

Montana Quality Assurance Plan for Investigation of Underground Storage Tank Releases

**Montana Department of Environmental
Quality**

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1.0 Project Management

1.1 Project/Task Organization

The corrective action oversight at leaking underground storage tank (LUST) sites in Montana is the responsibility of the LUST/Brownfields Section (LBS) and the Petroleum Technical Section (PTS) of the Hazardous Waste Site Cleanup Bureau, within the Remediation Division of the Department of Environmental Quality (DEQ). The LBS Manager is Jeff Kuhn, the PTS Manager is Rebecca Ridenour, and the Hazardous Waste Site Cleanup Bureau (HWSCB) Chief is Mike Trombetta. The Remediation Division Administrator is Sandi Olsen. The DEQ Director is Richard Oppen.

DEQ attorneys support and advise the director and staff on legal aspects of the leaking underground storage tank (LUST) program including contractual, enforcement, and policy matters.

Montana's project officer at the U.S. Environmental Protection Agency (EPA) Region VIII is Lisa Luebke who oversees the State program. The Quality Assurance Officer (QAO) for EPA Region VIII, Linda Himmelbauer, advises the DEQ on quality assurance (QA) procedures and is available to assist in the resolution of problems.

The LBS and PTS QAO, Scott Gestring, is responsible for overseeing all QA activities discussed in this document. He informs management of QA requirements, problems, and overall status, and is the lead point-of-contact for QA matters pertaining to the LUST Program.

1.2 Problem Definition/Background

The DEQ LUST Program Quality Assurance Project Plan (QAPP) provides guidance for Montana's LUST programs to ensure that data collected at LUST sites are defensible and of known quality and origin. QA controls are required to prevent, identify, and correct errors that may occur at any point in the sampling process including container preparation, sampling and handling, sample analysis, and final reporting. The data are intended to be used to support monitoring, investigation, and enforcement activities associated with the release of petroleum and other regulated substances.

In 1984 and 1986, in amendments to the Resource Conservation and Recovery Act (RCRA), Congress directed the EPA to establish standards and regulations for management of underground storage tanks (USTs). In 1987, the Montana Legislature amended the Montana Solid and Hazardous Waste Act (Title 26, Chapter 14, Montana Code Annotated 1953, as amended) to authorize the Department of Health and Environmental Sciences (DHES) to develop an UST program that would meet federal requirements for delegation of primacy. On July 1, 1995, the DEQ was established by merging certain programs from three former state agencies, including the DHES UST program, into one agency. Subsequent reorganization within the DEQ established the Remediation Division on July 1, 1996. Montana's LUST and UST programs were granted primacy by the EPA on March 4, 1996.

1.3 Project/Task Description

All soil and water sample analyses will be performed by a State of Montana approved laboratory (see Appendix 1). All laboratory methods will be performed as prescribed in Section 2.4 and quality control (QC) requirements for physical and chemical analyses will be performed as outlined in Section 2.5.

All test methods will be performed as prescribed by:

- A. the Massachusetts Department of Environmental Protection Method for the Determination of Volatile Petroleum Hydrocarbons (VPH) May 2004;
- B. the Massachusetts Department of Environmental Protection Method For The Determination of Extractable Petroleum Hydrocarbons (EPH) May 2004;
- C. Test Methods For Evaluating Solid Waste (SW 846, Third Edition, 1996), EPA's Determination Of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/Mass Spectrometry (GC/MS) (TO-15), dated January 1999;
- D. the Method for the Determination of Air-Phase Petroleum Hydrocarbons (APH), developed by the Massachusetts Department of Environmental Protection, dated December 2008; and
- E. Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act; Final Rule and Interim Final Rule and Proposed Rule (40 CFR Part 136 - Federal Register, Friday, October 26, 1984, current edition of standard methods).

Implementation of QC requirements for sampling is the responsibility of LBS and PTS staff and under the direction of the LUST Program QAO. LBS and PTS project managers will follow the sampling procedures described in Sections 2.1 and 2.3 of this document. Analytical data will be reviewed by individual site project managers, and if necessary, the LUST Program QAO, the LBS or PTS Manager and the HWSCB Chief.

1.4 Data Quality Objectives and Criteria

The overall data quality objective (DQO) is to develop and implement procedures for field sampling, chain-of-custody protocol, and laboratory analysis and reporting that yield reliable data that can easily be verified and defended. Specific procedures to be used for sampling, chain-of-custody, instrument calibration, laboratory analyses, reporting, internal QC audits, and corrective actions are described in this QAPP. The purpose of this section is to define goals for completeness, accuracy, precision, bias, representativeness, and comparability. The QA requirements for each parameter are contained in the Massachusetts Department of Environmental Protection Method for the Determination of Volatile Petroleum Hydrocarbons (VPH) May 2004, Massachusetts Department of Environmental Protection Method For The Determination of Extractable Petroleum Hydrocarbons (EPH) May 2004, EPA's Determination Of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/Mass Spectrometry (GC/MS) (TO-15), dated January 1999, the Method for the Determination of Air-Phase Petroleum Hydrocarbons (APH), developed by the Massachusetts Department of Environmental Protection, dated December 2008, or in SW-846, Third Edition.

Data Accuracy

Accuracy is defined as the degree of agreement of a measurement X, with an accepted reference value T, and is measured by calculating percent recovery. The difference between X and T will be expressed as a percentage of the reference value according to the formula:

$$\text{Percentage Difference} = 100 (X-T)/T$$

Accuracy is influenced by random error or precision and systematic error or bias that may occur during sampling and analysis. External accuracy audits will be conducted by the LUST Programs with the support of the approved laboratory by submitting blind standards, spikes, and field blanks to the laboratory. The analytical results must meet acceptable accuracy objectives.

