A1 TITLE PAGE

QUALITY ASSURANCE PROJECT PLAN
CITY OF LAS VEGAS EPA BROWNFIELDS CLEANUP GRANT FOR SYMPHONY PARK PARCELS J/K AND PARCELS L North/M4

Grant Number BF-98T69401

Period Of Applicability:
10/1/2023- 9/30/2027

Prepared for City of Las Vegas

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September 24, 2025

A2 APPROVAL PAGE

CITY OF LAS VEGAS EPA BROWNFIELDS CLEANUP
GRANT FOR SYMPHONY PARK PARCELS J/K AND PARCELS L North/M4

Prepared for:
City Of Las Vegas

September 2025

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LIST OF ACRONYMS

BGS	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEM	Certified Environmental Manager
CFR	Code of Federal Regulations
CPM	Consultant Project Manager
CRM	certified reference materials
CWA	Clean Water Act
DQI	data quality indicators
DQO	data quality objective
EC	electrical conductivity
EDD	electronic database deliverable
EPA	United States Environmental Protection Agency
ESA	Environmental Site Assessment
FSP	field sampling plan
GC/MS	gas chromatography/mass spectrometry
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HPLC	high performance liquid chromatography
ICP-MS	inductively coupled plasma mass spectrometry
IDW	investigation-derived waste
IS	internal standard
LCS	laboratory control spike
LCSD	laboratory control spike duplicate
MCL	maximum contaminant levels
MDL	method detection limit
µg/L	micrograms per liter
mg/L	milligrams per liter
MS	matrix spike
MSD	matrix spike duplicate
NAC	Nevada Administrative Code
NDEP	Nevada Division of Environmental Protection
NESHAPs	National Emissions Standards for Hazardous Air Pollutants
OSHA	Occupational Health and Safety Administration
OSWER	Office of Solid Waste and Emergency Response
PARCC	precise, accurate, representative, comparable, and complete
PCB	polychlorinated biphenyls
PPE	personal protective equipment
PQL	Practical Quantitation Limit
QA	quality assurance
QA/QC	quality assurance/quality control
QAM	Quality Assurance Manager
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	quality control
QCSM	Quality Control System Manager
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
RSL	Regional Screening Level
SAP	sampling and analysis plan
SDWA	Safe Drinking Water Act
SGMP	soil and groundwater management plan
SOP	standard operating procedure

SVOCs	Semi-volatile Organic Compounds
TPH	Total Petroleum Hydrocarbons
UST	underground storage tank
VOC	volatile organic compounds
XRF	x-ray fluorescence

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A4 Project Purpose, Problem Definition, and Background

A4.1 Project Purpose and Problem Definition

The United States Environmental Protection Agency (EPA) awarded the City of Las Vegas (City) a Brownfields Cleanup grant (BF-98T69401) to address remediation and clean-up needs on combined Parcels J/K, and combined Parcels L North/M4 in Symphony Park, Las Vegas, NV. Each of the two sets of combined parcels will be developed separately from the other, but each of the parcels within a group are adjacent to one another, and each has a separate Assessor's Number.

The purpose and the target of the approved Brownfields Cleanup Plan (BCP) is to address clean-up needs (during development) on combined Parcels J/K (4.82 acres in size) and combined parcels L North/M4 (2.1 acres in size). *Funding is provided in the Brownfields grant for both combined parcels* that will include the preparation of site-specific Sampling and Analysis Plans (SAP) and Health and Safety Plans (HSP), preparation of a stormwater pollution prevention plan, and development of a dust mitigation plan. In consultation with EPA, the CEM will determine if sampling is necessary during or post the clean-up work and will arrange to evaluate if the clean-up meets health and safety standards, thereby allowing plans to safely redevelop Parcels J/K and L North /M4.

The plan is to remediate specific areas of the subject parcels to allow for their development in a manner that the development is not hindered by handling impacted soil during construction. If not remediated prior to site development, construction activities that result in excavation will encounter known impacts at the subject parcels. Prior to conducting remediation, assessment of the known impacts must be undertaken. This is a requirement of a Soil and Groundwater Management Plan (SGMP) developed for Symphony Park in 2007. More information regarding the SGMP is provided in Section A4.2.

In addition to providing funding to clean up Parcels J/K and Parcels L North/M4, this EPA Brownfields cleanup grant also provides funding to perform required site-specific assessment work. The pre-remediation sampling work was approved in the grant application submittal to further refine the extent of impacts specific to individual development plans on each parcel. This is an essential element of the remediation plan for parcel-specific, precise, and strategic remediation so the developer can proceed knowing where impacts will be encountered. This work was defined and will conform with the NDEP-approved Brownfields SGMP as part of the remediation of each parcel. Site specific assessment will be used to collect site data to assist with the management impacts encountered during development. The regulatory standards for comparison are defined in the SGMP prepared for and approved by the NDEP specifically for site assessment activities at Symphony Park.

It should be noted that this QAPP will serve as an umbrella document, but the established Symphony Park SGMP will be applied as the primary field guidance document. If a conflict of consequence is identified, the QAPP will prevail, unless otherwise approved by EPA. Sampling design strategies will be used as guides to evaluate factors unique to a site, including redevelopment options, exposure potential, and projected site reuse. Site specific sampling design strategies will be identified in a Sampling and Analysis Plan (SAP) developed for the Phase II ESA. The Phase II ESA's will be conducted pursuant to the requirements of developing an SAP pursuant to the SGMP. See Appendix D-2.

The QAPP format was derived following EPA Region 9 Directive CIO 2105-S-02.1. This document presents functions, procedures, and specific quality assurance (QA) and quality control (QC) activities to ensure Phase II EPA sampling analytical data is consistently produced and is of known quality in support of the cleanup of Symphony Park Parcels J/K and L North/M4 and to certify data is of sufficient quality to help make redevelopment decisions. The procedures described are designed to ensure that precise, accurate, representative, comparable, and complete (PARCC) data are collected throughout the data collection program.

A4.2 Background

The City of Las Vegas, Nevada was settled along old stagecoach routes that ultimately became major railroad routes. It is the largest city in Nevada, the Clark County seat, and home to 662,400 (2020 Census) people. The Las Vegas Valley with its meadows and artesian springs attracted early Native American populations, followed by ranchers and farmers. The Salt Lake City to Los Angeles Railroad was completed in 1905 and urbanization followed. The initial railroad lines ultimately became part of the greater Union Pacific Railroad system.

Following WWII, many functions of the railroad system declined, and Union Pacific Railroad (UPRR) began closing operations. In the heart of downtown, UPRR closed their 61-acre site, which served as a main fueling and maintenance yard for over 70 years. UPRR operated the site as a railroad fuel storage and maintenance facility.

After active operations, UPRR conducted assessment and remediation of the site under the regulatory oversight of the NDEP. Substantial contaminated soil was removed, and the site was granted conditional closure by NDEP with development conditions attached. This railroad site was considered the largest brownfields site in the City, with contamination from fuels affecting both the soil and groundwater. The City and their affiliated non-profit corporation, City Parkway V, acquired the former UPRR site, which is now known as Symphony Park. Because of the extent of remaining contamination and the development conditions, the City partnered with the Nevada Brownfields program and a Symphony Park SGMP was initiated in March of 2007. Since 2007, soil and groundwater on the site have been assessed on a parcel specific manner in accordance with the SGMP prior to and during development.

Since that time, the City has been in the process of redeveloping vacant, highly contaminated railroad property while managing removed impacted soil and groundwater pursuant to the requirements of the SGMP.

Parcels J/K consist of two adjacent development parcels (under one APN), both with remnant total petroleum hydrocarbon (TPH) contamination remaining from the operation of the former UPRR fueling loading, pump house, and storage tanks. Prior to the purchase of the site, a large portion of this area was remediated by UPRR, including the removal of soil to a depth of 7.5 feet. It was assumed that remediated areas would not require further action, but portions of the site are known to be impacted and will likely need to have soil removed for the intended uses. Clean-up will include the excavation and offsite disposal of contaminated soil to remove the TPH. Groundwater testing on the site shows that groundwater contamination is not present. There are currently no occupied permanent structures on this site. A portion of the site is paved as a temporary parking lot. Parcels J/K are planned for a 100,000 square foot medical office with the remainder planned for parking and an as yet undetermined use.

Parcels L North/M4 are planned for an art museum with an open public sculpture park. Parcel L North includes the undeveloped portion of Parcel L adjacent to Parcel M4. Both Parcels L North and M4 were relatively recently paved and used as temporary parking areas until remediation and development are initiated.

Most of Parcels L North/M4 are located within the UPRR remediation areas. A small portion along the eastern edge of the parcel is located outside the former remediation area; however, this EPA Brownfields clean-up grant will be used to remove remaining TPH contamination in this area (where encountered).

Parcel M4, located adjacent to the north of Parcel L North, is also the location of former railroad siding tracks. As part of UPRR remediation efforts, TPH impacted soil with concentrations up to 35,000 mg/Kg was removed from the site up to depths of 5-feet over most of the parcel. The majority of Parcel M4 is located within the UPRR remediation areas; however, a portion of the northeastern area of the parcel is located outside the former remediation area. TPH contamination in this area will be remediated (where encountered).

Parcel L North is planned for development with the 90,000 square foot Las Vegas Museum of Art, and Parcel M4 is planned for a public sculpture park including a pedestrian bridge landing area.

A4.3 Non-Direct Measurements (Existing Data)

A review of existing data for each individual site will be included as part of the site-specific SAP.



Figure 1. Project Location Map



Figure 2. Project Area Map

A5 Project Task Description

The Project is designed to identify and manage contaminants of concern in soil and groundwater associated with past releases of petroleum, solvents, and metals associated with operations that were conducted by UPRR as a railroad fuel storage and maintenance facility. The 61-acre site, named Symphony Park, was purchased by the City in 2000 and, since that time, has been transformed from a vacant, highly contaminated railroad site to a cultural center envisioned by the City. The transformation began in 2000, when the City secured a commitment from the Cleveland Clinic to locate a major brain health clinic on the site and, later, an agreement with the Smith Performing Arts Center to locate a world-class performance center to Symphony Park. Both are world class centers that are now complete and operational and have helped to spur revitalization on other parcels in Symphony Park and the surrounding areas of downtown. New retail, restaurants, additional medical clinics, and housing are planned, have been developed, or are under development. Some parcels remain in the Symphony Park that are pending development. As part of that vision, the City has identified two high priority brownfields sites in Symphony Park that are planned for redevelopment; Parcels J/K are planned for reuse with a 100,000 square foot medical office building and another yet undetermined development type. Parcels L North/M4 are planned for the 90,000 square foot Las Vegas Museum of Art and a public sculpture park.

For pre-development assessment, specific constituents that will be sampled and the proposed analytical methods will be discussed in the individual SAPs. The data quality objectives (DQOs) will be site-specific and will be discussed in the individual SAPs. A detailed description of the constituents to be monitored and the information used to develop the list of constituents will be discussed in the individual SAPs that will be developed for each individual development. The scope of work at each site could include subsurface soil, soil gas, and groundwater sampling. Information collected from the site-specific assessments will be used to determine if impacts to the site exist and assist in cleanup planning. The work under the EPA Brownfields grant will be directed at the two previously mentioned high priority parcels planned for redevelopment. Eliminating and addressing contamination encountered during development that remains from the release of petroleum products and/or hazardous substances will help facilitate the reuse of these parcels and help the City achieve its overall economic development and revitalization goals for Symphony Park.

A schedule for this work has yet to be developed. Initial plans for development are currently being completed. Once completed, it is estimated that it will take approximately four weeks to prepare each individual SAP. Each individual pre-remediation assessment will require approximately six weeks to complete. Remediation schedules will be dependent upon the development plans. Remediation will only occur in areas where excavation associated with planned site development are anticipated to encounter impacts to the subsurface. Once remediation is complete, site development can be undertaken.

As a part of this effort, the following documents are expected to be produced:

- SAPs for each development
- A report detailing the findings of each assessment conducted will be prepared
- Specifications for each planned remediation (based on the plans for development created by others) will be provided to each selected remediation contractor
- Final reports detailing areas remediated, types of remediation (excavation), and amount of material remediated will be repaired

A6 Information/Data Quality Objectives and Performance/Acceptance Criteria

A6.1 Quality Objectives and Criteria for Measuring Data

DQOs will be selected for this project based on the expected data usage and are designed to ensure that accurate, precise, representative, and complete data are collected throughout the monitoring program. Site specific DQOs will be provided for each individual SAP. The EPA cites seven criteria for DQOs in its draft EPA Region 9 Requirements for QAPPs in Region 9 (EPA, 2010). These include:

1. **Goal Statement.** For the two Brownfields target areas, once the footprint of planned development have been identified site specific assessment will be conducted. Proposed sample locations will be based on development plans and completed following the approval of the SAP.
2. **Identify decision points.** The location and number of samples for assessment will be based upon the development plan for each site. The locations will be chosen to collect sufficient quantity and quality of data to identify areas of contamination in the subsurface within the footprint of proposed site development.
3. **Identify inputs to the decision.** Compare media-specific constituent concentrations against background levels and/or screening levels. Screening levels are established in the SGMP and generally include State of Nevada adopted regulations that govern the reporting of releases of pollutants, contaminants, petroleum products, and hazardous substances; EPA RSLs for soil; MCLs for groundwater; and the EPA OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils. Tables for the most encountered compounds and their reporting limits have been compiled and provided in Appendix B. Also included in Appendix B is Section 4.0 Soil and Waste Classification from the SGMP which provides contaminant levels that are used to define waste classification for offsite disposal purposes.
4. **Define the study area.** The overall study area is located at Symphony Park located as noted on Figures 3, 4, & 5. Site assessment and cleanup activities will be conducted at Parcels J/K and Parcels L North/M4.
5. **Develop a decision rule.** If site soil results are below screening levels, the soil will not be considered a source of contamination. If site groundwater results are below screening levels, source contamination has not impacted groundwater resources. If soil gas results (if sampled) are below screening levels, soil vapor intrusion will not be considered a concern for the site. If soil gas data indicates there is an area with concentrations above screening levels, additional soil and/or groundwater samples may be collected, or sample locations may be adjusted to collect data in the potential source areas.
6. **Specify the limits on decision errors.** These limits are defined by laboratory method detection limits that will be provided in the site-specific SAP.
7. **Optimize the design for obtaining data.** The investigation rationale provides data optimization for each media (soil gas, soil, and groundwater).

A6.2 Regulatory Requirements

For releases of pollutants, contaminants, petroleum products, and hazardous substances, the reportable quantities established in Title 40, Code of Federal Regulations (CFR) Part 302, the EPA RSLs for soil, and the MCLs for groundwater will be compared to data obtained. In addition, the State of Nevada Environmental Commission has adopted regulations that govern the reporting of releases of pollutants, contaminants, petroleum products, and hazardous substances. These regulations are contained in Nevada Administrative Code (NAC) 445A.345 to 445A.348. For hazardous substances, the State reportable quantities are established for soil and for groundwater.

For the Phase II ESAs to be conducted, the objective is not to identify if a release has occurred. The objective is to define the levels of impacts as defined in the SGMP developed for Symphony Park. Categories of impacts are defined that dictate the requirements for managing impacted material encountered during site development. These are defined in Section 4, Soil and Waste Classifications, of the SGMP. This has been included in Appendix B.

The State of Nevada does not regulate soil gas and has not established safe levels for soil gas. Therefore, the EPA OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils may be used to determine if concentrations are above screening levels for this project. This information can be used to determine risk and evaluate if additional soil and groundwater sampling may be required at a site.

A6.3 Measurement of Quality Objectives and Data Quality Indicators

The following sections represent Data Quality Indicators (DQIs) that will be considered during the development of the SAPs.

Accuracy. Accuracy describes how close an analytical measurement is to its true value. Accuracy is typically measured by analyzing a sample of known concentration (prepared using analytical-grade standards) and comparing the analytical result with the known concentration.

Precision. Precision describes how well repeated measurements agree. Precision is typically evaluated by comparing analytical results from duplicate (also called replicate) samples and calculating the relative percent difference (RPD), where RPD is defined as:

$RPD = (|C_1-C_2|/((C_1+C_2)/2))x100$

Precision will be measured using both field and laboratory duplicates in addition to duplicate laboratory control spikes.

Bias. The bias of the data is the systematic or persistent distortion of a measurement process that causes errors in one direction. DQI will use reference materials or analytical spike matrix samples to determine bias data.

Representativeness. The representativeness of the data is mainly dependent on the sampling locations (spatial), sampling frequency (temporal), sample collection procedures, and analytical constituents and methods. The sampling approach will be described in detail within the individual site SAP to ensure data collected during the project are representative to the extent possible. For example, physical samples will be collected in a manner such that the resulting data appropriately reflects the environment or conditions being measured.

Completeness. Completeness measures the amount of valid data needed to be obtained from a planned measurement system. It is expressed as a percentage and is calculated by subtracting the number of rejected and unreported results from the total planned results and dividing them by the total number of planned results. Estimated results do not count against completeness because they are considered usable if limitations are identified. Results rejected because of out-of-control analytical conditions, severe matrix effects, broken or spilled samples, or samples that could not be analyzed for other reasons are subtracted from the total planned number of results to calculate completeness. The goal for the percentage completeness of samples for each site will be 90% for each method and sample matrix.

Comparability. Data comparability is the confidence with which one data set can be compared to another data set. Data comparability will be achieved by using standard sampling and analytical techniques and by documenting QA/QC measures and procedures. Comparability evaluates whether the reported data is comparable with similar data reported by other organizations. This includes analytical results that are in the same units as action levels established by regulatory programs. The use of approved analytical methods and certified laboratories will provide some level of comparability. Evaluation of performance evaluation samples is another measure of comparability. Certified laboratories are required to analyze performance evaluation samples on a regular basis to evaluate the comparability of their reported results.

Sensitivity. Sensitivity evaluates the capacity of a method or instrument to detect a target analyte above the background or noise level.

Quality Control Limits. For QC samples and/or QC checks, the QC limits used for precision and accuracy determinations will be the same as those established by the laboratory used for the project. Laboratories used for this project will be requested to supply analyte and method specific quality control acceptance criteria. This information will be reviewed before the laboratory is used to evaluate if the laboratory PQLs are below standards that will be used for comparisons. Additionally, the laboratory RPD and QC limits for accuracy will be reviewed to evaluate if they are within acceptable industry standards. The laboratories will qualify data that is not within their control limits. The laboratory likely to be most utilized for this project has provided their Quality Manual (see Appendix A).

Laboratories will report detection limits based on current statistical detection limit studies and reporting limits based on the low standards in their calibration curves. Proposed analytical methods shall be used unless approval for alternative methods is given by the QAO.

A7 Distribution List

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A8 Project Organization

The following table provides the names and contact information for the designated personnel responsible for project quality control that will receive copies of reports necessary to implement the overall program.

Brownfields Project Team			
Name	**Affiliation**	**Title**	**Contact Information**
Tracy Reich	City of Las Vegas	Project Coordinator	ph: 702-229-2083 treich@lasvegasnevada.gov
Mr. Thomas Mix	Converse Consultants	Quality Assurance Officer and Point of Contact	ph: (707) 206-1647 tmix@converseconsultants.com
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Mr. Rob Gegenheimer	Converse Consultants	Data Management Coordinator	ph: (702) 263-7600 fax: (702) 269-8353 rgegenheimer@converseconsultants.com
Mr. Keith Houk (tentative)	Converse Consultants	Field Team Leader	ph: 702-249-6024 fax: 702-269-8353 khouk@converseconsultants.com
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Notes:
QM = Quality Assurance Manager
EPA = United States Environmental Protection Agency
TBD = To Be Determined

A8.1 Environmental Protection Agency

The federal government, through the EPA, operates a national Brownfields and Revitalization Program and serves as the administrator for the EPA Brownfields Community-Wide Site Assessment Grants, as authorized under Section 104(k) of the Brownfields Law to fund environmental assessments and cleanups.

EPA Quality Manager (QM) - Audrey L. Johnson, as the EPA Manager, Quality Assurance Branch, has the responsibility to assess that the QAPP contains the type and quality of data needed for environmental decisions and that the methods required for collecting, analyzing, and assessing the data will support these decisions. Ms. Johnson will coordinate with Ms. Stephanie Steinbrecher, the EPA project officer, regarding the review and approval process.

EPA Project Officer – Stephanie Steinbrecher has the overall responsibility of assessing that the work meets the grant terms and conditions and coordinates directly with Ms. Tracy Reich, Project Coordinator for the City. The EPA Project Officer reviews the project schedule and budget and is responsible for monitoring compliance with the project guidelines, including determining site eligibility and approving the QAPP.

A8.2 City Project Coordinator

The City, as the grantee (grant number BF-98T69401), is responsible for adhering to the terms and conditions of the cooperative agreement with EPA. The City is the principal data user and decision maker and will interface with EPA's project officer and EPA QAM to assure adherence to the QAPP. Ms. Tracy Reich, Project Coordinator, has the responsibilities and duties for the following: define project objectives, establish project policy and procedures to address specific needs of the project, review and analyze overall task performance, approve work products submitted by the consultants, and represent the City at meetings.

A8.3 Consultant Responsibilities

Under the direction of the Project Coordinator, Converse is responsible for implementing the work. Primary roles include developing and following the SAP, sample collection, data processing, data interpretation, presentation, reporting, and creating and following the QA procedures and QC measures associated with these activities. Descriptions of project responsibilities below refer to positions of the specific team members:

Principal-in-Charge - Mr. Kurt Goebel of Converse is the Principal-in-Charge and will be responsible for the overall technical review of the project and will monitor that the necessary resources are available to complete the scope of work. He will have the ultimate decision-making authority for the decisions made by the consulting team.

Quality Assurance Officer (QAO) - Mr. Thomas Mix of Converse is responsible for evaluating the field work and assuring that the required QA/QC procedures are in place before personnel are dispatched to the field. Mr. Mix will review reports to review the quality of the final product. He will ensure that the work products associated with this QAPP and SAPs are delivered to those on the distribution list.

Consultant Project Manager (CPM) – Mr. Rob Gegenheimer is responsible for overall assessment work project planning including establishing project objectives, scope, budget, schedule, and preparing the final submittals. He will schedule and coordinate field and laboratory activities. The Project Manager will be responsible for the implementation of this QAPP, Phase IIs, and SAPs and will provide overall direction for the QC function of field and laboratory activities. The Project Manager or his designee will, as necessary, perform audits, surveillance, document reviews, and other functions as required to determine the continued effectiveness of this QAPP.

The Project Manager has the authority to stop work that is not in compliance with the SAP and QAPP. Other responsibilities will include:

- Reporting to the Quality Assurance Officer on the status of QAPP implementation
- Providing orientation training and disseminating applicable quality information to the project staff
- Coordinating QC functions on the project to include assigning quality review staff
- Identifying the need for corrective actions and initiating, recommending, and coordinating solutions for quality issues
- Reviewing laboratory procurement documents to ensure that applicable quality requirements are adequately stipulated and followed
- Providing QC oversight of equipment preventive maintenance and decontamination

Data Management Coordinator – Mr. Rob Gegenheimer will review field and laboratory data for completeness, accuracy, and compliance with the QAPP and SAP.

Field Team Leader – Mr. Keith Houk is responsible for confirming that the procedures are followed as required in each individual SAP. Field teams will document compliance with the SAP and Standard Operating Procedures (SOPs) by recording activities and observations in the field.

A8.4 Environmental Laboratory Services

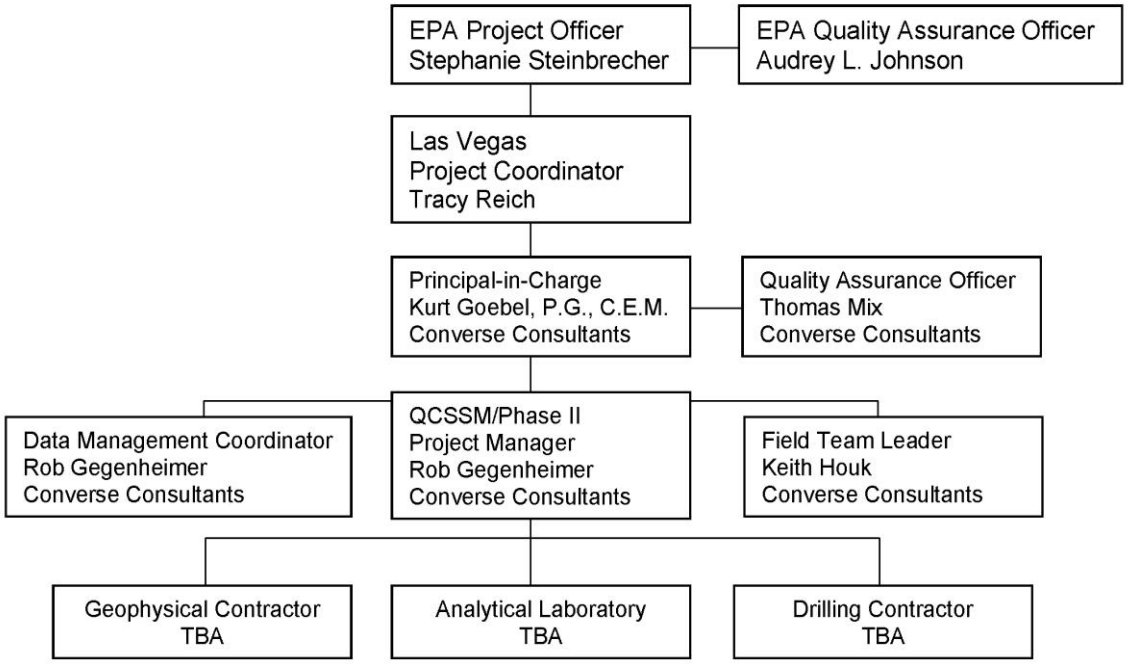
The NDEP operates an environmental laboratory certification program for the purpose of ensuring the citizens of Nevada have access to quality analytical services. Certification of environmental laboratories is required for the analysis of samples associated with the Clean Water Act (CWA), the Safe Drinking Water Act (SDWA), and the Resource Conservation and Recovery Act (RCRA), which serve as the three primary authorities for site cleanup under Nevada State Law. Projects conducted in the State are required to use analytical laboratories certified by the State of Nevada. The responsibility of laboratory certification resides with NDEP's Bureau of Water Quality Planning, Environmental Laboratory Services. The investigations performed under this QAPP will utilize analytical laboratories certified by the State of Nevada. If the primary laboratory used is not certified for a specific analysis required under an SAP, they will be required to utilize a sub-contracted laboratory that is certified for that analysis.

A9 Project Quality Assurance Manager Independence

The Quality Assurance Manager will be Mr. Thomas Mix of Converse. He has the responsibility to assess that the QAPP contains the type and quality of data needed for environmental decisions and that the methods required for collecting, analyzing, and assessing the data will support these decisions. Mr. Mix will coordinate with Ms. Stephanie Steinbrecher, the EPA project officer, regarding the review and approval process. Mr. Mix is independent of the entities responsible for daily operations associated with site assessment/remediation who will be the CLV and Consultants identified in Sections A8.2 and A8.3.

A10 Project Organization Chart and Communications

The Brownfields Clean-Up/Assessment Grant is being administered by the City. Converse is responsible for the preparation of and adherence to the QAPP. An organizational structure chart showing relationships of individuals and lines of communication among organizations and program personnel is provided below.



Organization Chart

A11 Personnel Training/Certification

Prior to commencing field activities, field personnel that participate in sampling will first review the site-specific SAP and will receive instructions, as necessary, from the project's QAM and/or Project Manager. Training will occur prior to the beginning of each Phase II ESA sampling event. Field personnel will be trained prior to the first sampling event in sample collection procedures (including QA/QC, grab sampling techniques, completing laboratory chain-of-custody forms, and the proper handling of samples), and field analysis (including instrument calibration, data recording procedures, and interpretation of collected data).

Laboratories used for the Phase II ESAs conducted under this QAPP will be Nevada Certified Laboratories. Laboratory personnel will be certified and trained as required by the laboratory's quality assurance manuals.

A11.1 Certified Environmental Manager (CEM)

Nevada Administrative Code 459.970 to 459.9729 requires that a person performing environmental services for a fee must meet the certification qualifications and be actively licensed as a CEM. There are provisions in the regulation for a CEM overseeing non-CEM personnel. However, the CEM must certify that "they are responsible for the services described in the document and for the preparation of this document. The services described in the document have been provided in a manner consistent with the current standards of the profession and, to the best of their knowledge, comply with Federal, State, and local statutes, regulations, and ordinances." Therefore, each person overseeing Phase II investigations will be a CEM.

A11.2 OSHA Hazardous Waste Operation and Emergency Response

Personnel actively involved in sample collection will have training pursuant to OSHA's 29 CFR 1910.120 requirements covering Hazardous Waste Operations and Emergency Response. Prior to arrival on site, each employer will be responsible for certifying that their employees meet the

requirements of pre-assignment training, consistent with OSHA 29 CFR 1910.120 paragraph (e)(3). The employer should be able to provide a document certifying that each worker who will be actively involved in sampling has received 40 hours of instruction off the site. The personnel must also receive 8 hours of refresher training annually. Site personnel are required to be trained in accordance with the standard. At a minimum, personnel are required to be trained to recognize the hazards on-site, the provisions of the HASP, and the responsible personnel.

A11.3 Asbestos Consultant

Any person sampling or otherwise disturbing potential asbestos containing building materials must be a NESHAP trained Asbestos Inspector and be a licensed Nevada Asbestos Abatement Consultant. This requires completion of a three-day certified training course and a one-year apprenticeship under a certified inspector. Additionally, Asbestos Inspectors must complete a four-hour annual refresher course.

A11.4 Lead-Based Paint Inspector

Any personnel involved in the evaluation and testing of suspected lead-based paint must be certified by the U.S. EPA as a Lead-Based Paint Inspector. If the inspection includes the use of an X-ray fluorescence (XRF) meter, the device used will be an LPA-1 XRF analyzer. Only persons certified to use the instrument will be allowed to operate the XRF. This requires the successful completion of an eight-hour class that has been approved by the manufacturer of the instrument. The guidelines that will be followed during sampling will be the Department of Housing and Urban Development Guidelines for the Evaluation and Control of Lead-Based Paint. Testing for lead-based paint is not anticipated for the Phase II ESAs planned for the sites to be assessed at Symphony Park (Parcels J/K and L North/M4). If such testing is required, appropriate guidelines will be followed and a copy of such guidelines will be submitted as an addendum to this QAPP.

A12 Documents and Records

The responsibility of maintaining and updating the QAPP will ultimately be with the City. As previously stated, Thomas Mix of Converse is assigned as the project QAO and will maintain the official approved QAPP. As necessary, the QAO, with concurrence from the Project Manager, may revise and update the QAPP after presenting the evidence for such changes and obtaining approval from EPA. The Project Manager will make sure each subcontractor involved with the Phase II ESA is aware of updates to the QAPP. Copies of the site-specific SAP and HASP documents will be made available at the site and subcontractors involved with the sampling activity will be required to follow these procedures. At the conclusion of field sampling activities, a Phase II investigation report will be developed that contains the details of field and analytical results and may include information from the following documents:

Quality Assurance Project Plan: The QAPP (this document) contains details on the QA and QC procedures that will be implemented throughout the project.

Sampling and Analysis Plans: The SAP contains information regarding sampling locations, frequencies, and sample collection methods.

Field Records: The Project Manager, or other designee, will maintain field records, including field data sheets documenting results of field analyses and QC samples, field forms documenting equipment maintenance and calibration, and sample collection and handling documentation (copies of chain-of-custody forms, shipping receipts, etc.).

Laboratory Records: Analytical labs will maintain sample receipt and storage documentation, instrument calibration logs, raw data, and QC sample records.

Data Validation Records: Field data sheets, field QC results, chain-of-custody forms, and lab reports from each sampling event will be reviewed by the Project Manager or Data Management Coordinator to assure compliance with the SAP.

A12.1 Retention of Project Documentation

The original data sheets, equipment maintenance/calibration logs, chain-of-custody forms, lab reports, field records, training documents, and data validation records will be stored by Converse Consultants until the project has been completed. Records will be maintained by Converse Consultants and analytical labs for five years after project completion. Final Phase II reports will be retained at the City repository for the duration of the grant period.

A12.2 Distribution of QAPP Revisions

Revisions that occur after the original QAPP is approved will be indicated on the QAPP title page and will be distributed by the project QAO to the parties listed on the distribution list.

A12.3 Project Specific Documentation

The sampling activities for Phase II ESAs will be completed within a defined framework and within the schedule outlined in the site-specific SAP. The program's activities are limited to field sampling, field measuring devices, laboratory analyses, and compiling information for a database. Other planning documents to be prepared as part of the City's Brownfields Cleanup/Site Assessment Project are discussed below.

A12.3.1 Site-Specific Health and Safety Plan

To protect workers during the Phase II ESA activities, site-specific Health and Safety Plan (HASP) documents will be prepared. The HASP informs workers of potential risks during field sampling activities and provides workers with engineering controls to avoid physical hazards. The HASP will be prepared to describe the safe use of equipment, evaluation of hazards, safe site investigation procedures, personal protective equipment, emergency procedures, and training required to conduct Phase II ESA activities, including the Occupational Safety and Health Administration (OSHA) certified 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) class. A copy of a general Health and Safety Plan is provided in Appendix C-8.

A12.3.2 Sampling and Analysis Plan

An SAP has already been prepared for the Symphony Park site as part of the SGMP. A specific SAP for parcels L North/M4 and one for J/K will be prepared that references the SAP in the SGMP and this QAPP. Based on how development progresses, more than two SAPs may be developed. The field sampling approach, including sample number, location, and the type of media to be sampled, will be determined based on the site-specific conditions and sampling objectives. The SAPs will be prepared in accordance with the SGMP prepared for Symphony Park. The Sampling and Analysis Plan Guidance and Template, Version 4, Brownfields Assessment Projects, August 2018 is provided in Appendix D-1.

A12.3.3 Draft and Final Assessment Reports

A Draft Assessment Report, describing the field and analytical methods used during the investigation, will be prepared by Converse for each site. Each report will provide details of the field methods used, sample analysis request forms and procedures, laboratory results, data validation, variances from the SAP, and conclusions. Draft Phase II reports will be circulated internally for review and comments and any comments will be addressed in preparing the Final Phase II ESA Reports.

B1 Identification of Project Environmental Information Operations

Typical designs for sample collection are expected to be one-time events using sampling methods based on the requirements of sampling frequencies required in the SGMP which will be used to prepare the SAPs. However, additional sampling may be necessary if plans for development change. This may occur prior to site development or may be conducted by the developers CEM during construction. It is anticipated that the sampling design will be based on discrete, biased sampling, or composite sampling. Discrete sampling is useful for identifying and quantifying chemicals in a specific area. Composite sampling is useful in identifying the average concentration of similar contaminants across an area where those conditions are similar. Composite samples are composed of more than one discrete sample collected from different locations and mixed into a single homogeneous sample. Compositing will not be done in the field when samples are to be analyzed for VOCs. While not anticipated for this project, in some cases, it may be appropriate to use statistically based sampling designs that use random or systematic sampling locations where bias sampling is not useful. The individual site-specific SAP will provide a detailed description of the sampling approach and rationale that was used to select sampling locations, sampling frequencies, and constituents that will be analyzed.

B2 Methods for Environmental Information Acquisition

Sampling types are anticipated to include subsurface soil, and groundwater. Though not anticipated, surface soil and soil gas may be sampled. The number, location, and schedule for both discrete and composite samples will be specified in the SAP.

While also not anticipated, if buried building materials are encountered, sampling of such may be required to assess for asbestos, lead-based paint, or PCB caulk. Potential assessment of those structural materials will be conducted in accordance with applicable regulations.

SOPs for conducting each type of sampling are also included in Appendix C.

The sampling locations and the schedule for sampling will be specified in the SAP. The duration over which samples are collected, the frequency of sampling, and whether the work will be done in phases, will also be outlined in the site-specific SAP.

Advanced planning for field sampling events is required to ensure that the necessary arrangements are in place and that the equipment is ready. The following will be considered when planning the sampling event:

- Sample Handling and Custody Procedures – Field personnel will make arrangements with the appropriate laboratory for proper sample containers and custody forms.
- Equipment – Field personnel will ensure that sampling equipment has been properly assembled, decontaminated, calibrated, and is functioning properly prior to use as part of the pre-field check process. Each piece of equipment will be checked for calibration data and recalibrated, as necessary.
- Field Forms – Field personnel will ensure that field forms, such as field logs, soil and groundwater sampling forms, and boring logs are assembled prior to the sampling event.
- Health and Safety – Field personnel will ensure that site-specific health and safety concerns are understood, and that appropriate personal protective equipment (PPE) is gathered. This information will be included in the HASP document developed for each Phase II investigation.
- Investigation-Derived Waste - Field personnel will plan for the generation of investigation-derived waste (IDW) and arrange to have appropriate containers for IDW.
- Paperwork and Permits – Prior to the sampling event, field personnel will ensure that other applicable paperwork is in order, such as permits and access agreements.

A review of existing data for each individual site will be included as part of the site-specific SAP.

B2.1 Sampling Methods

Proper sample collection procedures are essential to ensure that representative and reliable data is collected. Sample collection will be performed according to the SOPs for Sample Collection and Handling, Documentation, and Delivery, included in Appendix C. Additionally, examples of chain-of custody forms are included in Appendix D-3.

In addition to SOPs, the QA procedures will generally follow the practices outlined below.

A checklist of equipment to be assembled and utilized for each sampling event (to be checked off prior to each sampling event) is included in Appendix D-3. If problems occur during sampling, the Project Manager will be notified. The source of the problem will be identified, and the appropriate corrective action taken. These incidents will be documented in the project folder and filed with the appropriate forms. If the problem compromised the quality of collected data, the data will be flagged within the database.

B2.1.1 Soil Gas Survey

Although not anticipated for these Phase II ESA's, soil gas collection can be helpful in evaluating contamination caused by volatile organics. Two types of soil gas collection will be considered during the Phase II ESAs. The first is a passive gas survey method. During passive gas surveys, a measuring device is placed into a soil void (this void is made by a slide hammer) and left in place for seven to ten days. The measuring devices are then collected and sent to the laboratory. The laboratory evaluates the concentration of each target chemical that was absorbed on the measuring device and an isobar map is developed to represent concentration gradients of chemicals of concern. This is a qualitative survey and can be helpful in identifying the horizontal extent of contamination. This type of survey must be coupled with follow-up soil and/or groundwater sampling. Gore Sorbors® will be utilized for data collection and the manufacturer recommendations will be followed in the placement and retrieval of the sampling devices.

The other type of soil gas survey that may be utilized is an active soil gas survey. This requires that a void be created in the soil at a given depth where the soil gas will be collected. This is usually achieved with direct push technology (Geo Probe). The void is sealed, a vacuum is placed on the soil, and an air sample is collected. The sample can be collected in a Summa Canister and be sent to a fixed laboratory for analysis, or it can be collected in a glass syringe and analyzed by an on-site laboratory. This is a quantitative survey and the results from this survey would be compared to risk-based numbers.

Soil gas sampling, if conducted, will be done in general accordance with the Final Draft Supplemental Guidance: Screening and Evaluating Vapor Intrusion, February 2023. To ensure that there are no compatibility issues with the carrier gas used during analysis, the tracer compound, Isopropyl Alcohol will be used for leak testing.

B2.1.2 Soil Sampling and Analysis

The purpose of a soil investigation is to assess if impacts will be encountered during proposed site development activities. This investigation may also evaluate the physical properties of the soil to determine if the soil is fill (treated fill) or native in origin. As petroleum impacted soil was removed by excavation from the former UPRR site, it was thermally treated onsite. The treated soil was then reused as onsite excavation backfill. This is referred to as "treated fill" and is considered legally clean pursuant to the SGMP. It is important to be able to recognize treated fill during any field investigations conducted at the site.

There are a variety of acceptable methods for the collection of soil samples and selection of an appropriate method will depend on site conditions. Methods commonly used to collect soil samples include drilling soil borings, digging test pits, sampling via hand auger, and digging with a shovel or trowel. Soil samples will be collected from designated locations as specified in the

individual SAP using methods proposed in the SOP contained in Appendix C. The number, location, depth(s), rationale, and requested sample analysis for soil sampling will be presented in the site-specific SAP.

B2.1.3 Groundwater Sampling and Analysis

The objective of groundwater sampling is to initially assess if potential impacts to groundwater are expected to be encountered during site development activities. Locations for groundwater sampling will be based on proposed site development plans. Groundwater samples will be submitted for analysis of appropriate analytes as identified in the SAP. Initial groundwater samples will be collected in the upper water-bearing zone.

Samples will be collected by trained staff and will follow the procedures outlined in the SOP included in Appendix C.

B2.1.4 Field Surveys (Asbestos, Lead-Based Paint)

Because unanticipated materials have been encountered at Symphony Park during site development activities (including buried transite pipe), there is a potential for non-routine sampling of unusual sample matrices, such as building materials. These matrices include lead-based paint, asbestos-containing materials, PCB-laden caulking, and other types of building materials. Collection of suspected asbestos-containing building materials will be done by a Nevada Certified Asbestos Consultant following NESHAP sampling protocol. Lead-Based surveys may consist of both field analysis and collection of samples for laboratory analysis. Field analysis of suspected lead-based paint samples will be conducted using an XRF. PCB sampling may consist of bulk samples, core samples, wipe samples or a combination of these methods. The Field Surveys will follow the SOP included in Appendix C.

B2.2 Field Methods

Field measurements will be conducted by Converse Consultants staff using portable meters and/or field test kits that follow EPA-approved methods. Field measurements will be taken using the procedures recommended by the manufacturer of the meter or test kit and procedures discussed in the SOP for Field Data Collection, where applicable. Results of field measurements will be recorded on field data sheets, included as Appendix D-3.

If necessary, data collected using XRF methods will follow EPA-approved methods, including calibration and training requirements. Results will be recorded on field data sheets created specifically for the XRF. The SOP for conducting lead-based paint surveys with the XRF is included in Appendix C.

B2.3 Analytical Methods

Laboratory analyses will be conducted by Nevada-certified analytical laboratories using methods approved by the EPA and NDEP. Specific analytical methods will be provided in the individual SAP. Proposed analytical methods and maximum allowable reporting limits are provided in the Appendices. Alternative methods may be requested by the laboratory performing the analyses. These alternative methods may be used only upon written approval from EPA Region 9. Such approval will be obtained prior to collection of samples. Major laboratory equipment or instruments that may be utilized include a gas chromatograph/mass spectrometer (GC/MS), inductively coupled plasma mass spectrometer (ICP-MS), high performance liquid chromatography (HPLC), automated colorimeter, ion chromatograph, and a carbon detector. If instrument failures occur, the laboratory will take immediate corrective action and notify the Project Manager if the quality of sample results were compromised.

B3 Integrity of Environmental Information

Custody procedures differ among laboratories. The analyzing laboratory's custody procedures are identified prior to field activities. Field personnel must make arrangements with the appropriate laboratory to obtain proper sample containers, preservatives, and sampling request forms. Sample custody must be traceable from the time of sample collection until results are reported. Sample custody procedures provide a mechanism for documenting information related to sample collection and handling. Each sample will be recorded on a field data sheet (see Appendix D-3) and a chain-of-custody form must be completed after sample collection and prior to sample shipment or release. The chain-of-custody form, sample labels, and field documentation must be cross-checked to verify sample identification, type of analyses, preservatives, and the number and type of containers. The samples will be transported or commercially shipped to the analytical lab in insulated containers within the appropriate holding time and will be accompanied by a chain-of-custody form. Custody seals will be placed on each cooler prior to delivery to the laboratory. If commercial shipment is needed, the samples will be packaged and shipped in accordance with U.S. Department of Transportation standards and custody seals will be placed on each cooler. Due to each cooler being protected under custody and the anticipated number of samples to be collected during the assessment activities, we do not propose using custody seals on each individual sample container.

The following sample control activities must be conducted at the laboratory:

- Initial sample login and verification of samples received with the chain-of-custody form
- Document discrepancies noted during login on the chain-of-custody
- Initiate internal laboratory custody procedure
- Verify sample preservation (e.g., temperature)
- Notify the Project Manager if problems or discrepancies are identified
- Proper sample storage, including daily refrigerator temperature monitoring and sample security

The recommended sample container type and volume and the initial preservative for analytes that may be tested will be identified in the SAP.

B4 Quality Control

QC samples may be collected and analyzed to ensure the accuracy and precision of both field and laboratory data. The following sections summarize the QC samples that will be collected for field and laboratory analysis.

B4.1 Quality Control for Field Measurements

QC for field measurements will be assessed using the following methods:

- Field instruments will be inspected, maintained, and calibrated prior to each sampling event.
- Calibration-checks will be performed to verify accuracy within 24 hours before and 24 hours after each day by analyzing a calibration standard.

B4.2 Quality Control for Laboratory Analyses

QC for laboratory analyses will be assessed using the results of both field-collected QC samples and laboratory-prepared QC samples, each of which is discussed below.

B4.2.1 Field-collected QC Samples

Field-collected QC samples (if collected) will primarily consist of field duplicates and blanks, which are described below. Only one type of blank will be collected each day. The order preference for collection of blanks is equipment blanks, field blanks, and trip blanks.

Field Duplicates. Field duplicates will be collected at the same time and in the same manner as the primary samples and will be used to assess the precision of steps after sample acquisition. Field duplicates will consist of collocated samples and will be collected and analyzed at a rate of at least ten percent (10%). When determining the number of duplicate samples to collect, the number will be rounded up (i.e., if 11 primary samples are collected, two duplicates would be collected). Field duplicates will be collected generally from locations with the highest anticipated concentrations of contaminants. However, under conditions where there are no indications of higher concentrations, a field duplicate will be collected from every tenth sample.

Equipment Blanks. Equipment blanks will be collected in the field to assess contamination from reusable sampling equipment and other external influences. A sample bottle will be filled with certified clean water from the laboratory and passed through the pre-cleaned (triple-rinsed with distilled water) sample collection equipment, mimicking actual sampling, and captured again for laboratory analysis. Equipment blanks will be collected at a rate of 1 per 20 samples with a minimum of one per day collected.

Field Blanks. Field blanks will be collected in the field to assess the contamination from field conditions during the sampling. A sample bottle will be filled in the field with certified clean water from the laboratory and preserved and shipped according to sample procedures. The frequency is typically 1 field blank per day or 1 field blank per 20 samples, whichever is more frequent.

Trip Blanks. Trip blanks are used to determine whether sample cross-contamination has occurred during sample transportation, delivery, and storage when collecting samples to be analyzed for volatile organic compounds. Trip blanks consist of pre-filled bottles of laboratory certified water that are transported along with the collected samples in each cooler containing samples for volatiles analysis.

For VOC and TPH samples additional sample volumes will be collected for laboratory QC analysis. Matrix Spike (MS) and Matrix Spike Duplicates (MSD) will be collected at a minimum of every 20 samples. A separate sample container will be used for the sample, MS and MSD.

Other field-collected QC samples may be utilized, as necessary, throughout the program if analytical results indicate the presence of QC error, such as unexplained contamination of equipment blanks, high RPDs between field duplicates, or low precision of analytical results.

An additional QC sample that may be used is the field split. Field splits may be used occasionally to assess the precision of the selected laboratory's analytical procedures and/or methods. A field split consists of a sample that is collected and split into two different samples, one of which is shipped to the normal lab for analysis, while the other is shipped to a different lab for similar analysis using either the same or different methods, depending on what information is desired. If split samples are analyzed using the same method, then results from both labs can be compared to assess the precision of the method. Alternatively, if the split samples are analyzed using different methods, results can be compared to assess the accuracy of the methods.

B4.2.2 Laboratory-prepared QC Samples

Several additional samples will be prepared and analyzed by the laboratory to evaluate precision, accuracy, and the potential for laboratory contamination. Each laboratory that is used will set its own warning limit criteria for QC samples based on the method requirements and the laboratory's QA manual. The QA manuals for laboratories that are selected will be included in Appendix A and will be reviewed by the project QAO for compliance with the project requirements. Descriptions of some of the laboratory-prepared QC samples that will be analyzed are included below. At a minimum, the frequency for analysis of matrix spikes (MS), duplicates, and blanks will meet method requirements.

Method Blanks. Method blanks (also called extraction blanks, procedural blanks, or preparation blanks) are used to assess laboratory contamination during each stage of sample preparation and analysis. Method blanks are prepared by the laboratory from reagent grade water and are processed through the entire analytical procedure in a manner identical to that of the samples. At a minimum, the laboratory should report method blanks at a frequency of one method blank for each batch of up to 20 samples. If the laboratory method blank indicates the presence of contamination, impacted samples in the analytical batch should be flagged. Subtracting method blank results from sample results is not permitted.

Matrix Spike (MS). MS will be used to evaluate the effect of the sample matrix on the recovery of the compound(s) of interest. To prepare an MS, a field sample is first homogenized and then split into two subsamples. Matrix spike samples will be selected at random at a rate of at least 10%. One of the subsamples is fortified with the MS solution and one subsample is analyzed to provide the background concentration for each analyte of interest. Recovery is the accuracy of an analytical test measured against a known analyte addition to a sample and is calculated as follows:

$$\text{Recovery} = \left(\frac{C_{matrix+spike} - C_{matrix}}{C_{spike(Expected)}} \right) * 100$$

Where C *is the measured concentration*

Recovery data for the fortified compound ultimately will provide a basis for determining the accuracy of the measurement and the prevalence of matrix effects in the samples analyzed during the project. Analysis of MS duplicates (MSD) is also useful for assessing laboratory precision.

Laboratory Control Spike (LCS). Laboratory control spikes are prepared by adding a known amount of target analyte(s) to reagent-grade water. When compared to the method blank, LCSs can be used to evaluate the accuracy (recovery) of the target analytes, excluding matrix effects.

Replicate Samples. Replicate (also called duplicates) samples are prepared by splitting a sample into two or more aliquots after delivery to the lab, but prior to sample preparation. Analysis of replicates is used to assess precision of an analytical method. Replicates that are typically utilized include:

- Laboratory replicates: These are replicates of the raw material that is extracted and analyzed in the same manner as the original sample to measure laboratory precision.

- MSD: These are used to assess both laboratory precision and accuracy within the sample matrix.
- Laboratory Control Spike Duplicate (LCSD): These are useful for assessing the accuracy and precision of the method, excluding matrix effects.

B4.2.3 Additional Laboratory Quality Control Requirements

Laboratories providing analytical support for this project will have the appropriate facilities to store, prepare, and process samples, and appropriate instrumentation and staff in order to provide data of the required quality within the time period dictated by the project. Laboratories shall be able to provide information documenting their ability to conduct the analyses with the required level of data quality. Such information may include results from inter-laboratory performance evaluation studies, control charts, and summary data from internal QA/QC checks, and results from analyses of Certified Reference Materials (CRM).

B5 Instrument/Equipment Calibration, Testing, Inspection, and Maintenance

B5.1 Field Equipment

Prior to each sampling event, inspection and preventive maintenance will be performed for field equipment in accordance with the manufacturer's specifications, including battery checks and routine replacement of detectors. Equipment will be re-inspected between each sampling site and after each sampling event. If problems occur and/or repair is needed during the sampling event, the field data sheet will be used to document the corrective action taken. If significant damage or equipment malfunctions are noted, the instrument(s) will be sent to the manufacturer for immediate repair. A maintenance/calibration log will be kept by the Field Team Leader or other designee which details the dates of instrument and sampling gear inspection; calibrations performed in the lab or field; battery replacement; dates reagents and standards are replaced; and problems noted with instruments, samplers, or reagents. The logbook will also be used to document corrective action that was taken if equipment deficiencies were noted during an inspection. A small inventory of critical spare parts for field equipment will be kept at the Converse main office and will be brought to the field, if needed; however, perishable supplies or expensive parts may not be kept on hand and will be ordered when needed. Spare parts and supplies will be obtained through the equipment manufacturer or other reputable sources.

B5.2 Laboratory Equipment

Laboratories providing support for this project will maintain analytical equipment in accordance with relevant SOPs, which include those specified by the manufacturer and those specified by the method. The laboratories will maintain a record of documented equipment inspections as well as preventive and corrective maintenance.

B5.3 Instrument/Equipment Calibration and Frequency

B5.3.1 Field Instruments

Field instruments will be calibrated according to the schedule recommended by the manufacturer. Standards will be purchased from a chemical supply company or prepared by (or with the assistance of) a professional laboratory. Calibration records will be kept in the maintenance/calibration log at the Converse main office, where it can be easily accessed before and after equipment use. Calibrations that are performed by personnel in the field may also be recorded on the field data sheets to indicate which samples were analyzed pre- and post-calibration for the specific sampling event. If calibration is not successful, or other issues pertaining to calibration arise, the equipment manufacturer will be contacted to determine the appropriate corrective action. The problem and corrective action will be documented in the maintenance/calibration logbook.

B5.3.2 Laboratory Instruments

Laboratories are certified by the NDEP and must maintain calibration practices and calibration-checks as required by their certifications.

B6 Inspection/Acceptance of Supplies and Services

Project supplies and consumables that may directly or indirectly affect the quality of results include the following:

- Conductivity, pH, and turbidity standards
- Buffer solutions
- Reagents
- Miscellaneous supplies including batteries, dissolved oxygen membranes, and o-rings

The Project Manager will ensure that the inspection/testing specifications and acceptance criteria are met. Upon receipt, buffer solutions, standards, reagents, and miscellaneous supplies will be inspected by the Project Manager or other designee for leaks or broken seals and to compare the age of each reagent to the manufacturer's recommended shelf-life. Additionally, conductivity, pH, and turbidity standards will be checked by comparing their readings with those generated by the current lot of standards. Other sampling equipment will be inspected for broken or missing parts and will be tested to ensure proper operation.

Reagents will be replaced before they exceed the manufacturer's recommended shelf life, which is typically one to two years. Specific replacement dates can often be found on the product or can be determined by providing the reagent lot number to the manufacturer. Reagent replacement dates will be noted in the maintenance log.

In addition, the Project Manager will provide a copy of the QAPP and SAP's to subcontractors (e.g., a drilling contractor or analytical laboratory). The Project Manager will discuss the goals of the project and answer any questions the subcontractor(s) may have. Specifically, the Project Manager will note the following portions of this QAPP with subcontractors:

- All subcontractors: Sections A4.1, A4.2, A11.2, A12.1, B6, and C1
- Drilling subcontractor: Section B2
- Laboratory subcontractor: Sections B2, B3, B4, B5, and B7

The Project Manager will also discuss pertinent sections of the SAPs with subcontractors,.

B7 Environmental Information Management

B7.1 Field Data

Field data will be documented on field data sheets, provided in Appendix D-3. One sheet will be used at each monitoring site and field staff will complete the necessary sections of the data sheet during the sampling event.

B7.2 Analytical Data

Analytical laboratories will provide reports in both hard copy and electronic formats. Requirements for electronic database deliverables (EDD) will be provided to selected analytical laboratories.

B7.3 Data Submittal

Laboratory reports, summarizing analytical results and QC results, will be provided to Converse Consultants electronically in the agreed upon format. Copies of chain of custody forms and laboratory reports will be forwarded to the Data Management Coordinator and/or the Quality Assurance Officer, as assigned by the Quality Assurance Officer for data verification and validation. The information contained within, and the format of the hard-copy data report package will be determined during the initial negotiations with the laboratory and will include, at a minimum, the sample identification, sampling date/time, test method, extraction date/time, analysis date/time, analytical results, QA sample results, instrument and equipment calibration summary information, and a description of the corrective action taken to resolve data quality issues.

The data generated and the reports will be controlled by the Data Management Coordinator. The Data Management Coordinator will distribute data/reports directly to the CLV Project Coordinator who will be responsible for distributing the information to the EPA Region 9 Project Officer. Original copies of data/reports that are corrected will be maintained by the Data Management Coordinator and CLV Project Coordinator after corrections are made. The data/reports will be maintained by the Data Management Coordinator for a minimum of five years.

C1 Assessments and Response Actions

Converse may conduct one field audit during the life of the project for the City. If the audit results indicate concerns, a follow-up audit will be conducted. The field audits will be used to reveal any weaknesses in field practices and procedures. The field audits will evaluate if the field personnel are following the procedures set forth in the SAP and the SOPs. It will be the responsibility of Converse to conduct these audits. The audit will be performed by senior staff members who are not part of the Phase II sampling team.

During the field audit, the assessor will conduct personnel interviews and direct observations to evaluate adherence to the SAP and SOPs. Specific items that will be verified include:

- Review of field documents (specifically that the SAP and HASP are available on-site for reference to the field sampling team)
- Documentation of field personnel training
- Verify that the proper laboratory container and proper preservatives are being utilized
- Verify that laboratory sample containers are properly labeled and stored, and that the laboratory chain-of-custody is filled out properly and completely
- Verify that the decontamination area is properly set up and functioning according to the SOP. This will be initiated if decontamination is required for the field activities being conducted.
- Verify that field equipment in use is functioning properly

During the audit, deficiencies, if any, will be discussed with field personnel and corrections will be made as soon as reasonably possible. If the field audit identified significant non-compliance issues, a follow-up field audit will be conducted. Audit results and corrective actions taken will be documented in internal memorandums prepared by the Project Manager. These memorandums will be made available to the EPA Project Officer through the CLV Project Coordinator. The Quality Assurance Officer for Converse will be responsible for tracking the success of audits and corrective actions taken.

C2 Oversight and Reports to Management

Interim and final reports associated with the Program will be issued by Converse to the City and US EPA, according to the table below.

Management Reports			
Type of Report	**Frequency**	**Projected Delivery Dates(s)**	**Report Recipients**
Draft QAPP	One time	July 2025	EPA/City
Final QAPP	One time	Sept./Oct. 2025	EPA/City
Sampling and Analysis Plans	2 to 4	October 2025	EPA/City
Final Phase II ESA Reports	2 to 4	TBD	EPA/City

Field reports will be generated by the Field Team Coordinator, who will provide physical copies to the Converse Project Manager. Such documentation will be made available to the CLV and EPA, as needed. All documents will be submitted to the CLV Project Coordinator by the Converse Project Manager via electronic mail. The CLV Project Coordinator will be responsible for providing all documents to the EPA Project Officer.

D1 Environmental Information Review

D1.1 Data Review, Verification, and Validation

Data verification is the process of evaluating completeness, correctness, conformance, and compliance of a specific data set against the method, procedural, or contractual requirements. Data verification evaluates whether sampling protocols, SOPs, analytical methods, and project specific planning documents were followed during data generation. Verification also involves examining the data for errors or omissions. Field and laboratory staff can verify that the work is producing appropriate outputs.

Data validation is a systematic process for reviewing data against a pre-established set of acceptance criteria defined in this QAPP and in project specific SAPs. Data validation is an analyte and sample-specific process that extends the evaluation of data beyond data verification and is performed to determine the analytical quality of a specific data set. Validation involves a detailed examination of the data package for precision, accuracy, and sensitivity. Each Phase II ESA report will be evaluated to ensure that:

- QC data is scientifically sound, appropriate to the method, and completely documented.
- QC samples yield results within established guidelines.
- Data are appropriately flagged by the laboratory.
- Anomalies in sample preparation and analysis are completely and accurately documented.
- Preservations were documented.
- Data is properly incorporated into the final report.
- The final report is complete and ready for release.

Data verification, validation, and review are done to ensure that environmental programs and decisions are supported by data of a type and quality needed and expected for their intended use.

D1.2 Verification and Validation Methods

Project team personnel will verify field data through reviews of data sets to identify inconsistencies or anomalous values. Any inconsistencies that have been discovered will be resolved as soon as possible by seeking clarification from field personnel responsible for data collection. Field personnel will be responsible for following the sampling and documentation procedures described in the SAP and QAPP documents so that defensible and justifiable data are obtained.

The steps for verifying/validating field activities include:

1. Evaluate field records for completeness and consistency.
2. Review field QC information.
3. Summarize deviations and determine effects on data quality.
4. Summarize number and type of samples collected.

Laboratory personnel will verify analytical data at the time of analysis and reporting and through subsequent reviews of the raw data for non-conforming data to the requirements of the analytical method. Laboratory personnel will make a systematic effort to identify outliers or errors before they report the data. Outliers that result from errors found during data verification will be identified

and corrected. Outliers that cannot be attributed to errors in analysis, transcription, or calculation will be clearly identified in the case narrative section of the analytical data package. Analytical data generated for this project is to be verified by the laboratory.

Verified data are checked for transcription errors, correct application of dilution factors, appropriate reporting of dry weight versus wet weight, and correct usage of conversion factors, among others. Verified data may have laboratory qualifiers. Verified data are one output of this process. Converse will evaluate the laboratory data for qualifiers and evaluate if the data meets the project standards.

D2 Usability Determination

In general, there are five steps that will be used during the process of reconciling the data collected during the Phase II ESAs:

1. Review the SAP and make sure that the final report answers the required questions. In general, is there a presence or absence of the chemicals of concern that were investigated? If contamination was encountered, has the extent of that contamination been identified and where will it be encountered during site development?

2. Conduct a preliminary data review or exploratory data analysis to understand the character and structure of the data set and to evaluate whether there are anomalies in the data that may not have been noticed during data verification and validation. Are there outliers or other anomalies that should be further investigated (i.e., conduct a focused data validation) before continuing with Step 3?

3. Plot data on site maps and identify data gaps.

4. Verify that areas of the site have been properly tested and have followed the testing designs planned during the SAP.

5. Draw conclusions from the data. Using multiple lines of evidence and professional experience, the data analyst should be able to provide conclusions and recommendations for the site. In some cases, the conclusion may be that more data is needed to answer the primary study questions.

Report Limitations

This document was prepared solely for the City in accordance with professional standards at the time the services were performed. This document is governed by the specific scope of work authorized by the City. It is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

APPENDIX A

- Veritas Laboratories Quality System Manual

Veritas Laboratories

Truth in Quality, Truth in Service

QUALITY MANUAL

for

Veritas Laboratories

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Section 3

INTRODUCTION AND SCOPE

The purpose of this *Quality Manual* is to outline the management system for Veritas Laboratories (VL). The *Quality Manual* defines the policies, procedures, and documentation that assure analytical services continually meet a defined standard of quality that is designed to provide clients with data of known and documented quality and, where applicable, demonstrate regulatory compliance.

The *Quality Manual* sets the standard under which all laboratory operations are performed, including the laboratory's organization, objectives, and operating philosophy. The *Quality Manual* has been prepared to assure compliance with the Nevada Division of Environmental Protection Bureau of Safe Drinking Water (NDEP BSDW), and the 2009 TNI Environmental Laboratory Sector Standard – Volume 1 – Management and Technical Requirements for Laboratories Performing Environmental Analysis (EL-V1-M1 through M7-ISO-2009). This Standard is consistent with ISO/IEC 17025:2005 requirements that are relevant to the scope of environmental testing services and thus, the laboratory operates a quality system in conformance with ISO/IEC 17025:2005(E). The policies and procedures outlined are compliant with the accreditation and certification programs listed in Appendix E.

3.1 Scope of Testing

The laboratory's certified scope of analytical testing services includes those listed in Appendix E. Analytes not listed are available to clients through various VL subcontractors. Table 25-1 lists several analytes for which VL routinely employs subcontract laboratories.

3.2 Table of Contents, References and Appendices

The Table of Contents is in Section 2 and Appendices are in Section 29.

This *Quality Manual* uses the references included in Modules 1-7 in the 2009 TNI Environmental Laboratory Sector Standard – Volume 1 – Management and Technical Requirements for Laboratories Performing Environmental Analysis. Reference methods used by VL can be found in the Table of Methods located in Appendix E.

3.3 Glossary and Abbreviations Used

Quality control terms are generally defined within the Section that describes the activity.

3.3.1 Glossary

A glossary of terms is found in Appendix D. Method-specific terms are defined in SOPs.

3.3.2 Abbreviations

A list of abbreviations used in this document and their definitions are:

AB	-	Accrediting Body
ANSI	-	American National Standards Institute
ASQC	-	American Society for Quality Control
ASTM	-	American Society for Testing and Materials
Blk	-	Blank
°C	-	degrees Celsius
cal	-	calibration
CAS	-	Chemical Abstract Service
CCV	-	Continuing calibration verification
COC	-	Chain of custody
CBI	-	Confidential Business Information
DO	-	Dissolved oxygen
DOC	-	Demonstration of Capability
EPA	-	Environmental Protection Agency
g/L	-	grams per liter
GC/MS	-	gas chromatography/mass spectrometry
ICP-MS	-	inductively coupled plasma-mass spectrometry
ICV	-	Initial (or Independent) calibration verification
IDOC	-	Initial Demonstration of Capability
ISO/IEC	-	International Organization for Standardization/International Electrochemical Commission
lb/in^2	-	pound per square inch
LCS	-	Laboratory control sample
LCSD	-	Laboratory control sample duplicate
MDL	-	method detection limit
MRL	-	minimum reporting level
mg/Kg	-	milligrams per kilogram
mg/L	-	milligrams per liter
MS	-	matrix spike
MSD	-	matrix spike duplicate
NDEP	-	Nevada Division of Environmental Protection
BSDW	-	Bureau of Safe Drinking Water
NELAC	-	National Environmental Laboratory Accreditation Conference
NELAP	-	National Environmental Laboratory Accreditation Program
NIST	-	National Institute of Standards and Technology
ODOC	-	Ongoing Demonstration of Capability

PT	-	Proficiency Test(ing)
PTP	-	Proficiency Testing Provider
PTPA	-	Proficiency Testing Provider Accreditor
QA	-	Quality Assurance
QC	-	Quality Control
QM	-	*Quality Manual*
RPD	-	Relative percent difference
RSD	-	Relative standard deviation
SOPs	-	Standard operating procedures
spk	-	spike
std	-	standard
TNI	-	The NELAC Institute
µg/L	-	micrograms per liter
UV	-	Ultraviolet
VOC	-	Volatile organic compound
VL	-	Veritas Laboratories

3.4 Management of the *Quality Manual*

The Quality Assurance Managers are responsible for maintaining the currency of the *Quality Manual.*

The *Quality Manual* is reviewed annually by the Quality Assurance Managers and laboratory personnel, as appropriate, to ensure it reflects current practices and meets the requirements of any applicable regulations or client specifications. Sections of the manual are updated by making a change to the Section and then changing the revision number dependent on the extent of changes made. The cover sheet of the *Quality Manual* (Section 1) must be re-signed and the Table of Contents (Section 2) updated whenever a Section is updated. A change in the revision number of the *Quality Manual* is not required if updates are made to the appendices in Section 29.

The *Quality Manual* is considered confidential within Veritas Laboratories and may not be altered in any way except by approval of the Laboratory Director/Quality Assurance Manager. If it is distributed to external users, it is for the purpose of reviewing Veritas Laboratories' management system and may not be used for any other purpose without written permission.

Section 4

ORGANIZATION

Veritas Laboratories (VL) is a legally identifiable organization. VL is responsible for carrying out testing activities that meet the requirements of the NDEP BSDW, the TNI Standard, the ISO/EIC 17025 Standard, and that meet the needs of the client. Through application of the policies and procedures outlined in this Section and throughout the *Quality Manual*:

- VL assures that it is impartial and that personnel are free from undue commercial, financial, or other undue pressures that might influence their technical judgment.
- Management and technical personnel have the authority and resources to carry out their duties and have procedures to identify and correct departures from the laboratory's management system.
- Personnel understand the relevance and importance of their duties as related to the maintenance of the laboratory's management system.
- An Ethics and data integrity policy and associated procedures (see Appendix A, Section 5 – "Management" and Section 19 – "Data Integrity Investigations") ensure personnel do not engage in activities that diminish confidence in the laboratory's capabilities.
- Confidentiality is maintained.

4.1 Organization

Veritas Laboratories is a privately owned laboratory. Its Clark County and Nevada business licenses and limited-liability company charter (State of Nevada) are posted and available upon request.

VL operates in Las Vegas, Nevada. Aside from its main facility, VL also operates in the field collecting samples and performing field tests.

VL's organization chart, staff résumés and job descriptions can be found in Appendix B. Additional information regarding responsibilities, authority and interrelationship of personnel who manage, perform or verify testing is included in Section 5 – "Management" and Section 20 – "Personnel". These Sections also include information on supervision, training, technical management, quality personnel, and appointment of deputies for key managerial personnel.

VL has the resources and authority to operate a management system that is capable of identifying departures from that system and from procedures during testing, and initiates actions to minimize or prevent departures.

4.2 Conflict of Interest and Undue Pressure

The organizational structure indicated above minimizes the potential for conflicting or undue interests that might influence the technical judgment of analytical personnel.

Veritas Laboratories acknowledges that the Laboratory Director also serves as a Quality Assurance Manager and also functions as a Project Manager/Salesperson. The Laboratory Director works with the Technical Director to provide checks and balances sufficient enough to ensure that the integrity of all laboratory operations is maintained.

Section 5

MANAGEMENT

VL maintains a management system that is appropriate to the scope of its activities.

5.1 Management Requirements

Top management includes the Laboratory Director and Technical Director, each of whom also serves in the Quality Assurance Manager role. Roles and responsibilities are defined in Section 5.2 below.

Management's commitment to good professional practice and to the quality of its products is defined in the Quality Policy statement, Section 5.3.

Management has overall responsibility for the technical operations and the authority needed to generate the required quality of laboratory operations. Management ensures communication within the organization to maintain an effective management system and to communicate the importance of meeting client, statutory, and regulatory requirements. Management assures that the system documentation is known and available so that appropriate personnel can implement their part. When changes to the management system occur or are planned, managers ensure that the integrity of the system is maintained.

The VL management system is structured such that all work performed meets the needs of its clients. In meeting client needs, VL also ensures that it meets the requirements of the NDEP BSDW, the TNI Standard and the ISO/IEC 17025 Standard.

Managers implement, maintain, and improve the management system, and identify noncompliance with the management system of procedures. Managers initiate actions to prevent or minimize noncompliance.

Management ensures technical competence of personnel operating equipment, performing tests, evaluating results or signing reports, and limits authority to perform laboratory functions to those appropriately trained and/or supervised. Section 20 – "Personnel" contains this information.

Management is responsible for defining the minimal level of education, qualifications, experience, and skills necessary for all positions in the laboratory and assuring that technical staff have demonstrated capabilities in their tasks.

Training is kept up to date as described in Section 20 – "Personnel" by periodic review of training records and through employee performance review.

Management bears specific responsibility for maintenance of the management system. This includes defining roles and responsibilities to personnel, approving documents, providing required training, providing a procedure for confidential reporting of data integrity issues, and periodically reviewing data, procedures, and documentation. The assignment of responsibilities, authorities, and interrelationships of the personnel who manage, perform, or verify work affecting the quality of environmental tests is documented in Section 20 – "Personnel."

Management ensures that audit findings and corrective actions are completed within required time frames.

Designated deputies are appointed by management during the absence of the Laboratory Director or Technical Director (both of whom fill the Quality Assurance Manager role), and is required in the case of a continued absence of more than 15 days.

5.2 Management Roles and Responsibilities

5.2.1 Laboratory Director

The Laboratory Director is responsible for the overall quality, safety, financial, human resource and service performance of the laboratory. The Laboratory Director provides the resources necessary to implement and maintain an effective quality and data integrity program.

5.2.1.1 Responsibilities

The Laboratory Director:

a. Ensures that personnel are free from any commercial, financial and other undue pressures that might adversely affect the quality of their work.
b. Ensures that all analysts have the appropriate education and training to properly carry out the duties assigned to them and ensures that this training has been documented.
c. Ensures that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth in the *Quality Manual*, laboratory SOPs or laboratory policies may be temporarily suspended by the Laboratory Director.
d. Reviews and approves all SOPs and policies prior to their implementation and ensures all approved SOPs and policies are provided to laboratory personnel and these SOPs and policies are followed strictly.

5.2.2 Quality Assurance Manager

The Quality Assurance Manager (or designee) is responsible for the oversight and review of quality control data, but is independent from laboratory operations. The Quality Assurance Manager's training and proof of experience in QA/QC procedures, knowledge of analytical methods, and the laboratory's management system are available in the summary of experience and education found in Appendix B and in training records, as appropriate.

5.2.2.1 Responsibilities

The Quality Assurance Manager is responsible for:

a. serving as a focal point for QA/QC;
b. arranging or conducting annual internal audits without outside (e.g., managerial) influence;
c. ensuring that deficiencies are documented, and monitoring corrective actions;
d. oversight and review of quality control data;
e. arranging and/or conducting internal audits annually;
f. ensuring that the management system related to quality is implemented and followed at all times;
g. monitoring and maintaining laboratory certifications; and
h. ensuring this *Quality Manual* is current.

5.2.3 Technical Director

The Technical Director (or designee) is a part-time laboratory staff member and assists with supervision of laboratory operations and data reporting. The Technical Director's credentials are found in Appendix B.

If the Technical Director is absent for fifteen (15) calendar days or more, a deputy (see Table 5-1 below) with appropriate qualifications will perform the Technical Director's duties. Beyond a thirty-five (35) calendar day absence, management will notify the primary accreditation body in writing of the absence of the Technical Director and the appointment of the deputy.

The Technical Director cannot be the technical director of more than one accredited environmental laboratory.

5.2.3.1 Responsibilities

The Technical Director is responsible for:

a. meeting the general and education requirements and qualifications found in Sections 4.1.7.2 and 5.2.6.1 of the TNI Standard - EL-V1M2-2009;
b. monitoring performance data and the validity of the analyses for the laboratory;
c. assisting the Laboratory Director in ensuring that personnel have appropriate education and technical background to perform tests for which the laboratory is accredited;
d. review and approval of all SOPs and policies prior to their implementation.

5.2.5 Laboratory Key Personnel Deputies

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

Table 5-1 Key Personnel Deputies

Key Personnel	Deputy	Comment
Laboratory Director/Quality Assurance Manager	Technical Director/Quality Assurance Manager (or designees)	Full-time staff assist the Technical Director in the absence of the Laboratory Director
Technical Director/Quality Assurance Manager	Laboratory Scientist, Full Time	In most cases, a deputy for this position is not necessary due to the size of the laboratory

5.3 Quality Policy

Management's commitment to quality and to the management system is stated in the Quality Policy below, which is upheld through the application of related policies and procedures described in the laboratory's *Quality Manual*, SOPs and policies.

Quality Policy

The objective of the Veritas Laboratories management system, and the commitment of its management, is to consistently provide our clients with data of known and documented quality that meets their requirements and is legally defensible. Our policy is to use good professional practices, to maintain quality, to uphold the highest quality of service, and to comply with all applicable standards. The laboratory ensures that personnel are free from any commercial, financial, and other undue pressures, which might adversely affect the quality of work. This policy is implemented and enforced through the commitment of management, at all levels, to the Quality Assurance (QA) principles and practices outlined in this manual. However, the primary responsibility for quality rests with each

individual within the laboratory organization. Every laboratory employee must ensure that the generation and reporting of quality analytical data is a fundamental priority. Every laboratory employee is required to familiarize themselves with the quality documentation and to implement the policies and procedures in their work. All employees are trained annually on ethical principles and procedures surrounding the data that is generated. The laboratory maintains a strict policy of client confidentiality.

5.4 Ethics and Data Integrity System

The laboratory has an Ethics and Data Integrity policy that is included in Appendix A. The laboratory's Ethics and Data Integrity program, training and investigations are discussed in Section 19 – "Data Integrity Investigations".

5.5 Documentation of Management/Quality System

The management system is defined through the policies and procedures provided in this *Quality Manual* and written laboratory Standard Operating Procedures (SOPs) and policies.

5.5.1 Quality Manual

The *Quality Manual* contains the following required items:

5.5.1.1 document title;

5.5.1.2 laboratory's full name and address;

5.5.1.3 name, address (if different from above), and laboratory's main telephone number.

5.5.1.4 identification of all major organizational units which are to be covered by this quality manual and the effective date of the version;

5.5.1.5 identification of the laboratory's approved signatories;

5.5.1.6 the signed and dated concurrence (with appropriate names and titles), of all responsible parties including the quality manager(s), technical manager(s), and the agent who is in charge of all laboratory activities, such as the laboratory director or laboratory manager;

5.5.1.7 the objectives of the management system and contain or reference the laboratory's policies and procedures;

5.5.1.8 the laboratory's official quality policy statement, which shall include management system objectives and management's commitment to ethical laboratory practices and to upholding the requirements of this Standard; and

5.5.1.9 a table of contents, and applicable lists of references, glossaries and appendices.

This *Quality Manual* contains or references all required elements as defined by the TNI Standard - V1:M2, Section 4.2.8.4.

5.5.2 Standard Operating Procedures (SOPs)

Standard operating procedures (SOPs) represent all phases of current laboratory operations (they include an effective date, revision number, and signature of the approving authorities (Laboratory Director and Technical Director) and are available to all personnel. They contain sufficient detail such that someone with similar qualifications could perform the procedures. There are two types of SOPs used in the laboratory: 1) test method SOPs, which have specific requirements as outlined below, and 2) general use SOPs, which document general procedures.

Each accredited analyte or method has an SOP. An SOP can be a copy of a method, and any additions or edits are clearly described. The laboratory's test method SOP's include the following topics, where applicable.

i. identification of the method;
ii. applicable matrix or matrices;
iii. limits of detection and quantitation;
iv. scope and application, including parameters to be analyzed;
v. summary of the method;
vi. definitions;
vii. interferences;
viii. safety;
ix. equipment and supplies;
x. reagents and standards;
xi. sample collection, preservation, shipment and storage;
xii. quality control;
xiii. calibration and standardization;
xiv. procedure;
xv. data analysis and calculations;
xvi. method performance;
xvii. pollution prevention;
xviii. data assessment and acceptance criteria for quality control measures;
xix. corrective actions for out-of-control data;
xx. contingencies for handling out-of-control or unacceptable data;
xxi. waste management;
xxii. references; and
xxiii. any tables, diagrams, flowcharts and validation data.

5.5.3 Order of Precedence

In the event of a conflict or discrepancy between policies, the order of precedence is as follows unless otherwise noted:

Quality Manual
SOPs and Policies
Client Quality Assurance Project Plan (QAPP)
Specific contract requirements, not related to compliance monitoring

Section 6

DOCUMENT CONTROL

This Section describes how the laboratory establishes and maintains a process for document management. Procedures for document management include controlling, distributing, reviewing, and accepting modifications. The purpose of document management is to preclude the use of invalid and/or obsolete documents.

Documents include, but are not limited to, SOPs, policy statements, specifications, calibration tables, charts, textbooks, posters, notices, memoranda, software, drawings and plans. These may be on various media, whether hard copy or electronic, and they may be digital, analog, photographic or written. Documents are distinguished from records in that they provide statements, requirements or explanations. Records are data (e.g., within a temperature logbook), raw data, and other such notes. Each entry of data is a record. Information about records is found in Section 16 – Control of Records.

The laboratory manages three types of documents: 1) controlled, 2) approved, and 3) obsolete.

A controlled document is one that is uniquely identified, issued, tracked, and kept current as part of the management system. Examples include but are not limited to SOPs, the *Quality Manual,* and the Chemical Hygiene Plan. In general, it is expected that controlled documents are subject to revision over time.

An approved document means it has been reviewed, and either signed and dated or acknowledged in writing or by secure electronic means by the issuing authority(ies). Examples include, but are not limited to, emails with electronic signatures, memoranda, training checklists and client reports.

Obsolete documents are those that have been superseded by more recent versions or are no longer needed.

6.1 Controlled Documents

Documents will be reviewed, revised (as appropriate) and approved for use by the Laboratory Director and Technical Director prior to issue.

Documents are reviewed annually to ensure their contents are suitable, in compliance with current management system requirements, and accurately describe current operations.

Approved copies of documents are available to staff at all locations where operations are essential to the effective functions of the laboratory. Documents (e.g., this *Quality Manual*) that are provided externally are catalogued (Document name, number, revision, date distributed and receiving party) but they are not signed for by the external party nor are they updated unless a specific request is made by the receiving external party. Copies of documents distributed to laboratory locations (e.g., Laboratory Departments or rooms) are consecutively numbered, if needed, from 1 to the total number of printed copies such as "1 of 5". In the case of distribution to a location, an employee is selected to sign for that location. The sequential number of each copy is recorded next to the individual's name in the distribution list. The date of distribution is recorded. The employee initials that the copy was received. When the document is no longer valid, the date the document became obsolete is recorded, and the retrieved copies are checked off next to each employee's name.

Controlled internal documents are uniquely identified with 1) a unique name or number identification 2) date of issue, 3) revision identification, 4) page number, 5) the total number of pages (or a mark to indicate the end of the document), and 6) the signatures of the issuing authority (i.e. management). Completed internal documents are reviewed by authors and then reviewed and signed by the Laboratory and Technical Directors.

A master list of controlled internal documents is maintained that includes distribution, location, and revision dates. A master list of controlled external documents is also maintained that includes title, author, copyright date, and date of publication, and location. The controlled document list is maintained by the Laboratory Director, or his designee, and is updated, at a minimum, every two years.

6.1.1 Document Changes to Controlled Documents

6.1.1.1 Paper Document Changes

Document changes are approved by the Laboratory Director or by the original approving authority.

The VL document management process allows for handwritten modifications to documents in between review cycles and during the annual review process. The date and approval is documented with the modifications. The handwritten change is made by the VL staff member most familiar with the procedure/policy. All changes and the reason for the changes are in ink, initialed and dated, on the original controlled document. Substantial changes, including significant process modifications, needed before the scheduled annual review may require that the document be formally revised. The Laboratory Director, who approves all handwritten changes, by initial/date of the change, determines if an immediate revision is necessary.

If immediate revision is not required, the original document with the approved handwritten changes is copied and replaces all other copies of that document within the laboratory. The removed copies are declared obsolete and the date is noted on the original document distribution list.

Handwritten amendments/modifications to documents are incorporated into a new revision and reissued when the document is reviewed and updated on or before its scheduled review cycle. The reason for the change should be included in the next revision to provide historical information for that particular procedure/policy.

6.1.1.2 Electronic Document Changes

Suggested revisions to electronic documents are presented to the Laboratory Director and Technical Director for review and approval. Changes to electronic documents are approved through the use of Microsoft Word's "Track Changes" function, which allows document changes to be reviewed prior to incorporation. VL chemists, analysts and technicians must be provided access to an editable copy of the original controlled document prior to making any changes and only staff with demonstrated skill in the use of the "Track Changes" function are allowed to make electronic changes. The use of flash drives for transfer of edited files is prohibited by all staff except the Laboratory Director and Technical Director.

6.2 Obsolete Documents

All invalid or obsolete documents are removed from general distribution, or otherwise prevented from unintended use.

