Layer?** No **# Sub-Samples** 5

Non-Fibrous Components (in approx. decreasing order): polymer, binder, filler

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber					
					Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	sheet flooring surface	50	tan	1	n.d.	n.d.	n.d.	-	-	-
2	sheet flooring backing	50	tan	3	10-20%	5-10%	>1-2%	-	-	-
	Total %	100		**Overall %**	5-10%	2-5%	<=1%	-	-	-
				Fiber Identification:	cellulose fiber	synthetic fiber (extr	glass fiber			

	Fibers	Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations				
									Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2	synthetic fiber (extruded)	W	E	N	N	H	+	P					
3	glass fiber	CL	D	Y									
4													
5													
6													

Sample Analytical Note

Procedure: tweased apart using forceps. Procedure: dissolution of vinyl matrix using solvent.

Sample Bldg 8 VT3 **Lab Number** 2013-06714- 28 **Sampled:** **Condition:** acceptable

Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Flooring Non-fibrous Solid

Homogeneous No **# Layers** 2 **Pos Layer?** Yes **# Sub-Samples** 5

Non-Fibrous Components (in approx. decreasing order): polymer, filler,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber					
					Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	floor tile	99	off-white	1	>1-2%	-	-	-	-	-
2	mastic	1	black	1	n.d.	-	-	-	-	-
	Total %	100		**Overall %**	>1-2%	-	-	-	-	-
				Fiber Identification:	chrysotile asbestos					

	Fibers	Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations				
									Oil	Col Par	Col Per	RI Par	RI Per
1	chrysotile asbestos	W	A	N	N	L	+	P	1.550	db/ly	sb/o	1.561	1.553
2													
3													
4													
5													
6													

Sample Analytical Note

Procedure: tweased apart using forceps. Procedure: dissolution of floor tile matrix and mastic using solvent.

Sample Bldg 8 MISC **Lab Number** 2013-06714- 29 **Sampled:** **Condition:** acceptable

Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Miscellaneous Fibrous Solid

Homogeneous No **# Layers** 3 **Pos Layer?** No **# Sub-Samples** 7

Non-Fibrous Components (in approx. decreasing order): polymer, binder,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber					
					Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	surface	15	off-white	1	n.d.	n.d.	-	-	-	-
2	bitumen-paper	83	brown	1	50-60%	10-20%	-	-	-	-
3	mastic	2	tan	1	n.d.	n.d.	-	-	-	-
	Total %	100		**Overall %**	40-50%	10-20%	-	-	-	-
				Fiber Identification:	cellulose fiber	synthetic fiber (extr				

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations				
									Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2	synthetic fiber (extruded)	W	E	N	N	H	+	P					
3													
4													
5													
6													

Sample Analytical Note

Procedure: tweased apart using forceps. Procedure: dissolution of vinyl matrix using solvent.

Sample Bldg 9 VT **Lab Number** 2013-06714- 30 **Sampled:** **Condition:** acceptable

Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Flooring Non-fibrous Solid

Homogeneous No **# Layers** 2 **Pos Layer?** No **# Sub-Samples** 4

Non-Fibrous Components (in approx. decreasing order): polymer, filler,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber					
					Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	floor tile	99.5	tan	1	n.d.	-	-	-	-	-
2	mastic	0.5	tan	1	2-5%	-	-	-	-	-
	Total %	100		**Overall %**	<=1%	-	-	-	-	-
				Fiber Identification:	cellulose fiber					

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations				
									Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2													
3													
4													
5													
6													

Sample Analytical Note

Procedure: tweased apart using forceps. Procedure: dissolution of floor tile matrix and mastic using solvent.

Sample Bldg 9 RS **Lab Number** 2013-06714- 31 **Sampled:** **Condition:** acceptable

Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Roofing Fibrous Solid

Homogeneous No **# Layers** 4 **Pos Layer?** No **# Sub-Samples** 8

Non-Fibrous Components (in approx. decreasing order): bitumen, ,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber					
					Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	bitumen	10	black	1	n.d.	-	-	-	-	-
2	roof ply	30	black	1	50-60%	-	-	-	-	-
3	roof ply	30	black	1	50-60%	-	-	-	-	-
4	roof ply	30	black	1	50-60%	-	-	-	-	-
	Total %	100		**Overall %**	50-60%	-	-	-	-	-
				Fiber Identification:	cellulose fiber					

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations				
									Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2													
3													
4													
5													
6													

Sample Analytical Note

Procedure: tweased apart using forceps. Procedure: dissolution of matrix using solvent.

Sample Bldg 9 IW **Lab Number** 2013-06714- 32 **Sampled:** **Condition:** acceptable

Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Wall System Fibrous Solid

Homogeneous No **# Layers** 2 **Pos Layer?** No **# Sub-Samples** 5

Non-Fibrous Components (in approx. decreasing order): powder, ,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber					
					Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	paper/cardboard	40	tan	2	90-100%	-	-	-	-	-
2	drywall core	60	white	3	<=1%	-	-	-	-	-
	Total %	100		**Overall %**	30-40%	-	-	-	-	-
				Fiber Identification:	cellulose fiber					

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations				
									Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2													
3													
4													
5													
6													

Sample Analytical Note

Procedure: tweased apart using forceps.

Sample Bldg 10 ESM **Lab Number** 2013-06714- 33 **Sampled:** **Condition:** acceptable

Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Miscellaneous Fibrous Solid

Homogeneous No **# Layers** 3 **Pos Layer?** No **# Sub-Samples** 7

Non-Fibrous Components (in approx. decreasing order): bitumen, polymer,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber					
					Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	surface	5	off-white	1	n.d.	-	-	-	-	-
2	bitumen-paper	90	black	1	60-70%	-	-	-	-	-
3	backing	5	green	2	n.d.	-	-	-	-	-
	Total %	100		**Overall %**	50-60%	-	-	-	-	-
				Fiber Identification:	cellulose fiber					

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations				
									Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2													
3													
4													
5													
6													

Sample Analytical Note

Procedure: tweased apart using forceps. Procedure: dissolution of vinyl matrix using solvent.

