DEPARTMENT OF ECOLOGY
State of Washington

Site Assessment Guidance for Underground Storage Tank Systems

Published January 2021
Revised October 2022
Publication 21-09-050

Publication and Contact Information

This document is available on the Department of Ecology's website at: https://fortress.wa.gov/ecy/publications/summarypages/2009059.html

For more information contact Ecology's underground storage tank unit.

UST hotline: (800) 826-7716

UST email: tanks@ecy.wa.gov

Mail: Underground Storage Tanks
P.O. Box 47600
Olympia, WA 98504-7600
Phone: 360-407-7170

Washington State Department of Ecology — www.ecology.wa.gov

• Headquarters, Olympia	360-407-6000
• Northwest Regional Office, Bellevue	206-594-0000
• Southwest Regional Office, Olympia	360-407-6300
• Central Regional Office, Union Gap	509-575-2490
• Eastern Regional Office, Spokane	509-329-3400

ADA Accessibility

The Department of Ecology is committed to providing people with disabilities access to information and services by meeting or exceeding the requirements of the Americans with Disabilities Act (ADA), Section 504 and 508 of the Rehabilitation Act, and Washington State Policy #188.

To request an ADA accommodation, contact Ecology by phone at (360) 407-7170 or email[1]. For Washington Relay Service or TTY call 711 or 877-833-6341. Visit Ecology's ADA website[2] for more information.

[1] ecyadacoordinator@ecy.wa.gov
[2] https://ecology.wa.gov/About-us/Accountability-transparency/Accessibility

Site Assessment Guidance for Underground Storage Tank Systems

Toxics Cleanup Program

Washington State Department of Ecology

Olympia, Washington

This page is purposely left blank.

Table of Contents

List of Acronyms

Acronym or Abbreviation	Definition
ASTM	American Society for Testing and Materials
BTEX	Benzene, toluene, ethylbenzene, and xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
EAP	Ecology's Environmental Assessment Program
EPA	Environmental Protection Agency
FID	Flame ionization detector
GC	Gas chromatograph
ICC	International Code Council
L&I	Washington State Department of Labor & Industries
MTCA	Model Toxics Control Act
MTBE	Methyl tertiary-butyl ether
NWTPH	Northwest Total Petroleum Hydrocarbon (method)
OSHA	Occupational Safety and Health Administration (federal)
PID	Photoionization detector
PPE	Personal protective equipment
QA/QC	Quality assurance/Quality Control
TPH	Total petroleum hydrocarbons
TPH-Dx	Total petroleum hydrocarbons – diesel- and heavy oil-range organics
TPH-Gx	Total petroleum hydrocarbons – gasoline range organics
TLC	Thin layer chromatography
UST	Underground storage tank
WAC	Washington Administrative Code
WISHA	Washington Industrial Safety and Health Act of 1973

Disclaimer

This document provides guidance to conduct Underground Storage Tank (UST) site assessments (including site checks) as required by the Washington UST regulations under chapter 173-360A WAC[3]. It is intended for persons with technical backgrounds and experience with UST systems.

WAC 173-360A-0730[4] outlines the requirements for conducting site assessments on regulated UST systems. This guidance provides supplemental information on sampling protocol, reporting of confirmed releases, and when a site assessment is required to be performed.

This guidance contains recommendations and best management practices that are not mandated by Washington state law or rule. Use best professional judgment when applying these guidelines to a specific UST site.

Although this guidance has undergone review to provide correct information, there is no assurance that this guidance is free from errors. The information in this guidance should be independently verified if something does not appear correct. This guidance does not establish or modify the rights or obligations of any person under the law. This guidance is not intended, and cannot be relied on, to create rights, substantive or procedural, enforceable by any party in litigation. The Washington State Department of Ecology (Ecology) may act at variance with this guidance and may modify or withdraw this guidance at any time. Further, in publishing this guidance, Ecology does not intend to impose upon itself any mandatory duties or obligations. Any regulatory decisions made by Ecology in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant fact.

[3] https://apps.leg.wa.gov/wac/default.aspx?cite=173-360A
[4] https://apps.leg.wa.gov/wac/default.aspx?cite=173-360A-0730

1.0 Introduction

This document provides guidance to underground storage tank Site Assessors and includes activities that are typically necessary to be performed up to the time that a release is confirmed or disproved. Refer to Ecology's *Guidance for Remediation of Petroleum Contaminated Sites*[1] for conducting follow up investigations to characterize the extent of a confirmed release.

This guidance document; however, does not intend to be a comprehensive "instruction manual" or textbook covering all UST systems and site conditions. For this reason, the Site Assessor's field observations, professional experience, and detailed documentation are essential.

1.1 Certification and licensing requirements

Site assessment investigations must be performed by an International Code Council (ICC)-certified Washington State Site Assessor, a Washington State Licensed Hydrogeologist, or a Washington State Professional Engineer, as described in WAC 173-360A-0930(3)[2]. The term Site Assessor is used throughout this document and may refer to any one of these qualified professionals.

1.2 Site assessment types

The UST regulations describe two types of site assessments. **With the exception of this section, site assessments referred to throughout this document include both site checks and site assessments.**

SITE CHECK – WAC 173-360A-0720(2)[3]

Use a site check to investigate an UST site when conditions indicate that a release to the environment *may* have occurred. A site check must be conducted within 30 days of identifying a suspected release. Situations requiring a site check include, but are not limited to, the following:

1. After discovery of a regulated substance or its constituents in soils, basements, sewer or utility lines, groundwater, in the air within buildings or other confined spaces, or surface waters.

[1] https://fortress.wa.gov/ecy/publications/documents/1009057.pdf
[2] https://apps.leg.wa.gov/wac/default.aspx?cite=173-360A-0930
[3] https://apps.leg.wa.gov/wac/default.aspx?cite=173-360A-0720

2. After an UST release detection method or test indicates a release may have occurred from the system.

3. After receiving direction from Ecology because a release is suspected.

4. When offsite environmental contamination is discovered and the UST system is the suspected source of the release. In these cases, the site check may be required at the direction of Ecology (or another agency).

SITE ASSESSMENT - WAC 173-360A-0730[4]

A site assessment investigates if a release to soil or groundwater occurred from an UST system when one of the following situations occur.

1. When suspending financial responsibility (for example, tank insurance) while tanks are temporarily closed. This does not apply to federal and state sites that are exempt from the financial responsibility requirements.

2. When the substance stored in an UST system changes from a regulated substance to an unregulated substance (that is, a change-in-service), a site assessment must be conducted **after** the tank system(s) are emptied and cleaned.

3. When an UST system, tank, piping, and/or dispenser is permanently closed by removal, the site assessment must be conducted **after** the UST system is removed. If an owner voluntarily removes an UST system that was previously closed in place or abandoned before December 22, 1998, a site assessment is required.

4. When an UST system, tank, piping, and/or dispenser is permanently closed in place, the site assessment must be conducted **after** the UST system is emptied and cleaned, and **prior** to filling the tank with an inert material.

5. When an UST operator wants to extend temporary closure for more than 12 months and the tanks or piping do not meet performance standards and upgrade requirements.

The Site Assessor must be present when the tank, piping, and dispenser of the UST system is removed.

[4] https://apps.leg.wa.gov/wac/default.aspx?cite=173-360A-0730

2.0 Data Gathering Activities

Before conducting field sampling activities, gather current and historical information about the UST facility, evaluate site conditions, and prepare a sampling and analysis plan.

2.1 UST sites with already-reported contamination

If the UST component or tank to be closed already has a confirmed release reported to Ecology and remediation is necessary, a site assessment is not required. In these cases, further characterization and remediation efforts should be made at the time of closure to reduce or eliminate the source of contamination.

2.2 Records review for site background information

The lists below describe general UST system and facility information the Site Assessor will find useful if collected before site assessment activities begin; they must also be included in the site assessment report, if applicable. When possible, collect this information before conducting field sampling activities and verify it after arriving on site. For background data which are not readily available, the Site Assessor should use best professional judgment to decide when it is appropriate to proceed with field sampling. Base this decision on the nature and extent of the missing data against site characteristics and the perceived importance of the missing data.