Obsolete documents are retained for legal use or for the preservation of historical knowledge. Obsolete documents are identified as being obsolete by laboratory management. All copies of obsolete documents are collected from employees according to the master distribution list, and each copied obsolete document is destroyed. One paper copy and an electronic copy of each appropriately marked obsolete document are retained for five years.

Section 7

REVIEW OF REQUESTS, TENDERS AND CONTRACTS

The review of all new work assures that oversight is provided so that requirements are clearly defined, the laboratory has adequate resources and capability, and the test method is applicable to the client's needs. This process assures that all work will be given adequate attention without shortcuts that may compromise data quality.

Contracts for new work may be formal bids, signed documents, or verbal/electronic agreements. The client's requirements, including the methods to be used, must be clearly defined, documented and understood. Requirements might include target analyte lists, project specific reporting limits (if any), project specific quality control requirements (if any), turnaround time, and requirements for data deliverables. The review must also cover any work that will be subcontracted by the laboratory.

7.1 Procedure for the Review of Work Requests

The Laboratory Director determines if the laboratory has the necessary accreditations, resources, including schedule, equipment, deliverables, and personnel to meet the work request. The Laboratory Director meets with analytical staff and the Technical Director, as needed, to review the client's request and determines whether VL can meet the client's requirements for a particular project/work request.

If the above review indicates any potential conflict, deficiency, lack of accreditation, or inability of the lab to the complete the work satisfactorily, the Laboratory Director informs the client of the results of the review.

The client is informed of all deviations from the contract including the test method or sample handling processes. Given that the contract must be acceptable to both VL and the client, differences between the request and the final contract are resolved and recorded before any work begins. Record of agreement between VL and the client is documented as appropriate by the Laboratory Director and included in the client's project file.

The review process is repeated when there are amendments to the original contract by the client. The participating laboratory personnel are notified of any contract change either verbally, in writing, by a change on the sample schedule, or by updated information in LIMS. The amendments are maintained in the client's project file, which may be in a paper or electronic format (e.g., LIMS), dependent on the client and the complexity of the project.

For repetitive routine tasks, the review may be made only at the initial inquiry stage or on granting of a contract for on-going routine work performed under a general agreement with the client, provided the client's requirements don't change.

The following are reviewed and evaluated for new projects (as appropriate):

1) Contractual obligations, bonding issues, insurance requirements and payment terms
2) Method capabilities, analyte lists, reporting limits and quality control limits
3) Turnaround time feasibility
4) QA/QC issues, including certification accreditation
5) Formal laboratory quote
6) Final report formatting and electronic deliverable documents
7) Time required to store sample after completion of work
8) Final sample disposal requirements

7.2 Documentation of Review

Records are maintained for every contract or work request, when appropriate. This includes pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract.

Records of all project-related communication with the client (e.g., e-mails, fax, telephone conversation) are retained in paper and/or electronic files.

Section 8

SUBCONTRACTING OF ENVIRONMENTAL TESTS

A subcontract laboratory is defined as a laboratory external to this laboratory, or at a different location than the address indicated on the front cover of this manual, that performs analyses for this laboratory.

When subcontracting analytical services, VL assures work requiring accreditation is given to an appropriately accredited laboratory or one that meets applicable statutory and regulatory requirements for performing the tests. VL will ensure that the subcontract laboratory understands the requirements and will meet the same commitments made to the client by VL.

8.1 Procedure

The Laboratory Director maintains a list of subcontractors.

A copy of the certificate and analyte list from subcontractors is maintained as evidence of compliance. This information is maintained by the Laboratory Director and is kept in paper or electronic files.

The certificate and analyte list are reviewed by the Laboratory Director to ensure the subcontracting laboratory has the appropriate accreditation to do the work.

The Laboratory Director may, dependent on the client, notify the client of the intent to subcontract work (or change the subcontractor), usually by phone call or email. Also, depending on the client/project, the laboratory gains the approval of the client for any changes prior to implementation of the changes.

The laboratory performing the subcontracted work is identified in the final report. VL assumes responsibility to the client for the subcontractor's work, except in the case where a client or a regulating authority specified which subcontractor is to be used.

Section 9

PURCHASING SERVICES AND SUPPLIES

VL ensures that purchased supplies and services (e.g., balance calibration and Class 1 weight calibration) that affect the quality of environmental tests are of the required or specified quality, by using approved suppliers and products.

The laboratory has procedures for purchasing, receiving, and storage of supplies that affect the quality of environmental tests.

9.1 Procedure

The Laboratory Director reviews and approves the supplier of services and supplies and approves technical content of purchasing documents prior to ordering.

Evaluation of suppliers is accomplished by ensuring the supplier ships the product or material ordered and that the material is of the appropriate quality by reviewing packing slips or other supply receipt documents. The purchasing documents contain the data that adequately describes the services and supplies ordered. The description may include type, class, grade, identification, specifications or other technical information.

The supplies received are inspected for breakage, leaks or any other damage. The supplies and chemicals are checked as appropriate for date of manufacture, lot number, expiration date, concentration, grade, and storage conditions. The supplies received are stored according to manufacturer's recommendations, laboratory SOPs or test method specifications. Purchased supplies that are used in the course of producing analytical data are logged into a Supply Receipt Logbook, which includes the Date Received, Vendor Name, Item Description, Catalog No., Lot No., Dept., Initials of person who received and logged in the supply, and any comments. All packing slips are stamped as being received and are initialed by the person who received and logged in the supply with the date of receipt and then filed by the receipt month.

Any documents received with the supplies and services including specifications, certificates of analyses, warranties, maintenance records or calibration records are kept on file with the appropriate laboratory personnel/departments.

The purchased supplies and reagents that affect the quality of the tests are not used until they are inspected or otherwise verified as complying with requirements defined in the test method.

9.2 Approval of Suppliers

The Laboratory Director maintains a list of approved suppliers.

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet the demand for their products, the overall quality of their services, their past history and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients.

Section 10

SERVICE TO THE CLIENT

VL collaborates with clients and/or their representatives in clarifying their requests and in monitoring laboratory performance related to their work. Each request is reviewed to determine the nature of the request and the laboratory's ability to comply with the request within the confines of prevailing statutes and/or regulations without risk to the confidentiality of other clients.

10.1 Client Confidentiality

The VL confidentiality policy is to not divulge or release any information to a third party without proper authorization. Third party requests for data and information are referred to the client. Data and records identified as proprietary, privileged, or confidential are exempt from disclosure.

All electronic data (storage or transmissions) are kept confidential, based on technology and laboratory limitations, as required by client or regulation. The following confidentiality statement is used on emails and transmitted (fax) information:

This message/document is intended exclusively for the individual or entity to which it is addressed. This communication may contain information that is proprietary, privileged or confidential or otherwise legally exempt from disclosure. If you are not the named addressee, you are not authorized to read, print, retain, copy or disseminate this message/document or any part of it. If you have received this message/ document in error, please notify Veritas Laboratories immediately by email and delete all copies of the message/document.

10.2 Client Support

Communication with the client, or their representative, is maintained to provide proper instruction and modification for testing. Technical staff is available to discuss any technical questions or concerns the client may have.

The client, or their representative, may be provided reasonable access to laboratory areas for observation of testing.

Delays or major deviations to the testing are communicated to the client immediately. Should delays or deviations occur, the Laboratory Director or his designee contacts the

client by telephone, email, or text, and the communication is documented in the client's project file or electronically.

The laboratory will provide the client with all requested information pertaining to the analysis of their samples. An additional charge may apply for additional data/information that was not requested prior to the time of sample analysis or previously agreed upon.

10.3 Client Feedback

The laboratory seeks both negative and positive feedback following the completion of projects and periodically for ongoing projects. Feedback provides acknowledgement, corrective actions where necessary, and opportunities for continuous improvement.

Negative client feedback is documented as a client complaint (see Section 11 – "Complaints"). The laboratory allows for the receipt of feedback, by communicating with clients throughout the course of the project. All clients, regardless of size, are advised that feedback is encouraged and welcomed at any time and especially if the client is concerned about the laboratory's quality and/or project progress.

Section 11

COMPLAINTS

The purpose of this Section is to assure that client complaints are addressed and corrected. This includes requests to verify results or analytical data. Complaints provide VL an opportunity to improve laboratory operation and client satisfaction.

Complaints by clients or other parties are reviewed by management and an appropriate action is determined. All client complaints are documented by the person receiving the complaint and addressed to the responsible staff member.

If it is determined that the complaint has merit, the procedures outlined in Section 14 – Corrective Action are utilized. If it is determined that a complaint is without merit, it is documented in the client's project file, and the client is contacted by the Laboratory Director or his designee.

A complaint such as a concern that data is repeatedly late should be reviewed for preventive action (see Section 15 – "Preventive Action") to minimize a future occurrence.

Section 12

CONTROL OF NON-CONFORMING ENVIRONMENTAL TESTING WORK

Non-conforming work is work that does not meet acceptance criteria or requirements. Nonconformances can include departures from standard operating procedures or test methods or unacceptable quality control results (see Section 27 – "Quality Assurance for Environmental Testing"). Identification of non-conforming work can come through client complaints, quality control, instrument calibration, evaluating consumable materials, staff observation, final report review, management reviews and internal and external audits.

12.1 Exceptionally Permitting Departures from Documented Policies and Procedures

Requests for departures from laboratory procedures are approved by the Laboratory Director or Technical Director and documented. Such requests are documented in the client's project file and/or on the chain of custody document. Planned departures from procedures or policies do not require audits or investigations. If a client requests a departure from laboratory procedures, the laboratory does not have to consider that departure as a nonconformance that requires corrective action. However, that nonconformance must be documented as a nonconformance that was approved by management. Examples of these departures include: Insufficient sample volume for a rerun, where holding time has already been exceeded, or where sample data are not affected by the nonconformance; VL did not receive the required sample volume and the client wants you to complete the analysis anyway. The departure would be documented and the data would be qualified if necessary.

12.2 Non-Conforming Work

The laboratory policy for control of non-conforming work is to identify the non-conformance, determine if it will be permitted, and take appropriate action. All employees have the authority to stop work on samples when any aspect of the process does not conform to laboratory requirements.

The responsibilities and authorities for the management of non-conforming work are detailed as follows: Corrective action for routine, non-recurring exceedances can be documented on raw data worksheets, logbooks, emails, a database, or other documents. More serious corrective actions require a more formal corrective action process that includes the use of a corrective action report. The procedure for investigating and taking appropriate corrective actions of non-conforming work are described in Section 14 – "Corrective Actions". Section 14.3 describes procedures for Technical Corrective

Actions. Formal corrective action procedures must be followed for non-conforming work that could reoccur (beyond expected random QC failures) or where there is doubt about the laboratory's compliance to its own policies and procedures.

The investigation and associated corrective actions of non-conforming work involving alleged violations of the company's Ethics and Data Integrity policies must follow the procedures outlined in Section 19 – "Data Integrity Investigations".

The laboratory evaluates the significance of the non-conforming work, and takes corrective action immediately. The client is notified if their data has been impacted. The laboratory allows the release of non-conforming data only with approval by the Laboratory Director on a case-by-case basis. Non-conforming data is clearly identified in the final report (see Section 28 – "Reporting the Results").

The discovery of a nonconformance for results that have already been reported to the client must be immediately evaluated for significance of the nonconformance, its acceptability to the client, and determination of the appropriate corrective action.

12.3 Stop Work Procedures

Personnel notify the Laboratory Director or Technical Director of any nonconformance (or specific nonconformances that require notification), who then review the significance of the nonconformance and develop a course of action. If data are questionable, clients are notified. When an investigation of nonconformance indicates that the cause of the nonconformance requires that a method be restricted or not used until modifications are implemented, the Laboratory Director and Technical Director will immediately notify all personnel of the suspension/restriction. The lab will hold all relevant reports to clients pending review. The Laboratory and Technical Directors must be involved with the resolution of the issue and must verify that the issue is resolved before work resumes. Personnel are notified by the Laboratory Director when the resumption of work is authorized. The Laboratory Director will document the issue, root cause and resolution using the Corrective Action procedures described in Section 14. The report of non-conforming work involving alleged violations of the laboratory's Ethics and Data Integrity policy must be reported to the Quality Manager. Procedures described in Section 19 – "Data Integrity Investigations" are followed.

Section 13

IMPROVEMENT

Improvement in the overall effectiveness of the VL management system is a result of the implementation of the various aspects of the laboratory's management system: quality policy and objectives (Section 5 – "Management"); internal auditing practices (Section 17 – "Audits"); the review and analysis of data (Section 27 – "Quality Assurance for Environmental Testing"); the corrective action (Section 14 – "Corrective Action") and preventive action (Section 15 – "Preventive Action") process; and the annual management review of the quality management system (Section 18 – "Management Reviews") where the various aspects of the management/quality system are summarized, and evaluated and plans for improvement are developed.

Section 14

CORRECTIVE ACTION

Corrective action is the action taken to eliminate the causes of an existing non-conformity, defect, or other undesirable situation in order to prevent recurrence.

Deficiencies cited in external assessments, internal quality audits, data reviews, client feedback/complaints, control of nonconforming work or managerial reviews are documented and require corrective action. Corrective actions taken are appropriate for the magnitude of the problem and the degree of risk.

14.1 General Procedure

VL uses a form to document and track corrective actions. A copy of the form is provided in Appendix I.

The analyst, as instructed by the Laboratory Director or Technical Director, is responsible for initiating corrective action on routine data reviews where a nonconformance is found that could reoccur (beyond expected random QC failures) or where there is doubt about the compliance of the laboratory to its own policies and procedures. The Laboratory Director, working with the analyst, is responsible for monitoring and recording the corrective action on the laboratory's corrective action form.

All deficiencies are investigated and a corrective action plan is developed and implemented if determined necessary. The implementation is monitored for effectiveness. All investigation and follow-up is to be recorded on the corrective action form. Appropriate documentation (e.g., instrument print-outs) should be included as a part of the completed corrective action.

14.1.1 Cause Analysis

When failures due to systematic errors have been identified, the first step of the corrective action process starts with the initial investigation and determination of root cause(s) of the problem. Records are maintained on the laboratory's corrective action form, which is maintained as an electronic record and also may be maintained in a paper file. The record of nonconformances requiring corrective action show that the root cause(s) was investigated, and includes the results of the investigation.

Where there may be non-systematic errors and as such the initial cause is readily identifiable or expected random failures (e.g. failed quality control), a formal root cause

analysis is not performed and the process begins with selection and implementation of corrective action (also see Section 14.3 "Technical Corrective Actions").

14.1.2 Selection and Implementation of Corrective Actions

Where uncertainty arises regarding the best approach for analysis of the cause of exceedances that require corrective action, the analyst, with concurrence of the Laboratory and/or Technical Directors, will recommend corrective actions that are appropriate to the magnitude and risk of the problem and that will most likely eliminate the problem and prevent reoccurrence.

The Laboratory Director ensures that corrective actions are discharged within the agreed upon time frame.

14.1.3 Monitoring of Corrective Action

The Laboratory Director will monitor implementation and documentation of the corrective action to assure that the corrective actions were effective.

14.2 Additional Audits

Where the identification of nonconformances or departure from normal lab procedures cast doubt on the laboratory's compliance with its own policies and procedures or on its compliance with the NDEP BSDW requirements and the TNI Standard, the laboratory ensures that the appropriate areas of activity are audited in accordance with Section 17 – "Audits" as soon as possible.

In many cases, the additional audits are follow-ups after the corrective action has been implemented to ensure it is effective. These are done when a serious issue or risk to the laboratory has been identified.

14.3 Technical Corrective Action

Sample data associated with a failed quality control are evaluated for the need to be reanalyzed or qualified. Unacceptable quality control results are documented, and if the evaluation requires a root cause analysis, the root cause and solution are recorded (also see Section 12 – "Control of Nonconforming Environmental Testing Work"). Analysts routinely implement corrective actions for data with unacceptable QC measures. First level correction may include re-analysis without further assessment. If the test method SOP addresses the specific actions to take, they are followed. Otherwise, corrective actions start with assessment of the cause of the problem.

The Laboratory Director and/or Technical Director review corrective action forms and suggest improvements, alternative approaches, and modified procedures where needed.

If the data reported are affected adversely by the nonconformance, the affected data is clearly identified in the report and the client is notified.

Section 15

PREVENTIVE ACTION

Preventive action is a pro-active process to identify opportunities for improvement rather than a reaction to the identification of problems or complaints.

Preventive action may include, but is not limited to:

1) review of QC data to identify quality trends
2) regularly scheduled staff quality meetings to ensure staff is knowledgeable in quality procedures
3) review of client feedback to look for improvement opportunities
4) review of proficiency testing data to look for analytes that were nearly missed
5) annual managerial reviews
6) scheduled instrument maintenance
7) other actions taken specifically to prevent problems

When improvement opportunities are identified or if preventive action is required, action plans are developed, implemented and monitored to reduce the likelihood of the occurrence of nonconformities.

Procedures for preventive actions include the initiation of such actions and subsequent monitoring to ensure that they are effective.

All personnel have the authority to offer suggestions for improvements and to recommend preventive actions, however management is responsible for implementing preventive action.

A Management of Change process may also be used. This process is designed to formally review any changes that are planned for the laboratory and look for potential issues that might arise. Issues are minimized through the development of preventive measures. Examples of changes that might be considered under this type of process include the installation of a new LIMS, key personnel changes, building renovation, addition/deletion of an accreditation, and addition of a new technology that requires new instrumentation.

Section 16

CONTROL OF RECORDS

Records are a subset of documents, usually data recordings that include annotations, such as daily refrigerator temperatures posted to a laboratory form, lists, spreadsheets, or analyst notes on a chromatogram. Records may be on any form of media, including electronic and hard copy. Records allow for the historical reconstruction of laboratory activities related to sample-handling and analysis.

VL maintains a record system appropriate to its needs, records all laboratory activities, and complies with applicable standards or regulations as required. Records of original observations and derived data are retained to establish an audit trail. Records help establish factors affecting the uncertainty of the test and enable test repeatability under conditions as close as possible to the original.

16.1 Records Maintained

Records of all procedures to which a sample is subjected while in the possession of the laboratory are kept. VL retains all original observations, calculations and derived data (with sufficient information to produce an audit trail), calibration records, personnel records and a copy of the test report for a minimum of five years from generation of the last entry in the records. At a minimum, the following records are maintained by the laboratory to provide the information needed for historical reconstruction:

i) all raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' worksheets and data output records (chromatograms, strip charts, and other instrument response readout records);

ii) a written description or reference to the specific method(s) used, which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value (a copy of all pertinent Standard Operating Procedures);

iii) laboratory sample ID number;

iv) date of analysis;

v) time of analysis [required if the holding time is seventy-two (72) hours or less, or when time critical steps are included in the analysis (e.g., extractions and incubations)];

vi) instrument identification and operating conditions/parameters (or reference to such data);

vii) all manual calculations (including manual integrations);

viii) analyst's or operator's initials/signature or electronic identification;

ix) sample preparation, including cleanup, separation protocols, incubation periods, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents;

x) test results (including a copy of the final report);

xi) standard and reagent origin, receipt, preparation, and use;

xii) calibration criteria, frequency and acceptance criteria;

xiii) data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions;

xiv) quality control protocols and assessment;

xv) electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries;

xvi) method performance criteria including expected quality control requirements;

xvii) proficiency test results;

xviii) records of demonstration of capability for each analyst;

xix) a record of names, initials, and signatures for all individuals who are responsible for signing or initialing any laboratory record;

xx) correspondence relating to laboratory activities for a specific project;

xxi) corrective action reports;

xxii) preventive action records;

xxiii) copies of internal and external audits including audit responses;

xxiv) copies of all current and historical laboratory SOPs, policies and *Quality Manuals*;

xxv) sample receiving records (including information on any interlaboratory transfers);

xxvi) sample storage records;

xxvii) data review and verification records;

xxviii) personnel qualification, experience and training records;

xxviv) archive records; and

xxviv) management reviews.

16.2 Records Management and Storage

VL maintains a record management system for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation, storage, and reporting. Data is recorded immediately and legibly in permanent blue ink (data generated by automated data collections systems is recorded electronically.) Corrections are initialed and dated with the reason noted for corrections other than transcription errors. A single line strikeout is used to make corrections so that the original record is not obliterated. VL considers electronic storage of records to be the primary storage medium if a record exists in both paper and electronic format. Final report documentation (e.g., COCs, analytical reports) is converted to electronic format, delivered to the client electronically and then stored on the laboratory's dedicated server in a secure directory. Scanned reports are reviewed for completeness prior to delivery to the client. Electronic records and instrument data are backed up to a secure directory on the laboratory's server. Redundancy among laboratory hard drives provides assurance that all electronic records can be retrieved even if a single hard-drive crash occurs.

Paper, which is the back-up medium, is stored on site for the five-year record retention requirement. Some paper records (e.g., logbooks) are retained in paper format only.

Records, including electronic records, are easy to retrieve, legible, and protected from deterioration or damage; held secure and in confidence; and are available to accrediting bodies for a minimum of five years or as required by regulation or contract. Records that are stored only on electronic media are supported by the hardware and software necessary for their retrieval. Access to protected records is limited to the Laboratory Director and Technical Director to prevent unauthorized access or amendment.

Additional information regarding control of data is included in Section 22.5 – "Control of Data".

Identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records are performed by the Laboratory Director or his designee. Quality records shall include reports from internal audits and management reviews as well as records of corrective and preventive actions. Scanned client project final reports are named by work order, client code, and electronically filed by year and month.

Archived information and access logs are protected against theft, loss, environmental deterioration, vermin, and in the case of electronic records, electronic or magnetic sources, and are stored in facilities equipped with automatic fire suppression systems. Archived records have limited access.

In the event that the laboratory transfers ownership or goes out of business, records are maintained or transferred according to client instructions. Appropriate regulatory and state legal requirements concerning laboratory records shall be followed.

16.3 Legal Chain of Custody Records

Evidentiary sample data are used as legal evidence. Procedures for evidentiary samples can be found in SOP #1000VL – Sample Receipt and Log-In. Clients requiring more stringent procedures for their samples may request that in their Quality Assurance Project Plan (QAPP).

Section 17

AUDITS

Audits measure laboratory performance and verify compliance with accreditation/ certification and project requirements. Audits specifically provide management with an on-going assessment of the management system. They are also instrumental in identifying areas where improvement in the management/quality system will increase the reliability of data. Audits are of four main types: internal, external, performance, and system. Section 17.5 discusses the handling of audit findings.

17.1 Internal Audits

Annually, VL, using the TNI Quality Systems checklist as guidance, prepares a schedule of internal audits to be performed during the year using the Veritas "QA Calendar". These audits verify compliance with the requirements of the management/quality system, including analytical methods, SOPs, the *Quality Manual*, ethics policies, data integrity, other laboratory policies, and the TNI Standard.

It is the responsibility of the Laboratory Director/Quality Assurance Manager to plan and organize audits as required by the schedule. These audits are carried out by trained and qualified personnel who are, wherever resources permit, independent of the activity to be audited.

In addition to the scheduled internal audits, it may sometimes be necessary to conduct special audits as a follow-up to corrective actions, PT results, complaints, regulatory audits or alleged data integrity issues. These audits address specific issues.

The area audited, the audit findings, and corrective actions are recorded. Audits are reviewed after completion to assure that corrective actions were implemented and effective. This review may occur during the next scheduled audit unless findings are observed that cast doubt on the validity of data. Corrective actions that warrant sooner review cannot wait for the next scheduled audit.

17.2 External Audits

It is the VL policy to cooperate and assist with all external audits, whether performed by clients or an accrediting body (e.g., NDEP BSDW). Management ensures that all areas of the laboratory are accessible to auditors as applicable and that appropriate personnel are available to assist in conducting the audit.

17.2.1 Confidential Business Information (CBI) Considerations

During on-site audits, on-site auditors may come into possession of information claimed as business confidential. A business confidentiality claim is defined as "a claim or allegation that business information is entitled to confidential treatment for reasons of business confidentiality or a request for a determination that such information is entitled to such treatment." When information is claimed as business confidential, the laboratory must place on (or attach to) the information at the time it is submitted to the auditor, a cover sheet, stamped or typed legend or other suitable form of notice, employing language such as "trade secret", "proprietary" or "company confidential". Confidential portions of documents otherwise non-confidential must be clearly identified. CBI may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. However, sample identifiers may not be obscured from the information.

17.3 Performance Audits

Performance audits may be Proficiency Test Samples, internal single-blind samples, double-blind samples through a PT sample provider or client, or anything that tests the performance of the analyst and method.

Proficiency Test Samples are discussed in Section 27 – "Quality Assurance for Environmental Testing".

17.4 System Audits

The Laboratory's management system is audited though annual management reviews. Refer to Section 18 – "Management Reviews" for further discussion of management reviews.

17.5 Handling Audit Findings

Internal or external audit findings are responded to within the time frame agreed to at the time of the audit. The response may include action plans that could not be completed within the response time frame. A completion date is established by management for each action item and included in the response.

The responsibility for developing and implementing corrective actions to findings is the responsibility of the Laboratory Director and/or Technical Director in consultation with the analyst. Corrective actions are documented through the corrective action process described in Section 14 – "Corrective Action".

Audit findings that cast doubt on the effectiveness of the laboratory operation to produce data of known and documented quality or that question the correctness or

validity of sample results must be investigated. Corrective action procedures described in Section 14 – "Corrective Action" must be followed. Clients must be notified in writing if the investigation shows the laboratory results have been negatively affected and the client's requirements have not been met. The client must be notified within two business days after the laboratory discovers the issue. Laboratory management will ensure that this notification is carried out within the specified time frame.

All investigations that result in findings of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients. See Section 19 – "Data Integrity Investigations" for additional procedures for handling inappropriate activity.

Section 18

MANAGEMENT REVIEWS

Top management (Laboratory Director and Technical Director) informally discuss management system topics (Section 18.1) continuously and formally on an annual basis and maintains records of review findings and actions as appropriate.

18.1 Management Review Topics

The following items, which may be considered during strategic planning and/or regular management meetings/dus, are reviewed to ensure their suitability and effectiveness:

- the suitability of policies and procedures;
- reports from managerial and supervisory personnel;
- the outcome of recent internal audits;
- corrective and preventive actions;
- assessments by external bodies;
- the results of interlaboratory comparisons or proficiency tests;
- changes in the volume and type of the work;
- client feedback;
- complaints;
- recommendations for improvement;
- completion of scheduled QA Calendar action items;
- other relevant factors, such as quality control activities, resources, and staff training.

18.2 Procedure

Findings and follow-up actions from management reviews are recorded. Management will determine appropriate completion dates for action items and ensure they are completed within the agreed upon time frame.

Section 19

DATA INTEGRITY INVESTIGATIONS

In addition to covering data integrity investigations, this Section covers all topics related to ethics and data integrity policies, procedures and training.

Veritas Laboratories is committed to ensuring the integrity of its data and providing valid data of known and documented quality to its clients. The elements in Veritas Laboratories' Ethics and Data Integrity program include:

- Documented data integrity procedures (as defined in Section 19.1) approved by top management.
- An Ethics and Data Integrity Policy signed by all management and staff at the beginning of employment and annually thereafter (see Appendix A). This policy is signed, dated and distributed by the Laboratory Director and/or Technical Director.
- Annual data integrity training.
- Procedures for confidential reporting of alleged data integrity issues.
- An audit program that monitors data integrity (see Section 17 – "Audits") and procedures for handling data integrity investigations and client notifications.

19.1 Ethics and Data Integrity Procedures

The Ethics and Data Integrity Policy provides an overview of the program. Written procedures that are considered part of the Ethics and Data Integrity program include:

Ethics and Data Integrity Policy (Appendix A)
Manual integration procedures (SOP # 1300VL)
Corrective action procedures (Section 14 of this QM)
Procedures for data integrity investigations (Section 19.4)
Test report amendment procedures (Section 28.5 of this QM)

Management reviews data integrity procedures yearly and updates these procedures as needed.

19.2 Training

Data integrity training is provided as a formal part of new employee orientation and a refresher is given annually for all employees. Employees are required to understand that any infractions of the laboratory data integrity procedures shall result in a detailed investigation that could lead to very serious consequences including immediate termination, debarment or civil/criminal prosecution. This is discussed in the Ethics and Data Integrity Policy training that every employee is required to attend and sign as completed annually.

Data integrity training emphasizes the importance of proper written narration on the part of the analyst with respect to those cases where analytical data may be useful, but are partially deficient. The following topics and activities are covered:

- 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;
- record keeping;
- training, including discussion regarding all data integrity procedures;
- data integrity training documentation;
- in-depth data monitoring and data integrity procedure documentation; and
- specific examples of breaches of ethical behavior such as improper data manipulations, adjustments of instrument time clocks, and inappropriate changes in concentrations of standards.

Topics covered are presented either in writing or by video presentation and provided to all trainees. Key topics covered during data integrity training should include: 1) the organizational mission and its relationship to the need for honesty and full disclosure in all analytical reporting 2) how and when to report data integrity issues 3) recordkeeping 4) discussion regarding all data integrity procedures 5) data integrity training documentation 6) in-depth data monitoring 7) data integrity procedure documentation 8) improper data manipulations 9) adjustments of instrument time clocks 10) inappropriate changes in concentrations of standards 11) the importance of proper written narration on the part of the analyst with respect to those cases where analytical data may be useful, but are in one sense or another partially deficient 12) attendance at training sessions and/or signing of an ethics agreement 13) examples of improper practices 14) examples of improper chromatographic manipulations 15) requirements for external ethics program training 16) any external resources available to employees and 17) consequences for data integrity infractions.

When contracted technical or support personnel are used the Laboratory Director is responsible for ensuring that they are trained to the VL management system and data

integrity procedures, competent to perform the assigned tasks, and appropriately supervised.

19.3 Confidential Reporting of Ethics and Data Integrity Issues

Confidential reporting of data integrity issues is assured through the following procedures. Employees are required to report issues to the Laboratory Director and/or Technical Director if the issue involves a non-management employee. If the issue should relate to the Laboratory Director, the Technical Director is to be notified and vice versa. Should both the management staff members be involved in the issue, the employee should approach management staff directly and demand resolution, per the laboratory's ethics and data integrity policy. If the management staff is not responsive in any of these circumstances, the employee should report the issue to the NDEP BSDW Laboratory Certification Officer.

19.4 Investigations

All investigations resulting from data integrity issues are conducted confidentially. They are documented and notifications are made to clients who received any negatively affected data that did not meet the client's data quality requirements. Procedures for such investigations are detailed below.

- Data packet(s) are prepared for the sample(s) in question, specifically related to the suspect data. This packet must include all information/data related to the sample.
- The packet(s) are reviewed by the Laboratory Director (if the data integrity issue involves an analyst or the Technical Director) to determine the validity of the data integrity issue.
- If the issue is deemed valid, the impact to the data and reporting of the data is determined.
- The Laboratory Director notifies the client if the affected data has already been reported. Data may be withdrawn or may be recalled and reported again with corrections or qualifiers, dependent on the circumstances of the data integrity issue.
- Re-issued report(s) will provide a narrative of the issue that caused the need for modification, or withdrawal, of the original report.
- Dependent on the nature of the data integrity issue, the responsible employee may be subject to disciplinary action.

Section 20

PERSONNEL

VL employs competent personnel based on education, training, experience and demonstrated skills as required. The VL organization chart, employee résumés and job descriptions can be found in Appendix B.

20.1 Overview

All personnel are responsible for complying with all quality and data integrity policies and procedures that are relevant to their area of responsibility.

All personnel who are involved in activities related to sample analysis, evaluation of results or who sign test reports, must demonstrate competence in their area of responsibility. Appropriate supervision is given to any personnel in training and the trainer is accountable for the quality of the trainees work. Personnel are qualified to perform the tasks they are responsible for based on education, training, experience and demonstrated skills as required for their area of responsibility.

VL provides goals with respect to education, training and skills of laboratory staff, which are outlined in each job description (Appendix B). Training needs are identified at the time of employment and when personnel are moved to a new position or new responsibilities are added to their job responsibilities. Ongoing training, as needed, is also provided to personnel in their current jobs. The effectiveness of the training must be evaluated before the training is considered complete.

Contracted personnel, when used, must meet the same competency standards and follow the same policies and procedures that laboratory employees must meet.

20.2 Job Descriptions

Description of job duties are available for all positions that manage, perform, or verify work affecting data quality, and are located in Appendix B. An overview of top management's responsibilities is included in Section 5 – "Management".
Job descriptions include the specific tasks, minimum education and qualifications, skills, and experience required for each position

20.3 Training

All personnel are appropriately trained and competent in their assigned tasks before they contribute to functions that can affect data quality. It is management's responsibility to assure personnel are trained. Training records are used to document management's approval of personnel competency. The date on which authorization and/or competence is confirmed is included.

Training records are maintained by the Laboratory Director and include analyst training checklists, initial and ongoing demonstrations of capability records for analyses performed, and verification of training on laboratory policies and the *Quality Manual*.

20.3.1 Training for New Staff

All new staff members are provided introductory training and orientation during the first week of employment. Training includes Data Integrity training which also requires the review and sign-off on the VL Ethics and Data Integrity Policy (Appendix A). Each new employee must also review and sign off on the Quality Manual and the Chemical Hygiene Plan.

Initial training for a new task or analysis includes the following steps:

1) All documentation involved with a new, unfamiliar task or analysis is read and understood by the trainee.
2) Training is under the direct supervision of a qualified analyst. During the time the analyst is in training, the trainee may sign laboratory notebooks, logbooks, worksheets, and other similar documents but they must be co-signed by the trainer; the trainer is responsible for the data generated by the trainee.
3) The trainee demonstrates competency in the new task or analysis before they can operate independently. Competency for a test method is accomplished by a demonstration of capability (DOC) as defined in Section 22 – "Environmental Methods and Method Validation". A training checklist is completed by the trainee and signed off by the Laboratory Director or his designee.
4) Each step of the training process is documented and documentation is maintained in the employee's training file.
5) As an employee is trained on a new analysis, a NELAC DOC list is updated and signed by laboratory management.

20.3.2 Ongoing Training

All staff members are given an annual refresher data integrity training and are required to sign off on the Ethics and Data Integrity Policy. This training is documented on a training attendance sheet that outlines the content of the training.

Ongoing training consists of:

1) The employee attests, through signature, that they have read, understood, and agree to perform/follow the latest version of the Quality Manual and any SOPs for which the analyst is responsible.
2) Annually, the analyst shows continued proficiency in each method they perform through Ongoing Demonstration of Capability (ODOC) as defined in Section 22 – "Environmental Methods and Method Validation" and in Appendix G.
3) Attending job-related training as required.
4) Maintaining training documentation in the employee's training record.

Section 21

ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS

21.1 Environmental

The VL facility is designed and organized to facilitate testing of environmental samples. Environmental conditions are monitored to ensure that conditions do not invalidate results or adversely affect the required quality of any measurement. Such environmental conditions include temperature, humidity, light, biological sterility, sound and vibration levels.

Back-up power is in place for the laboratory's server.

If a method or regulation requires that the laboratory environment be controlled, the adherence is recorded.

Environmental tests are stopped when the environmental conditions jeopardize the results. Particular care shall be taken when sampling and tests and/or calibrations are undertaken at sites other than a permanent facility (e.g., sampling in the field).

21.2 Work Areas

Work areas may include access and entryways to the laboratory, sample receipt area, sample storage areas, sample processing areas, instrumental analysis areas, chemical and waste storage area and data handling and storage areas.

Access to, and use of, areas affecting the quality of the environmental tests is controlled by restriction of areas to authorized personnel only. See Section 21.4 below.

The laboratory work spaces are adequate for their use, and appropriately clean to support environmental testing and ensure an unencumbered work area. Laboratory housekeeping includes janitorial service provided by external personnel, periodic dedicated clean-up periods and commitment from each employee to keep individual work areas clean and uncluttered.

Laboratory space is arranged to minimize cross-contamination between incompatible areas of the laboratory. Volatiles analysis is in a room with a separate air system from the rest of the lab. Electronic balances are located away from drafts and doorways, and mounted in areas where their use is not affected by vibration. Biological work areas are cleaned and sterilized between uses.

21.3 Floor Plan/Description of Laboratory Spaces

Description of the laboratory spaces can be found in Appendix C.

21.4 Building Security

VL is kept secure during off hours with locks and an alarm system.

A Visitor's Logbook is available for visitors to sign in and out if they are going to enter controlled laboratory spaces. Visitors must be accompanied by laboratory personnel when in such areas.

Signs are used to designate secure areas.

Section 22

ENVIRONMENTAL METHODS AND METHOD VALIDATION

Methods and/or procedures are available for all activities associated with the analysis of the sample including preparation and testing. For purposes of this Section, "method" refers to both the sample preparation and determinative methods. The Table of Methods used by VL is found in Appendix E.

Before being put into use, a test method is confirmed by an initial demonstration of capability (IDOC) or method validation process.

All methods are published or documented. Deviations from the methods are allowed only if the deviation is documented, technically justified, authorized by management and accepted by the client.

22.1 Method Selection

A reference method is a method issued by an organization generally recognized as competent to do so. When a laboratory is required to analyze a parameter by a specified method due to a regulatory requirement, the parameter/method combination is recognized as a reference method.

VL uses methods that meet the needs of the client. Such methods will be based on the latest edition of the method unless it does not meet the needs of the client.

VL selects methods that are appropriate to the client needs. When the regulatory authority mandates or promulgates methods for a specific purpose, only those methods will be used.

If a method proposed by a client is considered to be inappropriate or out-of-date, the client is informed and the issue resolved before proceeding with analysis of any samples (see Section 7 – "Review of Requests, Tenders and Contracts").

If a method is not specified by the client, an appropriate method will be selected based on the list of methods for which VL is certified and any regulatory requirements specified by the client. VL assures to the client that data reporting and final use of data objectives are met.

When a method is not specified by the client, or the proposed method is inappropriate, VL selects a method that is appropriate to the end use of the data: 1) If the data are to be submitted to a regulatory authority, the method(s) specified by the regulatory authority will be used 2) For drinking water compliance a method will be selected from those specified in 40 CFR Part 141, or the applicable state regulations. 3) For NPDES permits, the method will be selected from those specified in 40 CFR Part 136. 4) If the end use of the data is not regulatory or if the regulatory authority does not specify a method, VL will determine the client needs in terms of reporting level (e.g., MRL, MDL), bias (e.g., screening versus quantitative) and its capabilities and capacity. Based on these criteria, the laboratory will select an appropriate method based on the following hierarchy: 1) Resources published in regional, national or international standards such as EPA 2) Methods published by other technical organizations such as ASTM, Standard Methods or AOAC 3) Methods developed by the instrument manufacturer and 4) Laboratory-developed methods.

As appropriate, all method selection/method change communications between VL and the client are documented.

22.2 Laboratory-Developed Methods

If VL develops a method, the process of designing and validating the method is carefully planned and documented. All personnel involved in the method design, development and implementation will communicate during all stages of development.

22.3 Method Validation

Validation is the confirmation, by examination and objective evidence, that the particular requirements for a specific intended use are fulfilled.

At a minimum, reference methods are validated by performing an initial demonstration of capability. Additional requirements are discussed for each technology.

All methods that are not reference methods are validated before use. The validation is designed so that VL can demonstrate that the method is appropriate for its intended use. All records (e.g., planning, method procedure, raw data and data analysis) shall be retained while the method is in use. Based on the validation process, the laboratory will make a statement in the method SOP of the intended use requirements and whether or not the validated method meets the use requirements.

Method validation and Demonstration of Capability procedures can be found in:

- Appendix G - Chemistry
- Appendix H – Microbiology

22.4 Estimation of Analytical Uncertainty

Analytical Uncertainty: A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis.

When requested, VL will provide an estimate of the analytical uncertainty. For each test measurement, the laboratory's uncertainty is characterized by the bias and precision of the analyte/parameter in the stated method. Bias and precision are based either on IDOC data or control charting of a minimum of the seven most recent LCSs for the analyte/parameter in a given method (for greater detail, see Appendix G).

22.5 Control of Data

To ensure that data are protected from inadvertent changes or unintentional destruction, VL uses procedures to check calculations and data transfers (both manual and automated). All raw data must be retained in an analytical logbook, or a paper or electronic file, and it is maintained as described in Section 16 – "Control of Records". Data from all electronic media are backed up according to Section 16.2, "Records Management and Storage".

22.5.1 Computer and Electronic Data Requirements

VL assures that all equipment, hardware and software used for the acquisition, processing, recording, reporting, storage, or retrieval of environmental test data are:

- documented in sufficient detail and validated as being adequate for use. Such documentation is included in the method SOPs and validated by the IDOCs;

- protected for integrity and confidentiality of data entry or collection, data storage, data transmission and data processing. VL controls access to all programs that are used to acquire, process, record or report data. All programs are password-protected. Each employee is granted access only to those programs that he or she uses. The password is unique to the individual, and cannot be shared;

- maintained to ensure proper functioning and are provided with the environmental and operating conditions necessary to maintain the integrity of environmental test data. Maintenance requirements are contained in method SOPs and maintenance logs provided documentation. VL maintains a list of competent service vendors for

maintenance and repairs beyond the capability of VL staff, including both equipment and facilities (e.g., air conditioning).

- held secure including the prevention of unauthorized access to, and the unauthorized amendment of, computer records. Data archive security, including electronic data back-ups, is addressed in Section 16 – "Control of Records" and building security is addressed in Section 21- "Accommodations and Environmental Conditions".

22.5.2 Data Reduction

Manual Calculations

- Validating Calculations: Method SOPs provide required concentration units, calculation formulas and any other information required to obtain final analytical results from raw data. As a part of the management system, all manual calculations may be checked by another individual. In addition, data transfers (e.g., data entry, transcribing raw or calculated data) are checked for accuracy.

- Manual Integration: VL has manual integration procedures that must be followed when integrating peaks during data reduction. The current version of SOP #1300VL details these procedures.

Spreadsheets

- The laboratory may use spreadsheets for some methods (e.g., TDS, alkalinity) to reduce raw data to final results. To ensure that the worksheet formulae are correct, the laboratory tests each set of cells used for input of the data as well as all cells used for calculations by comparing the results of the spreadsheet with manually calculated data. The primary validated spreadsheet is maintained in the electronic folder containing the SOP for which it is used. The validated spreadsheet is protected from inadvertent manipulations.

Significant Figures

- All results are captured (raw data) with at least four significant figures. For reporting following data reduction, results are generally reported to two significant figures.

Application Software

- VL has several instruments that, through the use of specialized software, convert raw data to final results. The software calculations are validated against the SOP/Reference Method calculations and they are password-protected.

LIMS

- In several tests within the LIMS, embedded calculations convert raw data to final results. These calculations are validated against the SOP/Reference Method calculations and they are password-protected.
- Several instruments upload results directly to the LIMS, a process which is also validated and password-protected.

22.5.3 Data Review Procedures

Data review procedures are located in Section 27.4 – "Data Review".

Section 23

CALIBRATION REQUIREMENTS

23.1 General Equipment Requirements

VL provides all the necessary equipment required for the correct performance of its scope of environmental testing.

All equipment and software used for testing and sampling are capable of achieving the accuracy required for complying with the specifications of the environmental test methods referenced in the SOPs.

Equipment is operated only by authorized and trained personnel (see Section 20 – "Personnel").

VL has procedures for the use, maintenance, handling, storage and transportation of equipment and they are readily available to laboratory personnel. Manuals provided by the equipment manufacturer provide information on use, maintenance, handling and storage of the equipment. VL maintains an equipment table that includes additional information on storage location. VL maintains a table that summarizes planned maintenance for support equipment. Manufacturer instrument manuals, which contain recommended maintenance procedures, are referenced in method SOPs. These procedures ensure proper functioning of the equipment.

All equipment is calibrated or verified before being placed in service to ensure that it meets laboratory specifications and relevant standard specifications. Records of instrument calibration are maintained in the instrument work area. Records of support equipment maintenance are maintained in central files, controlled by the QA Manager. All instrument and equipment maintenance and calibration records are archived according to procedures in Section 16 – "Control of Records".

Test equipment, including hardware and software, are safeguarded from adjustments that would invalidate the test result measurements by limiting access to the equipment and using password protection where possible (see Section 22.5 – "Control of Data").

Equipment that has been subject to overloading, mishandling, given suspect results, or shown to be defective or outside specifications is taken out of service. The equipment is isolated to prevent its use or clearly labeled as being out of service until it has been shown to function properly. If it is shown that previous tests are affected, then procedures for nonconforming work are followed and results are documented (see Section 12 – "Control of Nonconforming Environmental Testing Work" and Section 14 – "Corrective Action").

VL does not use any equipment that is outside of its permanent control.

Each item of equipment and software used for testing and significant to the results is uniquely identified in maintenance records and in method SOPs. Records of equipment and software are maintained. This information includes the following:

a) identity of the equipment and its software;
b) manufacturer's name, type identification, serial number or other unique identifier;
c) checks that equipment complies with specifications of applicable tests;
d) current location;
e) manufacturer's instructions, if available, or a reference to their location;
f) dates, results and copies of reports and certificates of all calibrations, adjustments, acceptance criteria, and the due date of next calibration;
g) maintenance plan where appropriate, and maintenance carried out to date; documentation on all routine and non-routine maintenance activities and reference material verifications;
h) any damage, malfunction, modification or repair to the equipment;

23.2 Support Equipment

Support Equipment includes, but is not limited to: balances, ovens, refrigerators, freezers, incubators, temperature measuring devices, and volumetric dispensing devices. All support equipment is maintained in proper working order.

All raw data records are retained to document equipment performance. These records include logbooks and bench sheets.

23.2.1 Support Equipment Maintenance

Regular maintenance of support equipment, such as balances and fume hoods is conducted at least annually.

Maintenance on other support equipment, such as ovens, refrigerators, and thermometers is conducted as needed.

Service and maintenance records are maintained in central files (Suite 4) and summary of support equipment calibration and maintenance requirements is found in Table 23-1.

Table 23-1 Summary of Support Equipment Calibration And Maintenance			
Instrument	**Activity**	**Frequency**	**Documentation**
Balance	1. Clean 2. Check alignment 3. Service Contract	1. Before use 2. Before use 3. Annually	Post annual service date on balance Vendor certificate maintained in central files
ASTM Class 1Weights	1. Only use for the intended purpose 2. Use plastic forceps to handle 3. Keep in case 4. Re-calibrate	1. Every year if weight is used for daily checks. 2. Every 5 years if weight is used only to check working standard weights which are then used for the daily checks.	Certificate maintained in central files
Working Standard Weights	1. Used to check balances before their use.	Every year.	Balance Logbook
NIST Traceable Digital Thermometers	Accuracy determined by A2LA-accredited weights and measurement laboratory.	Replaced or re-certified internally every year.	Thermometer certificates and re-certification data maintained in central files
Thermometers: 1. Electronic 2. IR thermometer	Check at the temperature used, against a reference NIST certified digital thermometer	1. Annually for electronic 2. Monthly for IR thermometers	Calibration factor and date of calibration on thermometer and in log book
pH meter	Calibration: 1. pH buffer aliquot are used only once 2. Buffers used for calibration will bracket the pH of the media, reagent, or sample tested.	Before use	Log book
pH probe	Maintenance: Use manufacturer's specifications	As needed	Log book
Automatic or digital type pipettes	Calibrate for accuracy and precision using reagent water and analytical balance	Quarterly	Logbook

Table 23-1 Summary of Support Equipment Calibration And Maintenance			
Instrument	**Activity**	**Frequency**	**Documentation**
Refrigerators, Freezers	1. Thermometers are immersed in liquid to the appropriate immersion line 2. The thermometers are graduated in increments of 0.1°C.	Temperatures are recorded each day in use	Log book
NIST Internet Time Services (Authenticated NTP Service)	Accuracy determined by NIST Physical Measurement Laboratory	Completed automatically	www.NIST.gov
Microbiological incubators	1. Thermometers in each unit are immersed in liquid to the appropriate immersion line 2. The thermometers are graduated in increments of 0.1°C.	Temperature of incubators and water baths will be recorded twice a day for each day in use with readings separated by at least four hours	Log book
Conductivity Meter	Calibration: 1. One-point calibration at 1413 µS	Before Use	Logbook

23.2.2 Support Equipment Calibration

All support equipment is calibrated or verified annually over the entire range of use using NIST traceable references where available. The result of support equipment calibration is within specifications or (1) the equipment is removed from service until repaired, or (2) records are maintained of correction factors to correct all measurements. If correction factors are used this information is clearly marked on or near the equipment.

Support equipment such as balances, ovens, refrigerators, freezers, and water baths are verified with a NIST traceable reference if available, each day prior to use, to ensure operation is within the expected range for the application for which the equipment is to be used.

Volumetric dispensing devices (except Class A glassware and Glass microliter syringes) are checked for accuracy on a quarterly basis.

Table 23-2 Calibration Acceptance Criteria for Support Equipment				
Equipment	**Type of Calibration/ Number of Standards**	**Frequency**	**Acceptance Limits**	**Corrective Action**
Analytical Balance	Accuracy determined using A2LA-accredited NIST weights. Minimum of 2 standards bracketing the weight of interest. Inspected and calibrated by A2LA accredited person annually.	Daily	± 0.2%	Clean, check level, insure lack of drafts, and that unit is warmed up, recheck. If fails, call service.
Electronic Thermometer	Replaced or re-certified internally.	Annually	N/A	N/A
InfraRed Temperature Guns	Against NIST-traceable thermometer	Monthly at appropriate temperature range for intended use	± 0.5°C	Repair/replace
Volumetric Dispensing Devices (Eppendorf ® pipette, automatic dilutor or dispensing devices)	One delivery by weight. Using DI water, dispense into tared vessel. Record weight with device ID number.	Monthly	± 2%	Adjust. Replace.
pH Meter	3-point calibration at pH 4.0, 7.0 and 10.0	Before Use	Slope greater than 0.95 and pH 7.0 check buffer ± 0.05	Recalibrate/ Probe maintenance
Conductivity Meter	1-point calibration at 1413 µS	Before Use	1413 ± 5%	Recalibrate/ Probe maintenance

Table 23-3 Acceptance Criteria for Support Equipment		
Equipment Identification	**Location/Use**	**Acceptance Criteria**
FRIDGE/ICP #1	Inorganics Lab/Reagent Storage	4°C ± 2°C
FRIDGE/ICP #2	Warehouse/Inorganics Sample Storage	4°C ± 2°C
OVEN #1	Inorganics Lab/EPA 2540C/2540D/Other	101°C ± 2°C
OVEN #2	Inorganics Lab/EPA 2540C/Other	180°C ± 2°C
OVEN #3	Wherehouse	For Back-Up Use
FRIDGE/ORG #1	Organics Lab/TPH/Volatile Samples	2°C ± 4°C
FREEZER/ORG #2	Organics Lab/Reagent Storage	-15°C ± 5°C
FRIDGE/ORG #3	Organics Lab/Reagent Storage	2°C ± 4°C
FREEZER/ORG #4	Organics Lab/TPH/Volatile Samples	-15°C ± 5°C
FRIDGE/IC #1	IC Lab/Reagent Storage	4°C ± 2°C
FRIDGE/IC #2	IC Lab/Sample Storage	4°C ± 2°C
FRIDGE/RECEIVING #1	Bottle Prep Room/VOC Samples	4°C ± 2°C
FREEZER/RECEIVING #1	Bottle Prep Room/Ice Storage	Not Monitored
FRIDGE/SUBCONTRACTING #1	Sample Receiving Room	4°C ± 2°C
FRIDGE/RECEIVING #2	Inorganic/Meter Room/Sample Receiving /Processing Storage	4°C ± 2°C
CHEST FREEZER	Suite 5/Bagged Ice and Ice Packs	Not Monitored
AUTOCLAVE	Inorganic/Meter Room/Waste Disposal	Monitor When In Use
CO_2 INCUBATOR	Micro Lab/Samples	35°C ± 0.5°C
FRIDGE/MICRO #1	Micro Lab/Sample Storage	4°C ± 2°C
FRIDGE/MICRO #2	Micro Lab/Plates/Media Storage	6°C ± 2°C
FRIDGE/MICRO #3	Micro Lab/Reagent Storage	6°C ± 2°C
INCUBATOR #1	Micro Lab/Samples	35°C ± 0.5°C/Other
INCUBATOR #2	Micro Lab/Samples	For Back-Up Use
INCUBATOR #3	Micro Lab/Samples	35°C ± 0.5°C/Other
WATER BATH	Micro Lab/Samples	44.5°C ± 0.5°C
BOD #1	Micro Lab/Samples	20°C ± 1°C
BOD #2	Micro Lab/Samples	20°C ± 1°C
LOW TEMP #1	Inorganic/Meter Room/Reagents	8°C ± 2°C
LOW TEMP #2	Inorganic/Meter Room/BOD Reagents	20°C ± 1°C

23.3 Analytical Equipment

23.3.1 Maintenance for Analytical Equipment

All equipment is properly maintained, inspected, and cleaned.

Maintenance of analytical instruments and other equipment may include regularly scheduled preventive maintenance or maintenance on an as-needed basis. Instrument malfunction is documented in Instrument Maintenance Logs, which become part of the laboratory's permanent records. A description of what was done to repair the malfunction and proof of return to control are also documented in the log.

Table 23-4 Analytical Equipment Maintenance

Instrument	Procedure	Frequency
ICP	Check pump tubing	Before use
	Check liquid argon supply	Before use
	Check fluid level in waste container	Before use
	Check filters	Quarterly
	Clean or replace filters	As needed
	Check torch	Before use
	Check sample spray chamber for debris	Monthly
	Clean and align nebulizer	Monthly
	Check entrance slit for debris	Monthly
	Replace pump tubing	As needed
Visible Spectrophotometer	Clean cell	As needed
	Wavelength verification check	Semi-annually
HP GC/MS	Inspect and clean GC injection port	Annually or as needed
	Ion gauge tube degassing	As needed
	Pump oil-level check	Monthly
	Pump oil changing	Semi-annually
	P&T Trap bake-out	Monthly or as needed
	P&T Sparge Tube cleaning	Monthly or as needed
	P&T Water management system	Replace annually
	Analyzer bake-out	As needed
	Analyzer cleaning	As needed
	Empty waste container	Weekly or as needed
	Check helium tank and replace as needed	Daily
	Check gas filters and replace	Annually or as needed

Table 23-4 Analytical Equipment Maintenance		
Instrument	**Procedure**	**Frequency**
Agilent GC	Check gas tanks and replace as needed Check gas filters and replace Check for gas leaks and repair Inspect and clean GC injection port Inspect and clean GC detector Septum replacement Change/replace columns	Daily Annually or as needed Weekly or as needed Semi-annually or as needed Annually or as needed As needed Annually or as needed
Balances	Class "1" traceable weight check Clean pan and check if level Field service	Before use Before use Annually
Conductivity Meter	0.01 M KCl calibration Conductivity cell cleaning	Before use As needed
Turbidimeter	Check light bulb	Before use
Deionized/Distilled Water	Check conductivity Check deionizer light Monitor for VOAs System cleaning Replace cartridge & large mixed bed resins	Daily Daily Each VOA analytical batch As needed As needed
Drying Ovens	Temperature monitoring Temperature adjustments	Daily As needed
Refrigerators/ Freezers	Temperature monitoring Temperature adjustment Defrosting/cleaning	Daily As needed As needed
Vacuum Pumps/ Air Compressor	Drained	As needed
pH Meter	Calibration/check slope Clean electrode	Before use As needed

23.3.2 Instrument Calibration

Information on instrument calibration can be found in Appendix G – "Chemistry".

Initial instrument calibration and continuing instrument calibration verification are an important part of ensuring data of known and documented quality. If more stringent calibration requirements are included in a mandated method or by regulation, those calibration requirements override any requirements outlined here or in laboratory SOPs. Generally, procedures and criteria regarding instrument calibrations are provided in test methods.

Section 24

MEASUREMENT TRACEABILITY

Measurement quality assurance comes in part from traceability of standards to certified materials.

All equipment and instruments affecting the quality of test results are calibrated prior to being put into service and on a continuing basis (see Section 23 – "Calibration Requirements"). These calibrations are traceable to national standards of measurement where available.

If traceability of measurements to SI units is not possible or not relevant, evidence for correlation of results through interlaboratory comparisons, proficiency testing, or independent analysis is provided.

24.1 Reference Standards

Reference standards are standards of the highest quality available at a given location, from which measurements are derived. The only reference standards used by VL are ASTM Class 1 weights, which are used for calibration only and for no other purpose.

ASTM Class 1 weights are calibrated by an entity that can provide traceability to national or international standards. VL sends its Class 1 weights out to be calibrated to a national standard as indicated in Section 23 – "Calibration Requirements".

24.2 Reference Materials

Reference materials are substances that have concentrations that are sufficiently well established to use for calibration or as a frame of reference.

Reference materials, where commercially available, are traceable to national standards of measurement, or to Certified Reference Materials, usually by a Certificate of Analysis.

Purchased reference materials require a Certificate of Analysis where available. If a reference material cannot be purchased with a Certificate of Analysis, it is verified by analysis and comparison to a certified reference material and/or demonstration of capability for characterization.

Internal reference materials, such as working standards or intermediate stock solutions, are checked as far as is technically and economically practical. Working standards or

intermediate stock solutions are checked against a second source at first time of use. When a second source is not available, a vendor-certified different lot is accepted as a second source. In most cases, the analysis of an Initial Calibration Verification (ICV) standard or a Laboratory Control Sample (LCS) can be used as a second source confirmation. Working standards and intermediate stock solutions are given expiration dates when they are prepared based on method or regulatory requirements. These standards are used up or disposed of by the expiration date or according to Section 24.4.

Additional working standards such as working class weights or internal thermometers are checked using the frequency summarized in Table 23-1 in Section 23 – "Calibration Requirements".

24.3 Transport and Storage of Reference Standards and Materials

VL handles and transports reference standards and materials in a manner that protects the integrity of the materials. Reference standard and material integrity is protected by separation from incompatible materials and/or minimizing exposure to degrading environments or materials.

Reference standards and materials are stored according to manufacturer's recommendations, method SOP requirements and separately from samples.

24.4 Labeling of Reference Standards, Reagents, and Reference Materials

VL has procedures for purchase, receipt and storage of standards, reagents and reference materials. Purchase procedures are described in Section 9 – "Purchasing Services and Supplies".

Expiration dates can be extended if the reference standard or material's integrity is verified. The extended date may not be beyond the expiration date of the referenced standards used to re-verify.

Reagent quality is verified during routine analyses of blanks.

24.4.1 Stock Standards, Reagents, Reference Materials and Media

Records for all standards, reagents, reference materials, and media include:

a) the manufacturer/vendor name (or traceability to purchased stocks or neat compounds)
b) the manufacturer's Certificate of Analysis or purity (if supplied)
c) the date of receipt
d) recommended storage conditions

Supply packing slips/receipts are centrally located in Suite #4 and organized in a master binder.

If the original container does not have an expiration date provided by the manufacturer or vendor it is not required to be labeled with an expiration date. If an expiration date is provided, it must be labeled with the expiration date.

In methods where the purity of reagents is not specified, analytical reagent grade is used. If the purity is specified, that is the minimum acceptable grade. Purity is verified and documented according to Section 9 – "Purchasing Services and Supplies".

24.4.2 Prepared Standards, Reagents, Reference Materials and Media

Records for standards, reagents, reference materials, and media preparation include:

e) traceability to purchased stock or neat compounds
f) reference to the method of preparation
g) date of preparation
h) an expiration date after which the material shall not be used (unless its reliability is verified by the laboratory)
i) preparer's initials (if prepared)

This information is recorded in a Standards Preparation Logbook.

All containers of prepared standards, reagents, or materials are labeled with a unique ID and an expiration date. The process for assigning unique IDs to standards is provided at the beginning of each standards logbook.

Prepared reagents are verified to meet the requirements of the test method through analyses of blanks.

Section 25

COLLECTION OF SAMPLES

VL can provide some sampling services upon request.

25.1 Sampling Containers

VL offers clean sampling containers for use by clients. Containers are purchased from suppliers that provide cleaned containers and provide certificates of quality confirming that the containers meet specifications (e.g., sterility, acid-washing).

25.1.1 Preparing Container Orders

Containers (with required preservatives) are provided to the client upon request. The Laboratory Director receives the clients' requests for analyses and forwards those requests to customer service staff, who then prepares containers following written common industry guidelines for the container type, size, and preservative needed for each analysis. Container orders are either picked up by the client or delivered to the client by
VL staff.

25.1.2 Sampling Containers, Preservation Requirements, Holding Times

Sampling container, preservation and holding time requirements can be found in Table 25-1 below. If preservation or holding time requirements are not met, the procedures in Section 12 – "Control of Nonconforming Environmental Testing Work" are followed.

Table 25-1 Summary of Sampling Container, Preservation and Holding Time Requirements

Parameter/Parameter Group	Method	Container Requirements (Per Sample)	Preservation	Holding Time
Aqueous				
Inorganics/Metals/Microbiology				
Alkalinity	SM 2320B	250 mL plastic	Cool 6°C	14 days
Ammonia	SM 4500-NH_3	250 mL plastic	H_2SO_4 to pH<2, Cool 6°C	28 days
$Arsenic^{+3}$ and $Arsenic^{+5}$	(Subcontracted)	**See NOTE below**		
BOD (5-day)	SM 5210B	1x 1L plastic	Cool 6°C	48 hours
Chloride	EPA 300.0/SW 846 9056	125 mL plastic	Cool 6°C	28 days
Coliforms, Total and *E. coli*	SM 9223B	100 mL sterile plastic	Cool 10°C	6 hours
Cyanide	SM 4500-CN E (Subcontracted)	250 mL plastic	NaOH to pH>12, Cool 6°C	14 days
Flash Point (Ignitability)	SW 846 1020B (Subcontracted)	125 mL glass	Cool 6°C	14 days
Fluoride	EPA 300.0/SW	125 mL plastic	None required	28 days

Table 25-1 Summary of Sampling Container, Preservation and Holding Time Requirements				
Parameter/Parameter Group	**Method**	**Container Requirements (Per Sample)**	**Preservation**	**Holding Time**
	846 9056			
Hexavalent Chromium (Chromium VI)	EPA 218.7 (Subcontracted)	**See NOTE below**		
Kjeldahl and Organic Nitrogen	SM 4500-N B (Subcontracted)	500 mL plastic	H_2SO_4 to pH<2, Cool 6°C	28 days
Mercury	EPA 7470A	250 mL plastic	HNO_3 to pH<2	28 days
Mercury, Dissolved	EPA 7470A	250 mL plastic	Field-filtered, Cool 6°C	28 days
Metals (except Hg and Cr^{+6})	EPA 200.7/SW 846 6010B	250 mL plastic	HNO_3 to pH<2	6 months
Metals, Dissolved	EPA 200.7/SW 846 6010B	250 mL plastic	Field-filtered, Cool 6°C	6 months
Nitrate as Nitrogen	EPA 300.0/SW 846 9056	125 mL plastic	Cool 6°C	48 hours
Nitrite as Nitrogen	EPA 300.0/SW 846 9056	125 mL plastic	Cool 6°C	48 hours
Oil and Grease	EPA 1664A	2 x 1 L Amber glass	HCl to pH<2, Cool 6°C	28 days
Organic Carbon, Total	EPA 9060 (Subcontracted)	125 mL Amber glass	HCl to pH<2, Cool 6°C	28 days
Perchlorate	EPA 314 (Subcontracted)	125 mL plastic	Field-filtered, Cool 6°C	28 days
pH (Hydrogen Ion)	SM 4500H+B	125 mL plastic	Cool 6°C	15 minutes
Phenolics	EPA 420.1 (Subcontracted)	2 x 1 L Amber glass	H_2SO_4 to pH<2, Cool 6°C	28 days
Phosphorus, Ortho	Hach 8190 (Subcontracted)	250 mL plastic	Cool 6°C	48 hours
Phosphorus, Total	Hach 8190	250 mL plastic	H_2SO_4 to pH<2, Cool 6°C	28 days
Specific Conductance	EPA 9050A	125 mL plastic	Cool 6°C	28 days
Solids, Total Dissolved (TDS)	EPA 2540C	250 mL plastic	Cool 6°C	7 days
Solids, Total Suspended (TSS)	EPA 2540D	250 mL plastic	Cool 6°C	7 days
Sulfate	EPA 300.0/SW 846 9056	125 mL plastic	Cool 6°C	28 days
Sulfide	SM 4500 S^{-} (Subcontracted)	250 mL plastic	NaOH to pH>9, ZnOAc, Cool 6°C	7 days
Sulfite	SM 4500 SO_3^{-2}	250 mL plastic	None required	24 hours
Turbidity	SM 2130B (Subcontracted)	125 mL plastic	Cool 6°C	48 hours
TOX (Total Organic Halogens)	Subcontracted	**See NOTE below**		
Organics				
Methane	Subcontracted	2 x 40 mL VOA Vials	Cool 6°C	14 days
Toxicity Characteristic Leaching Procedure (TCLP)	1311 (Subcontracted)	1 x 1 L Glass min.	Cool 6°C	14 days
Volatile Organic Compounds (VOC)	EPA 624/SW 846 8260	2 x 40mL VOA Vials	HCL pH<2/ZHS/6°C	14 days
Benzene, Toluene,Ethylbenzene, Xylenes/Methy tert-butyl Ether (BTEX/MTBE)	EPA 8260	2 x 40mL VOA Vials	HCl to pH<2, ZHS, Cool 6°C	14 days
Semi-Volatile Organic Compounds (SVOC)	EPA 8270 (Subcontracted)	2 x 1 Liter Amber glass	Cool 6°C	7 days extraction
Pesticides, Chlorinated	608/EPA 8081 (Subcontracted	2 x 1 L Amber Glass	Cool 6°C	7 days
Herbicides, Chlorinated	615/EPA 8151 (Subcontracted)	2 x 1 L Amber Glass	Cool 6°C	7 days
Organophosphorus Pesticides	614/EPA 8141 (Subcontracted)	2 x 1 L Amber Glass	Cool 6°C	7 days
Total Petroleum Hydrocarbons (TPH)	TNRCC 1005	3 x 40 mL VOA Vials	HCL to pH<2, Cool 6°C	14 days

Table 25-1 Summary of Sampling Container, Preservation and Holding Time Requirements				
Parameter/Parameter Group	**Method**	**Container Requirements (Per Sample)**	**Preservation**	**Holding Time**
Polyaromatic Hydrocarbons (PAH)	EPA 8270 (Subcontracted)	1 x 1 L Amber Glass	Cool 6°C	7 days extraction
Polychlorinated Biphenyls (PCB)	EPA 8082 (Subcontracted)	1 x 1 L Amber Glass	Cool 6°C	7 days extraction
Soils				
		Inorganics/Metals		
Metals (except Hg and Cr^{+6})	SW 846 6010B	250 mL WM jar	None required	6 months
Total Soluble Sulfate and Corrosivity	See Appendix E, Table of Methods	250 mL WM jar	Cool 6°C	28 days extractions
		Organics		
TCLP	EPA 1311 (Subcontracted)	100 g min	Cool 6°C	14 days
TPH	TNRCC 1005	125 mL WM jar	Cool 6°C, < -7°C upon receipt	14 days
VOC	EPA 8260	2 x 40 mL VOA Vials(5g)	Cool 6°C, < -7°C upon receipt	14 days
Semi-volatile Organic Compounds (SVOC)	EPA 8270 (Subcontracted)	250 mL WM jar	Cool 6°C	14 days
Methane	Subcontracted	125 mL WM jar	Cool 6°C, < -7°C upon receipt	14 days
PAH	EPA 8270 (Subcontracted)	250 mL WM jar	Cool 6°C	7 days extraction
PCBs/Pesticides/Herbicides	8082/8081/8151 (Subcontracted	250 mL WM jar	Cool 6°C	14 days

Abbreviations:
HCL = Hydrochloric Acid
HNO_3= Nitric Acid
$Na_2S_2O_3$ = Sodium Thiosulfate
ZHS = Zero Head Space
H_2SO_4 = Sulfuric Acid
NaOH= Sodium Hydroxide
WM = Wide-mouth
NH_4Cl = Ammonium Chloride
HDPE = High Density Polyethylene

NOTE: For subcontracted analytes, the method, container requirements, preservative, and holding time should be confirmed with the subcontractor.

25.2 Sampling Plan

If VL personnel or hired subcontractor provides the sampling service, VL uses sampling plans provided by clients or prepared in consultation with the client. The plan must include any factors that must be controlled to ensure the validity of the test. Sampling plans and written sampling procedures are used for sampling substances, materials or products for testing. The plan and procedures are kept with sampling personnel and made available to the client at the sampling location.

VL procedures for dealing with nonconformances are used when the client requests any deviations from the sampling plan or sampling procedures. The requests are documented and included in the final test report.

25.3 Sampling Records

The following relevant sampling data are recorded on the completed Chain of Custody (COC) document that accompanies the samples: sampling procedure used (e.g., grab or composite), the date and time of sampling, the identification of the sampler, environmental conditions (if relevant), the sampling location, and any field measurements.

Section 26

HANDLING SAMPLES AND TEST ITEMS

26.1 Sample Receipt

When samples are received at VL, the chain-of-custody (COC) is reviewed, condition is documented, samples are given unique identifiers, and they are logged into the sample tracking system. Detailed procedures are found in SOP #1000VL.

26.1.1 Chain of Custody

The COC and/or sample submission sheets from the field are reviewed. This documentation is completed in the field and provides a written record of the handling of the samples from the time of collection until they are received at the laboratory. Section 25 – "Collection of Samples" outlines what information is needed on this record. The COC form also provides information on what type of testing is being requested and can act as an order for laboratory services in the absence of a formal contract. The VL COC form can be found in Appendix I. The COC and any additional records received at the time of sample submission are maintained by the laboratory in hard copy files and electronically that are uniquely identified. COC documents are scanned and are included with the client's report.

26.1.1.1 Legal Chain of Custody

Because clients have not requested this service, VL does not have procedures in place for legal/evidentiary work. If a client were to request this service, VL would implement special chain of custody procedures. The following is an example of procedures that would be implemented: Custody seals are sent by VL if the sampling containers are ordered from the laboratory, shipping records are maintained with the chain of custody, internal chain of custody is initiated that provides additional documentation of internal handling by analysts and a disposal record is provided.

26.2 Sample Acceptance

Procedures for opening shipping containers (e.g., coolers) and examining samples are provided in SOP #1000VL. The Cooler/Sample Receipt Form is found in Appendix I.

The laboratory has sample collection and acceptance requirements that are made available to sample collection personnel. These requirements are provided in SOP #100VL. They emphasize the need for use of water resistant ink, providing proper

documentation (to include sample ID, location, date and time of collection, collector's name, preservation type, sample type and any special remarks about the sample), labeling of sample containers to include a unique sample ID, use of appropriate containers, adherence to holding times, sample volume requirements, and the presence of ice.

VL also has nonconformance/corrective action procedures to handle samples that don't meet the requirements above or show signs of damage, contamination, inadequate preservation or cooling. A Sample Receipt Checklist is provided to the client with the final data report and COC form with indicates any sample receipt non-compliance (temperature non-compliance is indicated on the COC form) Data may be qualified where samples are reported that do not meet sample acceptance requirements.

The laboratory checks samples for the conditions above, where appropriate, to evaluate sample acceptance. Criteria regarding preservation, holding time and sample volume requirements can be found in Section 25 – "Collection of Samples", Table 25-1. In certain circumstances if these conditions are not met, the client is contacted prior to any further processing, then 1) the sample is rejected as agreed with the client, 2) the decision to proceed is documented and agreed upon with the client, 3) the condition is noted on the COC form and/or lab receipt documents, and 4) the data may be qualified in the report. Unless otherwise communicated with the client, sample pH and temperature non-compliance are documented and the requested analysis can proceed. The final data report cover report states that "Any sample receipt non-compliance is understood by the client as potentially having an impact on the data quality. All requested tests were performed regardless of any non-compliance unless otherwise communicated to the client."

26.2.1 Preservation Checks

The following preservation checks are performed and documented upon receipt:

26.2.1.1 *Thermal preservation:*

a) For temperature preservation of chemistry samples, the acceptable temperature range is from 0°C to 6°C. For microbiology samples the acceptable temperature range is from 0°C to 10°C.

b) Samples that are delivered to the lab on the same day of collection are not likely to have reached a fully chilled temperature. This is acceptable if the samples were received on ice and the chilling process has begun ("evidence of cooling").

c) Record on the COC form if ice is present, the received temperature, and indicate if the sample temperature is in compliance.

Chlorine checks:

d) Laboratories that receive microbiology samples from potable water supplies (including source water) that have a demonstrated history of acceptable preservation may check a sample from each client at a frequency of once per month if:

   i) VL can show that the received sample containers were supplied by VL;

   ii) sufficient sodium thiosulfate was in each container before sample collection to neutralize at minimum 5 mg/L of chlorine for drinking water and 15 mg/L of chlorine for wastewater samples;

   iii) one container from each batch of laboratory prepared containers or lot of purchased ready-to-use containers is checked to ensure efficacy of the sodium thiosulfate to 5 mg/L chlorine or 15 mg/L chlorine as appropriate and the check is documented;

   iv) chlorine residual is checked in the field and actual concentration is documented with sample submission.

pH checks:

e) The pH of samples requiring acid/base preservation is checked upon sample receipt and upon initiation of certain analyses.

26.3 Sample Identification

Samples, including subsamples, extracts and digestates, are uniquely identified in a permanent chronological record in appropriate logbooks and the LIMS to prevent mix-up and to document receipt of all sample containers.

Samples are assigned sequential numbers that reference more detailed information kept in the sample receipt logbook and the LIMS. The full sample identification procedure can be found in SOP #1000VL.

The following information is included in the LIMS and/or sample receipt logbook:

- Client or project name
- Date and time of receipt at lab
- Unique laboratory identification number
- Signature or initials of person making the entries

In addition, the following information is maintained and linked to the log-in record:

- Date and time of sampling linked to the date and time of laboratory receipt.
- Unique field identification number linked to the laboratory sample ID
- Analyses requested (including applicable approved method numbers) linked to the laboratory sample ID.
- Comments regarding rejection (if any).

All documentation received regarding the sample, such as memos or chain of custody, are retained in a client project folder.

26.4 Sample Aliquots/Subsampling

In order for analysis results to be representative of the sample collected in the field, the laboratory has subsampling procedures that are found in SOP #1000VL.

26.5 Sample Storage

Storage conditions are monitored for any required criteria, verified, and the verification recorded in logbooks.

Samples that require thermal preservation are stored under refrigeration that is +/-2°C of the specified preservation temperature unless regulatory or method specific criteria require something different. For samples with a specified storage temperature of 4°C, storage at a temperature above the freezing point of water to 6°C is acceptable.

Samples are held secure, as required. Samples are accessible only to laboratory personnel.

Samples are stored apart from standards, reagents, food or potentially contaminating sources, and such that cross-contamination is minimized. All portions of samples, including extracts, digestates, leachates, or any product of the sample is maintained according to the required conditions.

26.6 Sample Disposal

Samples are retained a minimum of 30 days after the delivery of the report unless other arrangements have been made with the client.

Samples are disposed of according to Federal, State and local regulations. Procedures are described in SOP #1400VL for the disposal of samples, digestates, leachates, and extracts.

26.7 Sample Transport

Samples that are transported under the responsibility of the laboratory, where necessary, are done so safely and according to storage conditions. This includes moving bottles within the laboratory. Specific safety operations are addressed outside of this document. Sample shipping procedures are described in SOP #1000VL.

- use of calibrations, continuing calibrations, certified reference materials and/or PT samples to monitor accuracy of the test method;
- measures to monitor test method capability, such as limit of detection, limit of quantitation, and/or range of test applicability, such as linearity;
- use of regression analysis, internal/external standards, or statistical analysis to reduce raw data to final results;
- use of reagents and standards of appropriate quality and use of second source materials as appropriate;
- procedures to ensure the selectivity of the test method for its intended use;
- measures to assure constant and consistent test conditions, such as temperature, humidity, rotation speed, etc., when required by test method;
- use of sterility checks for equipment, media and dilution water for microbiology; and
- use of positive and negative culture controls for microbiology.

27.2 Internal Quality Control Practices

Analytical data generated with QC samples that fall within all prescribed acceptance limits indicate the test method is deemed to be in control.

QC samples that fall outside QC limits indicate the test method are deemed to be out of control (nonconforming) and that corrective action is required and/or that the data are qualified (see Section 12 – "Control of Nonconforming Environmental Testing Work" and Section 14 - "Corrective Action").

Detailed QC procedures and QC limits are included in test method standard operating procedures (SOPs).

All QC measures are assessed and evaluated on an on-going basis, so that trends are detected.

27.2.1 General Controls

The following general controls are used:

27.2.1.1 Positive and Negative Controls such as:

a) Blanks (negative)
b) Laboratory control sample (positive)
c) Sterility checks and control cultures (positive and negative).

27.2.1.2 Selectivity is assured through:

a) absolute and relative retention times in chromatographic analyses;

b) two-column confirmation when using non-specific detectors, as required by reference methods;

c) use of acceptance criteria for mass-spectral tuning (found in test method SOPs);

d) use of the correct method according to its scope assessed during method validation; and

e) use of reference cultures (positive and negative) from a recognized manufacturer (where applicable).

27.2.1.3 Consistency, Variability, Repeatability, and Accuracy are assured through:

a) proper installation and operation of instruments according to manufacturer's recommendations or according to the processes used during method validation;

b) monitoring and controlling environmental conditions (temperature, access, proximity to potential contaminants);

c) selection and use of reagents and standards of appropriate quality; and

d) cleaning glassware appropriate to the level required by the analysis as demonstrated with method blanks

e) following SOPs and documenting any deviation, assessing for impact, and treating data appropriately;

f) testing to define the variability and/or repeatability of the laboratory results, such as replicates;

g) use of measures to assure the accuracy of the test method, including calibration and/or continuing calibrations, use of certified reference materials, proficiency test samples, or other measures; and

h) use of duplicate plate counts on positive samples (microbiology only).

27.2.1.4 Test Method Capability (also see Section 22 – "Environmental Methods and Method Validation") is assured through:

a) establishment of the limit of detection where appropriate;

b) establishment of the limit of quantitation or reporting level; and/or

c) establishment of the range of applicability such as linearity.

27.2.1.5 Data reduction is assured to be accurate by:

a) selection of appropriate formulae to reduce raw data to final results such as regression;

b) following specific procedures for data reduction such as manual integration procedures;

c) periodic review of data reduction processes to assure applicability;

d) microbiological calculations, data reduction, and statistical interpretations specified by each test method; and

27.2.1.6 Sample Specific controls are used to evaluate the effect of sample matrix on the performance of the selected analytical method (not a measure of laboratory performance):

Examples:

- Matrix Spike and Matrix Spike Duplicate (MS/MSD)
- Surrogate Spikes
- Sample Duplicates

27.2.1.7 The following tables summarize the key elements of a quality control system for a laboratory performing chemistry and microbiology testing.

Table 27-1 Essential Quality Control Elements for Chemistry

Item	Frequency	Acceptance Criteria	Corrective action
Negative Control (Method Blank)	1/batch	Method specific or reporting limit	Qualify data and take corrective action
Positive Control (Laboratory Control Sample)	1/batch	Method specific or determined by laboratory	Reprocess, reanalyze, or qualify data.
Matrix Spike; Matrix Spike Duplicates *Note : Samples are designed as data quality indicators for a specific sample using the designated method. These controls alone are not used to judge a laboratory's performance.*	Per method requirement	Method specific or determined by laboratory	Corrective action and qualify data.
Surrogate spikes *See note above.*	Per method requirement	Method specific or determined by laboratory	Corrective action and qualify data
Matrix Duplicates	Per method requirement	Method specific or	Corrective action and qualify

Table 27-1 Essential Quality Control Elements for Chemistry			
Item	**Frequency**	**Acceptance Criteria**	**Corrective action**
See note above.		determined by laboratory	data
Continuing Calibration Verification	Per method requirement	Method specific or determined by the laboratory	Reanalyze standard immediately; Corrective action
Initial calibration Verification	Start of each analytical run	Method specific or determined by laboratory	Reanalyze standard immediately; Corrective action

Table 27-2 Essential Quality Control Requirements for Microbiology			
Item	**Frequency**	**Acceptance Criteria**	**Corrective Action[2]**
Sterility check	Each lot of media prior to first use	No growth	Investigate cause
Sterility check containers	One container (bottle) for each lot or batch sterilized (NSGM)	No growth	Investigate cause
Sterility check dilution water	One per batch of dilution water (NSGM)	No growth	Investigate cause
Positive control[1]	pure culture of target organisms/ each lot or batch of medium (prior to first use of medium)	Positive reaction	Investigate cause If necessary reject the medium
Negative control[1]	Pure culture of non-target organisms/each lot or batch of medium (prior to first use of medium)	Negative reaction	Investigate cause If necessary reject the medium
1) Microorganisms are single use preparations. 2) Corrective Action may include the need to retrain. 3) NSGM: Non-selective growth media			

Table 27-3 Stock Cultures		
Item	**Frequency**	**Handling**
Reference cultures	Single use	Preserved and handled per manufacturer specifications

27.2.2 Specific Controls

27.2.2.1 Method Blanks

Method blanks are processed along with and under the same conditions as the associated samples to include all steps in the method. A method blank must be analyzed at a minimum of one per preparation batch. When no separate preparation method is used the batch is defined as the

environmental samples that are analyzed with the same method and personnel, using the same lots of reagents, not to exceed the analysis of twenty environmental samples, not including method blanks, LCS, matrix spikes and matrix duplicates. The matrix of the method blank must be similar to the associated samples and be free from any analytes of interest. Method blanks are not required for some analyses such as pH, specific conductance (conductivity), ignitability (flash point), and temperature.

The laboratory identifies a blank as contaminated when analyte results are greater than the reporting limit AND greater than 1/10 of that found in any sample, or where the contamination affects the sample results according to test method requirements or client objectives.

When a blank is determined to be contaminated, the cause must be investigated and measures taken to minimize or eliminate the problem.

Data that are unaffected by the blank contamination (non-detects or other analytes) are reported unqualified.

Sample data that are suspect due to the presence of a contaminated blank are reanalyzed, qualified, or voided.

27.2.2.2 Laboratory Control Samples

Laboratory Control Samples (LCS) are prepared from analyte free water or other clean matrix, and spiked with verified and known amounts of analytes for the purpose of establishing precision or bias measurements.