Sample Bldg 10 RS **Lab Number** 2013-06714- 34 **Sampled:** **Condition:** acceptable

Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Roofing Fibrous Solid

Homogeneous Yes **# Layers** 1 **Pos Layer?** No **# Sub-Samples** 3

Non-Fibrous Components (in approx. decreasing order): bitumen, rock,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber					
					Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	roofing roll/shingle	100	black	1	40-50%	-	-	-	-	-
	Total %	100		**Overall %**	40-50%	-	-	-	-	-
				Fiber Identification:	cellulose fiber					

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations				
									Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2													
3													
4													
5													
6													

Sample Analytical Note

Procedure: tweased apart using forceps. Procedure: dissolution of matrix using solvent.

Sample Bldg 10 IW **Lab Number** 2013-06714- 35 **Sampled:** **Condition:** acceptable

Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Wall System Fibrous Solid

Homogeneous No **# Layers** 3 **Pos Layer?** No **# Sub-Samples** 7

Non-Fibrous Components (in approx. decreasing order): powder, ,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber					
					Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	texture/joint compound	2	white	3	n.d.	-	-	-	-	-
2	paper/cardboard	48	tan	2	90-100%	-	-	-	-	-
3	drywall core	50	white	3	<=1%	-	-	-	-	-
	Total %	100		**Overall %**	40-50%	-	-	-	-	-
				Fiber Identification:	cellulose fiber					

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations				
									Oil	Col Par	Col Per	RI Par	RI Per
1	cellulose fiber	W	F	N	N	H	+	U					
2													
3													
4													
5													
6													

Sample Analytical Note

Procedure: tweased apart using forceps. Procedure: dissolution of matrix using dilute HCl acid.

Sample Bldg 10 EW **Lab Number** 2013-06714- 36 **Sampled:** **Condition:** acceptable

Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Cementitious Fibrous Solid

Homogeneous No **# Layers** 2 **Pos Layer?** Yes **# Sub-Samples** 5

Non-Fibrous Components (in approx. decreasing order): powder, polymer, filler

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber					
					Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	paint	8	tan	1	n.d.	-	-	-	-	-
2	cem/asb board	92	gray	2	5-10%	-	-	-	-	-
	Total %	100		**Overall %**	5-10%	-	-	-	-	-
				Fiber Identification:	chrysotile asbestos					

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations				
									Oil	Col Par	Col Per	RI Par	RI Per
1	chrysotile asbestos	W	A	N	N	L	+	P	1.550	db/ly	sb/o	1.556	1.549
2													
3													
4													
5													
6													

Sample Analytical Note

Procedure: tweased apart using forceps. Procedure: dissolution of matrix using dilute HCl acid. Procedure: dissolution of matrix using solvent.

Sample Bldg 10 VT **Lab Number** 2013-06714- 37 **Sampled:** **Condition:** acceptable

Analyzed By MAC 7/26/2013 **An?** OK **Apparent Smp Type** Flooring Non-fibrous Solid

Homogeneous No **# Layers** 2 **Pos Layer?** No **# Sub-Samples** 5

Non-Fibrous Components (in approx. decreasing order): filler, polymer,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber					
					Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	floor tile	99	off-white	1	n.d.	-	-	-	-	-
2	mastic	1	tan	1	n.d.	-	-	-	-	-
	Total %	100		**Overall %**	n.d.	-	-	-	-	-
				Fiber Identification:	none					

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations: Oil	Col Par	Col Per	RI Par	RI Per
1	none												
2													
3													
4													
5													
6													

Sample Analytical Note

Procedure: tweased apart using forceps. Procedure: dissolution of floor tile matrix and mastic using solvent.

Fr=Friability: 1=very non-friable; 2= non-friable; 3=friable; 4=highly friable
Colors: B=black;BL=blue;BR=brown;CL=clear;G=Green;GY=gray;OR=orange;OW=off-white;PN=pink;PU=purple;R=red;TN=tan;W=white;Y=yellow;V=various
Fiber Morphology: A=fine fibers/bundles, white, sinewy, flexible; B=fine fibers/bundles, w-br, straight, broomed ends; C=fine fibers/bundles, blue, straight, broomed ends; D=fine to coarse fibers, CL-B, brittle; E=coarse fibers,CL or dyed, striated; F=coarse fibers or splinters, W-BR, ribbon-like; G=lath-like or shards, low aspect ratio, may taper
Iso=isotropism - may be yes or no; Pleo=pleochroism - may be yes or no; Bi=birefringence - may be None, Low, Medium or High
Elg=sign of elongation - may be +, - or B (both); Ext=extinction - may be Parallel, Oblique, None or Undulating; Oil=medium used to for dispersion staining
Col Par=dispersion staining colors parallel to the fiber (fiber/halo): b/w=black/white; dg/py=dark gray/pale yellow; vg/y=violet gray/yellow; db/ly=dark blue/lemon yellow; vb/g= vivid blue/gold; sb/o=sky blue/orange; pb/r=pale blue/red; gb/dr=gray blue/dark red; w/b=white/black. Col Perp=same only perpendicular to fiber.
RI Par=refractive index parallel to fiber; RI Perp=refractive index perpendicular to fiber

Analyst: MICHAEL A. COOK

Printed: 26-Jul-13

Original Print Date: 26-Jul-13

Larry S. Pierce, Approved Accreditation Signatory

FIBERQUANT ANALYTICAL SERVICES

Fiberquant Analytical Services 5025 S. 33rd St.;
Phoenix, AZ 85040; Phone: 602-276-6139; FAX: 602-276-4558;
info@fiberquant.com

Analysis Request/Chain-of-Custody Form

Submitted by (Company)	BEC Environmental Inc
Address	7660 W. Sahara Ave #150
City, State, Zip Code	LV, NV 89117
Phone	702 304 9830
FAX	
Email	brian@becnv.com

Invoice to (Company)	Same as above
Address	
City, State, Zip Code	
Phone	
FAX	

Contact (print)	Brian Loffman
Sampled by (signature)	
Job Number or Project Name	804.11.TZE
PO Number	