Facility Data:

- Business name.
- Property owner(s) and UST operator(s) names and contact information.
- Site address.

UST System Data: Check with the UST owner and operator and review readily available UST system plans, specifications, and other information to obtain the following information about each tank system.

- Capacity, dimensions, age, construction, and material of each tank and piping.
- Location of fill pipes, remote fills, containment sumps, vent piping, dispensers, and product piping runs, including to satellite dispensers.
- Current and historical substances stored.
- Type of leak detection systems used.

- Locations of observation wells and groundwater monitoring wells.
- History of previously-known leaks or spills, including type, volume, and date discovered.

Site Data: Collect the following information by reviewing available records, visiting the site, or locating utilities.

- Distances from tank(s) to nearby buildings and structures.
- Ecology's Confirmed and Suspected Contaminated Sites List to check if the site is listed. If so, it is recommended that the records be reviewed to determine where contamination is known to be present and how it might impact the current site assessment project.
- Type and location of below-ground utility lines (including water, sewer, electric, telephone and gas). Sanitary and storm sewers, water lines, and other buried utility lines and utility trenches can create pathways for released product, either liquid or vapor, to migrate in directions that are not anticipated by site soil characteristics or site hydrogeological. Contact Washington's Utility Notification Center[5] or *Call Before You Dig* (811 or 800-424-5555) before digging to determine locations of below-ground utilities.
- Locations of paved and unpaved areas.

Hydrogeological and Soil Characteristics: Review available information to determine site specific features associated with the site, such as:

- Depths to groundwater, including historical depths and seasonal fluctuations.
- Available data from previous soil or groundwater sampling conducted at the site.

2.3 Collecting site background information

Some site background information may be collected only during a field visit or by site research conducted before field sampling. An onsite visit can help determine field sampling approaches and locations. Activities that should be completed during a site inspection include:

- Visually inspect the ground surface for indications of current or past releases.
- Locate aboveground and buried UST system components to verify they are correctly shown on readily available plans or site map.
- Confirm the substance(s) currently stored in each tank.

[5] http://www.callbeforeyoudig.org/washington/

- Verify tank size(s) set in the automatic tank gauge (ATG), or by other known information.

- Identify above-ground utilities (such as overhead power lines) or surface indications of below-ground utilities (such as access covers, changes in pavement, surface mounding or depressions, vaults, or emergent piping).

During your onsite inspection, check the following areas for evidence of leaks or releases:

- **Vent pipes, fill pipes, and other risers** - Check and describe evidence of overfills around the base of the risers or on the ground surface.

- **Pavement and concrete cover** – Look for pavement patches or repairs that indicate subsurface investigations (for example, excavation test pits and borings) or problems (for example, tank or piping leaks) may have occurred. Look for oily substance stains, subsidence, buckling of pavement, or other changes in the paved surface.

- **Dispenser islands** - Remove lower panels around dispensers to look for cracks or stains at pump bases. Look for evidence of abraded hoses, staining on UST equipment, soil staining, or petroleum eroded paved areas near island. Check to see if dispensers are in good condition and not tilted, as if they might have been struck by a car. Note if under dispenser containment sumps are installed and if they appear liquid tight. If there is disconnected and capped piping, check for signs of leaking.

- **Submersible turbine pumps (STP)** - Note whether containment sumps are installed around the STPs and if they appear to be liquid tight. If turbines are directly buried in the soil, look for product staining on soil or signs of a recent release.

- **Storm drains** – Look for evidence of staining or a sheen around storm drains, which may indicate petroleum products have been flushed into these drains. Identify where drains lead and inspect trenches and drains for oil and silt.

- **Spill prevention equipment** - Check for signs of contaminated soil around fill pipes, tilted spill buckets, missing fill caps, evidence of recent excavation or repair work, and visible cracks or holes in the spill prevention equipment.

- **Vapor recovery system** – If the vapor recovery lines have condensate collection basins, check for evidence of product accumulation or leakage.

- **Monitoring or observation wells** – Measure depth to groundwater and check if there are signs of petroleum products in groundwater. Ask the owner or operator for previous monitoring or laboratory analytical reports.

- **Distressed vegetation** - Look for evidence of distressed vegetation, which may have been impacted by released or spilled regulated substances.

2.4 Field sampling and analysis plan preparation

The Site Assessor is responsible for preparing a sampling and analysis plan before conducting site assessment sampling. Except as provided in Section 4.2, the sampling plan should comply with the minimal sampling procedures specified in this document and include the following information.

- Conditions that led to a site assessment (for example, tank closure, environmental contamination, failed line or tank leak test).
- Sampling approach and methods.
- Environmental media (for example, soil, soil gas, groundwater) to be sampled.
- Number of samples, sample locations, and unique sample numbers to be used.
- Sample container and preservation procedures.
- Laboratory analysis to be performed, including an explanation as to why any required test outlined in Appendix A was omitted.
- Name of the Washington State certified laboratory to be used for chemical analysis.
- Description of quality assurance/quality control (QA/QC) procedures to be followed.
- Description of how soil and groundwater will be sampled, if groundwater is encountered.

Site Assessors must coordinate their sampling effort with the analytical laboratory to assure that adequate volumes of samples are collected, samples are properly preserved, and sample holding times are understood.

Unless explicitly requested by Ecology, or delegated agency, the sampling and analysis plan is not required to be submitted before sampling.

2.5 Alternative sampling procedures

The Site Assessor will decide when alternative sampling procedures are needed, due to variability among UST site conditions and UST system configurations. These procedures may be used only if they meet the substantive site assessment requirements, they can be justified to Ecology, and they are included with the site assessment report to be reviewed by Ecology (see requirements for reporting results of site assessments in Section 7.2.3).

The Site Assessor should contact Ecology's UST inspector overseeing site assessment activities to discuss if alternative sampling procedures will satisfy the requirements, when considering an alternative sampling plan. Justification for alternative sampling procedures cannot be based on economic considerations alone. As such, the Site Assessor shall document that the alternative sampling procedures used were equally as likely to determine if a release from the UST system occurred as the sampling procedures specified in WAC 173-360A-0730[6].

If satisfactory justification is not provided, Ecology may determine that further investigation and sampling is needed to meet the site assessment requirements.

[6] https://apps.leg.wa.gov/wac/default.aspx?cite=173-360A-0730

3.0 Health and Safety Requirements

A number of factors may constitute imminent dangers to the health and safety of personnel conducting onsite UST investigations. When conducting work around tanks, it's important to recognize the potential risks. Below is a short list of OSHA-documented incidents that resulted in fatalities over the past several years.

Tank-Related Incidents Reported to OSHA

Incident 1: In September 2019, an employee working inside a 10,000-gallon fiberglass gasoline storage tank was draining some brine water while cleaning the tank. The employee used a drill while inside the tank and ignited the gasoline vapors, exploding it, and setting it on fire. The employee was caught in the explosion and killed.

Incident 2: In September 2019, an employee was cutting a pipe at the bottom of an oil storage tank when the tank exploded, killing him.

Incident 3: In November 2015, Employee #1 and Employee #2 were performing repair work at a facility. Employee #1 was assigned to repair a crack that had developed in a 20,000-gallon stainless steel storage tank, while Employee #2 served as an attendant. Before work, atmospheric testing measured the oxygen level in the tank; however, its contents were not completely emptied. As Employee #1 was located inside the tank, performing TIG stick welding to repair the crack, an explosion occurred. Both Employees #1 and #2 suffered third-degree burns for which they were hospitalized and treated. Employee #1 died on December 25, 2015, as a result of his injuries, and Employee #2 was released from the hospital approximately two weeks after the incident.

The purpose of this section is to provide a general overview of health and safety considerations associated with conducting an UST site assessment. The Site Assessor is responsible for maintaining and managing a safe working environment while conducting site assessment activities.