Each laboratory utilized by the LUST Programs must participate in ongoing performance audit programs administered by the LUST Programs. References or spiked samples will be used where appropriate.

Data Precision

Precision is defined as a measure of mutual agreement among individual measurements of the same property. External precision audits will be conducted by submitting blind duplicates to the laboratory and comparing the results with the acceptance criteria.

Data Bias

Bias is the measure of the systematic variance in the expected sample measurement from the sample's true value.

Data Completeness

Completeness is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is to generate a sufficient amount of valid data. At least 90 percent completeness is required by the LUST program.

Data Representativeness

Representativeness is the assurance that analytical data are derived from sampling techniques and laboratory procedures that achieve a characteristic sample. To assure representativeness, all sampling will be conducted according to the protocols set forth in Section 2.

Data Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. The data generated will be reported in units consistent with other laboratories that report similar analyses. This will allow comparison of data among organizations. Standardized data formats for calculating and reporting of analytical results will facilitate the process. The standard operating procedures for sampling described in Section 2.0 will be followed for each sampling event.

1.5 Project Narrative

Data from LUST sites will be used to evaluate compliance with the DEQ LUST program and the protection of public health and the environment. These include data that indicate no environmental effects from the release of petroleum and Hazardous Substance List (HSL) compounds (as defined by the federal Comprehensive Environmental Responsibility, Compensation, and Liability Act (CERCLA),

Section 101[14]) to the environment, successful corrective actions and closure of LUSTs, and data to support potential enforcement actions.

The primary goal of the LBS and PTS sampling program is the identification and quantification of HSL or petroleum compounds released from USTs. Proper quantification of these regulated substances is necessary to identify leaking tanks and the presence of petroleum or HSL compounds that threaten human health and the environment.

Sampling for regulated substances may be necessary in a variety of matrices. Water sampling, including groundwater and surface water, and soil sampling will comprise most of the sampling to be conducted. Environmental sampling at some sites could include air, sludge, and non-aqueous phase liquids (NAPL). In all cases, the sampling and analysis program will be performed in accordance with a site-specific sampling and analysis plan (SAP). The SAP will establish the number and types of environmental samples to be collected, analytical methods to be used, and QA/QC procedures to be followed.

All sampling requires proper collection and preservation methods and chain-of-custody documentation to be maintained from sample collection through final analysis. Sample locations associated with corrective action may vary depending on intended use of data. The DEQ project manager will determine number, types, and locations of samples for subsurface investigations and for confirmation samples associated with corrective action.

Parameters for which each sample will be analyzed depends on individual project objectives. These include analysis for petroleum products, petroleum derivatives, HSL compounds defined by CERCLA and any known breakdown products of these compounds. It may also be necessary to perform other waste analyses for some sites to determine the appropriate treatment and disposal methods for remediation of wastes.

The analytical laboratories are responsible for QA from the time samples are received for analysis until the analytical results are reported to the DEQ project manager. Laboratories must practice QA controls for sample custody and handling, instrument calibration and maintenance, and data reduction and validation. They are also responsible for problems that are detected during these procedures. Table 1 includes the minimum QA/QC specifications for the contract laboratories for the Method Blank, Surrogate Recovery, Matrix Spike and the Duplicate for soil and water samples.

QA/QC samples will also be required with each batch of air samples, analyzed as detailed in Table 2 below. All samples and QA/QC will be injected with an internal standard that will be measured to demonstrate the consistency of the method.

Analytical results meeting DQOs for completeness, accuracy, and precision will be accepted. If QC samples are outside acceptable criteria, they will be referred for corrective action to be taken by the subject laboratory. The corrective action may entail reanalysis of the sample(s) or QC, recalibration and reanalysis of the sample batch, repreparing and analyzing the sample batch. Two types of corrective action reports routinely used by the contract labs are the Analytical Non-Conformance Report and a Corrective Action Report.

Internal audits of the laboratory's quality assurance system are to be conducted on an annual basis. Internal audits of specific areas of concern or specific methods will be conducted by the QAO as directed

by the laboratory manager or as deemed necessary by the QAO.

Table 1
Quality Assurance/Quality Control Specifications for Soil and Water Methods

Parameter	Method Reference	Method Blank	Surrogate Recovery	Matrix Spike Frequency Recovery	Duplicate
Volatile Petroleum Hydrocarbons (VPH)	Massachusetts Method	Every 12 Hours <MDL	2,5 dibromotoluene 40 - 140% Rec.	5-10% of Samples 70-130 % Rec.	MSD <50% RPD
Extractable Petroleum Hydrocarbons (EPH)	Massachusetts Method	Every 12 Hours <MDL	4 surrogates 40 - 140% Rec.	5-10% of Samples 40-140 % Rec.	MSD <50% RPD
Purgeable Organics	8260/624	5% of Samples <MDL	3 surrogates 80-120%	5% of Samples	MSD 5% of Samples CLP QC Limits
Regulated & Unregulated Volatile Organic Compounds	524.2	5% of Samples <MDL	3 surrogates 80-120%	5% of Samples 60-140 % Rec.	10% of Samples

DEQ – Department of Environmental Quality

MDL – Method detection limit

MSD – Matrix spike duplicate

RPD – Relative percent difference

CLP – Contract lab program

QC – Quality control

Table 2
Quality Assurance/Quality Control Specifications for Air Methods

Analysis	QC Parameter				
	Tune	CCV	LMB	LCS	Duplicate
TO-15	Required daily	Required daily	Required daily	Not required	Not required
APH	Required daily	Required daily & per batch of 20 samples	Required for each batch of 20 samples	Required for each batch of 20 samples	Required for each batch of 20 samples

1.6

Documentation and Records

Field sampling information will be maintained in facility files and/or in field logbooks that will contain all information pertinent to each sampling event. The information recorded by the sampler should include at a minimum:

- A. Date;
- B. Site name, location, and facility ID and release numbers;
- C. Site description including weather conditions and photo documentation;
- D. Name of sampler;
- E. Purpose of sampling;
- F. Sample number, type, location, and time of collection;
- G. Type(s) of sample containers and preservatives used;
- H. Field stabilization data, including, but not limited to pH, conductivity, and temperature, with instrument model and number, and calibration results. Other parameters that may be required include dissolved oxygen (DO), oxidation-reduction potential (ORP), and turbidity;
- I. Chain-of-custody information including date and time of sample collection and transfer to the approved laboratory; and
- J. Documentation of sample storage on ice in a cooler for transport.