<Analysis Method Requested> ONLY ONE METHOD per COC				Turn-around-time (circle one) Rush		Norm	Ext.
Asbestos by PLM	Method >	(Improved)	Interim	Urgent Rush <3 hrs	<6 hrs	(1-3 days)	15-30 days
	Analyze >	(All)	ATPF				
	If ATPF then >	by Layer	by Sample				
	Single Layer Protocol >	Yes	No				
Fibers by PCM	Method > 7400 (Area)	ORM (Personal)		<4 hrs		24 hrs	-
Asbestos by TEM	in Air > AHERA	Mod. AHERA		<6 hrs		24 hrs	3-5 days
	in Water* > Water	Sludge		1-2 days		3-5 days	N/A
	in Bulk (Annex2) > Chatfield	Full Quant.					
	in Dust > ASTM D5755-03			3-5 days		5-10 days	N/A
Pb by FLAA	Analyte > Pb	Other		<6 hrs		2-3 days	N/A
	Matrix > Filter >	MCE	FG				
	Paint >	by Area (mg/cm²)	by Weight (ppm)				
	Soil >						
	Wipe >						
	Initial here certifying wipes used are ASTM E1792 compliant _____						
Fungi	Air Sample >	Zefon	Aller	Other	<6 hrs		1-2 days	N/A
	Bulk >	Sample	Swab				
	Tape Lift >	Qualitative (% & type)					
		Quantitative (type/cm2)					
Soot	ASTM D6602-03b	Optical		<6 hrs		1-2 days	N/A
		Optical & TEM		1-2 days		3-5 days	N/A
Other				Call		Call	

Sample # (1 per line)	Description/Location	Sample Date	Sample Time	Vol. or Area
1) Bldg 1-N	Building 1 Bar/service shop	4-17-13	9:54	
2) Bldg 1-S			9:56	
3) Bldg 1-E			9:58	
4) Bldg 1-W			9:59	
5) Bldg 3-N	Building 3 hydraulic tank bldg		10:06	
6) Bldg 3-S			10:10	
7) Bldg 5 INS	Bldg 5 Interior Ceiling Insulation		10:11	
8) Bldg 5 VT1	Bldg 5 Vinyl Tile + mastic		10:15	
9) Bldg 5 VT2	Bldg 5 Vinyl Tile + mastic		10:20	
10) Bldg 5 TSI	Bldg 5 Pipe TSI under Floor		10:23	
11) Bldg 5 TE	Bldg 5 exterior Panel + siding		10:27	
12) Bldg 5 RS	Bldg 5 asphaltic roofing shingle		10:30	
13) Bldg 5 IW	Bldg 5 Interior wall board		10:33	
14) Bldg 6-5 VT	Bldg 6 unit 5 Vinyl Tile		10:36	
15) Bldg 6-4 VT	Bldg 6 unit 4 Vinyl Tile		10:38	
16) Bldg 6-5 IW	Bldg 6 unit 5 Interior Wallboard		10:41	
17) Bldg 6-6 EW	Bldg 6 unit 6 exterior wall mat.		10:42	
18) Bldg 6-3	Bldg 6 unit 3 misc material		10:44	
19) Bldg 6 RS	Bldg 6 roofing material		10:46	
20) Bldg 6-2 ES	Bldg 6 unit 2 exterior siding		10:49	

1)Relinquished by:	Date: 7/22/13	Time: 10:30	3)Relinquished by:	Date:	Time:
2)Received by:	Date: 7-23-13	Time: 10:30	4)Received by:	Date:	Time:
* TEM Water: Sampler's name Required by State of Arizona	Print Name	FX	Fiberquant assigned Job Number>	20130714	
Review of Analysis Request (Initials):				Page 1 of 2	

Note: Data completed by client (including number and identity of samples) is assumed to be correct until it is verified at time of sample preparation.

FIBERQUANT ANALYTICAL SERVICES

Fiberquant Analytical Services 5025 S. 33rd St.:
Phoenix, AZ 85040; Phone: 602-276-6139; FAX: 602-276-4558;
info@fiberquant.com

Analysis Request/Chain-of-Custody Form

Submitted by (Company)	BEC Environmental Inc
Address	7660 W. Sahara Ave #90
City, State, Zip Code	LV, NV 89117
Phone	702 304 9830
FAX	
Email	brian@becnv.com

Invoice to (Company)	
Address	Same as above
City, State, Zip Code	
Phone	
FAX	

Contact (print)	Brian Loffman
Sampled by (signature)	
Job Number or Project Name	804.11.T2E
PO Number	

<Analysis Method Requested> ONLY ONE METHOD per COC			Turn-around-time (circle one) Rush		Norm	Ext.
Asbestos by PLM	Method > (Improved) Interim		Urgent Rush <3 hrs	<6 hrs	(1-3 days)	15-30 days
	Analyze > (All) ATPF					
	If ATPF then > by Layer by Sample					
	Single Layer Protocol > Yes No					
Fibers by PCM	Method > 7400 (Area) ORM (Personal)		<4 hrs		24 hrs	-
Asbestos by TEM	in Air > AHERA Mod. AHERA		<6 hrs		24 hrs	3-5 days
	in Water* > Water Sludge		1-2 days		3-5 days	N/A
	in Bulk (Annex2) > Chatfield Full Quant.					
	in Dust > ASTM D5755-03		3-5 days		5-10 days	N/A
Pb by FLAA	Analyte > Pb Other		<6 hrs		2-3 days	N/A
	Matrix > Filter > MCE FG					
	Paint > by Area (mg/cm²) by Weight (ppm)					
	Soil >					
	Wipe >					
	Initial here certifying wipes used are ASTM E1792 compliant ____					
Fungi	Air Sample > Zefon Aller Other		<6 hrs		1-2 days	N/A
	Bulk > Sample Swab					
	Tape Lift > Qualitative (% & type)					
	Quantitative (type/cm2)					
Soot	ASTM D6602-03b	Optical	<6 hrs		1-2 days	N/A
		Optical & TEM	1-2 days		3-5 days	N/A
Other			Call		Call	