3.1 Federal, state, and local regulations

Numerous federal, state, and local regulations mandate worker and public safety standards at dangerous waste sites and construction sites. Site Assessors are required to comply with these regulations. In particular, 29 CFR 1910.120[7], of the Code of Federal Regulations, and chapter

[7] https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.120

296-843 WAC[8] establish regulations for individuals working with hazardous substances, petroleum, and confined spaces.

For nearly all employers and employees in Washington State, the Washington Industrial Safety and Health Act (WISHA) requires compliance with workplace safety and health regulations administered by the Washington State Department of Labor and Industries (L&I). For contaminated site cleanup, in addition to core workplace safety requirements, chapter 296-843 WAC describes specific requirements for site safety plans, characterization, monitoring, and employee training.

L&I's *A Guide to Workplace Safety and Health in Washington State*[9] publication provides an overview of L&I's requirements and services, including employer and worker responsibilities. If you need additional assistance or copies of L&I regulations, contact L&I by calling 1-800-423-7233 or by visiting L&I's website[10].

Federal Occupational Safety and Health Administration (OSHA) standards are covered in 29 CFR Part 1910[11]. For more information on OSHA requirements, contact OSHA's Seattle office at 206-757-6677 or visit OSHA's website[12].

3.2 Health and safety plan

Proper planning can significantly prevent injuries during field operations. A site safety plan, which identifies potential hazards, must be completed before conducting site assessment field activities and kept available onsite. Each field worker should be educated on the plan, be given a copy of the plan, and be informed of any specific hazards. The site safety plan must comply with L&I regulations under WAC 296-843-12005.

3.3 Safety training requirements

All persons working on a contaminated UST site must have received health and safety training to meet the requirements of chapter 296-62 WAC[13] and all other applicable federal, state and local regulations.

[8] https://app.leg.wa.gov/wac/default.aspx?cite=296-843
[9] https://www.lni.wa.gov/dA/5f2b60572d/F416-132-000.pdf
[10] https://lni.wa.gov/safety-health/safety-rules/rules-by-chapter/
[11] https://www.osha.gov/laws-regs/regulations/standardnumber/1910
[12] http://www.osha.gov/
[13] https://app.leg.wa.gov/WAc/default.aspx?cite=296-62

3.4 Hazard communication

New or unanticipated releases of petroleum or hazardous substances (as defined in Section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980) discovered at the UST site must be communicated by the Site Assessors to all individuals working at the site.

4.0 Sampling Procedures

This section describes soil and groundwater sampling approaches and procedures for investigating a release and the minimum number of samples required to be collected. Although this section focuses on the sampling of petroleum hydrocarbons in soil and groundwater, which are commonly found at UST facilities, the procedures also apply to non-petroleum substances.

When determining the contaminants of concern, consider all substances a tank has historically or recently stored. This may include lead or fuel additives, for example, and depend on the age of the tank and when it was in use.

For guidance regarding sampling containers, preservation, and holding times for samples collected during the site check or site assessment, contact the laboratory where the samples will be analyzed.

The Site Assessor must be on-site during all sampling activities and when tank(s) and piping are removed.

4.1 Field screening

When conducting a site assessment, Ecology recommends using field instruments to preliminarily evaluate if a release occurred and identify sampling areas not previously listed in the sampling plan. Field instruments also provide a way to monitor potential exposure to regulated substances as a health and safety precaution. Field instruments for air and soil screening include, but are not limited to:

- Visual and olfactory observation.
- Sheen tests.
- Non-aqueous phase liquid jar tests.
- Photoionization detectors.
- Flame ionization detectors.
- Thin layer chromatography.
- Portable gas chromatographs.
- Colorimetric test kits.
- Fiber optic chemical sensors

See the Field Screening Methods section of Ecology's *Guidance for Remediation of Petroleum Contaminated Sites* for a description of how and when to use each field screening method and their advantages.

4.2 Soil sampling

The goal of a site assessment is to collect enough onsite data to identify if a release occurred from an UST system. A Site Assessor relies on historical release information, field observations, and field instruments to identify where contamination is most likely present. Acceptable soil sampling procedures are described in the following sections and MTCA's *Minimum Number and Location of Soil Samples* table (Appendix B).

4.2.1 Soil characterization

A site assessment report must include a description of the surface gradient, soil classification, and fill material at the UST site. To report soil characteristics consistently, use soil classification terminology found in Appendix C and derived from ASTM International, ASTM D2487-17e1, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

4.2.2 Soil sampling methods

The Site Assessor should collect and analyze discrete grab samples at all times unless composite samples are appropriate, as indicated below. Discrete samples minimize contaminant loss through volatilization and non-detection of hot spots because of chemical dilution. When sampling soil from an open excavation, remove at least six inches of soil so samples can be collected from an unexposed area.

Depending on site conditions, collect soil samples using one or more of the following methods.

- HAND AUGER/SOIL CORER: A hand tool used if large rocks, cemented soil layers, solid fill material, or extremely deep sample collection points are not a factor.

- SPLIT SPOON: Split spoon samplers require the use of drilling rigs. Consideration should be given to selecting the best size and length of split spoon sampler to retrieve sufficient volume to accommodate the desired analysis. Further, subsurface rocks can prevent soil filling the spoon during pushing, so sampling in even slightly rocky conditions can be challenging.

- SHELBY TUBE: Shelby tube sample collection devices also require the use of drilling rigs. Like split spoon samplers, Shelby tube samplers are pushed ahead of the drilling stem, and offer collection of a relatively undisturbed sample.

- BACKHOE AND HAND TOOLS: During most tank removals and when subsurface soils are very rocky or large quantities of debris are present, a backhoe is used to collect soil samples at the desired depth. Depending on the size of the excavation and soil type present, a backhoe is useful for collecting samples from sidewalls and bottoms of excavations.

  The excavator collects a bucket of soil from the desired sampling depth and brings it to the ground surface. In order to minimize contamination and loss of product through volatilization, the Site Assessor should collect the soil sample from the center of the bucket and at least six (6) inches deep.

  When excavated soils are stockpiled, use hand tools to collect representative samples from the stockpiled soil. Soil samples shall not be collected from the surface of the pile because that area may contain lower contaminant concentrations as a result of volatilization.

  The Site Assessor may composite samples to evaluate excavated soils provided only two individual field samples are composited equally and mixing occurs in the lab immediately before analysis. Coordination with the lab is necessary to lab-composite the specific samples collected.

The Site Assessor carefully collects and containerizes soil cutting (or piles and covers with plastic sheeting), pending analytical laboratory results. The results will guide appropriate waste management and disposal. All soil borings must be decommissioned, in accordance with Washington's *Minimum Standards for Construction and Maintenance of Wells* regulations (Chapter 173-160 WAC[14]).

TAKE CAUTION: Before operating drilling rigs and other excavating equipment, locate buried utility lines, and identify product piping material. If an impressed current system is present, the electrical power to the rectifier must be disconnected prior to the UST removal. Operator and Ecology records can provide information about UST equipment installed, and as-built diagrams may help identify the location of underground lines.

[14] https://app.leg.wa.gov/wac/default.aspx?cite=173-160

4.2.3 Required number and location of soil samples

The number of soil samples needed to adequately sample a site will vary depending on site-specific conditions and UST system designs and installation methods. Site Assessors must collect soil samples around a tank and associated piping where contamination is observed, field instruments indicate contamination exists, or contamination is most likely to be present.

Contamination is often present at the lowest point of the interface between the backfill material and native soil beneath the tank. The less permeable native soil beneath the relatively coarse-grained backfill material (usually pea gravel, crushed rock, or sand) can slow the progress movement of a released substance. If fill dirt was used as backfill material, or the interface is not apparent and no field evidence of contamination exists, soil samples must be collected one to two feet beneath the bottom of the tank or piping system.

If the existing excavation was part of an over-excavation of a previous tank removal, it may be filled with an abundance of pea gravel that prevents sampling adjacent to the tanks. In this case, the Site Assessor should document in the report the size of the previous excavation (including below grade surface depth and horizontal widths) that was subsequently filled with tanks and pea gravel. As pea gravel is removed, conduct field screening of the material to identify depth and locations of impacted areas and help with sorting stockpiles. Contaminated pea gravel shall be disposed of appropriately.