Laboratory control samples are analyzed at a frequency mandated by method, regulation, or client request, whichever is more stringent. The standard frequency of LCS preparation and analysis is one per analytical batch or as otherwise stated in a laboratory SOP. Exceptions would be for those analytes where no spiking solution is available, such as TSS, TDS, pH, temperature, and turbidity. When no separate preparation method is used the batch is defined as the environmental samples that are analyzed with the same method and personnel, using the same lots of reagents, not to exceed the analysis of twenty environmental samples, not including method blanks, LCS, matrix spikes and matrix duplicates.

The analytes to be spiked in the LCS are specified in the test method SOP. In some cases a client may specify a list of analytes for spiking and the request is handled using the laboratory's nonconformance procedures.

The results of laboratory control samples (LCS) are calculated in percent recovery. The laboratory documents the calculation below:

$$\%R = \frac{AV}{TV} \times 100$$

Where
AV = Analyzed Value
TV = True Value

The individual LCS is compared to the acceptance criteria as published in the mandated test method, as documented in SOPs, or, where there are no established criteria, the laboratory established limits as described in SOPs.

27.2.2.3 Matrix Spikes and Matrix Spike Duplicates

Matrix Spikes and Matrix Spike Duplicates (MS/MSD) are environmental samples fortified with a known amount of analyte to help assess the effect of the matrix on method performance.

The laboratory procedure for MS/MSD includes spiking appropriate analytes at appropriate concentrations, calculating percent recoveries and relative percent difference (RPD), and evaluating and reporting the results. The procedure can be found below.

$$\%R = \frac{AV}{TV} \times 100$$

Where
AV = Spike Result – Sample Result
TV = True Value

$$RPD = \frac{|S - D|}{\frac{(S + D)}{2}} \times 100$$

Where:
S=Sample Concentration
D=Duplicate Concentration

Where there are no established criteria in the mandated test methods, the laboratory uses ±30% Recovery and 15% RPD as the control limits for MS/MSD.

For MS/MSD results outside established criteria corrective action is documented or the data are reported with appropriate data qualifying codes. Only the data from the spiked sample is qualified. The corrective action for organics is to evaluate the LCS for comparison and note in the narrative that

there may be matrix interference present. The data to be qualified is only that of the parent sample.

27.2.2.4 Surrogate Spikes

Surrogate spikes are substances with chemical properties and behaviors similar to the analytes of interest used to assess method performance in individual samples. Surrogates are added to all samples (in test methods where surrogate use is appropriate) prior to sample preparation or extraction.

Surrogate recovery results are compared to the acceptance criteria as published in the mandated test method. Where there are no established criteria, the laboratory uses ±30% recovery as surrogate control limits.

For surrogate results outside established criteria, data are evaluated to determine the impact. Corrective actions include re-run, preventive maintenance and recalibration, qualification of the data, and discussion with the client as appropriate.

27.3 Proficiency Test Samples or Interlaboratory Comparisons

27.3.1 Compliance to Accreditation Requirements

VL analyzes at least two TNI-compliant Proficiency Testing (PT) samples per calendar year for each Field of Proficiency Testing (FoPT) for which the laboratory is accredited. An exception is made in the following circumstances:

- analytes for which no semi-annual PT is available from an approved PT provider; in these cases VL will run the PTs in the minimum time frame that the PT provider makes them available;
- analytes for which there are no PTs available from an approved PT provider; in these cases VL will not run PTs.

The successive PTs are analyzed within 6 months of closing dates unless the PT is being used for corrective action to maintain or reinstate accreditation, in which case the dates of successive PT samples for the same accreditation FoPT is at least fifteen days apart, from closing date to opening date.

VL analysts certified to analyze Drinking Water (DW) samples under 40CFR141 accreditation must analyze a least two PT samples per calendar year for each FoPT for which they are DW certified.

27.3.2 PT Sample Handling, Analysis and Reporting

The laboratory does not share PT samples with other laboratories, does not communicate with other laboratories regarding current PT sample results, and does not attempt to obtain the assigned value of any PT sample from the PT provider.

PT samples are treated as typical samples in the normal production process where possible, including the same analysts, preparation, calibration, quality control and acceptance criteria, sequence of analytical steps, number of replicates, and sample log-in. PT samples are not analyzed multiple times unless routine environmental samples are analyzed multiple times. Where PT samples present special problems in the analysis process, they will be treated as laboratory samples where clients have special requests.

The type, composition, concentration and frequency of quality control samples analyzed with the PT samples are the same as with typical samples.

Prior to the closing date of a study, laboratory personnel do not:

- Subcontract analysis of a PT sample to another laboratory being run for accreditation purposes.
- Knowingly receive and analyze a PT for another laboratory being run for accreditation purposes.
- Communicate with an individual from another laboratory concerning the analysis of the PT sample.
- Attempt to find out the assigned value of a PT from the PT Provider.

PT results that fall below the laboratory reporting limit or Minimum Reporting Level (MRL) are reported as N.D. PT reporting procedures are found in SOP #1200VL.

The laboratory institutes corrective action procedures for failed PT samples following the guidelines in Section 14 – "Corrective Action".

Retention of PT records is similar to that maintained for regular environmental samples. In addition, the lab maintains a copy of the online data entry summary when the PT results are submitted online or when submitted via FAX.

27.4 Data Review

The laboratory reviews all data generated in the laboratory for compliance with method, laboratory and, where appropriate, client requirements.

Initially, the analyst reviews data for acceptability of quality control measures and accuracy of the final result(s).

After the initial review, a second peer reviewer considers all manual transfers and calculations of data in detail and spot checks all electronic transfers of data.

Final reports are compared to raw data either directly or through several review steps.

All data are reviewed to determine coherence and, if available, compared to historical data. Results that are significantly different from historical data for a particular site are reanalyzed prior to submitting the report to the client.

More specific procedures follow.

27.4.1 Manual entry of data recorded on bench sheets

For some analyses (e.g. pH, TDS, TSS, Conductivity), bench sheets are used to record the information required for traceability of the analysis. The bench sheets include quality control measurements. Acceptance criteria for each analysis are found in the method SOP. Data are recorded on the bench sheets promptly at the time of the analysis, in blue ink. Analysts review sample data and the QC information at the time of analysis and indicate if the QC parameters meet the acceptance criteria by marking the bench sheet. The analyst's name and analysis date are on the bench sheet and the analysis performs the primary review of the analysis, indicating whether QC acceptance criteria are met or whether a data qualifier is necessary. When the analyst has finished the primary analysis review, another person in the laboratory may check the bench sheet for the following items: a) All required information has been recorded on the bench sheet. B) QC criteria have been met or exceptions are documented in the comments section of the bench sheet. C) Manual calculations are checked for accuracy. When these checks have been completed, the reviewer signs and dates the bench sheet to document that the review has been performed. Following the review process, the bench sheet is used by the analyst to enter the data in the LIMS. The final report is printed and submitted to one of the approved signatories for final review and signature. This final review includes verifying that the data entered on the worksheet has been appropriately transferred to the LIMS and that the data is coherent, that QC results are acceptable, QC exceptions are appropriately reflected on the final report, and results are in line with historical values, if known.

27.4.2 Manual entry of instrument-generated data

For some analyses (e.g., alkalinity), a laboratory instrument will provide a printout of data that is subsequently reviewed by the analyst to determine if QC acceptance criteria have been met. The analyst will respond to any failure of QC acceptance criteria as described in this section. Once all samples have been analyzed and the analyst confirms that all acceptance criteria are met, the analyst will initial and date the instrument

printout. When the analyst has finished the primary analysis review, another person in the laboratory may check the instrument printout for the following items: QC criteria have been met or exceptions are documented. When this has been completed, the reviewer signs and dates the printout to document that the review has been performed. The analyst then enters the data in the LIMS. The final report is printed and submitted to one of the approved signatories for final review and signature. This final review includes verifying that the data entered on the bench sheet has been appropriately transferred to the LIMS and that the data is coherent, that QC results are acceptable, QC exceptions are appropriately reflected on the final report, and results are in line with historical values, if known.

27.4.3 Electronic upload of instrument-generated data

For a number of analyses performed by VL, data is uploaded electronically to the LIMS (e.g., metals, TPH, VOC). The analyst reviews all the data to determine that QC acceptance criteria are met; and takes appropriate actions, as described in this section, if there are acceptance criteria failure(s). Once the analyses are complete, the analyst selects data for uploading to the LIMS. Once uploaded, the analyst reviews the uploaded data to ensure that the LIMS data matches the data selected for upload. Once the analyst determines that the uploaded data is correct, they "approve" the uploaded data. The final report is printed and submitted to one of the approved signatories for final review and signature. This final review includes verifying that the uploaded data matches the data selected by the analyst for upload, and that the data is coherent, that QC results are acceptable, QC exceptions are appropriately reflected on the final report, and results are in line with historical values, if known.

Section 28

REPORTING THE RESULTS

The result of each test performed is reported accurately and objectively and complies with all specific instructions contained in the test method.

Results are reported in a test report that includes all the information requested by the client and necessary for the interpretation of the test results and all information required by the method used.

Data are reported without qualification if they are greater than the lowest calibration standard, lower than the highest calibration standard, and without compromised sample or method integrity. The above requirements are met whether the report is issued as hard copy or by electronic data transfer.

28.1 Test Reports

The report format has been designed to accommodate each type of test performed and to minimize the potential for misunderstanding or misuse. VL does not issue multiple reports for the same samples where there is different information on each report unless required to meet regulatory needs and approved by the Laboratory Director. Some regulatory reporting requirements or formats, such as monthly operating reports, may not require all items listed below; however, VL shall provide all the required information to their client for use in preparing such regulatory reports. Each test report generated contains the following information unless otherwise indicated:

a) a client Project Name and/or Project Number;

b) VL name and address;

c) unique identification of the test report (VL Lab Order ID), on each page and a pagination system that ensures that each page is recognized as part of the test report and a clear identification of the end of the report, such as 3 of 10;

d) the name and address of the client;

e) the identification of the method used;

f) a matrix description and identification of the sample(s) tested, including the client sample identification;

g) the date of sample receipt, date and time of sample collection, and dates the tests were performed. The date and/or time of sample preparation and analysis is available upon request;

h) the test results, units of measurement, sample dilution factor, an indication of when results are reported on any basis other than as received (e.g. dry weight), subcontract laboratories used, failures identified; see Appendix F for a list of laboratory qualifiers;

i) the name, function, and signature or an equivalent electronic identification of the person authorizing the test report, and the date of issue;

j) a statement to the effect that the results relate only to the samples;

k) a statement that, unless otherwise indicated on the chain of custody, report case narrative, or the Sample Receipt Checklist, samples were submitted not sampled by Veritas Laboratories, were received in good condition, properly preserved, within the proper temperature range, and within the recommended holding time;

l) a statement that any sample receipt non-compliance is understood by the client as potentially having an impact on the data quality and that requested tests were performed regardless of any non-compliance unless otherwise communicated to the client;

m) a statement that all reported analyses were generated by a laboratory certified by the Nevada Division of Environmental Protection for which a certification is required and offered and that all analyses were performed by VL unless otherwise indicated on the data pages;

n) a statement that the report shall not be reproduced except in full without written approval of VL.

o) a copy of the submitted Chain of Custody form;

p) a copy of the Sample Receipt Checklist;

28.2 Supplemental Test Report Information

When necessary for interpretation of the results or when requested by the client, test reports can include the following additional information in a Case Narrative or on the report cover page:

a) deviations from, additions to, or exclusions from the test method, information on specific test conditions, such as environmental conditions, and any non-standard

conditions that may have affected the quality of the results, and any information on the use and definitions of data qualifiers;

b) a statement of compliance/non-compliance when requirements of the management system are not met, including identification of test results that did not meet the laboratory and regulatory sample acceptance requirements, such as holding time, preservation, etc.;

c) where applicable and when requested by the client, a statement on the estimated uncertainty of the measurement;

d) where appropriate and needed, opinions and interpretations; when opinions and interpretations are included, the basis upon which the opinions and interpretations are documented; opinions and interpretations are clearly marked as such in the test report;

e) additional information which may be required by specific methods or client;

f) qualification of results with values outside the calibration range as appropriate.

In addition to the items above, for test reports that contain the results of sampling, the following is provided when necessary for the interpretation of the results:

a) description/identification of the material sampled;

b) the specific location(s) of the sampling;

c) a reference to the sampling procedures and equipment used (e.g., grab or composite sample, bailer or automated composite sampler);

d) deviations, additions to or exclusions from the sampling procedures.

28.3 Environmental Testing Obtained from Subcontractors

Test results obtained from tests performed by subcontractors are clearly identified on the test report by subcontractor name and accreditation number.

The subcontractors report their results in writing or electronically. A copy of the subcontractors report is made available to the client if requested. If requested, VL forwards the actual report received from the subcontractor on their letterhead with the test results.

28.4 Electronic Transmission of Results

All test results transmitted by telephone, fax, e-mail, or other electronic means comply with the requirements of the TNI Standard and associated procedures to protect the confidentiality and proprietary rights of the client (see Section 22- "Environmental Methods and Method Validation").

28.4.1 Electronic Data Deliverables (EDD)

a) VL can provide a standard EDD format from the LIMS, which is offered to all clients and includes detailed format information.
b) A project-specific EDD can be ~~is~~ created in the LIMS and validated against both the client specifications and LIMS data. This EDD is saved and maintained on the server for future use on this project.
c) Upon request, VL can generate customized EDDs from non-LIMS applications (e.g., Excel) using LIMS data. Because this type of EDD requires transcription of data from the LIMS to a non-LIMS application, a peer review process ensures accuracy of the EDD.

28.5 Amendments to Test Reports

Material amendments to a test report after it has been issued are made only in the form of another document or data transfer. All supplemental reports meet all the requirements for the initial report and the requirements of this *Quality Manual.*

Amended test reports include the statement on the cover page, "This is a revised report that reflects (*reason for re-issue)*".

Also on the cover page of the revised report is a new signature date (if revised on a different date than the original report) with "Revised" appearing next to the new date.

Appendix A

Veritas Laboratories Ethics and Data Integrity Policy

A.1 Introduction

Veritas Laboratories is a private environmental laboratory operating in Las Vegas, Nevada, certified by the Nevada Division of Environmental Protection's Bureau of Safe Drinking Water. Analytical work performed for Veritas Laboratories clients must meet regulatory requirements, including the Clean Water Act (CWA), the Resource Conservation and Recovery Act (RCRA), and the Safe Drinking Water Act (SDWA) and/or may be used for decision-making purposes. Veritas Laboratories continually strives to ensure "Truth in Quality, Truth in Service".

A.2 Ethics

According to Webster, ethics are "the principles of conduct governing an individual or group". For Veritas Laboratories, the principles of conduct are contained within its standard operating procedures and within this *Quality Manual.* Ethical lapses occur if an employee is unwilling or unable to abide by these principles of conduct.

A.3 Data Integrity

The integrity of laboratory data is maintained when data is unchanged from the source and has not been accidentally or intentionally modified, altered or destroyed. Aspects of data integrity include accuracy, correctness and validity. Employees of Veritas Laboratories maintain the integrity of data by following procedures exactly and by adhering to ethical laboratory practices.

A.4 Commitment to Ethical Laboratory Practices

The owners and employees of Veritas Laboratories are committed to the production of data that meets the required levels of accuracy and precision and, without exception, conduct their work abiding by the sound scientific and ethical practices that govern the analysis of environmental samples.

A.5 Failure to Meet Ethical Standards

Misrepresentation of facts or the manipulation and/or falsification of data is strictly prohibited and all employees acknowledge that ***such activities result in disciplinary action, up to, and including, termination.***

A.6 Training

Employees of Veritas Laboratories are provided training on this *Quality Manual* and on all analytical procedures for which they are responsible. In addition, specific training related to the concepts of laboratory ethics and data integrity are provided when an employee is hired and annually thereafter. Each employee is required to read this policy and provide a signature indicating that they understand, and agree to abide by, the policy. In doing so, they formally acknowledge that these concepts are understood and they accept the consequences of not performing their work in an ethical manner.

A.7 Improper Practice vs. Fraud per the Environmental Protection Agency (EPA) and the EPA Office of the Inspector General (OIG)

A.7.1 Improper Practice: A scientifically unsound or technically unjustified omission, manipulation, or alteration of analytical procedures.

A.7.2 Fraud: The ***deliberate*** falsification of analytical and quality assurance results where failed method and contractual requirements are made to appear acceptable.

A.7.3 The performance of improper practices does not always constitute fraud. Improper training and poor decision making can lead to such mistakes (Section A.8). Section A.9 discusses conditions that might lead an analyst to make mistakes that might be deemed fraudulent.

A.8 Examples of Improper Laboratory Practices

A.8.1 Improper Preparation Practices

- Not preparing a Performance Testing (PT) sample before analysis
- Not preparing calibration standards when required by the method
- Not adding surrogates or spikes until after preparation – post spike
- Not digesting samples for metals analysis when required by the method

A.8.2 Treating Batch QC Differently from Samples

- Not treating batch QC samples in the same way as the rest of the batch
  - Not extracting or digesting method blank or LCS
  - Not using the same clean-up techniques on the QC samples as on client samples
- Reserving special glassware for blanks
  - Blank may appear cleaner than samples would
  - May report sample results that are blank-related but not reflective of the sample itself

A.8.3 Improper Spiking Procedures

- Spiked samples must be subjected to all the analytical processes as the client samples (e.g., extraction)

A.8.4 Improper Calibration Procedures

- Using calibration procedures that are not allowed by the approved method for the analysis (e.g., second-order curve)

- Selective removal of "bad" points to avoid re-running standards

A.8.5 Data Deletion

- Removal of existing data to give the appearance of "non-detect" results (the particular location is always "non-detect", so analyst makes that true by deleting contrary data)
- Selective removal of MDL data points (choosing the "best" seven of eight data points)
- Raw data packages not containing all the data, including failed data

A.8.6 Improper Use of QC Data

- Selective use of QC data
    - Running extra QC in case some results don't "work out" and not using the "bad" data
    - Running QC samples without documented evaluation criteria, leading to inconsistent evaluation of the results

A.8.7 Improper Analytical Procedures – Data Modification/Manipulation/Selection

- Modification of existing data to represent values different from the actual results
- Time travel (making it appear that the samples were analyzed at a time different from the actual time)
- Improper manual integration (procedures for integration and examples of improper integration found in SOP # 1300VL
- Dry labbing of data
    - Changing a computer-generated report to represent sample results which were never actually generated by the lab
    - Using the result from one sample and applying it to others even if the others weren't actually analyzed
    - Manually entering random values for results never determined through actual analysis (e.g., the results for this location are always non-detect, so analyst enters non-detect without performing the analysis)

A.9 Potential Causes of Ethical Lapses

- Production pressure – A heavy workload and meeting turnaround times could cause an analyst to resort to improper practices if there is a perceived pressure to get results, "no matter what".
- Conflicts of interest – The client is interested in getting *specific* results and the laboratory's continued relationship with that client depends on *specific* results, so the analyst or laboratory director chooses an improper practice over the truth.
- Lack of awareness – The analyst is not aware of a certain improper practice(s).
- Misinterpretation of method requirements – The way the analyst interprets the method requirement is different from either the regulator or laboratory certification officer.
- Personality and attitude – An analyst feels that they are above the "law" or they don't care about the reputation of the laboratory or meeting the goals of the laboratory (VL – "Truth in Quality, Truth in Service"). The analyst is a poor decision-maker.
- Financial Instability – Cutting corners or participating in improper laboratory practices helps the "bottom line".

- Poor workload management – pressure is created due to either inequitable distribution of work or too much work for the number of analysts.
- Inadequate documentation and document control – Proper practices that are improperly documented or not documented at all are *Improper* practices.
- Unclear roles and responsibilities – Analyst unclear as to who is ultimately responsible for the results generated by the laboratory; also unclear as to who should be consulted when questions arise.
- Inadequate procedures for addressing ethical dilemmas – Laboratory staff should all have someone with whom they can discuss any particular ethical dilemma ***before*** an improper practice is performed.
- Inadequate oversight – Consistent review of data packages will help uncover any improper practices. Emphasis on laboratory ethics keeps the analysts aware of their responsibility in generated accurate, valid, defensible data.

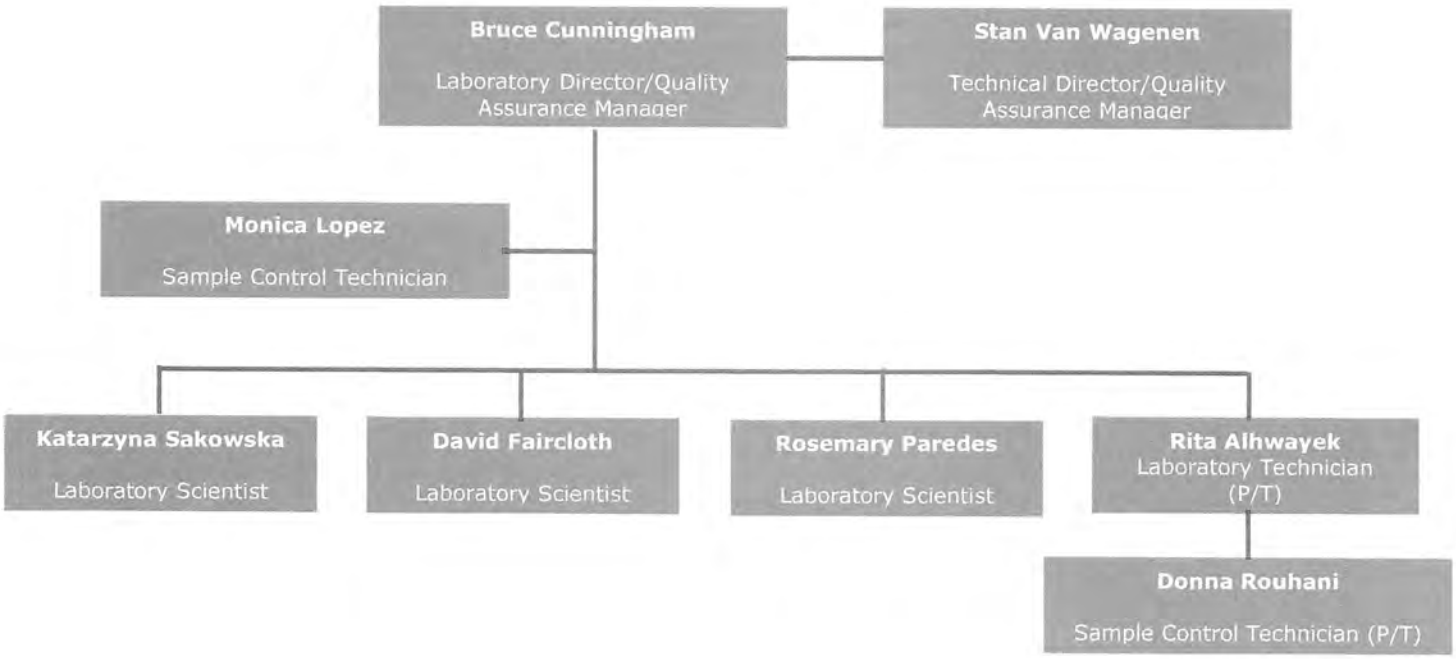
A.10 Summary Statement

"Real science is a search for the truth as can be demonstrated by repeatable measurements of natural phenomena. There should never be undue pressure for results to turn out in some pre-conceived way. Hypotheses should be tested honestly. Conclusions should not be exaggerated. If errors are made, they should be admitted and then everyone should move forward for the greater good. A true scientist is a person of undeniable integrity, who is trustworthy in the face of all odds."

Credit: Russ Frydenborg, Environmental Assessment Section Administrator, Florida DEP

Appendix B

Organization Chart
Résumés and Job Descriptions



Résumés

Bruce G. Cunningham

B.A. in Biology-Laboratory Director and QA Manager

Bruce has worked in the environmental laboratory industry since 1985. He established Veritas Laboratories in October, 2004, and is responsible for the day-to-day laboratory operations, sample log-in, data reporting, sales and marketing activities, and accounting functions. Bruce also performs soil sample preparation and operates a GC for TPH. He assists clients with defining analytical objectives for permitting requirements and regulatory compliance. These requirements and compliance include those for wastewater, hazardous waste, storm water, and drinking water. He also oversees and participates in the company's Project Management and Customer Service Functions, while assisting clients with project planning, status, and final data preparation.

Stan K. Van Wagenen

B.S. in Chemistry; M.S. in Toxicology-Technical Director and QA Manager

In addition to being co-owner, Stan serves as a consultant to Veritas Laboratories in the capacity of Technical Director and QA Manager. Stan has extensive experience in the environmental laboratory industry, in both the private and public sectors. Stan received his M.S. in Toxicology from the University of Arizona (U of A) in 1986 after receiving his B.S. in Chemistry from the U of A. Subsequent to obtaining his masters' degree, he spent six years as the laboratory supervisor of the environmental lab at the Nevada Test Site operated by REECo. There he gained experience in GC/MS, HPLC, IC, GC, radiochemistry and wet chemistry techniques. He joined Nevada Environmental Laboratories in 1992, where he was the Laboratory Manager for ten years. Since 2002, Stan has been employed in the public sector, specifically in the drinking water industry. Stan possesses extensive knowledge in GC, GC/MS, IC and wet chemistry techniques as well as state and federal regulations.

Monica Lopez – Sample Control Technician

Monica graduated from Chaparral High School in Las Vegas. She joined Veritas Laboratories in September of 2022.

Katarzyna (Kasia) Sakowska-Laboratory Scientist

Kasia earned a master engineer degree in Technology of Food Chemistry from the Technical University of Lodz in Poland. Prior to Veritas Laboratories, she was employed for three years

as a Chemist at Effex Analytical in Las Vegas. She joined Veritas Laboratories in October 2016.

Rosemary Paredes-Laboratory Scientist

Rosemary earned her Bachelor of Science Degree in Biological Sciences from the University of Nevada-Las Vegas. Rosemary joined Veritas Laboratories in April of 2022.

David (Dave) Faircloth – Laboratory Scientist

Dave earned a Masters Degree in V.P.I and S.U. in Blacksburg, Virginia. Prior to Veritas Laboratories, he was employed for ten years as a QC Officer/Technical Director at SEM/Silver State Labs Inc. in Las Vegas, NV. He joined Veritas Laboratories in 2018.

Rita Alhawyek – Laboratory Technician (Part-Time)

Rita earned her Bachelor of Science in Biology from the University of Nevada-Las Vegas. She joined Veritas Laboratories in July of 2024. Rita is currently enrolled in UNLV's Master's Program in which she's majoring in Environmental Engineering.

Donna Rouhani - Sample Control Technician

Donna will graduate with her Bachelor of Science Degree in Mathematics from the University of Nevada-Las Vegas in May of 2025. Donna is currently a Undergraduate Research Assistant investigating disinfection by-products removal from drinking water using environmentally sustainable and inexpensive hydrochar derived from walnut shells. She has operated a GC-MS instrument in her research and has performed general laboratory maintenance and upkeep. Donna joined Veritas Laboratories in November of 2024.

Job Descriptions

Introduction: Veritas Laboratories is a small private environmental laboratory with two owners, one of which leads the day-to-day operations of the laboratory. Then second owner acts in an advisory technical capacity and is not present in the day-to-day operations of the laboratory. Along with the owners, there are four full-time employees.

Although desired education and experience requirements are detailed in the below job descriptions, VL is dependent on filling positions as quickly as possible and may hire staff that, although they do not meet the stated education and training requirements, demonstrate the capacity to acquire the skills necessary for success in that job description. A six-month probationary period allows for assessment of the employee's progress toward meeting their VL job goals.

In addition, there may be some cross-over of duties among job descriptions dependent on the workload within each of the analytical disciplines. Each VL staff member is expected to assist as needed so that VL can meet all commitments to its clients. VL ensures that staff members are adequately trained for any job duties to which they are assigned.

Laboratory Scientist

General:
The Laboratory Scientist works independently under the general supervision of the Laboratory Director and fills the highest analytical (bench) level in the VL organizational structure. This position is primarily responsible for the performance of complex instrumental analyses (e.g., GC and GC/MS) while also assisting with lower-level analytical work.

Job Responsibilities:
Responsibilities below are reflective of the types of responsibilities within this job description but do not include all possible responsibilities.

1) Adherence to health and safety guidelines as appropriate for job functions and responsibilities and as detailed in the Chemical Hygiene Plan and method SOPs
2) Preparation of samples using procedures prescribed in method SOPs
3) Performing chemical analyses using written method SOPs
4) Using manual and instrument methods to determine analytical results for samples
5) Recording and/or uploading analytical results to the Laboratory Information Management System (LIMS)
6) Reviews raw data (e.g., chromatograms) to determine validity of results relative to instrument method and quality assurance requirements
7) Reviews final results to determine consistency with previously reported results
8) Recognizes and reports analytical anomalies to the Laboratory Director ; works, according to the laboratory's quality assurance procedures, to correct anomalies
9) Performs routine maintenance of instruments
10) Conforms to laboratory QA/QC practices

11) Performs general housekeeping in work area

Job Requirements:
Individuals in this position must have, or demonstrate the aptitude/ability to acquire, the following knowledge, skills and abilities:

1) Knowledge of scientific methods and the ability to read, interpret and follow standard analytical methods
2) Knowledge of analytical and/or general scientific principles
3) Demonstration of strong mathematical aptitude
4) Ability to learn and operate complex instrumentation, including, but not limited to, gas chromatography, gas chromatography/mass spectrometry, inductively coupled plasma (ICP), and instrument specific data systems (e.g., data reduction software such as Chromeleon) and instrument methods
5) Ability to make modifications to instrument methods to improve method performance
6) Ability to use a LIMS
7) Knowledge of general laboratory procedures
8) Knowledge of laboratory safety procedures and rules
9) Knowledge of chemical hazards and ability to mitigate such hazards in the laboratory
10) Ability to manage a varied workload and establish workload priority based on analytical requirements and client need

Education and Experience:
A Bachelor's degree in the physical sciences from an accredited college/university is required. Experience working in an environmental or other similar analytical laboratory is desirable. Appropriate experience may also be substituted for a portion of the educational requirement (e.g., Associates degree plus 4 years appropriate experience).

Laboratory Analyst

General:
The Laboratory Analyst works independently under the general supervision of the Laboratory Director with guidance, as needed, from the Laboratory Scientist. This position is primarily responsible for instrumental analyses such as Ion Chromatography (IC) and Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES) while also assisting with lower level analytical work.

Job Responsibilities:
Responsibilities below are reflective of the types of responsibilities within this job description but do not include all possible responsibilities.

1) Adherence to health and safety guidelines as appropriate for job functions and responsibilities and as detailed in the Chemical Hygiene Plan and method SOPs
2) Preparation of samples using procedures prescribed in method SOPs
3) Performing chemical analyses using written method SOPs
4) Using manual and instrument methods to determine analytical results for samples

5) Recording and/or uploading analytical results to the Laboratory Information Management System (LIMS)
6) Reviews raw data to determine validity of results relative to method and quality assurance requirements
7) Reviews final results to determine consistency with previously reported results
8) Recognizes and reports analytical anomalies to the Laboratory Director ; works, according to the laboratory's quality assurance procedures, to correct anomalies
9) Conforms to laboratory QA/QC practices
10) Performs general housekeeping in work area

Job Requirements:
Individuals in this position must have, or demonstrate the aptitude/ability to acquire, the following knowledge, skills and abilities:

1) Knowledge of scientific methods and the ability to read, interpret and follow standard analytical methods
2) Knowledge of analytical and/or general scientific principles
3) Demonstration of strong mathematical aptitude
4) Ability to learn and operate instrumentation, including, but not limited to, autotitrator, ion chromatography (IC), inductively coupled plasma-optical emission spectrometry (ICP-OES), and instrument specific data systems (e.g., data reduction software such as Chromeleon) and instrument methods
5) Ability to use a LIMS
6) Knowledge of general laboratory procedures
7) Knowledge of laboratory safety procedures and rules
8) Knowledge of chemical hazards and ability to mitigate such hazards in the laboratory
9) Ability to manage a varied workload and establish workload priority based on analytical requirements and client needs

Education and Experience:
An Associate's degree in the physical sciences from an accredited two-year college is required. Two years experience in an environmental or other similar analytical laboratory is desirable. Appropriate experience may also be substituted for the educational requirement (e.g., high school diploma plus 4 years appropriate experience).

Laboratory Technician

General:
The Laboratory Technician works under the direct supervision of the Laboratory Director with guidance, as needed, from the Laboratory Analyst and Laboratory Scientist. The position is primarily responsible for bench-level wet chemistry while also assisting with instrumental analyses such as IC and ICP-OES.

Job Responsibilities:

1) Adherence to health and safety guidelines as appropriate for job functions and responsibilities and as detailed in the Chemical Hygiene Plan and method SOPs

2) Preparation of samples using procedures prescribed in method SOPs
3) Performing chemical analyses using written method SOPs
4) Using manual and instrument methods to determine analytical results for samples
5) Recording and/or uploading analytical results to the Laboratory Information Management System (LIMS)
6) Reviews raw data to determine validity of results relative to method and quality assurance requirements; follows established quality assurance practices to ensure data meets requirements prior to data entry or uploading
7) Conforms to laboratory QA/QC practices
8) Performs general housekeeping in work area

Job Requirements:

1) Knowledge of scientific methods and the ability to read, interpret and follow standard analytical methods
2) Knowledge of analytical and/or general scientific principles
3) Ability to learn and operate instrumentation, including, but not limited to, autotitrator, ion chromatography (IC), inductively coupled plasma-optical emission spectrometry (ICP-OES), and instrument specific data systems (e.g., data reduction software such as Chromeleon) and instrument methods
4) Ability to use a LIMS
5) Knowledge of general laboratory procedures
6) Knowledge of laboratory safety procedures and rules
7) Knowledge of chemical hazards and ability to mitigate such hazards in the laboratory
8) Ability to manage a varied workload

Education and Experience:
A high school diploma, with high school chemistry and biology, is required. Two years experience in an environmental or other similar analytical laboratory is desirable.

Sample Control Technician

General:
The Sample Control Technician works under the direct supervision of the Laboratory Director. The position is primarily responsible for receiving, logging and disbursing samples to the appropriate VL staff member or providing for shipment of sample(s) to a designated subcontractor. This position also performs limited wet chemistry, including pH and conductivity analyses.

Job Responsibilities:

1) Receives incoming samples and verifies all aspects of the receipts with the chain-of-custody (COC) document, noting and correcting (if possible) discrepancies
2) Logs samples into the Laboratory Information Management System (LIMS)
3) Creates sample labels and ensures that samples are properly stored and/or delivered to the appropriate VL laboratory
4) Prepares bottle kits for clients according to SOP or other guidelines

5) Ships samples to designated subcontract laboratories, ensuring adequate preservation and packaging of samples
6) Monitors freezer and refrigerator temperatures according to quality assurance requirements
7) Schedules couriers for sample pick-up or delivery of samples to local subcontractors
8) Adherence to health and safety guidelines as appropriate for job functions and responsibilities and as detailed in the Chemical Hygiene Plan and method SOPs
9) Performs chemical analyses using written method SOPs
10) Conforms to laboratory QA/QC practices
11) Performs general housekeeping in work area

Job Requirements:

1) Ability to communicate orally and in writing
2) Knowledge of office practices and equipment
3) Ability to use a LIMS
4) Knowledge of basic laboratory testing procedures
5) Knowledge of laboratory safety procedures and rules
6) Knowledge of chemical hazards and ability to mitigate such hazards in the laboratory
7) Ability to organize work and pay attention to detail

Education and Experience:

A high school diploma is required. Job experience demonstrating an individual's ability to meet specified job requirements is desirable.

Appendix C

Description of Laboratory Spaces and Floor Plans

Suite 4 (1,249 sq. ft.):

1) Primary office area with desk and associated office equipment.
2) Wet chemistry (autotitrator and IC)
3) Organic chemistry (GC and GC/MS)
4) Storage and future analytical space
5) Lunch room/conference room
6) Bathroom

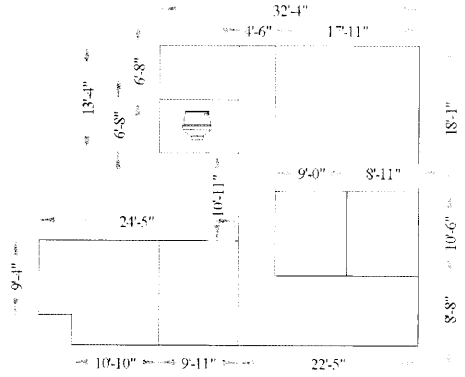
Suite 5 (599 sq. ft.):

1) Sample receiving area
2) Microbiology (IDEXX Quanti-Tray®), basic wet chemistry [pH, conductivity, Hach spectrophotometric analyses (e.g., phosphate)
3) Storage for supplies (e.g., bottles) and primary storage of samples (refrigerators and freezers)
4) Bathroom

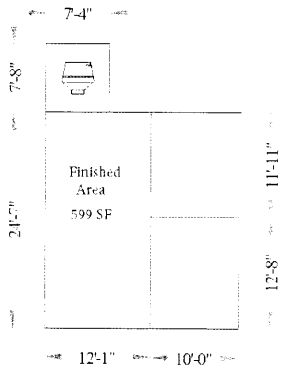
Suite 8 (924 sq. ft.):

1) Metals analysis (ICP-OES)
2) Wet chemistry (TDS, TSS, Oil and Grease, sample filtration, sample digestion)
3) Sample storage room with refrigerators
4) Sample disposal
5) General storage
6) Bathroom

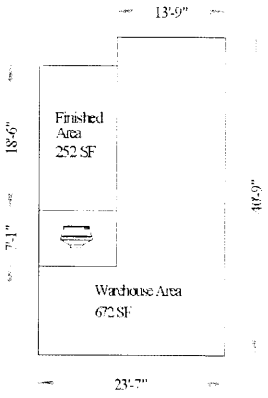
Veritas Laboratories
Floor Plans



6245 Harrison Drive, Suite 4
1,249 Total SF



6245 Harrison Drive, Suite 5
599 Total SF



6245 Harrison Drive, Suite 8
924 Total SF

Appendix D

Glossary

Acceptance Criteria: Specified limits placed on characteristics of an item, process, or service defined in requirement documents.
Accreditation: The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory.
Accreditation Body: The territorial, state or federal agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation.
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 that are due to sampling and analytical operations; a data quality indicator.
Analysis Date: The calendar date of analysis associated with the analytical result reported for an accreditation or experimental field of proficiency testing.
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.
Analytical Uncertainty: A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis.
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 laboratory accreditation).
Audit: A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives.
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 (1) to twenty (20) environmental samples of the same quality systems 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 twenty-four (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 quality system matrices and can exceed twenty (20) samples.
Bias: The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value).
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:
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.
Calibration Blank: A sample of analyte-free media which is used to establish the low range of a calibration.
Equipment Blank: A sample of analyte-free media which 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.
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.
Single Blind: A sample submitted to evaluate performance with concentration and identity unknown to the analyst but known to the provider.
Double Blind: A sample submitted to evaluate performance with concentration and identity unknown to the analyst and laboratory; the concentration and identity is also unknown to the provider but acceptance limits for the results are generally calculated from results received from double blind samples.
Calibration: A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards.
1) In calibration of support equipment the values realized by standards are established through the use of reference standards that are traceable to the International System of Units (SI).
2) In calibration according to methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the laboratory with a certificate of analysis or purity, or prepared by the laboratory using support equipment that has been calibrated or verified to meet specifications.
Calibration Curve: The mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response.
Calibration Standard: A substance or reference material used for calibration.
Certified Reference Material (CRM): Reference material, accompanied by a certificate (e.g., Certificate of Analysis), having a value, measurement uncertainty, and stated metrological traceability chain to a national metrology institute.
Chain of Custody Form: 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; the collector; time of collection; preservation; and requested analyses. See also Legal Chain of Custody Protocols.
Continuing Calibration Verification (CCV): An analytical standard prepared from the same source as the calibration standards that is analyzed periodically prior to, during, and/or after analysis of samples to verify the continued accuracy of an instrument calibration.
Confirmation: Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to: Second column confirmation, Alternate wavelength, Derivatization, Mass spectral interpretation, Alternative detectors, or Additional cleanup procedures.

Data Reduction: The process of transforming the number of data items by arithmetic or statistical calculation, standard curves, and concentration factors, and collating them into a more useful form.
Demonstration of Capability: A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision. **Initial Demonstration of Capability (IDOC)** and **Ongoing Demonstration of Capability (ODOC).**
Experimental Field of Proficiency Testing (Experimental FoPT): Analytes for which a laboratory is required to analyze a PT sample if they seek or maintain accreditation for the field of accreditation but for which successful analysis is not required in order to obtain or maintain accreditation.
Field of Accreditation: Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation.
Field of Proficiency Testing (FoPT): Analytes for which a laboratory is required to successfully analyze a PT sample in order to obtain or maintain accreditation, collectively defined as: matrix, technology/method, analyte.
Finding: An assessment conclusion referenced to a laboratory accreditation standard and supported by objective evidence that identifies a deviation from a laboratory accreditation standard requirement.
Holding Times: The maximum time that can elapse between two (2) specified activities.
Initial (or Independent) Calibration Verification (ICV): An analytical standard used to verify calibration prior to analysis of samples. The ICV is obtained from a ***separate source*** than the calibration standards, but may be from a ***different lot*** from the same vendor.
Internal Standard: A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method.
Laboratory Control Sample (LCS): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes and taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a reference method. 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. This is sometimes referred to as a Laboratory Fortified Blank (LFB).
Legal Chain of Custody Protocols: Procedures employed to record the possession of samples from the time of sampling through the retention time specified by the client or program. These procedures are performed at the special request of the client and 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.
Matrix Duplicate: A replicate aliquot of the same sample (i.e., matrix) prepared in the laboratory and analyzed to obtain a measure of precision.
Matrix Effects: Manifestations of non-target analytes or physical/chemical characteristics of a sample that prevents the accurate quantification of the target analyte (i.e., the compound or element of interest being effectively quantified by the test method) as it is routinely performed, typically adversely impacting the reliability of the determination. For example, a matrix effect can give rise to a high or low bias.

Matrix Spike: An aliquot of a sample prepared by adding a known amount of target analyte(s) to a specified amount of the sample for which an independent test result of target analyte(s)' concentration is available. The prepared sample is then taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a reference method. Matrix spikes are used, for example, to determine the effect of the sample's matrix on a method's recovery efficiency.
Matrix Spike Duplicate: A replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.
Measurement System: A method, as implemented at a particular laboratory, which includes the equipment used to perform the test and the operator(s).
Method: A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification), systematically presented in the order in which they are to be executed.
Method Detection Limit (MDL): The minimum concentration of a substance 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. The MDL is determined using the procedure at 40 CFR 136, Appendix B.
Minimum Reporting Level (MRL): The minimum value below which data are documented as non-detects.
Mobile Laboratory: A portable enclosed structure with necessary and appropriate accommodation and environmental conditions for a laboratory, within which testing is performed by analysts. Examples include but are not limited to trailers, vans, and skid-mounted structures configured to house testing equipment and personnel.
National Institute of Standards and Technology (NIST): A federal agency of the US Department of Commerce's Technology Administration that is designed as the United States national metrology institute (NMI).
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 is usually expressed as standard deviation, variance or range, in either absolute or relative terms.
Preservation: Any conditions under which a sample must be kept in order to maintain chemical and/or biological integrity prior to analysis.
Primary Accreditation Body (Primary AB): The accreditation body responsible for assessing a laboratory's total quality system, on-site assessment, and PT performance tracking for fields of accreditation.
Procedure: A specified way to carry out an activity or process. Procedures can be documented or not.
Proficiency Testing (PT): A means to evaluate a laboratory's performance under controlled conditions relative to a given set of criteria, through analysis of unknown samples provided by an external source.
Proficiency Testing Program (PT Program): The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of results and the collective demographics and results summary of all participating laboratories.
Proficiency Testing Provider (PTP): A person or organization accredited by the TNI-approved Proficiency Testing Provider Accreditor to operate a TNI-compliant PT program.

Proficiency Testing Provider Accreditor (PTPA): An organization that is approved by TNI to accredit and monitor the performance of proficiency testing providers.
Proficiency Testing Sample (PT Sample): 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.
Proficiency Testing Study (PT Study): A single complete sequence of circulation of proficiency testing samples to all participants in a proficiency test program.
Protocol: A detailed written procedure for field and/or laboratory operation (e.g., sampling, analysis) which must be strictly followed.
PT Study Closing Date: The calendar date for which analytical results for a PT sample shall be received by the PT provider from the laboratory.
PT Study Opening Date: The calendar date that a PT sample is first made available to any laboratory by a PT provider.
Quality Assurance: An integrated system of ***management activities*** involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the client.
Quality Control: The overall system of ***technical activities*** that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against "out of control" conditions and ensuring that the results are of acceptable quality.
Quality Control Sample: A sample used to assess the performance of all or a portion of the measurement system. One of any number of samples, such as Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking, intended to demonstrate that a measurement system or activity is in control.
Quality Manual: 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 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 quality assurance (QA) and quality control (QC) activities.
Quality System Matrix: These matrix definitions are to be used for purposes of batch and quality control requirements:
Air and Emissions: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device.
Aqueous: Any aqueous sample excluded from the definition of Drinking Water or Saline/Estuarine. Includes surface water, ground water effluents, and TCLP or other extracts.
Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

Chemical Waste: A product or by-product of an industrial process that results in a matrix not previously defined.
Drinking Water: Any aqueous sample that has been designated a potable or potential potable water source.
Non-Aqueous Liquid: Any organic liquid with <15% settleable solids.
Saline/Estuarine: Any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.
Solids: Includes soils, sediments, sludges and other matrices with >15% settleable solids.
Raw Data: The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, electronic data, magnetic tapes, untabulated sample results, QC sample results, print outs of chromatograms, instrument outputs, and handwritten records.
Reference Material: Material or substance one or more of whose property values are sufficiently homogeneous and 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 reference method is a method issued by an organization generally recognized as competent to do so. When a laboratory is required to analyze a parameter by a specified method due to a regulatory requirement, the parameter/method combination is recognized as a reference method.
Reference Standard: Standard used for the calibration of working measurement standards in a given organization or at a given location.
Revocation: The total or partial withdrawal of a laboratory's accreditation by an accreditation body.
Sample: A part of a larger whole or a single item of a group; a finite subset of a statistical population. A representative sample serves to provide data or information concerning the properties of the whole group or population.
Sampling: Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure.
Second Source Calibration Standard: A standard obtained or prepared from a source independent of the source of standards for the initial calibration that is used to verify the correctness of a calibration. ***The second source standard is used to prepare the ICV.***
Selectivity: The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent or that may behave similarly to the target analyte or parameter within the measurement system.
Sensitivity: The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest.
Standard: The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of standard setting and meets the approval requirements of standard adoption organizations procedures and policies.
Standard Operating Procedures (SOPs): A written document that details the method for an operation, analysis, or action, with thoroughly prescribed techniques and steps. SOPs are officially approved as the methods for performing certain routine or repetitive tasks.
Stock Solution: A solution containing an analyte that is prepared using a reference traceable to EPA, the NIST or a source that will attest to the purity and authenticity of the reference material.
Study: This term refers to a PT Study or Supplemental PT Study.

Supplemental Proficiency Testing Study (Supplemental PT Study): A PT sample that may be from a lot previously released by a PT Provider that meets the requirements for supplemental PT samples but does not have pre-determined opening and closing dates.
Surrogate Standard: A non-target analyte that has similar chemical properties to the analyte of interest. The surrogate standard is added to the sample in a known amount and used to evaluate the response of the analyte to preparation and analysis procedures.
Suspension: The temporary removal of a laboratory's accreditation for a defined period of time, which shall not exceed six (6) months or the period of accreditation, whichever is longer, in order to allow the laboratory time to correct deficiencies or area of non-conformance.
Technology: A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.
TNI PT Board: A board consisting of TNI members or affiliates, appointed by the TNI Board of Directors, which is responsible for the successful implementation and operation of the TNI Proficiency Testing Program. The duties of the TNI PT Board are defined in the TNI PT Board Charter.
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.
Verification: Confirmation by examination and objective evidence that specified requirements have been met.
NOTE: In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment. The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.

Appendix E

Laboratory Accreditation/Certification/Recognition

Veritas Laboratories maintains the following certifications and accreditations:

Organization	Certificate Number	Certificate Issued	Certificate Number
Nevada Division of Environmental Protection, Bureau of Safe Drinking Water (NDEP BSDW)	NV00918	Clark County, Nevada Building Department	IA-22232-RN03202024
Centers for Disease Control and Prevention (CDC), Elite Progam	WA Acct. #5001756		

The parameter lists for each organization may be found below. If accreditation is terminated or suspended, the laboratory will immediately cease to use the certificate number reference in any way and inform clients impacted by the change.

Table of Methods I	
Accreditation Body: Clark County Building Department, Expiration Date: 03/21/25	
Matrix: Soil	
Method	**Analyte**
ASTM 2791, ASTM D516/Hach 8051, EPA 9045D, SM 2540C, SM 2580B, SM4500-S2 D/Hach 8131, SM 4500-Cl E, AASHTO T-288, EPA 6010B, SM 4500-SO4 E, AASHTO T-291 A, AASHTO T-290 B	Soluble Sodium, Soluble Sulfate, Resistivity, Redox Potential (ORP), Soluble Sulfide, pH, Soluble Chloride, Total Soluble Sodium Sulfate, Total Soluble Salts (Solubility)

Table of Methods II
Accreditation Body: NDEP BSDW, Expiration Date: 07/31/2025
Matrix: CWA (Non Potable Water), RCRA (Non Potable Water), RCRA (Solid and Waste Materials), SWA (Potable Water)
Ceritied Analytes: See Following Pages

Table of Methods III
Accreditation Body: Centers for Disease Control (CDC), Expiration Date: 12/01/25
Matrix: Potable and Non-Potable Water
Ceritied Analytes: Legionella, Total and Serotypes by CDC Culture Method

State of Nevada

Department of Conservation and Natural Resources
Division of Environmental Protection, Laboratory Certification Program (LCP)

Laboratory Certificate for:

Veritas Laboratories
6245 Harrison Drive, Suite 4
Las Vegas, NV 89120-4035

State Lab ID: NV00918
Effective Date: 12/09/2024
Expiration Date: 07/31/2025
Document ID: NV-C24-00297

Conditions of Certification

This laboratory is hereby approved for environmental testing in accordance with the State of Nevada Administrative Code (NAC) 445A. Approval is granted only for those parameters specified on the attached Fields of Accreditation (FoA) list. For continued approval, the laboratory must maintain compliance with all applicable program requirements, including proficiency testing. The laboratory must immediately report to the Nevada Laboratory Certification Program any instance where compliance with NAC 445A requirements is not maintained. Laboratory clients may contact this agency for the most recently issued laboratory certificate.

Jasmine Curiel Digitally signed by Jasmine Curiel
Date: 2024.12.09 08:33:33 -08'00'

Issued By: Jasmine Curiel, Laboratory Certification Manager

Approved Analytical Parameters

Matrix	Program	Method	Analyte	Status
DW	SDWA	EPA 200.7	Aluminum	Certified
DW	SDWA	EPA 200.7	Barium	Certified
DW	SDWA	EPA 200.7	Beryllium	Certified
DW	SDWA	EPA 200.7	Boron	Certified
DW	SDWA	EPA 200.7	Cadmium	Certified
DW	SDWA	EPA 200.7	Calcium	Certified
DW	SDWA	EPA 200.7	Chromium	Certified
DW	SDWA	EPA 200.7	Copper	Certified
DW	SDWA	EPA 200.7	Iron	Certified
DW	SDWA	EPA 200.7	Magnesium	Certified
DW	SDWA	EPA 200.7	Manganese	Certified
DW	SDWA	EPA 200.7	Nickel	Certified
DW	SDWA	EPA 200.7	Potassium	Certified
DW	SDWA	EPA 200.7	Silver	Certified
DW	SDWA	EPA 200.7	Sodium	Certified
DW	SDWA	EPA 200.7	Zinc	Certified
DW	SDWA	EPA 245.1	Mercury	Certified
DW	SDWA	EPA 300.0	Chloride	Certified
DW	SDWA	EPA 300.0	Chlorite	Certified
DW	SDWA	EPA 300.0	Fluoride	Certified
DW	SDWA	EPA 300.0	Nitrate as N	Certified
DW	SDWA	EPA 300.0	Nitrite as N	Certified
DW	SDWA	EPA 300.0	Sulfate	Certified
DW	SDWA	HACH 8167	Total Residual Chlorine	Certified

DW	SDWA	Modified Colitag	Escherichia coli (E. coli)	Certified
DW	SDWA	Modified Colitag	Total coliforms	Certified
DW	SDWA	SM 2340 B	Calcium hardness as CaCO3	Certified
DW	SDWA	SM 2340 B	Hardness (calc.)	Certified
DW	SDWA	SM 2540 C	Residue-filterable (TDS)	Certified
DW	SDWA	SM 4500-H+ B	pH	Certified
DW	SDWA	SM 9215 B (PCA)	Heterotrophic plate count	Certified
NPW	CWA	By Calculation *	Alkalinity, Bicarbonate (as CaCO3) *	Certified
NPW	CWA	EPA 1664B	Hexane Extractable Material - Silica Gel Treated (HEM-SGT)	Certified
NPW	CWA	EPA 1664B	n-Hexane Extractable Material (O&G)	Certified
NPW	CWA	EPA 200.7	Aluminum	Certified
NPW	CWA	EPA 200.7	Antimony	Certified
NPW	CWA	EPA 200.7	Arsenic	Certified
NPW	CWA	EPA 200.7	Barium	Certified
NPW	CWA	EPA 200.7	Beryllium	Certified
NPW	CWA	EPA 200.7	Boron	Certified
NPW	CWA	EPA 200.7	Cadmium	Certified
NPW	CWA	EPA 200.7	Calcium	Certified
NPW	CWA	EPA 200.7	Chromium	Certified
NPW	CWA	EPA 200.7	Cobalt	Certified
NPW	CWA	EPA 200.7	Copper	Certified
NPW	CWA	EPA 200.7	Iron	Certified
NPW	CWA	EPA 200.7	Lead	Certified
NPW	CWA	EPA 200.7	Magnesium	Certified
NPW	CWA	EPA 200.7	Manganese	Certified
NPW	CWA	EPA 200.7	Molybdenum	Certified
NPW	CWA	EPA 200.7	Nickel	Certified

NPW	CWA	EPA 200.7	Potassium	Certified
NPW	CWA	EPA 200.7	Selenium	Certified
NPW	CWA	EPA 200.7	Silica as SiO2	Certified
NPW	CWA	EPA 200.7	Silver	Certified
NPW	CWA	EPA 200.7	Sodium	Certified
NPW	CWA	EPA 200.7	Strontium	Certified
NPW	CWA	EPA 200.7	Thallium	Certified
NPW	CWA	EPA 200.7	Vanadium	Certified
NPW	CWA	EPA 200.7	Zinc	Certified
NPW	CWA	EPA 245.1	Mercury	Certified
NPW	CWA	EPA 300.0	Chloride	Certified
NPW	CWA	EPA 300.0	Fluoride	Certified
NPW	CWA	EPA 300.0	Nitrate as N	Certified
NPW	CWA	EPA 300.0	Nitrate plus Nitrite as N	Certified
NPW	CWA	EPA 300.0	Nitrite as N	Certified
NPW	CWA	EPA 300.0	Sulfate	Certified
NPW	CWA	EPA 624.1	1,1,1,2-Tetrachloroethane	Certified
NPW	CWA	EPA 624.1	1,1,1-Trichloroethane	Certified
NPW	CWA	EPA 624.1	1,1,2,2-Tetrachloroethane	Certified
NPW	CWA	EPA 624.1	1,1,2-Trichloroethane	Certified
NPW	CWA	EPA 624.1	1,1-Dichloroethane	Certified
NPW	CWA	EPA 624.1	1,1-Dichloroethylene	Certified
NPW	CWA	EPA 624.1	1,2,3-Trichloropropane	Certified
NPW	CWA	EPA 624.1	1,2,4-Trichlorobenzene	Certified
NPW	CWA	EPA 624.1	1,2,4-Trimethylbenzene	Certified
NPW	CWA	EPA 624.1	1,2-Dichlorobenzene (o-Dichlorobenzene)	Certified
NPW	CWA	EPA 624.1	1,2-Dichloroethane (Ethylene dichloride)	Certified

NPW	CWA	EPA 624.1	1,2-Dichloropropane	Certified
NPW	CWA	EPA 624.1	1,3,5-Trimethylbenzene	Certified
NPW	CWA	EPA 624.1	1,3-Dichlorobenzene (m-Dichlorobenzene)	Certified
NPW	CWA	EPA 624.1	1,4-Dichlorobenzene (p-Dichlorobenzene)	Certified
NPW	CWA	EPA 624.1	2-Butanone (Methyl ethyl ketone, MEK)	Certified
NPW	CWA	EPA 624.1	2-Chloroethyl vinyl ether	Certified
NPW	CWA	EPA 624.1	2-Hexanone	Certified
NPW	CWA	EPA 624.1	4-Methyl-2-pentanone (MIBK)	Certified
NPW	CWA	EPA 624.1	Acetone	Certified
NPW	CWA	EPA 624.1	Benzene	Certified
NPW	CWA	EPA 624.1	Bromodichloromethane	Certified
NPW	CWA	EPA 624.1	Bromoform	Certified
NPW	CWA	EPA 624.1	Carbon disulfide	Certified
NPW	CWA	EPA 624.1	Carbon tetrachloride	Certified
NPW	CWA	EPA 624.1	Chlorobenzene	Certified
NPW	CWA	EPA 624.1	Chlorodibromomethane	Certified
NPW	CWA	EPA 624.1	Chloroethane (Ethyl chloride)	Certified
NPW	CWA	EPA 624.1	Chloroform	Certified
NPW	CWA	EPA 624.1	cis-1,2-Dichloroethylene	Certified
NPW	CWA	EPA 624.1	cis-1,3-Dichloropropene	Certified
NPW	CWA	EPA 624.1	Dibromomethane (Methylene bromide)	Certified
NPW	CWA	EPA 624.1	Dichlorodifluoromethane (Freon-12)	Certified
NPW	CWA	EPA 624.1	Ethylbenzene	Certified
NPW	CWA	EPA 624.1	Hexachlorobutadiene	Certified
NPW	CWA	EPA 624.1	m+p-xylene	Certified
NPW	CWA	EPA 624.1	Methyl bromide (Bromomethane)	Certified
NPW	CWA	EPA 624.1	Methyl chloride (Chloromethane)	Certified

NPW	CWA	EPA 624.1	Methyl tert-butyl ether (MTBE)	Certified
NPW	CWA	EPA 624.1	Methylene chloride (Dichloromethane)	Certified
NPW	CWA	EPA 624.1	Naphthalene	Certified
NPW	CWA	EPA 624.1	o-Xylene	Certified
NPW	CWA	EPA 624.1	Styrene	Certified
NPW	CWA	EPA 624.1	Tetrachloroethylene (Perchloroethylene)	Certified
NPW	CWA	EPA 624.1	Toluene	Certified
NPW	CWA	EPA 624.1	Total Xylene	Certified
NPW	CWA	EPA 624.1	trans-1,2-Dichloroethylene	Certified
NPW	CWA	EPA 624.1	trans-1,3-Dichloropropylene	Certified
NPW	CWA	EPA 624.1	Trichloroethene (Trichloroethylene)	Certified
NPW	CWA	EPA 624.1	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	Certified
NPW	CWA	EPA 624.1	Vinyl chloride (Chloroethene)	Certified
NPW	CWA	HACH 8167	Total Residual Chlorine	Certified
NPW	CWA	HACH 8190	Total Phosphorus	Certified
NPW	CWA	SM 2320 B	Alkalinity as CaCO3	Certified
NPW	CWA	SM 2340 B	Calcium hardness as CaCO3	Certified
NPW	CWA	SM 2340 B	Hardness (calc.)	Certified
NPW	CWA	SM 2510 B	Conductivity	Certified
NPW	CWA	SM 2540 C	Residue-filterable (TDS)	Certified
NPW	CWA	SM 2540 D	Residue-nonfilterable (TSS)	Certified
NPW	CWA	SM 4500-H+ B	pH	Certified
NPW	CWA	SM 4500-NH3 B	Ammonia as N	Certified
NPW	CWA	SM 4500-NH3 C	Ammonia as N	Certified
NPW	CWA	SM 5210 B	Biochemical Oxygen Demand (BOD)	Certified
NPW	CWA	SM 9223 B (Colilert-18 Quanti-Tray)	Escherichia coli (E. coli)	Certified
NPW	CWA	SM 9223 B (Colilert-18 Quanti-Tray)	Fecal coliforms	Certified

NPW	RCRA	EPA 6010D	Aluminum	Certified
NPW	RCRA	EPA 6010D	Antimony	Certified
NPW	RCRA	EPA 6010D	Arsenic	Certified
NPW	RCRA	EPA 6010D	Barium	Certified
NPW	RCRA	EPA 6010D	Beryllium	Certified
NPW	RCRA	EPA 6010D	Boron	Certified
NPW	RCRA	EPA 6010D	Cadmium	Certified
NPW	RCRA	EPA 6010D	Calcium	Certified
NPW	RCRA	EPA 6010D	Chromium	Certified
NPW	RCRA	EPA 6010D	Cobalt	Certified
NPW	RCRA	EPA 6010D	Copper	Certified
NPW	RCRA	EPA 6010D	Iron	Certified
NPW	RCRA	EPA 6010D	Lead	Certified
NPW	RCRA	EPA 6010D	Magnesium	Certified
NPW	RCRA	EPA 6010D	Manganese	Certified
NPW	RCRA	EPA 6010D	Molybdenum	Certified
NPW	RCRA	EPA 6010D	Nickel	Certified
NPW	RCRA	EPA 6010D	Potassium	Certified
NPW	RCRA	EPA 6010D	Selenium	Certified
NPW	RCRA	EPA 6010D	Silica as SiO2	Certified
NPW	RCRA	EPA 6010D	Silver	Certified
NPW	RCRA	EPA 6010D	Strontium	Certified
NPW	RCRA	EPA 6010D	Thallium	Certified
NPW	RCRA	EPA 6010D	Vanadium	Certified
NPW	RCRA	EPA 6010D	Zinc	Certified
NPW	RCRA	EPA 8260D	1,1,1,2-Tetrachloroethane	Certified
NPW	RCRA	EPA 8260D	1,1,1-Trichloroethane	Certified

NPW	RCRA	EPA 8260D	1,1,2,2-Tetrachloroethane	Certified
NPW	RCRA	EPA 8260D	1,1,2-Trichloroethane	Certified
NPW	RCRA	EPA 8260D	1,1-Dichloroethane	Certified
NPW	RCRA	EPA 8260D	1,1-Dichloroethylene	Certified
NPW	RCRA	EPA 8260D	1,1-Dichloropropene	Certified
NPW	RCRA	EPA 8260D	1,2,3-Trichlorobenzene	Certified
NPW	RCRA	EPA 8260D	1,2,3-Trichloropropane	Certified
NPW	RCRA	EPA 8260D	1,2,4-Trichlorobenzene	Certified
NPW	RCRA	EPA 8260D	1,2,4-Trimethylbenzene	Certified
NPW	RCRA	EPA 8260D	1,2-Dibromo-3-chloropropane (DBCP)	Certified
NPW	RCRA	EPA 8260D	1,2-Dibromoethane (EDB, Ethylene dibromide)	Certified
NPW	RCRA	EPA 8260D	1,2-Dichlorobenzene (o-Dichlorobenzene)	Certified
NPW	RCRA	EPA 8260D	1,2-Dichloroethane (Ethylene dichloride)	Certified
NPW	RCRA	EPA 8260D	1,2-Dichloropropane	Certified
NPW	RCRA	EPA 8260D	1,3,5-Trimethylbenzene	Certified
NPW	RCRA	EPA 8260D	1,3-Dichlorobenzene (m-Dichlorobenzene)	Certified
NPW	RCRA	EPA 8260D	1,3-Dichloropropane	Certified
NPW	RCRA	EPA 8260D	1,4-Dichlorobenzene (p-Dichlorobenzene)	Certified
NPW	RCRA	EPA 8260D	2,2-Dichloropropane	Certified
NPW	RCRA	EPA 8260D	2-Butanone (Methyl ethyl ketone, MEK)	Certified
NPW	RCRA	EPA 8260D	2-Chloroethyl vinyl ether	Certified
NPW	RCRA	EPA 8260D	2-Chlorotoluene	Certified
NPW	RCRA	EPA 8260D	2-Hexanone	Certified
NPW	RCRA	EPA 8260D	4-Chlorotoluene	Certified
NPW	RCRA	EPA 8260D	4-Isopropyltoluene (p-Cymene)	Certified
NPW	RCRA	EPA 8260D	4-Methyl-2-pentanone (MIBK)	Certified
NPW	RCRA	EPA 8260D	Acetone	Certified

NPW	RCRA	EPA 8260D	Benzene	Certified
NPW	RCRA	EPA 8260D	Bromobenzene	Certified
NPW	RCRA	EPA 8260D	Bromodichloromethane	Certified
NPW	RCRA	EPA 8260D	Bromoform	Certified
NPW	RCRA	EPA 8260D	Carbon disulfide	Certified
NPW	RCRA	EPA 8260D	Carbon tetrachloride	Certified
NPW	RCRA	EPA 8260D	Chlorobenzene	Certified
NPW	RCRA	EPA 8260D	Chlorodibromomethane	Certified
NPW	RCRA	EPA 8260D	Chloroethane (Ethyl chloride)	Certified
NPW	RCRA	EPA 8260D	Chloroform	Certified
NPW	RCRA	EPA 8260D	cis-1,2-Dichloroethylene	Certified
NPW	RCRA	EPA 8260D	cis-1,3-Dichloropropene	Certified
NPW	RCRA	EPA 8260D	Di-isopropylether (DIPE)	Certified
NPW	RCRA	EPA 8260D	Dibromomethane (Methylene bromide)	Certified
NPW	RCRA	EPA 8260D	Dichlorodifluoromethane (Freon-12)	Certified
NPW	RCRA	EPA 8260D	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)	Certified
NPW	RCRA	EPA 8260D	Ethylbenzene	Certified
NPW	RCRA	EPA 8260D	Hexachlorobutadiene	Certified
NPW	RCRA	EPA 8260D	Isopropylbenzene	Certified
NPW	RCRA	EPA 8260D	m+p-xylene	Certified
NPW	RCRA	EPA 8260D	Methyl bromide (Bromomethane)	Certified
NPW	RCRA	EPA 8260D	Methyl chloride (Chloromethane)	Certified
NPW	RCRA	EPA 8260D	Methyl tert-butyl ether (MTBE)	Certified
NPW	RCRA	EPA 8260D	Methylene chloride (Dichloromethane)	Certified
NPW	RCRA	EPA 8260D	n-Butylbenzene	Certified
NPW	RCRA	EPA 8260D	n-Propylbenzene	Certified
NPW	RCRA	EPA 8260D	Naphthalene	Certified

NPW	RCRA	EPA 8260D	o-Xylene	Certified
NPW	RCRA	EPA 8260D	sec-Butylbenzene	Certified
NPW	RCRA	EPA 8260D	Styrene	Certified
NPW	RCRA	EPA 8260D	tert-amyl methyl ether (TAME)	Certified
NPW	RCRA	EPA 8260D	tert-Butyl alcohol (2-Methyl-2-Propanol)	Certified
NPW	RCRA	EPA 8260D	tert-Butylbenzene	Certified
NPW	RCRA	EPA 8260D	Tetrachloroethylene (Perchloroethylene)	Certified
NPW	RCRA	EPA 8260D	Toluene	Certified
NPW	RCRA	EPA 8260D	Total Xylene	Certified
NPW	RCRA	EPA 8260D	trans-1,2-Dichloroethylene	Certified
NPW	RCRA	EPA 8260D	trans-1,3-Dichloropropylene	Certified
NPW	RCRA	EPA 8260D	Trichloroethene (Trichloroethylene)	Certified
NPW	RCRA	EPA 8260D	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	Certified
NPW	RCRA	EPA 8260D	Vinyl chloride (Chloroethene)	Certified
NPW	RCRA	EPA 9050A	Conductivity	Certified
NPW	RCRA	EPA 9056A	Chloride	Certified
NPW	RCRA	EPA 9056A	Fluoride	Certified
NPW	RCRA	EPA 9056A	Nitrate as N	Certified
NPW	RCRA	EPA 9056A	Nitrite as N	Certified
NPW	RCRA	EPA 9056A	Sulfate	Certified
NPW	RCRA	SM 2540 C	Residue-filterable (TDS)	Certified
NPW	RCRA	TNRCC 1005	Diesel Range Organics (DRO)	Certified
NPW	RCRA	TNRCC 1005	Gasoline Range Organics (GRO)	Certified
NPW	RCRA	TNRCC 1005	Residual Range Organics (RRO) - Oil Range Organics *	Certified
S	RCRA	EPA 6010D	Aluminum	Certified
S	RCRA	EPA 6010D	Antimony	Certified
S	RCRA	EPA 6010D	Arsenic	Certified

S	RCRA	EPA 6010D	Barium	Certified
S	RCRA	EPA 6010D	Beryllium	Certified
S	RCRA	EPA 6010D	Boron	Certified
S	RCRA	EPA 6010D	Cadmium	Certified
S	RCRA	EPA 6010D	Calcium	Certified
S	RCRA	EPA 6010D	Chromium	Certified
S	RCRA	EPA 6010D	Cobalt	Certified
S	RCRA	EPA 6010D	Copper	Certified
S	RCRA	EPA 6010D	Iron	Certified
S	RCRA	EPA 6010D	Lead	Certified
S	RCRA	EPA 6010D	Lithium	Certified
S	RCRA	EPA 6010D	Magnesium	Certified
S	RCRA	EPA 6010D	Manganese	Certified
S	RCRA	EPA 6010D	Molybdenum	Certified
S	RCRA	EPA 6010D	Nickel	Certified
S	RCRA	EPA 6010D	Potassium	Certified
S	RCRA	EPA 6010D	Selenium	Certified
S	RCRA	EPA 6010D	Silver	Certified
S	RCRA	EPA 6010D	Sodium	Certified
S	RCRA	EPA 6010D	Strontium	Certified
S	RCRA	EPA 6010D	Thallium	Certified
S	RCRA	EPA 6010D	Vanadium	Certified
S	RCRA	EPA 6010D	Zinc	Certified
S	RCRA	EPA 8260D	1,1,1,2-Tetrachloroethane	Certified
S	RCRA	EPA 8260D	1,1,1-Trichloroethane	Certified
S	RCRA	EPA 8260D	1,1,2,2-Tetrachloroethane	Certified
S	RCRA	EPA 8260D	1,1,2-Trichloroethane	Certified

S	RCRA	EPA 8260D	1,1-Dichloroethane	Certified
S	RCRA	EPA 8260D	1,1-Dichloroethylene	Certified
S	RCRA	EPA 8260D	1,1-Dichloropropene	Certified
S	RCRA	EPA 8260D	1,2,3-Trichlorobenzene	Certified
S	RCRA	EPA 8260D	1,2,3-Trichloropropane	Certified
S	RCRA	EPA 8260D	1,2,4-Trichlorobenzene	Certified
S	RCRA	EPA 8260D	1,2,4-Trimethylbenzene	Certified
S	RCRA	EPA 8260D	1,2-Dibromo-3-chloropropane (DBCP)	Certified
S	RCRA	EPA 8260D	1,2-Dibromoethane (EDB, Ethylene dibromide)	Certified
S	RCRA	EPA 8260D	1,2-Dichlorobenzene (o-Dichlorobenzene)	Certified
S	RCRA	EPA 8260D	1,2-Dichloroethane (Ethylene dichloride)	Certified
S	RCRA	EPA 8260D	1,2-Dichloropropane	Certified
S	RCRA	EPA 8260D	1,3,5-Trimethylbenzene	Certified
S	RCRA	EPA 8260D	1,3-Dichlorobenzene (m-Dichlorobenzene)	Certified
S	RCRA	EPA 8260D	1,3-Dichloropropane	Certified
S	RCRA	EPA 8260D	1,4-Dichlorobenzene (p-Dichlorobenzene)	Certified
S	RCRA	EPA 8260D	2,2-Dichloropropane	Certified
S	RCRA	EPA 8260D	2-Butanone (Methyl ethyl ketone, MEK)	Certified
S	RCRA	EPA 8260D	2-Chloroethyl vinyl ether	Certified
S	RCRA	EPA 8260D	2-Chlorotoluene	Certified
S	RCRA	EPA 8260D	2-Hexanone	Certified
S	RCRA	EPA 8260D	4-Chlorotoluene	Certified
S	RCRA	EPA 8260D	4-Isopropyltoluene (p-Cymene)	Certified
S	RCRA	EPA 8260D	4-Methyl-2-pentanone (MIBK)	Certified
S	RCRA	EPA 8260D	Acetone	Certified
S	RCRA	EPA 8260D	Benzene	Certified
S	RCRA	EPA 8260D	Bromobenzene	Certified

S	RCRA	EPA 8260D	Bromodichloromethane	Certified
S	RCRA	EPA 8260D	Bromoform	Certified
S	RCRA	EPA 8260D	Carbon disulfide	Certified
S	RCRA	EPA 8260D	Carbon tetrachloride	Certified
S	RCRA	EPA 8260D	Chlorobenzene	Certified
S	RCRA	EPA 8260D	Chlorodibromomethane	Certified
S	RCRA	EPA 8260D	Chloroethane (Ethyl chloride)	Certified
S	RCRA	EPA 8260D	Chloroform	Certified
S	RCRA	EPA 8260D	cis-1,2-Dichloroethylene	Certified
S	RCRA	EPA 8260D	cis-1,3-Dichloropropene	Certified
S	RCRA	EPA 8260D	Dibromomethane (Methylene bromide)	Certified
S	RCRA	EPA 8260D	Dichlorodifluoromethane (Freon-12)	Certified
S	RCRA	EPA 8260D	Ethylbenzene	Certified
S	RCRA	EPA 8260D	Hexachlorobutadiene	Certified
S	RCRA	EPA 8260D	Isopropylbenzene	Certified
S	RCRA	EPA 8260D	m+p-xylene	Certified
S	RCRA	EPA 8260D	Methyl bromide (Bromomethane)	Certified
S	RCRA	EPA 8260D	Methyl chloride (Chloromethane)	Certified
S	RCRA	EPA 8260D	Methyl tert-butyl ether (MTBE)	Certified
S	RCRA	EPA 8260D	Methylene chloride (Dichloromethane)	Certified
S	RCRA	EPA 8260D	n-Butylbenzene	Certified
S	RCRA	EPA 8260D	n-Propylbenzene	Certified
S	RCRA	EPA 8260D	Naphthalene	Certified
S	RCRA	EPA 8260D	o-Xylene	Certified
S	RCRA	EPA 8260D	sec-Butylbenzene	Certified
S	RCRA	EPA 8260D	Styrene	Certified
S	RCRA	EPA 8260D	tert-Butylbenzene	Certified

S	RCRA	EPA 8260D	Tetrachloroethylene (Perchloroethylene)	Certified
S	RCRA	EPA 8260D	Toluene	Certified
S	RCRA	EPA 8260D	Total Xylene	Certified
S	RCRA	EPA 8260D	trans-1,2-Dichloroethylene	Certified
S	RCRA	EPA 8260D	trans-1,3-Dichloropropylene	Certified
S	RCRA	EPA 8260D	Trichloroethene (Trichloroethylene)	Certified
S	RCRA	EPA 8260D	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	Certified
S	RCRA	EPA 8260D	Vinyl chloride (Chloroethene)	Certified
S	RCRA	EPA 9045D	Corrosivity (pH)	Certified
S	RCRA	TNRCC 1005	Diesel Range Organics (DRO)	Certified
S	RCRA	TNRCC 1005	Gasoline Range Organics (GRO)	Certified
S	RCRA	TNRCC 1005	Residual Range Organics (RRO) - Oil Range Organics *	Certified

CERTIFICATE OF PROFICIENCY

ELITE Program

Veritas Laboratories

6245 Harrison Drive Suite 4

Las Vegas, NV 89120

United States of America

Member Since: 11/22/2017

Expiration Date: 12/1/2025

ELITE

Issued by:

Environmental *Legionella* Isolation Techniques Evaluation

Respiratory Diseases Branch

National Center for Immunization and Respiratory Diseases

Coordinating Center for Infectious Diseases

Centers for Disease Control and Prevention (CDC)

DEPARTMENT OF HEALTH & HUMAN SERVICES · USA

CDC

CENTERS FOR DISEASE CONTROL AND PREVENTION

CLARK COUNTY DEPARTMENT OF BUILDING & FIRE PREVENTION
4701 W. Russell Rd * Las Vegas, NV 89118

CLARK COUNTY APPROVED AGENCY

Agency Name: **Veritas Laboratories**
Agency ID#: **IA-22232-RN03202024**
Business Address: **6245 Harrison Drvie**
Las Vegas, NV 89120

Listing Date: 03/21/2014 **Expiration Date: 03/21/2025**

The above agency is approved for the items listed below:

Inspection Item Approvals:

Subcontracting/Testing Approvals:

Laboratory Approvals: Soils Chemical Testing

Approval is contingent upon continued compliance with Clark County Building Administrative Code, International Building Code, technical guidelines, technical codes, and all applicable referenced standards.

James Gerren, P.E.
Director of the Building Department

Appendix F

Data Qualifiers

Qualifier	TextBody
B	Analyte detected in the associated Method Blank
DO	Spike/Surrogate diluted out
E	Reported concentration exceeded the calibration range of the instrument
H1	Sample received past or too close to recommended EPA holding time expiration, holding time exceeded. Analysis performed at client's request
H2	Recommended EPA holding time for sample preparation/extraction exceeded. Sample was analyzed within holding time after preparation/extraction
H3	Recommended EPA holding time for analysis exceeded
H4	Initial analysis was performed within the EPA recommended holding time. Reanalysis for dilutions or due to QC acceptance issues was beyond the holding time
H5	Samples were received and analyzed past the EPA recommended holding time of 15 minutes after sample collection
H6	Recommended EPA holding time for sample preparation/extraction was met. Sample analysis holding time after preparation/extraction was exceeded
J	Analyte concentration is reported below the Minimum Reporting Limit (MRL) but above the Method Detection Limit (MDL)
JA	Analyte positively identified but quantitation is an estimate due to the analyte being outside of laboratory limits for the batch Continuing Calibration Verification (CCV) sample
M	Surrogate masked by hydrocarbon concentration in the same peak range. The surrogate data is not sufficient for proper evaluation
R	RPD outside of accepted laboratory limits
S1	Spike/Surrogate recovery outside of accepted recovery limits (low). Sample results may be biased low
S2	Spike/Surrogate recovery outside of accepted recovery limits (high). Sample results may be biased high
S3	Spike/Surrogate recovery outside of accepted recovery limits due to probable matrix interference
T	The analysis was from an improperly preserved sample
V	The sample concentration is too high to accurately evaluate spike recoveries
NC	VL not certified by the NDEP for this analysis/parameter

Appendix G

Chemistry

G.1 Method Validation

Reference methods are validated by determining the Method Detection Limit (MDL) and/or Minimum Reporting Level (MRL) by procedures outlined below, and determining precision and bias by using the demonstration of capability procedures (Section G.2).

Before any non-standard method is used in the laboratory, the laboratory determines the data quality indicators that must be used to ensure that the data are acceptable for the intended use. Based on the intended use, the laboratory establishes quality control acceptance criteria for precision, accuracy, selectivity (if applicable). In addition, the action level (compliance level, project decision level, etc.) is used to establish the MRL and/or MDL.

a) Method Detection Limit (MDL)

The Method Detection Limit (MDL) is the laboratory's estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect in their facility.

MDLs are not required for any parameter for which spiking solutions or quality control samples are not available (e.g., temperature) or for which detection limits are not defined (e.g., specific gravity, pH, ignitability, and turbidity).

The laboratory will select methods with MDLs that are expected to meet the intended data use.

MDLs are determined in samples that represent the quality system matrices to be evaluated. All sample processing/preparation steps and all determinative steps are used to validate the method for all targeted analytes. The representative quality system matrix will be free from the target analytes of interest or interfering analytes that impact the MDL.

When the method or applicable regulation specifies an MDL study, only the specified method will be used. The laboratory will document, in the method SOP, the process used to derive the MDL and will retain all the supporting data. When providing compliance data under 40 CFR Part 136, the lab follows 40 CFR Part 136, Appendix B Revision 2, and uses the MDL derived from that process as the MDL. The 40 CFR Part 136, Appendix B Revision 2 procedure has been incorporated into this Appendix as G.4 Method Detection Limit Determination.

For methods without prescribed MDL procedures, the following procedures are used:

1) For methods employing calibration curves, the laboratory will follow the procedure outlined in 40 CFR Part 136 Appendix B revision 2 for determining the MDL.

2) For methods not requiring a calibration curve (e.g. alkalinity), dilute a standard until it is no longer detected. The MDL is the level that was last detected.

Once the MDL has been determined the validity of the MDL is verified by detection (value above zero) for each target analyte in a quality control sample of a representative quality system matrix. The concentration of the analytes in the sample will be no more than 3 times the derived MDL unless the test contains multiple analytes. In the latter case, the concentration of the target analytes will be no greater than 4 times the MDL. This verification will be performed on each instrument that is used for the test.

MDLs are performed/repeated:

- before reporting the MDL for a given analyte
- any time there is a change that affects how the method is performed or
- when there is a change in instrumentation that affects the sensitivity of the analysis.

MDLs are verified annually (at a minimum) for each quality system matrix/technology/analyte combination.

b) Minimum Reporting Level

The Minimum Reporting Level (MRL) is an estimate of the minimum amount of a substance that can be reported with a specified degree of confidence.

If an MDL study is not performed, concentration values less than the MRL are not reported but are appropriately flagged.

MRLs are not required for components or properties for which spiking solutions or QC samples are not available. These include temperature and specific gravity.

An MRL study includes all sample processing and analysis steps in the analytical method. The study is performed in each quality system matrix for which the test will be performed. The procedure is documented and all supporting data are retained. The resulting MRL will be above the MDL (if determined). The MRL is no less than 3 times the method detection level. The MRL may also be established by the low calibration standard.

The laboratory will verify the MRL by the analysis of a QC sample containing the analytes of concern at a concentration of 1 to 2 times the derived (claimed) MRL. The MRL is considered verified if recovery of each analyte is within the laboratory's acceptance limits, or the client's data quality objectives.