Sample # (1 per line)	Description/Location	Sample Date	Sample Time	Vol. or Area
1) Bldg 6-1 ES	Bldg 6 unit 1 exterior siding	4-17-13	10:52	
2) Bldg 6-3 IW	Bldg 6 unit 3 interior wallboard		10:55	
3) Bldg 7 IW	Bldg 7 Interior wallboard		11:00	
4) Bldg 7 EW	Bldg 7 exterior wall		11:10	
5) Bldg 7 RS	Bldg 7 roofing sample		11:11	
6) Bldg 8 VT1	Bldg 8 Vinyl Tile		11:13	
7) Bldg 8 VT2	Bldg 8 Vinyl Tile		11:15	
8) Bldg 8 VT3	Bldg 8 Vinyl Tile		11:17	
9) Bldg 8 MISC	Bldg 8 misc wall material		1120	
10) Bldg 9 VT	Bldg 9 Vinyl Tile		11:25	
11) Bldg 9 RS	Bldg 9 Roofing Sample		11:30	
12) Bldg 9 IW	Bldg 9 Interior wallboard		11:31	
13) Bldg 10 ESM	Bldg 10 exterior siding material		1133	
14) Bldg 10 RS	Bldg 10 roofing sample		11:35	
15) Bldg 10 IW	Bldg 10 Interior wall board		11:37	
16) Bldg 10 EW	Bldg 10 exterior wall siding		11:39	
17) Bldg 10 VT	Bldg 10 Vinyl Tile.		11:42	
18)				
19)				
20)				

1)Relinquished by:	Date: 4/22/13	Time: 10:30	3)Relinquished by:	Date:	Time:
2)Received by:	Date: 4.23.13	Time: 10:30	4)Received by:	Date:	Time:
* TEM Water: Sampler's name Required by State of Arizona	Print Name		Fiberquant assigned Job Number>	20130714	
Review of Analysis Request (Initials):				Page 2 of 2	

Note: Data completed by client (including number and identity of samples) is assumed to be correct until it is verified at time of sample preparation.

Appendix I

Lead-Based Paint Laboratory Analytical Data Reports

SilverState
Analytical Laboratories

LABORATORY REPORT

DATE: July 29, 2013

REPORT NUMBER: 13-3128

CLIENT: BEC Environmental, Inc.
7660 W. Sahara Ave #150
Las Vegas, NV 89117

PAGE: 1 of 3

CLIENT PO# : 804.11.T2E

Sampled By: B. Loffman
Date Sampled: 04/17/13
Time Sampled: Refer to COC

Submitted by: B. Loffman
Date Received: 07/19/13
Time Received: 0815

Report Attention:

Case Narrative

Samples were received on July 19, 2013 at 0815 in good condition. There were no problems encountered during receipt or during processing of samples. Any problems encountered during analysis are noted in EPA flags section.

EPA Flag: None

REVIEWED BY:

John Sloan
Laboratory Director

3638 East Sunset Road, Suite 100 • Las Vegas, NV 89120 • Tel: 702-873-4478 Fax: 702-873-7967
4587 Longley Lane, No. 2 • Reno, NV 89502 • Tel: 775-825-1127 Fax: 775-825-1167
www.ssalabs.com • www.envirotechonline.com

Silver State Analytical Laboratories
Report Number: 13-3128
July 29, 2013

Sample ID	Parameter	Result	Unit	Reporting Limit	Method	Date Analyzed	Analyst
1A Bldg 1	Lead	66.7	mg/kg	5	EPA 6010B	07/25/13	ET
1B Bldg 1	Lead	24.3	mg/kg	5	EPA 6010B	07/25/13	ET
1C Bldg 1	Lead	21.4	mg/kg	5	EPA 6010B	07/25/13	ET
1D Bldg 1	Lead	44.5	mg/kg	5	EPA 6010B	07/25/13	ET
2A Bldg 2	Lead	30.9	mg/kg	5	EPA 6010B	07/25/13	ET
2B Bldg 2	Lead	223	mg/kg	5	EPA 6010B	07/25/13	ET
2C Bldg 2	Lead	36.0	mg/kg	5	EPA 6010B	07/25/13	ET
3A Bldg 3	Lead	229	mg/kg	5	EPA 6010B	07/25/13	ET
3C Bldg 3	Lead	35.8	mg/kg	5	EPA 6010B	07/25/13	ET
5A Bldg 5	Lead	2530	mg/kg	5	EPA 6010B	07/25/13	ET
6A Int Bldg 6	Lead	32100	mg/kg	25	EPA 6010B	07/25/13	ET
6B Bldg 6	Lead	50.4	mg/kg	5	EPA 6010B	07/25/13	ET
6C Bldg 6	Lead	58400	mg/kg	25	EPA 6010B	07/25/13	ET
6A Ext Bldg 6	Lead	15.1	mg/kg	5	EPA 6010B	07/25/13	ET
6D Bldg 6	Lead	31.9	mg/kg	6.25	EPA 6010B	07/25/13	ET
7A Int Bldg 7	Lead	23.1	mg/kg	5	EPA 6010B	07/25/13	ET
7A Ext Bldg 7	Lead	47.2	mg/kg	5	EPA 6010B	07/25/13	ET
8A Int Bldg 8	Lead	13.8	mg/kg	6.25	EPA 6010B	07/25/13	ET
8B Ext Bldg 8	Lead	23.6	mg/kg	5	EPA 6010B	07/25/13	ET

ND: non-detect
EPA Flags: None

Silver State Analytical Laboratories
Report Number: 13-3128
July 29, 2013

Sample ID	Parameter	Result	Unit	Reporting Limit	Method	Date Analyzed	Analyst
9B Bldg 9	Lead	15.1	mg/kg	6.25	EPA 6010B	07/25/13	ET
9C Bldg 9	Lead	44.1	mg/kg	5	EPA 6010B	07/25/13	ET
10A Int Bldg 10	Lead	2490	mg/kg	5	EPA 6010B	07/25/13	ET
10C Ext Bldg 10	Lead	52.6	mg/kg	25	EPA 6010B	07/25/13	ET

ND: non-detect
EPA Flags: None

SilverState Analytical Laboratories

www.ssalabs.com

☒ 3638 E. Sunset Rd., Ste. 100, Las Vegas NV 89120
Phone: (702) 873-4478 Fax: (702) 873-7967

☐ 4587 Longley Lane, No. 2, Reno, NV 89502
Phone: (775) 825-1127 Fax: (775) 825-1167

CHAIN-OF-CUSTODY RECORD

Project/Job #: 804.11.T2E | Payment Method/PO #:

SEND INVOICE TO:
Name: Brian Loffman
Company: BEC Environmental, Inc
Mailing Address: 7660 W. Sahara Ave #150
City, State, Zip: LV, NV 89117

REPORT RESULTS TO: (INDICATE METHOD)
Name: Brian Loffman
Company: BEC
Mailing Address: 7660 W. Sahara Ave #150
City, State, Zip: LV NV 89117
Phone: 702 304-9830 (Email) OR Fax: brian@becnv.com

Sampled By: Brian Loffman
Report Attention: Brian Loffman
On-Site pH/Temperature:

Turnaround Time (Specify Below with an X):
Standard 10 Business Days ☐
1 Day | 2 Day | 3 Day | Other
NOTE: A surcharge is applied for rush samples

Other Pertinent Info:

Circle Applicable Program: SDWA CWA RCRA Other Non-Reg
Reporting requirements: RL MDL PQL
Report Level: I II III IV
NOTE: Surcharges apply to level II, III and IV reports.