Each sample must have a chain-of-custody record that includes sample number, date and time of collection, place of collection, environmental matrix, sample container, preservation method, signature of the collector, and signature and dates of persons involved in the transportation and handling of the sample.

DEQ will maintain final reports including technical review documentation, raw data, data collection sheets (as specified above), calculations, instrument calibration records, and QA information.

2.0 Measurement/Data Acquisition

2.1 Sampling Process Design

Investigations at UST sites in response to known or suspect releases require chemical and physical analyses of soil, groundwater, and air samples collected on site. The data obtained serves as the basis for the evaluation of impacts to soil and potential drinking water supplies and in the assessment of actual and potential impacts to human health and the environment. Data obtained from soil, groundwater, and air samples at UST sites must be accurate and representative of site conditions.

Environmental samples must be collected during UST closure, subsurface investigations, and after

corrective actions at LUST sites. All samples must be analyzed by a State of Montana approved laboratory. Soil samples may also be collected and analyzed for soil type and classification (e.g., the Unified Soil Classification System). The following is a brief discussion of factors for determining sample location, soil and groundwater sampling protocol, and other considerations in sampling.

UST Closure Sampling Locations

Sample locations associated with UST site assessment should conform with ARM 17.56.703 (Appendix 2). UST closure sampling must comply with the Waste and Underground Storage Tank Management Bureau (WUSTMB) permit requirements. Closure sample locations depend on the number and capacities of tanks at the site and whether groundwater is encountered during excavation. If no groundwater is encountered, two soil samples must be collected 1 to 2 feet below each end of a single tank equal to or greater than 600 gallons in capacity. A minimum of one soil sample must be collected at a depth of 1 to 2 feet below the center of each tank having a capacity less than 600 gallons. If groundwater is encountered, at least one groundwater grab sample should be collected. When groundwater is encountered, soil sample(s) should be collected from the unsaturated zone immediately above the soil-water interface. Groundwater samples must be collected using proper surface water collection techniques or from a properly installed groundwater monitoring well.

For piping removals, required soil samples must be collected at the base of the piping trench at suspected worst case locations and one sample taken for every 20 feet of piping. Up to five piping trench samples may be composited into a single sample if there is no qualitative evidence of petroleum contamination. If groundwater is encountered at the base of the excavation trench, soil samples should be collected from the unsaturated zone immediately above the soil-water interface and a groundwater sample should be collected using proper surface water collection techniques or from a properly installed groundwater monitoring well.

Other closure samples required include suspected worst-case locations which may include areas around the tank and piping that record the highest concentrations of hydrocarbon vapor recorded with vapor monitoring instruments, areas around the tank and piping that look stained or discolored, the lowest point of the base of the tank, where the tank meets the piping, and beneath fill lines and vent piping.

Subsurface Investigation Sampling Locations

Soil borings and monitoring wells are installed as part of subsurface investigations to delineate the lateral and vertical extent of contamination at LUST sites. Decisions on the location and number of soil borings and monitoring wells must be made in consultation with the DEQ project manager and will be based on site-specific information. At some sites three or four soil borings may be adequate to delineate the extent of contamination, while at other sites a dozen or more borings may be required. Soil samples shall be collected at five-foot intervals and screened in the field using the heated headspace method with a photoionization detector or flame ionization detector. A minimum of one soil sample from each boring must be sent to a laboratory for analysis, regardless of depth of the boring. One soil sample shall be collected from the soil/groundwater interface, or the bottom of the soil boring if groundwater is not encountered. A second sample must be collected from the zone of worst contamination as determined by the heated headspace sampling. If the soil/groundwater interface is the zone of worst contamination, then one soil sample is sufficient. More samples may be required if there are multiple zones of contamination.

Groundwater monitoring wells are required at sites where groundwater may be impacted. A minimum of three groundwater-monitoring wells is necessary to define the groundwater flow direction. In practice, more than three wells are typically necessary so that at least one monitoring well is directly down gradient from the source of the contamination. A down gradient monitoring well is necessary to demonstrate if contamination remains onsite or has migrated off site or if clean, can provide water quality data for natural attenuation determinations. Conversely, an up gradient well will demonstrate if contamination is moving on to the site from an off-site source. Well installation and abandonment must be conducted in accordance with the Montana Department of Natural Resources (DNRC) Board of Water Well Contractors specifications.

If soil borings or wells are employed, the following information is required:

- A. The type of drilling equipment and decontamination procedures used, and detailed geologic boring logs with an appropriate vertical scale shown;
- B. As-built drawings showing: well and/or boring identification number; total depth of well and boring; well construction materials including casing screen type, length, slot size, and filter pack material and particle size; location of the bentonite seal, sample locations for soil or groundwater; and any organic vapor meter measurements;
- C. The type and placement of extraction pumps, if applicable;
- D. Identification of the depth of groundwater encountered at the site during sampling or investigation; and
- E. Description of the volume of purge water generated and the procedures used to dispose of drill cuttings, purged water or other waste materials generated during any phase of the work at the release site.