Since pea gravel cannot be analyzed by a laboratory, additional effort to dig wide and deep may need to be taken to collect native soil using the backhoe bucket. Another option is to use boring equipment to collect native soil samples from a depth that represents soil beneath the bottom of the tanks.

If field observations or screening do not identify contaminated areas or more appropriate sampling locations, use Appendix B to determine the minimum number and location of soil samples to be collected. Deviations from these minimum requirements may be permitted on a site-specific basis provided alternative sampling strategies are justified and consistent with the procedures and criteria described in Section 2.5.

If water is encountered within the backfill material or within the excavation, collect soil samples at the approximate top of the apparent water table. In these cases, Ecology will not accept a grab water sample as quantitatively representative of groundwater conditions.

4.3 Groundwater sampling

Groundwater samples must be collected during a site check or site assessment when any of these five conditions exist.

1) The lowest point of the UST system, including piping, is located in groundwater.

2) Field instruments or analytical results indicate that a release may have occurred, and the lowest point of the UST system, including piping, is within two feet of the seasonal high water table.

3) Existing monitoring wells allow for the collection of representative samples and the wells are located such that they will provide useful data.

4) Observation wells indicate the presence of regulated substances.

5) Physical conditions prevent soil sample collection in accordance with this guidance and groundwater sampling is used as part of an alternative sampling approach (see Section 2.5).

6) Site Check results suggest an immediate assessment of groundwater conditions is necessary to protect human health or the environment (for example, a suspected release has occurred in the immediate vicinity of a drinking water well).

If groundwater sampling is required and groundwater flow direction is known, collect a minimum of three groundwater samples (one up gradient and two downgradient of the potential contamination source). When the groundwater flow direction is uncertain, collect at least four groundwater samples around the UST system.

If groundwater samples are collected from groundwater monitoring wells, they must be checked for the presence of non-aqueous-phase liquids and have a cased water column. Non-aqueous-phase liquids include free petroleum products that may be either floating on top of the water or in a separate layer at the bottom of the well casing. Non-aqueous liquids can be detected using one of the following methods:

1. Before purging, carefully lower a clear bailer into the well and observe liquids removed from the top and the bottom of the water column. If petroleum is visibly floating on top of water, measure and document the thickness of free product.

2. Use an electronic device designed to detect and measure the thickness of non-aqueous liquids. Follow manufacturer instructions to record product thickness, and measure the thickness of the non-aqueous layer.

Ecology recommends using a low-flow groundwater sampling method. If not available, samples can also be collected using bailers or positive displacement pumping systems. Before collecting

groundwater samples, purge and develop monitoring wells as described in Ecology's *Standard Operating Procedure EAP099*[15].

When sampling for petroleum products in groundwater, use inert sampling devices made of glass, polytetrafluoroethylene (for example, Teflon), or stainless steel. If groundwater samples are analyzed for metals, submit unfiltered samples to the laboratory.

It is common for observations wells to be installed around tank systems so groundwater can be checked for the presence of free product or for removing it quickly when discovered. Observation wells do not meet monitoring well specifications so representative groundwater samples cannot be collected from them. They do; however, provide the Site Assessor an opportunity to check if contamination is present before removing tanks.

In high groundwater areas or where native soils are less permeable, a tank pit will create a mounding effect to the groundwater surrounding it. As a result, observations wells should not be used to evaluate depth to groundwater, groundwater flow direction, or quantitative contaminant concentrations. The mounding effect may also influence groundwater levels in nearby groundwater monitoring wells.

4.4 Discovery of highly contaminated media

During a site assessment, Site Assessors may encounter free product or soils heavily saturated with released regulated substances. This may include pools of free product on the ground surface or in excavations, highly contaminated soil or backfill material, and non-aqueous liquids floating on (or sinking below) water. When free product or highly contaminated soil is discovered, a release from the UST system is confirmed and no further site assessment sampling is required. As with other confirmed releases, the Site Assessor must report the release to Ecology and the tank owner within 24 hours. A site characterization must be performed in accordance with the Model Toxics Control Act (Chapter 173-340 WAC[16]).

4.5 Decontamination procedures

To collect representative samples and avoid sample cross-contamination, decontaminate sampling equipment and containers before and after sampling. Cross-contamination can be a significant problem when attempting to identify extremely low concentrations of organic compounds or when working with highly-contaminated soils.

In most sampling situations, you will thoroughly scrub sampling equipment with a stiff brush in a water solution and laboratory anionic detergent and then rinse with deionized water. If concentrated petroleum products or highly contaminated soils are encountered during

[15] https://fortress.wa.gov/ecy/publications/SummaryPages/1803214.html
[16] https://app.leg.wa.gov/wac/default.aspx?cite=173-340

sampling, additional measures may be required to remove heavy petroleum residues from sampling equipment.

After lids are tightly sealed on the collected sample, clean the exterior portion of sample containers using similar procedures described for cleaning sampling equipment. Solvents should not be used to wash the container because of the potential to contaminate the sample.

Decontamination wash water and rinsate solutions must be containerized and properly disposed in accordance with federal, state, and local regulations. Include disposal records in the site assessment report.

4.6 Field or mobile laboratories

Field or mobile laboratories range in size from small trailer-mounted units with simple analytical equipment to fully-equipped accredited environmental laboratories that compare to a fixed laboratory. Mobile laboratories report results quickly allowing the Site Assessor to make real-time decisions in the field and adjust analytical methods to site-specific conditions. Potential adjustments include changing the suite of chemicals being tested, sampling protocols, sample preparation methods, or laboratory instrumentation.

For more detailed information about mobile labs, refer to the Field or Mobile Laboratories section in Ecology's *Guidance for Remediation of Petroleum Contaminated Sites*.

5.0 Sample Analytical Requirements

5.1 Contaminants commonly associated with petroleum releases

Petroleum products are a complex mixture of hydrocarbons that tend to separate into five phases when released from an UST system: (1) vapors, (2) dissolved in groundwater, (3) adsorbed to soil, (4) in soil pore space, and (5) floating on groundwater. The composition of petroleum constituents dissolved in groundwater is heavily dominated by aromatics, such as benzene, toluene, ethylbenzene, and xylene (collectively, BTEX).

At older releases, BTEX may be present at the site only in small quantities because they tend to degrade more quickly than petroleum products as a whole. Older spills, however, can retain pockets of material resembling free product. In these cases, BTEX may be present at concentrations similar to those found at a new spill.

For more information about the characteristics of petroleum releases, review Ecology's *Guidance for the Remediation of Petroleum Contaminated Sites*[17].

5.2 Minimum laboratory analysis required

The minimum requirements for laboratory analysis depend on substances currently and historically stored in the UST. Because site assessments identify **if** a release occurred rather than characterize the extent of a release, you do not need to identify and measure all suspected contaminants. Typically, a Site Assessor can confirm a release using the minimum required laboratory analysis described in Appendix A.

In situations where the Site Assessor cannot determine the type of substance stored or the appropriate analysis, contact Ecology's Toxics Cleanup Program for advice on the correct analysis to perform.

Appendix A shows required and recommended analytical testing for petroleum and unknown substances. If the UST stores a hazardous substance, analyze the sample for that hazardous substance along with the most common byproducts associated with the substance. The specific analytical methods used must detect a constituent at or below the cleanup action levels identified in Appendices D and E of this document.

[17] https://fortress.wa.gov/ecy/publications/documents/1009057.pdf

6.0 Quality Assurance and Quality Control Requirements

During a site assessment, collect samples with sufficient quality assurance and quality control (QA/QC) procedures to obtain representative and reliable results. The following sections describe steps a Site Assessor can take to assure data from sampling activities accurately assesses the presence or absence of contamination at a site.