The MRL will be verified annually (at a minimum) for each quality system matrix, technology and analyte unless the MDL was determined or verified.

c) Precision and Bias

Precision is the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. Precision is usually expressed as standard deviation, variance, or range, in either absolute or relative terms.

Bias is the systematic error that contributes to the difference between the mean of a significant number of test results and the accepted reference value.

Precision and bias using non-reference, modified reference or laboratory-developed methods are established using the procedure outlined below and compared to the criteria established by the client (when requested), the method, or the laboratory.

Precision and bias are determined by processing samples through all phases of the method (e.g., sample preparation, cleanup, and analysis) and are evaluated near the MRL to provide the measurement's highest variability. This study is performed for all quality system matrices for which the test will be used.

The laboratory's procedure for evaluating a test method's precision and bias follows:

1) Analyze QC samples in triplicate containing the analytes of interest at 3 to 4 times the method's MRL (not to exceed the calibration mid-range).
2) Analyze these samples on three separate days processing them through the entire measurement system for each analyte of interest (total number of samples analyzed = 9).
3) A method blank will be analyzed on each day along with the triplicate QC samples.
4) For each analyte, calculate the mean recovery and standard deviation.
5) Calculate the relative standard deviation for each of the analyte mean recoveries.
6) Compare the mean recoveries and relative standard deviation with the established criteria in the laboratory methods (or client specific quality assurance plan).

d) Selectivity

Selectivity is the capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances (EPA-QAD).

The laboratory evaluates selectivity through procedures defined in the test method SOPs. These procedures include evaluation of sample blanks, matrix spike QC sample relative responses, retention time windows, mass spectral tuning, ICP inter-element interference checks, and specific electrode response factors.

G.2 Demonstration of Capability

Demonstration of Capability (DOC): A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision.

Before reporting any data with a given method, a satisfactory DOC is performed. Thereafter, each analyst demonstrates continuing proficiency through the procedures outlined in Ongoing Demonstration of Capability.

a) Initial Demonstration of Capability (IDOC)

An IDOC is performed:

- Before using any method
- Each time there is a change in instrument type, personnel or method and
- If the laboratory or analysts has not performed the method in a twelve-month period.

The IDOC(s) for each analyst is documented and maintained in training folders. The document identifies the analyst(s) involved in preparation and/or analysis; matrix; analyte(s), class of analyte(s), or measured parameter(s); the method(s) performed; the laboratory-specific SOP used for analysis (including revision number); the date(s) of analysis; and a summary of the results used to calculate the mean recovery and standard deviations.

All raw data, preparation records, and calculations for each IDOC are retained and are available for review. Not all test methods are amenable to spiking, and therefore may require alternate procedures for IDOC.

When the method specifies a procedure to be followed only that procedure will be used. If no procedures are specified the laboratory uses its own procedure, which is documented below:

1) A quality control sample is obtained from an outside source or the QC sample is prepared using a secondary standard not used for calibration(s).
2) The analyte(s) is diluted in a volume of clean system matrix sufficient to prepare at least five aliquots at one to four times the MRL.
3) These QC samples are analyzed over a minimum of three days.
4) Using all results, calculate the mean recovery and the standard deviation for each analyte of interest.
5) Compare the information from G.2.4 above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory-generated acceptance criteria found in each SOP if method criteria are not provided. If all parameters meet the acceptance criteria, the analysis of samples may begin. If any one of the parameters does not meet the acceptance criteria, results may not be reported for that analyte until corrective action is taken and acceptable results are obtained. These corrective actions should include:

a. Beginning at G.2.2 above, repeat the test for all analytes of interest, or optionally, just those that failed an acceptance criteria. Repeated failure of acceptance criteria requires the corrective action below (b).
b. Locate and correct the source of the problem and repeat the test for all analytes of interest beginning with G.2.2 above.

b) Ongoing Demonstration of Capability

After the demonstration of capability is completed, on-going proficiency is maintained and demonstrated at least annually. Each analyst is expected to consistently meet the QC requirements of the method, the laboratory SOP, client requirements and/or the TNI Standard. Ongoing DOCs (ODOCs) are completed according to the following procedures. Documentation of the ODOCs will be compiled upon request and retained in the analysts' training files.

The laboratory uses the following procedure to demonstrate ongoing DOC:

1) Acceptable performance of a blind sample (single blind to the analyst). Successful analysis of a blind performance sample on a similar method using the same technology (e.g., GC/MS VOCs by P&T for EPA Methods 624 or 8260) would only require documentation of one test.
2) Another IDOC
3) At least four consecutive passing laboratory control standards (LCS), analyzed on separate days, for each method for each analyst. The average recovery (accuracy) for the four LCSs must be 80-120% and the relative percent difference (precision) must be less than 15%. This can be documented annually, or for audit/demonstration purposes, the last four consecutive LCSs for a method, analyst pair can be retrieved for calculation of accuracy and precision.

G.3 Calibration

Section 23.2.2 includes information on calibration of support equipment. This Section covers calibration of analytical equipment. Initial instrument calibration and continuing instrument calibration verification are an important part of ensuring data of known and documented quality. If more stringent calibration requirements are included in a mandated method or by regulation, those calibration requirements override any requirements outlined here and will also be incorporated in laboratory SOPs. Generally, procedures and criteria regarding instrument calibrations are provided in laboratory test methods.

G.3.1 Initial Instrument Calibration

- Records:

  Initial instrument calibration includes calculations, integrations, acceptance criteria, and associated statistics referenced in the test method SOP. Sufficient raw data records are collected to allow reconstruction of the initial instrument calibration. These include, at a minimum, calibration date, test method, instrument, analysis date, analyte names, analysts signature or initials, concentration and response, calibration curve or response factor, or unique equation or coefficient used to reduce instrument responses to concentration. Calibration date and expiration date (when recalibration is due) is documented for equipment requiring calibration, where practicable (see Section 23.1).

- Tuning Requirements:

  If the reference or mandated method uses an instrument (e.g., GC/MS) with specific tuning requirements, these tuning criteria are captured in the laboratory's test method SOPs. The validity of the instrument tune must be validated prior to calibration and sample analysis.

- Number of Standards and Concentrations:

  If the reference or mandated method does not specify the number of calibration standards to use, the minimum number is three, not including blanks or a zero standard, except as noted below. For instrumentation where single point calibration is recommended by manufacturer's instructions, such as with some ICP and ICP/MS technologies (with a zero and single point calibration), the following apply:

  a) Zero blank and single point calibration standards are analyzed with each analytical batch for methods where they are specified.
  b) The linearity of single point plus zero blank calibrations is verified at a frequency established by the method or the manufacturer.

  The lowest calibration standard is the lowest concentration for which quantitative results can be reported without qualification. The lowest calibration standard is at or below the Minimum Reporting Level (MRL) and is greater than the Method Detection Limit (MDL). Results that are less than the MRL are considered to have increased uncertainty, and are reported with a qualifier and explained in the case narrative.

  The highest calibration standard is the highest concentration for which quantitative results can be reported. Data reported exceeding the highest calibration standard without dilutions is considered to have increased uncertainty and are diluted and reanalyzed, or reported with a qualifier and explained in the case narrative.

- Evaluation, Verification and Corrective Action

  All initial instrument calibrations are verified with a standard obtained from a second source traceable to a national standard when commercially available. If a second source is not available, a standard prepared from a different lot may be used.

  Criteria for the acceptance of an initial instrument calibration is established (e.g., correlation coefficient or relative percent difference) and defined in the laboratory test method SOPs. The criteria used are appropriate to the calibration technique.

  Where appropriate, the laboratory has manual integration procedures (SOP 1300VL) that are adhered to when evaluating calibration data.

  Any samples that are analyzed after an unacceptable initial calibration are re-analyzed or the data are reported with qualifiers, appropriate to the scope of the unacceptable condition (see Section 12 – "Control of Nonconforming Environmental Testing").

  Quantitation is always determined from the initial calibration unless the test method or applicable regulations require quantitation from the continuing instrument calibration verification.

  Corrective actions are performed when the initial calibration results are outside acceptance criteria. Calibration points are not dropped from the middle of the curve unless the cause is determined and documented. If the cause cannot be determined, the calibration curve is re-prepared. If the low or high calibration point is dropped from the curve, the working curve is adjusted and sample results outside the curve are qualified.

G.3.2 Continuing Instrument Calibration

- Records

  The calculations and associated statistics for continuing instrument calibration are included or referenced in the laboratory test method SOPs.

  Sufficient raw data records are retained to allow reconstruction of the continuing instrument calibration verification. Continuing instrument calibration verification records connect the continuing verification date to the initial instrument calibration.

  Where appropriate, the laboratory has manual integration procedures (SOP 1300VL) that are adhered to when evaluating calibration data.

- Frequency

  Calibration is verified for each compound, element, or other discrete chemical species. For multi-component analytes, such as aroclors, chlordane, toxaphene, or total petroleum hydrocarbons, a representative chemically related substance or mixture is used.

  Calibration verifications are performed:

  - at the beginning and end of each analytical batch, except for instances when an internal standard is used. For methods employing internal standards, one verification is performed at the beginning of the analytical batch. Some methods have more frequent CCV requirements (see specific SOPs). Many inorganic methods require the CCV to be analyzed after every 10 samples.
  - whenever it is expected that the analytical system may be out of calibration or might not meet verification acceptance criteria.
  - when the time period for calibration or the most recent calibration verification has expired.
  - for all analytical systems that have a calibration verification requirement. Requirements can be found in the laboratory test method SOPs.

- Evaluation, Verification and Corrective Actions

  The validity of the initial calibration is verified prior to sample analysis by use of a continuing instrument calibration verification (CCV) standard. Acceptance criteria for a CCV is found in the laboratory's test method SOPs.

  Corrective action is initiated for CCV results that are outside of acceptance criteria (see Section 12 – "Control of Nonconforming Environmental Testing").

G.3.3 Unacceptable Continuing Instrument Calibration Verifications

If routine corrective action for continuing instrument calibration verification fails to produce a second consecutive (immediate) calibration verification within acceptance criteria, then a new calibration is performed or acceptable performance is demonstrated after corrective action with two consecutive calibration verifications.

For any samples analyzed on a system with an unacceptable calibration, some results may be useable if qualified and under the following conditions:

a) If the acceptance criteria are exceeded high (high bias) and the associated samples are below detection, then those sample results that are non-detects may be reported as non-detects.

b) If the acceptance criteria are exceeded low (low bias) and there are samples that exceed the maximum regulatory limit, then those exceeding the regulatory limit may be reported.

G.4 DEFINITION AND PROCEDURE FOR THE DETERMINATION OF THE METHOD DETECTION LIMIT REVISION 2

This procedure contains the text of Revision 2 of the method detection limit procedure from 40 CFR 136 Appendix B

Definition

The method detection limit (MDL) is defined as the minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results.

Scope and Application

The MDL procedure is designed to be a straightforward technique for estimation of the detection limit for a broad variety of physical and chemical methods. The procedure requires a complete, specific, and well- defined analytical method. It is essential that all sample processing steps used by the laboratory be included in the determination of the method detection limit.

The MDL procedure is *not* applicable to methods that do not produce results with a continuous distribution, such as, but not limited to, methods for whole effluent toxicity, presence/absence methods, and microbiological methods that involve counting colonies. The MDL procedure also is *not* applicable to measurements such as, but not limited to, biochemical oxygen demand, color, pH, specific conductance, many titration methods, and any method where low-level spiked samples cannot be prepared. Except as described in the addendum, for the purposes of this procedure, "spiked samples" are prepared from a clean reference matrix, such as reagent water, spiked with a known and consistent quantity of the analyte. MDL determinations using spiked samples may not be appropriate for all gravimetric methods (e.g., residue or total suspended solids), but an MDL based on method blanks can be determined in such instances.

Procedure

(1) Estimate the initial MDL using one or more of the following:

(a) The mean determined concentration plus three times the standard deviation of a set of method blanks.

(b) The concentration value that corresponds to an instrument signal-to-noise ratio in the range of 3 to 5.

(c) The concentration equivalent to three times the standard deviation of replicate instrumental measurements of spiked blanks.

(d) That region of the calibration where there is a significant change in sensitivity, i.e., a break in the slope of the calibration.

(e) Instrumental limitations.

(f) Previously determined MDL.

It is recognized that the experience of the analyst is important to this process. However, the analyst should include some or all of the above considerations in the initial estimate of the MDL.

(2) Determine the initial MDL

Note: The Initial MDL is used when the laboratory does not have adequate data to perform the Ongoing Annual Verification specified in Section (4), typically when a new method is implemented or if a method was rarely used in the last 24 months.

(a) Select a spiking level, typically 2 – 10 times the estimated MDL in Section 1. Spiking levels in excess of 10 times the estimated detection limit may be required for analytes with very poor recovery (e.g., for an analyte with 10% recovery, spiked at 100 micrograms/L, with mean recovery of 10 micrograms/L; the calculated MDL may be around 3 micrograms/L. Therefore, in this example, the spiking level would be 33 times the MDL, but spiking lower may result in no recovery at all).

(b) Process a minimum of seven spiked samples and seven method blank samples through all steps of the method. The samples used for the MDL must be prepared in at least three batches on three separate calendar dates and analyzed on three separate calendar dates. (Preparation and analysis may be on the same day.) Existing data may be used, if compliant with the requirements for at least three batches, and generated within the last twenty four months. The most recent available data for method blanks and spiked samples must be used. Statistical outlier removal procedures should not be used to remove data for the initial MDL determination, since the total number of observations is small and the purpose of the MDL procedure is to capture routine method variability. However, documented instances of gross failures (e.g., instrument malfunctions, mislabeled samples, cracked vials) may be excluded from the calculations,

provided that at least seven spiked samples and seven method blanks are available. (The rationale for removal of specific outliers must be documented and maintained on file with the results of the MDL determination.)

(i) If there are multiple instruments that will be assigned the same MDL, then the sample analyses must be distributed across all of the instruments.

(ii) A minimum of two spiked samples and two method blank samples prepared and analyzed on different calendar dates is required for each instrument. Each analytical batch may contain one spiked sample and one method blank sample run together. A spiked sample and a method blank sample may be analyzed in the same batch, but are not required to be.

(iii) The same prepared extract may be analyzed on multiple instruments so long as the minimum requirement of seven preparations in at least three separate batches is maintained.

(c) Evaluate the spiking level: If any result for any individual analyte from the spiked samples does not meet the method qualitative identification criteria or does not provide a numerical result greater than zero, then repeat the spiked samples at a higher concentration. (Qualitative identification criteria are a set of rules or guidelines for establishing the identification or presence of an analyte using a measurement system. Qualitative identification does not ensure that quantitative results for the analyte can be obtained.)

(d) Make all computations as specified in the analytical method and express the final results in the method-specified reporting units.

(i) Calculate the sample standard deviation (S) of the replicate spiked sample measurements and the sample standard deviation of the replicate method blank measurements from all instruments to which the MDL will be applied.

(ii) Compute the MDL_s (the MDL based on spiked samples) as follows:

$$MDL_S = t_{(n-1,\ 1-\alpha = 0.99)} S_S$$

Where:

MDL_S = the method detection limit based on spiked samples

$t_{(n-1,\ 1-\alpha = 0.99)}$ = the Student t-value appropriate for a single-tailed 99th percentile t statistic and a standard deviation estimate with n-1 degrees of freedom. See Table1.

S_S = sample standard deviation of the replicate spiked sample analyses.

(iii) Compute the MDL_b (the MDL based on method blanks) as follows:

(A) If none of the method blanks give numerical results for an individual analyte, the MDL_b does not apply. A numerical result includes both positive and negative results, including results below the current MDL, but not results of "ND" (not detected) commonly observed when a peak is not present in chromatographic analysis.

(B) If some (but not all) of the method blanks for an individual analyte give numerical results, set the MDL_b equal to the highest method blank result. If more than 100 method blanks are available, set MDL_b to the level that is no less than the 99th percentile of the method blank results. For "n" method blanks where $n \geq 100$, sort the method blanks in rank order. The (n * 0.99) ranked method blank result (round to the nearest whole number) is the MDL_b. For example, to find MDL_b from a set of 164 method blanks where the highest ranked method blank results are … 1.5, 1.7, 1.9, 5.0, and 10, then 164 x 0.99 = 162.36 which rounds to the 162nd method blank result. Therefore, MDL_b is 1.9 for n =164 (10 is the 164th result, 5.0 is the 163rd result, and
1.9 is the 162nd result). Alternatively, you may use spreadsheet algorithms to calculate the 99th percentile to interpolate between the ranks more precisely.

(C) If all of the method blanks for an individual analyte give numerical results, then calculate the MDL_b as:

$$MDL_b = \bar{X} + t_{(n-1,1-\alpha=0.99)}S_b$$

Where:

MDL_b = the MDL based on method blanks

$\bar{X}$ = mean of the method blanks results (use zero in place of the mean if the mean is negative)

$t_{(n-1,1-\alpha=0.99)}$ = the Student's t-value appropriate for the single-tailed 99th percentile t statistic and a standard deviation estimate with n-1 degrees of freedom. See Table 1.

S_b = sample standard deviation of the replicate method blank sample analyses.

Note: If 100 or more method blanks are available, as an option, MDL_b may be set to the concentration that is greater than or equal to the 99th percentile of the method blank results, as described in Section (2)(d)(iii)(B).

(e) Select the greater of MDL_s or MDL_b as the initial MDL.

(3) Ongoing Data Collection

(a) During any quarter in which samples are being analyzed, prepare and analyze a minimum of two spiked samples on each instrument, in separate batches, using the same spiking concentration used in Section 2. If any analytes are repeatedly not detected in the quarterly spiked sample analyses, or do not meet the qualitative identification criteria of the method (see Section 2(c) of this procedure), then this is an indication that the spiking level is not high enough and should be adjusted upward. Note that it is not necessary to analyze additional method blanks together with the spiked samples, the method blank population should include all of the routine method blanks analyzed with each batch during the course of sample analysis.

(b) Ensure that at least seven spiked samples and seven method blanks are completed for the annual verification. If only one instrument is in use, a minimum of seven spikes are still required, but they may be drawn from the last two years of data collection.

(c) At least once per year, re-evaluate the spiking level.

(i) If more than 5% of the spiked samples do not return positive numerical results that meet all method qualitative identification criteria, then the spiking level must be increased and the initial MDL re-determined following the procedure in Section 2.

(d) If the method is altered in a way that can be reasonably expected to change its sensitivity, then re- determine the initial MDL according to Section 2, and the restart the ongoing data collection.

(e) If a new instrument is added to a group of instruments whose data are being pooled to create a single MDL, analyze a minimum of two spiked replicates and two method blank replicates on the new instrument. If both method blank results are below the existing MDL, then the existing MDL_b is validated. Combine the new spiked sample results to the existing spiked sample results and recalculate the MDL_s as in Section 4. If the recalculated MDL_s does not vary by more than the factor specified in Section 4(f) of this procedure, then the existing MDL_s is validated. If either of these two conditions is not met, then calculate a new MDL following the instructions in Section 2.

(4) Ongoing Annual Verification

(a) At least once every thirteen months, re-calculate MDL_s and MDL_b from the collected spiked samples and method blank results using the equations in

Section 2.

(b) Include data generated within the last twenty four months, but only data with the same spiking level. Only documented instances of gross failures (e.g., instrument malfunctions, mislabeled samples, cracked vials) may be excluded from the calculations. (The rationale for removal of specific outliers must be documented and maintained on file with the results of the MDL determination.) If the laboratory believes the sensitivity of the method has changed significantly, then the most recent data available may be used, maintaining compliance with the requirement for at least seven replicates in three separate batches on three separate days (see Section 2b).

(c) Include the initial MDL spiked samples, if the data were generated within twenty four months.

(d) Only use data associated with acceptable calibrations and batch QC. Include all routine data, with the exception of batches that are rejected and the associated samples reanalyzed. If the method has been altered in a way that can be reasonably expected to change its sensitivity, then use only data collected after the change.

(e) Ideally, use all method blank results from the last 24 months for the MDL_b calculation. The laboratory has the option to use only the last six months of method blank data or the fifty most recent method blanks, whichever criteria yields the greater number of method blanks.

(f) The verified MDL is the greater of the MDL_s or MDL_b. If the verified MDL is within 0.5 to 2.0 times the existing MDL, and fewer than 3% of the method blank results (for the individual analyte) have numerical results above the existing MDL, then the existing MDL may optionally be left unchanged. Otherwise, adjust the MDL to the new verification MDL. (The range of 0.5 to 2.0 approximates the 95th percentile confidence interval for the initial MDL determination with six degrees of freedom.)

ADDENDUM: DETERMINATION OF THE MDL FOR A SPECIFIC MATRIX

The MDL may be determined in a specific sample matrix as well as in reagent water.

(1) Analyze the sample matrix to determine the native (background) concentration of the analyte(s) of interest.

(2) If the response for the native concentration is at a signal-to-noise ratio of approximately 5-20, determine the matrix-specific MDL according to Section 2 but without spiking additional analyte.

(3) Calculate MDL_b using the method blanks, not the sample matrix.

(4) If the signal-to-noise ratio is less than 5, then the analyte(s) should be spiked into the sample matrix to obtain a concentration that will give results with a signal-to-noise ratio of approximately 10-20.

If the analytes(s) of interest have signal-to-noise ratio(s) greater than approximately 20, then the resulting MDL is likely to be biased high.

Documentation

The analytical method used must be specifically identified by number or title and the MDL for each analyte expressed in the appropriate method reporting units. Data and calculations used to establish the MDL must be able to be reconstructed upon request. The sample matrix used to determine the MDL must also be identified with MDL value. Document the mean spiked and recovered analyte levels with the MDL. The rationale for removal of outlier results, if any, must be documented and maintained on file with the results of the MDL determination.

Table 1: Single-Tailed 99th Percentile *t* Statistic

Number of	Degrees of freedom	$t_{(n-1, 0.99)}$
7	6	3.143
8	7	2.998
9	8	2.896
10	9	2.821
11	10	2.764
16	15	2.602
21	20	2.528
26	25	2.485
31	30	2.457
32	31	2.453
48	47	2.408
50	49	2.405
61	60	2.390
64	63	2.387
80	79	2.374
96	95	2.366
100	99	2.365

Appendix H

Microbiology

H.1 Method Validation

In general, VL uses established, validated reference methods for its microbiological procedures. Should VL need to validate alternate methods (not reference methods), validation includes demonstration of accuracy, precision and selectivity (sensitivity).

Accuracy – Use at least one (1) known pure reference culture at the anticipated environmental conditions, and compare the method results to that of the reference method

Precision – Perform at least ten (10) replicate analyses with both the proposed and reference method, using the target microorganisms of choice. The results shall show that the methods are not statistically different.

Selectivity (Sensitivity) – Verify all responses in at least ten (10) samples using mixed cultures that include the target organism(s), and at varying concentrations (microbial identification testing or equivalent processes may be used). Calculate the number of false positive and false negative results.

The laboratory will compare the results of these tests with the data quality objectives stated by the client, if applicable. The data from the above tests must be equal to or better than the stated DQOs. A statement comparing the client DQOs against the above-mentioned QC measures will be included in the validation records.

The laboratory will confirm the validation by participating in a proficiency test program with acceptable results and retain the records of the validation for five years past the date of last use of the method.

H.2 Demonstration of Capability (DOC)

Demonstration of Capability: A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision.

Before reporting any data with a given method, a satisfactory initial DOC (IDOC) is performed. Thereafter, each analyst will demonstrate continuing proficiency through the procedures outlined in Ongoing Demonstration of Capability.

a) Initial Demonstration of Capability (IDOC)

An IDOC is performed:

- before using any method;
- each time there is a change in instrument type, personnel or method; and
- if the laboratory or analysts has not performed the method in a twelve-month period.

The IDOC(s) for each analyst is documented in the analyst training file. The document identifies the analyst(s) involved in preparation and/or analysis; matrix; analyte(s), class of analyte(s), or measured parameter(s); the method(s) performed; the laboratory-specific SOP used for analysis (including revision number); the date(s) of analysis; and a summary of the results.

All raw data, preparation records, and calculations for each DOC are retained and are available for review.

When a method specifies an IDOC procedure to be followed, that procedure will be used. If no procedure is specified the laboratory uses its own procedure, which is documented below.

Microbiological methods used by VL are a combination of qualitative (presence/absence) and quantitative (MPN) methods. Specifically, products are used that indicate the presence or absence of certain organisms (e.g., *E. coli*) and the numbers of those organisms present based on reactions among a specific number of containers (wells). Products used by VL are primarily supplied by the company named IDEXX.

- Each analyst is required to analyze samples with concentrations of prepared positive and negative pure cultures of the target organisms and other organisms expected in routine samples. The selection of organisms should include positive responses to the selective media, negative responses to the selective media, and no detectable response to the selective media. (e.g., for fecal coliforms, the organisms chosen are *E. coli, K. pneumoniae,* and *P. aeruginosa*). VL uses the product Quanti-Cult™ for this part of the IDOC. Expected results are included with this IDEXX product

- Each analyst is required to participate in a blind study, performance testing (PT) samples, which is sponsored by a State-approved PT provider. Successful completion of two consecutive PT samples, at least 15 days apart, is required.

- If there is a failure in either of the above elements of the IDOC, the analyst should locate and correct the source of the failure and repeat the required procedure.

- Continued failure may indicate a problem with the measurement system and/or its components, which will require a comprehensive review of all aspects of the procedure (including equipment, media and containers) to determine the source of the failure. Once the source of the problem has been corrected, procedures will be repeated by the analyst until success is achieved.

Ongoing Demonstration of Capability

After the demonstration of capability is completed, on-going proficiency is maintained and demonstrated at least annually. Each analyst is expected to consistently meet the QC requirements of the method, the laboratory SOP, client requirements and/or the TNI standard. Ongoing DOCS are documented in the analyst's training file, and all records related to the demonstration are retained.

The laboratory uses the following procedure to demonstrate ongoing DOC:

- QC samples (such as Quanti-Cult™) may be used with each batch of samples
- The analysis of real-world samples with results within a predefined acceptance criteria may be used.
- Semi-annual PT samples are to be analyzed.

H.3 Calibration

Section 23.2.2 includes information on calibration of support equipment. This section covers calibration of equipment unique to microbiological methods.

H.3.1 Specific Equipment Requirements

- Autoclave (steam sterilizer) – VL uses the autoclave only for sterilization of biohazardous materials prior to disposal.

  The laboratory initially evaluates the performance of each autoclave before first use by establishing its functional properties and performance by verifying heat distribution characteristics with respect to typical uses.

  Autoclaves meet specified temperature of 121°C and 15 psi.

With each use:

- The laboratory ensures that the sterilization temperature is reached by using a maximum registering thermometer.
- The laboratory records date, contents, maximum temperature reached, pressure, time in sterilization mode, total run time (may be recorded as time in and time out) and analyst's initials.
- Biohazardous materials are autoclaved for 30 minutes at 121°C, 15 psi. Larger loads may require more time
- Temperature sensitive tape is used with the contents of each autoclave run to indicate that the autoclave contents have been processed.

On a monthly basis, when the autoclave is in use for making media, the laboratory verifies that the autoclave is effectively sterilizing the contents by using a vial or ampoule of *Bacillus stearothermophilus* spores. After the sterilization process, the vial of spores is incubated at the appropriate temperature to ensure that they are no longer viable.

The autoclave mechanical timing device is checked quarterly against a stopwatch and the actual time elapsed documented.

Autoclave maintenance, completed by VL staff or a contractor, is performed annually. The activities include a pressure check and verification of temperature device.

- Water Baths and Incubators
  The laboratory initially establishes the uniformity of temperature distribution in incubators and water baths through the use of NIST-certified thermometers in multiple locations throughout the incubator or water bath.

  On each day of use, the temperature of incubators and water baths is recorded twice a day, at least four hours apart.

Appendix I – Forms

Corrective Action Form
Chain of Custody Form
Cooler/Sample Receipt Form
Signature Verification Form

VERITAS LABORATORIES
LAB ID #NV00918
CORRECTIVE ACTION FORM

Date: _____
Veritas Lab/Sample ID: _____
Batch ID: _____
Analyst: _____

Check box below, if applicable:

	Surrogate Recovery Failed Acceptance Criteria
	LCS Recovery Failed Acceptance Criteria
	Method Blank Contaminated
	ICV/CCV Recovery Failed Acceptance Criteria
	MS/MSD Recovery Failed Acceptance Criteria
	MS/MSD Recovery Failed RPD Acceptance Criteria
	Other:

Describe the Out of Control Event/Situation:

_____
_____
_____
_____
_____
_____

Explanation of Probable Cause:

_____
_____
_____
_____
_____
_____

Action Taken to Correct and to Prevent Further Occurrence:

_____
_____
_____
_____
_____
_____

Analyst: _____ Date: _____
Laboratory Director: _____ Date: _____
Technical Director: _____ Date: _____

Property of Veritas Laboratories

Veritas Laboratories
Truth in Quality, Truth in Service
6245 Harrison Drive, Suite 4, Las Vegas, NV 89120
(702) 321-8315 Phone
(702) 597-2098 Fax
Email: veritaslabs@msn.com

Veritas Lab Order ID: _____

Company:	Telephone:
Address:	Fax:
	Email:
	Project Name/Project Number:
Attention:	
Invoice To:	
Sampled By:	P.O. Number:

Client Sample Identification	Veritas Sample Identification	Date Sampled	Time Sampled	Com-posite	Grab	Matrix Code[1]	Total # of Containers	Preservation Code[2]	Container Code[3]

ATTESTATION OF AUTHORITY
By signing this Chain of Custody, the sampler attests to the validity and authenticity of submitted sample(s). Sampler is aware that tampering with or intentionally mislabeling the sample(s) location, date, or time of collection may be considered fraud and subject to legal action.

Comments

All Data Reported on a Wet-Weight Basis Unless Otherwise Specified

Relinquished by: (Signature)	Date/Time:	Turnaround Time:	[1]Matrix Code	[2]Preservation Code	[3]Container Code
Received by: (Signature)	Date/Time:	____ Same Day ____ 1 Day ____ 2 Days ____ 3 Days ____ 5 Days (Normal) ____ Other	A = Air DW = Drinking Water GW = Groundwater O = Other OL = Organic Liquid S = Soil/Solid SL = Sludge W = Wipe WW = Wastewater	H = HCL I = Iced N = HNO_3 NO = None O = Other S = H_2SO_4 T = $Na_2S_2O_3$ X = NaOH Z = ZnAc	A = Amber G = Glass O = Other P = Plastic ST = Sterile T = Tube TB = Tedlar Bag V = VOA Vial W = Wipe
Relinquished by: (Signature)	Date/Time:				
Received by: (Signature)	Date/Time:	_____ Date Needed			

For Lab Use Only
Received in Good Condition? Yes/No
Custody Seals? Yes/No
Samples Received On Ice? Yes/No
Temperature _____ °C

By signing this Chain of Custody, the Client Agrees to Veritas Laboratories' Published Standard Terms and Conditions.

CHAIN OF CUSTODY

Page _____ of _____

To Reorder call Creative Digital Printing (702) 837-9009 • Form No. 75760

WORK ORDER

V24K286

Printed: 12/1/2024 3:52:39PM

Veritas Laboratories

Client	OGI Environmental	**Project Manager**	Bruce Cunningham
Project	New Image Dry Cleaners	**Project Number**	2nd Semi-Annual (Nov.), 2024

Report To
OGI Environmental
Rob Thompson
7260 W. Azure Drive, #140-361
Las Vegas, NV 89130

Date Due	Dec-06-2024 17:00 (7 day TAT)		
Received By	Monica Lopez	Date Received	Nov-27-2024 14:07
Logged In By	Monica Lopez	Date Logged In	Nov-27-2024 17:02

Samples Received at: 1.0°C

Custody Seals?	No	Received On Ice?	No	Preservation Rqd: Metals, TOC, TPH, Ammonia, etc.?	No
COC Signed When Relinquished/Received?	No	Temperature In Compliance?	No	If Preserved With pH, Checked 7/12 At After Analysis?	No
Samples Name on COC?	No	COC Labels Agree?	No	Matrix: Samples Are Preservative?	No
Proper & Intact Container Sufficient Volume?	No	Received Within Holding Time (Unless Field Parameters)?	No	Vials Samples Are Preservative?	No
Samples In Compliance? (Does Not Determine)	No	24/72 Hour Rush Surcharge? (Does Not Determine)	No		

Analysis	Due	TAT	Comments
V24K286-01 Outfall 1 - Composite [Aqueous] Sampled Nov-27-2024 08:50			
Zinc, Total 200.7	Dec-06-2024 17:00	7	
Total Suspended Solids (TSS) SM 2540-D	Dec-04-2024 17:00	7	
Total Dissolved Solids (TDS)	Dec-06-2024 17:00	7	
Phosphorus, Total, Method 6010C	Dec-06-2024 17:00	7	
Nickel, Total 200.7	Dec-06-2024 17:00	7	
Copper, Total 200.7	Dec-06-2024 17:00	7	
Chromium, Total 200.7	Dec-06-2024 17:00	7	
Biochemical Oxygen Demand (BOD)	Dec-06-2024 17:00	7	
Ammonia as N by SM 4500-NH3 B,C	Dec-06-2024 17:00	7	
V24K286-02 Outfall 1 - Grab [Aqueous] Sampled Nov-26-2024 05:32			
TPH by TNRCC 1005 Extended	Dec-06-2024 17:00	7	
pH, Field	Dec-04-2024 17:00	7	

TPH by TNRCC 1005 Extended
TPH Ranges: TNRCC 1005

Reviewed By: _____ Date: _____

Veritas Laboratories
Signature Verification
Date, Year

Name	Emp. #	Signature	Initials	Date

Appendix J – Laboratory Equipment and Instrumentation

Table J-1 Laboratory Support Equipment				
Name - Unique Identifier	**Description**	**Location**	**Brand/Model**	**Serial Number**
Water System 1	Type I Reagent Water System	Suite 1/Prep. Lab		
	a. RO/GAC Syst.	Suite 1/Prep. Lab	Flexeon LT-300	
	b. DI/TOC Syst.	Suite 1/Prep. Lab	MilliQ/Gradient A10	F6SN14372A
Acculab 1	Pan Balance	Suite 1/Prep. Lab	Acculab/LT-7200	80804509
Denver 1	Analytical Bal.	Suite 1/Prep. Lab	Denver Inst/M120	N0082579
Weights 1	Class 1 Weights	Suite 1/Prep. Lab	OHAUS	5502
Cond 1	Conductivity Meter	Suite 1/Prep. Lab	Thermo Orion/162A	014460
OVEN#1	Oven, Forced Air	Suite 1/Prep. Lab	SHELLAB/SM03	11030915
OVEN#2	Oven, Forced Air	Suite 1/Prep. Lab	VWR/1370FM	1101596
OVEN#3	Oven, Convection	Suite 1/Prep. Lab	RIS/Model D	621743
ICP 1	Inorg Refrigerator	Suite 1/Prep. Lab	Haier/HSW02C	2004660652
Turb 1	Turbidimeter	Suite 1/Prep. Lab	HANNA/HI88713	HI88173
DigiBlock01	Digi Block	Suite 1/Prep. Lab	SCP Science/ MSX030	7270421
DigiBlock01	Digi Control	Suite 1/Prep. Lab	SCP Key Pad/ KPX030	7180843
DigiBlock02	Digi Block	Suite 1/Prep. Lab	SCP Science/ MSX101	9462107
DigiBlock02	Digi Control	Suite 1/Prep. Lab	SCP/Key Pad/ KPX101	9434284
	Shaker Bath	Suite 1/Prep. Lab	LabLine/3540	0495-0158
O&G Machine #1	O&G Extractor	Suite 1/Prep. Lab	Horizon/3000XL	07-2092
	Ultasonic Bath	Suite 1/Prep. Lab	Branson/CPX2800H	BGG011694670B
	Vacuum Pump	Suite 1/Prep. Lab	Gast DAA-V716-EB	0616007425
Incubator 1	Incubator, Convect.	Suite 1/Micro	Fisher Sci/655D	1O0039
Incubator 2	Incubator, Convect.	Suite 1/Micro	Lab Line/Model 100	0N88012S
Incubator 3	Incubator, Convect.	Suite 1/Micro	Quincy Lab 12-140	112-3491
CO2 Incubator 1	CO2 Incubator	Suite 1/Micro	Allegiance	400878-50
BOD 1	BOD Incubator	Suite 1/Micro	VWR/2005	901801
BOD 2	BOD Incubator	Suite 1/Micro	VWR/2005	40200346
Water Bath 1	Water Bath, Stirring	Suite 1/Micro	LW Scientific	18020017
Sealer 1	QuantiTray® Sealer	Suite 1/Micro	IDEXX	11-353-07347
	Stirring Hot Plate	Suite 1/Micro	Corning/PC-420	30059901864

Table J-1 Laboratory Support Equipment				
Name - Unique Identifier	**Description**	**Location**	**Brand/Model**	**Serial Number**
BOD Analyzer 1	BOD Analyzer	Suite 1/Micro		
	a. Multimeter	Suite 1/Micro	YSI/4210-2W	21141550
	b. BOD Probe	Suite 1/Micro	YSI/PROoBOD	626492
	Vortex Mixer	Suite 1/Micro	Fisher Scientific	100722014
	UV Light	Suite 1/Micro	Spectroline/EA160	1832207
	UV Light	Suite 1/Micro	Spectroline/EA160	1342555
	Quebec Colony Ctr	Suite 1/Micro	Reichert/3325	01599-0207
MICRO#1	Samples Refrig.	Suite 1/Micro	GE/SMR04CASACS	ZG302438
MICRO#2	Plate Media Refrig.	Suite 1/Micro	KMore/546.9149910	031121706
MICRO#3	Stand/Reag Refrig.	Suite 1/Micro	Tramont/80901102	112502950
	Vacuum Pump	Suite 1/Micro	DAA-V715	0207614836
LUSEAL	Discrete Analyzer	Suite 1/Inorg. Lab 2	SEAL AQ2+	090556
AUTOCLAVE1	Autoclave	Suite 1/Inorg. Lab 2	Pelton&Crane/OCM	83-68400
RECEIVING#2	Sample Refrig.	Suite 1/Inorg. Lab 2	ArticAir/R22CW10	31000651
LOW TEMP. #1	BOD Incubator	Suite 1/Inorg. Lab 2	Precision/Model 818	604041224
LOW TEMP. #2	BOD Incubator	Suite 1/Inorg. Lab 2	Precision/Model 818	604041223
CHILLY	Ice Maker	Suite 1/Inorg. Lab 2	Darby/DIM 1524W	010502320301222
TWISTER	Centrifuge	Suite 1/Warehouse	IEC/HN-SII	235519331
RECEIVING#1	VOC Sample Refrig.	Suite 1/Bottle Rm.	GE/TBX1459BBLW	RT737344
SUBCONTRACT. #1	Subcontacting Refrig.	Suite 1/Receiving	Insigna NS-CF26WH9	21L18W00810
Metttler1	Pan Balance	Suite 4/Org. Lab	Mettler	1116513612
LIZZY	GC/MS VOA-1	Suite 4/Org. Lab		
	a. GC	Suite 4/Org. Lab	Agilent/6890	US00004160
	b. MS	Suite 4/Org. Lab	Agilent/5972	3609A03405
	c. P&T Sample	Suite 4/Org. Lab	OI/4660	D547466578
	d. Autosampler	Suite 4/Org. Lab	OI/4552	14545
DAISY	GC/MS VOA-2	Suite 4/Org. Lab		
	a. GC	Suite 4/Org. Lab	HP/5890 II	2950A28299
	b. MS	Suite 4/Org. Lab	Agilent/5973	US42590529
	c. P&T Sample	Suite 4/Org. Lab	Tekmar/Velocity XPT	US05321002
	d. Autosampler	Suite 4/Org. Lab	Tekmar/Aquatech 70	US03161001
ELSA	GC/FID-1	Suite 4/ Org. Lab	Agilent/6890 Plus+	US00039879
	Zero Air Generator	Suite 4/ Org. Lab	Whatman/76-803	09055004
	Compressor	Suite 5/Storage	CA AT/10010DCAD	110822-001
BELLA	GC-FID-2	Suite 4/ Org. Lab	Agilent/6890 Plus+	DE00022306
ORG#1	VOC Sample Refrig	Suite 4/ Org. Lab	ArcticAir/R22CW12	WA43500351
ORG#2	VOC Standard Frezr	Suite 4/ Org. Lab	Emerson/CR500	011070476H
ORG#3	VOC Standard Ref	Suite 4/ Org. Lab	Emerson/CR500	011070476H

Table J-1 Laboratory Support Equipment				
Name - Unique Identifier	**Description**	**Location**	**Brand/Model**	**Serial Number**
ORG#4	TPH Sample Frezr	Suite 4/ Org. Lab	GE/FUM14DRARW	AH165938
TPH Extr. Hood	Fume Hood	Suite 4/ Org. Lab	HEMCO Corp./90405	H11-4396
BULLWINKLE	IC-1	Suite 4/Inorg Lab		
	a. Column Enc.	Suite 4/Inorg Lab	Dionex/LC20	99090028
	b. Grad. Pump	Suite 4/Inorg Lab	Dionex/GP50	99080572
	c. Cond. Det.	Suite 4/Inorg Lab	Dionex/CD25	05120716
	d. Autosampler	Suite 4/Inorg Lab	Dionex/AS40	96090280
BLAZE	pH Meter	Suite 4/Inorg. Lab	Orion 420A	039151
PROBE #1	pH/ISE Meter	Suite 4/Inorg. Lab	Denver Instr./225	K07175
Stirring Plate #1	Stirring Plate	Suite 4/Inorg. Lab	Corning/PC-410D	153416102139
Stirring Plate #2	Stirring/Hot Plate	Suite 4/Inorg. Lab	Fisher Sci./A325109	90N0042
Spec 1	Visible Spectro.	Suite 4/Inorg. Lab	Hach/DR4000U	01U0005406
Spec 2	Visible Spectro.	Suite 4/Inorg. Lab	Hach/DR2010	98110001116
IC#1	Standards Refrig.	Suite 4/Inorg. Lab	GE/SMR04DASBCS	FL608214
IC#2	Standards Refrig.	Suite 4/Inorg. Lab	Whirlpool/WH43S1E	14100491628
FLASH	Flame Photometer	Suite 4/Inorg. Lab	Cole Parmer	26522
BORRIS	ICP/OES-1	Suite 4/Metals Lab	Spectro/Genesis	4R0007
	a. Autosampler	Suite 4/Metals Lab	Cetac/ASX-520	020533A520
	b. Chiller	Suite 4/Metals Lab	Neslab/Merlin M33	10437013
NATASHA	Mercury Analyzer	Suite 4/Metals Lab	Teledyne-Leeman/M 760	US22195001
	a. Autosampler	Suite 4/Metals Lab	CETAC ASX-520	0813161A520

Veritas Laboratories
Signature Verification
December, 2024

Name	Emp. #	Signature	Initials	Date
Bruce G. Cunningham	01			
Stan Van Wagenen	02			
Katarzyna Sakowska	22			
David Faircloth	26			
Rosemary Paredes	30			
Monica Lopez	31			
Rita Alhwayek	32			
Donna Rouhani	33			

APPENDIX B

- Regulatory and Reporting Limits for Soil, Soil Vapor, and Groundwater

Semivolatile Organic Compounds							
Analyte	CAS No.	SRL (mg/kg)	SRL (ug/L)	RSL Resident Soil (mg/kg)	RSL Industrial Soil (mg/kg)	MCL (ug/L)	EPA Test Method
~Acenaphthene	83-32-9	5.7E +02	NA	3.5E +03	4.5E +04	NA	8270C SIM
~Acenaphthylene	208-96-8	NA	NA	NA	NA	NA	8270C SIM
~Anthracene	120-12-7	1.2E +04	NA	1.7E +04	2.3E +05	NA	8270C SIM
~Benz[a]anthracene	56-55-3	1.5E -01	NA	1.5E -01	2.9E +00	NA	8270C SIM
~Benzo[g,h,i]perylene	191-24-2	NA	NA	NA	NA	NA	8270C SIM
~Benzo[a]pyrene	50-32-8	1.5E -02	2.0E -01	1.5E -02	2.9E -01	2.0E -01	8270C SIM
~Benzo[b]fluoranthene	205-99-2	1.5E -01	NA	1.5E -01	2.9E +00	NA	8270C SIM
~Benzo[k]fluoranthene	207-08-9	1.5E +00	NA	1.5E +00	2.9E +01	NA	8270C SIM
~Chrysene	218-01-9	1.5E +01	NA	1.5E +01	2.9E +02	NA	8270C SIM
~Dibenz[a,h]anthracene	53-70-3	1.5E -02	NA	1.5E -02	2.9E -01	NA	8270C SIM
~Fluoranthene	206-44-0	2.3E +03	NA	2.3E +03	3.0E +04	NA	8270C SIM
~Fluorene	86-73-7	5.6E +02	NA	2.3E +03	3.0E +04	NA	8270C SIM
~Indeno[1,2,3-cd]pyrene	193-39-5	1.5E -01	NA	1.5E -01	2.9E +00	NA	8270C SIM
~Methylnaphthalene, 1-	90-12-0	2.2E +01	NA	1.7E +01	7.3E +01	NA	8270C SIM
~Methylnaphthalene, 2-	91-57-6	3.1E +02	NA	2.3E +02	3.0E +03	NA	8270C SIM
~Naphthalene	91-20-3	3.9E +00	NA	3.8E +00	1.7E +01	NA	8270C SIM
Phenanthrene	85-01-8	NA	NA	NA	NA	NA	8270C SIM
~Pyrene	129-00-0	1.7E +03	NA	1.7E +03	2.3E +04	NA	8270C SIM

mg/kg - milligrams per kilograms
ug/L - micrograms per liter
SRL - State Reporting Limits, January 2009
RSL - Regional Screening Levels Set by EPA Region 9, January 2015
MCL - Maximum Concentration Levels for Drinking Water Set by EPA

Polychlorinated Biphenyls (PCBs)					
Analyte	CAS No.	SRL (mg/kg)	RSL Residential Soil (mg/kg)	RSL Industrial Soil (mg/kg)	EPA Test Method
~Aroclor 1016	12674-11-2	3.9E+00	4.0E+00	3.0E+01	8082
~Aroclor 1221	11104-28-2	1.7E-01	1.5E-01	6.6E-01	8082
~Aroclor 1232	11141-16-5	1.7E-01	1.5E-01	6.6E-01	8082
~Aroclor 1242	53469-21-9	2.2E-01	2.4E-01	1.0E+00	8082
~Aroclor 1248	12672-29-6	2.2E-01	2.4E-01	1.0E+00	8082
~Aroclor 1254	11097-69-1	2.2E-01	2.4E-01	1.0E+00	8082
~Aroclor 1260	11096-82-5	2.2E-01	2.4E-01	1.0E+00	8082
~Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189)	39635-31-9	1.1E-01	1.2E-01	5.3E-01	8082
~Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167)	52663-72-6	1.1E-01	1.2E-01	5.3E-01	8082
~Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157)	69782-90-7	1.1E-01	1.2E-01	5.3E-01	8082
~Hexachlorobiphenyl, 2,3,3',4,4',5- (PCB 156)	38380-08-4	1.1E-01	1.2E-01	5.3E-01	8082
~Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169)	32774-16-6	1.1E-04	1.2E-04	5.3E-04	8082
~Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123)	65510-44-3	1.1E-01	1.2E-01	5.3E-01	8082
~Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118)	31508-00-6	1.1E-01	1.2E-01	5.3E-01	8082
~Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105)	32598-14-4	1.1E-01	1.2E-01	5.3E-01	8082
~Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114)	74472-37-0	1.1E-01	1.2E-01	5.3E-01	8082
~Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126)	57465-28-8	3.4E-05	3.7E-05	1.6E-04	8082

mg/kg - milligrams per kilograms
SRL - State Reporting Limits, January 2009
RSL - Regional Screening Levels Set by EPA Region 9, January 2015

METALS						
Analyte	CAS No.	SRL (mg/kg)	SRL (ug/L)	RSL Resident Soil (mg/kg)	RSL Industrial Soil (mg/kg)	MCL (ug/L)
Aluminum	7429-90-5	7.7E+04	NA	7.7E+04	1.1E+06	NA
Arsenic, Inorganic	7440-38-2	3.9E-01	1.0E+01	6.7E-01	3.0E+00	1.0E+01
Barium	7440-39-3	1.6E+03	2.0E+03	1.5E+04	2.2E+05	2.0E+03
Cadmium	7440-43-9	8.0E+00	5.0E+00	7.0+01	8.0+02	5.0E+00
Chromium(III), Insoluble Salts	16065-83-1	1.2E+05	NA	1.2E+05	1.8E+06	NA
Chromium(VI)	18540-29-9	3.8E+01	NA	3.0E-01	6.3E+00	NA
Chromium, Total	7440-47-3	3.8E+01	NA	NA	NA	1.0E+02
Cobalt	7440-48-4	2.3E+01	NA	2.3E+01	3.5E+02	NA
Copper	7440-50-8	3.1E+03	1.3E+03	3.1E+03	4.7E+04	1.3E+03
Fluoride	16984-48-8	4.7E+03	NA	3.1E+03	4.7E+04	NA
Lead Compounds						
~Lead acetate	301-04-2	NA	NA	1.9E+00	8.2E+00	NA
~Lead and Compounds	7439-92-1	4.0E+02	1.5E+01	4.0E+02	8.0E+02	1.5E+01
~Lead subacetate	1335-32-6	NA	NA	6.3E+01	2.7E+01	NA
~Tetraethyl Lead	78-00-2	6.1E-03	NA	6.2E-03	8.2E-02	NA
Manganese (Non-diet)	7439-96-5	1.8E+03	NA	1.8E+03	2.8E+04	NA
Mercury Compounds						
~Mercuric Chloride (and other Mercury salts)	7487-94-7	2.3E+01	NA	2.3E+01	3.5E+02	2.0E+00
~Mercury (elemental)	7439-97-6	6.7E+00	2.0E+00	9.4E+00	4.0E+01	2.0E+00
~Methyl Mercury	22967-92-6	7.8E+00	NA	7.8E+00	1.2E+02	NA
Nitrate	14797-55-8	1.3E+05	1.0E+04	1.3E+05	1.9E+06	1.0E+04
Nitrite	14797-65-0	7.8E+03	1.0E+03	7.8E+03	1.2E+05	1.0E+03
Selenium	7782-49-2	5.0E+00	5.0E+01	3.9E+02	5.8E+03	5.0E+01
Silver	7440-22-4	3.4E+01	NA	3.9E+02	5.8E+03	NA
Zinc Phosphide	1314-84-7	2.3E+01	NA	2.3E+01	3.5E+02	NA
Zinc and Compounds	7440-66-6	NA	NA	2.3E+04	3.5E+05	NA

mg/kg - milligrams per kilograms
ug/L - micrograms per liter
SRL - State Reporting Limit, January 2009
RSL - Regional Screening Levels Set by EPA Region 9, January 2015
MCL - Maximum Concentration Levels for Drinking Water Set by EPA
Test Method will bee in The EPA Series 6000 and 7000

EPA Office of Solid Waste and Emergency Response (OSWER) Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils

CAS No.	Chemical	Target Indoor Air Concentration to Satisfy Both the Prescribed Risk Level and the Target Hazard Index [R=10-6, HI=1) Ctarget		Target Shallow Gas Concentration Corresponding to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor=0.1 Csoil-gas		Target Deep Soil Gas Concentration Corresponding to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor=0.01 Csoil-gas		Target Groundwater Concentration Corresponding to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor = 0.001 and Partitioning Across the Water Table Obeys Henry's Law Cgw (ug/L)
		(ug/m3)	(ppbv)	(ug/m3)	(ppbv)	(ug/m3)	(ppbv)	
83329	Acenaphthene	2.1E+02	3.3E+01	2.1E+03	3.3E+02	2.1E+04	3.3E+03	**
75070	Acetaldehyde	1.1E+00	6.1E-01	1.1E+01	6.1E+00	1.1E+02	6.1E+01	3.4E+02
67641	Acetone	3.5E+02	1.5E+02	3.5E+03	1.5E+03	3.5E+04	1.5E+04	2.2E+05
75058	Acetonitrile	6.0E+01	3.6E+01	6.0E+02	3.6E+02	6.0E+03	3.6E+03	4.2E+04
98862	Acetophenone	3.5E+02	7.1E+01	3.5E+03	7.1E+02	3.5E+04	7.1E+03	8.0E+05
107028	Acrolein	2.0E-02	8.7E-03	2.0E-01	8.7E-02	2.0E+00	8.7E-01	4.0E+00
107131	Acrylonitrile	3.6E-02	1.7E-02	3.6E-01	1.7E-01	3.6E+00	1.7E+00	8.5E+00
309002	Aldrin	5.0E-04	3.3E-05	5.0E-03	3.3E-04	5.0E-02	3.3E-03	7.1E-02
319846	alpha-HCH (alpha-BHC)	1.4E-03	1.1E-04	1.4E-02	1.1E-03	1.4E-01	1.1E-02	3.1E+00
100527	Benzaldehyde	3.5E+02	8.1E+01	3.5E+03	8.1E+02	3.5E+04	8.1E+03	3.6E+05
71432	Benzene	3.1E-01	9.8E-02	3.1E+00	9.8E-01	3.1E+01	9.8E+00	5.0E+00 †
205992	Benzo(b)fluoranthene	1.2E-02	1.1E-03	1.2E-01	1.1E-02	1.2E+00	1.1E-01	**
100447	Benzylchloride	5.0E-02	9.7E-03	5.0E-01	9.7E-02	5.0E+00	9.7E-01	3.0E+00
91587	beta-Chloronaphthalene	2.8E+02	4.2E+01	2.8E+03	4.2E+02	2.8E+04	4.2E+03	**
92524	Biphenyl	1.8E+02	2.8E+01	1.8E+03	2.8E+02	1.8E+04	2.8E+03	**
111444	Bis(2-chloroethyl)ether	7.4E-03	1.3E-03	7.4E-02	1.3E-02	7.4E-01	1.3E-01	1.0E+01
108601	Bis(2-chloroisopropyl)ether	2.4E-01	3.5E-02	2.4E+00	3.5E-01	2.4E+01	3.5E+00	5.1E+01
542881	Bis(chloromethyl)ether	3.9E-05	8.4E-06	3.9E-04	8.4E-05	3.9E-03	8.4E-04	4.5E-03
75274	Bromodichloromethane	1.4E-01	2.1E-02	1.4E+00	2.1E-01	1.4E+01	2.1E+00	2.1E+00
75252	Bromoform	2.2E+00	2.1E-01	2.2E+01	2.1E+00	2.2E+02	2.1E+01	8.3E-03
106990	1,3-Butadiene	8.7E-03	3.9E-03	8.7E-02	3.9E-02	8.7E-01	3.9E-01	2.9E-03
75150	Carbon disulfide	7.0E+02	2.2E+02	7.0E+03	2.2E+03	7.0E+04	2.2E+04	5.6E+02
56235	Carbon tetrachloride	1.6E-01	2.6E-02	1.6E+00	2.6E-01	1.6E+01	2.6E+00	5.0E+00 †
57749+14:26133:26	Chlordane	2.4E-02	1.5E-03	2.4E-01	1.5E-02	2.4E+00	1.5E-01	1.2E+01
126998	2-Chloro-1,3-butadiene (chloroprene)	7.0E+00	1.9E+00	7.0E+01	1.9E+01	7.0E+02	1.9E+02	1.4E+01
108907	Chlorobenzene	6.0E+01	1.3E+01	6.0E+02	1.3E+02	6.0E+03	1.3E+03	3.9E+02
109693	1-Chlorobutane	1.4E+03	3.7E+02	1.4E+04	3.7E+03	1.4E+05	3.7E+04	2.0E+03
124481	Chlorodibromomethane	1.0E-01	1.2E-02	1.0E+00	1.2E-01	1.0E+01	1.2E+00	3.2E+00
75456	Chlorodifluoromethane	5.0E+04	1.4E+04	5.0E+05	1.4E+05	**	**	**
75003	Chloroethane (ethyl chloride)	1.0E+04	3.8E+03	1.0E+05	3.8E+04	1.0E+06	3.8E+05	2.8E+04
67663	Chloroform	1.1E-01	2.2E-02	1.1E+00	2.2E-01	1.1E+01	2.2E+00	8.0E+01 †
95578	2-Chlorophenol	1.8E+01	3.3E+00	1.8E+02	3.3E+01	1.8E+03	3.3E+02	1.1E+03
75296	2-Chloropropane	1.0E+02	3.2E+01	1.0E+03	3.2E+02	1.0E+04	3.2E+03	1.7E+02
218019	Chrysene	1.2E+00	1.2E-01	1.2E+01	1.2E+00	**	**	**
156592	cis-1,2-Dichloroethylene	3.5E+01	8.8E+00	3.5E+02	8.8E+01	3.5E+03	8.8E+02	2.1E+02
123739	Crotonaldehyde (2-butenal)	4.5E-03	1.6E-03	4.5E-02	1.6E-02	4.5E-01	1.6E-01	5.6E+00
98828	Cumene	4.0E+02	8.1E+01	4.0E+03	8.1E+02	4.0E+04	8.1E+03	8.4E+00

CAS No.	Chemical	Target Indoor Air Concentration to Satisfy Both the Prescribed Risk Level and the Target Hazard Index [R=10-6, HI=1) Ctarget		Target Shallow Gas Concentration Corresponding to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor=0.1 Csoil-gas		Target Deep Soil Gas Concentration Corresponding to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor=0.01 Csoil-gas		Target Groundwater Concentration Corresponding to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor = 0.001 and Partitioning Across the Water Table Obeys Henry's Law Cgw (ug/L)
		(ug/m3)	(ppbv)	(ug/m3)	(ppbv)	(ug/m3)	(ppbv)	
72559	DDE	2.5E-02	1.9E-03	2.5E-01	1.9E-02	2.5E+00	1.9E-01	2.9E+01
132649	Dibenzofuran	1.4E+01	2.0E+00	1.4E+02	2.0E+01	1.4E+03	2.0E+02	**
96128	1,2-Dibromo-3-chloropropane	2.0E-01	2.1E-02	2.0E+00	2.1E-01	2.0E+01	2.1E+00	3.3E+01
106934	1,2-Dibromoethane (ethylene dibromide)	1.1E-02	1.4E-03	1.1E-01	1.4E-02	1.1E+00	1.4E-01	3.6E-01
541731	1,3-Dichlorobenzene	1.1E+02	1.7E+01	1.1E+03	1.7E+02	1.1E+04	1.7E+03	8.3E+02
95501	1,2-Dichlorobenzene	2.0E+02	3.3E+01	2.0E+03	3.3E+02	2.0E+04	3.3E+03	2.6E+03
106467	1,4-Dichlorobenzene	8.0E+02	1.3E+02	8.0E+03	1.3E+03	8.0E+04	1.3E+04	8.2E+03
75718	Dichlorodifluoromethane	2.0E+02	4.0E+01	2.0E+03	4.0E+02	2.0E+04	4.0E+03	1.4E+01
75343	1,1-Dichloroethane	5.0E+02	1.2E+02	5.0E+03	1.2E+03	5.0E+04	1.2E+04	2.2E+03
107062	1,2-Dichloroethane	9.4E-02	2.3E-02	9.4E-01	2.3E-01	9.4E+00	2.3E+00	5.0E+00 †
75354	1,1-Dichloroethylene	2.0E+02	5.0E+01	2.0E+03	5.0E+02	2.0E+04	5.0E+03	1.9E+02
78875	1,2-Dichloropropane	4.0E+00	8.7E-01	4.0E+01	8.7E+00	4.0E+02	8.7E+01	3.5E+01
542756	1,3-Dichloropropene	6.1E-01	1.3E-01	6.1E+00	1.3E+00	6.1E+01	1.3E+01	8.4E-01
60571	Dieldrin	5.3E-04	3.4E-05	5.3E-03	3.4E-04	5.3E-02	3.4E-03	8.6E-01
115297	Endosulfan	2.1E+01	1.3E+00	2.1E+02	1.3E+01	**	**	**
106898	Epichlorohydrin	1.0E+00	2.6E-01	1.0E+01	2.6E+00	1.0E+02	2.6E+01	8.0E+02
60297	Ethyl ether	7.0E+02	2.3E+02	7.0E+03	2.3E+03	7.0E+04	2.3E+04	5.2E+02
141786	Ethylacetate	3.2E+03	8.7E+02	3.2E+04	8.7E+03	3.2E+05	8.7E+04	5.6E+05
100414	Ethylbenzene	2.2E+00	5.1E-01	2.2E+01	5.1E+00	2.2E+02	5.1E+01	7.0E+02 †
75218	Ethylene oxide	2.4E-02	1.4E-02	2.4E-01	1.4E-01	2.4E+00	1.4E+00	1.1E+00
97632	Ethylmethacrylate	3.2E+02	6.8E+01	3.2E+03	6.8E+02	3.2E+04	6.8E+03	9.1E+03
86737	Fluorene	1.4E+02	2.1E+01	1.4E+03	2.1E+02	**	**	**
110009	Furan	3.5E+00	1.3E+00	3.5E+01	1.3E+01	3.5E+02	1.3E+02	1.6E+01
58899	gamma-HCH (Lindane)	6.6E-03	5.5E-04	6.6E-02	5.5E-03	6.6E-01	5.5E-02	1.1E+01
76448	Heptachlor	1.9E-03	1.2E-04	1.9E-02	1.2E-03	1.9E-01	1.2E-02	4.0E-01 †
87683	Hexachloro-1,3-butadiene	1.1E-01	1.0E-02	1.1E+00	1.0E-01	1.1E+01	1.0E+00	3.3E-01
118741	Hexachlorobenzene	5.3E-03	4.5E-04	5.3E-02	4.5E-03	5.3E-01	4.5E-02	1.0E+00 †
77474	Hexachlorocyclopentadiene	2.0E-01	1.8E-02	2.0E+00	1.8E-01	2.0E+01	1.8E+00	5.0E+01 †
67721	Hexachloroethane	6.1E-01	6.3E-02	6.1E+00	6.3E-01	6.1E+01	6.3E+00	3.8E+00
110543	Hexane	2.0E+02	5.7E+01	2.0E+03	5.7E+02	2.0E+04	5.7E+03	2.9E+00
74908	Hydrogen cyanide	3.0E+00	2.7E+00	3.0E+01	2.7E+01	3.0E+02	2.7E+02	5.5E+02
78831	Isobutanol	1.1E+03	3.5E+02	1.1E+04	3.5E+03	1.1E+05	3.5E+04	2.2E+06
7439976	Mercury (elemental)	3.0E-01	3.7E-02	3.0E+00	3.7E-01	3.0E+01	3.7E+00	6.8E-01
126987	Methacrylonitrile	7.0E-01	2.6E-01	7.0E+00	2.6E+00	7.0E+01	2.6E+01	6.9E+01
72435	Methoxychlor	1.8E+01	1.2E+00	**	**	**	**	**
79209	Methyl acetate	3.5E+03	1.2E+03	3.5E+04	1.2E+04	3.5E+05	1.2E+05	7.2E+05
96333	Methyl acrylate	1.1E+02	3.0E+01	1.1E+03	3.0E+02	1.1E+04	3.0E+03	1.4E+04
74839	Methyl bromide	5.0E+00	1.3E+00	5.0E+01	1.3E+01	5.0E+02	1.3E+02	2.0E+01
74873	Methyl chloride (chloromethane)	2.4E+00	1.2E+00	2.4E+01	1.2E+01	2.4E+02	1.2E+02	6.7E+00
108872	Methylcyclohexane	3.0E+03	7.5E+02	3.0E+04	7.5E+03	3.0E+05	7.5E+04	7.1E+02

CAS No.	Chemical	Target Indoor Air Concentration to Satisfy Both the Prescribed Risk Level and the Target Hazard Index [R=10-6, HI=1) Ctarget		Target Shallow Gas Concentration Corresponding to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor=0.1 Csoil-gas		Target Deep Soil Gas Concentration Corresponding to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor=0.01 Csoil-gas		Target Groundwater Concentration Corresponding to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor = 0.001 and Partitioning Across the Water Table Obeys Henry's Law Cgw (ug/L)
		(ug/m3)	(ppbv)	(ug/m3)	(ppbv)	(ug/m3)	(ppbv)	
74953	Methylene bromide	3.5E+01	4.9E+00	3.5E+02	4.9E+01	3.5E+03	4.9E+02	9.9E+02
75092	Methylene chloride	5.2E+00	1.5E+00	5.2E+01	1.5E+01	5.2E+02	1.5E+02	5.8E+01
78933	Methylethylketone (2-butanone)	1.0E+03	3.4E+02	1.0E+04	3.4E+03	1.0E+05	3.4E+04	4.4E+05
108101	Methylisobutylketone	8.0E+01	2.0E+01	8.0E+02	2.0E+02	8.0E+03	2.0E+03	1.4E+04
80626	Methylmethacrylate	7.0E+02	1.7E+02	7.0E+03	1.7E+03	7.0E+04	1.7E+04	5.1E+04
91576	2-Methylnaphthalene	7.0E+01	1.2E+01	7.0E+02	1.2E+02	7.0E+03	1.2E+03	3.3E+03
1634044	MTBE	3.0E+03	8.3E+02	3.0E+04	8.3E+03	3.0E+05	8.3E+04	1.2E+05
108383	m-Xylene	7.0E+03	1.6E+03	7.0E+04	1.6E+04	7.0E+05	1.6E+05	2.3E+04
91203	Naphthalene	3.0E+00	5.7E-01	3.0E+01	5.7E+00	3.0E+02	5.7E+01	1.5E+02
104518	n-Butylbenzene	1.4E+02	2.6E+01	1.4E+03	2.6E+02	1.4E+04	2.6E+03	2.6E+02
98953	Nitrobenzene	2.0E+00	4.0E-01	2.0E+01	4.0E+00	2.0E+02	4.0E+01	2.0E+03
79469	2-Nitropropane	9.0E-04	2.5E-04	9.0E-03	2.5E-03	9.0E-02	2.5E-02	1.8E-01
924163	N-Nitroso-di-n-butylamine	1.5E-03	2.4E-04	1.5E-02	2.4E-03	1.5E-01	2.4E-02	1.2E-01
103651	n-Propylbenzene	1.4E+02	2.8E+01	1.4E+03	2.8E+02	1.4E+04	2.8E+03	3.2E+02
88722	o-Nitrotoluene	3.5E+01	6.2E+00	3.5E+02	6.2E+01	3.5E+03	6.2E+02	6.8E+04
95476	o-Xylene	7.0E+03	1.6E+03	7.0E+04	1.6E+04	7.0E+05	1.6E+05	3.3E+04
106423	p-Xylene	7.0E+03	1.6E+03	7.0E+04	1.6E+04	7.0E+05	1.6E+05	2.2E+04
129000	Pyrene	1.1E+02	1.3E+01	**	**	**	**	**
135988	sec-Butylbenzene	1.4E+02	2.6E+01	1.4E+03	2.6E+02	1.4E+04	2.6E+03	2.5E+02
100425	Styrene	1.0E+03	2.3E+02	1.0E+04	2.3E+03	1.0E+05	2.3E+04	8.9E+03
98066	tert-Butylbenzene	1.4E+02	2.6E+01	1.4E+03	2.6E+02	1.4E+04	2.6E+03	2.9E+02
630206	1,1,1,2-Tetrachloroethane	3.3E-01	4.8E-02	3.3E+00	4.8E-01	3.3E+01	4.8E+00	3.3E+00
79345	1,1,2,2-Tetrachloroethane	4.2E-02	6.1E-03	4.2E-01	6.1E-02	4.2E+00	6.1E-01	3.0E+00
127184	Tetrachloroethylene	8.1E-01	1.2E-01	8.1E+00	1.2E+00	8.1E+01	1.2E+01	5.0E+00 †
108883	Toluene	4.0E+02	1.1E+02	4.0E+03	1.1E+03	4.0E+04	1.1E+04	1.5E+03
156605	trans-1,2-Dichloroethylene	7.0E+01	1.8E+01	7.0E+02	1.8E+02	7.0E+03	1.8E+03	1.8E+02
76131	1,1,2-Trichloro-1,2,2-trifluoroethane	3.0E+04	3.9E+03	3.0E+05	3.9E+04	3.0E+06	3.9E+05	1.5E+03
120821	1,2,4-Trichlorobenzene	2.0E+02	2.7E+01	2.0E+03	2.7E+02	2.0E+04	2.7E+03	3.4E+03
79005	1,1,2-Trichloroethane	1.5E-01	2.8E-02	1.5E+00	2.8E-01	1.5E+01	2.8E+00	5.0E+00 †
71556	1,1,1-Trichloroethane	2.2E+03	4.0E+02	2.2E+04	4.0E+03	2.2E+05	4.0E+04	3.1E+03
79016	Trichloroethylene ††	2.2E-02	4.1E-03	2.2E-01	4.1E-02	2.2E+00	4.1E-01	5.0E+00 †
75694	Trichlorofluoromethane	7.0E+02	1.2E+02	7.0E+03	1.2E+03	7.0E+04	1.2E+04	1.8E+02
96184	1,2,3-Trichloropropane	4.9E+00	8.1E-01	4.9E+01	8.1E+00	4.9E+02	8.1E+01	2.9E+02
95636	1,2,4-Trimethylbenzene	6.0E+00	1.2E+00	6.0E+01	1.2E+01	6.0E+02	1.2E+02	2.4E+01
108678	1,3,5-Trimethylbenzene	6.0E+00	1.2E+00	6.0E+01	1.2E+01	6.0E+02	1.2E+02	2.5E+01
108054	Vinyl acetate	2.0E+02	5.7E+01	2.0E+03	5.7E+02	2.0E+04	5.7E+03	9.6E+03
75014	Vinyl chloride (chloroethene)	2.8E-01	1.1E-01	2.8E+00	1.1E+00	2.8E+01	1.1E+01	2.0E+00 †

†AF = 0.1 for Shallow Soil Gas Target Concentration AF = 0.01 for Deep Soil Gas Target Concentration AF = 0.001 for Groundwater Target Concentration

* Health-based target breathing concentration exceeds maximum possible chemical vapor concentration (pathway incomplete)

** Target soil gas concentration exceeds maximum possible vapor concentration (pathway incomplete)

† The target groundwater concentration is the MCL. (The MCL for chloroform is the MCL for total Trihalomethanes. The MCL listed for m-Xylene, o-Xylene, and p-Xylene is the MCL for total Xylenes.)

†† The target concentration for trichloroethylene is based on the upper bound cancer slope factor identified in EPA's draft risk assessment for trichloroethylene (US EPA, 2001). The slope factor is based on state-of-the-art methodology, however the TCE assessment is still undergoing review. As a result, the slope factor and the target concentration values for TCE may be revised further. (See Appendix D.)

4 SOIL AND WASTE CLASSIFICATIONS

As shown on Figure 4, UPRR did not excavate and remediate soils across the entire 61-acre Symphony Park site. This SGMP applies specifically to those areas inside the UPRR remediation extents. For those areas outside the UPRR remediation extents, it is assumed that the soils are clean. However if, during the course of development in an area outside of the UPRR remediation extents, the CEM observes indications of potentially impacted soils, the potentially impacted soils will be evaluated under the stipulations of this SGMP.

Additionally, it should be noted that UPRR remediated only the lighter petroleum hydrocarbons (C23 and lighter) so the presence of heavier petroleum hydrocarbons is possible inside the UPRR remediation extents and within areas containing treated undocumented fill.

Testing of soils will be conducted in accordance with the Sampling and Analysis Plan (SAP) and method detection limits shall be lower than the appropriate regulatory limit, defined below in Table 4.1. Based upon the analytical results, the soil will be classified as discussed in this Section.

Classifications of soil and wastes for regulatory compliance, as well as for tracking and payment purposes, are described in this section. The decision tree matrix for classifying the soil, as defined in this Section, is provided as Figure B-1 in Appendix B.

Under the initial SGMP (Kleinfelder 2007a), the contaminant action levels for contaminants other than TPH were based upon the EPA Region 9 Preliminary Remediation Goals (PRGs) (October 2004). Due to the overall future use of the site, the Residential PRGs for soil have been selected as appropriate. The PRGs were replaced in 2009 with Regional Screening Levels (RSLs) which were developed by the EPA by harmonizing the Region 9 PRGs with similar risk-based screening levels used by EPA Regions 3 and 6. NDEP's Draft Guidelines for Discovery Events provide Reportable Concentrations (RCs) based on the EPA RSLs. The EPA RSLs are currently updated twice per year.

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Under the initial SGMP, hydrocarbon-impacted soils were characterized based on the concentration of TPH, with soils containing 100 mg/kg or more of TPH being considered *contaminated*. Under this revised SGMP, hydrocarbon-impacted soils will be characterized based on the concentration of the hydrocarbon constituents, such as benzene. The 100 mg/kg threshold for TPH may be applicable, however, for contaminated soils being exported from the 61-acre Symphony Park site for recycling and disposal or possible reuse.

It is understood that the NDEP is continuously evaluating and updating their RCs and that the EPA updates their RSLs twice per year. It is the responsibility of the user of this SGMP or CEM to ensure that the latest applicable RCs, RSLs, or other applicable standards are being used.

A risk assessment performed in 2007 determined a range of 1 to 15 mg/kg for background concentrations of arsenic, which was used to establish a site-specific action level for the Symphony Park site of 15 mg/kg (Converse, 2007a).

4.1. CLEAN

Soils that are tested and found to be below laboratory detection limits for the constituents of concern are considered as *clean*. The constituents of concern are: BTEX (benzene, toluene, ethylbenzene, and total xylenes), RCRA 8 Metals (arsenic, barium, cadmium, total chromium, lead, mercury, selenium, and silver), and other VOCs, SVOCs, and PCBs as appropriate based on individual project location. This material has no environmental reuse restrictions and, depending on its geotechnical suitability, can either be used on-site as backfill material, or transported off-site for reuse by others.

It should be noted that for off-site reuse by others, the receiving entity may have specific soil acceptance criteria that are not part of the Symphony Park suite of analyses. The Developer/General Contractor may be required to provide a copy of the analytical results and should verify each receiving entity's acceptance criteria.

4.2. LEGALLY CLEAN

Soils that are tested and found to contain constituents of concern at concentrations less than their respective regulatory limits are considered as *legally clean*. *Legally clean* soils may contain

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one or more of the following: BTEX (benzene, toluene, ethylbenzene, and total xylenes), RCRA 8 Metals (arsenic, barium, cadmium, total chromium, lead, mercury, selenium, and silver), and other VOCs, SVOCs, and PCBs at less than their respective EPA RSL for residential soils or the site-specific action level in the case of arsenic. Table 4-1 provides these criteria.

TABLE 4-1

CONTAMINANT ACTION LEVELS

TARGET COMPOUND[1]	EPA RSL[2] (MG/KG)	SITE-SPECIFIC ACTION LEVEL (MG/KG)
Benzene	1.2[3]	None
Toluene	4,900[4]	None
Ethylbenzene	5.8[3]	None
Xylenes, total	580[4]	None
PCBs (Aroclor 1016)	4.1[4]	None
PCBs (Aroclor 1254)	0.24[3]	None
Arsenic	0.68[3]	15[5]
Barium	15,000[4]	None
Cadmium	71[4]	None
Chromium (total)	None	None
Lead	400[4]	None
Mercury	23[4]	None
Selenium	390[4]	None
Silver	390[4]	None

TABLE 4-1 Notes:

1) The individual compounds most likely to be present in the soil are presented.
2) Based on the overall future use of the project, the EPA Regional Screening Levels for Residential
   Soil are listed (May 2016). Where both are provided, the lesser of the carcinogenic and non-carcinogenic RSL is presented.
3) Carcinogenic RSL.
4) Non-carcinogenic RSL.
5) Kleinfelder 2007d, Document 80359/LVE7L139.

4.2.1. Legally Clean, On-Site Reuse

This material can be used on-site as backfill material.

4.2.2. Legally Clean, Off-Site Transport

If *legally clean* material will be taken off-site, it should be noted that the receiver may have specific acceptance criteria which may require additional testing and/or a project-specific risk assessment. The Developer/Site General Contractor will need to verify the acceptance criteria for off-site disposal or reuse.

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4.3. CONTAMINATED, NON-HAZARDOUS

Soil that has been tested and found to contain constituents of concern at concentrations exceeding their respective regulatory limits (Table 4.1), but whose concentrations are less than their respective RCRA limits (Tables 4.2 and 4.3), are considered to be *contaminated, non-hazardous* soil.

If *contaminated, non-hazardous* soil will be reused on the 61-acre Symphony Park site, a use-specific risk assessment must be conducted for the soil prior to its placement. If a developer gains approval to reuse *contaminated, non-hazardous* soil on-site, CEM oversight is required during that reuse.

It should be noted that intended reuse sites may have requirements for accepting the soil which may require additional testing and/or a project specific risk assessment. If *contaminated, non-hazardous* soil will be transported off site for reuse, additional testing for Total Petroleum Hydrocarbons (TPH) may be required to determine reuse acceptability.

If *contaminated, non-hazardous* soil will be transported off site for either disposal or recycling, it must go to a facility capable of accepting the material. Within southern Nevada, *contaminated, non-hazardous* soil is typically accepted by the following facilities:

- Las Vegas Paving's petroleum impacted soils recycling facility, located in Clark County, Nevada
- Republic Services of Southern Nevada's APEX Regional Landfill, located in Clark County, Nevada
- US Ecology Nevada facility, located in Nye County, near Beatty, Nevada

City Parkway V will be notified to coordinate/arrange for the transport and disposal. The CEM will assist with the coordination, if requested.

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If an analyte result exceeds its respective RSL or site-specific limit, it may be necessary to request soil sample(s) be additionally run for Toxicity Characteristic Leaching Procedure (TCLP) analyses, to verify if such soils may be classified as *RCRA hazardous*. *RCRA hazardous* soils are discussed in Section 4.4.

4.4. RCRA HAZARDOUS (FEDERALLY DESIGNATED WASTES)

As previously stated, if the result of an analyte exceeds its respective RSL or site-specific limit, it may be necessary to further evaluate the soil to determine whether it should be classified as *RCRA hazardous* instead of *contaminated, non-hazardous* prior to disposal off-site.

For metals, initial screening would be determined by use of the 20 times rule. For non-metals, this would be determined by comparing the concentration of the analyte in question to its respective TCLP limit, if established. Tables 4-2 and 4-3 provide these criteria for metals and non-metals, respectively. If initial laboratory analysis results in a concentration that exceeds the constituent's 20 times rule (metals) or TCLP limit (non-metals), then TCLP analysis must be performed.

Soil that has been tested by TCLP and found to contain constituents of concern at concentrations exceeding their respective RCRA TCLP limits, are considered to be *RCRA hazardous*. Soil that is reported to contain PCB is considered as *RCRA hazardous*. *RCRA* hazardous soils shall not be reused on the 61-acre Symphony Park site and must be exported for disposal. RCRA *hazardous* wastes require a hazardous waste transporter, a hazardous waste manifest, and disposal at a facility capable of accepting the material. Within southern Nevada, *RCRA hazardous* soil is typically accepted by US Ecology Nevada facility, located in Nye County, near Beatty, Nevada.

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TABLE 4.2

RCRA TCLP CRITERIA – METALS

ANALYTE	TCLP LIMITS (MG/L)	20 TIMES TCLP CRITERIA (MG/KG)
Arsenic	5.0	100
Barium	100	2000
Cadmium	1.0	20
Chromium	5.0	100
Lead	5.0	100
Mercury	0.2	4.0
Selenium	1.0	20
Silver	5.0	100

TABLE 4.3

RCRA TCLP CRITERIA – NON-METALS

ANALYTE	TCLP LIMITS (MG/L)
Benzene	0.5
Carbon Tetrachloride	0.5
Chlordane	0.03
Chlorobenzene	100.0
Chloroform	6.0
o-Creosol	200.0[1]
m-Creosol	200.0[1]
p-Creosol	200.0[1]
2,4-D	10.0
1,4-Dichlorobenzene	7.5
1,2-Dichlorobenzene	0.5
1,1-Dichloroethylene	0.7
2,4-Dinitrotolune	0.13
Hexachlorobenzene	0.13
Hexachlorobutadiene	0.5
Hexachloroethane	3.0
Tetrachloroethylene	0.7
Trichloroethylene	0.5
Vinyl Chloride	0.2

Note: [1] If o-, m-, and p-Creosol concentrations cannot be differentiated, the total Creosol concentration is used. The regulatory level of total creosol is 200 mg/L.

City Parkway V will be notified to coordinate/arrange the transport and disposal. The CEM will assist with the coordination, if requested.

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4.5. IMPORT FILL MATERIAL

If import material is required, fill import will need to meet the definition of *clean* or *legally clean*, as defined in Sections 4.1 and 4.2. The Developer/General Contractor shall certify the material as *clean* or *legally clean*.

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APPENDIX C

- C-1: Soil Sampling SOP
- C-2: Groundwater Sampling SOP
- C-3: Active Soil Vapor Sampling SOP
- C-4: Lead-based Paint Sampling SOP
- C-5: Polychlorinated Biphenyls Sampling SOP
- C-6: Asbestos Sampling SOP
- C-7: Decontamination SOP
- C-8: General Health & Safety Plan

C-1: Soil Sampling SOP

CONVERSE CONSULTANTS
SOIL SAMPLING SOP
DATED May 2015

1) INTRODUCTION

The purpose of this Standard Operating Procedure (SOP) is to provide a description of the procedures for the collection of representative soil samples. Soil samples will consist of two types, grab samples and composite. Samples can also be taken at variable depths below ground surface. In some cases, hand sampling equipment can be used, in other cases power equipment may be utilized. Power equipment may include back-hoes or drill-rigs (direct push or hollow stem auger).

These are standard (i.e. typically applicable) operating procedures which may be varied or changed, as required, dependent upon site conditions, equipment limitation, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

2) SAMPLE TYPES

Grab Samples:

A grab sample is defined as a discrete aliquot representative of a specific location at a given point in time. The sample is collected all at once at one particular point in the sample medium. The representativeness of such samples is defined by the nature of the materials being sampled. In general, as sources vary over time and distance, the representativeness of grab samples will decrease.

Grab samples will be collected using disposable or decontaminated instruments. The samples will be collected directly into acetate or brass sleeves or transferred into a sterile laboratory supplied container. The containers will be handled as described in SECTION 4 of this SOP.