Date Sampled	Time Sampled	Sample Location/ Sample ID	Silver State Lab ID	Comp/ Grab	Matrix*	Preservative	Number/Type of Containers**	ANALYSES REQUESTED: Lead
4/17/13	1201	1A Bldg 1	31284		OT	none	1 OT	X
	1204	1B Bldg 1	-2		OT	none	1 OT	X
	1206	1C Bldg 1	-3		OT	none	1 OT	X
	1209	1D Bldg 1	-4		OT	none	1 OT	X
	1214	2A Bldg 2	-5		OT	none	1 OT	X
	1217	2B Bldg 2	-6		OT	none	1 OT	X
	1219	2C Bldg 2	-7		OT	none	1 OT	X
	1223	3A Bldg 3	-8		OT	none	1 OT	X

*Metals: mg/kg %

I attest to the validity and authenticity of the sample. I am aware that tampering with or intentionally mislabeling the sample location, date or time is considered fraud and may be grounds for legal action.

Relinquished by Signature/Print: Brian Loffman	Time/Date: 8:15 7/19/13	Received by Signature/Print:	Time/Date: 815 7-19-13
Relinquished by Signature/Print:	Time/Date:	Received by Signature/Print:	Time/Date:
Relinquished by Signature/Print:	Time/Date:	Received by Signature/Print:	Time/Date:

Authorized by:
Signature/Print: Date: 7/19/13
Authorization is required to process samples. This obligates your organization for fee pertaining to services rendered. If collections or legal services are required to recover said fees, your organization will be responsible for all fees and cost in addition to service fees.

Method of Delivery: Receiving Laboratory:
Special Instructions:
Note: Samples are discarded 30 days after results are reported. Samples deemed hazardous are returned to the client upon completion of analysis.

* Key: AQ – Aqueous S – Soil W – Waste OT – Other

** Key: P – Plastic G – Glass V – VOA Vial OT - Other

SilverState Analytical Laboratories

www.ssalabs.com

3638 E. Sunset Rd., Ste. 100, Las Vegas NV 89120
Phone: (702) 873-4478 Fax: (702) 873-7967

☐ 4587 Longley Lane, No. 2, Reno, NV 89502
Phone: (775) 825-1127 Fax: (775) 825-1167

CHAIN-OF-CUSTODY RECORD

Project/Job #: 304.11.T2E Payment Method/PO #:

SEND INVOICE TO:
Name: Brian Loffman
Company: BEC Environmental Inc
Mailing Address: 7660 W. Sahara Ave #150
City, State, Zip: LV NV 89117

REPORT RESULTS TO: (INDICATE METHOD)
Name: Brian Loffman
Company: BEC
Mailing Address: 7660 W. Sahara Ave #150
City, State, Zip: LV, NV 89117
Phone: 702 304 9830 Email OR Fax: brian@becnv.com

Sampled By: Brian Loffman
Report Attention: Brian Loffman
On-Site pH/Temperature:

Turnaround Time (Specify Below with an X):
Standard 10 Business Days ☐

1 Day	2 Day	3 Day	Other

NOTE: A surcharge is applied for rush samples

Other Pertinent Info:

Circle Applicable Program: SDWA CWA RCRA Other Non-Reg

Reporting requirements: RL MDL PQL

Report Level: I II III IV

NOTE: Surcharges apply to level II, III and IV reports.

Date Sampled	Time Sampled	Sample Location/ Sample ID	Silver State Lab ID	Comp/ Grab	Matrix*	Preservative	Number/Type of Containers**	ANALYSES REQUESTED: Lead	
4/17/13	1226	3C Bldg 3	3128-9		OT	none	1 OT	X	*Metals:
	1230	5A Bldg 5	-10		OT	none	1 OT	X	
	1232	6A Int Bldg 6	-11		OT	none	1 OT	X	
	1234	6B Bldg 6	-12		OT	none	1 OT	X	
	1236	6C Bldg 6	-13		OT	none	1 OT	X	
	1237	6A Ext Bldg 6	-14		OT	none	1 OT	X	
	1240	6D Bldg 6	-15		OT	none	1 OT	X	
	1243	7A Int Bldg 7	-16		OT	none	1 OT	X	

I attest to the validity and authenticity of the sample. I am aware that tampering with or intentionally mislabeling the sample location, date or time is considered fraud and may be grounds for legal action.

Relinquished by Signature/Print: Brian Loffman	Time/Date: 815 7/19/13	Received by Signature/Print:	815 7-19-13 Time/Date:
Relinquished by Signature/Print:	Time/Date:	Received by Signature/Print:	Time/Date:
Relinquished by Signature/Print:	Time/Date:	Received by Signature/Print:	Time/Date:

Authorized by:

Signature/Print: _____ Date: _____

Authorization is required to process samples. This obligates your organization for fee pertaining to services rendered. If collections or legal services are required to recover said fees, your organization will be responsible for all fees and cost in addition to service fees.

Method of Delivery: Receiving Laboratory:

Special Instructions:

Note: Samples are discarded 30 days after results are reported. Samples deemed hazardous are returned to the client upon completion of analysis.