Corrective Action Confirmation Sampling Locations

Corrective action confirmation samples are samples that are collected to demonstrate that cleanup goals have been achieved after corrective action at the site is thought to be complete. The number and locations of samples must be determined in consultation with the DEQ project manager and are usually based on the following information:

- A. Confirmation samples (soil, groundwater, etc.) are required any time contamination is removed from the subsurface or release site area;
- B. At least one soil sample should be collected and analyzed from each sidewall and the pit bottom of an excavation pit after over-excavation is complete; and
- C. Groundwater samples should be collected from each monitoring well or select monitoring wells at a site after groundwater remediation is complete.

Soil Sampling

Sampling and analysis of soils is an integral part of the investigation and evaluation at petroleum release sites. Numerous methodologies can be utilized in the collection of surface and subsurface soils to help determine the extent and magnitude of contamination at LUST sites. These methodologies may include, but are not limited to: grab samples, hand augers, direct push including Geoprobos®, rotosonic and

hollow stem auger drill rigs with split spoons, etc. Care should be taken to ensure the cleanliness of all sampling equipment. To minimize or avoid cross-contamination, all non-disposable sampling equipment must be cleaned and properly stored/handled between sample locations. An acceptable decontamination protocol should be included in the firm's Standard Operating Procedure (SOP) documents on file with DEQ and strictly adhered to. If a current SOP is not on file with DEQ, a detailed decontamination procedure will be included in the work plan.

Technical Guidance Document #8 (*Laboratory Analytical Requirements for Petroleum Releases*—see Appendix 3) should be consulted to determine the appropriate analytical requirements for individual samples. Sampling procedures must be conducted in a manner that minimizes the loss of volatile organic compounds (VOCs). The sample container must be full with no air or head-space between the soil and the cap. All samples should be preserved with ice (cooled to 4 degrees Centigrade) and shipped to an approved laboratory as soon as reasonably possible after sampling. The maximum holding time from sample collection (as published in SW 846, 3rd edition and in the Massachusetts Method) to analysis may not be exceeded.

Photo-ionization detectors (PID) and flame ionization detectors (FID) are commonly used organic vapor analyzers. Field screening using a PID/FID is necessary for the protection of worker health as well as screening of environmental samples. Field screening results aid in the determination of which samples to analyze and provide the relative concentrations of organic vapors that the samples may contain.

Groundwater Sampling

Several methodologies may be employed in the collection of groundwater samples. They include, but are not limited to, low-flow sampling, submersible and peristaltic pumps, and bailing. Guidelines for using these methods are outlined in detail in Technical Guidance Document #18 (*Groundwater Sampling Methodologies*—included in Appendix 3). In general, the following requirements are necessary during groundwater sample acquisition.

Prior to initiating sampling activities at a given location, depth to water should be measured at all existing wells that are accessible. The static water level in a well will be measured using an electronic water-level indicator or an electronic oil/water interface probe to the nearest one hundredth of a foot (0.01 foot). The water level will be measured from a scribed mark at the top of the steel or PVC well casing that corresponds to the point at which the elevation for the well was surveyed to in accordance with Technical Guidance Document #2 (*Licensed Surveyor Required for Determining Monitoring Well Elevations*—see Appendix 3). All measurements will be recorded. If non-aqueous phase liquid (NAPL) is suspected or verified during water level measurement, an interface probe should be used to measure the apparent thickness. If NAPL is present, consult with the DEQ project manager prior to purging.

Monitoring wells should be evacuated and sampled beginning with the least contaminated and proceeding to the most contaminated well to minimize the potential for cross-contamination. The sampling order of the wells from least to most contaminated should be based on historical data or knowledge of the existing site conditions. Purge water should be handled in a manner consistent with Technical Guidance #10 (*Options for Discharge of Hydrocarbon Contaminated Wastewater*—included in Appendix 3).

Collection of field parameters is necessary during collection of groundwater samples to help ensure the validity of the sample results. These parameters should include, at a minimum, pH, temperature and

conductivity. Other parameters that should be considered include dissolved oxygen (DO), oxidation-reduction potential (ORP) and turbidity. Field meters used during sampling will be checked for calibration consistent with manufacturer-recommended procedures. At a minimum, field instrument and equipment calibration should be conducted daily. Calibration is the process of establishing a relationship of a measured output to a known input and provides a point of reference to which other sample analyses can be correlated. More frequent calibration will be conducted as necessary, based on instrument performance checks and operator judgment. All calibrations will be performed using standard industry practices and/or equipment manufacturer recommendations.

Care should be taken to ensure the cleanliness of all sampling equipment. Non-disposable sampling equipment should be decontaminated between each location. An acceptable decontamination protocol must be included in the firm's SOP on file with the DEQ LUST Program and strictly adhered to. If a current SOP is not on file at DEQ, a detailed decontamination procedure will be included in the work plan.

Sampling consistency will produce repeatable results and data of a higher quality. Multiple purging methods will not be accepted at a site unless approval is granted by DEQ. The collected sample should be of sufficient volume to fill the sampling container to its recommended level. For a VOA sample, no air should be allowed between the liquid surface and the lid of the container. Once the sample is collected, Technical Guidance Document #8 (*Laboratory Analytical Requirements for Petroleum Releases*) should be consulted to determine the appropriate analytical requirements for individual samples. Also refer to Technical Guidance #11 (*Filtering or Decanting Samples Prior to Laboratory Analysis*—please see Appendix 3). The maximum holding time from sample collection (as published in SW 846, 3rd edition and the Massachusetts Method) to analysis may not be exceeded.