Composite Samples

Composites are non-discrete samples composed of more than one specific aliquot collected at various sampling locations and/or different points in time. Analysis of this type of sample produces an average value and can, in certain instances, be used as an alternative to analyzing a number of individual grab samples and calculating an average value. It should be noted, however, that compositing can mask problems by diluting isolated concentrations of some hazardous compounds below detection limits. Compositing is often used for environmental samples and may be used for hazardous samples under certain conditions. For example, compositing of hazardous waste is often performed after compatibility tests have been completed to determine an average value over a number of different locations (group of drums). This procedure generates data that can be useful by providing an average concentration within a number of units, can serve to keep analytical costs down, and can provide information useful to transporters and waste disposal operations.

Once the need for composite sampling is identified in the Field Sampling Plan (FSP), the location of the sample points will be identified by one of two methods. The first method will involve identifying a sub-area within the larger area to be sampled, and then a set number of random samples would be collected within that area and composited. The second method would be to identify a grid in the area to be sampled and a sample would be collected at each grid point. Soil from a given number grid points would them be composited.

To composite a soil sample, a predetermined amount of soil will be identified in the FSP (this is generally one spade full). This amount of soil will be collected from each identified location and placed in a pre-cleaned container (plastic bucket). The soil will then be mixed thoroughly using the collection spade. After mixing, a sample will be removed and placed in a sterile laboratory supplied container.

3) TYPES OF SAMPLE COLLECTION

3.1 Near Surface Soil Samples

Near surface samples (0-2 feet below grade) can be collected with hand tools which include spades, scoops, or bucket auger. These tools must be properly decontaminated before, between, and after sampling events. The Converse SOP for Decontamination must be followed.

Once the soil is collected, it will be placed in a sterile laboratory supplied container. The containers can include 4 or 8 ounce glass jars or plastic container. Glass containers must be used for soil samples that will be analyzed for organic compounds.

A portion of each sample to be analyzed VOCs will be collected in accordance with the Environmental Protection Agency (EPA) method EPA Method 5035 using single-use EnCore sample containers. Care should be taken to disturb the sample as little as possible during collection. Sub-samples will be collected from the primary sample containers by pushing the EnCore samplers into the primary sample. Please note these samples only have a 24 hour hold time.

3.2 Collection of Soil Samples Utilizing a Backhoe

For collection of deeper samples, test pits and trenches can be dug utilizing a backhoe or excavator. The trench of test pits deeper than 5 feet cannot be entered unless they are sloped or scored. In most cases, soil samples can be collected from the backhoe bucket using the following procedure:

- Have the backhoe operator place his back hoe against the test pit wall or bottom of excavation in the area where you wish to collect the sample.

- Roll the bucket so the teeth of the back hoe scrapes the area where you wish to collect the sample.
- Lift the bucket straight up and place bucket on ground where the sampling personnel can reach it. The sampling personnel will then remove the soil from the teeth of the backhoe with a clean, gloved hand. Care must be taken to collect soil in a way to gather the soil that has not come into direct contact with the backhoe bucket.

Once the soil is collected it will be placed in a sterile laboratory supplied container. The containers can include 4 or 8 ounce glass jars or plastic containers. Glass containers must be used for soil samples that will be analyzed for organic compounds.

A portion of each sample to be analyzed VOCs will be collected in accordance with the Environmental Protection Agency (EPA) method EPA Method 5035 using single-use EnCore sample containers. Care should be taken to disturb the sample as little as possible during collection. Sub-samples will be collected from the primary sample containers by pushing the EnCore samplers into the primary sample. Please note these samples only have a 24 hour hold time.

3.3 Collection of Soil Samples Direct Push

Samples can be collected at depth using direct push technology. The technician will sample at the depth identified on the FSP. A four to five foot acetate liner will be pushed into the ground at selected depths. Based upon the field screening required for the project, selected lengths of samples will be chosen and the liner cut in the lengths required. Teflon film and tight fitting plastic caps will be placed on each end of the cut sample sleeves.

As an alternative, the acetate sleeves can be cut open and the soil removed and placed in sterile laboratory supplied container. The containers can include 4 or 8 ounce glass jars or plastic containers. Glass containers must be used for soil samples that will be analyzed for organic compounds.

A portion of each sample to be analyzed VOCs will be collected in accordance with the Environmental Protection Agency (EPA) method EPA Method 5035 using single-use EnCore sample containers. Care should be taken to disturb the sample as little as possible during collection. Sub-samples will be collected from the primary sample containers by pushing the EnCore samplers into the primary sample. Please note these samples only have a 24 hour hold time.

3.4 Collection of Soil Samples from a Drill-Rig

Samples can be collected from samplers advanced by a hollow stem auger drill rig. The sampler (split spoon) will be advanced at selected sampling depths. The split spoon will be removed from the ground and disconnected from drill rig flight. The split spoon will

be opened and the soil placed in a sterile laboratory supplied container. The containers can include 4 or 8 ounce glass jars or plastic containers. Glass container must be used for soil samples that will be analyzed for organic compounds. As an alterative, the split spoon can be lined with a metal liner and the liner can be removed from the device and plastic caps placed on the ends.

A portion of each sample to be analyzed VOCs will be collected in accordance with the Environmental Protection Agency (EPA) method EPA Method 5035 using single-use EnCore sample containers. Care should be taken to disturb the sample as little as possible during collection. Sub-samples will be collected from the primary sample containers by pushing the EnCore samplers into the primary sample. Please note these samples only have a 24 hour hold time.

4) SAMPLE HANDLING

All laboratory samples will be labeled in the field with a Sharpie® or equivalent water-proof labeler with the following information:

- Sample Location
- Date Sample Collected
- Time Sample Collected
- Technicians Initials

After the jars are labeled, a custody seal should be placed on sample container or on the cooler at the completion of sample collection for the project (see example of custody seals attached to SOP). Samples must be placed in coolers with ice. Ice should be placed in zip lock bags or other water tight containers and the samples containers should be placed in the cooler in such a way as to avoid melted ice water getting into the containers.

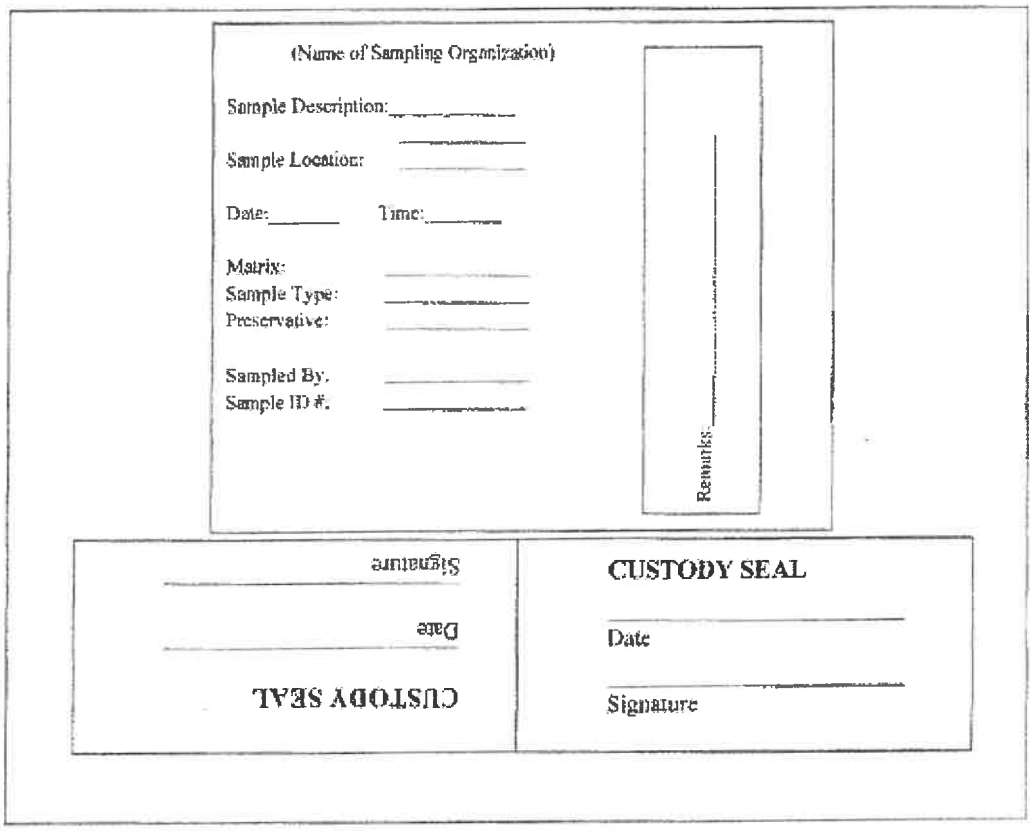
Samples should be delivered to the laboratory as soon as reasonably possible after the sampling event. If the samples are to be shipped to the laboratory, the cooler can be used as a shipping container and blue ice can be substituted for the ice used during field collection.

5) FIELD SUPPLIES

Before each sampling event the technician should collect the field supply check list (a copy of the check list is attached to this SOP).

6) ATTACHMENTS

EXAMPLE OF SHIPPING LABLES AND CUSTODY SEALS



Project: _____ Project #: _____ Weather: _____

Date of Field Work :_____Site Manager:_____

Field Supply Check List

Item	Need for Project	Date Cleaned and Checked	Date Loaded	Date Returned
Maps/Plot Plan		NA		NA
GIS				
Tape Measure				
Measuring Wheel				
Survey Stakes and Flags		NA		NA
Camera				
PID				
Zip Lock Bags		NA		
4 oz Glass Soil Jars*		NA		NA
8 oz Glass Soil Jars*		NA		NA
VOAs*		NA		NA
Amber Bottles*		NA		NA
Water Bottles for Metal*		NA		NA
Sample Labels		NA		NA
Chain-of-Custody		NA		NA
Custody Seals		NA		NA
Cooler				
Ice		NA		NA
3 or More Clean Plastic Buckets**				
Scrub Brush**				
Sponge**				
Alconox**				
Paper Towels**				
Plastic Sheets**				
Hand Spade				
Hand Auger				
Disposable Bailers				
Hard Hat***		NA		NA
Tyvek Suite***		NA		NA
Respirator***				NA
Disposal Latex Gloves***		NA		NA
XRF				

*Supplied by Laboratory
**Decontamination Supplies
***PPE

C-2: Groundwater Sampling SOP

1) INTRODUCTION

The purpose of this Standard Operating Procedure (SOP) is to provide information on the collection of groundwater samples from borings and groundwater monitoring wells. This SOP applies only to sampling of the subsurface saturated zone. This SOP should be used when sampling groundwater for volatiles, semi-volatiles, pesticides, metals, and biological parameters.

These are standard (i.e. typically applicable) operating procedures which may be varied or changed, as required, dependent upon site conditions, equipment limitation, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

2) SAMPLE TYPES

Boring Grab Samples:

In some cases, groundwater grab samples are collected directly from borings during the initial phases of an investigation. The collection is conducted when advancement of the boring is completed. In a tight soil formation, groundwater may not be apparent when the boring is advanced but will fill the void space with time.

Grab samples will be collected using disposable mini bailers and/or with the aid of mini well screens. After collection, the sample will be placed in a sterile laboratory supplied container. The containers will be handled as described in SECTION 4 of this SOP.

Monitoring Well Samples

In some cases, monitoring wells will be utilized during a project. In order to obtain a representative sample for chemical analysis, it is important to remove stagnant water in the well casing and the water immediately adjacent to the well before collecting the sample. After collection, the sample will be placed in a sterile laboratory supplied container. The containers will be handled as described in SECTION 4 of this SOP.

3) TYPES OF SAMPLE COLLECTION

3.1 Boring Grab Samples:

Need for groundwater sampling will be defined in the FSP. In general, if samples will be collected from borings, the technician will establish depth to groundwater during the initial field exploration. Soil moisture should be carefully observed. If the soil appears to be saturated, but no free water is encountered, the boring should be checked for free water after it is allowed to set for no less than 15 minutes. If the boring is stable and

does not appear to be collapsing, a disposable mini bailer should be used to collect the water sample. The technician should attach the bailer to the clean string from the field box.

Once the sample is collected, it will be transferred into laboratory supplied sample containers with Teflon lined septa. The type of analysis for which each sample is being analyzed determines the type of bottles and preservatives required. The technician should verify with the project manager that proper containers and preservatives are loaded in the field kit before leaving for the job site.

For volatile compounds, the samples should be slowly poured into the lab provided 40 milliliter (mL) glass sample vial with Teflon lined septa and the vial must be filled so there is a meniscus formed at the top of the container. The lid is them placed tightly on the top of the container and the vial is inverted and checked for air bubbles. If bubbles are present, the sample must be discarded and a new sample collected. After the sample is collected, place it in a protective cover and place on its side in the cooler (not straight up). After use, the bailer and used string should be properly disposed of. If the boring is not stable, a mini well screen should be used to stabilize the boring to allow water collection. Once the screen is inserted water can be collect with the mini bailer as outlined above.

3.2 Monitoring Well Samples:

In order to obtain a representative sample for chemical analysis, it is important to remove stagnant water in the well casing and the water immediately adjacent to the well before collecting the sample. This may be achieved with a bailer or submersible pump. At a minimum, three well volumes should be purged. The water level within the well and the total depth of the well should be measured before purging and the well should be sampled as soon as possible after purging. Well volume should be calculated using the attached sheet. If wells are known to be contaminated or the condition of the water is unknown, the purge water must be drummed for disposal.

Equipment must be decontaminated prior to use and between wells. Sampling should occur in a progression from the least to the most contaminated well, if this is known. A clean disposable bailer (not the bailer used to purge the well) should be used to collect the water sample. The technician should attach the bailer to the clean string located in the field box.

Once the sample is collected, it will be transferred into laboratory supplied sample containers with Teflon lined septa. The type of analysis for which each sample is being analyzed determines the type of bottles and preservatives required. The technician should verify with the project manager that proper containers and preservatives are loaded in the field kit before leaving for the job site.

For volatile compounds, the samples should be slowly poured into the lab provided 40 milliliter (mL) glass sample vial with Teflon lined septa and the vial must be filled so there is a meniscus formed at the top of the container. The lid is them placed tightly on the top of the container and the vial is inverted and checked for air bubbles. If bubbles are present, the sample must be discarded and a new sample collected. After the sample is collected, place it in a protective cover and place on its side in the cooler (not straight up). After use, the bailer and used string should be properly disposed of.

4) SAMPLE HANDLING

All laboratory samples will be labeled in the field with a Sharpie® or equivalent water-proof labeler with the following information:

- Sample Location
- Date Sample Collected
- Time Sample Collected
- Technicians Initials

A After the jars are labeled, a custody seal should be placed on sample container or on the cooler at the completion of sample collection for the project (see example of custody seals attached to SOP). Samples must be placed in coolers with ice. Ice should be placed in zip lock bags or other water tight containers and the samples containers should be placed in the cooler in such a way as to avoid melted ice water getting into the containers.

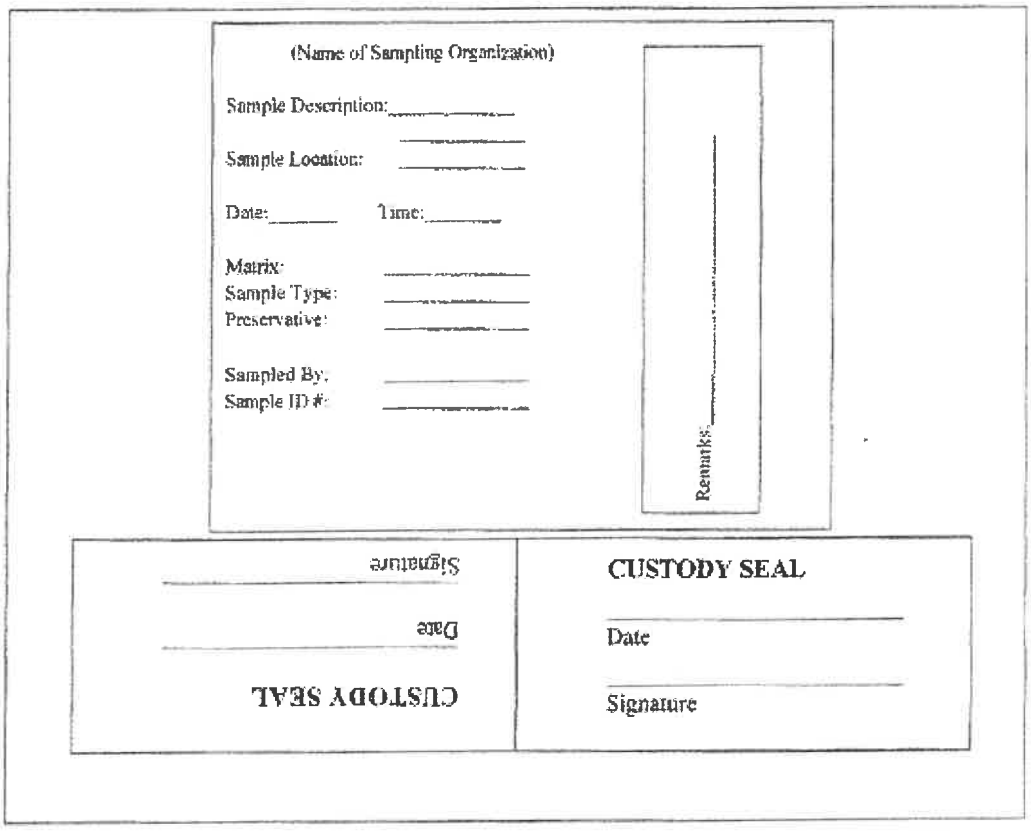
Samples should be delivered to the laboratory as soon as reasonably possible after the sampling event. If the samples are to be shipped to the laboratory, the cooler can be used as a shipping container and blue ice can be substituted for the ice used during field collection.

5) FIELD SUPPLIES

Before each sampling event, the technician should collect the field supply check list, (a copy of the check list is attached to this SOP).

6) ATTACHMENTS

EXAMPLE OF SHIPPING LABLES AND CUSTODY SEALS



Project: _____ Project #: _____ Weather: _____

Date of Field Work : _____ Site Manager: _____

Field Supply Check List

Item	Need for Project	Date Cleaned and Checked	Date Loaded	Date Returned
Maps/Plot Plan		NA		NA
GIS				
Tape Measure				
Measuring Wheel				
Survey Stakes and Flags		NA		NA
Camera				
PID				
Zip Lock Bags		NA		
4 oz Glass Soil Jars*		NA		NA
8 oz Glass Soil Jars*		NA		NA
VOAs*		NA		NA
Amber Bottles*		NA		NA
Water Bottles for Metal*		NA		NA
Sample Labels		NA		NA
Chain-of-Custody		NA		NA
Custody Seals		NA		NA
Cooler				
Ice		NA		NA
3 or More Clean Plastic Buckets**				
Scrub Brush**				
Sponge**				
Alconox**				
Paper Towels**				
Plastic Sheets**				
Hand Spade				
Hand Auger				
Disposable Bailers				
Hard Hat***		NA		NA
Tyvek Suite***		NA		NA
Respirator***				NA
Disposal Latex Gloves***		NA		NA
Water Level Indicator				

*Supplied by Laboratory
**Decontamination Supplies
***PPE

C-3: Active Soil Vapor Sampling SOP

1) INTRODUCTION

The purpose of this Standard Operating Procedure (SOP) is to provide a description of the procedures for the collection of representative soil vapor samples. Soil vapor samples will consist of two types, the direct push drive rod method and the direct push method. Samples can be taken at variable depths below ground surface. Power equipment may be utilized, which include drill-rigs (direct-push or hollow-stem-auger).

These are standard (i.e. typically applicable) operating procedures which may be varied or changed, as required, dependent upon site conditions, equipment limitation, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

2) SAMPLE TYPES

Direct Push Drive Rod Method:

The direct push drive rod method consists of advancing a drill rod with a detachable tip to the desired sample depth. The rod will then be retracted, allowing the tip to detach and exposing the open sample rod to the soil vapor at the desired sample depth. New Teflon tubing will then be inserted into the sample rod and attached to a threaded port at the base of the rod. Hydrated bentonite will then be placed around the drill rod at the ground surface, and atop the drill rod to provide a seal. Subsurface conditions will then be allowed to equilibrate for a minimum period of 20 minutes before sample collection. Once the sample is collected, the sample tubing will be removed and disposed of, and the drill rod will continue with the next sample interval by advancing another rod and repeating the process until all desired sample depths have been sampled, or until refusal has been encountered. The containers will be handled as described in SECTION 4 of this SOP.

Direct Push Method:

The direct push method consists of advancing a drill rod (Geoprobe or hollow-stem auger [HSA] drilling methods) to the desired maximum depth of the boring, or until refusal has been encountered. Soil vapor implants attached to sample tubing will then be installed to the bottom of each boring and a sand pack will be placed around and approximately 6-inches above the implants. Bentonite chips will then be placed above the sand pack and hydrated up to the base of the next sample interval. The process will be repeated until probes are set at all sample intervals. A final bentonite seal will then be placed from above the uppermost sand pack up to ground surface. Direct-push or HSA borings will then be allowed to equilibrate for a minimum of 30 minutes and 48- hours, respectively, prior to sampling. The containers will be handled as described in SECTION 4 of this SOP.

Converse Consultants

(757) 856-3833

Reno, Nevada 89502

Fax (775) 856-3513

Sample Transmittal Form

Project Name: _____ Contact Person: _____ Page ___ of ___

Project Number: Date Sampled: Contact Phone Number:

Analysis Type:	PCM-Air:	PLM-Bulk:	TEM:	GC
	NIOSH 7400 Method	Standard EPA Method	Air Water	AA
	Other Method	Point Count Method	Bulk Other	Others

Special Notes:

Turn-A-Round Time: (Circle) RUSH 24 Hours 2 Days 1 Week If PLM Sample-test to First Positive Yes No

Requested: Verbals Fax Samples Collected By: Sample Type**: Background Pre-Abatement During Clearance

Laboratory Number	Sample Number	Sample Location	Sample Description	Type** Pump #	Time Started	Time Ended	Total Minutes	Flow Rate	Volume (liters)	Analyst	Fiber Fields	F/mm2	F/cc

Relinquished By: Relinquished By: Relinquished By: Relinquished By:
Date/Time: Date/Time: Date/Time: Date/Time:
Received By: Received By: Received By: Received By:

White = Converse Copy / Yellow = Laboratory File Copy

3) TYPES OF SAMPLE COLLECTION

Prior to sample collection, a tracer gas is placed at the drill rod at ground surface or the tubing/surface interface to verify the integrity of the bentonite seal. The tracer gas is analyzed during the analytical run to determine if there are surface leaks into the subsurface due to improper installation of the probes.

A purge volume determination test is performed by the mobile laboratory at the first vapor probe location on the first day of sampling. The purge volume is determined by collecting three consecutive samples from the same locations at three different volumes (1, 3, and 7 times "sample train" volumes). The volume of this "sampling train" is determined by calculating the volume of the annular space around the probe and the volume of the sample tubing {5 milliliters per foot (ml/ft) of tubing} in accordance with the January 2003 advisory - Active Soil Gas Investigations. Once the desired purge volume is accomplished the sample is collected using glass, gas-tight syringes equipped with Teflon plungers. The purge volume samples are analyzed by the same analytical method used to analyze the primary samples. Based upon the results of the purge volume test, all subsequent probes are sampled using the designated purge volume. Samples should be collected in gas-tight opaque/dark containers, such as syringes, glass bulbs wrapped in aluminum foil or Summa canisters.

4) SAMPLE HANDLING

All laboratory samples will be labeled in the field with a Sharpie® or equivalent water-proof labeler with the following information:

- Sample Location
- Date Sample Collected
- Time Sample Collected
- Technicians Initials

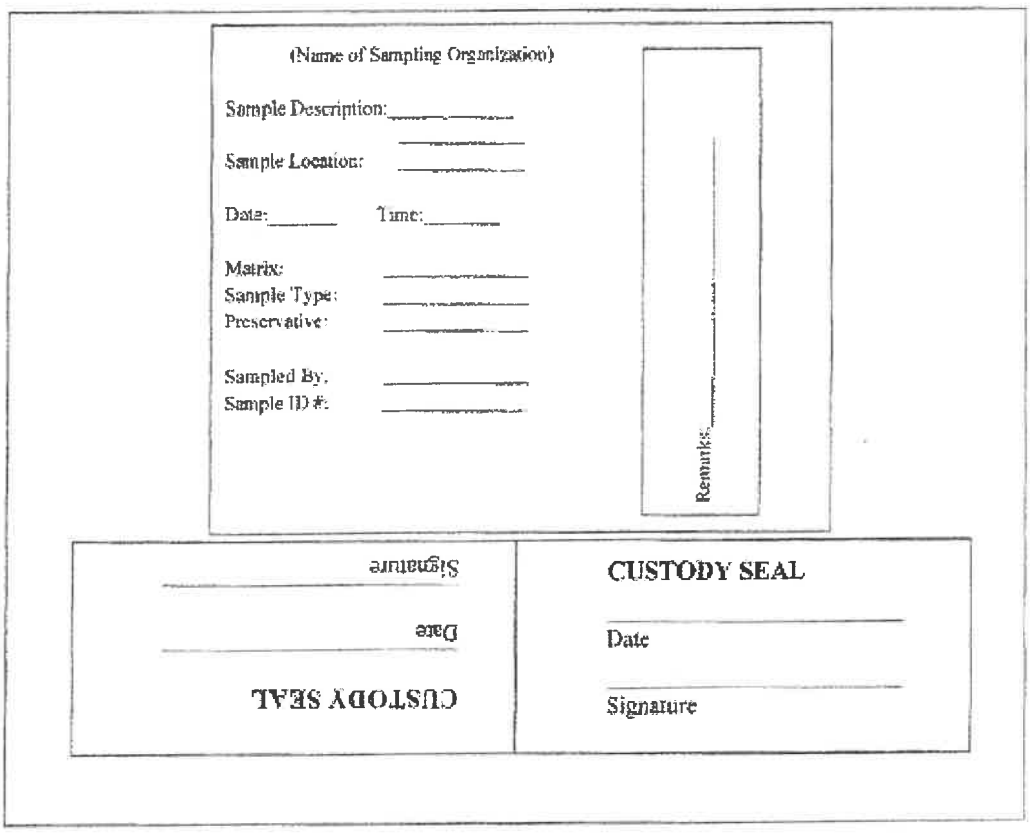
After the sample containers are labeled, a custody seal should be placed on sample container (see example of custody seals attached to SOP). If the sample is not to be analyzed immediately after collection on-site by a mobile laboratory, the labeled samples should be placed in a dry location. Exposure to light, changes in temperature and pressure will accelerate sample degradation. To protect sample integrity, sample should not be chilled and should not be subjected to changes in ambient pressure. If condensation is observed in the sample container, the sample should be discarded and a new sample should be collected. The samples should be delivered to the laboratory as soon as reasonably possible after the sampling event.

5) FIELD SUPPLIES

Before each sampling event the technician should collect the field supply check list (a copy of the check list is attached to this SOP).

6) ATTACHMENTS

EXAMPLE OF SHIPPING LABLES AND CUSTODY SEALS



Project: _____ Project #: _____ Weather: _____

Date of Field Work: _____ Site Manager: _____

Field Supply Check List

Item	Need for Project	Date Cleaned and Checked	Date Loaded	Date Returned
Maps/Plot Plan		NA		NA
GIS				
Tape Measure				
Measuring Wheel				
Survey Stakes and Flags		NA		NA
Camera				
PID				
Zip Lock Bags		NA		
4 oz Glass Soil Jars*		NA		NA
8 oz Glass Soil Jars*		NA		NA
VOAs*		NA		NA
Amber Bottles*		NA		NA
Water Bottles for Metal*		NA		NA
Sample Labels		NA		NA
Chain-of-Custody		NA		NA
Custody Seals		NA		NA
Cooler				
Ice		NA		NA
3 or More Clean Plastic Buckets**				
Scrub Brush**				
Sponge**				
Alconox**				
Paper Towels**				
Plastic Sheets**				
Hand Spade				
Hand Auger				
Disposable Bailers				
Hard Hat***		NA		NA
Tyvek Suite***		NA		NA
Respirator***				NA
Disposal Latex Gloves***		NA		NA
XRF				

*Supplied by Laboratory
**Decontamination Supplies
***PPE

C-4: Lead-based Paint Sampling SOP

1) INTRODUCTION

The purpose of this Standard Operating Procedure (SOP) is to provide a description of the procedures for the collection of representative lead-based paint (LBP) samples. LBP samples will consist of two types, x-ray fluorescent device (XRF) samples and bulk samples.

These are standard (i.e. typically applicable) operating procedures which may be varied or changed, as required, dependent upon site conditions, equipment limitation, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

2) SAMPLE TYPES

A visual survey of the on-site structure(s) will be initially conducted for painted surfaces. Samples of general building components (i.e., visually identical surface paints) will be assumed to be representative throughout a site.

3) TYPES OF SAMPLE COLLECTION

3.1 XRF Samples:

Samples of potential LBPs will be collected in representative homogeneous areas, which are determined by visual examination. Surveys will be performed using a direct reading XRF.

3.2 Bulk Samples:

If inconclusive readings are determined by XRF, bulk samples will be collected following accepted Environmental Protection Agency (EPA) procedures and will be analyzed for lead content. Representative samples will be collected from all paint surfaces and exterior paint on all surfaces and open areas. During collection of bulk LBP samples, damage to the paint sampled is often necessary to obtain representative samples. Samples collected will be processed for shipment to an accredited laboratory following EPA protocol and chain-of-custody procedures. Samples at the laboratory will be analyzed for lead content.

4) SAMPLE HANDLING

All XRF samples will be logged in the field onto a log sheet or into the XRF and all laboratory samples will be labeled in the field with a Sharpie® or equivalent water- proof labeler with the following information;

- Sample Location
- Substrate of Sample
- Sample Color
- Date Sample Collected
- Time Sample Collected
- Technicians Initials

After the laboratory samples are labeled, a custody seal should be placed on the sample container. (see example of custody seals attached to SOP).

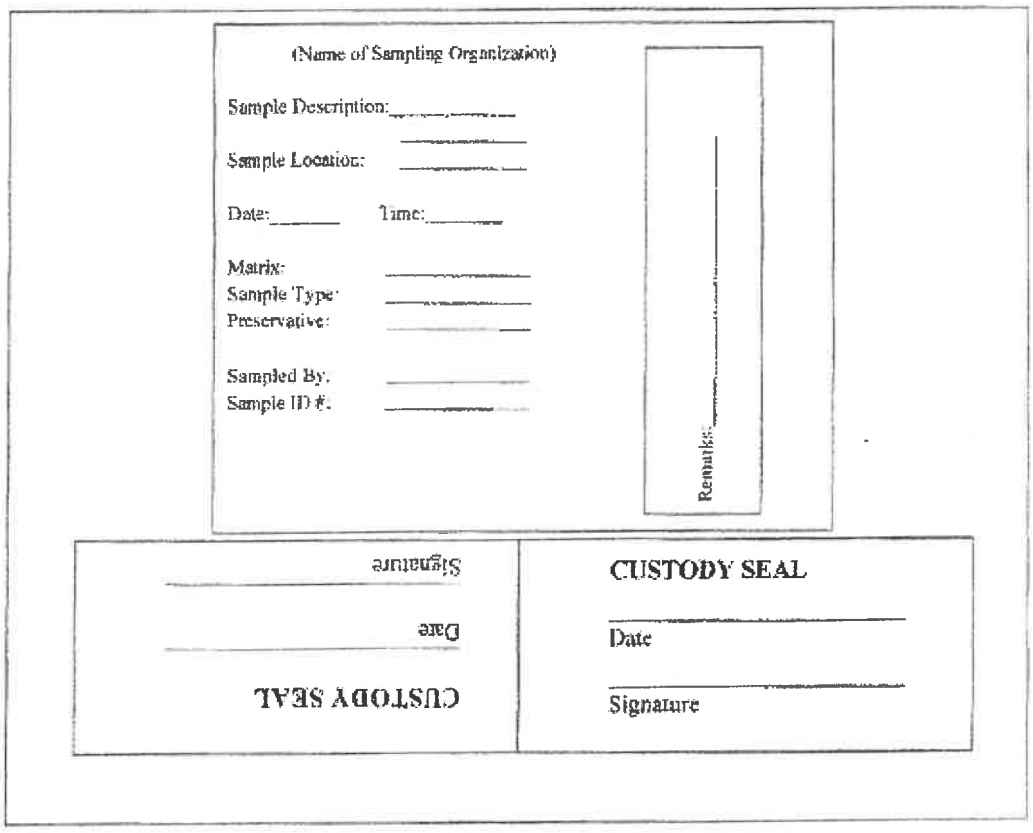
Samples should be delivered to the laboratory as soon as reasonably possible after the sampling event.

5) FIELD SUPPLIES

Before each sampling event the technician should collect the field supply check list (a copy of the check list is attached to this SOP).

6) ATTACHMENTS

EXAMPLE OF SHIPPING LABLES AND CUSTODY SEALS



Project: _____ Project #: _____ Weather: _____

Date of Field Work :_____Site Manager:_____

Field Supply Check List

Item	Need for Project	Date Cleaned and Checked	Date Loaded	Date Returned
Maps/Plot Plan		NA		NA
GIS				
Tape Measure				
Measuring Wheel				
Survey Stakes and Flags		NA		NA
Camera				
PID				
Zip Lock Bags		NA		
4 oz Glass Soil Jars*		NA		NA
8 oz Glass Soil Jars*		NA		NA
Voas*		NA		NA
Amber Bottles*		NA		NA
Water Bottles for Metal*		NA		NA
Sample Labels		NA		NA
Chain-of-Custody		NA		NA
Custody Seals		NA		NA
Cooler				
Ice		NA		NA
3 or More Clean Plastic Buckets**				
Scrub Brush**				
Sponge**				
Alconox**				
Paper Towels**				
Plastic Sheets**				
Hand Spade				
Hand Auger				
Disposable Bailers				
Hard Hat***		NA		NA
Tyvek Suite***		NA		NA
Respirator***				NA
Disposal Latex Gloves***		NA		NA
XRF				

*Supplied by Laboratory
**Decontamination Supplies
***PPE

C-5: Polychlorinated Biphenyls Sampling SOP

1) INTRODUCTION

The purpose of this Standard Operating Procedure (SOP) is to provide a description of the procedures for the collection of representative Polychlorinated Biphenyl (PCB) caulk samples.

These are standard (i.e. typically applicable) operating procedures which may be varied or changed, as required, dependent upon site conditions, equipment limitation, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

2) SAMPLE TYPE

A visual survey of the on-site structure(s) will be initially conducted for presumed PCBs and homogeneous areas (areas that have uniform color, texture, and appearance).

Samples will be collected using disposable or decontaminated instruments. The samples will be collected directly into zip lock bags, or transferred into a sterile laboratory supplied containers. The containers will be handled as described in SECTION 4 of this SOP.

3) TYPES OF SAMPLE COLLECTION

Samples of potential PCB caulks will be collected in representative homogeneous areas, which are determined by visual examination. Samples collected will be processed for shipment to an accredited laboratory following Environmental Protection Agency (EPA) protocol and chain-of-custody procedures.

4) SAMPLE HANDLING

All laboratory samples will be labeled in the field with a Sharpie® or equivalent water-proof labeler with the following information:

- Sample Location
- Date Sample Collected
- Technicians Initials

After the samples are labeled, a custody seal should be placed on the sample container. (see example of custody seals attached to SOP).

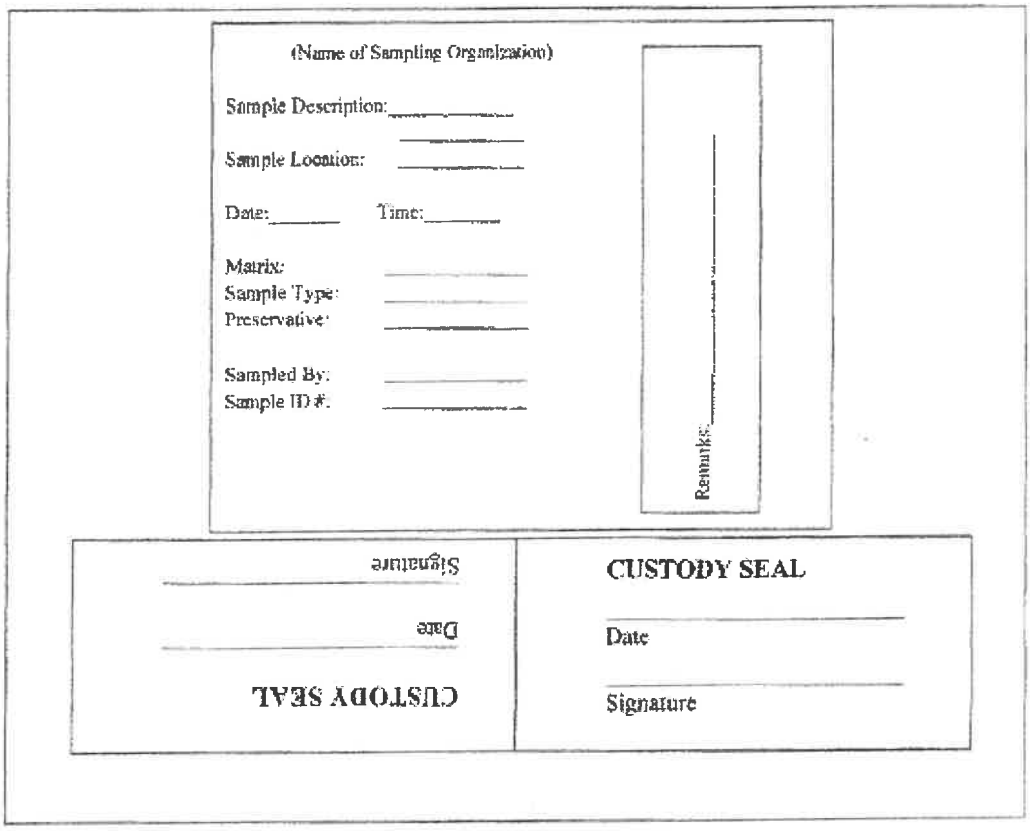
Samples should be delivered to the laboratory as soon as reasonably possible after the sampling event.

5) FIELD SUPPLIES

Before each sampling event the technician should collect the field supply check list (a copy of the check list is attached to this SOP).

6) ATTACHMENTS

EXAMPLE OF SHIPPING LABLES AND CUSTODY SEALS



Project: _____ Project #: _____ Weather: _____

Date of Field Work :_____Site Manager:_____

Field Supply Check List

Item	Need for Project	Date Cleaned and Checked	Date Loaded	Date Returned
Maps/Plot Plan		NA		NA
GIS				
Tape Measure				
Measuring Wheel				
Survey Stakes and Flags		NA		NA
Camera				
PID				
Zip Lock Bags		NA		
4 oz Glass Soil Jars*		NA		NA
8 oz Glass Soil Jars*		NA		NA
Voas*		NA		NA
Amber Bottles*		NA		NA
Water Bottles for Metal*		NA		NA
Sample Labels		NA		NA
Chain-of-Custody		NA		NA
Custody Seals		NA		NA
Cooler				
Ice		NA		NA
3 or More Clean Plastic Buckets**				
Scrub Brush**				
Sponge**				
Alconox**				
Paper Towels**				
Plastic Sheets**				
Hand Spade				
Hand Auger				
Disposable Bailers				
Hard Hat***		NA		NA
Tyvek Suite***		NA		NA
Respirator***				NA
Disposal Latex Gloves***		NA		NA
XRF				

*Supplied by Laboratory
**Decontamination Supplies
***PPE

C-6: Asbestos Sampling SOP

1) INTRODUCTION

The purpose of this Standard Operating Procedure (SOP) is to provide a description of the procedures for the collection of representative asbestos samples.

These are standard (i.e. typically applicable) operating procedures which may be varied or changed, as required, dependent upon site conditions, equipment limitation, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

2) SAMPLE TYPE

A visual survey of the on-site structure(s) will be initially conducted for presumed Asbestos-Containing Materials (ACMs) and homogeneous areas (areas that have uniform color, texture, and appearance). If available, construction plans and/or specifications can be reviewed to help in the identification of potential ACMs. Suspect materials will be divided into friable and non-friable materials. The homogenous materials will be placed in one of the following Environmental Protection Agency (EPA) categories:

- Surfacing Materials (sprayed or troweled-on materials)
- Thermal Systems Insulations (materials generally applied to various mechanical systems)
- Miscellaneous Materials (any materials which do not fit in the above categories)

Samples will be collected using disposable or decontaminated instruments. The samples will be collected directly into zip lock bags, ointment cans, or vials. The containers will be handled as described in SECTION 4 of this SOP.

3) TYPES OF SAMPLE COLLECTION

Samples of potential ACMs will be collected in representative homogeneous areas, which are determined by visual examination and review of plans. Samples collected will be processed for shipment to an accredited laboratory following EPA protocol and chain-of-custody procedures.

4) SAMPLE HANDLING

All laboratory samples will be labeled in the field with a Sharpie® or equivalent water-proof labeler with the following information:

- Sample Location
- Date Sample Collected
- Technicians Initials

After the samples are labeled, a custody seal should be placed on the sample container. (see example of custody seals attached to SOP).

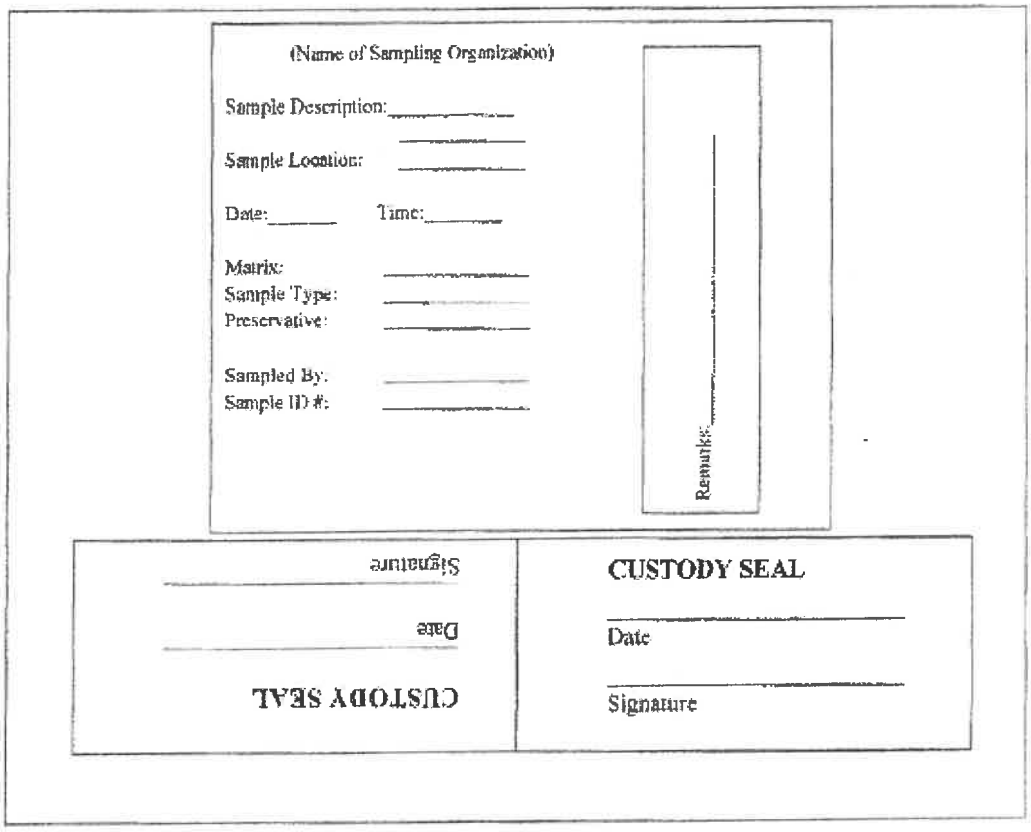
Samples should be delivered to the laboratory as soon as reasonably possible after the sampling event.

5) FIELD SUPPLIES

Before each sampling event the technician should collect the field supply check list (a copy of the check list is attached to this SOP).

6) ATTACHMENTS

EXAMPLE OF SHIPPING LABLES AND CUSTODY SEALS



Project: _____ Project #: _____ Weather: _____

Date of Field Work :_____Site Manager:_____

Field Supply Check List

Item	Need for Project	Date Cleaned and Checked	Date Loaded	Date Returned
Maps/Plot Plan		NA		NA
GIS				
Tape Measure				
Measuring Wheel				
Survey Stakes and Flags		NA		NA
Camera				
PID				
Zip Lock Bags		NA		
4 oz Glass Soil Jars*		NA		NA
8 oz Glass Soil Jars*		NA		NA
Voas*		NA		NA
Amber Bottles*		NA		NA
Water Bottles for Metal*		NA		NA
Sample Labels		NA		NA
Chain-of-Custody		NA		NA
Custody Seals		NA		NA
Cooler				
Ice		NA		NA
3 or More Clean Plastic Buckets**				
Scrub Brush**				
Sponge**				
Alconox**				
Paper Towels**				
Plastic Sheets**				
Hand Spade				
Hand Auger				
Disposable Bailers				
Hard Hat***		NA		NA
Tyvek Suite***		NA		NA
Respirator***				NA
Disposal Latex Gloves***		NA		NA
XRF				

*Supplied by Laboratory
**Decontamination Supplies
***PPE

C-7: Decontamination SOP

1) INTRODUCTION

The purpose of this Standard Operating Procedure (SOP) is to provide a description of the methods used for preventing, minimizing, or limiting cross-contamination of samples due to inappropriate or inadequate equipment decontamination. It also provides general guidelines for developing decontamination procedures for sampling equipment to be used during hazardous waste operations as per 29 Code of Federal Regulations (CFR) 1910.120. This SOP does not address personnel decontamination.

These are standard (i.e. typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitation, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

To help control cross-contamination, when possible, disposal and one time use items will be used for sample collection.

2) DECONTAMINATION SETUP FOR HAND COLLECTION INSTRUMENTS

During each sampling event where it is necessary to decontaminate hand collection instruments, a decontamination area will be set up. A plastic sheet will be placed on the ground. Three clean plastic buckets will placed on the plastic sheet. The first bucket will be filled with tap water and Alconox® soap, a scrub brush, and sponge. The second bucket will contain clean tap water, and the third bucket will be used to collect distilled/de-ionized water.

3) DECONTAMINATION STEPS FOR HAND COLLECTION INSTRUMENTS

Step 1: Place item to be decontaminated into first bucket. Use brush and sponge to wash item.
Step 2: Rinse the item in the second bucket.
Step 3: Hold item over third bucket and pour distilled/de-ionized water over item (if required, some of this last rinse water can be collect for laboratory sampling to verify effectiveness of the decontamination process) .
Step 4: Place item on clean towel to air dry.

4) DECONTAMINATION OF POWER SAMPLING EQUIPMENT (I.E. DRILL RIGS)

The drilling subcontractor must steam clean the auger flights before mobilizing to the site. When possible, all soil samples will be collected in a single use plastic sleeve. If a reusable split spoon sampler is used, it will be decontaminated before each use by the same proceeded used to decontaminated hand tools.

If auger flights or Geoprobe rods need to be reused during a single day of sampling, it will be the sub-contractors responsibility to set up a station to decontaminate this equipment either by scrubbing as described above or using a low-pressure water wash to remove all visible contaminates. The low-pressure water wash method consists of a container which is filled with water and then is pumped full of air to create pressure. A slender nozzle and hose allow the user to spray in hard-to-reach places. For a highly contaminated site, additional on-site decontamination may be required. This will be discussed with the sub-contractor on a site by site basis.

C-8: General Health & Safety Plan

Emergency Medical Help Procedures

If necessary, call for emergency services **Phone: 911**

Call hospital (XXX Name): **Phone: (XXX) XXX-XXXX**

Hospital Address: XXX SSSS

Hospital Location: xxxxx

If the injury is life-threatening, follow steps 1 through 8 below. If the injury is not life-threatening, perform necessary first aid and consider the need for decontamination prior to transport.

1. Perform first aid necessary to determine victim(s) medical status;
2. Call emergency transport;
3. Give specific directions to location of emergency;
4. Give phone from which you are calling;
5. Tell emergency services what happened. Inform that victim(s) may be wearing contaminated clothing;
6. Inform emergency services how many persons need help;
7. Inform emergency services what is being done for the victim(s);
8. Stay on telephone until told to hang-up;

Transport to hospital, if appropriate.

Emergency Contact/Notification System

The following list provides names and telephone numbers for emergency contact personnel.

Organization		Telephone
Ambulance:		911
Police:		911
Fire:		911
Hospital:	XXXXXXXXXXXX XXXXXXX XXXX XXXXX	XXX-XXX-XXXX
EPA Emergency Response Team		908-321-6660
National Response Center		800-424-8802
Center for Disease Control		404-639-7405
Converse Consultants –	Tracy Johnston Cell:	775-225-7655

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1.0 INTRODUCTION

The purpose of this Site Health and Safety Plan (HASP) is to define the requirements and designate protocols to be followed at the Site during the soil, groundwater, soil gas, asbestos and lead sampling activities. Applicability extends to all employees, contractors, subcontractors, and visitors.

All personnel on site, contractors and subcontractors included, will be informed of the site emergency response procedures and any potential fire, explosion, health, or safety hazards of the operation.

All personnel prior to entering the work area must review this plan. All visitors entering the work area at the Site will be required to read and verify compliance with the provisions of this HASP. Note that this plan explicitly covers Converse employees only and does not cover other workers. Each subcontractor will provide a HASP covering their operations, which acknowledge their review and inclusion of the provisions of this document as appropriate.

2.0 KEY PERSONNEL/IDENTIFICATION OF HEALTH AND SAFETY

2.1 Key Personnel

The following personnel and organizations are critical to the planned activities at the Site.

Technical Assistance Team Representatives

Tracy Johnston
Baltazar Pulido-Bautista
Frank Reynolds

2.2 Site Specific Health and Safety Personnel

The Site Health and Safety Officer (HSO) has total responsibility for ensuring that the provisions of this HASP are adequate and implemented in the field. The HSO is also responsible for conducting site inspections on a regular basis to ensure the effectiveness of this plan. The HSO at the site is Philip Childers. The designated alternate is Connor Welsh.

2.3 Organizational Responsibility

Technical Assistance Team (TAT): The TAT is responsible for providing assistance and support regarding all technical, regulatory, and safety aspects of site activity.

3.0 TASK/OPERATION SAFETY AND HEALTH RISK ANALYSIS

3.1 Historical Overview of Site

This HASP defines the hazards and methods to protect personnel from those hazards as identified in previous site work or background information. For a thorough overview of historical information concerning the Site see the following document: Phase I Environmental Site Assessment, Title XXX

The "Site" is defined herein to include Adress, APN XXX-XX-XXX

The purpose of this Phase II Environmental Site Assessment (ESA) is to reconcile the *recognized environmental condition* (REC) that was identified during the Phase I ESA at the Site. The REC that was identified _____

For additional site information, please refer to the Field Sampling Plan available on site.

3.2 Risk Analysis

The following presents an excerpt from the NIOSH Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities regarding the chemical hazards potentially (although with the exception of gasoline constituents, asbestos, and lead, not expected) associated with this project. Language and Table 5-2 will vary depending on the REC and Hazard identified.

Table 5-2. Common Chemical Toxicants Found at Hazardous Waste Sites, Their Health Effects and Medical Monitoring

HAZARDOUS SUBSTANCE OR CHEMICAL GROUP	COMPOUNDS	USES	TARGET ORGANS	POTENTIAL HEALTH EFFECTS	MEDICAL MONITORING
Aromatic Hydrocarbons	Benzene Ethyl benzene Toluene Xylene	Commercial solvents and intermediates for synthesis in the chemical and pharmaceutical industries	Blood Bone marrow CNS[a] Eyes Respiratory system Skin Liver Kidney	All cause: CNS[a] depression decreased alertness, headache, sleepiness, loss of consciousness Defatting dermatitis Benzene suppresses bone-marrow function, causing blood changes. Chronic exposure can cause leukemia Note: Because other aromatic hydrocarbons may be contaminated with benzene during distillation, benzene-related health effects should be considered when exposure to any of these agents is suspected.	Occupational/ general medical history emphasizing prior exposure to these or other toxic agents. Medical examination with focus on liver, kidney, nervous system, and skin. Laboratory testing: CBC[c] Platelet count Measurement of kidney and liver function
Asbestos (or asbestiform particles)		A variety of industrial uses, including: Building Construction Cement work Insulation Fireproofing Pipes and ducts for water, air, and chemicals Automobile brake pads and linings	Lungs Gastrointestinal system	Chronic effects: Lung cancer Mesothelioma Asbestosis Gastrointestinal malignancies Asbestos exposure coupled with cigarette smoking has been shown to have a synergistic effect in the development of lung cancer	History and physical examination should focus on the lungs and gastrointestinal system Laboratory tests should include a stool test for occult blood evaluation as a check for possible hidden gastrointest-inal malignancy A high quality chest X-ray and pulmonary function test may help to identify long-term changes associated with asbestos diseases, however, early ident-ification of low-dose exposure is unlikely
Dioxin (see Herbicides)					

HAZARDOUS SUBSTANCE OR CHEMICAL GROUP	COMPOUNDS	USES	TARGET ORGANS	POTENTIAL HEALTH EFFECTS	MEDICAL MONITORING
Herbicides	Chlorophenoxy compounds: 2,4-dichloro-phenoxyacetic acid (2,4-D) 2,4,5-trichloro-phenoxyacetic acid (2,4,5-T) Dioxin (tetrachloro-dibenzo-p-dioxin, TCDD), which occurs at a trace contaminant in these compounds, poses the most serious health risk.	Vegetation control	Kidney Liver CNS[a] Skin	Chlorophenoxy compounds can cause chloracne, weakness or numbness of the arms and legs, and may result in long-term nerve damage Dioxin causes chloracne and may aggravate pre-existing liver and kidney diseases	History and physical exam should focus on the skin and nervous system Laboratory tests include Measurement of liver and kidney function, where relevant. Urinalysis.
Organochlorine Insecticides	Chlorinated ethanes: DDT Cyclodienes Aldrin Chlordane Dieldrin Endrin Chlorocyclo-hexanes Lindane	Pest control.	Kidney Liver CNS[a]	All cause acute symptoms of apprehen-sion, irritability, dizzi-ness, disturbed equili-brium, tremor, and convulsions Cyclodienes may cause convulsions without any other initial symptoms Chlorocyclohexanes can cause anemia Cyclo-dienes and chlorocyclo-hexanes cause liver toxicity and can cause permanent kidney damage	History and physical exam should focus on the nervous system Laboratory tests include Measurement of kidney and liver function CBC[b] for exposure to chlorocyclo-hexanes

HAZARDOUS SUBSTANCE OR CHEMICAL GROUP	COMPOUNDS	USES	TARGET ORGANS	POTENTIAL HEALTH EFFECTS	MEDICAL MONITORING
Organo-phosphate and Carbamate Insecticides	Organophosphate Diazinon Dichlorovos Dimethoate Trichlorfon Malathion Methyl parathion Parathion Carbamate. Aldicarb Baygon Zectran	Pest control	CNS[1] Liver Kidney	All cause a chain of internal reactions leading to neuromuscular block-age. Depending on the extent of poisoning, acute symptoms range from headaches, fatigue, dizziness, increased salivation and crying, profuse sweating, nausea, vomiting, cramps, and diarrhea to tightness in the chest, muscle twitching, and slowing of the heartbeat. Severe cases may result in rapid onset of unconsciousness and seizures. A delayed effect may be weakness and numbness in the feet and hands. Long-term, permanent nerve damage is possible.	Physical exam should focus on the nervous system. Laboratory tests should include: RBC[4] cholinest-erase levels for recent exposure (plasma cholinest-erase for acute exposures) Measurement of delayed neuro-toxicity and other effects
Polychlorinated Biphenyls (PCBs)		Wide variety of industrial uses	Liver CNS[3] (specula-tive) Respiratory system (specula-tive) Skin	Various skin ailments, including chloracne, may cause liver toxicity, carcinogenic to animals.	Physical exam should focus on the skin and liver. Laboratory tests include: Serum PCB levels. Triglycerides and cholesterol. Measurement of liver function.

[1] CNS = Central nervous system
[2] CBC = Complete blood count
[3] Long-term effects generally manifest in 10 to 30 years
[4] RBC=Red blood count.

More information on these hazards can be found on the attached NIOSH Pocket Guide. In general, we do not anticipate that high concentrations of any of the above contaminants will be encountered. Soil samples will be collected in acetate sleeves advanced by direct-push technology. Standard sampling procedure hygiene should be adequate to protect project personnel against chemical exposure.

3.3 Hazard Descriptions

Example (UST Removal):

Hazards generally associated the proposed activities include:

- Trenching and excavation;
- Tank pressure testing;
- Purging and inerting of tanks;
- Buried utilities;
- Heavy equipment operation;
- General safety hazards, including ignition sources, electrical hazards, powered equipment hazards, walking working surface

Asbestos Sampling:

Hazards generally associated the proposed activities include:

- Exposure to high levels of asbestos particles that can increase the risk of some types of respiratory illnesses and cancer

Lead Sampling:

Hazards generally associated the proposed activities include:

- Breathing in lead-containing dust and fumes;
- Accidental ingestion of lead particles

Avian Feces:

Hazards generally associated the proposed activities include:

- Avian Pathogens

The following steps will minimize the identified hazards:

- Maintaining situational awareness;
- Use of proper personal protective equipment;
- Avoiding placing any part of the body in the line of fire;
- Pre-planning interaction with heavy equipment operator;
- Training, review, and compliance with manufacturer's instruction for operating equipment such as hand-held XRF, excavating equipment and all PPE;
- Proper lifting (pre-lift weight assessment, use of legs, multiple personnel) techniques will prevent back strain. Use slow easy motions when shoveling and digging to decrease muscle strain;
- Adhere to OSHA standards for asbestos and lead sampling;
- First aid equipment is available based on NIOSH Pocket Guide information.

3.4 Physical and Chemical Hazards

See attached above NIOSH excerpts and attached NIOSH Pocket Guide for general chemical information.

There are no anticipated physical hazards such as fire, explosion, or chemical reactivity associated with this project, based on the previous assessment of chemicals and expected concentration.

4.0 PERSONNEL TRAINING REQUIREMENTS

Consistent with OSHA's 29 CFR 1910.120 regulation covering Hazardous Waste Operations and Emergency Response, all site personnel are required to be trained in accordance with the standard. At a minimum, all personnel are required to be trained to recognize the hazards on site, the provisions of this HASP, and the responsible personnel. Employees not involved in soil sampling do not have a reasonable possibility of exposure to contaminates at this site.

Prior to arrival on site, each employer will be responsible for certifying that his/her employees meet the requirements of pre-assignment training, consistent with OSHA 29 CFR 1910.120 paragraph (e)(3). The employer should be able to provide a document certifying that each worker assigned to soil sampling has received 40 hours of instruction off the site. The personnel must also receive 8 hours of refresher training annually.

4.1 Training and Briefing Topics

The following items will be discussed by a qualified individual at the start of the job:

- Chemical hazards for the anticipated or potential contaminants.
- Emergency response plan, Sec. 10.0.
- Personnel protective equipment, Sec. 5.0.
- Operation of all field instrumentation and equipment.

A Job Safety Analysis (JSA) will be prepared by each worker daily.

5.0 PERSONAL PROTECTIVE EQUIPMENT TO BE USED

This section describes the general requirements of PPE (Levels D) which is to be used for soil and groundwater sampling:

- Appropriate gloves, for sampling and construction of monitoring points;
- Steel or composite toed boots/shoes, leather or chemical resistant;
- Safety glasses;

- Hearing protection;
- Hard hat.

The Level of Protection provided by PPE selection will be upgraded as necessary based upon a change in site conditions or findings of investigations. When a significant change occurs, the hazards should be reassessed.

For the ACM and LBP sampling the following guidance will be followed:

Respiratory
- For limited exposure use an N95 dust mask. For prolonged exposure use an air purifying respirator with high efficiency particulate air (HEPA) filters. Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or symptoms are experienced.

Eye/Face
- Wear safety goggles.

Skin/Body
- Wear appropriate gloves. Wear long sleeves and/or protective coveralls.

Environmental Exposure Controls
- Controls should be engineered to prevent release to the environment, including procedures to prevent spills, atmospheric release and release to waterways. Follow best practice for site management and disposal of waste.

Additional Protection Measures
- An eyewash station and emergency shower must be available to the work station.

6.0 INJURY AND EXPOSURE REPORTING

If any employees are injured or potentially exposed above established exposure limits, the employee is required to report it immediately, and will seek medical attention and physical testing. Depending upon the type of exposure, it is critical to perform follow- up testing within 24 to 48 hours. It will be up to the employer's medical consultant to advise the type of test required to accurately monitor for exposure effects.

7.0 FREQUENCY AND TYPES OF AIR MONITORING/SAMPLING

This section explains the general concepts of an air monitoring program and specifies the surveillance activities that will take place during project completion at the Site.

The purpose of air monitoring is to identify and quantify airborne contaminants to verify and determine the level of worker protection needed.

Direct Reading Monitoring Instruments will be used at this site. Direct reading instruments provide information at the time of sampling, enabling rapid decision making. Data obtained from the real time monitors are used to assure proper selection of personnel

protection equipment, engineering controls, and work practices. Overall, the instruments provide the user the capability to determine if site personnel are being exposed to concentrations which exceed exposure limits or action levels for specific hazardous materials

7.1 Direct Reading Instruments

- Instrument: Photo Ionization Detector (PID):
  - Hazard Monitored: Many organic gases and vapors.
  - Application: In survey mode, detects the concentration of many
  - organic gases and vapors.

  - General Care/Maintenance:
    - Calibrate daily with isobutylene standard or equivalent;
    - Recharge or replace battery;
    - Perform routine maintenance, as described in the manual.

7.2 Specific Contaminants to be monitored at the Site

- Organic gases and vapors.

7.3 Site Air Monitoring and Sampling Program

A. Air Monitoring Instruments

Photo Ionization Detector (PID)
Frequency: During subsurface soil sampling.
Locations: Work area.

B. Action Levels

PID Organic gases and vapors:
Action Level
If measured levels exceed **5-meter units** over background in ambient air on the PID evacuate work area, reassess PPE.

8.0 SITE CONTROL MEASURES

The following section defines measures and procedures for maintaining site control.

8.1 Site Communications Plan

Successful communications between field teams and contact with personnel in the support zone is essential. The following communications systems will be available during activities at the Site.

- Verbal communication

8.2 Map to Nearest Medical Facility

8.3 Standing Orders for Work Area

- No smoking, eating, or drinking allowed in work area.
- Employees must wear the appropriate level of protection as defined in the Safety Plan.

9.0 DECONTAMINATION PLAN

Personnel involved in soil sampling should wash their hands before leaving the site and between restroom breaks.

10.0 EMERGENCY RESPONSE/CONTINGENCY PLAN

This section describes contingencies and emergency planning procedures to be implemented at the Site. This plan is compatible with local, state, and federal disaster and emergency management plans, as appropriate.

10.1 Pre-Emergency Planning

During the site briefings which will be held daily, all employees will be trained in and reminded of provisions of the emergency response plan, communication systems, and evacuation routes, and prepare a personal JSA for the day. Table 10.1 identifies the hazardous conditions associated with specific site activities. The plan will be reviewed and revised if necessary, on a regular basis by the Site Supervisor. This will ensure that the plan is adequate and consistent with prevailing site conditions.

10.2 Personnel Roles and Lines of Authority

The Site Supervisors have primary responsibility for responding to and correcting emergency situations. This includes taking appropriate measures to ensure the safety of site personnel and the public. They are additionally responsible for ensuring that corrective measures have been implemented, appropriate authorities notified, and follow up reports completed. The Site Supervisor is Philip Childers. The alternate is Connor Welsh.

10.3 Emergency Recognition/Prevention

See above NIOSH excerpts and attached NIOSH Pocket Guide.

10.4 Evacuation Routes/Procedures

In the event of an emergency which necessitates an evacuation of the site, the following alarm procedures will be implemented:

Evacuation notification will be given verbally by the Site Supervisor. All personnel should evacuate upwind of any activities.

10.5 Emergency Procedures

A. Hazard Exposures

- Skin-remove contaminated clothing immediately; wash with soap and water.
- Inhalation-remove to fresh air. Where necessary, call emergency medical help (ambulance. hospital. police) and follow medical emergency help procedures.
- Eye Contact-flush with eye wash or water at least 15 minutes. Follow emergency medical help procedures, if indicated. Contaminants may be absorbed through the eyes.
- Ingestion-obtain medical help if indicated.
- Injuries-administer first aid if necessary. Follow emergency medical procedures below, if necessary. Medical emergencies take precedence over decontamination.

B. Emergency Medical Help Procedures

If necessary, call for emergency services **Phone: 911**

Call hospital (Name of Hospital): **Phone: (XXX) XXX-XXXX**

Hospital Address: xxxxxxx

Hospital Location: xxxxx

If the injury is life-threatening, follow steps 1 through 8 below. If the injury is not life-threatening, perform necessary first aid and consider the need for decontamination prior to transport.

1. Perform first aid necessary to determine victim(s) medical status;

2. Call emergency transport;

3. Give specific directions to location of emergency;

4. Give phone from which you are calling;

5. Tell emergency services what happened. Inform that victim(s) may be wearing contaminated clothing;

6. Inform emergency services how many persons need help;

7. Inform emergency services what is being done for the victim(s);

8. Stay on telephone until told to hang-up;

Transport to hospital, if appropriate.

10.6 Emergency Contact/Notification System

Emergency Contact/Notification System

The following list provides names and telephone numbers for emergency contact personnel.

Organization	Telephone
Ambulance:	911
Police:	911
Fire:	911
Hospital: XXXXXXXXXXXX XXXXXXX XXXX XXXXX	XXX-XXX-XXXX
EPA Emergency Response Team	908-321-6660
National Response Center	800-424-8802
Center for Disease Control	404-639-7405
Converse Consultants – Tracy Johnston Cell:	775-225-7655

10.7 Fire or Explosion

In the event of a fire or explosion, the local fire department should be summoned immediately. Upon their arrival, the project manager or designated alternate will advise

the fire commander of the location, nature, and identification of the hazardous materials on site.

If it is safe to do so, site personnel may:

- Use fire fighting equipment available on site to control or extinguish the fire if appropriate and safety permits;
- Remove ignition sources;
- Remove or isolate flammable or other hazardous materials which may contribute to the fire.
- Evacuate to upwind location if fire cannot be controlled with a fire extinguisher.

10.8 Spill or Leaks

In the event of a spill or a leak, site personnel will:

- Inform their supervisor immediately.
- Evacuate area, if necessary;
- Locate the source of the spillage and stop the flow if it can be done safely.
- Begin containment and recovery of the spilled materials if it can be done safely.

10.9 Unanticipated Conditions

In the event unanticipated conditions are encountered:

- Suspend all non-emergency activities;
- Notify safety officer and project manager immediately. Do not restart planned operations in the area until authorized by the safety officer and project manager;
- If the unanticipated condition(s) is the presence of unidentifiable nonhydrocarbon related contaminants, site conditions, required protective equipment level and action levels will have to be reevaluated by the safety officer, project manager and site safety coordinator prior to restarting planned operations.

10.10 Emergency Equipment/Facilities

The following equipment is available at the following locations:

- First aid kit, Supervisor's/Alternate's Truck.
- Eyewash, Supervisor's/Alternate's Truck.
- Fire extinguisher, Supervisor's/ Alternate's Truck.
- Site telephone, Supervisor's/ Alternate's cell.

11. Employee Training and Information

Prior to starting work, each employee will attend a health and safety orientation, and will this review this plan.

This document confirms that the hazards of the tasks presented herein have been appropriately described to the undersigned.

Name	Date	Company

APPENDIX D

- D-1: Sampling and Analysis Plan Template
- D-2: Sampling and Analysis Plan from SGMP
- D-3: Data Sheet

D-1: Sampling and Analysis Plan Template

SAMPLING AND ANALYSIS PLAN

GUIDANCE AND TEMPLATE

VERSION 4, Brownfields Assessment Projects

August 2018

This Sampling and Analysis Plan (SAP) guidance and template is intended to assist organizations in documenting the procedural and analytical requirements for Brownfields Assessment projects involving the collection of water, soil, sediment, or other samples taken to characterize areas of potential environmental contamination. It combines, in a short form, the basic elements of a Quality Assurance Project Plan (QAPP) and a Field Sampling Plan (FSP). Once prepared and approved it will meet the requirements for any U.S. Environmental Protection Agency (EPA) Region 9 Brownfields project in which environmental measurements are to be taken.

The format is designed to accommodate projects of limited scope and presumes that the work will be going to a laboratory whose analytical services are not funded directly by EPA. This might include, but not be limited to, a private or commercial laboratory, a state laboratory, an in-house laboratory or any other laboratory under contract to the organization writing the SAP. It is intended to be used for projects generating a limited number of samples to be collected over a relatively short time. This template is not intended to be used for on-going monitoring events, or for remediation or removal activities. Exceptions to these requirements will be considered on a case-by-case basis, but they should be discussed with Region 9 QA Section staff before the template is used and before the SAP is submitted for approval. This template may be used by state, municipal and local agencies, contractor, non-profit organizations, and by EPA staff.

This guidance - template provides item-by-item instructions for each section of a SAP. If the sections are appropriate for the project, they may be used verbatim, or modified as needed to reflect project- and sampling-specific requirements. Not all sections will apply to every organization or to every project.

Some sections, such as those describing sampling procedures, contain example language which may be used with or without modification. If these procedures do not meet project needs, the organization may substitute a specific description of sampling procedures or provide copies of the sampling standard operation procedures (SOPs). Other alternatives should be discussed with QA Section staff.

An electronic version of the template is available and may be used to prepare the SAP. The format of the template is as follows:

The two types of shaded text are to be deleted from the final SAP:

1. Tutorial information presented in *italic* type. This information includes definitions and background information pertaining to a given section of the SAP.
2. Specific instructions given inside brackets [in normal type].

Suggested text which may be included in the SAP is presented in normal type. This text can be used, modified, or deleted depending on the nature of the project. For example, if only groundwater will be sampled, delete the discussion of sampling other matrices. If more than one option is presented, pick the appropriate one and delete the others.

If the use of a Standard Operating Procedure (SOP) is appropriate, the SOP should be included as an appendix to the final SAP and referenced in the appropriate section.

An underlined blank area [_____] indicates that text should be added. Examples or choices may be provided in [brackets] following the blank. If appropriate, select one and delete the others. The underlining should be deleted.

If a given section does not apply, it is recommended that the section state “Not applicable” or “Does not apply” under the section heading. By including the section, the writer avoids having to renumber sections. However, sections can be removed altogether and the remaining sections renumbered.

Example forms are located in Attachment 1. They should be deleted and organization appropriate ones included in the final SAP.

The U.S. EPA Region 9 Quality Assurance Section is available to provide assistance in completing the SAP. Contact Audrey L. Johnson at 415-972-3431, or Mr. Derrick Williamson at 415-972-3698.

Sampling and Analysis Plan [Title of Project] SITE [Address]

Prepared for:

[Name of Organization]

[Date]

Prepared by:

[Name of Organization] [Address]

APPROVAL PAGE

Approved by: _____ _____
[Grantee Name] Project Manager **Date**

Approved by: _____ _____
[Contractor Name] Project Manager **Date**

Approved by: _____ _____
[Contractor Name] Quality Assurance Officer **Date**

Approved by: _____ _____
Project Officer, USEPA Region IX **Date**

Approved by: _____ _____
Quality Assurance Manager, USEPA Region IX **Date**

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Include a list of figures referred to in the report. The following list can be used as a starting point. Add or delete figures as appropriate.

Figure 2-1 Site Location Map

Figure 2-2 Site Layout Map

Figure 4-1 Proposed Soil Sampling Locations

Figure 4-2 Proposed Groundwater Sampling Locations

Figure 4-3 Proposed Soil Vapor Sampling Locations

LIST OF TABLES

Include a list of tables referred to in the report. The following list can be used as a starting point. Add or delete tables as appropriate.

Table 1-1 Key Project Personnel Contact Information

Table 2-1 Contaminants of Concern, Previous Investigations

Table 3-1 Contaminants of Concern, Laboratory and Screening or Action Levels

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Table 5-3 Analytical Services – Soil Vapor or Indoor Air

Table 6-1 Field and Sampling Equipment

Table 6-2 Field Equipment/Instrument Calibration, Maintenance, Testing and Inspection

LIST OF APPENDICES

Include a list of appendices referred to in the report. The following list can be used as a starting point. Add or delete appendices as appropriate.

Appendix A Data Quality Objective Worksheet

Appendix B Site-Specific Health and Safety Plan

DISTRIBUTION LIST

Add additional names as appropriate.

[Grantee Name, Title]
[Grantee Address]

[Contractor Name, Title]
[Contractor Address]

[Name, USEPA Project Officer]
[Division or Section]
US EPA Region 9
75 Hawthorne Street
San Francisco, CA 94105

[Name, USEPA QA Manager]
Quality Assurance Section
US EPA Region 9
75 Hawthorne Street
San Francisco, CA 94105

ABBREVIATIONS AND ACRONYMS

Include and define all acronyms and abbreviations used throughout the plan. The following list can be used as a starting point. Add or delete acronyms and abbreviations as appropriate.

ASTM	American Society for Testing and Materials
CERCLA	Comprehensive Environmental Response, Cleanup, and Liability Act
CFR	Code of Federal Regulations
CHHSL	California Human Health Screening Levels
CLP	Contract laboratory program
CWA	Clean Water Act
DQA	Data quality assessment
DQI	Data quality indicators
DQO	Data quality objectives
EPA	U.S. Environmental Protection Agency
ESA	Environmental site assessment
ESL	Environmental Screening Levels
FSP	Field sampling plan
GC/MS	Gas chromatography and mass spectrometry
IDW	Investigation-derived waste
LCS	Laboratory control sample
MDL	Method detection limit
MQO	Measurement quality objective
MS/MSD	Matrix spike and matrix spike duplicate
mg/L	Milligrams per liter
µg/L	Micrograms per liter
PARCCS	Precision, accuracy, representativeness, completeness, comparability, and sensitivity
PE	Performance evaluation
PRQL	Project-required quantitation limit
QA	Quality assurance
QA/QC	Quality assurance/quality control

ABBREVIATIONS AND ACRONYMS (Continued)

QAPP	Quality assurance project plan
QC	Quality control
QL	Quantitation limit
RCRA	Resource Conservation and Recovery Act
RPD	Relative percent difference
RSL	Regional Screening Level
%R	Percent recovery
SAP	Sampling and analysis plan (an integrated FSP and QAPP)
SOP	Standard operating procedures
SOW	Statement of work
SVOC	Semi-volatile organic compound
TNI	The NELAC Institute
VOC	Volatile organic compound

1. INTRODUCTION

1.1 SITE HISTORY

This section should include a brief description of the project, including the history, problem to be investigated, scope of sampling effort, and types of analyses required. These topics will be covered in depth later so do not include a detailed discussion here. Include tentative sampling dates.

For Brownfields projects, the type of grant (Assessment, Cleanup, Revolving Loan Fund or 128(a)) should be specified and whether it is for hazardous substances or petroleum products. Assessment grants should also state whether it is an area-wide or site-specific grant.

1.2 SITE NAME OR SAMPLING AREA

Provide the most commonly used name of the site or sampling area. Also include the name or abbreviation ("the Site"), if any, that will be used throughout the plan.

1.3 SITE OR SAMPLING AREA LOCATION

Provide a general description of the region (residential, commercial, light industrial, mixed, etc.), state or tribal area in which the site or sampling area is located. Include street address, city, state, and postal code, if appropriate. Detailed information should be provided later in Section 2.

1.4 RESPONSIBLE ORGANIZATION

Provide a description of the organization conducting the sampling.

1.5 PROJECT ORGANIZATION

Table 1-1 should be completed. Provide the name, phone number and email address of the person(s) and/or contractor working on the sampling project as listed in the table. The table can be modified to include titles or positions appropriate to the specific project. Delete personnel or titles not appropriate to the project. A brief description of the roles and responsibilities for each key position should be included either in the table (as shown) or within the text of this section.

An Organization Chart should be included showing the lines of communication. The above information may also be included on the Organization Chart, if appropriate.

It is the responsibility of the Quality Assurance (QA) Officer to oversee the implementation of the Sampling and Analysis Plan, including whether specified quality control (QC) procedures are being followed a described. Ideally, this individual should discuss QA issues with the Project Manager, but should not be involved in the data collection/analysis/interpretation/reporting process except in a review or oversight capacity. If the project is small, another technical person may fulfill this role.

Table 1-1
Key Project Personnel Contact Information and Responsibilities

Title	Name	Phone Number Email Address	Responsibilities
EPA Project Manager			
EPA Quality Assurance Officer (QAO)			
Grantee Project Manager			
Contractor Project Manager (include Company Name)			
Contractor QAO			
Contractor Field Team Leader			
Laboratory Quality Assurance Officer (include Laboratory Name)			

2. BACKGROUND

This section provides an overview of the location, previous investigations, and the apparent problem(s) associated with the site or sampling area.

2.1 SITE OR SAMPLING AREA DESCRIPTION

Two maps of the area should be provided: the first, on a larger scale, should place the area within its geographic region; the second, on a smaller scale, should mark the sampling site or sampling areas within the local area. Additional maps may be provided, as necessary, for clarity. Maps should include a North arrow, a surface and/or ground water directional flow arrow (if appropriate), buildings or former buildings, spill areas, etc. If longitude or latitude information is available, such as from a Global Positioning System (GPS), provide it.

Fill in the blanks.

The site or sampling area occupies_____*[acres or square feet*] in a/an _____ [*urban, commercial, industrial, residential, agricultural, or undeveloped*] area. The site or sampling area is bordered on the north by_____, on the west by_____, on the south by_____, and on the east by _____. The specific location of the site or sampling area is shown in Figure 2.2.

The next paragraph(s) should describe historic and current on-site structures. These should be shown on one of the figures.

Depending on the nature of the project, some of the following sections may not be applicable. If this is the case, do not delete the section. Instead enter "Not Applicable" or other text to indicate that the section does not apply or that the information is not available.

2.2 OPERATIONAL HISTORY

As applicable, describe in as much detail as possible (i.e., use several paragraphs) the past and present activities at the site or sampling area. The discussion might include the following information:

- *a description of the owner(s) and/or operator(s) of the site or areas near the site or sampling area (present this information chronologically);*
- *a description of past and current operations or activities that may have contributed to suspected contamination;*
- *a description of the processes involved in the operation(s) and the environmentally detrimental substances, if any, used in the processes;*
- *a description of any past and present waste management practices.*

2.3 PREVIOUS INVESTIGATIONS/REGULATORY INVOLVEMENT

Summarize all previous sampling efforts at the site or sampling area, including:

- *the sampling date(s);*
- *name of the party(ies) that conducted the sampling;*
- *local, tribal, state or federal government agency for which the sampling was conducted;*
- *a rationale for the sampling;*
- *the type of media sampled (e.g., soil, sediment, water, soil vapor);*
- *laboratory methods that were used;*
- *a discussion of what is known about data quality and usability.*

The summaries should be presented in subsections chronologically. Attach reports or summary tables of results, or include in appendices, if necessary. See Table 2-1 for an example. Previous sampling locations can be shown on one of the figures, or additional figures can be included.

If results from previous sampling events are being used in a general nature, the results can be summarized (e.g., report the highest hits or the range of the results). If specific results are being used to direct the current sampling effort, those specific results must be reported on an analyte- by-analyte basis.

2.4 SCOPING MEETING

Summarize the scoping meeting and/or site visit, including:

- *the date the meeting was held*
- *who attended*
- *what was discussed*

- *what decisions were made*

If more than one scoping meeting/site visit was conducted, include the above information for each.

2.5 GEOLOGICAL/METEOROLOGICAL INFORMATION

For surface and/or ground water sampling: Provide a description of the hydrogeology of the area. Indicate the direction of flow and include a directional flow arrow on the appropriate figure.
For soil sampling: Provide a description of the geology of the area.
For air sampling: Provide prevailing wind direction, temperature, etc.

2.6 IMPACT ON HUMAN HEALTH AND/OR THE ENVIRONMENT

Discuss what is known about the possible and actual impacts of the potential environmental problem at the site on human health and/or the environment.

Table 2-1
Contaminants of Concern, Previous Investigations
Matrix = xx

Analytical Parameter (Contaminants of Concern)	Date of sampling	Sampling contractor	Laboratory Analytical Results (units)	Regulatory Limit (specify)[1]

Specify the source of the regulatory limit(s). For example:

DTSC = Calif. Department of Toxic Substances Control
RWQCB = Regional Water Quality Control Board
RSLs = EPA Region IX Regional Screening Levels
CHHSLs = California Human Health Screening Levels
ESLs = Environmental Screening Levels

3. PROJECT AND DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) are qualitative and quantitative statements for establishing criteria for data quality and for developing data collection designs. This section is crucial to SAP approval, since it defines what the data will be used for and what quality of data are needed to make decisions. EPA's Guidance for Systematic Planning Using the Data Quality Objectives Process (EPA QA/G-4, February 2006) should be consulted for more information. The DQO section should cover the following items:

- Concisely describe the problem to be investigated.
- Identify what questions the investigation will attempt to resolve, what actions (decisions) may result, and who the primary decision maker is.
- Identify the information that needs to be obtained and the measurements that need to be taken to resolve the decision statement(s).
- Define study boundaries and when and where data should be collected.

Most projects utilizing this template are small. Therefore, defining action levels and measurement quality objectives (MQOs) for field and laboratory measurements used on the project are usually sufficient. MQOs define criteria for calibration and quality control (QC) for field and laboratory methods. MQOs are discussed more thoroughly below.

3.1 PROJECT TASK AND PROBLEM DEFINITION

Describe the purpose of the environmental investigation in qualitative terms and how the data will be used. Discuss how the site history relates to the problem to be investigated, scope of sampling effort, and types of analyses that will be required. Include all measurements to be made on an analyte specific basis in whatever media (soil, sediment, water, etc.) is to be sampled. This discussion should relate to how this sampling effort will support the specific decisions described in Section 3.2, DQOs, below.

Redevelopment plans, if known, should be included. If the future use of the site is not known, this should be stated.

3.2 DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) are quantitative and qualitative criteria that establish the level of uncertainty associated with a set of data. They answer the question: How sure are you that the values of the data are what the analyses have determined them to be? All the elements of the sampling event, from the sampling design through laboratory analysis and reporting, affect the quality of the data. The project manager, or other decision maker identified earlier in the project organization section, must make the decision as to what level of uncertainty is acceptable or appropriate. Depending on what the contaminants of concern are, what effect they may have on human and environmental health, and at what level, data quality may need to be legally defensible or capable of answering only a simple "presence-absence" question. More sophisticated DQO discussions involve defining null testing hypotheses and confidence intervals. These should be considered depending on project decision making needs, but such discussions are generally not expected in one-time event SAPs. (A description of the "Seven Step DQO Process" is included in Attachment A).