* Key: AQ – Aqueous S – Soil W – Waste OT – Other

** Key: P – Plastic G – Glass V – VOA Vial OT - Other

SilverState Analytical Laboratories

www.ssalabs.com

3638 E. Sunset Rd., Ste. 100, Las Vegas NV 89120
Phone: (702) 873-4478 Fax: (702) 873-7967

☐ 4587 Longley Lane, No. 2, Reno, NV 89502
Phone: (775) 825-1127 Fax: (775) 825-1167

CHAIN-OF-CUSTODY RECORD

Project/Job #: 804.11.T2E | Payment Method/PO #:

SEND INVOICE TO:
Name: Brian Loffman
Company: BEC Environmental Inc
Mailing Address: 7660 W. Sahara Ave #150
City, State, Zip: LV NV 89117

REPORT RESULTS TO: (INDICATE METHOD)
Name: Brian Loffman
Company: BEC
Mailing Address: 7660 W. Sahara Ave #150
City, State, Zip: LV NV 89117
Phone: 702 304-9830 Email OR Fax: brian@becnv.com

Sampled By: Brian Loffman
Report Attention: Brian Loffman
On-Site pH/Temperature:

Turnaround Time (Specify Below with an X):
Standard 10 Business Days ☐

1 Day	2 Day	3 Day	Other

NOTE: A surcharge is applied for rush samples

Other Pertinent Info:

ANALYSES REQUESTED

Circle Applicable Program: SDWA CWA RCRA Other Non-Reg

Reporting requirements: RL MDL PQL

Report Level: I II III IV

NOTE: Surcharges apply to level II, III and IV reports.

Date Sampled	Time Sampled	Sample Location/ Sample ID	Silver State Lab ID	Comp/ Grab	Matrix*	Preservative	Number/Type of Containers**	Lead	*Metals:
4/17/13	1246	7A Ext Bldg 7	3128-17		OT	None	1 OT	X	
	1252	8A Int Bldg 8	-18		OT	None	1 OT	X	
	1256	8B Ext Bldg 8	-19		OT	None	1 OT	X	
	1303	9B Bldg 9	-20		OT	None	1 OT	X	
	1306	9C Bldg 9	-21		OT	None	1 OT	X	
	1312	10A Int Bldg 10	-22		OT	None	1 OT	X	
	1314	10C Ext Bldg 10	-23		OT	None	1 OT	X	
					~~OT~~	~~None~~	~~1 OT~~	X	

I attest to the validity and authenticity of the sample. I am aware that tampering with or intentionally mislabeling the sample location, date or time is considered fraud and may be grounds for legal action.

Relinquished by Signature/Print: Brian Loffman	Time/Date: 815 7/19/13	Received by Signature/Print:	Time/Date: 815 7-19-13
Relinquished by Signature/Print:	Time/Date:	Received by Signature/Print:	Time/Date:
Relinquished by Signature/Print:	Time/Date:	Received by Signature/Print:	Time/Date:

Authorized by:

Signature/Print: _____ Date: _____

Authorization is required to process samples. This obligates your organization for fee pertaining to services rendered. If collections or legal services are required to recover said fees, your organization will be responsible for all fees and cost in addition to service fees.

Method of Delivery: | Receiving Laboratory:

Special Instructions:

Note: Samples are discarded 30 days after results are reported. Samples deemed hazardous are returned to the client upon completion of analysis.

* Key: AQ – Aqueous S – Soil W – Waste OT – Other

** Key: P – Plastic G – Glass V – VOA Vial OT - Other

Appendix J

Groundwater Collection Logs

Summary of Groundwater Multi-Meter Results

Soil Boring	SB-8	SB-9	SB-10	SB-11
Sample Date	6/25/2013	6/25/2013	N/A	6/28/2013
Depth to Water (Below Ground Surface)	60' 5"	63' 1"	N/A	55'
pH	6.75	6.85	N/A	6.62
Conductance (s/m)	1.33	0.789	N/A	0.864
Temperature(C)	18.4	20.1	N/A	24.4
Dissolved Oxygen (g/L)	4.11	2.1	N/A	3.11
Turbidity (NTU)	132.03	258	N/A	311
Total dissolved solids (g/L)	8	5	N/A	5.4

Note: Due to suspected caving issues and time constraints water samples were taken through the air rotary drill pipe shortly after the re-drilling of boring SB-11. The elevated water level is believed to be a result of the submerged pipe and possible caving, since the water level was not allowed to settle for several hours as was the case with the other soil borings.

bec environmental, inc.

Environmental Consulting

Date: June 25, 2013

Time: 7:22 AM

Site Conditions/Weather: Clear sky with a few clouds. Cool wind approximatley 1 to 5 miles per hour

Team Member(s): John Yuon

SAMPLE NUMBER: SB2-1, SB2-2, SB2-3 SB2-4, and SB2-5

SAMPLE LOCATION: SB-2 (SB-8)

ANALYSIS:

- ☐ Total Arsenic ☐ TPH
- ☐ Total Lead ☐ Asbestos
- ☐ Other:

Stored by Lab: Y N

SAMPLE DESCRIPTION: Water Samples from SB-2

NOTES/SITE SKETCH:

pH 6.75

Temp 18.4°C

Conductance 1.33 S/M

DO 4.11 g/L

Turbidity 132.0 NTU

TDS 8 g/L

Depth to Groundwater ~~60' 9"~~ 60' 5"

bec environmental, inc.

Environmental Consulting

Date: June 26, 2013

Time: 7:20 AM

Site Conditions/Weather: Clear Skies, no clouds. Temperature is in the 80's. Cool breeze headed north approximatley 1 mile per hour

Team Member(s): John Yuen

SAMPLE NUMBER: SB3-1 SB3-2 SB3-3 SB3-4 SB3-5

SAMPLE LOCATION: SB-3 (SB-9)

ANALYSIS:	
☐ Total Arsenic	☐ TPH
☐ Total Lead	☐ Asbestos
☐ Other:	
Stored by Lab: Y	N

SAMPLE DESCRIPTION: Water Samples for SB-3. Multi-meter results and water Soanding depth.

NOTES/SITE SKETCH:

pH 6.85

Depth to Groundwater 63'

Temp. 20.1°C

Conductance .789 S/M

DO 2.1 g/L

Turbidity 258.0 NTU

TDS 5.0 g/L

7660 West Sahara Avenue · Suite 150 · Las Vegas · Nevada · 89117 · phone 702.304.9830 · fax 702.304.9839

bec environmental, inc.