6.1 Laboratory quality control and quality assurance

All samples must be submitted to a laboratory accredited under chapter 173-50 WAC[18]. Ecology's Manchester Lab maintains an extensive list of labs throughout the country that meet this criteria. Use Manchester's Lab Search[19] tool to find a lab.

It is important to routinely run the following required quality control analysis because they provide information for interpreting the accuracy, precision, and detection capabilities of the analytical procedures.

- Check standards – A standard with a known concentration that is used to estimate the precision of the method and to check for bias due to calibration error.
- Duplicates – Two samples analyzed from the same media used to check the testing precision of field sampling, preservation, or storage internal to the laboratory.
- Matrix spike – A calibration technique used to evaluate the performance of an analytical method by determining the recovery of a known amount of contaminant spiked into a sample.
- Blanks – A sample of analyte-free media used to verify absence of instrument or laboratory contamination.

Laboratories are required to use QA/QC procedures. Site Assessors have two approaches to verify these requirements are met.

1. Obtain from the laboratory the QA/QC results for each batch of laboratory analysis performed in addition to the detailed records of the site assessment. The Site Assessor reviews the QA/QC data and includes them with the site assessment report.

[18] https://apps.leg.wa.gov/wac/default.aspx?cite=173-50
[19] https://apps.ecology.wa.gov/laboratorysearch/

2. Obtain from the laboratory director a letter stating the laboratory operates and maintains records of its QA/QC program for site assessment samples and that their results meet the standards identified in this document.

6.2 Field quality control and quality assurance

Field QA/QC should include one duplicate sample collected for each sampled matrix (for example, soil, groundwater, and free product) to provide an estimate of the total variability in sampling and analytical procedures. Duplicate samples submitted to the laboratory must have a unique identifying number (for example, "Sample 1 Dup" for a duplicate to "Sample 1"). A transport blank collected from each sampled matrix should also accompany samples being transported to the laboratory.

Generally, transfer and rinsate blanks are not required for site assessment sampling because of the minimal nature of these investigations. If a release is confirmed and further investigations are necessary, then blanks need to be included in the Quality Assurance Project Plan.

6.3 Documentation of field activities

The Site Assessor should write field notes using insoluble ink to record times, dates, depths, and locations of all samples; dated daily events, observations, and field measurements; weather conditions; name of individual documenting field notes; and any other applicable information obtained during the field investigation. Notes and photographs should document conditions and any unusual circumstances encountered in the investigation. Field notes, photographs, and other site-specific records should be kept for a minimum of six years to help reconstruct sampling procedures and, if necessary, to aid in legal testimony. Additional information on documentation and custody is presented in Ecology's *Guidance for Remediation of Petroleum Contaminated Sites*.

6.4 Chain of Custody

Chain of Custody includes the following: sample identification, security seals and locks, security procedures, chain of custody record, and field log book. All samples must immediately be placed in decontaminated containers (see Section 4.5) and be tightly sealed and cooled on ice. The laboratory will provide labels to uniquely identify and adhere to each sample.

If you ship samples to the lab or deliver them after the lab has closed, use sample custody seals provided by the lab. The sampler must sign these seals and affix them to the sample cooler in a way that would require breaking the seal to open the cooler. If the sampler delivers samples directly to the laboratory, custody seals are not required.

Fill out a Chain of Custody form for all samples submitted for analysis. Maintain this sheet from the time the sample is collected to the time it is submitted to the lab. Obtain chain of custody forms from the lab.

7.0 Results Evaluation and Reporting Requirements

7.1 Evaluation of field sampling results

To evaluate if regulated substances released to the environment and determine if further investigations and cleanup are needed, compare sample concentrations to MTCA soil and groundwater cleanup levels using the following approaches.

7.1.1 Tanks storing petroleum substances

Analyze site assessment samples based on current and historical petroleum product(s) stored in the tank. Appendix A lists indicator constituents and required analysis for UST sites where petroleum substances are stored.

7.1.2 Tanks storing hazardous substances

For hazardous substance USTs, (as defined in WAC 173-360A-0150[20] and on CERCLA's list of hazard substances[21]), analyze site assessment samples for the hazardous substance **and** the most common byproducts associated with the hazardous substance. Compare analytical results to the appropriate MTCA cleanup standards in chapter 173-340 WAC[22].

7.2 Reporting requirements

7.2.1 No confirmed contamination

If site assessment sampling results indicate no contamination poses a threat to human health and the environment, a *Site Assessment Checklist*[23] (completed by the Site Assessor), site assessment sampling report, and *Permanent Closure Checklist*[24] (completed by the Decommissioner) must be submitted to Ecology within 30 days. For ease of reporting, the site assessment report may include the checklists.

These three documents must be provided to the owner and/or operator in a timely manner so that the owner or operator can submit them to Ecology within 30 days of completing the site assessment activities.

[20] https://apps.leg.wa.gov/wac/default.aspx?cite=173-360A-0150
[21] https://www.epa.gov/epcra/consolidated-list-lists-under-epcracerclacaa-ss112r-june-2019-version
[22] https://app.leg.wa.gov/wac/default.aspx?cite=173-340
[23] https://fortress.wa.gov/ecy/publications/SummaryPages/ECY010158.html
[24] https://fortress.wa.gov/ecy/publications/SummaryPages/ECY02094.html

7.2.2 Confirmed contamination

The Site Assessor, tank owner, or tank operator must report confirmed releases from an underground storage tank system to the regional Ecology office **within 24 hours**. A Site Assessor shall immediately notify tank owners and operators of a confirmed release. **Ecology requires only one party to report the release but failure of any party to report a release is a compliance issue for all parties.**

The reporting party should have all the information about the facility and the release. Ecology will enter the report in its Environmental Report Tracking System (ERTS) and generate an ERTS tracking number.

Within 30 days of completing site assessment activities, the owner or operator is responsible for signing and submitting the *Permanent Closure Checklist* (completed by the Decommissioner) and *Site Assessment Checklist* (completed by the Site Assessor).

The MTCA regulations require the UST owner or operator to investigate the extent of contamination at the site. After collecting additional soil and groundwater samples that document the extent of contamination, an environmental consultant prepares a site characterization report for submittal to Ecology within 90 days after confirming contamination at the site. Ecology recommends including any previously-submitted checklists with the site characterization report.

7.2.3 Site assessment report contents

The site assessment report shall include the following items, if applicable. Appendix F includes recommended sections for a site assessment report.

- The Site Assessor name and company.
- Copy of WA State Site Assessor ICC certification, WA State Professional Engineer license, or WA State Hydrogeologist license that demonstrates the qualification to conduct site assessment work.
- Location of the UST site on a site and vicinity map.
- Parcel number.
- A summary of information collected before field sampling, including history of the current, and previous UST systems.
- UST system data (see Section 2.2), including tank dimensions.
- Location and status of any previous and remaining USTs.
- Soil characteristics (see Unified Soil Classification System in Appendix C).

- Depth, width, and type of bedding and backfill materials.
- Depth to native soil and sampling locations.
- Depth to the top of the tank before its removal.
- Apparent water in the tank excavation, or, if not present, information about depths to groundwater in nearby wells or other sources.
- Description of surrounding land use, including direction of surface gradient surrounding the UST system.
- Summary of field sampling activities conducted, including the number and types of samples collected; the methods used to collect and analyze the samples; and the name and address of the lab analyzing samples. The summary must provide justification for, and a description of, alternative sampling procedures if they differ from those specified in this guidance (see Section 2.5).
- Site diagram(s) showing the locations and unique identifying numbers for all tanks, piping, dispensers, and samples analyzed by a lab. Distinguish groundwater samples from soil samples. Show sample depths and approximate limits of excavation pit. Include a north arrow; adjacent buildings and structures; on-site and nearby utilities; and adjacent streets.
- Description of factors that may have compromised data quality or the validity of the sampling and analysis results.
- Data table summarizing each unique sample identification name, sample type, collection date, depth, and lab results. Include units, analytical method, detection limit, and MTCA cleanup level for each analyzed constituent. The table should clearly note if the Site Assessor composited stockpiled soil samples.
- Receipts for disposal of contaminated soils, regulated product, sludge material, and tanks.
- Conclusions about whether a release of a regulated substance from the UST system assessed has occurred.
- Description of any recommendations made to the UST owner or operator for further site characterization of potentially contaminated soil or groundwater.
- Description of remediation activities planned for the future, specify if no remediation activities are planned.
- Signature of the Site Assessor who performed the site assessment.