Air Sampling

Air sampling is often utilized to determine potential impacts to the human health and the environment. Several different types of environmental samples may be collected: soil vapor samples, sub-slab vapor samples, samples from the air found in crawl spaces, indoor air samples, and outdoor air (sometimes referred to as "ambient air") samples.

Soil vapor/Soil gas samples are collected to characterize the nature and extent of vapor contamination in the soil in a given area. They may be collected before sub-slab vapor and/or indoor air samples to help identify buildings or groups of buildings that need to be sampled. Soil gas samples are used to determine the potential for vapors to accumulate beneath buildings. Soil gas samples are also used on undeveloped properties (no structures) to determine the possibility of vapor intrusion in future structures.

Please note that soil gas samples are not the same as soil samples. Soil gas samples only assess contamination present in the soil vapor between the soil particles. Soil samples measure the total amount of contamination present in the soil, including that which adheres to soil particles and is not detected in a soil vapor sample (e.g. metals).

Sub-slab vapor samples are collected to characterize the nature and extent of vapor contamination in the soil immediately beneath a building with a slab. In buildings without a slab, crawl space air and/or soil gas samples may be collected below the building. Sub-slab vapor results are used to determine the potential for vapor intrusion as are soil gas samples collected from beneath buildings without slabs.

Indoor air samples are collected to characterize the nature and extent of vapors within a building. Indoor air sample results help to evaluate whether vapors are currently migrating in to a building. They are also compared to sub-slab vapor and outdoor ambient air results to help determine where volatile chemicals may be coming from (indoor sources, outdoor sources, and/or beneath the building).

Outdoor ambient air samples are collected to characterize site-specific background air conditions. Outdoor air results are used to evaluate the extent to which outdoor sources, such as automobiles, lawn mowers, oil storage tanks, gasoline stations, commercial/industrial facilities, and so forth, may be affecting indoor air quality.

In addition to the types of air sampling mentioned above, air samples may also be collected from remediation systems (i.e. soil vapor extraction systems) to determine system performance and efficiency. Also, field screening air samples using a PID/FID can aid in qualitatively determining the extent and magnitude of impacts to soil and groundwater, but more quantitative results are obtained through proper sample collection and laboratory sample analysis.

Air sampling procedures must be conducted in a manner that minimizes the loss of volatile organic compounds (VOCs). The sample container should be shipped to an approved laboratory as soon as reasonably possible after sampling. The maximum holding time from sample collection to analysis may not be exceeded. Tedlar bag samples have a holding time of 72 hours.

2.2 Sampling Methods Requirements

Sampling will be conducted following the protocol established in A Guide for Field Samplers (EPA Region VIII ESD, 1980), Standard Operating Procedures for Field Samplers (EPA Region VIII ESD, 1986), Samplers and Sampling Procedures for Hazardous Waste Streams (January 1980, EPA document 600/2-80-018), Sampling for Hazardous Materials (course book EPA course 165.9, EPA Hazardous Response Support Division, Cincinnati, Ohio), and National Handbook of Recommended Methods for Water Data Acquisition (revised), U.S. EPA et al, 1984.

Samples must be collected using equipment that has been properly decontaminated and procedures appropriate to site-specific factors including the matrix, the parameters to be analyzed, and the sampling objective.

The volume of the sample collected must be sufficient to perform the analyses requested, as well as the QA/QC requirements. Sample volumes, container types, and preservation techniques should also be confirmed with the approved laboratory.

Tables 1 and 2 in Technical Guidance Document #8 (Appendix 3) contain the required analytical methods for soil sampling groundwater sampling, respectively. All soil and water samples must be preserved with ice from the time of collection until analysis. For soil samples being analyzed for volatile constituents, sample containers will be completely filled.

DEQ requires that all indoor air samples collected at sites with volatile petroleum hydrocarbon contamination, such as gasoline, mineral spirits, kerosene, #2 diesel, jet fuels, and certain petroleum naphthas, be analyzed using EPA's Determination Of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/Mass Spectrometry

(GC/MS) (TO-15), dated January 1999, and using the Method for the Determination of Air-Phase Petroleum Hydrocarbons (APH), developed by the Massachusetts Department of Environmental Protection, dated December 2008. The TO-15 analysis must include lead scavengers ethylene dibromide and 1,2-dichloroethane unless DEQ determines that these chemicals of concern (COCs) are not necessary.

After the initial samples are collected from a particular location in the vicinity of a petroleum release, the DEQ case manager will determine whether subsequent samples may be analyzed only for APH. This may be the case in a location where levels of contamination are high enough that they will be detected by the APH method, where no constituents are detected in the TO-15 analysis that can not be detected by the APH method, *and* where soil and groundwater contaminant levels are well documented and are expected to remain static. As contamination drops to levels below that which the APH method can detect, TO-15 analysis will once again be required.

Before leaving the facility, the sampler should:

- A. Check all paper work for accuracy and completeness.
- B. Match the physical samples with the paper work. The sampler should check for proper samples in the correct containers and that the field numbers on the samples correspond with the numbers on the sample request forms.
- C. Verify that samples are properly stored and secure for transport.
- D. Clean and package all non-disposable equipment.
- E. Make sure the items on the sample tags, request forms, chain-of-custody record, and log book match.
- F. Bag all disposable items that need to be discarded.
- G. Ensure that all sample containers are free of any debris.

2.3 Sample Handling and Custody Requirements

In order for analytical results to be defensible, a chain-of-custody must be established for all samples collected. Chain-of-custody must demonstrate that samples have not been tampered with during collection, transfer, storage, or analysis. This requires custody of the samples to be documented from the time the samples are collected.