Environmental Consulting

Date: June 28, 2013

Time: 8:32 AM

Site Conditions/Weather: Sunny, with winds headed west / Southwest at approximatley 10 to 15 miles per hour. Temperature in the 90s

Team Member(s): John Yeon

SAMPLE NUMBER: SB1-1, SB1-2, SB1-3, SB1-4, SB1-5, SB1-6, SB1-7

SAMPLE LOCATION: SB-1, Coaldale (SB-11)

ANALYSIS:

- ☐ Total Arsenic
- ☐ TPH
- ☐ Total Lead
- ☐ Asbestos
- ☐ Other: _____

Stored by Lab: Y N

SAMPLE DESCRIPTION: Water Samples for Boring SB-1 Coaldale, Nevada

NOTES/SITE SKETCH:

pH 6.62

Groundwater Depth 55'

Temp. 24.4°C

Conductance .864 S/M

DO 3.11 g/L

Turbidity 311 ntu

TDS 5.4 g/L

7660 West Sahara Avenue · Suite 150 · Las Vegas · Nevada · 89117 · phone 702.304.9830 · fax 702.304.9839

Appendix K

Waste Manifest and Disposal Documentation

USEcology

WASTE PROFILE FORM

US Ecology Nevada (Beatty) usencs@usecology.com
US Ecology Idaho (Grand View) useics@usecology.com
US Ecology Texas (Robstown) usetcs@usecology.com
US Ecology Michigan (Detroit) usemcs@usecology.com

PROFILE #_____

A. GENERATOR INFORMATION

1. Generator SN Trust	☐ Billing information is same ☐ P.O. required for payment
2. Facility Address N 38.02722 W 117.88323 Nye County NV	12. Billing Company Double Barrel Environmental Services
3. Mailing Address PO Box 60	13. Billing Address 121 Main Street
4. City/State/Zip Tonopah, NV 89049	14. City/State/Zip Riverside, CA 92501
5. Technical Contact Ed Yist--Trustee	15. Billing Contact Accounts Payable
6. Phone (775) 482-4309 7. Fax	16. Phone (951) 683-6994 17. Fax
8. Generator Status ☐ CESQG ☐ SQG ☐ LQG	18. Email peggys@dbhzmat.com
9. EPA ID # Exempt	10. State ID #
11. SIC Codes:	

B. SHIPPING INFORMATION

1. US DOT Shipping name: Non-Hazardous waste solid

2. Hazard Class:	3. UN/NA #:	4. Packaging Group:	5. RQ:

6. Container Type ☑ Bulk ☐ Totes ☐ Pallet ☐ Boxes ☐ Drums ☐ Other, Describe:

7. Frequency ☐ Year ☐ Quarterly ☐ Monthly ☑ 1 time ☐ Other, Describe:

8. Shipment Size: 20Yard Quantity: 1-2

9. Waste Import ☐ Yes ☐ No
If yes, complete Waste Import Supplement

C. GENERAL MATERIAL & REGULATORY INFORMATION

1. Common name for this waste:
Non Hazardous Petroleum Contaminated Soil

2. Process generating the material:
Drill cuttings from site assessment

3. Describe physical appearance and odor of the waste:
Brown, solid, trace hydrocarbons

4. Odor of the waste ☐ None ☑ Slight ☐ Strong	5. Physical State: ☐ Liquid ☐ Sludge/Slurry ☑ Solid
6. Describe Color: brown	7. Liquid phases: ☐ Single ☐ Double Layer ☐ Multi-layer
8. Knowledge is from ☐ Lab analysis ☐ MSDS	☑ Process/generator knowledge
9. Waste Type (US EcologyTexas customers only): ☐ Industrial	☐ Non-Industrial
10. Is the waste restricted under EPA Land Disposal Restrictions (§268)	☐ Yes ☑ No
11. If LDR "Yes", is waste: ☐ Wastewater ☐ Non-wastewater ☐ Debris (§268.2)	12. Alt. Standards for soil? ☐ Yes ☐ No
13. Is the waste RCRA hazardous waste containing benzene and originating at a Petroleum Refinery (SIC 2911), Chemical Manufacturing Plant (SIC 2800 thru 2899) or Coke by-Product Recovery Plant (SIC 3312)? (If "Yes" complete Benzene Waste Operations Supplement form)	☐ Yes ☐ No
14. VO Conc.(§264.1083) ☐ <500 ppmw ☐ ≥500ppmw	15. Has waste been treated after point of generation? ☐ Yes ☑ No
16. CERCLA Regulated (Superfund) Waste ☐ Yes ☐ No	17. Butadiene waste regulated by §63 Subpart XX ☐ Yes ☑ No
18. Waste contains UHC constituent(s) (§268.48), above a treatment standard, other than those for which the waste exhibits a characteristic. (If "yes", list all UHC's in Section D)	☐ Yes ☑ No
19. Waste exempt from definition of "solid waste" or "hazardous waste" (If "Yes", list reference 40CFR _____)	☐ Yes ☑ No

20. State Waste Codes						
21. RCRA Waste Codes						

22. Source Code: G_____	23. Form Code: W_____	24. Management Code: H_____

D. MATERIAL COMPOSITION

Values are: ☐ TCLP ☐ TOTALS

Constituent	Units	Range total ≥ 100% Typical	Min	Max
Soil	%	100%	100%	100%

E. WASTE CHARACTERISTICS

1.	Oxidizer	☐ Yes	☑ No	9.	Reactive sulfides _____ppm	☐ Yes	☑ No
2.	Explosive	☐ Yes	☑ No	10.	Reactive cyanides_____ppm	☐ Yes	☑ No
3.	Organic peroxide	☐ Yes	☑ No	11.	Water/air reactive	☐ Yes	☑ No
4.	Shock sensitive	☐ Yes	☑ No	12.	Thermally unstable	☐ Yes	☑ No
5.	Tires	☐ Yes	☑ No	13.	TSCA regulated PCB waste *(control sheet required with shipment)*	☐ Yes	☑ No
6.	Pyrophoric	☐ Yes	☑ No	14.	Medical/infectious waste	☐ Yes	☑ No
7.	Compressed gas	☐ Yes	☑ No	15.	Radioactive (*If yes, complete Profile Addendum for Radioactive Waste)*	☐ Yes	☑ No
8.	Halogenated organics	☐ Yes	☑ No				

16. Possibility of incidental liquids from transportation? ☐ Yes ☑ No

17. Is waste a solid using the paint filter test? ☐ Yes (solid) ☐ No (not solid)

18. pH Range _____ to _____ Typical 6-8 ☐ ≤ 2 ☑ 2 < 12.5 ☐ ≥ 12.5

19. Flash Point none º F ☐ < 140 º F

F. GENERATOR'S CERTIFICATION

☑ Yes ☐ No I certify this material may be disposed without further treatment.