Appendices

Appendix A. Required testing for petroleum releases (from MTCA Table 830-1)

	Gasoline Range Organics (GRO)[1]	Diesel Range Organics (DRO)[2]	Heavy Oils (DRO)[3]	Mineral Oils[4]	Waste Oils and Unknown Oil[5]
Volatile Petroleum Compounds					
Benzene	X[6]	X[7]			X[8]
Toluene	X[6]	X[7]			X[8]
Ethyl benzene	X[6]	X[7]			X[8]
Xylenes	X[6]	X[7]			X[8]
n-Hexane	X[9]				
Fuel Additives and Blending Compounds					
Dibromoethane, 1-2 (EDB); and Dichloroethane, 1-2 (EDC)	X[10]				X[8]
Methyl tertiary-butyl ether (MTBE)	X[11]				X[8]
Total Lead and Other Additives	X[12]				X[8]
Other Petroleum Components					
Carcinogenic PAHs		X[13]	X[13]		X[8]
Naphthalenes	X[14]	X[14]	X[14]		X[14]
Other Compounds					
Polychlorinated Biphenyls (PCBs)			X[15]	X[15]	X[8]
Halogenated Volatile Organic Compounds (VOCs)					X[8]
Other	X[16]	X[16]	X[16]	X[16]	X[16]
Total Petroleum Hydrocarbons Methods					
TPH Analytical Method for Total TPH (Method A Cleanup Levels)[17]	NWTPH-Gx	NWTPH-Dx	NWTPH-Dx	NWTPH-Dx	NWTPH-Gx & NWTPH-Dx
TPH Analytical Methods for TPH fractions (Methods B or C)[17]	VPH	EPH	EPH	EPH	VPH and EPH

Use of Appendix A: An "X" in the box means that the testing requirement applies to groundwater and soil if a release is known or suspected to have occurred to that medium, unless otherwise specified in the footnotes. A box with no "X" indicates (except in the last two rows) that, for the type of petroleum product release indicated in the top row, analyses for the hazardous substance(s) named in the far-left column corresponding to the empty box are not typically required as part of the testing for petroleum releases. However, such analyses may be required based on other site-specific information. Note that testing for Total Petroleum Hydrocarbons (TPH) is required for every type of petroleum release, as indicated in the bottom two rows of the table. The testing method for TPH depends on the type of petroleum released and whether Method A or Method B or C is being used to determine TPH cleanup levels. See WAC 173-340-830 for analytical procedures. The footnotes to this table are important for understanding the specific analytical requirements for petroleum releases.

Footnotes:

[1] The following petroleum products are common examples of GRO: automotive and aviation gasolines, mineral spirits, stoddard solvents, and naphtha. To be in this range, 90% of the petroleum components need to be quantifiable using the NWTPH-Gx; if NWTPH-HCID results are used for this determination, then 90% of the "area under the TPH curve" must be quantifiable using NWTPH-Gx. Products such as jet fuel, diesel No. 1, kerosene, and heating oil may require analysis as both GRO and DRO depending on the range of petroleum components present (range can be measured by NWTPH-HCID). (See footnote 17 on analytical methods).

[2] The following petroleum products are common examples of DRO: Diesel No. 2; fuel oil No. 2, light oil (including some bunker oils). To be in this range, 90% of the petroleum components need to be quantifiable using the NWTPH-Dx quantified against a diesel standard. Products such as jet fuel, diesel No. 1, kerosene, and heating oil may require analysis as both GRO and DRO depending on the range of petroleum components present as measured in NWTPH-HCID.

[3] The following petroleum products are common examples of the heavy oil group: Motor oils, lube oils, hydraulic fluids, etc. Heavier oils may require the addition of an appropriate oil-range standard for quantification.

[4] Mineral oil means non-PCB mineral oil, typically used as an insulator and coolant in electrical devices such as transformers and capacitors.

[5] The waste oil category applies to waste oil, oily wastes, and unknown petroleum products and mixtures of petroleum and nonpetroleum substances. Analysis of other chemical components (such as solvents) than those listed may be required based on site-specific information. Mixtures of identifiable petroleum products (such as gasoline and diesel, or diesel and motor oil) may be analyzed based on the presence of the individual products, and need not be treated as waste and unknown oils.

[6] When using Method A, testing soil for benzene is required. Furthermore, testing groundwater for BTEX is necessary when a petroleum release to groundwater is known or suspected. If the groundwater is tested and toluene, ethyl benzene or xylene is in the groundwater above its respective Method A cleanup level, the soil must also be tested for that chemical. When using Method B or C, testing the soil for BTEX is required and testing for BTEX in groundwater is required when a release to groundwater is known or suspected.

[7] (a) For DRO releases from other than home heating oil systems, follow the instructions for GRO releases in Footnote (6).

(b) For DRO releases from typical home heating oil systems (systems of 1,100 gallons or less storing heating oil for residential consumptive use on the premises were stored), testing for BTEX is not usually required for either groundwater or soil. Testing of the groundwater is also not usually required for these

systems; however, if the groundwater is tested and benzene is found in the groundwater, the soil must be tested for benzene.

[8] Testing is required in a sufficient number of samples to determine whether this chemical is present at concentrations of concern. If the chemical is found to be at levels below the applicable cleanup level, then no further analysis is required.

[9] Testing for n-hexane is required when VPH analysis is performed for Method B or C. In this case, the concentration of n-hexane should be deleted from its respective fraction to avoid double-counting its concentration. n-Hexane's contribution to overall toxicity is then evaluated using its own reference dose.

[10] Volatile fuel additives (such as dibromoethane, 1-2 EDB (CAS# 106-93-4) and dichloroethane, 1-2 EDC (CAS# 107-06-2)) must be part of a volatile organics analysis (VOA) or GRO-contaminated groundwater. If any is found in the groundwater, then the contaminated soil must also be tested for these chemicals.

[11] Methyl tertiary-butyl either (MTBE) (CAS# 1634-04-4) must be analyzed in GRO-contaminated groundwater. If any is found in groundwater, then the contaminated soil must also be tested for MTBE.

[12] (a) For automotive gasoline where the release occurred prior to 1996 (when "leaded gasoline" was used), testing for lead is required unless it can be demonstrated that lead was not part of the release. If this demonstration cannot be made, testing is required in a sufficient number of samples to determine whether lead is present at concentrations of concern. Other additives and blending compounds of potential environmental significance may need to be considered for testing, including; tertiary-butyl alcohol (TBA); tertiary-amyl methyl ether (TAME); ethyl tertiary-butyl ether (ETBE); ethanol; and methanol. Contact the department for additional testing recommendations regarding these and other additives and blending compounds.

(b) For aviation gasoline, racing fuels and similar products, testing is required for likely fuel additives (especially lead) and likely blending compounds, no matter when the release occurred.

[13] Testing for carcinogenic PAHs is required for DRO and heavy oils, except for the following products for which adequate information exists to indicate their absence: Diesel No. 1 and 2, home heating oil, kerosene, jet fuels, and electrical insulating mineral oils. The carcinogenic PAHs include benzo(a)pyrene, chrysene, dibenzo(a,b)anthracene. ideno(1,2,3-cd)pyrene, benzo(k)fluoranthese, benzo(a)anthracene, and benzo(b)fluoranthene.

[14] (a) Except as noted in (b) and (c), testing for the non-carcinogenic PAHs, including the "naphthalenes" (naphthalene, 1-methyl-naphthalene, and 2-methyl-napthalene) is not required when using Method A cleanup levels, because they are included in the TPH cleanup level.
(b) Testing of soil for naphthalenes is required under Methods B and C when the inhalation exposure in evaluated.
(c) In napthalenes are found in ground water, then the soil must also be tested for napthalenes.