A sample is under custody if:

- A. It is in the person's possession, or
- B. It is in the person's view, after being in the person's possession, or
- C. It was in the person's possession and then it was locked up or placed in a sealed container to prevent tampering, or
- D. It is in a designated secure area.

Coordination with an Analytical Laboratory

The sampler should contact a State-approved laboratory before sampling to verify that the lab is capable of conducting the sample analysis within the holding time specified.

Preservation and Shipping Procedures

Soil and water samples must be placed on ice immediately after collection to minimize the loss of volatiles. Once the sampling is complete and the sampler has left the site, chain-of-custody must be maintained and properly documented. Preferably, soil, groundwater and air samples should be transported directly to the laboratory by the sampler or representative. When shipping is required, the samples must be placed in a container acceptable to both the laboratory and the carrier. Dry ice should not be used when shipping water samples to prevent the samples from freezing and breaking the glass containers. When shipping samples of a NAPL, space should be left in the top of the container to prevent breakage of the glass container from expansion that can occur during transport.

2.4 Analytical Methods Requirements

All samples must be analyzed using appropriate analytical methods for the constituents associated with product type. Table 2 in this document and Tables 1 and 2 in Technical Guidance Document #8 (Appendix 3) list the analytical methods required for most product types and compounds encountered during UST closures and corrective actions. Analysis of additional constituents may be required as determined by the DEQ project manager.

Analytical method selection will be based on whether the method provides comparable, representative, complete, precise and accurate data for the sample matrix and the range of expected values for the constituents for which the samples are being analyzed. Only EPA-approved methods and the Massachusetts Methods will be used for analysis. These methods are described in Test Methods for Evaluating Solid Waste (SW846, Second Edition and its subsequent revisions), 40 CFR 136, October 26, 1984, Methods for Chemical Analysis of Water and Wastes (EPA-600/4-79-020), Standard Methods for the Examination of Water and Wastewater, 16th Edition, APHA, et al., 1985, Method for the Determination of Volatile Petroleum Hydrocarbons (VPH), Massachusetts Department of Environmental Protection May 2004, Method for the Determination of Extractable Petroleum Hydrocarbons (EPH), Massachusetts Department of Environmental Protection May 2004, the Method for the Determination of Air-Phase Petroleum Hydrocarbons (APH), Massachusetts Department of Environmental Protection, December 2008, and EPA's Determination Of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/Mass Spectrometry (GC/MS) (TO-15), dated January 1999.

2.5 Quality Control Requirements

Field Quality Control Samples

Field QC samples will be submitted to an approved laboratory as appropriate and as often as reasonably practical during field investigations. Project managers, working in coordination with the LBS and PTS QAO and the laboratory will select the appropriate field originated QC samples. The approach outlined in this document for QC samples represents standard operating procedures and may need to be changed or varied under some circumstances. Field-originated water QC samples will be prepared according to Procedures for Preparing Blind Duplicate and Spiked Field Samples in Water, Document Control R8-QAO-82-SOP-011. Such QC check samples may consist of:

- A. One or more duplicate samples;
- B. One or more field blanks, trip blanks, rinsate blank;
- C. Co-located samples;
- D. One or more split samples;
- E. Spiked samples;
- F. Performance-evaluation samples provided by EPA.

Duplicates: The number and frequency of duplicates will be determined by the QAO and the sampler prior to going into the field. Duplicates will be prepared by collecting characteristic samples of the same matrix from the same location at the same time. True duplicates can only be collected from homogeneous systems. Co-located samples will be used for any non-homogeneous matrix. Following initial field preparation, all duplicate samples will be handled in the same manner as all other samples being analyzed for the same parameter. Identification will be fictitious but consistent with the identification of principal study samples. The number of blind duplicates required will usually be 1 in every 20 samples collected. Duplicates will be collected on a site-specific basis and may not be required at all sites investigated. Criteria for acceptance is specific to the method.

Field Blanks: Field blanks will be submitted to the laboratory for analysis after being prepared in the field by filling the appropriate container with clean sand, clean soil, or distilled/deionized water. Field blanks should be submitted at a rate of one per day per site. Criteria for acceptance are below detection limits of any analyte being tested for at a site.

Trip Blanks: Trip blanks are required only when sampling for volatile organics. Trip blanks are prepared in the laboratory prior to sampling by filling the appropriate container with distilled/deionized water. The trip blank is transported to the field, handled in the same manner as the other VOC samples, and submitted to the lab with the other samples for analysis. A minimum of one trip blank should be analyzed per VOC sampling excursion. Criteria for acceptance are below detection limits of any analyte being tested for at a site.

Rinsate Blanks: Rinsate blanks are prepared in the field by collecting distilled/deionized water in sample containers after the water has been used to rinse decontaminated equipment prior to sampling. Rinsate blanks should be collected at a rate of one per day per sampling device unless dedicated or disposable sampling equipment is used. Criteria for acceptance are below detection limits of any analyte being tested for at a site.

Co-located Samples: Co-located samples are used to assess variability of soils and contaminants within a small area. Co-located samples are collected in the appropriate container within a few feet of routine field samples. Co-located samples will be collected only when necessary to the investigation of the site but typically at a rate of 1 in every 20 samples. Criteria for acceptance are values within 10% RPD for water samples and 35% RPD for soil samples.

Split Samples: Split samples are field samples collected from the same location but sent to an alternate lab for analysis. Split samples will be selected on a site-specific basis but should be collected at a minimum of two per site when utilized. Criteria for acceptance are values within 10% RPD for water samples and 35% RPD for soil samples.

Spiked Samples: Spiked samples are prepared in the field by adding a known concentration of target

analyte to a matrix sample. Spiked samples are used to evaluate the effect of the matrix on the recovery efficiency of the analytical method. Criteria for acceptance are 80% to 120% recovery.