This section should describe decisions to be made based on the data and provide criteria on which these decisions will be made. Inclusion of one or more tables is recommended. Tables should contain, at a minimum, the main contaminants of concern, their associated action levels and detection limits, and the source of the action level (regulation, health based criteria, water quality standards, etc.) If a contaminant does not have an action level, or will not be used in decision making, the text should discuss how the data for that contaminant will be used. (See Attachment B for a discussion of the relationship between project action limits (PALs), detection limits (DLs) and quantitation limits (QLs).)

The use of "If...then" statements are recommended. Decisions do not have to involve regulatory or legal action (and for Brownfields projects, few are expected to). Some examples: "If contaminants of concern are not detected above the action limits, then no further action is required." or: "If one or more contaminants of concern are found above the action level, then recommendations for further action, such as additional assessment, remediation, or removal will be evaluated."

Discuss Data Quality Objectives, action levels, and decisions to be made based on the data. A table should be constructed which includes the analytes of concern, action limits and detection limits. See Table 3-1 for an example. A separate table should be prepared for each matrix/media to be sampled.

3.3 MEASUREMENT QUALITY OBJECTIVES

Measurement Quality Objectives are criteria established to assess the viability and usability of data. These are based on both field and laboratory protocols that examine whether the data quality indicators (DQIs), i.e.,

precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS), meet criteria established for various aspects of data gathering, sampling, or analysis activity. In defining MQOs specifically for the project, the level of uncertainty associated with each measurement is defined. Some DQIs are quantitative, others are more qualitative. (See Attachment C for a discussion of the PARCCS parameters.)

The values that are to be assigned to the quantitative data quality indicators (precision, accuracy, completeness and sensitivity) and statements concerning the qualitative indicators (representativeness and comparability) are determined by the answers to the questions in Section 3.2.

Project specific requirements for precision, accuracy, representativeness, completeness, comparability and sensitivity (PARCCS) should be discussed here. Where applicable, precision and accuracy acceptance limits, for both laboratory and field measurements, may be presented in a tabular format. A separate table should be prepared for each matrix or media to be sampled. Otherwise, MQO tables or laboratory SOPs should be included as appendices and referenced. This is discussed in greater detail in Section 5.2.

3.4 DATA REVIEW AND VALIDATION

Region 9 has adopted a tiered approach to data review. Details on validation are available from the QA Office, but a brief summary follows:

- Tier 1 involves a cursory review of the QC data for the project. This is sometimes referred to as a "Summary Forms" review. At a minimum, all data should receive a Tier 1 review.
- Tier 2 involves a selected validation based on several factors which should be defined in the DQOs for the project. Candidates might be a specific area within the sampling area, specific analytes or analyses of concern critical to decision making, or some other factor(s). The review may also focus on anomalies noted during the Tier 1 review.
- Tier 3 involves a traditional full validation. Data reviewed include the raw data, standards log books, extractions logs, instrument printouts, chromatograms (if applicable), mass spectra (if applicable), etc. Calibration data, sample analysis data, and quality control data are all evaluated. Typically, this is a "3rd party review" and isbased on strict protocols, such as the National Functional Guidelines.

There is no requirement that all data adhere to the same Tier; the project can mix and match depending on project needs and requirements. It is recommended that if validation will be a part of the data review process, that SOP(s) from the organization which will perform the validation be attached.

Discuss data review and data validation including what organizations or individuals will be responsible for what aspects of data review and what the review will include. This section should also discuss how data that do

not meet data quality objectives will be designated, flagged, or otherwise handled. Possible corrective actions associated with the rejection of data, such as reanalysis or resampling, also need to be addressed.

3.5 DATA MANAGEMENT

Provide a list of the steps that will be taken to ensure that data are transferred accurately from collection to analysis to reporting. Discuss the measures that will be taken to review the data collection processes, including field notes or field data sheets; to obtain and review complete laboratory reports; and to review the data entry system, including its use in reports. A checklist is acceptable.

3.6 ASSESSMENT OVERSIGHT

Describe the procedures which will be used to implement the QA Program. This would include oversight by the Quality Assurance Manager or the person assigned QA responsibilities. Indicate how often a QA review of the different aspects of the project, including audits of field and laboratory procedures, use of performance evaluation samples, review of laboratory and field data, etc., will take place. Describe what authority the QA Manager or designated QA person has to ensure that identified field and analytical problems will be corrected and the mechanism by which this will be accomplished.

Table 3-1
Contaminants of Concern, Laboratory, and Screening or Action Levels Matrix = xx

Analytical Parameter (Contaminants of Concern)	Laboratory Reporting or Quantitation Limits	Screening or Action Levels		

4. SAMPLING DESIGN AND RATIONALE

For each sampling event, the SAP must describe the sampling locations, the media tobe sampled, and the analytes of concern at each location. A rationale should then be provided justifying these choices. This information may be presented in a tabular format. (See Tables 4-1and 4-2 for examples.) This section is crucial to plan approval and should be closely related to previously discussed DQOs.

The following subsections are subdivided on a media specific basis among soil, sediment, and water. Other media should be added as needed. Appropriate figures should be included showing proposed sampling locations.

Information regarding the collection of field duplicates may be included in these sections. Provide a rationale for the selection of these locations. If locations will be determined in the field, the criteria that will be used to make these selections should be provided. Alternatively, field duplicates may be discussed in Section 10.1.2.

Do not include sampling procedures, preservation, etc., as these topics are covered in later sections.

4.1 SOIL SAMPLING

Provide a general overview of the soil sampling event. Present a rationale for choosing each sampling location at the site or sampling area and the depths at which the samples are to be taken, if relevant. If decisions will be made in the field, provide details concerning the criteria that will be used to make these decisions (i.e., the decision tree to be followed). List the analytes of concern at each location and provide a rationale for why the specific chemical or group of chemicals (e.g., organochlorine pesticides) was chosen. Include a figure showing sampling locations.

4.2 SEDIMENT SAMPLING

Provide a general overview of the sediment sampling event. Present a rationale for choosing each sampling location at the site or sampling area and the depths or area of the river, stream or lake at which the samples are to be taken, if relevant. If decisions will be made in the field, provide details concerning the criteria that will be used to make these decisions (i.e., the decision tree to be followed). List the analytes of concern at each location and provide a rationale for why the specific chemical or group of chemicals (e.g., organochlorine pesticides) was chosen. Include a figure showing sampling locations.

4.3 WATER SAMPLING

Provide a general overview of the water sampling event. For groundwater, describe the wells to be sampled or how the samples will be collected (e.g., hydro punch), including the depths at which the samples are to be taken. For surface water, describe the depth and nature of the samples to be collected (fast or slow-moving water, stream traverse, etc.). Present a rationale for choosing each sampling location or sampling area. If decisions will be made in the field, provide details concerning the criteria that will be used to make these decisions (i.e., the decision tree to be followed). List the analytes of concern at each location and provide a rationale for why the specific chemical or group of chemicals (e.g., organochlorine pesticides) was chosen. Include a figure showing sampling locations.

4.4 SOIL VAPOR SAMPLING

Describe soil vapor considerations and discuss whether soil vapor may be a potential concern, and if sampling may be warranted at the site. All assessments should consider the potential for vapor intrusion to ensure that any redevelopment activities protect the health of current and future site occupants. Evaluate the site conditions and determine the potential soil vapor intrusion. concerns. State if soil vapor intrusion is a concern at the site based on the flowchart provided below, and if warranted, describe any soil vapor sampling activities.

Below is some suggested language:

Vapor intrusion is defined as the migration of chemical vapors from contaminated soil and groundwater into existing or planned buildings. Vapor intrusion exposes building occupants to potentially toxic levels of vapors when volatile organic compounds (VOCs) present in contaminated soil or groundwater emit vapors that migrate into overlying buildings. VOCs in contaminated soil and groundwater emit vapors that rise through the pore space of the unsaturated zone above the water table. These vapors can move laterally as well as vertically from the source of contamination. Generally, soil or groundwater contamination within 100 feet (laterally or vertically) of any current or future on-site or off-site buildings contains the potential for releasing hazardous vapors to the indoor air. Any passageway, such as a sand or gravel layer, buried utility line, or animal burrow, may facilitate the flow of soil vapor. Properties with a higher potential for soil vapor intrusion include industrial and commercial areas, such as former manufacturing and chemical processing plants, warehouses, train yards, dry cleaners, and gas stations.

4.5 OTHER SAMPLING

Describe other media that may be sampled. Present a rationale for choosing each sampling location at the site or sampling area and the depths at which the samples are to be taken, if relevant. If decisions will be made in the field, provide details concerning the criteria that will be used to make these decisions (i.e., the decision tree to be followed). List the analytes of concern at each location and provide a rationale for why the specific chemical or group of chemicals was chosen. Include a figure showing sampling locations.

4.6 CULTURAL RESOURCE DISCOVERIES

The disturbance of site soils carries the potential of unanticipated discovery of cultural resources. Cultural resources are artifacts, relics, or other physical traces, regardless of condition, that may be associated with prehistoric or indigenous occupation and use of the site and may possess archeological significance or be of importance to existing tribes. Information describing the steps to be implemented if cultural resources are discovered should be included in this section. Different regions, municipalities, agencies, states, or other organizations, such as a local tribe, may already have an appropriate plan developed. If so, a copy should be included with this document and referenced here.

Table 4-1
Sampling Design and Rationale Matrix = Soil

Sampling Location/ID Number	Depth (feet)	Analytical Parameter	Rationale *

* Include rationale for location, depth and analysis.

Table 4-2
Sampling Design and Rationale
Matrix = Groundwater

Sampling Location/ID Number	Analytical Parameter	Rationale *

* Include rationale for location and analysis.

5. REQUEST FOR ANALYSES

This section should discuss the following analytical support for the project: the analyses requested, analytes of concern, turnaround times, available resources, available laboratories, etc. The use of tables is highly recommended. If samples will be sent to more than one organization, it should be clear which samples will be sent to each laboratory. Field analyses for pH, conductivity, turbidity, or other field tests should be discussed in the sampling section. Field measurements in a mobile laboratory should be discussed here and differentiated from samples to be sent to a fixed laboratory. Field screening tests (for example, immunoassay tests) should be discussed in the sampling section, but the confirmation tests should be discussed here and the totals included in the tables.

5.1 ANALYSES NARRATIVE

Complete this subsection concerning the analyses for each matrix. An analytical services table is recommended for each matrix to be sampled. See Tables 5-1 and 5-2 for examples. Each table must include the analytical parameters for each type of sample. Quality Control (QC) samples, such as blanks, duplicates, splits, and laboratory QC samples, should be indicated in the column titled "Special Designation." The selected analyses must be consistent with earlier discussions concerning DQOs and analytes of concern.

Information on container types, sample volumes, preservatives, special handling, and analytical holding times for each parameter may be included here or on a separate table. See Tables 5-3 and 5-4 for examples.

Include any special requests, such as fast turn-around time (2 weeks or less), specific QC requirements, or modified sample preparation techniques in this section. Provide information for each analysis requested.

Note: Rationale for the selection of duplicate and laboratory QC sample locations is to be provided in Section 10.0.

5.2 ANALYTICAL LABORATORY

When an organization contracts for analytical work it has two options. In Option 1, MQOs for laboratory work are defined in the SAP. The MQOs are provided to the laboratory which then acknowledges that it is capable of meeting these criteria, and also states it is willing to do so. In Option 2, the sampling organization reviews the information from the laboratory on its QA/QC Program and C criteria and determines whether the laboratory can meet project needs.

If the first approach is taken, the organization writing the SAP should include the appropriate QC tables in the SAP. The Region 9 QA Office has MQO tables available for most routine analyses. These tables can be

attached to the SAP and referenced in this section. Plan preparers are free to request these tables, review them for their appropriateness for the project, and incorporate all or some of them in original or modified form into their SAP.

If the second approach is taken, the sampling organization must acknowledge that it understands and agrees to the MQOs defined by the contract laboratory which will be used for the project. MQOs or QC criteria for work performed by the laboratory will be found in either the laboratory's QA Plan and/or its SOPs, which must be included with the sampling plan for review.

Field analyses for pH, conductivity, turbidity, or other field tests should be discussed in the sampling section. Field measurements in a mobile laboratory (for example, the Field Analytical Support Program (FASP) laboratory) should be discussed here and differentiated from samples to be sent to a fixed laboratory. Field screening tests (for example, immunoassay tests) should be discussed in the sampling section, but the confirmation tests should be discussed here and the totals included in the tables.

The narrative subsection concerning laboratory analytical requirements should be completed. Appropriate MQO tables, or the laboratory QA Plan and relevant SOPs for the methods to be performed, must accompany the SAP. EPA does not approve or certify laboratories; however, it will review the laboratory's QA Plan and provide comments to the SAP's originator concerning whether the laboratory's QA/QC program appears to be adequate to meet project objectives. It is recommended that any issues raised be discussed with the laboratory and resolved before work commences. Note that the more the SAP "defaults" to laboratory capabilities, the greater emphasis will be placed on the adequacy of the laboratory's QA program. If MQO tables, or the equivalent, are used, less emphasis will be placed on the laboratory's QA Program.

Table 5-1 Analytical Services Matrix = Soil

Sample Number	Sample Location	Depth (feet)	Special Designation	Analytical Methods			
Total number of Soil Samples, excluding QC:							
Total number of Soil Samples, including QC:							

Table 5-2

Analytical Services
Matrix = Groundwater

Sample Number	Sample Location	Special Designation	Analytical Methods			
Total number of samples, excluding QC						
Total number of samples, including QC						

6. FIELD METHODS AND PROCEDURES

In the general introductory paragraph to this section, there should be a description of the methods and procedures that will be used to accomplish the sampling goals, e.g., "...collect soil, sediment and water samples." It should be noted that personnel involved in sampling must wear clean, disposable gloves of the appropriate type. The sampling discussion should track the samples identified in Section 4.0 and Analytical Services table(s). A general statement should be made that refers to the sections containing information about sample tracking and shipping (Section 7). Provide a description of the sampling procedures. Example procedures are provided below, but the organization's own procedures can be used instead. In that case, attach a copy of the applicable SOP. Some sampling procedures are available from EPA. Contact the QA Office or visit the Region 9 laboratory's web page.

6.1 FIELD EQUIPMENT

6.1.1 List of Equipment Needed

List all the equipment that will be used in the field to collect samples, including decontamination equipment, if required. Discuss the availability of back-up equipment and spare parts. This information can be presented in a tabular format. See Table 6-1 for an example.

6.1.2 Calibration of Field Equipment

Describe the procedures by which field equipment is prepared for sampling, including calibration standards used, frequency of calibration and maintenance routines. Indicate where the equipment maintenance and calibration record(s) for the project will be kept. See Table 6-2 for an example.

6.2 FIELD SCREENING

In some projects a combination of field screening using a less accurate or sensitive method may be used in conjunction with confirmation samples analyzed in a fixed laboratory. This section should describe these methods or reference attached SOPs. Analyses such as XRF or immunoassay kits are two examples.
Describe any field screening methods to be used on the project, including how samples will be collected, prepared, and analyzed in the field. Include in an appendix, as appropriate, SOPs covering these methods. Confirmation of screening results should also be described. The role of field screening in decision making for the site should also be discussed here if it has not been covered previously.

6.3 SOIL SAMPLING

6.3.1 Surface Soil Sampling

Use this subsection to describe the collection of surface soil samples that are to be collected within 6-12 inches of the ground surface. Specify the method (e.g., hand trowels) that will be used to collect the samples and then transfer samples to the appropriate containers, or reference the appropriate sections of a Soil Sampling SOP. If SOPs are referenced, they should be included in an appendix.

If exact soil sampling locations will be determined in the field, this should be stated. The criteria that will be used to determine sampling locations, such as accessibility, visible signs of potential contamination (e.g., stained soils, etc.), and topographical features which may indicate the location of hazardous substance disposal (e.g., depressions that may indicate a historic excavation) should be provided.

Include this paragraph first if exact sampling locations are to be determined in the field; otherwise delete.

Exact soil sampling locations will be determined in the field based on accessibility, visible signs of potential contamination (e.g., stained soils), and topographical features which may indicate location of hazardous substance disposal (e.g., depressions that may indicate a historic excavation). Soil sample locations will be recorded in the field logbook as sampling is completed. A sketch of the sample location will be entered into the logbook and any physical reference points will be labeled. If possible, distances to the reference points will be given.

If surface soil samples are to be analyzed for volatile organic compounds (VOCs), use this paragraph; otherwise delete. It is Region 9 policy that soils collected for volatile and gasoline analyses be collected in hermetically sealed sampling devices (such as EnCore samplers) and analyzed within the holding time specified in EPA Method 5035, or immediately preserved by one of the processes specified in EPA Method 5035. A rationale should be provided if more than one preservation method is specified. Collection in brass tubes, even if subsequently preserved, is not acceptable.

Samples to be analyzed for volatile organic compounds will be collected first. Surface soil samples for VOC analyses will be collected as grab samples (independent, discrete samples) from a depth of 0 to ____ inches below ground surface (bgs). Surface soil samples will be collected using [specify the type of sampling device], and will be collected in triplicate. Samples will be sealed and placed in a zip lock bag. See Section 7.1 for preservation and shipping procedures.

If surface soil samples are to be analyzed for compounds other than volatiles, use this paragraph; otherwise delete.

Surface soil samples will be collected as grab samples (independent, discrete samples) from a depth of 0 to inches below ground surface (bgs). Surface soil samples will be collected using a stainless-steel hand trowel. Samples to be analyzed for_____[list all analytical methods for soil samples except for volatile organic compounds] will be placed in a sample-dedicated disposable pail and homogenized with a trowel. Material in the pail will be transferred with a trowel from the pail to the appropriate sample containers. Sample containers will be filled to the top, taking care to prevent soil from remaining in the lid threads prior to being closed to prevent potential contaminant migration to or from the sample. [Alternatively, samples will be retained in the brass sleeves in which collected until samples preparation begins.] See Section 7.1 for preservation and shipping procedures.

6.3.2 Subsurface Soil Sampling

Use this subsection for subsurface soil samples that are to be collected 12 inches or more below the surface. Specify the method (e.g., hand augers) that will be used to access the appropriate depth and then state the depth at which samples will be collected and the method to be used to collect and then transfer samples to the appropriate containers, or reference the appropriate sections of a Soil Sampling SOP. If SOPs are referenced, they should be included in an Appendix.

If exact soil sampling locations will be determined in the field, this should be stated. The criteria that will be used to determine sampling locations, such as accessibility, visible signs of potential contamination (e.g., stained soils), and topographical features which may indicate the location of hazardous substance disposal (e.g., depressions that may indicate a historic excavation) should be provided. There should also be a discussion concerning possible problems, such as subsurface refusal.

Include this paragraph first if exact sampling locations are to be determined in the field; otherwise delete.

Exact soil sampling locations will be determined in the field based on accessibility, visible signs of potential contamination (e.g., stained soils), and topographical features which may indicate location of hazardous substance disposal (e.g., depressions that may indicate a historic excavation). Soil sample locations will be

recorded in the field logbook as sampling is completed. A sketch of the sample location will be entered into the logbook and any physical reference points will be labeled. If possible, distances to the reference points will be given.

If subsurface samples are to be analyzed for volatile organic compounds, use this paragraph; otherwise delete
It is Region 9 policy that soils collected for volatile and gasoline analyses be collected in hermetically sealed sampling devices (such as EnCore samplers) and analyzed within the holding time specified in EPA Method 5035, or immediately preserved by one of the processes specified in EPA Method 5035. A rationale should be provided if more than one preservation method is specified. Collection in brass tubes, even if subsequently preserved, is not acceptable.

Samples to be analyzed for volatile organic compounds will be collected first. Subsurface samples will be collected by boring to the desired sample depth using _____. Once the desired sample depth is reached, soil samples for VOC analyses will be collected as independent, discrete samples. Surface soil samples will be collected using [specify the type of sampling device], and will be collected in triplicate. Samples will be sealed using the Encore sampler and placed in a zip lock bag. See Section 7.1 for preservation and shipping procedures.

If subsurface soil samples are being collected for compounds other than volatiles, use these paragraphs; otherwise delete.

Subsurface samples will be collected by boring to the desired sample depth using _____. Once the desired sample depth is reached, the _____ [hand- or power-operated device, such as a shovel, hand auger, hollow-stem auger or split-spoon sampler] will be inserted into the hole and used to collect the sample. Samples will be transferred from the _____[sampling device] to a sample-dedicated disposable pail and homogenized with a trowel. Material in the pail will be transferred with a trowel from the pail to the appropriate sample containers. Sample containers will be filled to the top taking care to prevent soil from remaining in the lid threads prior to being sealed to prevent potential contaminant migration to or from the sample. See Section 7.1 for preservation and shipping procedures.

Include this as the final paragraph for subsurface soil samples.

Excess set-aside soil from the above the sampled interval will then be repacked into the hole.

6.4 SEDIMENT SAMPLING

Use this subsection if sediment samples are to be collected. Specify the method (e.g., dredges) that will be used to collect the samples and at what depth samples will be collected. Describe how samples will be homogenized and the method to be used to transfer samples to the appropriate containers, or reference the appropriate sections of a Soil Sampling SOP. If SOPs are referenced, they should be included in an appendix.

If exact sediment sampling locations will be determined in the field, this should be stated. Describe where sediment samples will be collected, e.g., slow moving portions of streams, lake bottoms, washes, etc.

Include this paragraph first if exact sampling locations are to be determined in the field; otherwise delete.

Exact sediment sampling locations will be determined in the field, based on _____ [describe the criteria to be used to determine sampling locations]. Care will be taken to obtain as representative a sample as possible. The sample will be taken from areas likely to collect sediment deposits, such as slow-moving portions of streams or from the bottom of the lake at a minimum depth of 2 feet.

The final paragraph describes sample homogenization, which is especially important if the sample is to be separated into solid and liquid phases, and container filling. Include this paragraph, or a modified form of it, for all sediment sampling. It is assumed that sediment samples will not be analyzed for volatile compounds. If sediment is to be analyzed for volatile organic compounds, the samples to be analyzed for volatile compounds should not be homogenized, but rather transferred directly from the sampler into the sample container. If feasible, a hermetically sealed sampling device should be used.

Material in the sampler will be transferred to a sample-dedicated disposable pail and homogenized with a trowel. Material from the pail will be transferred with a trowel from the bucket to the appropriate sample containers. Sample containers will be filled to the top taking care to prevent soil from remaining in the lid groves prior to being sealed in order to prevent potential contamination migration to or from the sample containers. See Section 7.2 for preservation and shipping procedures.

6.5 WATER SAMPLING

6.5.1 Surface Water Sampling

Use this subsection if samples are to be collected in rivers, streams, lakes and reservoirs, or from standing water in runoff collection ponds, gullies, drainage ditches, etc. Describe the sampling procedure, including the type of sample (grab or composite - see definitions below), sample bottle preparation, and project-specific directions for taking the sample. State whether samples will be collected for chemical and/or microbiological analyses. Alternatively, reference the appropriate sections of attached SOPs.

Grab: Samples will be collected at one time from one location. The sample should be taken from flowing, not stagnant water, and the sampler should be facing upstream in the middle of the stream. Samples will be collected by hand or with a sample bottle holder. For samples taken at a single depth, the bottle should be uncapped and the cap protected from contamination. The bottle should be plunged into the water mouth down and filled 6 to 12 inches below the surface of the water. If it is important to take samples at depths, special samplers (e.g., Niskin or Kemmerer Depth Samplers) may be required.

Time Composite: Samples are collected over a period of time, usually 24 hours. If a composite sample is required, a flow- and time-proportional automatic sampler should be positioned to take samples at the appropriate location in a manner such that the sample can be held at $4^{o}C$ for the duration of the sampling.

Spatial Composite: Samples are collected from different representative positions in the water body and combined in equal amounts. A Churn Splitter or equivalent device will be used to ensure that the sample is homogeneously mixed before the sample bottles are filled. Volatile organic compound samples will be collected as discrete samples and not composited.

If exact surface water sample locations will be determined in the field, this should be stated. Describe the criteria that will be used to determine where surface water samples will be collected.

Include this paragraph first if exact sampling locations are to be determined in the field; otherwise delete.

Exact surface water sampling locations will be determined in the field based on _____ [describe the criteria to be used to determine sampling locations]. Sample locations will be recorded in the field logbook as sampling is completed. A sketch of the sample location will be entered into the logbook and any physical reference points will be labeled. If possible, distances to the reference points will be given.

Use this paragraph if samples are to be collected in rivers, streams, lakes and reservoirs, or from standing water in runoff collection ponds, gullies, drainage ditches, etc. Describe the sampling procedure, sample bottle preparation, and project-specific directions for taking the sample, or reference the appropriate sections of a Water Sampling SOP. If SOPs are referenced, they should be included in an appendix.

Samples will be collected from_____[describe the sampling location]. The sample will be taken from flowing, not stagnant water. The sampler will face upstream in the middle of the stream. Samples will be collected by hand or with a sample bottle holder. For samples taken at a single depth, the bottle should be uncapped and the cap protected from contamination. The bottle should be plunged into the water mouth down and filled 6 to 12" below the surface of the water. If it is important to take samples at depths, special samplers (e.g., Niskin or Kemmerer Depth Samplers) may be required. See Section 7.3 for preservation and shipping procedures.

6.5.2 Groundwater Sampling

This subsection contains procedures for water level measurements, well purging, and well sampling. Relevant procedures should be described under this heading with any necessary site- specific modifications, or reference sections of an appropriate SOP. If SOPs are referenced, they should be included in an appendix.

6.5.3 Water-Level Measurements

The following language may be used as is or modified to meet project needs.

All field meters will be calibrated according to manufacturer's guidelines and specifications before and after every day of field use. Field meter probes will be decontaminated before and after use at each well.

If well heads are accessible, all wells will be sounded for depth to water from top of casing and total well depth prior to purging. An electronic sounder, accurate to the nearest $\pm$0.01 feet, will be used to measure depth to water in each well. When using an electronic sounder, the probe is lowered down the casing to the top of the water column; the graduated markings on the probe wire or tape are used to measure the depth to water from the surveyed point on the rim of the well casing. Typically, the measuring device emits a constant

tone when the probe is submerged in standing water and most electronic water level sounders have a visual indicator consisting of a small light bulb or diode that turns on when the probe encounters water. Total well depth will be sounded from the surveyed top of casing by lowering the weighted probe to the bottom of the well. The weighted probe will sink into silt, if present, at the bottom of the well screen. Total well depths will be measured by lowering the weighted probe to the bottom of the well and recording the depth to the nearest 0.1 feet.

Water-level sounding equipment will be decontaminated before and after use in each well. Water levels will be measured in wells which have the least amount of known contamination first. Wells with known or suspected contamination will be measured last.

6.5.4 Purging

Describe the method that will be used for well purging (e.g., dedicated well pump, bailer, hand pump), or reference the appropriate sections in a Ground Water SOP. If SOPs are referenced, they should be included in an Appendix. Note: A combination of purging methods may be used.

Include this paragraph if dedicated well pumps will be used; otherwise delete.

All wells will be purged prior to sampling. If the well casing volume is known, a minimum of three casing volumes of water will be purged using the dedicated well pump.

Include this paragraph if hand pumps, submersible pumps, bailers, or other sampling methods will be used; otherwise delete.

All wells will be purged prior to sampling. If the well casing volume is known, a minimum of three casing volumes of water will be purged using [specify sampling method]. When a submersible pump is used for purging, clean flexible Teflon tubes will be used for groundwater extraction. All tubes will be decontaminated before use in each well. Pumps will be placed 2 to 3 feet from the bottom of the well to permit reasonable draw down while preventing cascading conditions.

The following paragraphs should be included in all sample plans.

Water will be collected into a measured bucket to record the purge volume. Casing volumes will be calculated based on total well depth, standing water level, and casing diameter. One casing volume will be calculated as:

$$\mathbf{V = \pi d^2 h / 77.01}$$

where: **V** is the volume of one well casing of water ($1ft^3 = 7.48$ gallons);

d is the inner diameter of the well casing (in inches);

h is the total depth of water in the well (in feet).

It is most important to obtain a representative sample from the well. Stable water quality parameter (temperature, pH and specific conductance) measurements indicate representative sampling is obtainable. Water quality is considered stable if for three consecutive readings:

- temperature range is no more than $\pm$1°C;
- pH varies by no more than 0.2 pH units;
- specific conductance readings are within 10% of the average.

The water in which measurements were taken will not be used to fill sample bottles.

If the well casing volume is known, measurements will be taken before the start of purging, in the middle of purging, and at the end of purging each casing volume. If the well casing volume is NOT known, measurements will be taken every 2.5 minutes after flow starts. If water quality parameters are not stable after 5 casing volumes or 30 minutes, purging will cease, which will be noted in the logbook, and ground water samples will be taken. The depth to water, water quality measurements and purge volumes will be entered in the logbook.

If a well dewaters during purging and three casing volumes are not purged, that well will be allowed to recharge up to 80% of the static water column and dewatered once more. After water levels have recharged to 80% of the static water column, groundwater samples will be collected.

6.5.5 Well Sampling

Describe the method that will be used to collect samples from wells. (This will probably be the same method as was used to purge the wells.) Specify the sequence for sample collection (e.g., bottles for volatile analysis will be filled first, followed by semivolatiles, etc.). State whether samples for metals analysis will be filtered or unfiltered. Include the specific conditions, such as turbidity, that will require samples to be filtered. Alternatively, reference the appropriate sections in the Ground Water SOP and state in which appendix the SOP is located.

The following paragraph should be included in all sample plans.

At each sampling location, all bottles designated for a particular analysis (e.g., volatile organic compounds) will be filled sequentially before bottles designated for the next analysis are filled (e.g., semivolatile organic compounds). If a duplicate sample is to be collected at this location, all bottles designated for a particular analysis for both sample designations will be filled sequentially before bottles for another analysis are filled. In the filling sequence for duplicate samples, bottles with the two different sample designations will alternate (e.g., volatile organic compounds designation GW-2, volatile organic compounds designation GW-4 (duplicate of GW-2), metals designation GW-2, and metals designation GW-4 (duplicate of GW-2). Groundwater samples will be transferred directly into the appropriate sample containers with preservative, if required, chilled if appropriate, and processed for shipment to the laboratory.

If samples are to be collected for volatiles analysis, the following paragraph should be added; otherwise delete.

Samples for volatile organic compound analyses will be collected using a low flow sampling device. A [specify type] pump will be used at a flow rate of_____. Vials for volatile organic compound analysis will be filled first to minimize the effect of aeration on the water sample. See Section 7.3 for preservation and shipping procedures.

If some samples for metals (or other) analysis are to be filtered, depending upon sample turbidity, the following paragraph should be added; otherwise delete.

After well purging and prior to collecting groundwater samples for metals analyses, the turbidity of the groundwater extracted from each well will be measured using a portable turbidity meter. A small quantity of groundwater will be collected from the well, transferred to a disposable vial, and a turbidity measurement will be taken. The results of the turbidity measurement will be recorded in the field logbook. The water used to measure turbidity will be discarded after use. If the turbidity of the groundwater from a well is above 5 Nephelometric Turbidity Units (NTUs), both a filtered and unfiltered sample will be collected. A [specify

size]-micron filter will be used to remove larger particles that have been entrained in the water sample. A clean, unused filter will be used for each filtered sample collected. Groundwater samples will be transferred from the filter directly into the appropriate sample containers with a preservative and processed for shipment to the laboratory. When transferring samples, care will be taken not to touch the filter to the sample container. After the filtered sample has been collected, an unfiltered sample will be collected. A sample number appended with an "Fl" will represent a sample filtered with a [specify size]-micron filter. See Section 7.3 for preservation and shipping procedures.

If samples are to be filtered for metals (or other) analysis regardless of sample turbidity, the following paragraph should be added; otherwise delete.

Samples designated for metals analysis will be filtered. A [specify size]-micron filter will be used to remove larger particles that have been entrained in the water sample. A clean, unused filter will be used for each filtered sample collected. Groundwater samples will be transferred from the filter directly into the appropriate sample containers to which preservative has been added and processed for shipment to the laboratory. When transferring samples, care will be taken not to touch the filter to the sample container. After the filtered sample has been collected, an unfiltered sample will be collected. A sample number appended with an "Fl" will represent a sample filtered with a [specify size]-micron filter. See Section 7.3 for preservation and shipping procedures.

6.6 OTHER SAMPLING

Describe the collection of other media, if any.

6.7 DECONTAMINATION PROCEDURES

Specify the decontamination procedures that will be followed if non-dedicated sampling equipment is used. Alternatively, reference the appropriate sections in the organization's Decontamination SOP and state in which appendix the SOP is located.

The decontamination procedures that will be followed are in accordance with approved procedures. Decontamination of sampling equipment must be conducted consistently as to assure the quality of samples collected. All equipment that comes into contact with potentially contaminated soil or water will be decontaminated. Disposable equipment intended for one-time use will not be decontaminated, but will be packaged for appropriate disposal. Decontamination will occur prior to and after each use of a piece of equipment. All sampling devices used, including trowels and augers, will be steam-cleaned or decontaminated according to EPA Region 9 recommended procedures.

The following, to be carried out in sequence, is an EPA Region IX recommended procedure for the decontamination of sampling equipment.

Use the following decontamination procedures; edit as necessary.

- Non-phosphate detergent and tap water wash, using a brush if necessary
- Tap-water rinse
- 0.1 N nitric acid rinse [For inorganic analyses, include an acid rinse. Otherwise, delete.]
- Deionized/distilled water rinse
- Pesticide-grade solvent (reagent grade hexane) rinse in a decontamination bucket [For organic analyses, include a solvent rinse. Otherwise, delete.]
- Deionized/distilled water rinse (twice)

Equipment will be decontaminated in a pre-designated area on pallets or plastic sheeting, and clean bulky equipment will be stored on plastic sheeting in uncontaminated areas. Cleaned small equipment will be stored in plastic bags. Materials to be stored more than a few hours will also be covered.

NOTE: If a different decontamination procedure is used; a rationale for using the different approach should be provided.

Table 6-1
Field and Sampling Equipment

Description of Equipment	Material (if applicable)	Dedicated (Yes/No)

Table 6-2
Field Equipment/Instrument Calibration, Maintenance, Testing, and Inspection

Analytical Parameter	Field Equipment/ Instrument	Calibration Activity	Maintenance and Testing/ Inspection Activity	Frequency	Acceptance Criteria	Corrective Action

7. SAMPLE CONTAINERS, PRESERVATION, PACKAGING AND SHIPPING

This section describes the types of containers to be used and the procedures for preserving, packaging and shipping samples. Some of this information may have been presented in tabular form previously. See Tables 5-1 and 5-2 for examples. The organization responsible for adding preservatives should be named.

The number and type of sample containers, volumes, and preservatives are listed in [specify table(s)]. The containers are pre-cleaned and will not be rinsed prior to sample collection. Preservatives, if required, will be added by_____[name of agency/organization doing the sampling] to the containers prior to shipment of the samples to the laboratory.

7.1 SOIL SAMPLES

Include this subsection if collecting soil samples; otherwise delete.

Include the following paragraphs, as appropriate; otherwise delete. Modify if necessary.

VOLATILE ORGANIC COMPOUNDS: Soil samples to be analyzed for volatile organic compounds will be stored in their sealed Encore samplers for no more than two days prior to analysis. Samples will be chilled to 4°C immediately upon collection.

Include these sentences if samples will be frozen or preserved; otherwise delete. Frozen Encore sampler samples will be stored for no more than 4 days prior to analysis. If samples are preserved by ejecting into either methanol or sodium bisulfate solution the holding time is two weeks.

OTHER ORGANIC COMPOUNDS: Soil samples for_____[include all requested analysis(ses)] will be homogenized and transferred from the sample-dedicated homogenization pail into 8-ounze wide-mouth glass jars using a trowel. A separate container will be collected for each laboratory. [Alternatively, samples will be retained in the brass sleeve in which collected until sample preparation begins.] The samples will be chilled to 4°C immediately upon collection.

METALS: Surface soil samples to be analyzed for metals will be homogenized and transferred from the sample-dedicated homogenization pail into 8-oz, wide-mouth glass jars. A separate container will be collected for each laboratory. Samples will not be chilled. Subsurface samples will be retained in their original brass sleeves or other container unless transferred to bottles.

7.2 SEDIMENT SAMPLES

Include this subsection if collecting sediment samples; otherwise delete.

Include the following paragraphs, as appropriate; otherwise delete. Modify if necessary.

VOLATILE ORGANIC COMPOUNDS: Sediment samples to be analyzed for volatile organic compounds will be stored in their sealed Encore samplers for no more than two days prior to analysis. Samples will be chilled to 4°C immediately upon collection.

Include these sentences if samples will be frozen or preserved; otherwise delete. Frozen EnCore samples will be stored for no more than 4 days prior to analysis. If samples are preserved by ejecting into either methanol or sodium bisulfate solution the holding time is two weeks.

OTHER ORGANIC COMPOUNDS: Soil samples for_____[include all requested analysis(ses)] will be homogenized and transferred from the sample-dedicated homogenization pail into 8-ounze wide-mouth glass jars using a trowel. A separate container will be collected for each laboratory. [Alternatively, samples will be retained in the brass sleeve in which collected until sample preparation begins.] The samples will be chilled to 4°C immediately upon collection.

METALS: Sediment samples, with rocks and debris removed, which are to be analyzed for metals will be homogenized and transferred from the sample-dedicated homogenization pail into 8-ounze, wide-mouth glass jars. A separate container will be collected for each laboratory. Samples will not be chilled.

7.3 WATER SAMPLES

Include this subsection if collecting water samples; otherwise delete.

Include the following paragraphs, as appropriate; otherwise delete. Modify if necessary.

VOLATILE ORGANIC COMPOUNDS: Low concentration water samples to be analyzed for volatile organic compounds will be collected in 40-ml glass vials. 1:1 hydrochloric acid (HCl) will be added to the vial prior to sample collection. During purging, a test vial will be filled with sample at each sample location and the pH will be measured using a pH meter or pH paper to ensure that sufficient acid is present to result in a pH of less than 2. If the pH is greater than 2, additional HCl will be added to the sample vials. Another vial will be pH tested to ensure the pH is less than 2. The tested vial(s) will be discarded. The sample vials will be filled so that there is no headspace. The vials will be inverted and checked for air bubbles to ensure zero headspace. If a bubble appears, the vial will be discarded and a new sample will be collected. The samples

will be chilled to 4°C immediately upon collection. Three vials of each water sample are required for each laboratory.

METALS: Water samples collected for metals analysis will be collected in 1-liter polyethylene bottles. The samples will be preserved by adding nitric acid (HNO_3) to the sample bottle. The bottle will be capped and lightly shaken to mix in the acid. A small quantity of sample will be poured into the bottle cap where the pH will be measured using pH paper. The pH must be $\leq$2. The sample in the cap will be discarded, and the pH of the sample will be adjusted further if necessary. The samples will be chilled to 4°C immediately upon collection. One bottle of each water sample is required for each laboratory.

OTHER PARAMETERS: [e.g., Anions, Pesticides, Semivolatile Organic Compounds]

If requested analyses require preservation, include this paragraph; otherwise delete. A separate paragraph should be included for each bottle type.

Water samples to be analyzed for [specify what parameters are included] will be collected in [specify size and type of container]. The [specify analysis(ses)] samples will be preserved by adding [describe preservative appropriate to each sample type] to the sample bottle. The bottle will be capped and lightly shaken to mix in the preservative. A small quantity of sample will be poured into the bottle cap where the pH will be measured using pH paper. The pH must be within the appropriate range. The sample in the cap will be discarded, and the pH of the sample will be adjusted further if necessary. Samples will be chilled to 4°C immediately upon collection.

If requested analyses do not require preservation, include this paragraph; otherwise delete. A separate paragraph should be included for each bottle type.

Water samples to be analyzed for _____ [specify analysis(ses)] will be collected in _____ [specify bottle type]. No preservative is required for these samples. The samples will be chilled to 4°C immediately upon collection. Two bottles of each water sample are required for each laboratory.

7.4 OTHER SAMPLES

If samples of other media (e.g., soil gas) are to be collected, specify the analyses that will be performed and the containers and preservatives required.

7.5 PACKAGING AND SHIPPING

The following paragraphs provide a generic explanation and description of how to pack and ship samples. They may be incorporated as is, if appropriate, or modified to meet any project-specific conditions.

All sample containers will be placed in a strong-outside shipping container .The following outlines the packaging procedures that will be followed for low concentration samples.

1. When ice is used, pack it in zip-lock, double plastic bags. Seal the drain plug of the cooler with fiberglass tape to prevent melting ice from leaking out of the cooler.

2. The bottom of the cooler should be lined with bubble wrap to prevent breakage during shipment.

3. Check screw caps for tightness and, if not full, mark the sample volume level of liquid samples on the outside of the sample bottles with indelible ink.

4. Secure bottle/container tops with clear tape and custody seal all container tops.

5. Affix sample labels onto the containers with clear tape.

6. Wrap all glass sample containers in bubble wrap to prevent breakage.

7. Seal all sample containers in heavy duty plastic zip-lock bags. Write the sample numbers on the outside of the plastic bags with indelible ink.

8. Place samples in a sturdy cooler(s) lined with a large plastic trash bag. Enclose the appropriate COC(s) in a zip-lock plastic bag affixed to the underside of the cooler lid.

9. Fill empty space in the cooler with bubble wrap or Styrofoam peanuts to prevent movement and breakage during shipment. Vermiculite should also be placed in the cooler to absorb spills if they occur.

10. Ice used to cool samples will be double sealed in two zip lock plastic bags and placed on top and around the samples to chill them to the correct temperature.

11. Each ice chest will be securely taped shut with fiberglass strapping tape, and custody seals will be affixed to the front, right and back of each cooler.

8. DISPOSAL OF RESIDUAL MATERIALS

This section should describe the type(s) of investigation-derived wastes (IDW) that will be generated during this sampling event. EPA recognizes that IDW may not be generated in all sampling events, in which case this section would not apply. Use the language below or reference the appropriate sections in a Disposal of Residual Materials SOP and state in which appendix the SOP is located. Depending upon site-specific conditions and applicable federal, state, and local regulations, other provisions for IDW disposal may be required. If any analyses of IDW are required, these should be discussed. If IDW are to be placed in drums, labeling for the drums should be discussed in this section.

In the process of collecting environmental, the sampling team will generate different types of potentially contaminated IDW that include the following:

- Used personal protective equipment (PPE)
- Disposable sampling equipment
- Decontamination fluids
- Soil cuttings from soil borings [Include this bullet when sampling soils; otherwise delete.]
- Purged groundwater and excess groundwater collected for sample container filling [Include this bullet when sampling groundwater; otherwise delete.]

The EPA's National Contingency Plan (NCP) requires that management of IDW generated during sampling comply with all applicable or relevant and appropriate requirements (ARARs) to the extent practicable. The sampling plan will follow the *Office of Emergency and Remedial Response (OERR) Directive 9345.3-02* (May 1991), which provides the guidance for the management of IDW. In addition, other legal and practical considerations that may affect the handling of IDW will be considered.

Listed below are the procedures that should be followed for handling the IDW. The procedures have enough flexibility to allow the sampling team to use its professional judgment as to the proper method for the disposal of each type of IDW generated at each sampling location. The following bullet is generally appropriate for site or sampling areas with low levels of contamination or for routine monitoring. If higher levels of contamination exist at the site or sampling area, other disposal methods (such as the drumming of wastes) should be used to dispose of used PPE and disposable sampling equipment.

- Used PPE and disposable equipment will be double bagged and placed in a municipal refuse dumpster. These wastes are not considered hazardous and can be sent to a municipal landfill. Any

PPE and disposable equipment that is to be disposed of which can still be reused will be rendered inoperable before disposal in the refuse dumpster.

Include this bullet if sampling for both metals and organics; otherwise delete.

- Decontamination fluids that will be generated in the sampling event will consist of dilute nitric acid, pesticide-grade solvent, deionized water, residual contaminants, and water with non-phosphate detergent. The volume and concentration of the decontamination fluid will be sufficiently low to allow disposal at the site or sampling area. The water (and water with detergent) will be poured onto the ground or into a storm drain. Pesticide-grade solvents will be allowed to evaporate from the decontamination bucket. The nitric acid will be diluted and/or neutralized with sodium hydroxide and tested with pH paper before pouring onto the ground or into a storm drain.

Include this bullet if sampling for metals but not organics; otherwise delete.

- Decontamination fluids that will be generated in the sampling event will consist of nitric acid, deionized water, residual contaminants, and water with non-phosphate detergent. The volume and concentration of the decontamination fluid will be sufficiently low to allow disposal at the site or sampling area. The water (and water with detergent) will be poured onto the ground or into a storm drain. The nitric acid will be diluted and/or neutralized with sodium hydroxide and tested with pH paper before pouring onto the ground or into a storm drain.

Include this bullet if sampling for organics but not metals; otherwise delete.

- Decontamination fluids that will be generated in the sampling event will consist of pesticide-grade solvent, deionized water, residual contaminants, and water with non- phosphate detergent. The volume and concentration of the decontamination fluid will be sufficiently low to allow disposal at the site or sampling area. The water (and water with detergent) will be poured onto the ground or into a storm drain. Pesticide- grade solvents will be allowed to evaporate from the decontamination bucket.

Include this bullet if sampling soils; otherwise delete.

  - Soil cuttings generated during the subsurface sampling will be disposed of in an appropriate manner.

Include this bullet if sampling groundwater; otherwise delete.

- Purged groundwater will be _____

Depending upon the degree of groundwater contamination, site-specific conditions, and applicable federal, state, and local regulations, disposal methods will vary. Disposal methods can also vary for purge water from different wells sampled during the same sampling event.

9. SAMPLE DOCUMENTATION

9.1 FIELD NOTES

This section should discuss record keeping in the field. This may be through a combination of logbooks, preprinted forms, photographs, or other documentation. Information to be maintained is provided below.

9.1.1 Field Logbooks

Describe how field logbooks will be used and maintained.

Use field logbooks to document where, when, how, and from whom any vital project information was obtained. Logbook entries should be complete and accurate enough to permit reconstruction of field activities. Maintain a separate logbook for each sampling event or project. Logbooks should have consecutively numbered pages. All entries should be legible, written in black ink, and signed by the individual making the entries. Use factual, objective language.

At a minimum, the following information will be recorded during the collection of each sample:

Edit this list as necessary.

- Sample location and description
- Site or sampling area sketch showing sample location and measured distances
- Sampler's name(s)
- Date and time of sample collection
- Designation of sample as composite or grab
- Type of sample (soil, sediment or water)
- Type of sampling equipment used
- Field instrument readings and calibration
- Field observations and details related to analysis or integrity of samples (e.g., weather conditions, noticeable odors, colors, etc.)
- Preliminary sample descriptions (e.g., for soils: clay loam, very wet; for water: clear water with strong ammonia-like odor)
- Sample preservation
- Lot numbers of the sample containers, sample identification numbers and any explanatory codes, and chain-of-custody form numbers

- Shipping arrangements (overnight air bill number)
- Name(s) of recipient laboratory(ies)

In addition to the sampling information, the following specific information will also be recorded in the field logbook for each day of sampling:

Edit this list as necessary.

- Team members and their responsibilities
- Time of arrival/entry on site and time of site departure
- Other personnel on site
- Summary of any meetings or discussions with tribal, contractor, or federal agency personnel
- Deviations from sampling plans, site safety plans, and QAPP procedures
- Changes in personnel and responsibilities with reasons for the changes
- Levels of safety protection
- Calibration readings for any equipment used and equipment model and serial number

A checklist of the field notes, following the suggestions above, using only those that are appropriate, should be developed and included in project field notes.

9.1.1 Photographs

If photographs will be taken, the following language may be used as is or modified as appropriate.

Photographs will be taken at the sampling locations and at other areas of interest on site or sampling area. They will serve to verify information entered in the field logbook. For each photograph taken, the following information will be written in the logbook or recorded in a separate field photography log:

- Time, date, location, and weather conditions
- Description of the subject photographed
- Name of person taking the photograph

9.2 SAMPLE LABELING

The following paragraph provides a generic explanation and description of the use of labels. It may be incorporated as is, if appropriate, or modified to meet any project-specific conditions.

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. A copy of the sample label is included in [specify appendix]. The samples will

have pre-assigned, identifiable, and unique numbers. At a minimum, the sample labels will contain the following information: station location, date of collection, analytical parameter(s), and method of preservation. Every sample, including samples collected from a single location but going to separate laboratories, will be assigned a unique sample number.

9.3 SAMPLE CHAIN-OF-CUSTODY FORMS AND CUSTODY SEALS

The following paragraphs provide a generic explanation and description of the use of chain-of- custody forms and custody seals. They may be incorporated as is, if they are appropriate, or modified to meet any project-specific conditions.

All sample shipments for analyses will be accompanied by a chain-of-custody record. A copy of the form is found in [specify appendix]. Form(s) will be completed and sent with the samples for each laboratory and each shipment (i.e., each day). If multiple coolers are sent to a single laboratory on a single day, form(s) will be completed and sent with the samples for each cooler.

The chain-of-custody form will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. Until the samples are shipped, the custody of the samples will be the responsibility of_____ [name of agency/ organization conducting sampling]. The sampling team leader or designee will sign the chain-of-custody form in the "relinquished by" box and note date, time, and air bill number.

A self-adhesive custody seal will be placed across the lid of each sample. A copy of the seal is found in [specify appendix]. For VOC samples, the seal will be wrapped around the cap. The shipping containers in which samples are stored (usually a sturdy picnic cooler or ice chest) will be sealed with self-adhesive custody seals any time they are not in someone's possession or view before shipping. All custody seals will be signed and dated.

10. QUALITY CONTROL

This section should discuss the quality control samples that are being collected to support the sampling activity. This includes field QC samples, confirmation samples, background samples, laboratory QC samples, and split samples. Wherever possible, the locations at which the samples will be collected should be identified and a rationale provided for the choice of location. Frequency of collection should be discussed. All samples, except laboratory QC samples, should be sent to the laboratory blind, wherever possible. Laboratory QC samples should be identified and additional sample (e.g., a double volume) collected for that purpose.

10.1 FIELD QUALITY CONTROL SAMPLES

Field quality control samples are intended to help evaluate conditions resulting from field activities and are intended to accomplish two primary goals, assessment of field contamination and assessment of sampling variability. The former looks for substances introduced in the field due to environmental or sampling equipment and is assessed using blanks of different types. The latter includes variability due to sampling technique and instrument performance as well as variability possibly caused by the heterogeneity of the matrix being sampled and is assessed using replicate sample collection. The following sections cover field QC.

10.1.1 Assessment of Field Contamination (Blanks)

Field contamination is usually assessed through the collection of different types of blanks. Equipment blanks are obtained by passing distilled or deionized water, as appropriate, over or through the decontaminated equipment used for sampling. They provide the best overall means of assessing contamination arising from the equipment, ambient conditions, sample containers, transit, and the laboratory. Field blanks are sample containers filled in the field. They help assess contamination from ambient conditions, sample containers, transit, and the laboratory. Trip blanks are prepared by the laboratory and shipped to and from the field. They help assess contamination from shipping and the laboratory and are for volatile organic compounds only.

Region 9 recommends that equipment blanks be collected, where appropriate (e.g., where neither disposable nor dedicated equipment is used). Field blanks are next in priority and trip blanks next. Only one blank sample per matrix per day should be collected. If equipment blanks are collected, field blanks and trip blanks are not required under normal circumstances.

10.1.1.1 Equipment Blanks

In general, equipment (rinsate) blanks should be collected when reusable, non-disposable sampling

equipment (e.g., trowels, hand augers, and non-dedicated groundwater sampling pumps) are being used for the sampling event. Equipment blanks can be collected for soil, sediment, and ground water samples. A minimum of one equipment blank is prepared each day for each matrix when equipment is decontaminated in the field. These blanks are submitted "blind" to the laboratory, packaged like other samples and each with its own unique identification number. Note that for samples which may contain VOCs, water for blanks should be purged prior to use to ensure that it is organic free. HPLC water, which is often used for equipment and field blanks, can contain VOCs if it is not purged.

If equipment blanks are to be collected describe how they are to be collected and the analyses that will be performed. A maximum of one blank sample per matrix per day should be collected, but at a rate to not exceed one blank per 10 samples. The 1:10 ratio overrides the one per day requirement. If equipment rinsate blanks are collected, field blanks and trip blanks are not required under normal circumstances. Use the language below or reference the appropriate sections in a Quality Control SOP and state in which appendix the SOP is located.

Include this subsection if equipment blanks are to be collected, otherwise, delete.

Include this paragraph if blanks will be analyzed for both metals and organic compounds; otherwise delete.

Equipment rinsate blanks will be collected to evaluate field sampling and decontamination procedures by pouring High Performance Liquid Chromatography (HPLC) organic-free (for organics) or deionized water (for inorganics) over the decontaminated sampling equipment. One equipment rinsate blank will be collected per matrix each day that sampling equipment is decontaminated in the field. Equipment rinsate blanks will be obtained by passing water through or over the decontaminated sampling devices used that day. The rinsate blanks that are collected will be analyzed for [include names of target analytes, e.g., metals, total petroleum hydrocarbons, volatile organic compounds, etc.].

Include this paragraph if blanks will be analyzed only for organic compounds; otherwise delete.

Equipment rinsate blanks will be collected to evaluate field sampling and decontamination procedures by pouring High Performance Liquid Chromatography (HPLC) organic-free water over the decontaminated sampling equipment. One equipment rinsate blank will be collected per matrix each day that sampling equipment is decontaminated in the field. Equipment rinsate blanks will be obtained by passing water through or over the decontaminated sampling devices used that day. The rinsate blanks that are collected will be analyzed for [include names of target analytes, e.g., volatile organic compounds, total petroleum hydrocarbons, etc.].

Include this paragraph if blanks will be analyzed only for metals; otherwise delete.

Equipment rinsate blanks will be collected to evaluate field sampling and decontamination procedures by pouring deionized water over the decontaminated sampling equipment. One equipment rinsate blank will be collected per matrix each day that sampling equipment is decontaminated in the field. Equipment rinsate blanks will be obtained by passing deionized water through or over the decontaminated sampling devices used that day. The rinsate blanks that are collected will be analyzed for metals.

Always include this paragraph.

The equipment rinsate blanks will be preserved, packaged, and sealed in the manner described for the environmental samples. A separate sample number and station number will be assigned to each sample, and it will be submitted blind to the laboratory.

10.1.1.2 Field Blanks

Field blanks are collected when sampling water or air and equipment decontamination is not necessary or sample collection equipment is not used (e.g., dedicated pumps). A methanol field blanks should also be collected when methanol is used as a preservative. A minimum of one field blank is prepared each day sampling occurs in the field, but equipment is not decontaminated. These blanks are submitted "blind" to the laboratory, packaged like other samples and each with its own unique identification number. Note that for samples which may contain VOCs, water for blanks should be purged prior to use to ensure that it is organic free. HPLC water which is often used for equipment and field blanks can contain VOCs if it is not purged.

Include this subsection if field blanks will be collected; otherwise delete. Only one blank sample per matrix per day should be collected. If field blanks are prepared, equipment rinsate blanks and trip blanks are not required under normal circumstances.

Include this paragraph if blanks will be analyzed for both metals and organic compounds; otherwise delete.

Field blanks will be collected to evaluate whether contaminants have been introduced into the samples during the sampling due to ambient conditions or from sample containers. Field blank samples will be obtained by pouring High Performance Liquid Chromatography (HPLC) organic-free water (for organics) and/or deionized water (for inorganics) into a sampling container at the sampling point. The field blanks that are collected will be analyzed for

_____ [include names of target analytes, e.g., metals, volatile organic compounds, etc.].

Include this paragraph if blanks will be analyzed only for organic compounds; otherwise delete.

Field blanks will be collected to evaluate whether contaminants have been introduced into the samples during the sampling due to ambient conditions or from sample containers. Field blank samples will be obtained by pouring High Performance Liquid Chromatography (HPLC) organic-free water into a sampling container at the sampling point. The field blanks that are collected will be analyzed for [include names of target analytes, e.g., volatile organic compounds, total petroleum hydrocarbons, etc.].

Include this paragraph if blanks will be analyzed only for metals; otherwise delete.

Field blanks will be collected to evaluate whether contaminants have been introduced into the samples during the sampling due to contamination from sample containers. Field blank samples will be obtained by pouring deionized water into a sampling container at the sampling point. The field blanks that are collected will be analyzed for metals.

Always include this paragraph.

The field blanks will be preserved, packaged, and sealed in the manner described for the environmental samples. A separate sample number and station number will be assigned to each sample, and it will be submitted blind to the laboratory.

10.1.1.3 Trip Blanks

Trip blanks are required only if no other type of blank will be collected for volatile organic compound analysis. If trip blanks are required, one is submitted to the laboratory for analysis with every shipment of samples for VOC analysis. These blanks are submitted "blind" to the laboratory, packaged like other samples and each is assigned its own unique identification number. Note that for samples which may contain VOCs, water for blanks should be purged prior to use to ensure that it is organic free. HPLC water, which is often used for trip blanks, can contain VOCs if it is not purged.

Include this subsection if trip blanks will be collected; otherwise delete. Only one blank sample per matrix per day should be collected. Trip blanks are only relevant to volatile organic compound (VOC) sampling efforts.

Trip blanks will be prepared to evaluate if the shipping and handling procedures are introducing contaminants into the samples, and if cross contamination in the form of VOC migration has occurred between the collected samples. A minimum of one trip blank will be submitted to the laboratory for analysis

with every shipment of samples for VOC analysis. Trip blanks are 40-ml vials that have been filled with HPLC-grade water that has been purged so it is VOC free and shipped with the empty sampling containers to the site or sampling area prior to sampling. The sealed trip blanks are not opened in the field and are shipped to the laboratory in the same cooler with the samples collected for volatile analyses. The trip blanks will be preserved, packaged, and sealed in the manner described for the environmental samples. A separate sample number and station number will be assigned to each trip sample and it will be submitted blind to the laboratory.

10.1.1.4 Temperature Blanks

Include this paragraph with all plans.

For each cooler that is shipped or transported to an analytical laboratory a 40-ml VOA vial will be included that is marked "temperature blank." This blank will be used by the sample custodian to check the temperature of samples upon receipt.

10.1.2 Assessment of Field Variability (Field Duplicate or Collocated Samples

Duplicate samples are collected simultaneously with a standard sample from the same source under identical conditions into separate sample containers. Field duplicates will consist of a homogenized sample divided in two or else a collocated sample. Each duplicate portion should be assigned its own sample number so that it will be blind to the laboratory. A duplicate sample is treated independently of its counterpart in order to assess laboratory performance through comparison of the results. At least 10% of samples collected per event should be field duplicates. At least one duplicate should be collected for each sample matrix, but their collection can be stretched out over more than one day (e.g., if it takes more than one day to reach 10 samples). Every group of analytes for which a standard sample is analyzed will also be tested for in one or more duplicate samples. Duplicate samples should be collected from areas of known or suspected contamination. Since the objective is to assess variability due to sampling technique and possible sample heterogeneity, source variability is a good reason to collect collocated samples, not to avoid their collection.

Duplicate soil samples will be collected at sample locations_____[identify soil sample locations from which duplicate or collocated samples will be collected]. Duplicate samples will be collected from these locations because_____. Add sentence(s) here explaining a rationale for collecting duplicate samples from these locations; e.g., samples from these locations are suspected to exhibit moderate concentrations of contaminants or previous sampling events have detected moderate levels of contamination at the site or sampling area at these locations.

Include this paragraph if collecting soil samples and analyzing for compounds other than volatiles; otherwise delete.

Soil samples to be analyzed for____[list all analytical methods for this sample event except for volatiles] will be homogenized with a with a trowel in a sample-dedicated 1-gallon disposable pail. Homogenized material from the bucket will then be transferred to the appropriate wide-mouth glass jars for both the regular and duplicate samples. All jars designated for a particular analysis (e.g., semivolatile organic compounds) will be filled sequentially before jars designated for another analysis are filled (e.g., metals).

Include this paragraph if collecting soil samples and analyzing for volatiles; otherwise delete.

Soil samples for volatile organic compound analyses will not be homogenized. Equivalent Encore samples from a collocated location will be collected identically to the original samples, assigned unique sample numbers and sent blind to the laboratory.

Include these paragraphs if collecting sediment samples. If volatile organic compound analysis will be performed on sediment samples, modify the above paragraph for soil sample volatile analyses by changing "soil" to "sediment."

Duplicate sediment samples will be collected at sample locations[identify_____ sediment sample locations from which duplicate or collocated samples for duplicate analysis will be obtained]. Duplicate samples will be collected from these locations because_____. Add sentence(s) here explaining a rationale for collecting duplicate samples from these locations; e.g., samples from these locations are suspected to exhibit moderate concentrations of contaminants or previous sampling events have detected moderate levels of contamination at the site or sampling area at these locations.

Sediment samples will be homogenized with a trowel in a sample-dedicated 1-gallon disposable pail. Homogenized material from the bucket will then be transferred to the appropriate wide- mouth glass jars for both the regular and duplicate samples. All jars designated for a particular analysis (e.g., semivolatile organic compounds) will be filled sequentially before jars designated for another analysis are filled (e.g., metals).

Include this paragraph if collecting water samples.

Duplicate water samples will be collected for water sample numbers_____[water sample numbers which will be split for duplicate analysis]. Duplicate samples will be collected from these locations because___. Add sentence(s) here explaining a rationale for collecting duplicate samples from

these locations; e.g., samples from these locations are suspected to exhibit moderate concentrations of contaminants or previous sampling events have detected moderate levels of contamination at the site or sampling area at these locations.

When collecting duplicate water samples, bottles with the two different sample identification numbers will alternate in the filling sequence (e.g., a typical filling sequence might be, VOCs designation GW-2, VOCs designation GW-4 (duplicate of GW-2); metals, designation GW-2, metals, designation GW-4, (duplicate of GW-2) etc.). Note that bottles for one type of analysis will be filled before bottles for the next analysis are filled. Volatiles will always be filled first.

Always include this paragraph.

Duplicate samples will be preserved, packaged, and sealed in the same manner as other samples of the same matrix. A separate sample number and station number will be assigned to each duplicate, and it will be submitted blind to the laboratory.

10.2 BACKGROUND SAMPLES

Background samples are collected in situations where the possibility exists that there are native or ambient levels of one or more target analytes present or where one aim of the sampling event is to differentiate between on-site and off-site contributions to contamination. One or more locations are chosen which should be free of contamination from the site or sampling location itself, but have similar geology, hydrogeology, or other characteristics to the proposed sampling locations that may have been impacted by site activities. For example, an area adjacent to but removed from the site, upstream from the sampling points, or up gradient or cross gradient from the groundwater under the site. Not all sampling events require background samples.

Specify the sample locations that have been designated as background. Include a rationale for collecting background samples from these locations and describe or reference the sampling and analytical procedures which will be followed to collect these samples.

10.3 FIELD SCREENING, INCLUDING CONFIRMATION SAMPLES, AND SPLIT SAMPLES

For projects where field screening methods are used (typically defined as testing using field test kits, immunoassay kits, or soil gas measurements or equivalent, but not usually defined as the use of a mobile laboratory which generates data equivalent to a fixed laboratory), two aspects of the tests should be described.

First, the QC which will be run in conjunction with the field screening method itself, and, second, any fixed laboratory confirmation tests which will be conducted. QC acceptance criteria for these tests should be defined in these sections rather than in the DQO section.

10.3.1 Field Screening Samples

For projects where field screening methods are used, describe the QC samples which will be run in the field to ensure that the screening method is working properly. This usually consists of a combination of field duplicates and background samples. The discussion should specify acceptance criteria and corrective action to be taken if results are not within defined limits. Discuss confirmation tests below.

10.3.2 Confirmation Samples (Field Screening)

If the planned sampling event includes a combination of field screening and fixed laboratory confirmation, this section should describe the frequency with which the confirmation samples will be collected and the criteria which will be used to select confirmation locations. These will both be dependent on the use of the data in decision making. It is recommended that the selection process be at a minimum of 10% and that selection criteria include checks for both false positives (i.e., the field detections are invalid or the concentrations are not accurate) and false negatives (i.e., the analyte was not detected in the field). Because many field screening techniques are less sensitive than laboratory methods false negative screening is especially important unless the field method is below the action level for any decision making. It is recommended that some “hits” be chosen and that other locations be chosen randomly.

Describe confirmation sampling. Discuss the frequency with which samples will be confirmed and how location will be chosen. Define acceptance criteria for the confirmation results (e.g., RPD$\leq$25%) and corrective actions to be taken if samples are not confirmed.

10.4 LABORATORY QUALITY CONTROL SAMPLES

Laboratory quality control (QC) samples are analyzed as part of standard laboratory practice. The laboratory monitors the precision and accuracy of the results of its analytical procedures through analysis of QC samples. In part, laboratory QC samples consist of matrix spike/matrix spike duplicate samples for organic analyses, and matrix spike and duplicate samples for inorganic analyses. The term “matrix” refers to use of the actual

media collected in the field (e.g., routine soil and water samples).

Laboratory QC samples are an aliquot (subset) of the field sample. They are not a separate sample, but a special designation of an existing sample.

Include the following language if soil samples are to be collected for other than volatiles; otherwise delete.

A routinely collected soil sample (a full 8-oz sample jar or two 120-mL sample vials) contains sufficient volume for both routine sample analysis and additional laboratory QC analyses. Therefore, a separate soil sample for laboratory QC purposes will not be collected.

Include the following language if soil samples are to be collected for volatiles; otherwise delete.

Soil samples for volatile organic compound analyses for laboratory QC purposes will be obtained by collecting double the number of equivalent Encore samples from a collocated location in the same way as the original samples, assigned a unique sample numbers and sent blind to the laboratory.

Include the following language if water samples are to be collected. Otherwise delete.

For water samples, double volumes of samples are supplied to the laboratory for its use for QC purposes. Two sets of water sample containers are filled and all containers are labeled with a single sample number. *For volatile samples this would result in 6 vials being collected instead of 3, for pesticides and semivolatile samples this would be 4 liters instead of 2, etc.*

The laboratory should be alerted as to which sample is to be used for QC analysis by a notation on the sample container label and the chain-of-custody record or packing list.

At a minimum, one laboratory QC sample is required per 14 days or one per 20 samples (including blanks and duplicates), whichever is greater. If the sample event lasts longer than 14 days or involves collection of more than 20 samples per matrix, additional QC samples will be designated.

For this sampling event, samples collected at the following locations will be the designated laboratory QC samples:

If a matrix is not being sampled, delete the reference to that matrix.

- For soil, samples_____[List soil sample locations and numbers designated for QA/QC.]
- For sediment, samples_____[List sediment sample locations and numbers designated for QA/QC.]

- For water, samples_____[List water sample locations and numbers designated for QA/QC.]

11. FIELD VARIANCES

It is not uncommon to find that, on the actual sampling date, conditions are different from expectations such that changes must be made to the SAP once the samplers are in the field. The following paragraph provides a means for documenting those deviations, or variances. Adopt the paragraph as is, or modify it to project-specific conditions.

As conditions in the field may vary, it may become necessary to implement minor modifications to sampling as presented in this plan. When appropriate, the QA Office will be notified and a verbal approval will be obtained before implementing the changes. Modifications to the approved plan will be documented in the sampling project report.

12. FIELD HEALTH AND SAFETY PROCEDURES

Describe any agency-, program- or project-specific health and safety procedures that must be followed in the field, including safety equipment and clothing that may be required, explanation of potential hazards that may be encountered, and location and route to the nearest hospital or medical treatment facility. A copy of the organization health and safety plan may be included as an Appendix and referenced in this section.

EXAMPLE FORMS

Table 1-1
Key Project Personnel Contact Information and Responsibilities

Title	Name	Phone Number Email Address	Responsibilities
EPA Quality Assurance Officer (QAO)			
EPA Project Manager			
Grantee Project Manager			
Contractor Project Manager (include Company Name)			
Contractor QAO			
Contractor Field Team Leader			
Laboratory Quality Assurance Officer (include Laboratory Name)			

Table 2-1
Contaminants of Concern, Previous Investigations Matrix = Soil

Analytical Parameter (Contaminants of Concern)	Date of sampling	Sampling contractor	Laboratory Analytical Results (units [µg/kg])	Regulatory Limit (specify)[1]
Benzene	06/24/01	ABC, Co.	200	50

µg/kg = micrograms per kilogram
[1] DTSC = Calif. Department of Toxic Substances Control

Table 3-1
Contaminants of Concern, Laboratory, and Screening or Action Levels Matrix = Soil

Analytical Parameter (Contaminants of Concern)	Laboratory Reporting or Quantitation Limits	Screening or Action Levels		
		EPA Residential RSLs	DTSC Residential RSLs	RWQCB Residential ESLs
Volatile Organic Compounds by Method 8260 (µg/kg)				
Benzene	10	640	NA	440
Tetrachloroethylene (PCE)	10	480	NA	87
Toluene	10	520000	NA	3300
Metals by Method 6010/7470 (mg/kg)				
Arsenic	1	0.07	0.07	Background
Chromium	2	210	0	1000
Lead	2	150	150	150

RL = Reporting Limit
EPA = US Environmental Protection Agency
DTSC = Calif. Department of Toxic Substances Control
RWQCB = Regional Water Quality Control Board
µg/kg = micrograms per kilogram mg/kg = milligrams per kilogram
RSLs = Regional Screening Levels
ESLs = Environmental Screening Levels
NA = Not available or Not applicable

Table 4-1
Sampling Design and Rationale Matrix = Soil

Sampling Location/ID Number	Depth (feet)	Analytical Parameter	Rationale *
SB1	0-1.5 2-4, 6-8	TPH-g/d, metals TPH-g/d, VOA & metals	Assess environmental conditions at the former UST and former fuel pump island locations. Volatiles will not be collected from the shallow soil due to probable weathering effects.
SB2	0-1.5 2-4, 6-8	TPH-g/d, metals TPH-g/d, VOA & metals	Assess the potential presence of contaminants in undocumented fill materials at the Site. Volatiles will not be collected from the shallow soil due to probable weathering effects.

* Include rationale for location, depth and analysis.

TPH –g/d = total petroleum hydrocarbons as gasoline and diesel VOA = volatile organic analyses

Table 4-2
Sampling Design and Rationale
Matrix = Groundwater

Sampling Location/ID Number	Analytical Parameter	Rationale *
SB1	TPH-g/d, VOA, metals	Assess the potential migration of contaminants to the groundwater at the former UST and former fuel pump island locations.
SB2	TPH-g/d, VOA, metals	Assess the potential migration of contaminants to the groundwater from the fill materials located on the Site.

*Include rationale for location and analysis.

TPH –g/d = total petroleum hydrocarbons as gasoline and diesel

VOA = volatile organic analyses

Table 5-1
Analytical Services
Matrix = Soil

Sample Number	Sample Location	Depth (feet)	Special Designation	Analytical Methods			
				SW846 Method 8015B (TPH as gasoline)	SW846 Method 8015B (TPH as diesel)	SW846 Method 8260B (volatiles)	SW846 Method 6010/7470 (metals)
SB-01-05	SB1	0-1.5		X	X		X
SB-01-24	SB1	2-4	MS/MSD	X	X	X	X
SB-01-68	SB1	6-8		X	X	X	X
SB-02-05	SB2	0-1.5		X	X		X
SB-02-24	SB2	2-4		X	X	X	X
SB-02-68	SB2	6-8		X	X	X	X
SB-01-10	SB2	6-8	Duplicate of SB-02-68	X	X	X	X
Total number of Soil Samples, excluding QC:				6	6	4	6
Total number of Soil Samples, including QC:				7	7	5	7

TPH = total petroleum hydrocarbons
MS/MSD = matrix spike/ matrix spike duplicate

Table 5-2
Analytical Services
Matrix = Groundwater

Sample Number	Sample Location	Special Designation	Analytical Methods			
			SW846 Method 8015B (TPH as gasoline)	**SW846 Method 8015B (TPH as diesel)**	**SW846 Method 8260B (Volatiles)**	**SW846 Method 6010/7470 (Metals)**
SB-01	SB1	MS/MSD	X	X	X	X
SB-02	SB2		X	X	X	X
SB-03	SB2	Duplicate of SB-02-68	X	X	X	X
Total number of Soil Samples, excluding QC:			2	2	2	2
Total number of Soil Samples, including QC:			3	3	3	3

TPH = total petroleum hydrocarbons
MS/MSD = matrix spike/ matrix spike duplicate

Table 5-3
Analytical Method, Container, Preservation, and Holding Time Requirements
Matrix = Soil

Analytical Parameter and/or Field Measurements	Analytical Method Number	Containers (number, type, size/volume)	Preservation Requirements (chemical, temperature, light protection)	Maximum Holding Times
Volatiles	SW-846 Method 8260B	Two EnCore Samplers	Chill with ice to 4°C	48 hours
Metals	SW-846 Method 6010/7470	4 oz glass jar	Chill with ice to 4°C	<180 days/<28 days for Hg

Table 5-4
Analytical Method, Container, Preservation, And Holding Time Requirements
Matrix = Groundwater

Analytical Parameter and/or Field Measurements	Analytical Method Number	Containers (number, type, size/volume)	Preservation Requirements (chemical, temperature, light protection)	Maximum Holding Times
Volatiles	SW-846 Method 8260B	3 x 40-ml VOA	Chill with ice to 4°CpH<2 with HCl	14 days
Metals	SW-846 Method 6010/7470	1 L HDPE	Chill with ice to 4°C pH<2 with HNO_3	6 months

VOA = volatile organic analysis
HDPE = high density polyethylene Hg = mercury
HCL = hydrochloric acid
HNO_3 = nitric acid

Table 6-1
Field and Sampling Equipment

Description of Equipment	Material (if applicable)	Dedicated (Yes/No)
Sampling sleeves	Acetate or equivalent	Yes
Hand auger	Hardened steel	No
EnCore® samplers	Plastic	Yes
Sampling trowel	Plastic or stainless steel	Yes
Bailer	Plastic or stainless steel	Yes
Conductivity meter	NA	No
Peristaltic pump with dedicated tubing	Tygon or HDPE tubing	no

NA = not applicable
HDPE = high density polyethylene

Table 6-2
Field Equipment/Instrument Calibration, Maintenance, Testing, and Inspection

Analytical Parameter	Field Equipment/ Instrument	Calibration Activity	Maintenance and Testing/ Inspection Activity	Frequency	Acceptance Criteria	Corrective Action
Temperature (sensor)	Multimeter Manufacturer X, Model Y	Annual check of endpoints of desired temperature range (0°C to 40°C) versus NIST thermometer	See manufacturer's manual	Annually	±0.2°C of true value at both endpoints (i.e., manufacturer's listed accuracy for the sensor)	Remove from use if doesn't pass calibration criteria
pH (electrode)	Multimeter Manufacturer X, Model Y	Initial: two-point calibration bracketing expected range (using 7.0 and either 4.0 or 10.0 pH buffer, depending on field conditions); followed by one-point check with 7.0 pH buffer Post: single-point check with 7.0 pH buffer	See manufacturer's manual	Initial: beginning of each day Post: end of each day	Initial: two-point calibration done electronically; one-point check (using 7.0 pH buffer) ±0.1 pH unit of true value Post:) ±0.5 pH unit of true value with both 7.0 pH and other "bracketing" buffer (and either 4.0 or 10.0 pH)	Recalibrate Qualify data

Attachment A

Seven Step DQOs Process

The following information can be found in "Guidance on Systematic Planning Using the Data Quality Objectives Process" (EPA QA/G-4, February 2006).

"The U.S. Environmental Protection Agency (EPA) has developed the Data Quality Objectives (DQO) Process as the Agency's recommended planning process when environmental data are used to select between two alternatives or derive an estimate of contamination. The DQO Process is used to develop performance and acceptance criteria (or data quality objectives) that clarify study objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions."

"Various government agencies and scientific disciplines have established and adopted different variations to systematic planning, each tailoring their specific application areas. For example, the Observational Method is a variation on systematic planning that is used by many engineering professions. The Triad Approach, developed by EPA's Technology Innovation Program, combines systematic planning with more recent technology advancements, such as techniques that allow for results of early sampling to inform the direction of future sampling. However, it is the Data Quality Objectives (DQO) Process that is the most commonly-used application of systematic planning in the general environmental community. Different types of tools exist for conducting systematic planning. The DQO Process is the Agency's recommendation when data are to be used to make some type of decision (e.g., compliance or non-compliance with a standard) or estimation (e.g., ascertain the mean concentration level of a contaminant)."

"The DQO Process is used to establish performance or acceptance criteria, which serve as the basis for designing a plan for collecting data of sufficient quality and quantity to support the

goals of a study. The DQO Process consists of seven iterative steps. Each step of the DQO Process defines criteria that will be used to establish the final data collection design."

Step 1 - State the Problem

- Give a concise description of the problem
- Identify the leader and members of the planning team
- Develop a conceptual model of the environmental hazard to be investigated

Step 2 - Identify the Goal of the Study

- Identify the principal sturdy question(s)
- Consider alternative outcomes or actions that can occur upon answering the question(s)
- For decision problems, develop decision statements, organize multiple decisions
- For estimation problems, state what needs to be estimated and key assumptions

Step 3 - Identify Information Inputs

- Identify types and sources of information needed to resolve decisions or produce estimates
- Identify the basis of information that will guide or support choices to be made in later steps of the DQO Process
- Select appropriate sampling and analysis methods for generating the information

Step 4 - Define the Boundaries of the Study

- Define the target population of interest and its relevant spatial boundaries
- Define what constitutes a sampling unit

- Specify temporal boundaries and other practical constraints associated with sample/data collection
- Specify the smallest unit on which decision or estimates will be made

Step 5 - Develop the Analytical Approach

- Specify appropriate population parameters for making decisions or estimates
- For decision problems, choose a workable Action Level and generate an "If… then…else" decision rule which involves it
- For estimation problems, specify the estimator and the estimation procedure

Step 6 - Specify Performance or Acceptance Criteria

- For decision problems, specify the decision rule as a statistical hypothesis test, examine the consequences of making incorrect decisions from the test, and place acceptable limits on the likelihood of making decision errors
- For estimation problems, specify acceptable limits on estimation uncertainty

Step 7 - Develop the Detailed Plan for Obtaining Data

- Compile all information and outputs generated in Steps 1 through 6
- Use this information to identify alternative sampling and analysis designs that are appropriate for your intended use
- Select and document a design that will yield data that will best achieve your performance or acceptance criteria

Attachment B

Project Action Levels (PALs), Detection Limits (DLs), and Quantitation Limits (QLs)

The Project Action Limits (PALs), as introduced and defined in Section 1.7, will help target the selection of the most appropriate method, analysis, laboratory, etc. (the analytical operation) for your project. One important consideration in this selection is the type of decision or action you may wish to make with the data, depending on whether you generate results in concentrations below, equal to, or above the PALs. In order to ensure some level of certainty of the decisions or actions, it is recommended that you consider choosing an analytical operation capable of providing quality data at concentrations less than the PALs.

When choosing an analytical operation, you will come across terms such as Detection Limit (DL) and Quantitation Limit (QL). These terms are frequently expressed by other terminology, but the two key words to look for are "detection" and "quantitation" (sometimes referred to as "quantification"). The following describes the differences between these terms:

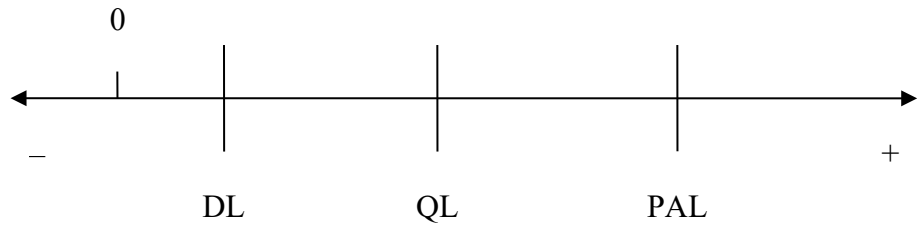
- **Detection Limit** or **DL** - This is the minimum concentration that can be detected above background or baseline/signal noise by a specific instrument and laboratory for a given analytical method. It is not recognized as an accurate value for the reporting of project data. If a parameter is detected at a concentration less than the QL (as defined below) but equal to or greater than the DL, it should be qualified as an estimated value.

- **Quantitation Limit** or **QL** - This is the minimum concentration that can be identified and quantified above the DL within some specified limits of precision and accuracy/bias during routine analytical operating conditions. It is matrix and media-specific, that is, the QL for a water sample will be different than for a

sediment sample. It is also recommended that the QL is supported by the analysis of a standard of equivalent concentration in the calibration curve (typically, the lowest calibration standard).

(Note: The actual "real time" sample Reporting Limit or RL is the QL adjusted for any necessary sample dilutions, sample volume deviations, and/or extract/digestate volume deviations from the standard procedures. It is important to anticipate potential deviations to minimize excursions of the RL above the PAL, whenever possible.)