[15] Testing for PCBs is required unless it can be demonstrated that:

(1) the release originated from an electrical device manufactured for use in the United States after July 1, 1979;

(2) oil containing PCBs was never used in the equipment suspected as the source of the release (examples of equipment where PCBs are likely to be found include transformers, electric motors, hydraulic systems, heat transfer systems, electromagnets, compressors, capacitors, switches, and miscellaneous other electrical devices); or,

(3) the oil release was recently tested and did not contain PCBs.

[16] Testing for other possible chemical contaminants may be required based on site-specific information.

[17] The analytical methods NWTPH-Gx, NWTPH-Dx, NWTPH-HCID, VPH, and EPH are methods published by the Department of Ecology and available on the department's website: https://fortress.wa.gov/ecy/publications/publications/97602.pdf.

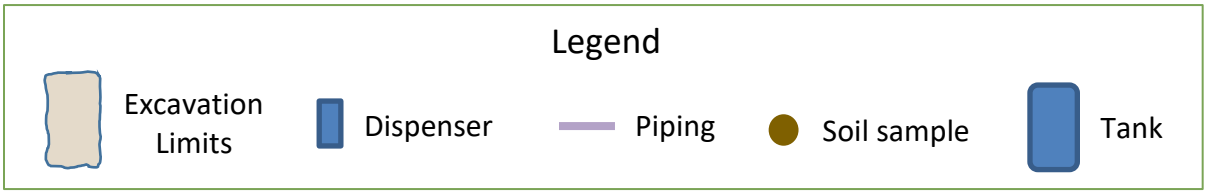
Appendix B. Minimum number and location of soil samples (from UST Table 0730-1)

<table>
<tr><th></th><th>Tanks</th><th>Piping</th><th>Dispenser</th></tr>
<tr><td>In Place</td><td>Collect the following samples around the excavation zone where contamination is most likely to be present:
When assessing single tank with a capacity of < 9,000 gallons, collect three samples, one at each end and one on another side of the tank.[1,2]
When assessing single tank with a capacity of ≥ 9,000 gallons, collect four samples, one at each side of the tank.[1,2]
When assessing multiple tanks in an excavation zone, collect four samples for the first tank and two additional samples for each additional tank, spacing the samples evenly around the excavation zone.[1,2]</td><td>Collect one sample for every 50 feet of piping. For example, collect one sample if the piping run is less than 50 feet and two samples if the piping run is 50 to 100 feet. Collect the samples adjacent to the piping where contamination is most likely to be present, such as at connections, fittings, or elbows.[1,2]</td><td>Collect one sample adjacent to each dispenser.[1,2]</td></tr>
<tr><td rowspan="3">Removed</td><td>Collect the following samples within the excavation zone where contamination is most likely to be present:
When assessing single tank with a capacity of < 9,000 gallons, collect three samples, one beneath the tank,[2] one beneath where the piping from the tank entered a sidewall, and one from another sidewall.
When assessing single tank with a capacity of ≥ 9,000 gallons, collect five samples, one from beneath the tank,[2] one beneath where the piping from the tank entered a sidewall, and one from each of the other three sidewalls.
When assessing multiple tanks from an excavation zone, collect five samples for the first tank and two additional samples for each additional tank, one beneath each tank,[2] one beneath where piping from each tank entered a sidewall, and spacing remaining samples evenly around the sidewalls.</td><td rowspan="3">Collect one sample for every 50 feet of piping. For example, collect one sample if the piping run is less than 50 feet and two samples if the piping run is 50 to 100 feet. Collect the samples beneath the piping where contamination is most likely to be present, such as at connections, fittings, or elbows.[2]</td><td rowspan="3">Collect one sample beneath each dispenser.[2]</td></tr>
<tr><td>Collect the following samples from excavated soils where contamination is most likely to be present:</td></tr>
<tr><td><table><tr><th>Cubic Yards of Soil</th><th>Minimum Number of Samples</th></tr><tr><td>0-25
26-50
51-100
101-500
501-1000
1001-2000
>2000</td><td>1
2
3
5
7
10
10 + 1 additional sample for each additional 500 cubic yards of soil</td></tr></table></td></tr>
</table>

[1] Horizontal distance: The specified samples must be collected from native soil as close as practicable to, but no more than ten feet from the applicable tank, pipe, or dispenser.

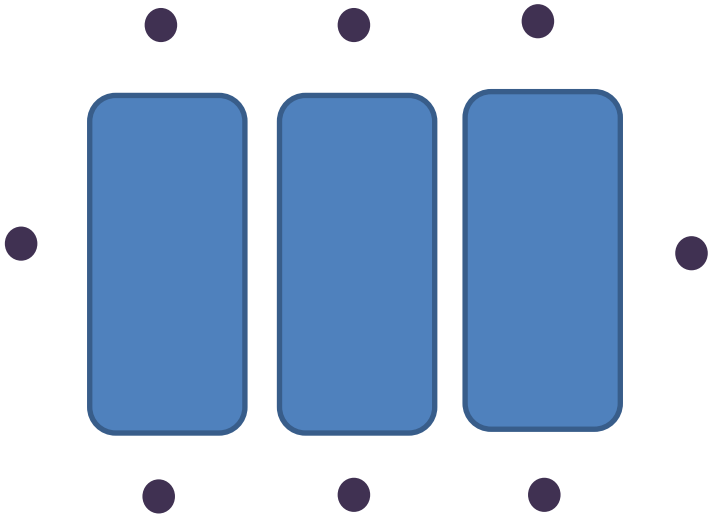
[2] Vertical distance: The specified samples must be collected from native soil as close as practicable to the bottom of the applicable tank, pipe, or dispenser. If groundwater is encountered, soil samples must be collected at the approximate top of the water table.

Sample location examples



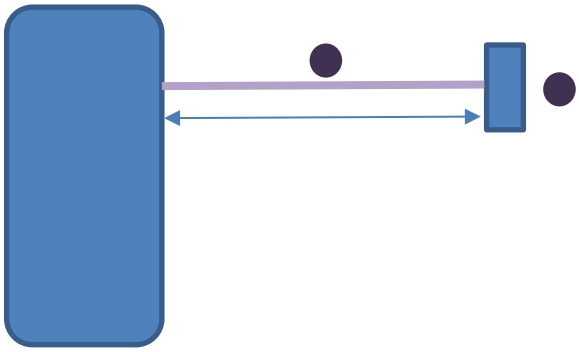
SCENARIO 1: MULTIPLE TANKS REMAIN IN PLACE

Collect four soil samples for the first tank **plus two additional** samples for each extra tank. Example: Collect eight soil samples for three tanks.



SCENARIO 2: PIPING OR DISPENSER REMAINS IN PLACE

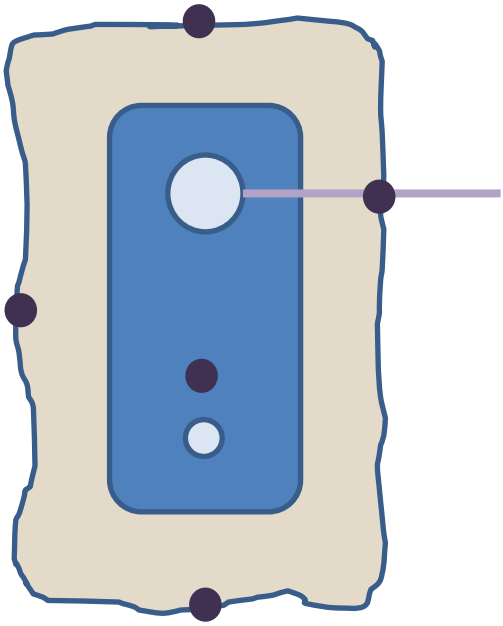
Collect one soil sample adjacent to each dispenser and for every 50 feet of piping.