Performance-evaluation Samples: Performance-evaluation samples are prepared by a third party with a concentration of analytes that will be known by the submitter but unknown to the lab. The Performance-evaluation samples should be submitted at a rate of one per analyte of interest. Criteria for acceptance are 80% to 120% recovery.

QC samples will be handled in the same manner as all other samples being analyzed for the same parameters. Identification will be consistent with the identification of principal study samples. The LBS and PTS QAO will maintain records concerning QC samples and results of their analysis. A summary of the results and any problems will be reported to the LBS or PTS Manager.

Montana's acceptance criteria for the evaluation of all field-collected samples (air, water, soil, etc.) are consistent with the Massachusetts Methods, SW-846 standards and current EPA Region VIII protocols. Analytical results are screened to ensure that the method reporting limit and the amount detected are within acceptable ranges. Corrective actions for samples not falling within the acceptable ranges will be dealt with on a case-by-case basis and shall require a determination of the cause for the non-compliance or deviation if possible (i.e. decontamination procedures; storage, transportation and handling procedures; correct usage of sampling tools; and sampling protocol including sampling techniques), and a correction of the variance. If QC sample results for critical data do not fall within the stated acceptance criteria, re-sampling will be performed to ensure data quality.

Laboratory QC Procedures

Internal QC procedures for sample analysis are the responsibility of the laboratory. These procedures include the use of duplicate analysis, spikes, calibration standards, internal standards, blanks, QC charts, standard reference materials, reagent checks and sample splits. Laboratory QA controls should be outlined in their individual QAPPs. Tables 1 and 2 on pages 5 and 6 include the minimum QA/QC Specifications for laboratories.

UST Performance, System Audits, and Corrective Action

The LBS and PTS QAO will monitor and audit performance of the QA procedure to ensure that all sampling activities are performed in accordance with approved QA procedures. Performance audits by LBS and PTS staff will be conducted periodically to evaluate whether samplers are adhering to the QA/QC controls identified herein, including the proper execution and use of sample identification, sample control, chain-of-custody procedures, documentation, and sampling procedures.

Analytical results meeting quality objectives of completeness, accuracy, and precision will be accepted. If QC samples are outside acceptance criteria, they will be evaluated by including field audit sets with internal laboratory QC samples. If combined sets meet acceptance criteria the data will be accepted. All analyzed data still not meeting acceptance criteria will be referred for corrective action. The corrective action may entail reanalysis of the sample(s) or QC, recalibration and reanalysis of the sample batch, reprepping and analyzing the sample batch. Two types of corrective action reports routinely used by contract labs are the Analytical Non-Conformance Report and a Corrective Action Report.

Internal audits of the laboratories quality assurance system are to be conducted on an annual basis. Internal audits of specific areas of concern or specific methods will be conducted by the QAO as directed by the laboratory manager or as deemed necessary by the QAO.

2.6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

Preventive maintenance tasks and schedules recommended by the manufacturers will be conducted and followed for all field instrumentation. Records of preventive maintenance performed will be maintained. The LBS and PTS QAO and the project manager will ensure that the prescribed maintenance on field instrumentation is conducted.

Preventive maintenance procedures for laboratory equipment are the responsibility of the laboratories and must be documented in logbooks that will be monitored periodically.

2.7 Instrument Calibration and Frequency

Laboratory calibrations will be conducted according to established EPA procedures. Equipment used for field measurements will be calibrated according to manufacturer's specifications. The project manager is responsible for recording calibration procedures for each sampling event.

3.0 Assessment/Oversight

3.1 Assessments and Response Actions

Data will be evaluated using accuracy, precision, and completeness criteria as detailed in Section 1.4. Approved laboratories will report only data that meet those criteria.

If the QC samples meet the criteria above, the reported data will be accepted. If not, the laboratory QAO will be consulted to see which samples were in the same batch as the failed QC samples. These samples will be included with the field audit set and reevaluated. If the combined set meets the acceptance criteria, the reported data will be accepted. If not, the data from analyzing the sample set will be used as a basis for a corrective action referral.

The LUST program agrees to allow the EPA Project Officer and the EPA Quality Assurance Staff to have access to oversee the field collection and the laboratory procedures.

3.2 Reports to Management

Site-specific QA/QC information will be included in the appropriate facility files from each sampling event. For each facility, the final summary of reported data from the laboratory will reflect all laboratory QA/QC measures taken. If further reporting and clarification is necessary, the laboratory QA chemist will prepare a report detailing recommendations and submit the report with the data to the LBS or PTS project manager and the QAO. These individuals will review the QA recommendations and take necessary corrective actions.

4.0 Data Validation & Usability

4.1 Data Review, Validation, and Verification Requirements

Data validation procedures will focus on determining if the data were generated according to EPA

protocol. Specifically, the LBS and PTS QAO will routinely audit sampling, calibration, field measurement, field logging, and chain-of-custody procedures. Where possible, generated data will be compared with previous data to evaluate consistency. Any data generated outside standard protocol will be either rejected or identified with the inconsistency.

All data review, validation, and verification requirements, other than the ones described above, are the responsibility of the approved laboratory.

4.2 Validation and Verification Methods (Data Analysis, Validation and Reporting)

Validation and integrity of data that is generated or received by the LUST programs are the responsibility of the project manager and assistance will be given by the LBS and PTS QAO, as needed. Most responsibility for data analysis, validation and reporting lies with the approved laboratory.

4.3 Reconciliation with User Requirements

If a QC audit results in detection of unacceptable conditions or data, the project manager and the LBS and PTS QAO will be responsible for developing and initiating corrective action. If the unacceptable conditions indicate a program difficulty or if corrective action is likely to require expertise not immediately available to the project team, the LBS or PTS Manager will be notified.