For any analytical operation, the relationship between the PAL, QL, and DL terms can be represented as:

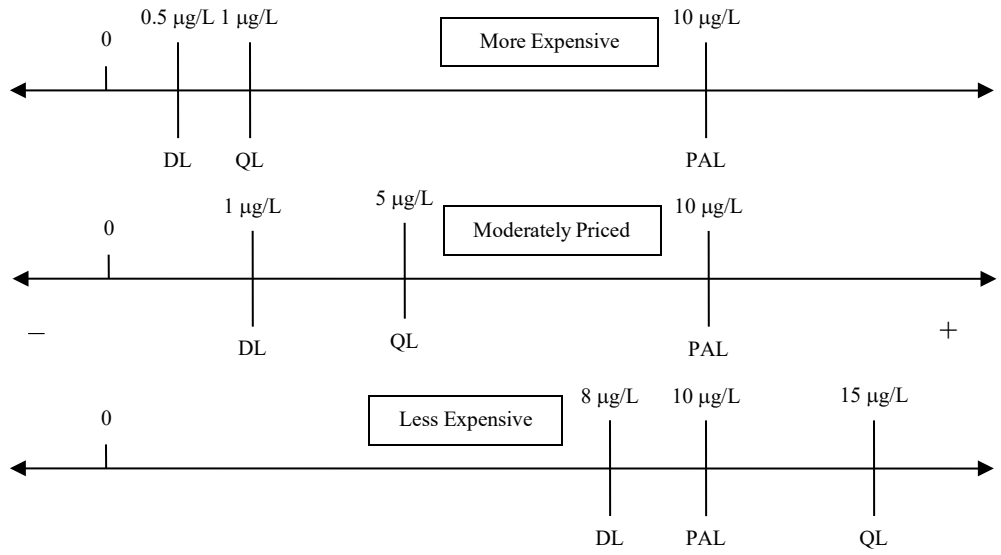


A standard general rule of thumb is to select an analytical operation capable of providing a QL in the range of 3-10 times lower than the PAL and 3-10 times higher than the DL. Some additional considerations for selecting an analytical operation with the most appropriate relationship for your data needs may include the following:

- When critical decisions will be made with project data exceeding the PALs, you may wish to have a greater level of certainty at the PAL concentration level. To accomplish this, you may want to select an analytical operation capable of providing a QL towards the lower end of the range (closer to values 5-10 times lower than the PAL). This would result in a greater distribution of concentrations that could be reported with certainty, both less than and approaching the PAL.
- When you're looking to minimize uncertainty of the project data reported at the QL, you may choose to select an analytical operation where the QL is much greater than the DL (closer to values 5-10 times higher than the DL). This would help to ensure less background noise impacts on the data.

Careful consideration of the PAL/QL/DL relationship should be given when balancing your data quality needs with project resources to get the most appropriate data quality for the least cost.

For example, the PAL for one analytical parameter may be 10 µg/l based on the Federal Water Quality Standard, and you have a choice between an expensive state-of-the-art analytical technology providing QL = 1 µg/l and DL = 0.5 µg/l, a moderately-priced standard method with QL = 5 µg/l and DL = 1 µg/l, or an inexpensive field measurement with QL = 15 µg/l and DL = 8 µg/l. These choices may be represented as follows:



If you are attempting to identify whether the analytical parameter exceeds the Federal Standard, the moderately priced method may serve your needs. However, if the parameter is known to be present and you're attempting to further identify the boundaries of those areas minimally impacted by low levels (for example, you're suspecting lower concentrations may pose a risk to some aquatic species of concern in the area), you may opt for the more expensive analysis with the lower QL and DL. In both of these examples, the inexpensive field measurement may not be appropriate to meet your project needs, as the lowest concentration that would be reported (15 µg/l) exceeds the PAL. However, if you are just trying to get a handle on whether some specific locations within your study region grossly exceed the PAL, data generated from the inexpensive field measurement may suit your project needs.

Attachment C

Data Quality Indicators (DQIs) and Measurement Performance Criteria (MPC) for Chemical Data

Identifying Data Quality Indicators (DQIs) and establishing Quality Control (QC) samples and Measurement Performance Criteria (MPC) to assess each DQI, as introduced in Section 1.7, are key components of project planning and development. These components demonstrate an understanding of how "good" the data need to be to support project decisions, and help to ensure there is a well-defined system in place to assess that data quality once data collection/generation activities are complete.

When faced with addressing data quality needs in your QA Project Plan, one of the first terms you may come across is Data Quality Indicators (DQIs). DQIs include both quantitative and qualitative terms. Each DQI is defined to help interpret and assess specific data quality needs for each sample medium/matrix and for each associated analytical operation. The principal DQIs and a brief summary of information related to assessing each DQI is as follows:

Precision

Questions answered: How reproducible do the data need to be? How good do I need to be at doing something (such as sample collection, sample prep/analysis, etc.) the same way two or more times?

Expressed in terms of "*relative percent difference*" (for the comparison of 2 data points).

Quantitative vs. Qualitative term: Quantitative.

QC samples (may include):

- Field duplicates - To duplicate all steps from sample collection through analysis;

- Laboratory duplicates - To duplicate inorganic sample preparation/analysis methodology; and/or
- Matrix spike/matrix spike duplicates - To duplicate organic sample preparation/analysis methodology; to represent the actual sample matrix itself.

Acceptance criteria or MPC: May be expressed in terms of Relative Percent Difference (RPD) between two data points representing duplicates and defined by the following equation:

$$RPD = \frac{|X_1 - X_2|}{(X_1 + X_2)/2} \times 100$$

where,

RPD = Relative Percent Difference (as %)

$|X_1 - X_2|$ = Absolute value (always positive) of $X_1 - X_2$

X_1 = Original sample concentration

X_2 = Duplicate sample concentration

For field duplicate precision, an RPD of ≤20% might serve as a standard rule of thumb for aqueous samples.

For laboratory QC sample precision, information provided in the analytical methods might be found to be adequate to meet your data quality needs.

Expressed in "*relative standard deviation*" or other statistical means for comparison of 3 or more data points - Follow a similar thought process as described above and include appropriate calculations.

Accuracy/Bias

Questions answered: How well do the measurements reflect what is actually in the sample? How far away am I from the accepted or "true" value, and am I above this value or below it?

Expressed in terms of *"Recovery"*

Quantitative vs. Qualitative term: Quantitative.

QC samples (may include)

- Matrix spikes - To monitor sample preparation/analysis methodology, as well as, to represent the actual sample matrix itself;
- Standard reference materials and/or laboratory control samples - To monitor sample preparation/analysis methodology and often of a similar media (such as water, soil, sediment) as the field samples; and/or
- Performance Evaluation (PE) samples – (may be appropriate for complex analyses) To serve as an external check on sample preparation/analysis methodology, as samples of known concentration are prepared external to the laboratory and submitted for analysis as "blind" or unknown samples.

(NOTE: The concentrations of these QC samples are typically near the middle of the calibration range.)

Acceptance criteria or MPC: MPC are typically expressed in terms of % Recovery of a known or accepted/true amount and defined by the following equation:

$$\%R = \frac{X}{K} \times 100$$

where,

$\%R$ = Recovery (as %)

X = Measured value or concentration

K = Known or accepted/true value or concentration

For matrix spikes, the % Recovery calculation typically takes into account correcting the matrix spike concentration for the naturally occurring amounts (as measured in the unspiked sample). The calculation may be represented by the following equation:

$$\%R = \frac{(A - B)}{K} \times 100$$

where,

$\%R$ = Recovery (as %)

A = Measured value or concentration in the matrix spike

B = Measured value or concentration in the unspiked sample

K = Known or accepted/true value or concentration in the matrix spike without native amounts present

For laboratory QC sample accuracy/bias, information provided in the analytical methods might be found to be adequate to meet your data quality needs.

For PE sample accuracy/bias, information is available from the PE sample vendor.

Expressed in terms of *"Contamination"*

Quantitative vs. Qualitative term: Quantitative.

QC samples (may include):

- Field blanks - To assess the effect of any potential sample collection contaminant sources on the associated sample data; and
- Laboratory blanks - To assess the effect of any potential laboratory preparation/analysis contaminant sources on the associated sample data.

Acceptance criteria or MPC: MPC are typically expressed in reference to the QL (as defined in Appendix A). MPC are often set at <QL for field blanks and <QL or some fraction of the QL (such as <1/2 QL) for laboratory blanks.

Representativeness

Questions answered: How well do the sample data reflect the environmental conditions? Is my 500mL sample representative of all the water in that lake? Is my sample still the same after that hot, bumpy truck ride to the laboratory?

Quantitative vs. Qualitative term: May include both.

If quantitative:

QC samples (may include):

- QC samples for other DQIs - To serve as overall checks of representativeness; and/or
- Temperature blanks (water samples that travel with samples from transport in the field to the laboratory) - To serve as a QC check for temperature-related sample preservation.

Acceptance criteria or MPC: For temperature blanks, MPC may be expressed in relation to an acceptable temperature range. For example, for field samples requiring preservation at 4°C, the MPC may be 4°C +/- 2°C.

If qualitative:

QC samples (may include): None.

Acceptance criteria or MPC: Assessing this DQI may include plans to verify that documented sample collection and analytical methods (including sample handling & chain-of-custody procedures, sample preservation, and sample holding times protocols) were followed to ensure the data reflects the environmental conditions. Assessing may also include a review of the sampling design to determine whether samples collected were representative of the environmental conditions and extent of physical boundaries, especially if the sampling design was based on judgmental sampling and not on statistical means.

Comparability

Questions answered: How similar do the data need to be to those from other studies or from similar locations of the same study, same sampling locations but at different times of the year, etc.? Are similar field sampling and analytical methods followed to ensure comparability? If variations are noted in field conditions (such as a stream bed being somewhat dry resulting in more turbid water samples), do these observations support poor comparability of associated data?

Quantitative vs. Qualitative: Qualitative.

QC samples (may include): None.

Acceptance criteria or MPC: Assessing this DQI may include plans to compare sample collection and handling methods, analytical procedures, and QA/QC protocols between studies, study locations, sampling time of year, etc. along with the associated data. Additionally, comparison of concentration units, types of equipment used, and weather/seasonal variations may be assessed.

Completeness

Questions answered: What amount (typically expressed in percentage) of the data you plan to collect is necessary to meet your project objectives? And, are there any data points that are absolutely critical and therefore may warrant re-sampling and/or re-analysis if not attained? After all the things that went wrong do I still have enough acceptable information and data to make a decision?

Quantitative vs. Qualitative: May include both.

If quantitative:

QC samples (may include): None.

Acceptance criteria or MPC: MPC are typically expressed in terms % Completeness between the amount of usable data collected versus the amount of data planned to be collected for the study. Completeness is defined by the following equation:

$$\%C = \frac{N}{T} \times 100$$

where,

$\%C$ = Completeness (as %)

N = Number of usable results

T = Targeted number of samples planned to be collected

Typical MPC may fall somewhere in the range of 75 - 90% completeness, depending on how critical it is to supporting project decisions.

If qualitative:

QC samples (may include): None.

Acceptance criteria or MPC: Assessing this DQI may include ensuring that any data points (locations and/or analyses) that were defined as being absolutely critical to the project have in fact produced usable data and, if not, have set plans in motion to re-sample and/or re-analyze.

Sensitivity

Questions answered: Are the field and/or laboratory methods sensitive enough to "see" or quantify your parameters of concern at or below the regulatory standards or your PALs? Are the QLs low enough to answer the question(s) you are asking? How low can I measure and still have confidence in the results?

Quantitative vs. Qualitative: Quantitative.

QC samples (may include):

- Calibration verification - To assess the ability to accurately quantify data at the low end of the calibration curve; and/or
- Laboratory QC samples (such as laboratory control samples, laboratory fortified blanks, etc.) - To ensure accurate quantifying of data at the QL.
- (NOTE: The concentrations of these samples are typically at or near the QL which is typically defined by the lowest point on a calibration range.)

Acceptance criteria or MPC: MPC may be expressed in terms of the laboratory's acceptable performance criteria for their QC checks. This is typically expressed as QL +/- some defined acceptable concentration value deviation.

Another way of approaching this material is through a systematic process broken down into several steps (for each sample medium and associated analytical operation:

Step 1 - Identify the most critical Data Quality Indicators (DQIs) for your project. (For example, sensitivity may be more critical than another DQI and would drive your selection of a sampling or analytical method.) DQIs should be associated with each sample medium/matrix and each sampling & measurement/analysis scheme planned. The principal DQIs include: precision, accuracy/bias, representativeness, comparability, completeness, and sensitivity (as described above).

Step 2 - Determine which of the DQIs will be assessed quantitatively (typically, these may include precision, accuracy/bias, and sensitivity) and which are more qualitative in nature (typically, these may include representativeness, comparability, and completeness).

Step 3 - Describe how each DQI will be assessed. Identify pertinent quality control (QC) samples that will serve as checks on data quality, and discuss how these QC samples will be evaluated.

Step 4 - For the DQIs that can be assessed quantitatively:

- Identify the QC samples selected for assessing each DQI. The QC samples, as discussed previously, may include both field QC samples (such as field duplicates, field/equipment blanks, etc.) and measurement/analysis QC samples (such as laboratory duplicates, method blanks, matrix spikes/matrix spike duplicates, laboratory control samples, etc.).
- Provide the calculation(s) that will be used to define the acceptance criteria or Measurement Performance Criteria (MPC) for each DQI.

(NOTE: These equations are generally included in Section 1.7 of the QA Project Plan. If they are presented in another section, Section 1.7 should clearly state where they will be found.)

- Identify the Measurement Performance Criteria (MPC) for each DQI and the associated QC samples selected for assessing whether the MPC was met. The MPC for your project may be defined by several options. The two primary options include:
- Project team defines project-specific criteria; or
- Project team defaults to QC criteria already defined by a sampling, field measurement, or analytical method once reviewed and deemed acceptable to meet the data needs of the project.

Types of QC Samples and MPC to consider include:

Field QC Samples - MPC to be assessed by field QC samples are generally defined by the project team. For example: If analyzing sodium in a surface water sample, you may collect field duplicate samples at a frequency of 1 duplicate for every set of 20 samples or less. These QC samples would be used to assess the precision encompassing both sample collection and analytical methods. In this case, the analytical parameter is sodium, the sample matrix is surface water, the DQI is precision of field plus analytical methods, and the MPC set might be Relative Percent Difference (RPD) < 20% between the results of the field duplicate pair.

Field Measurement QC – MPC and associated QC samples are generally defined by the project team in conjunction with any information provided in the associated field instrument manuals.

Analytical QC - For laboratory measurements, the selected laboratory is often helpful in providing information on its internal quality control (QC) measures and criteria that may be "accepted" by (or defaulted to) the project team. It's important that the project team reviews the laboratory information and decides whether the criteria are rigorous enough for its use. To do this, you will need to identify a lab, make contact with it, and ask for its QA Manual and relevant standard operating procedures (SOPs). Within the QA Manual and SOPs, you will need to look for QC acceptance criteria usually in the form of numerical values. (NOTE: Some lab QA plans lack specific QC acceptance criteria. Instead, these plans may provide marketing information and

simply “say” the laboratory is good for the reasons they will list. In this case, the pertinent QC information is probably included in the SOPs.) Alternatively, you may choose to specify the criteria you’re expecting the laboratory to meet. If you choose to do this, you will need to have the associated laboratory contract criteria ready to insert into the QA Project Plan.

(NOTE: The MPC and associated field, measurement, and/or analytical QC samples are generally provided in Section 1.7 of the QA Project Plan. If they are presented in another section of the QA Project Plan, Section 1.7 should clearly state where they will be found. This information can very easily be combined with Section 2.5 Quality Control Requirements and summarized in a table similar to Table 2-4 of the QA Project Plan Template included in Module 2. If the project team has reviewed the QC acceptance limits summarized in Table 2-4 and has selected to accept these as the MPC meeting the data quality needs of the project, this needs to be clearly stated within Section 1.7.)

Step 5 - For the DQIs that will be assessed qualitatively, discuss the plans to assess each DQI and support the assurance that the quality of the data generated will be acceptable for making project decisions. Some examples to consider include:

Representativeness - Discuss how you will follow standardized and well-accepted sampling and analytical methods for ensuring the data collected reflects the environmental conditions. Describe the importance of any pertinent chain-of-custody procedures, sample preservation, and/or maximum sample holding times.

Comparability - Discuss if/how similar the project data need to be to those from other studies, similar locations within the same study, same sampling locations at different times of the year, etc. Compare sample collection and handling methods, analytical procedures, and QA/QC protocols as pertinent.

Completeness - Describe the amount, usually expressed in percentage, of data you plan to collect that is essential/necessary to meet your project objectives. Identify any data points (locations and/or measurements/analyses) that are absolutely critical and therefore may warrant re-sampling and/or re-analysis if not attained.

Attachment D

Selecting an Environmental Laboratory

In order for an environmental monitoring program or single sampling event project to be successful, it is usually necessary to locate and hire an environmental laboratory. The guidance in this module is designed to provide perspective on a number of the areas you may want to consider in selecting a laboratory to support the data quality needs of your project. The information is presented as a starting point. For additional assistance, feel free to consult with the Region's U.S. EPA QA staff, talk with other Grantees regarding laboratories they may be familiar with, and/or, if necessary, consider hiring a consultant.

Careful selection of laboratories and analytical methods is critical to the success of your project. Many routine laboratory procedures may not be able to support your data quality needs and/or report data to low enough limits to support decisions for your specific project. Following a review of a laboratory's qualifications and credentials, you may end up selecting a different laboratory and/or analytical method than originally considered. This decision point is critical to the success of your project. If an inappropriate laboratory and/or analytical procedure are selected, you may end up having to repeat your entire study.

There are several factors to consider when selecting a commercial laboratory including:

Technical and Logistical Qualification

- Experience with sample media/matrices and analyses
- State certification and/or TNI accreditation
- Laboratory capacity
- Laboratory location and support services
- Experience with other tribal projects

- Cost

Quality System Documentation

- Laboratory Quality Assurance Plan (or Manual)
- Standard operating procedures
- Personnel resumes
- Cost of QC
- Chain-of-custody
- Archiving data

Other Factors

- Data review procedures
- Laboratory report content
- Sample retention and disposal
- Laboratory subcontracts

Additional guidance on these factors is provided in the subsections that follow.

Technical and Logistical Qualifications:

Experience with sample media/matrices and analyses - *Does the laboratory have experience analyzing the types of samples* (e.g., water, drinking water, waste water, sediment, soil, fish tissue, plant materials, etc.) *that you want analyzed? Does the laboratory perform the specific analyses that you require?* Some laboratories may specialize in analyses based on either a particular matrix (e.g., drinking water, fish tissue, etc.) or a particular type of analysis (e.g., pesticides, dioxin, etc.). Others are full service organizations that can handle many types of matrices/media and analyses.

It is important that you determine what matrices/media and analyses you require while you are planning your project (and prior to writing your QA Project Plan). Usually laboratories have a business manager, client services manager, sales representative, etc. who will work with you to determine whether they can provide the particular analyses required for your project. Most laboratories will perform routine surface or ground water analyses. Two types of water analyses not always available at every laboratory include: organic chemistry methods for drinking water compliance analyses (as these methods require a laboratory to handle reporting at the low detection limits); and dioxin analyses (as these methods require special reagents, instruments, and expertise).

Lack of prior experience should not necessarily disqualify a laboratory, but should lead to a more thorough investigation of the laboratory's qualifications.

State certification and/or TNI accreditation - *Does the laboratory have state certification in the state in which your grantee resides? Does the certification include the types of sample media/matrices and analyses of interest for your project?* It is important to note that all states do not run their certification program the same way. Some state certifications include only drinking water, while others may include many different media (e.g., waste water, hazardous waste, tissue, etc.). Even laboratories within a given state seldom are certified for exactly the same media or analytical parameters. Laboratories are certified for specific media and analyses depending on their interest to pursue specific certification categories, as well as their ability to demonstrate compliance with the associated qualifications. State certification by itself does not guarantee that good quality work will be produced, but it may provide a good starting point to help you evaluate a laboratory's ability to support your project needs.

Does the laboratory have TNI accreditation? Does the accreditation include the types of sample media/matrices and analyses of interest for your project? Many states, independent of size, also participate in TNI (The NELAC Institute).

This program attempts to ensure a national uniformity in accreditations (similar in intent to certifications), and involves a more detailed review than that provided historically by many state certification programs.

Has the laboratory successfully analyzed all recent performance evaluation (PE) samples? Usually state certification and/or TNI accreditation requires regular participation in some kind of PE program. Although these PE programs do not cover all analyses or all possible analytes, they usually cover many of the most common analytes of interest to water monitoring programs. It is recommended that you request the laboratory's most recent (last two years is good) PE results. If there have been recent problems, you should inquire about the results of the laboratory's investigation of the problem and its corrective actions to ensure the problem was fixed.

Do you know the current status the laboratory's state certification or TNI accreditation? You may want to request the certification/accreditation audit reports, although the laboratory is not obligated to share them with you (as their availability may be dictated by company or laboratory confidentiality policy). The state certification/TNI accreditation agency will, however, tell you the media/matrices, analytes, and methods the laboratory is certified/accredited for, as well as whether the laboratory is in good standing with regards to its certification/accreditation.

Laboratory capacity - *Does the laboratory have the capacity to handle your samples (and all related sample preparation and analyses) on the schedule you need?* Do they have sufficient instruments (and back-up instruments in case of instrument failure) and personnel to handle the anticipated sample load?

If you are not generating a large number (typically, less than 40) of samples, most laboratories can handle this sample load without problem. However, if your project will generate a large number samples at one time and/or you have samples to be analyzed for a variety of analytical

parameters, you need to ensure that the laboratory can handle the work load in all of its departments. For example, a laboratory may have capacity to analyze 60 metals analyses (as these are relatively fast and involve minimal preparation), but they might not be able to analyze 60 pesticide or semivolatile organic compound analyses (as these require more time consuming sample preparation steps, as well as longer analysis time) in a specific time frame.

Make sure you discuss sample capacity loads, sampling holding times, and data deliverables with the laboratory and then make plans to schedule your sample collection accordingly; or, find a different laboratory that can handle your samples when they need to be analyzed, if you cannot be flexible in your sample collection and shipping schedule.

Laboratory location and support services - *Is the laboratory location convenient?* A local laboratory may be advantageous to your project as it may more easily facilitate transferring your samples directly to the laboratory the same day as collected, either hand-delivered by a project team member or picked up by a laboratory courier service. This may be especially critical if your project's analytical methods require that your samples be analyzed within a short time frame (after collection) to ensure sample integrity. However, with overnight courier services, shipping samples within a state or even to another state doesn't necessarily mean that processing of the samples will start any later than if they were delivered to a local laboratory.

What support services does the laboratory provide, and what is its sample receipt policy? You also need to discuss with the laboratory how it typically receives samples and what support it might provide in this regard. For example, the laboratory may provide coolers for shipping, chain-of-custody forms, free pre-cleaned/certified sample bottles and preservatives, courier service, etc. Some laboratories have staff available to receive samples after hours or on Saturdays, but not all do.

Cost - *Are the laboratory's prices reasonable?* Shop around and find the laboratory that best meets your needs and look for a competitive price. Sometimes there are economies by making a longer-term commitment (e.g., for all four quarterly monitoring events in a year) or in sending all your samples to one laboratory facility (e.g., rather than splitting up samples submitted for various analyses to two or more individual laboratories).

Quality System Documentation:

Laboratory Quality Assurance Plan (or Manual) - *Does the laboratory have a written Quality Assurance (QA) Plan, and is it adequate to meet your project's data quality needs?* Almost all laboratories will have some form of QA Plan, but these documents may vary considerably in terms of their content.

Some QA Plans are designed to provide general information as a form of marketing tool. These plans might describe the laboratory's capabilities, identify any state certifications or accreditations, discuss the QA program in place (in a general sense), list the methods it performs, describe the matrices it typically handles, list personnel and their qualifications, and provide an overview of the organization. This type of QA Plan may be supplemented with additional information available in other laboratory documentation, such as standard operating procedures (SOPs). However, acquiring this additional information may require you to "dig deeper" and ask more questions.

The other end of the spectrum might be a QA Plan containing similar types of information (as discussed above), while being much more detailed in scope. For example, this type of QA Plan might include lists of analytes associated with each method (rather than just listing the methods alone), as well as the reporting limits and/or method detection limits for each analyte for each

method. Rather than merely stating it has a QA program, this type of plan might provide specifics with respect to: the types of QC samples run; the frequency with which they are run; the sources and concentrations of specific spiking solutions that are used (in preparing surrogate spikes, matrix spikes, and/or laboratory control sample mixtures); the acceptance criteria associated with each type of QC check (on an analyte-specific basis); and the corrective actions taken when these criteria are not met. Details on calibration criteria and associated corrective action criteria may also be included in this type of plan.

Standard operating procedures - *Does the laboratory have written standard operating procedures (SOPs) for all of its operations?* Most full-service laboratories are divided up into departments or sections that include: sample receipt; organic sample preparation; inorganic sample preparation; metals analysis; general chemistry analyses; gas chromatography/mass spectrometry (GC/MS) analyses (often including separate volatile and semivolatile organic compound analysis areas); and gas chromatography (GC) analyses (often including separate pesticide, polychlorinated biphenyl (PCB), and total petroleum hydrocarbon analysis areas). Some laboratories also offer microbiological analyses or toxicity testing, while others may provide analysis of tissue or foliage samples.

Each laboratory department or section should document its procedures in written SOPs. SOPs for each analytical method should include detailed step-by-step procedures, as well as specific QC requirements, frequency, acceptance criteria, and corrective actions (to be taken if these criteria are exceeded) associated with that method. It is important to remember that a "published method" is not an SOP. In general, published methods such as EPA methods or those in Standard Methods vary considerably in their method description and may need to be supplemented with specific QC requirements, calibration criteria, reporting limits and/or method detection limits, etc. At times, the published methods may be modified to improve performance if necessary to meet a project objective.

Personnel resumes - *Are the resumes of key personnel available for review, if necessary?* Sometimes this information is found in the laboratory's QA Plan, while other times resumes are kept confidential unless requested specifically. State certification agencies typically have minimum experience and/or educational requirements for management and supervisory positions, and they may review the laboratory's general qualifications as part of

the certification process. However, you may want to review specific resumes if there are concerns related to a critical analysis area, especially for the more complex analyses.

Cost of QC - *What QC samples are analyzed and typically reported by the laboratory on a routine basis, and what QC samples may will require an additional cost to the grantee?*

Unless requested otherwise, most laboratories will perform their QC analyses on a batch basis. A batch is a set number of samples (frequently, 20) of a similar matrix/medium. The batch may be comprised of samples from a single client or include small groups of samples from multiple clients. The intent of batching samples is for the laboratory to avoid performing an overall disproportionate number of QC sample analyses. For example, a grantee may submit 5 samples and another client may submit 10 samples for the same type of analysis. But, as the laboratory typically performs analysis of the associated QC check samples (that may include a laboratory blank, a matrix spike, laboratory duplicate and possibly a laboratory control sample) at a rate of one for every 20 samples, the laboratory may combine the grantees samples and the other clients' samples into one batch and report the same batch QC results to both clients. This is logical from a laboratory perspective, as the laboratory typically absorbs the cost of these QC samples. But, this batching could result in generating results of matrix spike and lab duplicate samples that may not be representative of the grantees samples. Thus, they provide information about the laboratory's performance, but not necessarily about the grantees sample matrix/medium. In most cases, batch QC is sufficient for tribal purposes, but in some cases having one of the grantees samples designated to serve as the matrix spike, laboratory duplicate, and/or matrix spike duplicate may be desirable. Some laboratories may batch an individual client samples together (even if just a small group) and not combine samples from different clients. If that is the case, they may use the grantees samples as a basis for the QC samples without any additional charge.

It is recommended that you engage the laboratory in discussions regarding what QC samples it runs routinely for each analysis (as they may differ from method to method), the frequency of those QC sample analyses, as well as which are performed at client versus laboratory expense. Samples sent blind to the laboratory, such as field duplicates and field blanks, will always be at client expense.

Chain-of-custody - *If there are legal considerations to the data, does the laboratory have a well-documented, internal chain-of-custody system?* Oftentimes this is done electronically or with a combination of electronic and logbook documentation.

Archiving data - *Does the laboratory have a system in place to track, store, and archive raw data and old data reports?* Most laboratories have retention policies, but you should know and understand what they might be. With the increasing use of electronic data, but ever changing formats, a permanent hard copy may be the only way to ensure data is available for any future use (such as if the client loses their data, a complete data package including raw data was not requested by the client but needed later on, etc.).

Other Factors:

Data review procedures - *Does the laboratory have defined procedures in place covering administrative tasks such as sample receipt and check in, as well as for the reporting and processing of data?* It is important to understand the level of review associated with these tasks. Most laboratories will have SOPs in place covering these tasks. Some specific questions to consider include:

- Does the QA Officer (or some individual independent of performing the actual activity) review all data or a fraction of the data in real time (prior to providing the data to the client)?
- Is there an automated data review system in place? Does the data review SOP describe the review system satisfactorily?
- Are data flagged for the client to review? How are data flagged? Is the system clear?
- Will all data reports contain a narrative explaining any problems?

Laboratory report contents - *What are the contents of a typical laboratory report?* It is recommended that you request to see a typical data report (to ensure the laboratory will provide the information you will need) prior to selecting your laboratory, and that you specify the laboratory QC data you need to be reported with its data (so that you will have the information necessary to perform at least a minimum QC check on your project data). You should ensure you have a clear understanding of the criteria by which the QC data were evaluated for inclusion in

your QA Project Plan (especially if this is not to be summarized in the data report). For example, seeing a matrix spike recovery of 50% might look unacceptable, but for certain difficult compounds this may be an excellent recovery justified by the laboratory QA Plan and/or analytical SOP.

In some cases, it may be desirable or necessary to have the laboratory provide a complete data package, sometimes called a data validation package. Basically, this data package includes all the data and sample information used to generate a sample result. It may include, but not be limited to, chain-of-custody and sample receipt records, sample preparation logs, analysis logs, standards logs, raw data from the instrument for both sample and QC sample analyses, calibration information for initial and continuing calibration analyses, sample analysis results, QC sample results, and all information related to sample processing (for example, results of manual integrations of results, etc.). (Note: For an example of items to consider for inclusion in a complete data package, visit the EPA Region 9 QA website at: http://www.epa.gov/region9/qa and download the document entitled *Draft Laboratory Documentation Requirements for Data Validation, R9QA/004.2, August 2001*) "Complete" data packages are typically required for litigation. This type of data package may cost an additional $50-100 or more per sample batch, if they are even offered as an option from a given laboratory (which is information you would want to know about up front). Such packages are usually considerably cheaper if ordered when the samples are analyzed. Asking the laboratory to generate this data package after the fact may cost considerably higher.

Sample retention and disposal - *What are the laboratory's policies with respect to retention and disposal of samples?* The grantee should be reassured that there is no future liability associated with providing samples to the laboratory.

Laboratory subcontracts - *What are the laboratory's policies with respect to subcontracts, and what samples might be subcontracted for your project?* The laboratory should have a system in place to evaluate its subcontractor's quality system. It should be reviewing subcontractor data as if it was its own, since it will be reported as such. It is important to note that a subcontractor does introduce another variable into the quality system, one that you may not be able to evaluate directly. Thus, it is important that you are comfortable with whatever samples might be sent out.

If considered critical to a project's success, you may need to request documentation (such as an SOP) from the subcontract laboratory, so that it too can be evaluated.

D-2: Sampling and Analysis Plan from SGMP

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Task #K01R-14-3

SAMPLING AND ANALYSIS PLAN
REVISION NO. 1

SYMPHONY PARK
[FORMERLY UNION PARK 61-ACRE SITE]
FORMER UNION PACIFIC RAILROAD
FUELING AND MAINTENANCE YARD
LAS VEGAS, NEVADA
FACILITY ID # H-000557
KLEINFELDER PROJECT NO.: 20154986.001A

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EM-2214 (expires 4/14/2017)

I 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.

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1 INTRODUCTION

The City Parkway V, Inc. (City Parkway V) is redeveloping the 61-acre site known as Symphony Park located just west of downtown Las Vegas. The site is bounded on the north and west by Grand Central Parkway, on the east by the Union Pacific railroad, and on the south by Bonneville Avenue. The City Parkway V is acting as the master developer. The Symphony Park vision is to develop a new skyline and destination for local residents with mutually supportive mixed uses and not dominated by one or two large uses. All of the infrastructure for the site will be developed by the City Parkway V.

During the course of normal operations, former Union Pacific Railroad (UPRR) operations on the site resulted in releases of petroleum hydrocarbons, various organic and inorganic solvents, and metals. Some of the petroleum-impacted soil has been removed and replaced with clean fill material according to an agreement between the Nevada Division of Environmental Protection (NDEP) and UPRR. However, subsequent analysis of soil and groundwater samples has revealed the presence of various contaminants of potential concern. Therefore, in order to have a common procedure to evaluate the materials to be encountered for the various redevelopment activities, the City desires a sampling and analysis plan (SAP) for the entire 61 acres.

This SAP would be used in conjunction with the separate Soil and Groundwater Management Plan (SGMP, Kleinfelder 2016) to provide the project-specific procedures for collecting samples from excavated soil stockpiles and obtaining the analytical data to be used in the decision criteria to be established in the SGMP for soil management. The constituents of concern are: volatile organic compounds (VOCs [alkyl benzenes, toluene, ethylbenzene, total xylenes, naphthalene, and etc.]), the Resource Conservation and Recovery Act (RCRA) 8 Metals (arsenic, barium, cadmium, total chromium, lead, mercury, selenium, and silver), semi-volatile organic compounds (SVOCs), and polychlorinated biphenyls (PCBs) as appropriate based on individual project location. The specific analyses for samples taken from the different areas within the 61 acres will be determined by the CEM based on the historical data from past reports.

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Groundwater sampling and analysis is not covered in this SAP. Groundwater should be addressed on a case-by-case basis by the individual contractors depending on whether building construction requires dewatering activities. If groundwater is encountered, it will require management under the SGMP. Sampling and analyses will need to follow the requirements set forth in the National Pollution Discharge Elimination System (NPDES) permitting guidelines. Based on previous projects on the Symphony Park site, it is anticipated that groundwater to be managed on the Symphony Park site can be discharged to the storm sewer requiring NPDES permits. This is further discussed in the SGMP.

1.1. SITE NAME

The sampling of the excavated soils will be located on various parcels and city right-of-ways within the site collectively known as the Symphony Park site in Las Vegas, Nevada.

1.2. SITE LOCATION

The site is located in the northwest ¼ of the northwest ¼ of Section 34, Township 20 South, Range 61 East. A site location map is presented as Figure 1-1. A detailed site layout showing the parcels and right-of-ways is presented as Figure 1-2.

1.3. RESPONSIBLE AGENCY

The field sampling will be performed per this SAP for the City Parkway V, Inc. The SAP was developed by Kleinfelder, under the direction of a Certified Environmental Manager (CEM).

1.4. ROLES AND RESPONSIBILITIES

The roles and responsibilities for the management of soils and groundwater are based upon the 2015 settlement between the City of Las Vegas and UPRR, in which the City of Las Vegas assumes all cost and risk for existing on-site contamination and relieved UPRR of their environmental obligations and are discussed in more detail in Section 3 of the SGMP.

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1.4.1. NDEP

The NDEP is the regulatory agency overseeing the project, and will be involved as appropriate. Unless NDEP specifies otherwise, soil characterization will be performed by the CEM in accordance with this SAP before transportation and disposal/treatment occurs. NDEP will review and approve this SAP prior to its implementation. Soil characterization in accordance with the SGMP and this SAP replaces NDEP approval for individual soil determinations.

1.4.2. City Parkway V, Inc.

City Parkway V will have overall coordination responsibility for the site as a whole and of the rights-of-ways. City Parkway V will designate area(s) for temporary stockpiling of soils.

1.4.3. Certified Environmental Manager

The CEM has the authority to implement the SAP in areas of known and unknown conditions. The CEM shall be present on-site during soil characterization, excavation, and removal activities. The CEM may be provided by City Parkway V or the Developer/General Contractor.

A CEM shall be required to be present during excavation on the Symphony Park Site, regardless of the location of the development relative to the UPRR remediation extents. The UPRR remediation extents shown on Figure 4 and subsequent figures should be considered approximate. It is the developer's responsibility to define or verify the UPRR remediation extents.

1.5. STATEMENT OF THE SPECIFIC PROBLEM

The presence of contaminated soil beneath the Symphony Park has been identified in various previous site characterization studies performed over the past several years. A summary of the relevant findings and conclusions to date is as follows:

- The site was extensively utilized as a fueling and maintenance yard by Union Pacific Railroad for more than a 70 year period, beginning in the early 1900s. The site contained locomotive fueling, service, repair, and cleaning areas, and was also used for

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material storage. From the 1940s to 1991, the property was used for locomotive fueling and maintenance purposes.

- Site characterization studies began in the late 1980s identifying areas of soil and groundwater contamination that included TPH, metals, VOCs, and SVOCs.

- The predominant contaminants at the site are petroleum hydrocarbons. Localized areas of soil are impacted with metals, VOCs, and SVOCs.
  - Eastbound Fueling Area - most of this area is situated on the adjoining property to the north.
  - Day Storage Tank – formerly located on the north end of the site.
  - Diesel Shop Area – formerly located on the center portion of the site.
  - Fuel Storage Area – formerly located on the south central portion of the site.
  - Wash Track Area – formerly located on the southwest portion of the site.
  - Evaporation Pond Area – formerly located on the west-central portion of the site.
  - The former areas where the contamination was found are shown on Plate 1-3 and identified as:

- Hydrocarbon impacted soils were found throughout the site from surface to the groundwater saturated zone. Measurable plumes of free phase floating product existed in the groundwater at the Eastbound Fueling Area, the Diesel Shop Area, and the Fuel Storage Area.

- Lead impacted soils were found in the Wash Track Area but did not extend beneath a depth of six feet below ground surface (bgs).

- VOCs and SVOCs were predominantly found at the Diesel Shop Area and were reported to be minor in extent.

- Contaminated soil (from surface to 2.5 feet bgs) and free product in the groundwater was removed by Union Pacific in the early 1990's, but there are still areas with TPH concentrations exceeding the NDEP action level of 100 mg/kg. There is also some residual free product in the groundwater in the vicinity of the former Fuel Storage Area and Diesel Shop Area.

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Much of this site has been investigated, areas have been remediated, and the extent of remaining impacted soil, as well as areas of impacted groundwater, have been delineated. Those remaining potential areas of contamination have been documented. For those areas outside the UPRR remediation extents, NDEP and City Parkway V have agreed that the soils are *legally clean* based on the No Further Action determination by NDEP following UPRR's remediation activity. However, if during the course of excavation in an area outside of the UPRR remediation extents, the CEM observes indications of potentially impacted soils, those potentially impacted soils will be evaluated under the stipulations of the SGMP. Additionally, if impacted soils have been discovered by investigations after the No Further Action determination and prior to development, those impacted soils will be evaluated under the requirements of the SGMP. The CEM shall also inform City Parkway V when potentially impacted soils are observed. This SAP has been designed so that excavation activities can be subsequently managed per the protocols of a separate soil management plan.

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2 BACKGROUND

The Symphony Park site consists of 21 separate parcels within 61 acres (see Figure 1-2). Upon development, the site will have several right-of-ways extending in an approximate northwest-southeast and northeast-southwest alignment across that include roads and walking promenades. The City Parkway V is acting as the master developer with the intent to develop a new skyline and destination for local residents. The development will have mutually supportive mixed uses and not be dominated by one or two large uses.

As previously described, over 70 years of UPRR operations on the site resulted in releases of petroleum hydrocarbons, various organic and inorganic solvents, and metals during the course of normal operations. Some lead-impacted soil has been removed and some of the petroleum-impacted soil has been removed and replaced with clean fill material according to an agreement between NDEP and UPRR. Areas still remain that are impacted by TPH, VOCs, SVOCs, some PCBs, or metals.

2.1. SITE DESCRIPTION

The Symphony Park site consists of 61 acres of land that is partially developed. There are no surface features present that are related to previous rail road operations. Prior to 2007, the land was used in support of nearby construction activities at the World Market Center and the Molasky Corporate Center as construction parking, equipment staging, and construction material lay-down areas. Since the original SGMP was written in 2007, several parcels have been developed. Parcel A1 was developed as the Cleveland Clinic Lou Ruvo Center for Brain Health with Parcel A2 as an associated temporary paved parking area. Parcel H/I was developed as the Smith Center for the Performing Arts, the Discovery Children's Museum, and an associated parking garage. Parcel B has been developed as a paved temporary parking area. Parcels K, L, M4, N, O1 and O2 have been connected as a paved parking area. Parcels M2, and M3 have been developed as green space. The Phase I roadways (Symphony Park Avenue, West Clark Avenue, Promenade Place, and South City Parkway) have been placed and paved. The remaining parcels remain undeveloped, and have been used as construction

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parking, equipment staging, construction material lay-down areas, and stockpile storage containment areas during construction activities since 2007.

2.2. OPERATIONAL HISTORY

The site served as a fueling and maintenance yard for UPRR for over a 70 year period, beginning in the early 1900s. The site contained locomotive fueling, service, repair, and cleaning areas, and was also used for material storage. The property was used for locomotive fueling and maintenance purposes from the 1940s until 1991.

2.3. PREVIOUS INVESTIGATIONS AND REGULATORY INVOLVEMENT

In 1992, remedial activities at the UPRR site began per a NDEP-approved Remedial Action Plan (RAP). Union Pacific negotiated cleanup standards with the NDEP consisting of:

1) Removing all petroleum hydrocarbon impacted soil exceeding 100 milligrams per kilograms (mg/kg), as determined by EPA test method 8015M from the ground surface to a depth of 2.5 feet bgs;
2) Removing all hydrocarbon impacted soil exceeding 10,000 mg/kg regardless of depth;
3) Responsibility for all hydrocarbon impacted soil exceeding 100 mg/kg which would be excavated during future site construction activities (such as the upcoming redevelopment projects);
4) Removing all lead-impacted soil in excess of 1,400 mg/kg; and
5) Recovering free phase hydrocarbon fuel product from the perched groundwater to a thickness of less than ½ inch in the formation.

It should be noted that UPRR remediated only the lighter petroleum hydrocarbons (C23 and lighter) so the presence of heavier petroleum hydrocarbons is possible inside the UPRR remediation extents. Existing treated fill on the Symphony Park site from the UPRR remediation activities is agreed by NDEP and City Parkway V to be *legally clean* based upon the No Further Action determination by NDEP in 1998. However, if indications of potentially impacted soils are observed by the CEM on-site during future development, the potentially impacted soils will be evaluated under the stipulations of the SGMP. Additionally, if impacted soils have been

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discovered by investigations after the No Further Action determination and prior to development, those impacted soils will be evaluated under the requirements of the SGMP.

A final closure report prepared in 1997 indicated that the requirements of the remedial action plan had been achieved. The lead-impacted soils were removed by excavation and transported offsite to an authorized disposal facility. Approximately 12,400 tons of lead-impacted soils were removed from the Wash Track Area. The TPH-impacted soils (as defined by the RAP) occurring at the targeted areas were removed by excavation and thermally treated onsite. Following treatment, the thermally treated soils were reused as on-site excavation backfill. According to the closure reports, approximately 26,000 tons of TPH-impacted soil were removed from the Eastbound Fueling Area; approximately 13,500 tons from the Day Storage Tank Area; approximately 25,500 tons from the Diesel Shop Area; approximately 103,000 tons from the Fuel Storage Area; approximately 16,000 tons from the Wash Track; and approximately 49,000 tons from the Evaporation Pond Area. A groundwater recovery system was installed east of the Diesel Shop Area and at the Eastbound Fueling Area. These groundwater recovery systems consist of interceptor trenches that pumped total fluids (groundwater and product) through an oil/water separator to recover the free product. The water was discharged to city drains under a City wastewater permit.

According to results of the on-site groundwater monitoring wells in December 2000 (Converse, 2000), fuel product was measured in one well at the Fuel Storage area at a thickness of 0.19 foot and in 3 wells at the Diesel Shop Area at thickness ranging from 0.04 to 0.53 foot. Fuel product was also measured in wells at the Eastbound Fueling Area. These wells were situated on the adjoining property to the northeast. In addition, low levels of TPH and VOCs (toluene, ethylbenzene, and xylene) were detected in the wells. The monitoring report indicates that no free product was recovered during the second half of 2000 from either the central or eastbound recovery systems. The report stated that very little recoverable petroleum product was left at the site and the recovery systems have since been shut-down (Converse, 2000).

2.4. GEOLOGICAL INFORMATION

The Las Vegas Valley is a topographic basin located in southern Nevada in the Basin and Range Physiographic Province in a transitional area between the "younger" Great Basin of Nevada and Utah and the "older" Basin and Range topography of Arizona and California. The

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Las Vegas Valley is bounded on the west by the Spring Mountains; on the north by the Desert, Sheep, and Las Vegas Ranges; on the east by the Frenchman and Sunrise Mountains; and on the south by the River Mountains and the McCullough Range. The mountains to the north, east, and west consist primarily of Paleozoic and Mesozoic sedimentary rocks. The mountains to the south consist predominantly of Tertiary volcanic rocks overlying Precambrian metamorphic and granitic rocks.

Groundwater is anticipated to initially flow toward the northeast, and then east following local topography and toward the Las Vegas Wash. The Las Vegas Wash lies approximately five miles to the east of the site. During recent activities on Parcel P/Q (February 2015), the depth to groundwater was measured between 24 and 33 feet bgs.

2.5. ENVIRONMENTAL AND/OR HUMAN IMPACT

As part of the due diligence effort, each individual developer on the site is required to evaluate the environmental and human health impact to their project by performing a Human Health Risk Assessment (HHRA). Each evaluation is performed independently and addresses these impacts based on environmental sampling, historical data, site specific data collection, building design and future intended land use. Structures that will be located on or near the areas found to have been of most impacted from past releases may require mitigation measures.

As required under appropriate EPA and OSHA regulations, worker health and safety during construction activities shall be addressed separately by the respective parcel contractors. Information provided in the historical documentation, this SAP and the SGMP shall be used to develop the proper precautions to be set forth related to possible hazardous material exposure.

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3 DATA QUALITY OBJECTIVES

3.1. PROJECT TASK AND PROBLEM DEFINITION

Soil samples will be collected and analyzed to evaluate if the soil being excavated during construction activities can be reused on-site, should be transported off-site for treatment by Las Vegas Paving at their thermal unit, or properly disposed of at an appropriately permitted facility. The CEM will determine the analyses required for each project based on information available from previous investigations. Soil samples may be analyzed for VOCs (EPA 8260), SVOCs (EPA 8270), PCBs (EPA 8082), and RCRA-8 metals (EPA 6010/7470). Additionally, soils may be analyzed for purgeable and extractable TPH (EPA 8015M), for reuse or disposal purposes. Analytical results will be used by the contractors and the CEM to determine the proper destination of the excavated soils.

3.2. DATA QUALITY OBJECTIVES

Four Quality Control (QC) levels are used to define the quality of analytical data:

Level I – Level I data have the lowest level of QC. These data are collected on-site using real-time monitoring equipment, such as portable field instruments.

Level II – Level II data are also collected on-site. However, additional QC procedures are required. Examples of Level II data include survey data or analytical data generated by a mobile laboratory.

Level III – Level III data have an intermediate to high level of QC. Level III data include results of organic and inorganic chemical analyses using laboratory procedures such as SW-846 or hazardous waste characteristic tests. Level III analytical methods are equivalent to those used for Level IV; however, the QC documentation requirements are less stringent.

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Level IV – Level IV data are generated in accordance with EPA Contract Laboratory Program (CLP) protocol. Level IV data are produced using the highest level of QC documentation procedures.

Data quality will be evaluated based on data quality objectives (DQOs), which specify quantitative and qualitative requirements for the data. The required DQOs are based on the end uses of the data, and are determined by the methods of analyses and by the level of QC and documentation that are used to produce the data. The data quality objectives for the sampling of excavated soil per this SAP is Level III, intermediate QC.

Contaminant concentrations relative to the EPA Regional Screening Levels (RSLs), or the site-specific action level in the case or arsenic, are the primary criteria of interest for this project. While the management of soil, based on these levels, is detailed in the SGMP, the contaminants of concern and their action levels are presented in Table 3-1 so that the analytical laboratory method detection limit can be verified for sample testing.

TABLE 3-1

CONTAMINANT ACTION LEVELS

TARGET COMPOUND[1]	EPA RSL[2] (MG/KG)	SITE-SPECIFIC ACTION LEVEL (MG/KG)
Benzene	1.2[3]	None
Toluene	4,900[4]	None
Ethylbenzene	5.8[3]	None
Xylenes	580[4]	None
PCBs (Aroclor 1016)	4.1[4]	None
PCBs (Aroclor 1254)	0.24[3]	None
Arsenic	0.68[3]	15[5]
Barium	15,000[4]	None
Cadmium	71[4]	None
Chromium (total)	None	None
Lead	400[4]	None
Mercury	23[4]	None
Selenium	390[4]	None
Silver	390[4]	None

TABLE 3-1 Notes:

1. The individual compounds most likely to be present in the soil are presented.
2. Based on the overall future use of the project, the EPA Regional Screening Levels for Residential Soil are listed (May 2016). Where both are provided, the lesser of the carcinogenic and non-carcinogenic RSL is presented.
3. Carcinogenic RSL.
4. Non-carcinogenic RSL.
5. Kleinfelder 2007d, Document 80359/LVE7L139.

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3.3. DATA QUALITY INDICATORS

Data Quality Indicators (DQIs) for VOCs, SVOCs, PCBs, and metals are presented in Appendix A. These DQIs will be included in the contract with the selected Nevada-certified analytical laboratory. The analytical laboratory used would have to agree to the DQIs set forth in this project.

3.4. DATA REVIEW AND VALIDATION

All data will be initially reviewed and processed by the analytical laboratory's analysts using appropriate methods (e.g., chromatographic software, instrument printouts, hand calculation, etc.). The resulting data set will be transferred into an electronic report form, printed and reviewed by the analyst for accuracy. The data will be forwarded to the laboratory supervisor or the department manager for review and recheck of a minimum of 10% of the calculations. When the entire data set has been found to be acceptable, a final copy of the report will be printed and signed by the laboratory's supervisor, departmental manager or senior laboratory staff. The entire data package will be placed into the appropriate service request file, and an electronic copy of the final data package will be forwarded to the appropriate personnel for archiving.

When the laboratory's analyst determines that the data package has met the data quality objectives of the methods and has qualified any anomalies in a clear, acceptable fashion, the data package will be reviewed by a trained chemist. Prior to release of the report, the project chemist will review and approve the entire report for completeness and to ensure that any and all client-specified objectives were successfully achieved. A case narrative may be written by the project chemist to explain any unusual problems with a specific analysis or sample. The original raw data, along with a copy of the final report, will be filed in project files for archiving.

Upon receipt of the data packages, the integrity of the data will be assessed by the project Quality Assurance Manager. The results of the analysis of method blanks, laboratory control samples, sample duplicates, matrix spiked samples, QC samples, etc. will be assessed.

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3.5. DATA MANAGEMENT

Sample chain-of-custody protocol will be followed throughout the investigation to maintain sample integrity from collection to analysis. For all samples, the chain-of-custody will be maintained during sample collection, transfer of samples between personnel, shipment to the laboratory, handling at the laboratory, and final disposal of the sample. Chain-of-custody forms will be used to document and track samples submitted for laboratory analysis. An example chain-of-custody form is provided in Appendix C.

Chain-of-custody procedures are detailed in Section 9.3, but are summarized below:

- The sampler will be responsible for custody of the samples until they are transported or shipped to the laboratory.
- All samples will be accompanied by a completed chain-of-custody form. The sampler will keep one copy of the completed chain-of-custody form. If transfer of custody is required prior to shipment, the parties relinquishing and receiving the samples will sign, date, and include the time of transfer on the chain-of-custody form.
- Custody during shipping will be maintained by shipping samples in insulated coolers sealed with custody seals. Each cooler will contain a separate signed chain-of-custody form identifying the contents. The completed chain-of-custody form will be placed in a zippered plastic bag inside the cooler. Unless delivered to the lab by the sampler and picked up by the laboratory courier, the cooler lid will be secured with strapping tape by wrapping the cooler completely in at least two locations.
- All sampling will be recorded in the daily field reports, complete with a hand sketch showing the arrangement(s) of the soil piles and the locations where samples were collected.
- The sampler will also record each sample onto the project sample log form. An example daily field report and an example sample log form are provided in Appendix B.
- All field notes, log forms, chain-of-custody forms, will be reviewed on a weekly basis by the Project Quality Assurance Manager to confirm their completeness, consistency, and clarity. The Project Quality Assurance Manager will also review the analytical data reports upon receipt along with the field notes, logs, and chain-of-custody.

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4 SAMPLING RATIONALE

During construction activities on the parcels and the right-of-ways (ROW), materials being excavated may be encountered which may not be suitable for on-site use as fill due to the presence of contaminants exceeding their respective project specific action limits. To evaluate the environmental usability of the material, samples will be collected during excavation activities as described in Section 4.1. The results of the sampling and analysis will be used to manage the soil as prescribed in the Soil and Groundwater Management Plan document.

4.1. SOIL SAMPLING

Two methods of soil assessment are discussed; Stockpile Sampling and Pre-excavation Sampling. City Parkway V has the discretion to determine which method will be implemented.

4.1.1. Stockpile Sampling

Soil shall be placed in stockpiles based on the location of the soil in the excavation, for example: Stockpile 1 could contain soil excavated between grid lines A and B and from depths of zero to three feet below ground surface. The original location of the soil in the stockpile will be recorded by the on-site CEM, and the CEM will mark the stockpiles with stakes indicating their assigned number and date of excavation.

The purpose of sampling the stockpiles is to obtain information for deciding whether the soil can be reused on the property, or whether the soil must be transported off-site for disposal or treatment and recycling. This determination is based upon the collection and analyses of samples obtained from the excavated material, is dependent upon the contaminant(s) of concern and the parcel (or location within a parcel) from which the material was excavated, and any specific testing requirements by the desired end user(s).

The number of samples required for each soil stockpile sampling event will be based upon the estimated quantity of the soil stockpile. Table 4-1 will be used as a guide in determining the appropriate number of minimum samples collected. Based on site observations, the on-site

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CEM can modify this frequency to a more strict frequency for all or part of the project site. This change will be documented as described in Sections 9 and 11 of this document.

Unless the on-site CEM observes conditions that would in his/her judgment require collecting a sample from a different depth, samples will be collected as 'grab' samples from a depth of between 6-inches and one (1) foot into the excavated material to preserve VOCs that may be present in the stockpiled soil. Locations will be selected by the on-site CEM based on their observations at the time of the sampling event, with the intent to evenly distribute the locations across the stockpile based on the stockpile dimensions.

Depending on the soil quantity, the 'grab' samples shall be collected at the frequency listed in Table 4-1 and composited for analysis by the analytical laboratory at the direction of the CEM.

TABLE 4-1

STOCKPILE SAMPLE FREQUENCY

ESTIMATED SOIL QUANITITY IN STOCKPILE (YD^3)	SAMPLE TYPE	
	NUMBER OF GRAB SAMPLES COLLECTED	NUMBER OF COMPOSITE SAMPLES CREATED FROM GRAB SAMPLES
0-200	4	1
200-300	8	2
300-400	8	2
400-500	8	2
500-800	12	3
800-1000	12	3
>1000 (per each 200 yd^3)	4	1

Based on the Minnesota Department of Agriculture Soil Sampling Guidance (2011).

To collect the 'grab' samples, the CEM will visually divide the stockpile into sections based on the number of 'grab' samples required. The CEM will then use a hand auger or other hand sampling tool to collect one to three subsamples at various depths within a single stockpile section, which will then make up the 'grab' sample for that stockpile section. Subsamples will be collected from depths within the stockpile greater than one foot, and the CEM will ensure that all depths and locations within the stockpile are sampled. Example stockpile sampling locations are presented in Figure 4-1, as recommended by the Minnesota Department of Agriculture (2011).

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The constituents of concern are: VOCs (alkyl benzenes, toluene, ethylbenzene, total xylenes, naphthalene, and etc.), RCRA 8 Metals (arsenic, barium, cadmium, total chromium, lead, mercury, selenium, and silver), SVOCs, and PCBs as appropriate based on individual project location. The samples will collected per the sample collection techniques discussed in Sections 6 and 7.

4.1.2. Pre-excavation Sampling

At the discretion of City Parkway V, the Developer/General Contractor with the assistance of the CEM shall characterize the subsurface soils to be excavated, prior to excavation activities, by creating a three-dimensional grid of the soil area to be excavated. In this case, samples will be collected from an excavation footprint rather than from a stockpile.

For those instances, to allow for contractor planning, the sampling will be performed in advance of the scheduled excavation. Pre-excavation sampling will be accomplished through the use of test pits, trenches, or boreholes. The contractor will need to provide a trackhoe or backhoe and operator for the pre-excavation sampling event to occur. If a trackhoe or backhoe and operator are not available, or the depth of planned excavation exceeds the reach of the excavator, other sampling techniques could be used, as coordinated with the contractor (such as a phased excavation schedule).

The number of samples required for each pre-excavation sampling event will be based upon the excavation footprint and the quantity of soil planned to be removed. Table 4-2 shall be used as a guide in determining the appropriate number of minimum samples collected. Based on the excavation footprint location and its dimensions, the on-site CEM can modify this frequency to increase, but not decrease, the number of samples. This change will be documented as described in Sections 9 and 11 of this document.

All samples will be collected as 'grab' samples from a depth of at least one foot beneath the planned excavation area (i.e., not surface samples); and if the planned excavation extends past three feet beneath grade, additional samples would be collected for each three feet of depth, or fraction of a three-foot depth interval, to the final excavation depth. A depth interval of three feet was chosen to roughly equate to the stockpile sampling frequency presented in Table 4-1.

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As with stockpiling samples, the pre-excavation sample locations selected by the on-site CEM would be collected based upon the contaminants of concern, the parcel (or location within a parcel) being excavated, any specific testing requirements by the desired end user(s), and the depth of planned excavation. The intent is to distribute the locations across the pre-excavation print in a random pattern. Depending on the footprint dimensions, the 'grab' samples shall be collected at the frequency listed in Table 4-2. If the excavation footprint is greater than 1,000 square feet, the grab samples would be composited into one sample for analyses by the analytical laboratory. Figure 4-2 provides a graphical example of the sampling of the pre-excavation scenario.

TABLE 4-2

PRE-EXCAVATION SAMPLING FREQUENCY

AREA OF EXCAVATION FOOTPRINT (FT^2) PER 3-FOOT DEPTH INTERVAL	GRAB SAMPLES COLLECTED PER EACH 3-FOOT DEPTH INTERVAL	COMPOSITES CREATED FROM GRAB SAMPLES PER EACH 3-FOOT DEPTH INTERVAL
0 to 1,500	4	1
1,500 to 2,500	8	2
2,500 to 3,500	8	2
3,500 to 4,500	8	2
4,500 to 7,500	12	3
7,500 by <10,000	12	3
Greater than 10,000	4 per each 1,500 ft^2 area	1 per each 1,500 ft^2 area

Adapted from the Minnesota Department of Agriculture Soil Sampling Guidance (2011).

The constituents of concern are: VOCs (alkyl benzenes, toluene, ethylbenzene, total xylenes, naphthalene, and etc.), RCRA 8 Metals (arsenic, barium, cadmium, total chromium, lead, mercury, selenium, and silver), SVOCs, and PCBs as appropriate based on individual project location. The samples will collected per the sample collection techniques discussed in Sections 6 and 7.

4.1.3 Excavation Monitoring and Screening

During ongoing excavation activities in areas where contamination is anticipated to be encountered, or which during excavation activities, soils (or the excavation face) exhibit evidence of odors, staining, or vapors; the on-site CEM may, at his/her discretion decide to screen the soils for the purpose of stockpile segregation. Screening would consist of one or more of the following techniques: Petroflag kit, PID readings, or visual observations for

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hydrocarbons, or field testing for arsenic, lead or PCBs. Field testing, if done, would follow the procedures discussed in Section 6.2

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5 REQUEST FOR ANALYSES

5.1. ANALYSES NARRATIVE

Each soil sample submitted for analyses will be analyzed for BTEX, RCRA 8 metals, and other VOCs, SVOCs, and PCBs as shown in Table 5-1. Four ounce (4 oz) wide mouth glass jars will be used for soil sampling containers. Upon collection and labeling as described in Sections 7 and 9, the samples will be placed immediately into an ice chest to be chilled to four degrees Celsius (°C). Samples will be analyzed under a normal turnaround time (TAT) typically between five and seven days. A quicker TAT can be coordinated if results are needed sooner.

TABLE 5-1

LABORATORY ANALYSIS PROTOCOL

ANALYSIS / METHOD	BOTTLE SIZE / TYPE	NO. OF BOTTLES	PRESERVATION	HOLDING TIME
TPH Full Range/EPA 8015M	4oz. WMGJ	1	Cool, 4° C	14 Days
Volatiles/EPA8270	4oz. WMGJ	1	Cool, 4° C	14 Days
Semi-Volatiles/EPA 8270	4oz. WMGJ	1	Cool, 4° C	14 Days for extraction/ 40 Days for analysis
PCBs/EPA 8082	4oz. WMGJ	1	Cool, 4° C	14 Days for extraction/ 40 Days for analysis
RCRA 8 Metals/EPA 6010/7470	4oz. WMGJ	1	Cool, 4° C	6 Months
All of the Above	4oz. WMGJ	2	Cool, 4° C	14 Days

WMGJ – Wide Mouth Glass Jar

If one or more metal analyte results exceeds the action level and the soil will be transported off-site for recycling or disposal, it may be necessary to request soil sample(s) be additionally run for Toxicity Characteristic Leaching Procedure (TCLP) analyses, as determined by use of the 20 times rule for metals. While this is a soil management plan component, and should be discussed in that plan, it is also discussed in this section because it is includes an analytical procedure component.

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Comparing the total metals analyte sample results to their respective 20 times characteristic hazardous waste concentration provides the criteria as to whether TCLP needs to be run and forms the basis for whether further action is recommended. The 20 times factor is used because for solids, Section 2.2 of SW846 1311 indicates "*...The solid phase is extracted with an amount of extraction fluid equal to 20 times the weight of the solid phase.*" It is the extraction that is analyzed during TCLP analyses, and the TCLP limits are based upon the extraction. Therefore, the total analyte result for a soil sample is compared to 20 times their respective TCLP limits (40CFR 266 Appendix VII), listed in Table 5-2.

According to the Nevada Administrative Code (NAC) 445A.2272 "Contamination of soil: Establishment of Action Levels," the state of Nevada has adopted by reference the Toxicity Characteristic Leaching Rule, 40 CFR Part 261.24. The Toxicity Characteristic Leaching Procedure (TCLP) criteria is a part of this rule and has been established as USEPA SW846 Analytical Method 1311 (Method 1311). Within Method 1311, Section 1.2 of SW846 1311 indicates "*If a total analysis of the waste demonstrates that individual analytes are not present in the waste, or that they are in such low concentrations that the appropriate regulatory levels could not possibly be exceeded, the TCLP need not be run.*"

The verbiage "*total analysis of the waste*" would refer to the total metals analyses of the soil samples to be collected and analyzed by USEPA SW846 Analytical Methods 6010/7470. The verbiage "*analytes are not present in the waste, or that they are in such low concentrations that the appropriate regulatory levels could not possibly be exceeded, the TCLP need not be run.*" means that if an analyte is reported by the analytical laboratory as below the reporting limit, or at levels less than the concentration that defines the material as a hazardous waste, then that analyte would not need to be further analyzed by TCLP analysis. If there is a detection of a metal that could characterize the excavated soil as *RCRA hazardous*, the CEM will make the determination if TCLP analysis is necessary to characterize the soil as either *contaminated, non-hazardous* or *RCRA hazardous* under the SGMP.

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TABLE 5-2

TCLP CRITERIA FOR RCRA 8 METALS

ANALYTE	TCLIP LIMIT (MG/KG)	20 TIMES TCLP CRITERIA (MG/KG)
Arsenic	5.0	100
Barium	100	2000
Cadmium	1.0	20
Chromium	5.0	100
Lead	5.0	100
Mercury	0.2	4.0
Selenium	1.0	20
Silver	5.0	100

5.2. ANALYTICAL LABORATORY

The laboratory selected by the City Parkway V, the CEM, or the Developer/General Contractor is required to meet all appropriate requirements at this SAP including method detection limits and the criteria stipulated in the DQIs presented in Appendix A.

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6 FIELD METHODS AND PROCEDURES

6.1. FIELD EQUIPMENT

Soil samples may be collected using stainless steel shovels, stainless steel and/or disposable trowels or spoons. Other field equipment will include coolers, buckets, brushes, detergent, distilled water, zip-lock bags, photo-ionization detector (PID), and personal protective equipment (PPE) such as steel-toed boots, nitrile gloves, hard hats, and safety glasses.

6.2. FIELD SCREENING

A PID may be used on-site as a possible field screening tool to determine how to best segregate piles, if necessary. The PID will not always detect TPH in soil, especially at lower concentrations or with heavier end hydrocarbons. However, it can be used at the discretion of the CEM when soils have higher concentrations and when workers can smell petroleum and/or organic odors. The PID will be calibrated according to manufacturer's instructions and guidelines before every day of field use. Petroflag kits and field testing for arsenic, lead, or PCBs may also be used to screen soil. Field testing procedures for arsenic, lead or PCBs may be used primarily for segregation purposes and will follow the manufacturer's recommended procedures.

6.3. SOIL SAMPLE COLLECTION

Soil samples will be collected primarily from excavated piles using a shovel or hand trowel to dig into the pile to the desired depth as discussed in Section 4. If samples are collected from a pre-excavation area sampling event, samples will be collected from the excavation bucket, or auger flights. Once the number of samples to be collected and their locations have been determined based on the rationale provided in Section 4, each sample will be collected and packaged into four-ounce jars per Sections 5 and 9. The jars will be placed together in labeled zip-lock bags and placed into the ice chest. The sample log, field report, and chain-of-custody will be filled out after sample collection from each stockpile.

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For example, a soil stockpile to be sampled that is between 100 and 200 cubic yards in size will have three distinct grab sample locations. The sampler will label each set of two jars following the guidance set forth in Section 9.2, collect a sample at the first location and place it into the first set of jars, then repeat for the other two grab sample locations. After the three locations are sampled, the sampler will place each set of two jars into zip-lock bags and then into the cooler on ice. The sampler will then:

- Fill out the sample log with the sample identification numbers, date, and time of sampling;
- Record the sampling on the daily field report showing a sketch of the pile location on the site and the locations of the grab samples, and their identification numbers; and
- Fill out the chain-of-custody form indicating to the lab to create a composite sample from the three grab samples for each of the analyses to be performed.

6.4. SEDIMENT SAMPLING

This section is not applicable to this project.

6.5. GROUNDWATER SAMPLING

Based on previous projects at the Symphony Park site, it is anticipated that groundwater to be managed on the Symphony Park site will be discharged to the storm sewer requiring NPDES permits. It is not known if groundwater will be encountered during the planned construction activities on the site. Therefore, groundwater will be addressed on a case-by-case basis by the individual contractors depending on whether building construction on their sites warrant dewatering activities. This should be further discussed in a separate project specific soil and groundwater management plan.

The individual contractors will be responsible for acquiring the appropriate NPDES permits for discharging groundwater to the storm sewer. If groundwater is to be encountered and managed on the site, the sampling and analyses will follow the requirements set-forth in the NPDES permitting guidelines and the NDEP Bureau of Water Pollution Control.

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6.6. BIOLOGICAL SAMPLING

This section is not applicable to this project.

6.7. DECONTAMINATION PROCEDURES

The decontamination procedures that will be followed are in accordance with generally followed industry procedures. Decontamination of sampling equipment must be conducted consistently as to assure the quality of samples collected. Any equipment (shovels, trowels, spoons) that comes into contact with potentially contaminated soil will be decontaminated. Disposable equipment intended for one-time use will not be decontaminated, but will be packaged for appropriate disposal. Decontamination will occur prior to and after each use of a piece of equipment. All sampling devices used, including trowels and spoons, will be decontaminated in sequence, according to the following procedures.

- Non-phosphate detergent and tap water wash, using a brush if necessary
- Distilled water rinse

Equipment will be decontaminated in a predesignated area on plastic sheeting. Cleaned small equipment will be stored in plastic bags. Materials to be stored more than a few hours will also be covered.

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7 SAMPLE CONTAINERS, PRESERVATION, AND STORAGE

The number of sample containers, the required sample volumes, the preservation, and the holding times are listed in Section 5.0. The sample containers shall be provided by the contracted analytical laboratory. The containers should be pre-cleaned and will not be rinsed prior to sample collection. Preservatives, if required, will be added to the containers by the laboratory prior to shipment prior to use in the field.

7.1. SOIL SAMPLES

Soil samples will be analyzed for VOCs, RCRA-8 metals, SVOCs, and PCBs as appropriate based on individual project location. The samples will be collected as specified in Section 6 and placed into four-ounce (oz), wide-mouth glass jars. For each sample location, two 4-oz wide-mouth glass jars will be collected to satisfy the volume needed for the analyses. Upon collection, the samples will be labeled and packaged per Sections 6 and 9 and placed into an ice chest to be chilled for preservation purposes. Samples will be controlled under a chain of custody and will be in the sampler's possession unless under custody seal. Samples will be submitted to the analytical laboratory the same day of collection, or first thing the following day.

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8 DISPOSAL OF RESIDUAL MATERIALS

In the process of collecting environmental samples at Symphony Park during the site excavation, the sampling team will generate different types of potentially contaminated investigation-derived waste (IDW) that include the following:

- Used personal protective equipment (PPE)
- Disposable sampling equipment
- Decontamination fluids

The EPA's National Contingency Plan (NCP) requires that management of IDW generated during sampling comply with all applicable or relevant and appropriate requirements (ARARs) to the extent practicable. The sampling plan follows the *Office of Emergency and Remedial Response (OERR) Directive 9345.3-02* (May 1991), which provides guidance for the management of IDW.

- Used PPE and disposable equipment will be double bagged and placed in a municipal refuse dumpster. These wastes are not considered hazardous and can be sent to a municipal landfill. Any PPE and disposable equipment that is to be disposed of which can still be reused will be rendered inoperable before disposal in the refuse dumpster.

- Decontamination fluids that will be generated in the sampling event will consist of deionized water, residual contaminants, and water with non-phosphate detergent. The volume and concentration of the decontamination fluid will be sufficiently low to allow disposal at the site or sampling area. The water (and water with detergent) may be poured onto the stockpile.

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9 SAMPLE DOCUMENTATION AND SHIPMENT

9.1. FIELD NOTES

9.1.1. Field Logbooks

As appropriate, the following information will be legibly recorded using ink (not pencil or erasable ink) during the collection of each sample:

- Sample location and description
- Site or sampling area sketch showing sample location and measured distances
- Sampler's name(s)
- Date and time of sample collection
- Designation of sample as composite or grab
- Type of sample (soil, sediment or water)
- Type of sampling equipment used
- Field instrument readings and calibration
- Field observations and details related to analysis or integrity of samples (e.g., weather conditions, noticeable odors, colors, etc.)
- Preliminary sample descriptions (e.g., for soils: clay loam, very wet)
- Sample preservation, if any
- Lot numbers of the sample containers, sample identification numbers and any explanatory codes, and chain-of-custody form numbers
- Name(s) of recipient laboratory(ies)

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In addition to the sampling information, the following specific information will also be recorded in the field logbook for each day of sampling:

- Team members and their responsibilities
- Date and weather conditions
- Time of arrival/entry on site and time of site departure
- Other personnel on site
- Summary of any meetings or discussions with city, contractor, or state agency personnel
- Deviations from the SAP, site safety plans, and QAPP procedures
- Changes in personnel and responsibilities with reasons for the changes
- Levels of safety protection
- Calibration readings for any equipment used and equipment model and serial number

9.1.2. Photographs

Photographs will be taken at the sampling locations and at other areas of interest on site or sampling area. If the camera being used has a date/time stamp function, that function should be used. Photographs will serve to verify information entered in the field logbook. For each photograph taken, the following information will be written in the logbook or recorded in a separate field photography log:

- Time, date, location, and weather conditions
- Description of the subject photographed
- Name of person taking the photograph

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9.2. LABELING

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. The samples will have preassigned, identifiable, and unique numbers. At a minimum, the sample labels will contain the following information: location, date of collection, analytical parameter(s), and method of preservation. Every sample will be assigned a unique sample number. Sample labeling format is discussed in the following subsections.

9.2.1. Stockpile Sample Labeling

The stockpile labeling system will be based on the location ID of the excavation, the sample date, stockpile number, and the grab sample number, as follows:

Stockpile Soil Samples: Location ID – Date – Stock Pile Number – Sample Number

For Example: A1 - 031507 - 3 - 1: **A1** denotes the location (i.e. parcel number), **031507** identifies the sample collection date (March 15th, 2007), **3** indicates the stock pile number, and **1** denotes the grab sample number.

9.2.2. Pre-Excavation Soil Sample Labeling

As presented in Section 4, it may become necessary to sample an area in-situ before it is excavated in order to plan for coordinating proper handling or disposal of potentially contaminated soils during the excavation. In this event, the labeled sample identification will be represented in the following manner:

Pre-excavation Soil Samples: Location ID – Date – pre-excavation hole number – Depth interval

For Example: M4 – 040107 – PRE 2 – 3-6: **M4** denotes the location (i.e. parcel number), 0**40107** identifies the sample collection date (April 1st, 2007), **PRE 2** represents the pre-excavation hole number (hole #2), and **3-6** indicates the sample depth.

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9.2.3. Drilled Shaft Spoils Sample Labeling

Drilled shaft spoils samples will be labeled in the following manner:

Drilled Shaft Samples: Location ID – Date – Shaft ID - Depth Interval

For Example: L – 042016 – ShaftA – 0-10: L denotes the location (i.e. parcel number), **042016** identifies the sample collection date (April 20th, 2016), **ShaftA** represents the drilled shaft number, and **0-10** indicates the depth interval from which the spoils were generated.

9.3. SAMPLE CHAIN-OF-CUSTODY FORMS AND CUSTODY SEALS

Chain-of-custody record forms are used to document sample collection and shipment to laboratories for analysis.

All sample shipments for analyses will be accompanied by a chain-of-custody record. An example of the form is found in Appendix C. Form(s) will be completed and accompany the samples for each shipment (i.e., each day). If multiple coolers are sent to the laboratory on a single day, form(s) will be completed and sent with the samples for each cooler.

The chain-of-custody form will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in their physical possession, in their view, locked up, or kept in a secured area that is restricted to authorized personnel. Until the samples are shipped, the custody of the samples will be the responsibility of the sampler. The sampling team leader or designee will sign the chain-of-custody form in the "relinquished by" box and note date, time, and air bill number, if appropriate.

The sample numbers for field collected quality control samples will also be documented on this form. Before submittal, a photocopy will be made of the form for the project files.

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9.4. PACKAGING AND SHIPMENT

All sample containers will be placed in a sturdy ice-filled cooler and delivered to/picked up by the laboratory. If samples are to be shipped to an analytical laboratory, the following outlines the packaging procedures that will be followed:

1. When ice is used, pack it in zip-locked, double plastic bags. Seal the drain plug of the cooler with fiberglass tape to prevent melting ice from leaking out of the cooler.
2. The bottom of the cooler should be lined with bubble wrap to prevent sample container breakage during shipment.
3. Check screw caps for tightness and, if not full, mark the sample volume level of liquid samples on the outside of the sample bottles with indelible ink.
4. Affix sample labels onto the containers with clear tape.
5. Wrap glass sample containers in bubble wrap to prevent breakage.
6. Seal sample containers in heavy duty plastic zip-lock bags. Write the sample numbers on the outside of the plastic bags with indelible ink.
7. Enclose the appropriate COC(s) in a zip-lock plastic bag affixed to the underside of the cooler lid.
8. Fill empty space in the cooler with bubble wrap or Styrofoam peanuts to prevent movement and breakage of sample containers during shipment.
9. Ice used to cool samples will be double sealed in two zip lock plastic bags and placed on top and around the samples to chill them to the correct temperature.
10. Each ice chest will be securely taped shut with fiberglass strapping tape, and custody seals will be affixed to the front, right and back of each cooler.

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Records will be maintained by the sample custodian of the following information:

- Sampling contractor's name
- Name and location of the site or sampling area
- Total number(s) by estimated concentration and matrix of samples shipped to each laboratory
- Carrier, air bill number(s), method of shipment (priority next day)
- Shipment date and when it should be received by lab
- Irregularities or anticipated problems associated with the samples
- Whether additional samples will be shipped or if this is the last shipment.

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10 QUALITY CONTROL

10.1. FIELD QUALITY CONTROL SAMPLES

Field quality control (Field QC) samples will be collected and used to help evaluate conditions resulting from field activities. Field QC Samples are intended to accomplish two primary goals, the evaluation of field contamination and the evaluation of sampling variability.

10.1.1. Field Contamination Evaluation (Blanks)

Field contamination arising from inadequately decontaminated sampling equipment will be evaluated through the use of equipment blanks collected in the field.

10.1.1.1. Equipment Blanks

Equipment rinsate blanks will be collected to evaluate field sampling and decontamination procedures by pouring commercially available distilled water over the decontaminated sampling equipment. A minimum of one equipment rinsate blank will be collected each day with one per 20 samples collected while sampling equipment is decontaminated in the field. Equipment rinsate blanks will be obtained by passing water through or over the decontaminated sampling devices used that day. The rinsate blanks that are collected will be analyzed forRCRA-8 metals, VOCs, PCBs, and SVOCs

The equipment rinsate blanks will be preserved, packaged, and sealed as described in Section 9.

10.1.1.2. Field Blanks

No field blanks will be collected for this project.

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10.1.1.3. Trip Blanks

Unless water samples are collected, no trip blanks will be included as part of this project.

10.1.1.4. Temperature Blanks

Temperature blanks will not be included with the samples. For each cooler that is shipped or transported to an analytical laboratory, the laboratory will take a temperature reading of the cooler interior. This temperature reading will be used by the sample custodian to check the temperature of samples upon receipt.

10.1.2. Field Variability Evaluation (Field Duplicate or Co-located Samples)

At the discretion of the on-site CEM, duplicate soils samples may be collected at sample locations of moderate contamination.

10.2. BACKGROUND SAMPLES

No background samples are planned to be collected as part of this project.

10.3. FIELD SCREENING AND CONFIRMATION SAMPLES

No field screening or confirmation samples will be collected as part of this project.

10.4. LABORATORY QUALITY CONTROL SAMPLES

Full 4-oz sample jar of soil contains sufficient volume for both routine sample analysis and additional laboratory QC analyses. Therefore, a separate soil sample for laboratory QC purposes will not be collected.

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11 FIELD VARIANCES

As conditions in the field may vary, it may become necessary to implement minor modifications to sampling as presented in this plan. When appropriate, the designated QA representative will be notified and a verbal approval will be obtained before implementing the changes. Modifications to the approved plan will be documented in the sampling project report.

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12 FIELD HEALTH AND SAFETY PROCEDURES

Field Health and Safety procedures shall need to be developed for implementation of this SAP, based upon the site specific hazards.

These procedures shall contain the components specified in 29 CFR 1910 and 29 CFR 1926 for environmental and construction activities.

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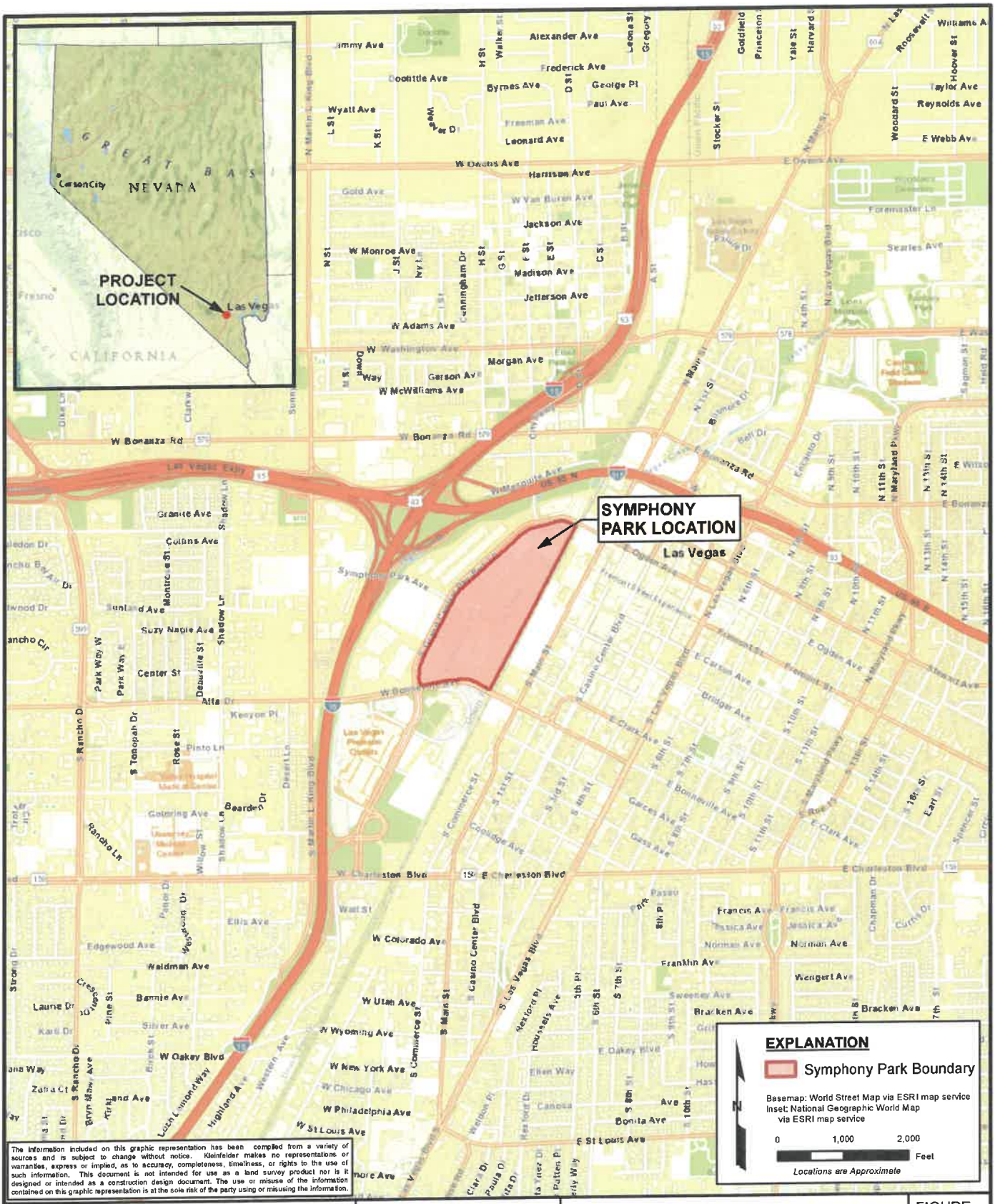
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United States EPA, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA publication SW-846, Third Edition, Final Updates I (1993), II (1995), IIA (1994), IIB (1995), III (1997), IIIA (1999), IIIB (2005), IV (2008), and V (2015), https://www.epa.gov/hw-sw846/sw-846-compendium.