I authorize US Ecology to correct inconsistencies on the waste profile form that impact waste management decisions with my oral or written authorization. US Ecology will require re-submittal of the waste profile information if substantial changes are determined necessary. I understand material that does not conform to specifications described in this profile may be rejected by US Ecology unless other contractual arrangements have been agreed to by both parties. I certify, under penalty of law, that I am familiar with this waste stream through analysis and/or process knowledge, and that all information provided is true, accurate, representative and complete, that all known or suspected hazards have been disclosed, and that this form was completed in accordance with the instructions provided.

Print Name	Signature	Title	Date
Ed Yost	Ed Yost	Trustee SN Trust	08/16/2013

NON-HAZARDOUS WASTE MANIFEST

Please print or type (Form designed for use on elite (12 pitch) typewriter)

NON-HAZARDOUS WASTE

NON-HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.

Manifest Document No: 8281

2. Page 1 of 1

GENERATOR

3. Generator's Name and Mailing Address
SN TRUST
PO BOX 60 TONOPAH, NV 89049

4. Generator's Phone: 775 482-4309

N 38.02722
W. 117.88323
NYE COUNTY, NV

5. Transporter 1 Company Name: DOUBLE BARREL ENVIRONMENTAL SERVICES

6. US EPA ID Number: NVR000087544

A. State Transporter's ID

B. Transporter 1 Phone: (702) 735-9761

7. Transporter 2 Company Name

8. US EPA ID Number

C. State Transporter's ID

D. Transporter 2 Phone

9. Designated Facility Name and Site Address
US ECOLOGY NEVADA, INC.
HWY 95, 11 MILES SOUTH OF BEATTY
BEATTY, NV 89003

10. US EPA ID Number: NVT330010000

E. State Facility's ID

F. Facility's Phone: (800) 239-3943

11. WASTE DESCRIPTION	Containers No.	Containers Type	13. Total Quantity	14. Unit Wt./Vol.
a. NON-REGULATED MATERIAL, NON-HAZARDOUS SOLID WASTE (PETROLEUM CONTAMINATED SOIL)	1	CM	5	Y
b.				
c.				
d.				

G. Additional Descriptions for Materials Listed Above
11A. PROFILE # 07020710-0
BIN # PT2382

H. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information: 24 HR. #(877) 324-9628 DBES# 8281

WEAR PROPER PPE WHEN HANDLING MATERIAL

16. GENERATOR'S CERTIFICATION: I hereby certify that the contents of this shipment are fully and accurately described and are in all respects in proper condition for transport. The materials described on this manifest are not subject to federal hazardous waste regulations.

Printed/Typed Name: ALEC GONZALES
Signature: "ON BEHALF OF"
Date: Month 8 Day 29 Year 13

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Randy Merch
Signature:
Date: Month 8 Day 29 Year 13

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name:
Signature:
Date: Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of the waste materials covered by this manifest, except as noted in item 19

Printed/Typed Name: Tyler Eades
Signature:
Date: Month 8 Day 30 Year 13

NON-HAZARDOUS WASTE MANIFEST

Please print or type (Form designed for use on elite (12 pitch) typewriter)

NON-HAZARDOUS WASTE

GENERATOR

NON-HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.

Manifest Document No: 8281B

2. Page 1 of 1

3. Generator's Name and Mailing Address
SN TRUST
PO BOX 60 TONOPAH, NV 89049

4. Generator's Phone (775) 482-4309

N 38.02722
W. 117. ~~88323~~
NYE COUNTY, NV

5. Transporter 1 Company Name: DOUBLE BARREL ENVIRONMENTAL SERVICES

6. US EPA ID Number: NVR000087544

A. State Transporter's ID

B. Transporter 1 Phone: (702) 735-9761

7. Transporter 2 Company Name

8. US EPA ID Number

C. State Transporter's ID

D. Transporter 2 Phone

9. Designated Facility Name and Site Address
US ECOLOGY NEVADA, INC.
HWY 95, 11 MILES SOUTH OF BEATTY
BEATTY, NV 89003

10. US EPA ID Number: NVT330010000

E. State Facility's ID

F. Facility's Phone: (800) 239-3943

11. WASTE DESCRIPTION	Containers No.	Containers Type	13. Total Quantity	14. Unit Wt./Vol.
a. NON-REGULATED MATERIAL, NON-HAZARDOUS SOLID WASTE (PETROLEUM CONTAMINATED SOIL)	1	CM	12	Y
b.				
c.				
d.				

G. Additional Descriptions for Materials Listed Above
11A. PROFILE # 07020770-0
BIN # DBES 1017

H. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information: 24 HR. # (877) 324-9628 DBES# 8281

WEAR PROPER PPE WHEN HANDLING MATERIAL

16. GENERATOR'S CERTIFICATION: I hereby certify that the contents of this shipment are fully and accurately described and are in all respects in proper condition for transport. The materials described on this manifest are not subject to federal hazardous waste regulations.

Printed/Typed Name: ALEC GONZALES
Signature: "ON BEHALF OF"
Date: Month 8 Day 29 Year 13

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Randy Melch.
Signature:
Date: Month 8 Day 29 Year 13

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name:
Signature:
Date: Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of the waste materials covered by this manifest, except as noted in item 19

Printed/Typed Name: Tyler Fowles
Signature:
Date: Month 8 Day 30 Year 13

USEcology, Inc.

Ticket: 133221

US Ecology Nevada
11 Miles South of Beatty
Beatty, NV 89003

Vehicle: 602

Manifest #:8281

Date: 8/30/2013
Time In: 08:13 AM
Time Out: 09:14 AM

In: 44560 lb
Out: 42380 lb
Net: 2180 lb

Net Tons:1.09 tons
Net Kg: 989 kilograms

USEcology, Inc.

Ticket: 133208

US Ecology Nevada
11 Miles South of Beatty
Beatty, NV 89003

Vehicle: 602

Manifest #:8281B

Date: 8/30/2013
Time In: 07:04 AM
Time Out: 08:13 AM

In: 61740 lb
Out: 44580 lb
Net: 17160 lb

Net Tons:8.58 tons
Net Kg: 7784 kilograms

For solidification