>50 feet

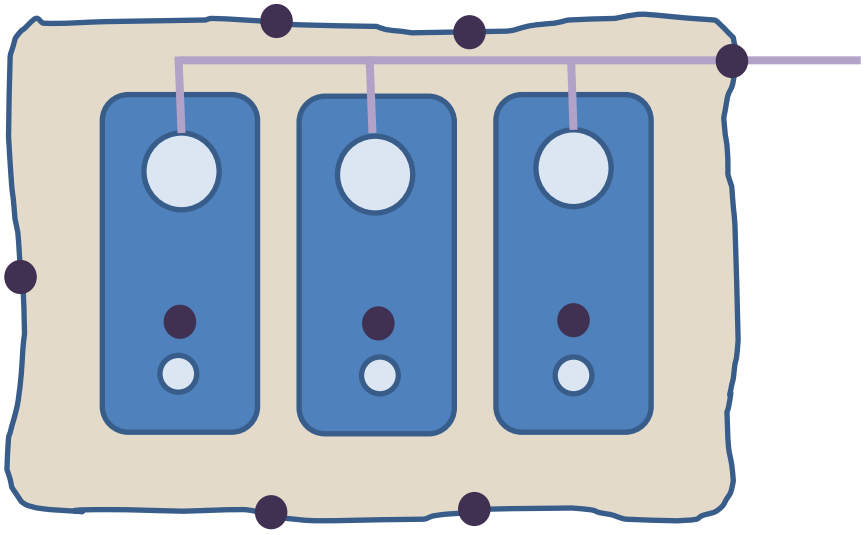
SCENARIO 3: SINGLE TANK REMOVED FROM THE GROUND

Collect five samples if the tank is greater than 9000 gallons.



SCENARIO 4: MULTIPLE TANKS REMOVED FROM THE GROUND

Collect five samples for the first tank and **two additional samples** for each extra tank.
Example: If removing three tanks, collect nine soil samples.



Appendix C. Unified soil classification system (from ASTM D2487e1)

Major Divisions			Group Symbol	Typical Names
Course-Grained Soils More than 50% retained on the 0.075 mm (No. 200) sieve	**Gravels** More than 50% of course fraction retained on the 4.75 mm (No. 4) sieve	Clean gravels (less than 5% fines)	GW	Well-graded gravels and gravel- sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel- sand mixtures, little or no fines
		Gravels with fines (more than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands 50% or more of course fraction passes the 4.75 (No. 4) sieve	Clean sands (less than 5% fines)	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with fines (more than 12% fines)	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils 50% or more passes the 0.075 mm (No. 200) sieve	**Silts and Clays** Liquid limit less than 50		ML	Inorganic silts, very fine sands, rock four, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays Liquid Limit 50 or more		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils

Group Symbol Key: Prefix + Suffix = Group Symbol (i.e. G + W = GW – Well-graded gravel)

Prefix: G = Gravel, S = Sand, M = Silt, C = Clay, O = Organic, PT = Peat
Suffix: W = Well Graded, P = Poorly Graded, M = Silty, L = Clay with LL < 50%, H = Clay with LL > 50%

Appendix D. Method A cleanup levels for unrestricted land use (from MTCA Table 740-1[1])

[1] See WAC 173-340-900 for caution on misusing the values in this table.

Petroleum or Hazardous Substance	MTCA Method A Cleanup Level (mg/kg)
Benzene	0.03
Ethylbenzene	6
Ethylene dibromide (EDB)	6
Naphthalenes	5
PAHs (carcinogenic)	See benzo(a)pyrene[2] in MTCA Table 740-1
PCB mixtures	1
Toluene	7
Total Petroleum Hydrocarbons (TPH) as Gasoline-range organics,[3] **no** benzene detected[4]	100
TPH as Gasoline-range organics, benzene detected	30
TPH as Diesel-range organics[5]	2,000
TPH as Heavy oils[6]	2,000
TPH as Mineral oils[7]	4,000
Xylenes	9

[2] If other carcinogenic PAHs are suspected of being present at the site, test for them and use this value as the total concentration that all carcinogenic PAHs must meet using the toxicity equivalency methodology in WAC 173-340-708(8).

[3] Gasoline-range organics denotes organic compounds measured using method NWTPH-Gx.

[4] And total of ethylbenzene, toluene, and xylenes are less than 1% of gasoline mixture.

[5] Diesel-range organics means organic compounds measured using NWTPH-Dx.

[6] Heavy oils means organic compounds measured using NWTPH-Dx.

[7] Mineral oil means non-PCB mineral oil, typically used as an insulator and coolant in electrical devices such as transformers and capacitors measured using NWTPH-Dx.

Appendix E. Method A cleanup levels for groundwater (from MTCA Table 720-1[1])

Petroleum or Hazardous Substance	MTCA Method A Cleanup Level (µg/L)
Benzene	5
Ethylbenzene	700
Ethylene dibromide (EDB)	0.01
Naphthalenes	160
PAHs (carcinogenic)	See benzo(a)pyrene[2] in MTCA Table 720-1
PCB mixtures	0.1
Toluene	1,000
Total Petroleum Hydrocarbons (TPH) as Gasoline-range organics,[3] **no** benzene detected[4]	1,000
TPH as Gasoline-range organics, benzene detected	800
TPH as Diesel-range organics[5]	500
TPH as Heavy oils[6]	500
TPH as Mineral oils[7]	500
Xylenes	1,000

[1] See WAC 173-340-900 for caution on misusing the values in this table.
[2] If other carcinogenic PAHs are suspected of being present at the site, test for them and use this value as the total concentration that all carcinogenic PAHs must meet using the toxicity equivalency methodology in WAC 173-340-708(8).
[3] Gasoline-range organics denotes organic compounds measured using method NWTPH-Gx.
[4] And total of ethylbenzene, toluene, and xylenes are less than 1% of gasoline mixture.
[5] Diesel-range organics means organic compounds measured using NWTPH-Dx.
[6] Heavy oils means organic compounds measured using NWTPH-Dx.
[7] Mineral oil means non-PCB mineral oil, typically used as an insulator and coolant in electrical devices such as transformers and capacitors measured using NWTPH-Dx.

Appendix F. Recommended site assessment report sections

Cover sheet
Terms
Table of Contents
List of Figures
List of Tables
List of Appendices
1.0 Introduction
    1.1 Site Name or Sampling Area
    1.2 Site or Sampling Area Location
    1.3 Regulatory Authority
    1.4 Assessment Organization
2.0 Background
    2.1 Site or Sampling Area Description
    2.2 Operational History
    2.3 Previous Assessment Summary
    2.4 Geologic and Soil Information
    2.5 Human and Ecological Impact
    2.6 Data Quality Objectives
    2.7 Assessment Objectives
3.0 Data Management
4.0 Sampling Rationale
    4.1 Soil Sampling
    4.2 Water Sampling
    4.3 Other Sampling
5.0 Request for Analysis
    5.1 Analyses Narrative
    5.2 Analytical Laboratory Credentials
6.0 Field Methods and Procedures
    6.1 Field Equipment and Calibration
    6.2 Field Screening
    6.3 Surface Soil Sampling
    6.4 Subsurface Soil Sampling
    6.5 Groundwater Sampling
    6.6 Other Sampling
    6.7 Decontamination Procedures
7.0 Sample Containers, Preservation, Packaging, and Shipping
    7.1 Soil Samples
    7.2 Water Samples
    7.3 Other Samples
    7.4 Packaging and Shipping

8.0 Waste Disposal
- 8.1 Soil and Fill Material
- 8.2 Water
- 8.3 Incidental Equipment and Supplies

9.0 Sample Documentation and Shipment
- 9.1 Field Note Summary
- 9.2 Photo Log
- 9.3 Sample Labeling
- 9.4 Sample Chain-of-Custody Protocols

10.0 Quality Control
- 10.1 Field Quality Control Samples
- 10.2 Background Samples
- 10.3 Field Screening, Confirmation, and Split Samples
- 10.4 Laboratory Quality Control Samples

11.0 Field Variances from Sampling Plan

12.0 Field Health and Safety Procedures