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Figures



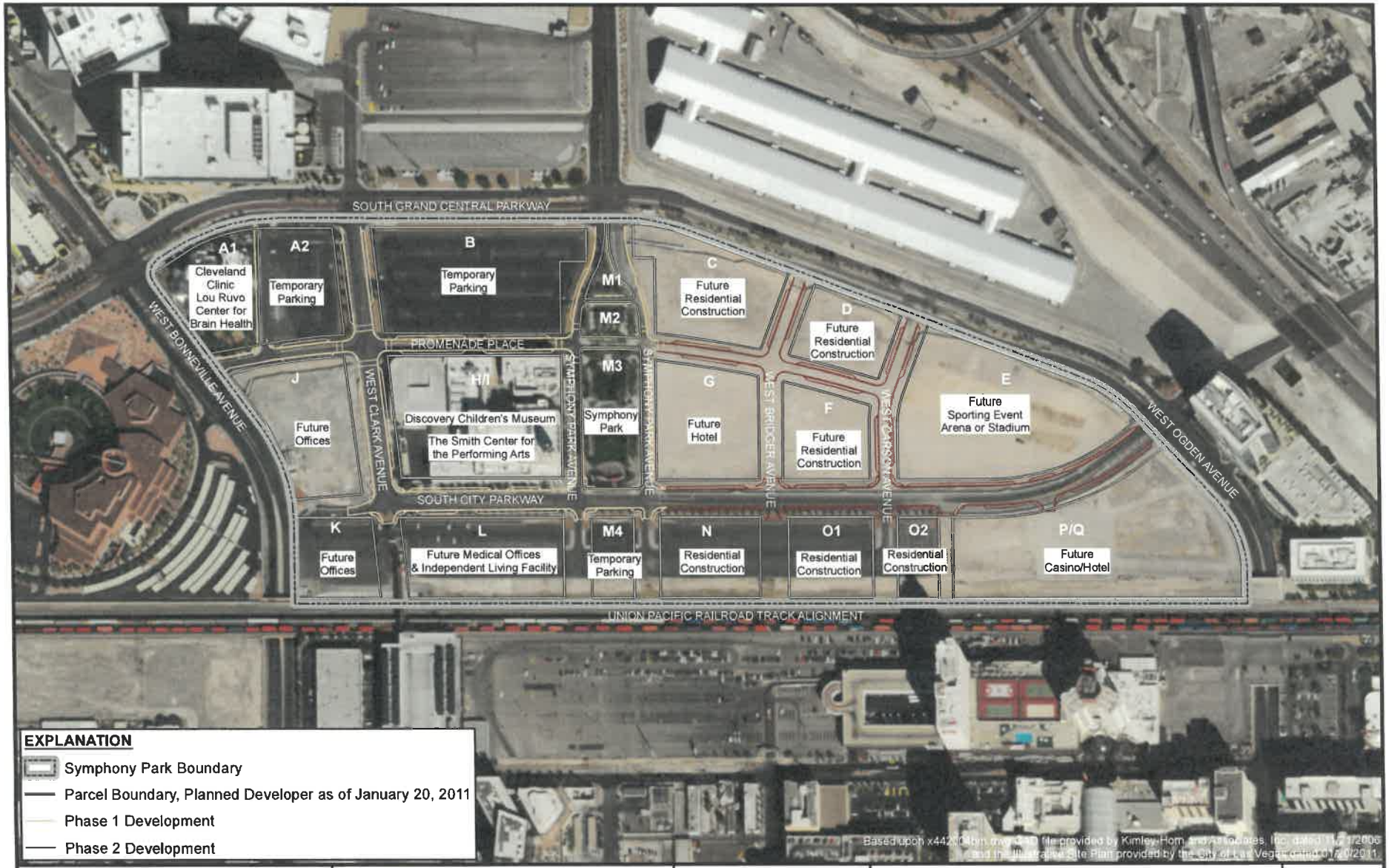
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SITE LOCATION MAP

SAMPLING AND ANALYIS PLAN
SYMPHONY PARK
LAS VEGAS, NEVADA

FIGURE
1-1



0 200 400 Feet

Locations are Approximate

Aerial imagery: ESRI World Imagery, USDA NAIP 6/6/2015.

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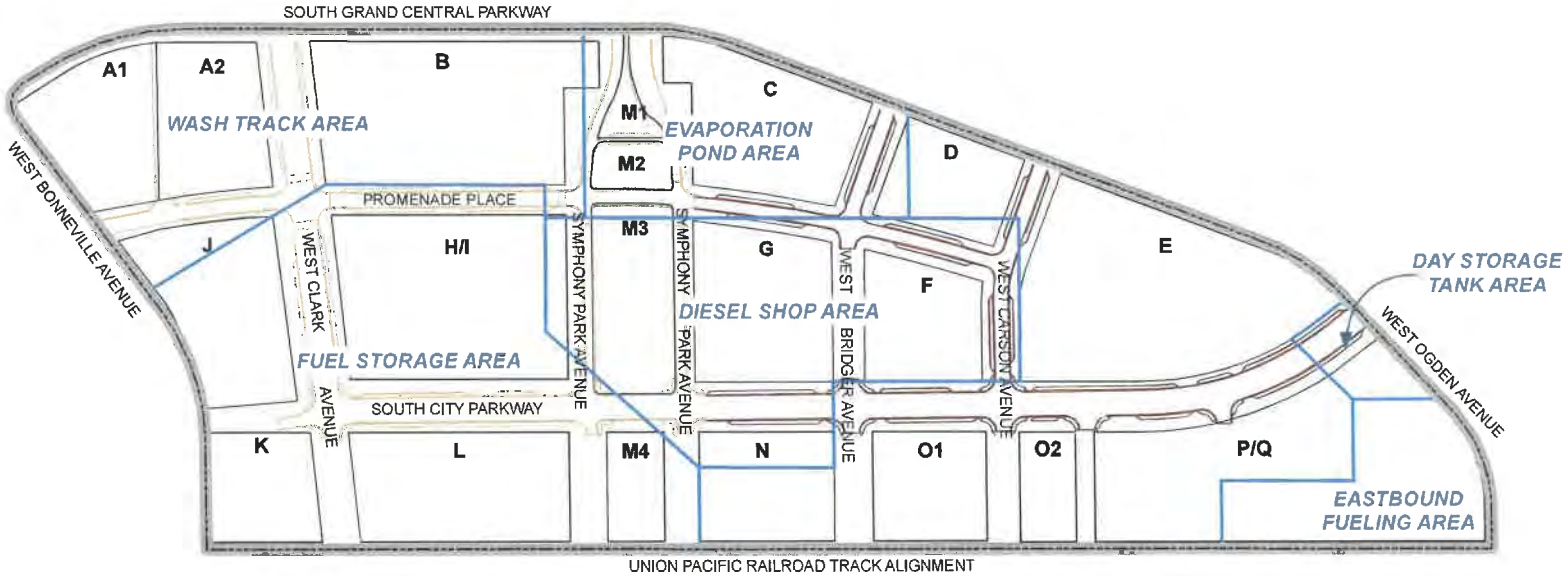
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SITE LAYOUT
SYMPHONY PARK SITE, PARCEL, AND RIGHT-OF-WAY LOCATIONS

SAMPLING AND ANALYSIS PLAN
SYMPHONY PARK
LAS VEGAS, NEVADA

FIGURE
1-2



EXPLANATION

- Symphony Park Boundary
- Former Operations Area
- Parcel Boundary
- Phase 1 Development
- Phase 2 Development

Based upon x442004bm.dwg CAD file provided by Kimley-Horn and Associates, Inc. dated 11/21/2006 and the Illustrative Site Plan provided by the City of Las Vegas dated 01/20/2011.

0 200 400 Feet

Locations are Approximate

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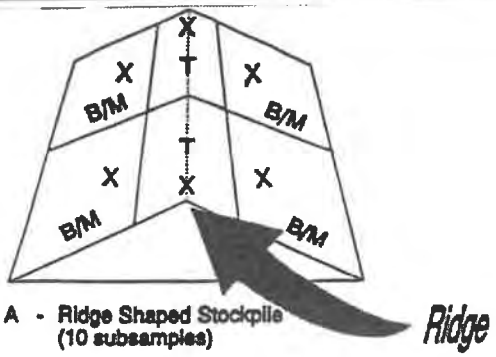
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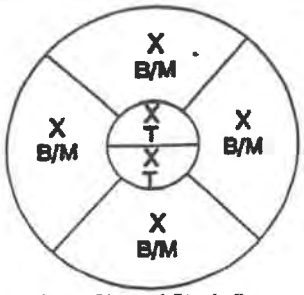
SITE LAYOUT
UNION PACIFIC FORMER OPERATIONS AREAS

SAMPLING AND ANALYSIS PLAN
SYMPHONY PARK
LAS VEGAS, NEVADA

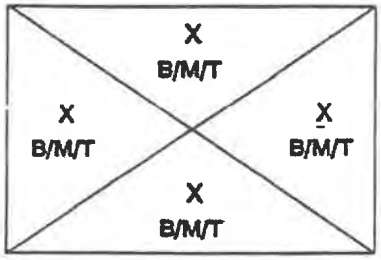
FIGURE
1-3



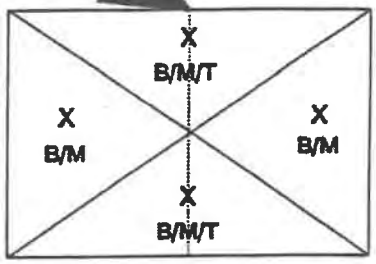
A - Ridge Shaped Stockpile (10 subsamples)



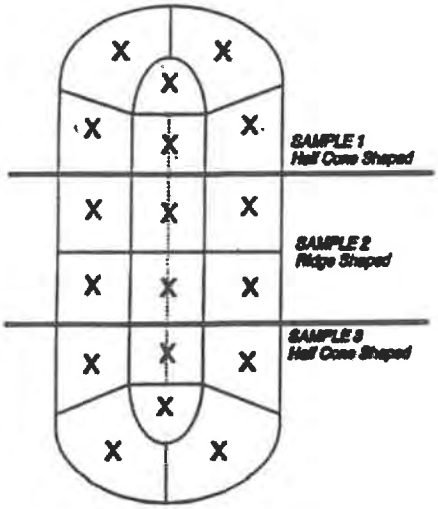
B - Cone Shaped Stockpile (10 subsamples)



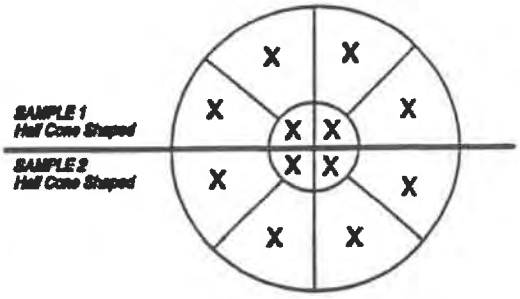
C - Level Filled Stockpile in a Container (12 subsamples)



D - Ridge Shaped Stockpile in a Container (10 subsamples)



E - Example of 750 Yard Stockpile Divided into Three 250 Yard Sections



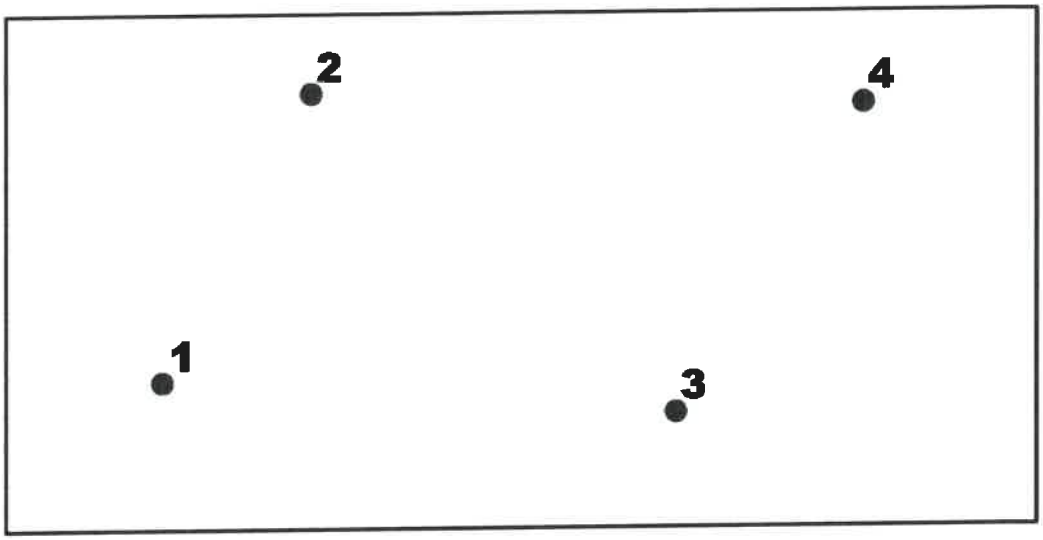
F - Example of 400 Yard Cone Shaped Stockpile Divided into Two 200 Yard Sections

KEY

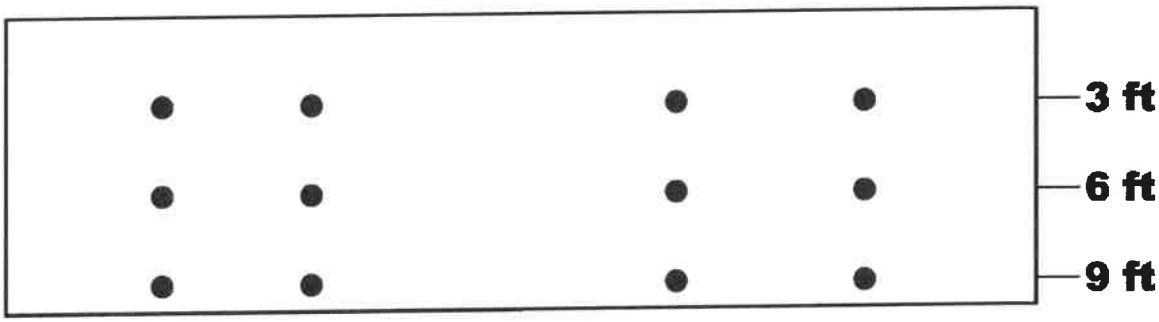
X - Boring location.
B - Collect subsample from bottom third of pile.
M - Collect subsample from middle third of pile.
T - Collect subsample from top third of pile.

Figure 1, reproduced from the Minnesota Department of Agriculture, 2011, Soil Sampling Guidance. Guidance Document 11. July. http://www.mda.state.mn.us/chemicals/spills/incidentresponse/guidelist/gd11.aspx

KLEINFELDER Bright People. Right Solutions. www.kleinfelder.com	PROJECT NO.: 20154986	EXAMPLE STOCKPILE SAMPLING FREQUENCY	FIGURE 4-1
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	DRAWN BY: KFH	SAMPLING AND ANALYSIS PLAN SYMPHONY PARK LAS VEGAS, NEVADA	
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PLAN VIEW



PROFILE VIEW

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EXAMPLE PRE-EXCAVATION SAMPLING LOCATIONS AND DEPTH INTERVALS

SAMPLING AND ANALYSIS PLAN
SYMPHONY PARK
LAS VEGAS, NEVADA

FIGURE
4-2

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Appendix A

APPENDIX A
DATA QUALITY INDICATORS

1.0 CALIBRATION PROCEDURES

Any equipment or methodology used to provide numerical data that influences a measured value is calibrated to the accuracy required for its use. Records are kept of all calibrations whether made externally or within the laboratory. Calibration schedules are established for all aspects of physical and chemical measurements and are strictly observed.

Physical calibration of instruments are carried out with standards or measuring devices traceable to national standards when available. Physical calibration schedules are dictated by the manufacturer and by the SOP for that instrument.

Chemical calibrations and standardizations are made using secondary standards traceable to primary standards. The primary standards, which include multi-component mixes, are made using materials of the highest obtainable purity prepared by analysts trained in the proper methods. The materials used to prepare the primary standards are traceable to the National Institute of Standards and Technology (NIST) or the Environmental Protection Agency (EPA) whenever possible.

Primary standards obtained commercially adhere to the requirements of internally prepared primary standards. Whenever possible NIST or EPA traceable standards are obtained. Suppliers must certify compliance and provide evidence of the quality of services and materials upon request.

Secondary standards used for calibration and standardization are validated by comparison to secondary standards prepared from another source and/or EPA/NIST traceable reference materials.

2.0 QUALITY CONTROL SAMPLES

Various types of quality control samples generated and used by the laboratory, in addition to client-submitted samples, are described in this section.

2.1 FIELD QC SAMPLES

Client should periodically prepare quality control (QC) samples in the field and submit for analysis with regular samples. These QC samples should consist of field blanks, travel blanks and replicate samples. QC samples should be given fictitious sample designations and handled and transported in the same manner as regular samples.

Both the correct and fictitious sample designations should be recorded on the sampling forms and on the chain-of-custody record. The frequency of QC samples should be as follows:

- One field travel blank is prepared in the field for every sampling event using laboratory-grade organic free water. The field travel blank is poured into a bottle at one of the sampling sites, which is noted on the field sampling form. The field travel blank is analyzed for the complete set of organic parameters requested for the regular samples.

- One replicate sample is collected for every sampling event and submitted for analysis. The replicate is analyzed for the complete set of parameters requested for the regular sample.

2.2 LABORATORY QC SAMPLES

2.2.1 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

MS/MSD is used to check for precision and accuracy. These are replicate samples spiked with a known spike concentration that are taken through the whole sample preparation and analysis process. MS/MSD analyses are performed on one sample in each group of 20 samples (5%) on each type of sample matrix. An MS must be performed on one sample in each group of 10 samples (10%) for drinking water analyses.

The sample analysis process and the spike sample process differ in the adding of known amounts of the substances to be analyzed to the aliquot of the replicate sample. The amount of spike added varies according to the working range of the analytical instrument.

Should the sample also have the native analyte present, the concentration of that analyte in the sample is subtracted from the value of the spiked sample and the percent (%) recovery of the spike is calculated using the following equation:

$$\text{Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Added}} \times 100\%$$

$$\text{Post Digestion Spike} = \frac{(\text{Spike Sample Result-df} \times \text{Sample Result})}{\text{Spike Value}} \times 100\%$$

At times the sample value is outside the operating range of the analytical instrument. In such cases, it is impossible to know the concentration of the analytes before the spike is added. Occasionally, the sample and the spiked sample require dilutions to allow analysis within the linear range of the instrument. This dilution adjusts the concentrations into the proper range, but it may also dilute the other spiked analytes below the range of detection. In this case, it is not possible to report spike recovery for those particular analytes. The data should be reported with the appropriate data qualifier.

The lack of spike recovery data for an analyte that has been diluted to levels outside the working concentration of the instrument are supplemented by the periodic analysis of laboratory control samples (LCS) and other additional sample data.

In the event that a matrix spike(s) recovery is outside the established control limits, the sample and the matrix spike must be sent through the entire sample preparation and analysis procedure a second time if there is not a documented matrix effect. Many metals analysis methods call for an external spike to be performed on the extract if the matrix spike(s) recovery is outside the established control limits. If the reanalysis of the sample and the matrix spike(s) are acceptable, the results of the reanalysis will be reported without a data qualifier. If the reanalysis of the

sample and the matrix spike(s) are outside the established control limits again, the results of the original analysis will be reported with the appropriate data qualifiers.

The calculated percent recoveries are then used to assess data precision expressed as relative percent deviation (RPD). It is calculated using the following equation:

$$RPD = \frac{(MS\ Result - MSD\ Result)}{Mean\ of\ MS\ and\ MSD\ Results} \times 100$$

Percent recoveries and RPD values outside of contract, method, or laboratory-determined control limits require addressing in the narrative, and a corrective action may be required based on the problem.

Blind replicate samples (inserted by QA Officer as "unknown" to analyzers) are replicate aliquots of a sample whose results are compared for precision using the RPD equation and laboratory-established acceptance criteria; they may be spiked at concentrations known to the QA Officer for determining accuracy (as percent recoveries).

2.2.2 Method Blanks

Method blanks, also known as reagent blanks, are analyzed for each matrix and each batch of sample analyses (about 1 per group of up to 20 samples) prepared at the same time. An aliquot equal in volume or weight to the sample is used for method blank analyses. The method blank is taken through the whole analytical process. The method blank must be free of any substances being analyzed, or interferences, as defined in method-specific SOPs, or corrective actions will be taken. For volatiles analyses, a method blank is run after the standard or standards and before any samples during every batch to demonstrate that the system is performing properly and there is no carryover.

2.2.3 Holding Blank

A holding blank is an aliquot of VOA-free laboratory reagent water or methanol contained in a 40-mL septum-sealed VOA vial free of headspace. It is prepared and carried through the holding period of a batch of sample shipments received and is used to monitor sample storage cross-contamination for volatile organics.

Presence of volatile organics in the holding blank indicates possible diffusion of volatile organics (particularly fluorocarbons and methylene chloride) past the septum seal of the contaminated sample during storage and handling.

2.2.4 Calibration Blank/System Blank

A calibration blank/system blank is prepared by analyzing the same matrix used for the preparation of the calibration standards. It is used to establish the analytical curve by taking into account background responses during the calibration process. It is also used to check for carry-over contamination after a standard run or after a contaminated sample run.

2.2.5 Laboratory Control Samples

The Laboratory Control Sample (LCS) is a standard of known concentration spiked into a consistent (homogeneous) matrix of soil or water, which is prepared and analyzed along with a batch of samples. The spiked materials are representative of the materials to be quantitated by the analysis.

LCS spiking solutions are obtained from USEPA Quality Assurance Branch, Environmental Monitoring and Support Laboratory (EMSL), by the National Institute of Standards and Technology (NIST), or they are prepared internally by the laboratory. The quality control samples are prepared for analysis in strict accordance with the procedures provided with the materials. LCS are prepared and analyzed with each sample batch to check accuracy of analysis and to monitor standard degradation. LCS are also used to check efficiency of the digestion, extraction and the instrumental analysis. For metals, commercially obtained/prepared LCS soils are used to check EPA 3050B digestion efficiency.

Results from LCS must be within the target range values (i.e., 99% confidence limits of the given values) or within the 99% confidence limits of the "true" value of the check standard as determined from running replicate analyses of the check standard; otherwise, corrective actions are taken.

2.2.6 Surrogate Spike Analyses

For GC/MS and GC methods, the analytical process includes the addition, subsequent detection, and recovery calculation of surrogate spiking compounds. Surrogate compounds are analyte compound substitutes, (i.e., compounds not specifically requested to be determined as analytes) that do not occur naturally. Surrogate compounds are added after sample aliquots have been measured out, prior to beginning the sample preparation process. Surrogate compounds must not interfere with the determination of the analytes of interest. Surrogates also must be chemically similar to the analytes of interest and capable of emulating the analyte responses.
Surrogate standard determinations are performed on all samples, blanks and quality control samples. All samples, blanks and quality control samples are spiked with surrogate spiking compounds before purging or extraction in order to monitor preparation and analysis of samples.

Percent recovery of the surrogates is determined and checked against laboratory established control limits.

Laboratory established control limits are used when method- or contract-specific criteria are not provided or when the lab can demonstrate tighter control of a system than given in the method. These results are plotted by the analyst to alert them to any trends that may suggest a problem. If a trend suggests a problem in the system, preventative action is taken to remedy the situation before a problem arises. If a surrogate fails the established control limits, the sample preparation and analysis must be repeated.

2.2.7 Method of Standard Addition

The method of standard additions is used to check the accuracy of the analysis method under optimum conditions and to provide an estimate of concentrations in the presence of chemical interferences from a sample matrix.

2.2.8 ICP Interference Check Sample Analysis

An ICP interference check sample verifies inter-element and background correction factors of the ICP instrument.

2.2.9 EPA, NIST, and/or Commercial Reference Standards

These standards are analyzed routinely for the parameter of interest. Commercial standards are checked for standard traceability. Secondary source standards are used to check the accuracy of the commercial standard and the laboratory preparation of the standards in use. Secondary source standards are also used in all MS, MSD and LCS to confirm the accuracy of the standard.

2.2.10 Internal Standards Analysis

For some methods, internal standard areas are monitored as a measure of instrument performance. Internal standard determinations are made on all samples and blanks to monitor instrument efficiency, and they are used as a reference retention-time indicator, to check retention-time shifts of peaks of interest. A known amount of internal standard is added to a sample extract prior to analysis. Like the surrogate standard, it must not interfere with the determination of the analytes of interest. It also must be chemically similar to the analytes of interest and capable of emulating the analyte response. Often these are isotopically-labeled materials, which can be distinguished by the mass spectrometer from native analytes.

2.2.11 Calibration Standards

Calibration standards are used to quantitate the concentrations of analytes present in the sample. These are analyzed prior to any sample analyses.

2.2.12 ICP, GFAA, and CVAA multi-point

Initial calibration verification and continuing calibration verification used for metals analysis at ≤10% ICV is second vendor.

3.0 QUALITY CONTROL CHARTS

Control charts are recognized as a prime means to document the statistical control of the measurement process and to describe measurement proficiency. It is a matter of policy that suitable control charts for all critical operations and sub-operations be developed. When the use of control charts and specific control samples are specified in a given SOP, they are maintained in as close to real time as possible and are the basis for corrective actions when indicated. The control

charts are either generated by the LIMS system or generated in a spreadsheet program by the LIMS system.

3.1 USE OF CONTROL CHARTS

The performance of a measurement system can be demonstrated by the measurement of homogeneous and stable control samples in planned repetitive process. The data generated are plotted as a control chart to indicate whether the system is providing adequate process control (i.e., staying within performance specifications). It alerts the laboratory to possible deviation from 95% confidence level by identifying systematic errors, drifts, or other types of problems.

The uses of control charts are summarized as follows:

- They provide graphic assessment of accuracy and precision for the analysis of each analyte and detection of erroneous data.
- They allow efficient observation of recovery trends for a particular analyte, and they provide a long-term mechanism for self-evaluation of analytical output.
- They provide assessment of the analytical capability of the staff chemists, with regard to the output of valid analytical data.

A system must be verified as being in control, in order to be maintained in control. A system is not in control if it is observed to produce unexpected data more than once every 20-25 runs or a trend of seven points on one side of the mean. Control limits usually become tighter once a process is under a controlled protocol (i.e., the original limits were based on data produced during uncontrolled operation).

3.2 TYPES OF CONTROL CHARTS USED

Control charts are used to monitor method performance:

- Accuracy Control Charts (e.g., Surrogate Recovery, LCS/LCSD Recovery, MS/MSD Recovery)
- Precision Control Charts (e.g., MS/MSD Relative percent difference, LCS/LCSD Relative percent difference)

3.3 CONTROL CHART PREPARATION

In methods for which quality control acceptance limits and corrective actions are not specifically established (e.g., non-CLP), control charts are used to evaluate lab performance. As a minimum for other methods, the Laboratory shall prepare a control chart for each type of analysis and sample matrix. Each control chart shall consist of a centerline, two warning limits, and two control limits, as described on page 42 of the HAZWRAP DOE/HWP-65/R1 and EPA Handbook on Analytical

Quality Control in Water and Wastewater Laboratories. Until the laboratory has 20 points to use in setting control chart limits, the recommended EPA recoveries for the methods shall be used.

3.4 APPROACH TO CONTROL CHART INTERPRETATION

For each method, representative concentrations of material described in reference methods and lab SOPs are spiked into a selected percentage of samples. A data base of percent recovery (%R) for QC reference samples or spiked samples is collected. The mean (x) and standard deviation(σ) of this set (usually at least 20 points are necessary) are calculated. From this information, warning and control limits for the method are determined. These are defined as:

- Warning Limits are defined as $x \pm 2\sigma$
- Control Limits are defined as $x \pm 3\sigma$. The %R of each QC sample or spike sample is plotted on a control chart and compared with the control limits.

Data precision (RPD) is evaluated based on the results of spiked samples analyzed in duplicate. Calculations for warning and control limits are the same as above for spiked samples.

Interpretation of control charts for out of control:

- one or more points outside the control limit (3σ)
- a run of two or more consecutive points outside warning limits (2σ)
- a run of seven or more consecutive points on the same side of the mean (x) indicating trends or shifts
- cycles or non-random patterns in the data
- a run of six or more consecutive points in the same direction

Corrective actions taken for out-of-control points are described in Nonconformance and Corrective Action.

4.0 NONCONFORMANCES AND CORRECTIVE ACTION

4.1 DEFINITIONS

An out-of-control event is defined as any occurrence failing to meet pre-established criteria. Nonconformance is a deficiency in documentation, or procedure sufficient to make the quality indeterminate or unacceptable. An out-of-control event is a subcategory of nonconformance.

When either situation is identified, it will be categorized as:

- Deficiency: recognition of a specific requirement (e.g., program, process or procedure) that has been violated.

- Observation: recognition of an activity or action that might be improved but is not in violation of a specific requirement. Left alone, the activity or action may develop into a deficiency.

4.1.1 Criteria Used for Determination of an Out-of-Control Event

Factors that affect data quality (failure to meet calibration criteria, inadequate record keeping, improper storage or preservation of sample) require investigation and corrective actions.

Some factors can be easily assessed through the use of control charts. Control charts can reveal shifts, trends, biases and conditions where parts of the analytical system are out of control.

The detection of one of these conditions is an indication that the analytical system is out of control. The out-of-control value(s) is placed on the control chart, circled and documented in a corrective action form according to SOP 4003. The Laboratory Manager is notified and both the analyst and Laboratory Manager investigate and determine whether the condition indicates a procedure that is truly out of control or which reflects a possible random error. The Laboratory Manager shall document corrective actions taken (i.e., whether the sample run was repeated or whether the data were reviewed and released for reporting to the client) on the corrective action form and submit to the QA Officer for placing in the permanent records.

SUMMARY OF QUALITY CONTROL PROCEDURES FOR METALS BY ICP

QC ELEMENT	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
Method Blank (MB)	1 per batch, not to exceed 20 samples (non-drinking water samples) 1 per batch, not to exceed 10 samples (drinking water samples)	< RL < 0.5*RL for all USACE projects RL = laboratory reporting limit	1) Check calculations. 2) Investigate contamination source 3) Take and document appropriate corrective action. 4) Reanalyze blank. If passes, report. 5) If still out, re-extract/reanalyze all samples. 6) Flag sample result associated with contaminated method blank.
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	1 per batch, not to exceed 20 samples (non-drinking water samples) 1 per batch, not to exceed 10 samples (drinking water samples)	Project specific requirements. If there are not project specific requirements use method specific requirements until in-house limits can be determined.	1) Check calculations. 2) Run external spike and external spike duplicate on original sample. 3) If still out, reanalyze external spike and external spike duplicate on original sample at a dilution. 4) If still out report with suspected matrix interference.
Laboratory Control Sample (LCS)	1 per batch, not to exceed 20 samples (non-drinking water samples) 1 per batch, not to exceed 10 samples (drinking water samples)	Project specific requirements. If there are not project specific requirements use method requirements until in-house limits can be determined.	1) Check calculations. 2) Identify correct and document problem. 3) Reanalyze LCS, if passes report. 4) If still out, re-extract/reanalyze LCS and associated samples.
Serial Dilution	1 per batch, not to exceed 20 samples (non-drinking water samples) 1 per batch, not to exceed 10 samples (drinking water samples)	± 10% of original concentration	1) Evaluate data for interference.
Interference Check Sample	Initial calibration	± 20%	1) Recalculate inter-element correction factors and reanalyze.
Reporting Limit Verification	Beginning of each run	± 100% of the true value	1) Reanalyze a new aliquot of of RLV solution. 2) If still out, reanalyzed calibration blank. 3) Reprint correlation coefficient. 4) Reanalyze instrument detection limit (IDL).
Continuing Calibration Verification Sample	1 per every 10 samples	Method requirements.	1) Reanalyze, if passes continue with analyses. 2) If still out, recalibrate.

SUMMARY OF QUALITY CONTROL PROCEDURES FOR METALS BY ICP/MS

QC ELEMENT	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
Method Blank (MB)	1 per batch, not to exceed 20 samples (non-drinking water samples) 1 per batch, not to exceed 10 samples (drinking water samples)	< RL < 0.5*RL for all USACE projects RL = laboratory reporting limit	1) Check calculations. 2) Investigate contamination source 3) Take and document appropriate corrective action. 4) Reanalyze blank. If passes, report. 5) If still out, re-extract/reanalyze all samples. 6) Flag sample result associated with contaminated method blank.
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	1 per batch, not to exceed 20 samples (non-drinking water samples) 1 per batch, not to exceed 10 samples (drinking water samples)	Project specific requirements. If there are not project specific requirements use method specific requirements until in-house limits can be determined.	1) Check calculations. 2) Run external spike and external spike duplicate on original sample. 3) If still out, reanalyze external spike and external spike duplicate on original sample at a dilution. 4) If still out report with suspected matrix interference.
Laboratory Control Sample (LCS)	1 per batch, not to exceed 20 samples (non-drinking water samples) 1 per batch, not to exceed 10 samples (drinking water samples)	Project specific requirements. If there are not project specific requirements use method requirements until in-house limits can be determined.	1) Check calculations. 2) Identify correct and document problem. 3) Reanalyze LCS, if passes report. 4) If still out, re-extract/reanalyze LCS and associated samples.
Serial Dilution	1 per batch, not to exceed 20 samples (non-drinking water samples) 1 per batch, not to exceed 10 samples (drinking water samples)	± 10% of original concentration	1) Evaluate data for interference.
Interference Check Sample	Initial calibration	± 20%	1) Recalculate inter-element correction factors and reanalyze.
Reporting Limit Verification	Beginning of each run	± 100% of the true value	1) Reanalyze a new aliquot of of RLV solution. 2) If still out, reanalyzed calibration blank. 3) Reprint correlation coefficient. 4) Reanalyze instrument detection limit (IDL).
Internal Standard (IS)	Every sample including QC	Method requirements	1) Check calculations. 2) Dilute the digest. Repeat if necessary.
Continuing Calibration Verification Sample	1 per every 10 samples	Method requirements	1) Reanalyze, if passes continue with analyses. 2) If still out, recalibrate.

SUMMARY OF QUALITY CONTROL PROCEDURES FOR METALS BY CVAA

QC ELEMENT	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
Method Blank (MB)	1 per batch, not to exceed 20 samples (non-drinking water samples) 1 per batch, not to exceed 10 samples (drinking water samples)	< RL < 0.5*RL for all USACE projects RL = laboratory reporting limit	1) Check calculations. 2) Investigate contamination source 3) Take and document appropriate corrective action. 4) Reanalyze blank. If passes, report. 5) If still out, re-extract/reanalyze all samples. 6) Flag sample result associated with contaminated method blank.
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	1 per batch, not to exceed 20 samples (non-drinking water samples) 1 per batch, not to exceed 10 samples (drinking water samples)	Project specific requirements. If there are not project specific requirements use method specific requirements until in-house limits can be determined.	1) Check calculations. 2) Run external spike and external spike duplicate on original sample. 3) If still out, reanalyze external spike and external spike duplicate on original sample at a dilution. 4) If still out report with suspected matrix interference.
Laboratory Control Sample (LCS)	1 per batch, not to exceed 20 samples (non-drinking water samples) 1 per batch, not to exceed 10 samples (drinking water samples)	Project specific requirements. If there are not project specific requirements use method requirements until in-house limits can be determined.	1) Check calculations. 2) Identify correct and document problem. 3) Reanalyze LCS, if passes report. 4) If still out, re-extract/reanalyze LCS and associated samples.
Continuing Calibration Verification Sample	1 per every 10 samples	Method requirements	1) Reanalyze, if passes continue with analyses. 2) If still out, recalibrate.

SUMMARY OF QUALITY CONTROL PROCEDURES FOR ORGANICS BY GC

QC ELEMENT	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
Method Blank (MB)	1 per batch, not to exceed 20 samples (non-drinking water samples) 1 per batch, not to exceed 10 samples (drinking water samples)	< RL < 0.5*RL for all USACE projects RL = laboratory reporting limit	1) Check calculations. 2) Investigate contamination source 3) Take and document appropriate corrective action. 4) Reanalyze blank. If passes, report. 5) If still out, re-extract/reanalyze all samples. 6) Flag sample result associated with contaminated method blank.
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	1 per batch, not to exceed 20 samples (non-drinking water samples) 1 per batch, not to exceed 10 samples (drinking water samples)	Project specific requirements. If there are not project specific requirements use method specific requirements until in-house limits can be determined.	1) Check calculations. 2) Reanalyze MS/MSD and sample. 3) If still out, re-extract/reanalyze MS/MSD and sample. 4) If still out report with suspected matrix interference.
Laboratory Control Sample (LCS)	1 per batch, not to exceed 20 samples (non-drinking water samples) 1 per batch, not to exceed 10 samples (drinking water samples)	Project specific requirements. If there are not project specific requirements use method requirements until in-house limits can be determined.	1) Check calculations. 2) Identify correct and document problem. 3) Reanalyze LCS, if passes report. 4) If still out, re-extract/reanalyze LCS and associated samples.
Surrogate spike	Every sample including QC	Method requirements until in-house limits can be established.	1) Check Calculations. 2) Evaluate batch for trends. 3) Reanalyze sample, if acceptable report. 4) If not acceptable, re-extract/reanalyze sample.
Continuing Calibration Verification Sample	1 per every 10 samples	Method requirements	1) Reanalyze, if passes continue with analyses. 2) If still out, recalibrate.

SUMMARY OF QUALITY CONTROL PROCEDURES FOR ORGANICS BY GC/MS

QC ELEMENT	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
Method Blank (MB)	1 per batch, not to exceed 20 samples (non-drinking water samples) 1 per batch, not to exceed 10 samples (drinking water samples)	< RL < 0.5*RL for all USACE projects RL = laboratory reporting limit	1) Check calculations. 2) Investigate contamination source 3) Take and document appropriate corrective action. 4) Reanalyze blank. If passes, report. 5) If still out, re-extract/reanalyze all samples. 6) Flag sample result associated with contaminated method blank.
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	1 per batch, not to exceed 20 samples (non-drinking water samples) 1 per batch, not to exceed 10 samples (drinking water samples)	Project specific requirements. If there are not project specific requirements use method specific requirements until in-house limits can be determined.	1) Check calculations. 2) Reanalyze MS/MSD and sample. 3) If still out, re-extract/reanalyze MS/MSD and sample. 4) If still out report with suspected matrix interference.
Laboratory Control Sample (LCS)	1 per batch, not to exceed 20 samples (non-drinking water samples) 1 per batch, not to exceed 10 samples (drinking water samples)	Project specific requirements. If there are not project specific requirements use method requirements until in-house limits can be determined.	1) Check calculations. 2) Identify correct and document problem. 3) Reanalyze LCS, if passes report. 4) If still out, re-extract/reanalyze LCS and associated samples.
Surrogate spike	Every sample including QC	Method requirements until in-house limits can be established.	1) Check Calculations. 2) Evaluate batch for trends. 3) Reanalyze sample, if acceptable report. 4) If not acceptable, re-extract/reanalyze sample.
Internal Standard spike (IS)	Every sample including QC	IS area 50-200% of the IS area in the CCV	1) Check sensitivity of instrument and sample. 2) Reanalyze sample or standard. 3) If still out and the failure is sample specific report data with suspected matrix interference.
MS Tune	Every 12 hours	Method abundance criteria.	1) Rerun tune. 2) If still out take and document appropriate corrective action.
Continuing Calibration Verification Sample	1 per every 10 samples	Method requirements	1) Reanalyze, if passes continue with analyses. 2) If still out, recalibrate.

4.2 RESPONDING TO NONCONFORMANCES; ROLES & RESPONSIBILITIES

When a nonconformance is recognized, each individual involved with the analysis in question has the following interactive role responsibilities:

- The Analyst: must be able to recognize nonconformance and immediately notify the QA Officer or Laboratory Manager as to the corrective action taken to solve the problem. Each analyst is responsible for documenting and correcting problems that might affect quality.

- The Data Reviewer: must review all analytical and QC data for reasonableness, accuracy, and clerical errors; he is also responsible for monitoring QC charts (in terms of control limits). In an out-of-control event, the Laboratory Manager works with the analyst and QA Officer to solve the problem and prevent the reporting of suspect data by stopping work on the analysis. All results that are suspect are repeated, if possible, after the source of the error is determined and remedied.

- Laboratory Manager: In the event that an out-of-control situation occurs that is unnoticed at the bench or review level, (i.e., performance failure on a QC sample), the Laboratory Manager will notify the analyst, help identify and solve the problem where applicable, ensure the work is stopped on the analysis, and verify that no suspect data are reported. The Laboratory Manager must review and approve all corrective action reports and submit them to the QA Officer for review. The QA Officer is responsible for reviewing nonconformance report forms, recommending or approving proposed corrective actions, maintaining an up-to-date nonconformance log, verifying that corrective actions have been completed, distributing and filing nonconformance report forms, and assisting in resolving disagreements.

4.3 PROCEDURES FOR STOPPING ANALYSIS

Whenever the analytical system is out of control, investigation-correction efforts are initiated by all concerned personnel.

If the problem is instrumental or specific only to preparation of a sample batch, any samples prepared after the out-of-control event are reprocessed after the instrument has been repaired and recalibrated, provided holding times have not been exceeded.

If a sample batch is still out of control after reanalysis, all method-related activities shall stop immediately. A detailed laboratory-wide investigation shall be conducted to isolate and correct faulty operations. Sample security, integrity of standards, reagents, glassware, laboratory notebooks, instrument performance, and adherence to the methods shall be included in the investigation.

All actions taken shall be documented and placed in their respective case/contract file.

4.4 CORRECTIVE ACTION

The need for corrective action comes from several sources: equipment malfunction, failure of internal QA/QC checks, failure of follow-up on performance or system audit findings, and noncompliance with QA requirements. When measurement equipment or analytical methods fail QA/QC requirements, the problems will immediately be brought to the attention of the Laboratory Manager. Corrective measures will depend on the type of analysis, the extent of the error, and whether the error is determinant or not. The corrective action will be determined by the Laboratory Manager, the analyst, and the QA Officer or by all of them in conference, if necessary.

A corrective action can be as extensive as replacing a complete lot of contaminated extraction solvent and reextracting and reanalyzing a complete batch of samples due to reagent blank contamination; or it can be as simple as recalculating a series of results because an incorrect dilution factor was applied. Furthermore, the "right" corrective action must be determined on a case-by-case basis.

If failure is due to equipment malfunction, the equipment will be controlled by segregation or tagging until its repair; precision and accuracy will be reassessed, and the analysis will be rerun. All attempts will be made to reanalyze all affected parts of the analysis so that in the end, the product is not affected by failure of QC requirements.

When a result in a performance audit is unacceptable, the laboratory will identify the problems and implement corrective actions immediately. A step-by-step analysis and investigation to determine the cause of the problem shall take place as part of the corrective action program. If the problem cannot be controlled, the laboratory will analyze the impact on the data.

When a system audit reveals an unacceptable performance, work shall be suspended until corrective action has been implemented and performance can be verified as acceptable.

If the external audit (system or performance) report identifies deficiencies that require corrective action, the QA Officer shall notify the responsible Laboratory Manager and log the pertinent information, including the date a response is due, in the nonconformance log.

The QA Officer and the Laboratory Manager shall assure that corrective action is taken. The QA Officer shall verify that the problem has been corrected. With the responsible supervisor, the QA Officer shall prepare a formal written response to the external organization, if required. The Laboratory Manager shall transmit the response to the external organization, with copies to other cognizant managers, as deemed necessary.

All incidents of QA failure and the corrective actions will be documented. Those reports will be placed in the appropriate case/contract file. Corrective action will be taken promptly for any deficiencies noted during the spot-check of raw data. When corrective actions are implemented, evidence of correction of deficiencies will be presented. Corrective action documentation will be forwarded to the Laboratory Manager for evaluation and approval.

4.5 DOCUMENTING CORRECTIVE ACTION

If at any time during analysis a process is out of control, corrective action shall be taken and documented with regard to:

- what actions were taken to bring the process back into control;
- what actions were taken to prevent recurrence of the out of control situation;
- what was done with the data obtained while the process was out of control.

This is accomplished by filling out a corrective action form. This form is initiated either by the Laboratory Manager or the QA Officer, depending on where the problem is recognized. The report will include the following information:

- nature of the problem
- analytical parameter affected
- sample lot affected
- corrective action measure(s) taken and final disposition/resolution of the problem
- dates (date recognized, date occurred, date corrected)
- signature of the Laboratory Manager

All corrective action forms will be submitted to the QA Officer for archiving and investigation to ensure that the proper corrective actions were taken and the system is performing correctly and considered in control.

5.0 DATA VALIDATION AND REPORTING

5.1 LABORATORY DATA

All bench chemists document sample preparation activities in bound laboratory notebooks or prenumbered, bound benchsheets. These serve as the primary record for subsequent data reduction. The data for GC/MS and GC analyses are generated by stand-alone computers and integrators, respectively. The data for atomic absorption analysis are collected using the instrument recorder to measure absorbance readings and strip charts to record absorbance expressed in peak height units. Results of each analysis are transferred onto analytical results forms specific to the particular analysis. Data are checked for accuracy and precision at the bench and instrument operator/analyst level, the Data Reviewer level, and the Laboratory Manager level. The validity of instrument-generated data shall be supported by the maintenance and inspection of the following records:

- description of the calibration performed;
- description of routine instrument checks (noise levels, drift, linearity, etc.);
- documentation of the traceability of instrument standards, samples and data;
- documentation of analytical methodology and QC methodology;
- description of the controls taken to determine and minimize interference contaminants in analytical methods (use of reference blanks and check standards for method accuracy and precision);
- description of routine maintenance performed; and
- documentation of sample preservation
- documentation of transport when shipped elsewhere.

Concentration of the analytes is expressed according to the required units, depending on the sample matrix (i.e., µg/L for aqueous samples and µg/kg for soil samples).

5.1.1 Gas Chromatograph Results

Calculations are performed for each analyte after its identity is determined. Identification is based on retention time of the suspect peak compared to the retention time of the standard; identifications are confirmed on a second GC column when specified by the method. The concentration of the analyte is determined by using the calibration curve and the peak area of the analyte. A response factor is determined from the calibration curve and used to calculate the concentration. Final results will be rounded to two significant figures.

5.1.2 Gas Chromatograph/Mass Spectrometry Results

Qualitative identifications are determined by obtaining extracted ion current profiles (EICPs) for the primary ion mass-to-charge ratio (m/z) and the secondary masses for each analyte. Positive identification is based on the following criteria:

- The intensity of the three characteristic masses of each analyte must maximize in the same ratio (± 20%), within one scan of each other.
- The retention time must fall within ± 30 seconds of the retention time of the authentic compound (± 0.06 RRT units).
- The relative peak heights of the three characteristic masses in the EICPs must fall within ± 20% of the relative intensities of these masses in a reference mass spectrum (standard analysis or reference library).

Structural isomers to be listed as separate analytes must have an acceptable resolution. Acceptable resolution is achieved if, in a standard mix, the baseline to valley height between the isomers is less than 25% of the sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs.

The calculation for the concentration of the suspect peak is made using the average response factor (RF) for each analyte.

$$\text{Concentration} = \frac{(A_S)\,(C_{IS})}{(A_{IS})\,(RF)}$$

where:

A_S = Area of characteristic m/z for the analyte to be measured
A_{IS} = Area of characteristic m/z for the internal standard
C_{IS} = Concentration of the internal standard, in ug/l
RF = Average response factor as calculated from the area on an intensity plot of the ion of interest.

A linear or quadratic calibration model may be used in place of the RF procedure. A minimum of 5 points must be used in a linear calibration model, the origin can not be forced through the origin. In addition the r-squared value for the linear calibration model must be at least 0.990. A minimum of 6 points must be used in a quadratic calibration model. The quadratic calibration model must not be used to compensate for detector or system saturation. The curve can not be forced through the origin when using a quadratic calibration model.

5.2 LABORATORY DATA VALIDATION AND DATA REPORTING

Data validation is the process whereby data are filtered and accepted or rejected, based on a set of criteria. It is a systematic procedure of reviewing a body of data against a set of criteria to provide assurance of its validity prior to its intended use.

Data validation is performed by the analyst, data reviewer, and the Laboratory Manager. Validation is accomplished through routine audits of the data collection and flow procedures and by monitoring of QC sample results.

Data validation includes dated and signed entries by analysts on the worksheets and logbooks used for all samples; the use of sample tracking and numbering systems to track the progress of samples through the laboratory; and the use of quality control criteria to reject or accept specific data. The process consists of data editing, screening, checking, auditing, verification, certification and review. The Laboratory shall certify in writing that the data have been validated in accordance with the defined process.

5.2.1 Validation Requirements

The minimum requirements for each analytical run are:

- at least three point calibrations (five points are recommended) and a continuing calibration check standard;
- continuing calibration check using an EPA or NIST reference, if available;
- laboratory control samples/QC sample included in each analysis;
- one method blank per matrix and per concentration level for every sample batch analyzed not to exceed 20 samples, for drinking water analyses 1 matrix spike for every sample batch analyzed not to exceed 10 samples.
- matrix spike and matrix spike duplicate per concentration level and per matrix for every sample batch analyzed not to exceed 20 samples.

Steps and checks used to validate precision and accuracy of the measured parameters and to support the representativeness, comparability, and completeness include:

- correlation coefficient > 0.990;
- documentation of the traceability of instrument standards;
- routine maintenance performed, found in instrument logs;
- documentation of sample preservation and transport.

5.2.2 Review of QC Samples Data

When the analyses of a sample set are completed, the results will be reviewed and evaluated to assess the validity of the data set. General principles for all parameters and methods apply as follow:

- Blank Evaluations - The reagent, instrument system, method and/or holding blank results are evaluated for high readings characteristic of background contamination. If high blank values are observed, laboratory glassware, air, and reagents will be checked for contamination and the analysis halted until the system is brought under control; no further sample analysis proceeds. A high background is defined as a background value sufficient to result in a difference in the sample value, if not corrected, greater than or equal to smallest significant digit known to be true.
- Field Blank Evaluation - field blank results are evaluated for high readings similar to the reagent and/or method blanks described above. If high field blank readings are encountered, the procedure for sample collection, shipment, and laboratory analysis should

be reviewed. If both the reagent and/or method blanks and the field blanks exhibit significant background contamination, the source of contamination is probably within the laboratory.

- Matrix Spike/Matrix Spike Duplicate Evaluation - If the observed recovery of the spike accuracy and/or precision values exceeds the acceptance criteria for the given parameters, the sample set must be reanalyzed for the parameter in question. Here the sample set is defined to be the matrix spike/matrix duplicate and the sample which was spiked.

- Calibration Standard Evaluation - The calibration curve is evaluated to determine linearity through its full range and to verify that sample values are within the range defined by the low and high standards. If the curve is nonlinear, plot sample concentrations on a graph or use an appropriate algorithm to fit a nonlinear curve to the standards. Alternately, the method of standard additions can be used.

- Duplicate Sample Evaluation - Duplicate sample analysis for the sample set is used to determine the precision of the analytical method for the sample matrix. The duplicate results are used to calculate the precision as defined by the relative percent difference (RPD). If the precision value exceeds the acceptance criteria for the given parameter in question, the QA Officer is notified. The sample set may be reanalyzed for the parameter in question. Here the sample set is defined to be the sample and its duplicate.

- Blind Replicate Evaluation - The blind replicate analysis is evaluated in the same manner as described above for the duplicate sample analysis and is treated as a duplicate result for purposes of evaluating the precision of the analytical method.

- Reference Standard Evaluation - Standard Reference Materials analyses are compared with "true" values and acceptable ranges.

  Values outside the acceptable ranges require corrective action to determine the source of error and provide corrective action. All sample analyses should be halted pending this evaluation. Following correction of the problem, the Standard Reference Material should be reanalyzed.

- Laboratory Control Sample Evaluation (LCS) - The results of LCS analysis are compared with the "true" values, and the percent recovery is calculated. If correction is required, the LCS should be reanalyzed to demonstrate that the corrective action has been successful.

- Surrogate Spike Evaluation - The results of surrogate spike determinations are compared with the "true" values spiked into the sample matrix prior to extraction and analysis and the percent recoveries of the surrogate standards are determined.

5.3 DATA COLLECTION AND FLOW AUDITS

Data collection and flow audits include the following:

- review of sample documents for completeness by the analyst(s) at each step of analysis;
- periodic review of instrument logs, performance test results, and analyst performance by the QA Officer;
- daily review of performance indicators (such as blanks, surrogate recoveries, duplicate/matrix spike duplicate analyses, matrix spike analyses, etc.) by analysts, data reviewer, and Laboratory Manager;
- random calculation checks;
- review of all reports prior to and subsequent to data entry.

5.4 DATA REVIEW

In the data review process, the data are compared to information such as sample history, sample preparation, and QC sample data to evaluate the validity of the results. Corrective action is minimized through the development and implementation of routine internal system controls. Analysts are provided with specific criteria that must be met for each procedure, operation or measurement system.

The review of data quality involves several levels of evaluation. In general, the analysts and the data reviewer are responsible for reviewing the data relative to instrument calibration, standard preparation, method blanks, raw data, calculations and transcriptions. The analyst normally reviews 100% of the raw analytical data generated, including the calibration data and all calculations. Upon completion of the analyst review, a second level of review of the raw data is performed by the data reviewer or Laboratory Manager who is generally responsible for a review of 100% of the data generated. The emphasis is on the data acceptability relative to the data quality indicators and on the accuracy of the final data summaries.

The Laboratory Manager, if not already involved in the review process, performs the subsequent review, where 25-100% of the data quality indicators (such as method blanks, replicate analyses and spike recovery determinations) are compared to the acceptance criteria described in the analytical procedures. The QA Officer randomly audits raw data and data quality indicators to ensure the quality of the overall system.

All analytical problems encountered during sample analysis are properly addressed to provide explanations for data users.

Once both field and analytical data have been combined, the resulting technical documentation is validated against the following criteria by the Laboratory Manager, or Project Manager:

- stated objectives of the work plan;
- stated QA objectives of the Quality Assurance Project Plan (QAPP);
- analysis date versus the applicable holding times;
- percentage of QA analyses conducted;
- field and laboratory blank contamination;
- laboratory accuracy (percent recovery versus control limits);
- laboratory and field precision (RPD versus control limits).

Descriptive statistics for completeness are to be calculated and reported, as a percentage of total valid data points, with explanations describing reasons for achieving less than stated objectives.

5.5 DATA REPORTING

The format and content of a data report shall be dependent upon project needs such as whether explanatory text is required, client or contract requirements, and government agency reporting formats.

Reports are prepared in a format suited to the end use. Each report contains the following information:

- complete description of samples (client and Laboratory ID, and other information submitted by the client)
- description of the methodology or a reference to a method
- summary of the sample data
- summary of QC data

Written results include only those analytes requested by the client. A list of personnel authorized to sign final reports is maintained by the Laboratory Manager. Signatories attest that data and associated information in the report are believed to be correct. Oral preliminary release of data is prohibited.

The content and format of data reports are approved by the Laboratory Managers and the QA Officer. Once a format is agreed upon, a report may not be issued that deviates from the format without the approval of the Laboratory Managers and the QA Officer.

The laboratory maintains on file all laboratory QA/QC documentation, reviewed for completeness. The following QA/QC is performed:

- The dates of sample extraction and analysis are compared with sample collection dates to ensure that the samples were analyzed within EPA established holding times.

- The respective sets of values from duplicate samples are compared for agreement. Results from field blanks are reviewed. Re-analyses are performed as necessary.

- Charge, mass and analyte balances are performed as appropriate to assure internal consistence of reported data.

Any discrepancies within the above QA/QC procedures are further investigated. Laboratory QA/QC documents are checked for accuracy. Analyses are repeated as warranted. Samples may be collected a second time and re-analyzed.

Any significant problems in the measurement process are resolved before reporting or the data are qualified by a statement describing the problem and its implications.

5.6 Data Archive

Client confidentiality and data integrity are of a high priority. All active client files and those files that are less than six months old are maintained by the Customer Service Representative. All raw data less than six months old are maintained by the analysts in daily files. These daily files contain all information necessary to reconstruct all analyses performed on that instrument in a day.

All data and original observations that are greater than six months old or existing in a completed log book are maintained in the laboratory archives. All data backup tapes are also maintained in the archives. Access to the archives requires approval by the archivist, who tracks archive activity.

The laboratory facility is kept under tight security. The facility is equipped with fire alarm systems and motion sensitive burglary systems. All visitors are required to be escorted through the facility and are not allowed access to any client records.

All data are maintained for a period of five years, unless other arrangements are made.

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Appendix B

APPENDIX B
EXAMPLE DAILY FIELD REPORT
AND SAMPLE LOG FORM

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Environmental
Field Daily Report

Report # : ____

Page ____ of ____

Project Name :		**Date :**	**Time Arrived :**
Project Manager :	**Site Location :**		**Time Departed :**
Project / Task # :	**Personnel :**		**Mileage :**
Weather Conditions :	**Wind from :**	at mph	**Temperature :** °F
Subcontractor :		**Time Arrived :**	**Time Departed :**
Name / Firm:		**Time Arrived :**	**Time Departed :**
Site Visitors :		**Time Arrived :**	**Time Departed :**
OIC Equipment :			

Primary Assignments :

Field Notes :

Attachments :		**Logbook ?** Y N	**Book # :**	**Pages :**	
Field Data Sheets?		Y N	**Total FDS's :**		
Chain of Custody ?		Y N **C-O-C No.'s :**		**Sample Control Log ?**	Y N
Utility Clearance :		**Ticket # :**	**Marks observed ?** Y N	**Comments :**	
Other attachments:					

DFR Submitted to : _____

eviewed by : _____

Signature : _____

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Environmental
Field Daily Report

Page ____ of ____

Project Name :	Date :	Report # :
Project / Task # :	Site Location :	

Field notes continued :

DFR Submitted to : _____

Reviewed by : _____

Signature : _____

KLEINFELDER SAMPLE CONTROL LOG

PROJECT NAME: _____ **PROJECT NUMBER:** _____ **DATES OF FIELD WORK:** _____

SAMPLE DESCRIPTION				SAMPLE CONTAINER					NOTES
DATE	TIME	FIELD SAMPLE NUMBER	SAMPLE LOCATION	MATRIX (Soil, etc.)	# OF CONTAINERS	CONTAINER TYPE	PRESERV.	FILTERED? (Y/N)	

Laboratory: _____ Chain-of-Custody No_____

Sampler: _____ Page __ of __

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Appendix C

APPENDIX C

EXAMPLE CHAIN-OF-CUSTODY FORM

Veritas Laboratories

6245 Harrison Drive, Suite 4, Las Vegas, NV 89120
(702) 321-8315 Phone
(702) 597-2098 Fax
Email: veritaslabs@msn.com

Veritas Lab ID: _____

Company: _____ Telephone: _____
Address: _____ Fax: _____
_____ Email: _____
Attention: _____ Project Name: _____
Invoice To: _____ Project Number _____
Sampled by: _____ Client P.O. No. _____

Sampler attests to authenticity and validity of information on this Chain of Custody _____ (initial).
Falsification of information on this Chain of Custody may be considered fraud.

Client Sample Identification	Veritas Lab ID #	Sampling Date	Sampling Time	Com-posite	Grab	Matrix Code*	# of Containers	Preservation**	Container Code:	Comments

A=Amber
G=Glass
P=Plastic
ST=Sterile
V=VOA Vial
T=Tedlar Bag
W=Wipe
O=Other

Relinquished by: (Signature)	Date/Time:
Received by: (Signature)	Date/Time:
Relinquished by: (Signature)	Date/Time:
Received by: (Signature)	Date/Time:

Turnaround Time:
____ 24 Hours
____ 48 Hours
____ 72 Hours
____ Normal
____ Other

_____
Date Needed

*Matrix Code
GW=Groundwater
WW=Wastewater
DW=Drinking Water
A=Air
S=Soil/Solid
SL=Sludge
OL=Organic Liquid
W=Wipe
O=Other

**Preservation Codes
I=Iced
H=HCL
N=HNO_3
S=H_2SO_4
X=NaOH
T=$Na_2S_2O_3$
Z=ZnAc
O=Other
NO=None

Received Temperature:
_____
Received in Good Condition?
Yes/No

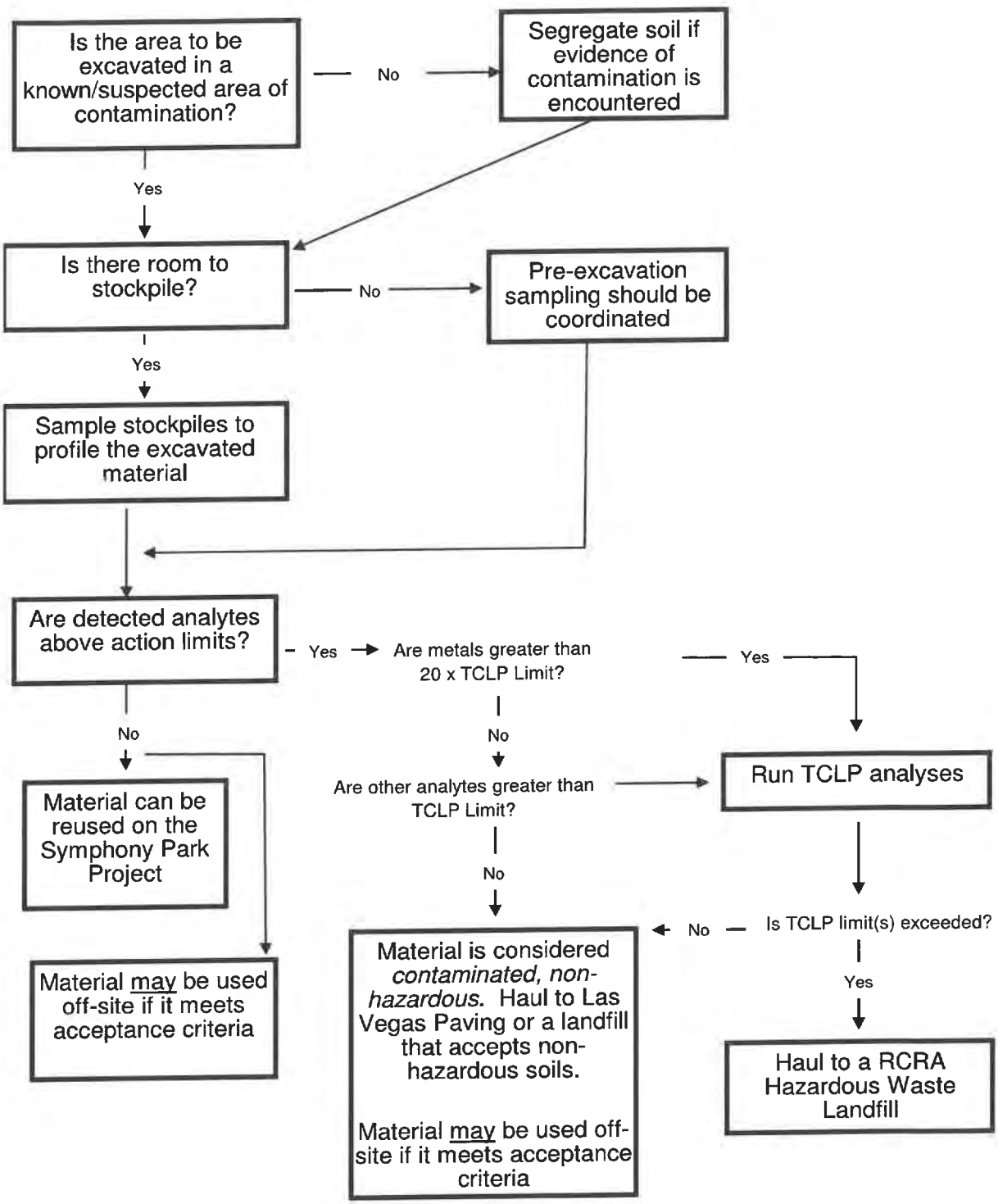
Custody Seals?
Yes/No

CHAIN OF CUSTODY *All Data Reported on a Wet-Weight Basis, Unless Otherwise Specified* **Page ____ of _____**

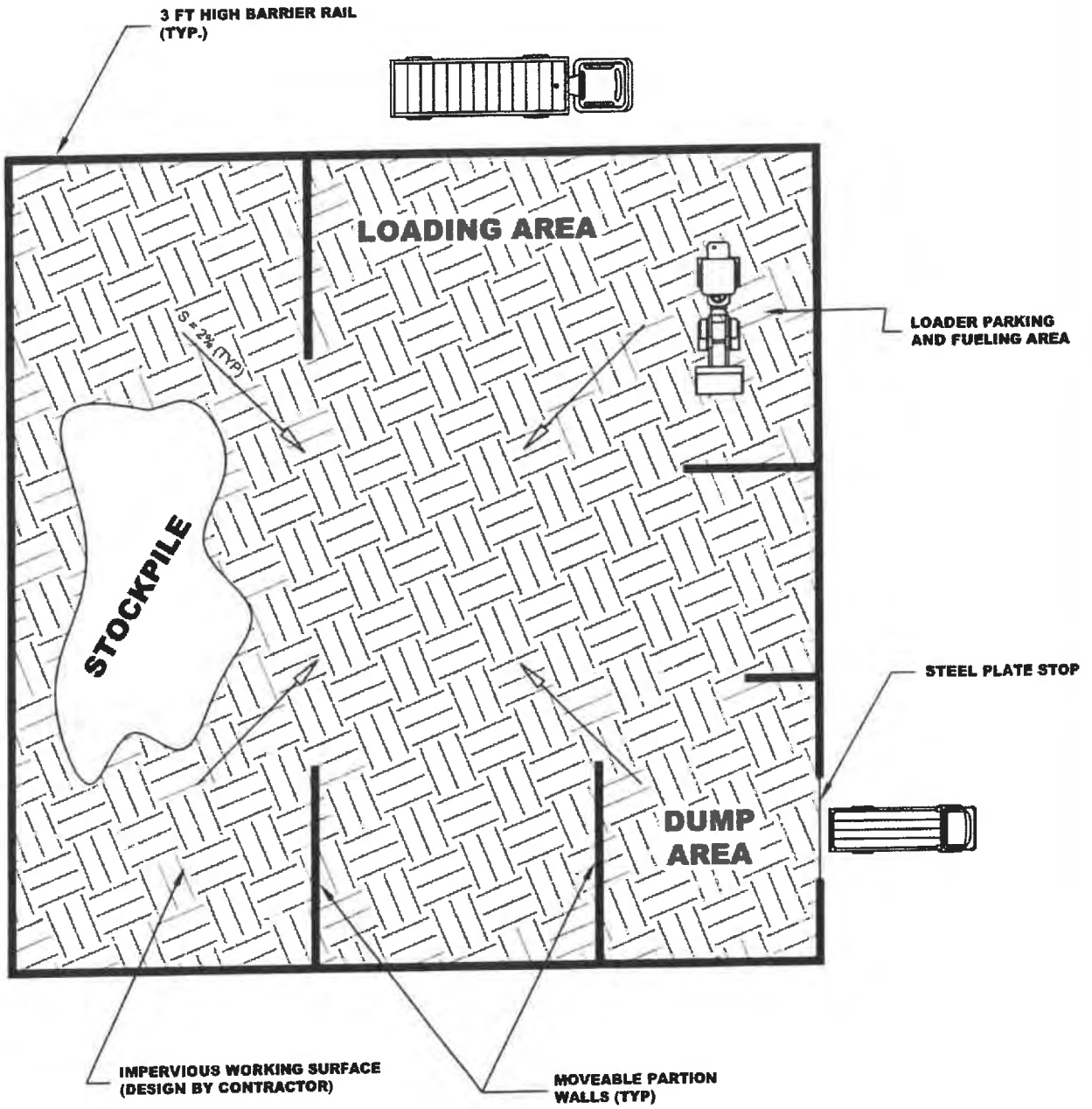
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Appendix B

APPENDIX B
SOIL/WASTE CLASSIFICATION MATRIX
AND
EXAMPLE SOIL STORAGE AREA DIAGRAM



KLEINFELDER *Bright People. Right Solutions.* www.kleinfelder.com	PROJECT NO.: 20154986 DRAWN: JAN 2017 DRAWN BY: KFH CHECKED BY: KLR FILE: Soil Waste Classification Matrix.ppt	**SOIL / WASTE CLASSIFICATION MATRIX** SOIL AND GROUNDWATER MANAGEMENT PLAN SYMPHONY PARK LAS VEGAS, NEVADA	FIGURE **B-1**



KLEINFELDER *Bright People. Right Solutions.* www.kleinfelder.com	PROJECT NO.: 20154986 DRAWN: JAN 2017 DRAWN BY: KFH CHECKED BY: KLR FILE: Soil Storage Area Diagram.ppt	**SOIL / WASTE CLASSIFICATION MATRIX** SOIL AND GROUNDWATER MANAGEMENT PLAN SYMPHONY PARK LAS VEGAS, NEVADA	FIGURE **B-2**

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Appendix C

APPENDIX C
EXAMPLE MANIFESTS

American Ecology Corporation Land Disposal Restriction Form

GENERATOR: _____ EPA I.D. NUMBER: _____

WASTE STREAM or PROFILE NUMBER: _____ MANIFEST DOC. NO. _____ LINE NO. _____

WASTE IS A: ☐ WASTEWATER ☐ NON-WASTEWATER ☐ DEBRIS

NOTIFICATION FREQUENCY: ☐ ONE TIME ☐ REQUIRED WITH EACH SHIPMENT

EPA WASTE CODES (from 40 CFR 268.40): _____ _____ _____ _____ _____ _____

_____ _____ _____ _____ _____ _____

UNDERLYING HAZARDOUS CONSTITUENTS (from 40 CFR 268.48): _____

_____

A. ☐ **Restricted Waste Meets Treatment Standards (40 CFR 268.7(a) (3))**

The restricted waste identified above meets the treatment standards in 40 CFR 268.40 or **Alternative LDR treatment standards for contaminated soil 40CFR268.49** and can be landfill disposed without further treatment. I have attached all supporting analytical data, where available.

I certify under penalty of law that I personally have examined and am familiar with the waste through analysis and testing or through knowledge of the waste to support this certification that the waste complies with the treatment standards specified in 40 CFR Part 268 Subpart D. I believe that the information I submitted is true, accurate and complete. I am aware that there are significant penalties for submitting a false certification, including the possibility of a fine and imprisonment.

B. ☐ **Restricted Waste Treated To Treatment Standards (40 CFR 268.7(b) (I) & 268.7 (b) (2))**

The treatment residue, or extract of such residue, or the restricted waste identified above has been tested to assure that the treatment residues or extract meet all applicable treatment standards in 40 CFR 268.40 and/or performance standards in 40 CFR 268.45. I have attached all supporting analytical data, where available.

I certify under penalty of law that I personally have examined and am familiar with the waste through analysis and testing or through knowledge of the waste to support this certification that the waste complies with the treatment standards specified in 40 CFR Part 268 Subpart D. I believe that the information I submitted is true, accurate and complete. I am aware that there are significant penalties for submitting a false certification, including the possibility of a fine and imprisonment.

C. ☐ **Restricted Waste With Technology Based Treatment Standards (40 CFR 268.7(b) (4))**

I certify under penalty of law that I personally have examined and am familiar with the treatment technology and operation of the treatment process used to support this certification and that based on my inquiry of those individuals immediately responsible for obtaining this information. I believe that the treatment process has been operated and maintained properly so as to comply with the treatment standards specified in 40 CFR 268.40, without impermissible dilution of the prohibited waste. I am aware that there are significant penalties for submitting a false certification, including the possibility of a fine and imprisonment.

D. ☐ **Restricted Waste Decharacterized But Requires Treatment For UHC (40 CFR 268.9)**

I certify under penalty of law that the waste has been treated in accordance with the requirements of 40 CFR 268.40 to remove the hazardous characteristic. This decharacterized waste contains Underlying Hazardous Constituents (UHC) that require further treatment to meet the universal treatment standards. I am aware that there are significant penalties for submitting a false certification, including the possibility of a fine and imprisonment.

E. ☐ **Restricted Waste Subject To Treatment (40 CFR 268.7(a) (2))**

The restricted waste identified above must be treated to the applicable treatment standards in 40 CFR 268.40, or treated to comply with applicable prohibitions set forth in Part 268.32 or RCRA Section 3004(d). I have attached all supporting analytical data, where available.

F. ☐ **Hazardous Debris Subject To Treatment (40 CFR 268.45)**

This hazardous debris identified above must be treated to the alternative treatment standards in 40 CFR 268.45.

G. ☐ **Restricted Waste Subject To A Variance or Extension (40 CFR 268.7(a) (4))**

This restricted waste identified above is subject to a case by case exemption under 40 CFR 268.5, an exemption under 40 CFR 268.6 or a nationwide capacity variance under Subpart C of 40 CFR 268, and is not prohibited from land disposal. LDR prohibitions become effective on _____ (date) for this restricted waste. The corresponding treatment standard(s) are promulgated in 40 CFR 268.40. I have attached all supporting analytical data, where available.

H. ☐ **Restricted Waste Managed In A "Lab Pack" (40 CFR 268.7(a) (9))**

I certify under penalty of law that I personally have examined and am familiar with the waste and that the lab pack contains only waste that have been excluded under appendix IV to 40 CFR Part 268 and that this lab pack may be sent to a combustion facility in compliance with the alternative treatment standards for lab packs at 40 CFR 268.42(c). I am aware that there are significant penalties for submitting a false certification, including the possibility of a fine and imprisonment.

I certify and warrant that the information that appears on this form, and appended documents, is true and correct. I have correctly indicated how my waste is to be managed in accordance with 40 CFR 268. My certification is based on personal examination of the information submitted, or is based on my inquiries of those individuals responsible for obtaining the information.

Authorized Signature _____ **Title** _____ **Date** _____

UHC list from 40 CFR Part 268.48 available upon request

NO.0144

NON-HAZARDOUS WASTE DATA FORM

TO BE COMPLETED BY GENERATOR

EPS I.D. NO. [redacted]

NAME _____ PROFILE NO. [redacted]

ADDRESS _____

CITY, STATE, ZIP _____ PHONE NO. _____

CONTAINERS: No. _____ VOLUME _____ WEIGHT _____

TYPE: ☐ TANK - TRUCK ☐ DUMP TRUCK ☐ DRUMS ☐ CARTONS ☐ OTHER _____

WASTE DESCRIPTION _____ GENERATING PROCESS _____

COMPONENTS OF WASTE	PPM	%	COMPONENTS OF WASTE	PPM	%
1.			5.		
2.			6.		
3.			7.		
4.			8.		

PROPERTIES: pH_____ ☐ SOLID ☐ LIQUID ☐ SLUDGE ☐ SLURRY ☐ OTHER _____

HANDLING INSTRUCTIONS: _____

THE GENERATOR CERTIFIES THAT THE WASTE AS DESCRIBED IS 100% NON-HAZARDOUS.

TYPED OR PRINTED FULL NAME & SIGNATURE DATE

TRANSPORTER

EPA I.D. NO. [redacted]

NAME _____

ADDRESS _____ SERVICE ORDER NO. _____

CITY, STATE, ZIP _____ PICK-UP DATE _____

PHONE NO. _____

TRUCK, UNIT, I.D. NO. TYPED OR PRINTED FULL NAME & SIGNATURE DATE

TSD FACILITY

EPA I.D. NO. NVD986768174

NAME Las Vegas Paving Corp.

ADDRESS 5300 North 5th Street

CITY, STATE, ZIP North Las Vegas, NV 89031

PHONE NO. (702) 649-7423

DISPOSAL METHOD

☐ LANDFILL ☒ OTHER _____

Incineration

TYPED OR PRINTED FULL NAME & SIGNATURE DATE

GEN	OLD/NEW	L A	TONS
TRANS		S B	
C/Q		RT/CD	HWDF NONE462

DISCREPANCY

Please print or type (Form designed for use on elite (12 - pitch) typewriter)

Form Approved. OMB No. 2050 - 0039 Expires 9 - 30 - 91

UNIFORM HAZARDOUS WASTE MANIFEST

1 Generator's US EPA ID No. | Manifest Document No. | 2. Page 1 of | Information in the shaded areas is not required by Federal law

3. Generator's Name and Mailing Address

4. Generator's Phone ( )

A. State Manifest Document Number

B. State Generator's ID

5. Transporter 1 Company Name | 6. US EPA ID Number

C. State Transporter's ID

D. Transporter's Phone

7. Transporter 2 Company Name | 8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address | 10. US EPA ID Number

G. State Facility's ID

H. Facility's Phone

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
GENERATOR a.					
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; **OR**, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name | Signature | Month Day Year

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | Month Day Year

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in item 19.

Printed/Typed Name | Signature | Month Day Year

EPA Form 8700 - 22 (Rev. 9 - 88) Previous editions are obsolete.

Converse Consultants
4840 Mill Street, Suite 5, Reno, Nevada 89502

SURVEY DATA

(775) 856-3833 FAX (775) 856-3513

Inspectors:	Project Name:	Project Number:	Date Sampled:
Contact:	Project Location:	Analysis Type: (Please Circle) Asbestos Air Bulk; Lead Air Bulk; Other	Instructions:
Phone #: (775) 856-3833	Client/Contact:		

Turn-A-Around Time: (Circle) RUSH 24 Hours 2 Days **Requested:** Verbals Fax **Test to First Positive:** Yes No

LAB #	SAMPLE #	MATERIAL DESCRIPTION	SAMPLE LOCATION	LOCATIONS OF MATERIAL	QNTY	COND	FRIABLE YES/NO	COMMENTS (DEBRIS, EXTENT OF DAMAGE)	ASBESTOS %
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								

MATERIAL			CONDITION	UNITS	ASBESTOS %	
PFI - Pipe Fitting Insulation	VT - Vinyl Tile	GA - Gasket	G - Good (No Maintenance is required currently)	LF - Linear Feet	A	Amosite Asbestos
PRI - Pipe Run Insulation	M - Mastic	D - Debris	D - Damaged (Some repair needed)	SF - Square Feet	C	Chrysotile Asbestos
DI - Duct Insulation	CBM - Cove Base Mastic	TSI - Thermal System Insulation	SD - Significantly Damaged (Repair or replace ASAP)	CF - Cubic Feet	NDA	No Asbestos Detected
TI - Tank Insulation	AT - Acoustic Tile	R - Roof			Assumed ACM	No Samples Taken
EJ - Expansion Joint	SA - Spray Acoustic	DW - Drywall				
BI - Boiler Insulation	W - Wall	JC - Joint Compound				
	P - Plaster					

Relinquished By:	Relinquished By:	Relinquished By:	Relinquished By:
Date/Time:	Date/Time:	Date/Time:	Date/Time:
Received By:	Received By:	Received By:	Received By:

Project: _____ Project #: _____ Weather: _____

Date:_____ Site Manager:_____ Start Time: _____ Complete Time:_____

SAMPLE LOG

LOCATION	DEPTH	PID READING	LATITUDE AND LONGITUDE	LAB TEST	NOTES

Page _____ Of_____

Converse Consultants

75 Years of Dedication in Geotechnical Engineering & Consulting, Environmental & Groundwater Science, Materials Testing & Inspection Services

Groundwater Sampling Form

Project Number:	**Well ID:**
Project Name:	**Date:**
Project Location:	**Sampler:**
Site Conditions/Weather:	
Comments:	

Analysis:	**Water Level Instrument:**	**Well Diameter (in):**
Screened Interval (ft):	**Water Quality Meter:**	**Static Water Level:**
Sampling Method:	**Low Flow or Net Purge:**	**Total Well Depth (ft):**
Dissolved Oxygen (mg/L):	**Minimum Purge Volume (3 casing volumes, Gal) :**	**Water Column (ft):**

Time	Volume Purged (Gal)	Water Level (feet btoc)	pH (S.U.)	Conductivity (µm/cm)	Temp. (°C)	DO (mg/L)	ORP (mV)	Remarks

1st East Liberty Street, Suite 600, Reno, Nevada 89501	Job No:		Boring No:	
	Address:		Boring Depth:	
	Date Installed:		Boring Diameter:	
	Installed By:		Drilling Method	
	Drilling Company:		GW Level (feet bgs):	

GL	LITHOLOGY	GW	Sample	PID (ppm)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

1st East Liberty Street, Suite 600, Reno, Nevada 89501	Job No:		Well No:	
	Address:		Well Depth:	
	Date Installed:		Well Diameter:	
	Installed By:		GW Level:	
	Drilling Company:		Drilling Method:	

GL	Casing	Annulus	LITHOLOGY	GW	Sample	Blows/6"	PID (ppm)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

Project: _____ Project #: _____ Weather: _____

Date of Field Work :_____Site Manager:_____

Field Supply Check List

Item	Need for Project	Date Cleaned and checked	Date Loaded	Date Returned
Maps/Plot Plan		NA		NA
GIS				
Tape Measure				
Measuring Wheel				
Survey St akes and Flags		NA		NA
Camera				
PID				
Zip Lock Bags		NA		
4 oz Glass Soil Jars*		NA		NA
8 oz Glass Soil Jars*		NA		NA
Voas*		NA		NA
Amber Bottles*		NA		NA
Water Bottles for Metal*		NA		NA
Sample Labels		NA		NA
Chain-of-Custody		NA		NA
Custody Seals		NA		NA
Cooler				
Ice		NA		NA
3 or More Clean Plastic Buckets**				
Scrub Brush**				
Sponge**				
Alconox**				
Paper Towels**				
Plastic Sheets**				
Hand Spade				
Hand Auger				
Disposable Bailers				
Hard Hat***		NA		NA
Tyvek Suite***		NA		NA
Respirator***				NA
Disposal Latex Gloves***		NA		NA
XRF				

*Supplied by Laboratory
**Decontamination Supplies
***PPE

Converse Consultants (757) 856-3833

Reno, Nevada 89502 Fax (775) 856-3513

Sample Transmittal Form

Project Name: _____ Contact Person: _____ Page of

Project Number: Date Sampled: Contact Phone Number:

Analysis Type:	PCM-Air:	PLM-Bulk:	TEM:	GC
	NIOSH 7400 Method	Standard EPA Method	Air Water	AA
	Other Method	Point Count Method	Bulk Other	Others

Special Notes:

Turn-A-Round Time: (Circle) RUSH 24 Hours 2 Days 1 Week If PLM Sample-test to First Positive Yes No

Requested: Verbals Fax Samples Collected By: Sample Type**: Background Pre-Abatement During Clearance

Laboratory Number	Sample Number	Sample Location	Sample Description	Type** Pump #	Time Started	Time Ended	Total Minutes	Flow Rate	Volume (liters)	Analyst	Fiber Fields	F/mm2	F/cc

Relinquished By: Relinquished By: Relinquished By: Relinquished By:
Date/Time: Date/Time: Date/Time: Date/Time:
Received By: Received By: Received By: Received By:

White = Converse Copy / Yellow = Laboratory File Copy