Corrective action may include:

- A. Reanalyzing the samples, if holding time criteria permit.
- B. Re-sampling and analysis of the samples.
- C. Evaluating and amending sampling and analytical procedures.
- D. Acceptance of data, with an acknowledgment of the level of uncertainty surrounding the analytical results.

The selected corrective action will depend on how critical the samples are and the range of the reported values. If reported data is not adequate to determine whether contamination is present or not, the samples will be reanalyzed or retaken.

5.0 References

- Administrative Rules of Montana (ARM) 17.56.703; <http://deq.mt.gov/dir/legal/Chapters/Ch56-07.pdf>
- Determination of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters and Analyzed By Gas Chromatography/Mass Spectrometry (GC/MS), Environmental Protection Agency, January 1999. <http://www.epa.gov/ttnamti1/files/ambient/airtox/to-15r.pdf>
- Final Rule and Interim Final Rule and Proposed Rule (40 CFR Part 136 - Federal Register, Friday, October 26, 1984, current edition of standard methods)
- A Guide for Field Samplers (EPA Region VIII ESD, 1980)
- Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act
- Hazardous Substance List (HSL) compounds (as defined by the federal Comprehensive Environmental Responsibility, Compensation, and Liability Act, Section 101[14])
- Massachusetts Method for the Determination of Volatile Petroleum Hydrocarbons (VPH), Massachusetts Department of Environmental Protection, May 2004
- Massachusetts Method for the Determination of Extractable Petroleum Hydrocarbons (EPH), Massachusetts Department of Environmental Protection, May 2004
- Massachusetts Method for the Determination of Air-Phase Petroleum Hydrocarbons (APH), Massachusetts Department of Environmental Protection, December 2008
- Methods for Chemical Analysis of Water and Wastes (EPA-600/4-79-020)
- Montana Department of Natural Resources (DNRC) Board of Water Well Contractors, March 1997
- Montana Solid and Hazardous Waste Act (Title 26, Chapter 14, Montana Code Annotated 1953)
- Montana Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases, MDEQ, October 2003
- Procedures for Preparing Blind Duplicate and Spiked Field Samples in Water, Document Control R8-QAO-82-SOP-011, EPA
- Sampling for Hazardous Materials (course book EPA course 165.9, EPA Hazardous Response Support Division, Cincinnati, Ohio)
- Samplers and Sampling Procedures for Hazardous Waste Streams (January 1980, EPA document 600/2-80-018)
- Standard Methods for the Examination of Water and Wastewater, 16th Edition, APHA, et al., 1985
- Standard Operating Procedures for Field Samplers (EPA Region VIII ESD, 1986)
- Technical Guidance Document #2 (*Licensed Surveyor Required for Determining Monitoring Well Elevations*), MDEQ; <http://deq.mt.gov/LUST/TechGuidDocs/techguid2.pdf>

Technical Guidance Document #8 (*Laboratory Analytical Requirements for Petroleum Releases*), MDEQ; <http://deq.mt.gov/LUST/TechGuidDocs/techguid8.pdf>

Technical Guidance #10 (*Options for the Discharge of Petroleum-Contaminated Wastewater*), MDEQ; <http://deq.mt.gov/LUST/TechGuidDocs/techguid10.pdf>

Technical Guidance Document #11 (*Filtering or Decanting Samples Prior to Laboratory Analysis*), MDEQ; <http://deq.mt.gov/LUST/TechGuidDocs/techguid11.pdf>

Technical Guidance Document #18 (*Groundwater Sampling Methodologies*), MDEQ; <http://deq.mt.gov/LUST/TechGuidDocs/techguid18.pdf>

Test Methods for Evaluating Solid Waste (SW846, Second Edition and its subsequent revisions), 40 CFR 136, October 26, 1984, EPA

Test Methods For Evaluating Solid Waste (SW 846, Third Edition, 1996), EPA

APPENDIX 1

SOIL AND WATER ANALYTICAL LABORATORIES

DISCLAIMER: This list provides directory information on commercial firms that offer analyses of petroleum contaminated soil and water samples. All laboratories that are included on this list have provided a Quality Assurance Plan of professional quality, a list of all analyses performed, a list of all equipment used, a price list, and a list of the positions and qualifications of all employees. In addition, all companies on this list have indicated that they perform the VPH and EPH analyses according to Montana Department of Environmental Quality (DEQ) guidelines. The DEQ does not necessarily endorse any listed companies. We recommend that a prospective customer contact a number of companies for the best service and price. Listed companies reserve the right to evaluate the extent of their services on a case-by-case basis. This list is subject to change without notice.

Contact lab prior to sampling and shipping for proper procedures.

Advanced Analytical Associates
6656 Falcon Lane, Suite 1A
Bozeman, MT 59718-7652
(406) 522-9635
(406) 581-1454 Cell #

Alpine Analytical, Inc.
1315 Cherry Avenue
Helena, MT 59601
(406) 449-6282

Anatek Labs
1917 South Main
Moscow, ID 83843
(208) 883-2839

Energy Laboratories, Inc.
P.O. Box 30916
Billings, MT 59107
(406) 252-6325
(800) 735-4489

Energy Laboratories, Inc.
3161 Lyndale Avenue
Helena, MT 59601
(406) 442-0711

Pace Analytical
602 South 25th Street
Billings, MT 59101
(406) 254-7226

SVL Analytical
One Government Gulch
P.O. Box 929
Kellogg, ID 83837
(208) 784-1258
(800) 597-7144

U. S. Filter/Enviroscan
301 West Military Road
Rothchild, WI 54474
(715) 359-7226