TCEQ REGULATORY GUIDANCE
Remediation Division
RG-411 ● Revised August 2012

Investigating and Reporting Releases from Petroleum Storage Tanks

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Abbreviations and Acronyms

AL—action level

AST—aboveground storage tank

BTEX—benzene, toluene, ethylbenzene, xylene

CAPM—corrective action project manager

CAS—see “RCAS”

COC—chemical of concern

EPA—U.S. Environmental Protection Agency

IR—incident report

LOSS—licensed on-site supervisor

LPST—leaking petroleum storage tank

MBTE—methyl tert-butyl ether

MDL—method detection limit

MQL— method quantitation limit

NAPL—nonaqueous phase liquid

NELAC—National Environmental Laboratory Accreditation Conference

NFA—no further action

NOD—notice of deficiency

PAH—polycyclic aromatic hydrocarbon

PST—petroleum storage tank

RCAS—registered corrective action specialist

RDR—release determination report

SPLP—synthetic precipitation leaching procedure

SDL—sample detection limit

TCEQ—Texas Commission on Environmental Quality

TPH—total petroleum hydrocarbon

USGS—United States Geological Survey

UST—underground storage tank

VOC—volatile organic compound

Introduction

This document pertains to the requirements for investigating and reporting releases from underground and aboveground storage tanks. It replaces all related guidance previously issued by the Petroleum Storage Tank (PST) Program.

Who Should Read This Guide?

Environmental professionals seeking release investigation and reporting information related to the PST Program, including:

- registered corrective action specialists (RCASs)
- corrective action project managers (CAPMs)
- tank contractors (licensed on-site supervisors or LOSSs).

The guidance will also help owners and operators understand and oversee release investigations conducted at their storage tank sites, should such activities become necessary.

Contact Information

Report all nonemergency releases, both suspected and confirmed, to the TCEQ PST Program in Austin within 24 hours of discovery. The PST Program may be notified by:

Phone:	512-239-2200
Fax:	512-239-2216
E-mail:	<pstrpr@tceq.texas.gov>

Use the Texas Petroleum Storage Tank Program—Incident Report Form (TCEQ-20097) for the initial release notification. Fax or mail the completed form to the PST Program. The mailing address is:

PST/DCRP Section, MC 137
TCEQ
P.O. Box 13087
Austin TX 78711

If you are notifying the program by telephone or e-mail, please assemble all of the information on the form before calling or e-mailing. All PST Program guidance and forms are available online at:

<www.tceq.texas.gov/goto/pst-downloads>

For emergencies such as fire, explosion, or vapor hazards, call the statewide Environmental Release Hotline at 800-832-8224, or call local emergency-response personnel by dialing 911.

Questions about this document? Call the PST Program at 512-239-2200 or e-mail <pstrpr@tceq.texas.gov>.

Where to Get More Information

Rules for the PST Program are included in Title 30 of the Texas Administrative Code, Chapter 334 (30 TAC 334). All rules can be downloaded from the Web at

<www.sos.state.tx.us/tac/index.shtml>

For more information on the PST Program in general, visit—

<www.tceq.texas.gov/nav/cleanups/pst.html>

—or call the PST Program at 512-239-2200.

Program Overview

The Texas PST Program is a comprehensive regulatory program for underground storage tanks (USTs), and to a lesser extent, aboveground storage tanks (ASTs). Regulated USTs are subject to extensive administrative and technical standards, including requirements for registration, installation, upgrades, repairs, removals, release reporting, corrective action, financial assurance, fees, contractor registration, reporting, and record keeping. Regulated ASTs are subject to registration, fees, release reporting, corrective action, record keeping, and other reporting requirements. The statute creating and governing the Texas PST Program is Texas Water Code Chapter 26, Subchapters I and K.

The PST Program regulates USTs and ASTs containing petroleum or hazardous substances. This guide primarily addresses the most common type of PST release: from a petroleum UST system. Figures 1, 2, and 14 illustrate release determination.

Action Levels

The PST Program has established action levels and screening criteria for PST chemicals of concern (COCs), to help determine whether sites must be assigned an LPST number. The action level for a COC is the concentration that, if exceeded, triggers the issuance of an LPST number and further investigation. The action levels for the most common PST COCs, applicable to releases reported to the TCEQ on or after March 19, 2009, are available online at:

<www.tceq.texas.gov/goto/pst-downloads>

The action level is the lowest applicable health-based or groundwater protective target concentration for the respective COC. For COCs not listed (for example, hazardous substances), contact the PST Program for assistance in determining the appropriate action level.

The action levels do not apply—and the TCEQ will designate the site an LPST site and assign it an ID number—when:

- surface water is affected or threatened by the release;
- a water well or surface water intake is affected or threatened;
- buildings or utilities are affected by vapors;
- nuisance conditions such as odors, discoloration, or taste degradation of water supplies are known or suspected; or
- non–aqueous phase liquid (NAPL) is present in groundwater.

When determining the analytical method to use for the analysis of COCs, the method quantitation limit (MQL) must be less than the action level or the most sensitive standard available method must be used for the COC. If the MQL of the analytical method used is greater than the action level, and the method is the most sensitive standard available method for the COC, then (in most cases) the MQL of that method becomes the action level for the COC. For more information on MQLs, see “Analytical Requirements.”

No action levels are established for TPH under the PST Program, and no LPST ID number will be assigned based on TPH alone. However, the program requires TPH testing to screen for polycyclic aromatic hydrocarbons (PAHs) using method TCEQ-1005 during initial release determination activities. If the laboratory reports any detection of hydrocarbons in the carbon range greater than nC_{12} (for example, $> nC_{12}–nC_{28}$, $> nC_{12}–nC_{35}$), the sample with the highest concentration of hydrocarbons in the $> nC_{12}$ range must be analyzed for PAHs. The required frequency of PAH analysis is one PAH analysis per source area (see next paragraph). The PAH results are compared to the PAH action levels. If one or more PAH result exceeds the corresponding action level, the TCEQ will assign an LPST number and will request further investigation.

Source areas are generally areas located near or underneath primary release sources such as leaking piping, tanks, or dispensers. *Note:* more than one source area may be present at any given tank system or PST site. Use your best professional judgment to identify, assess, and characterize each source area, as applicable.

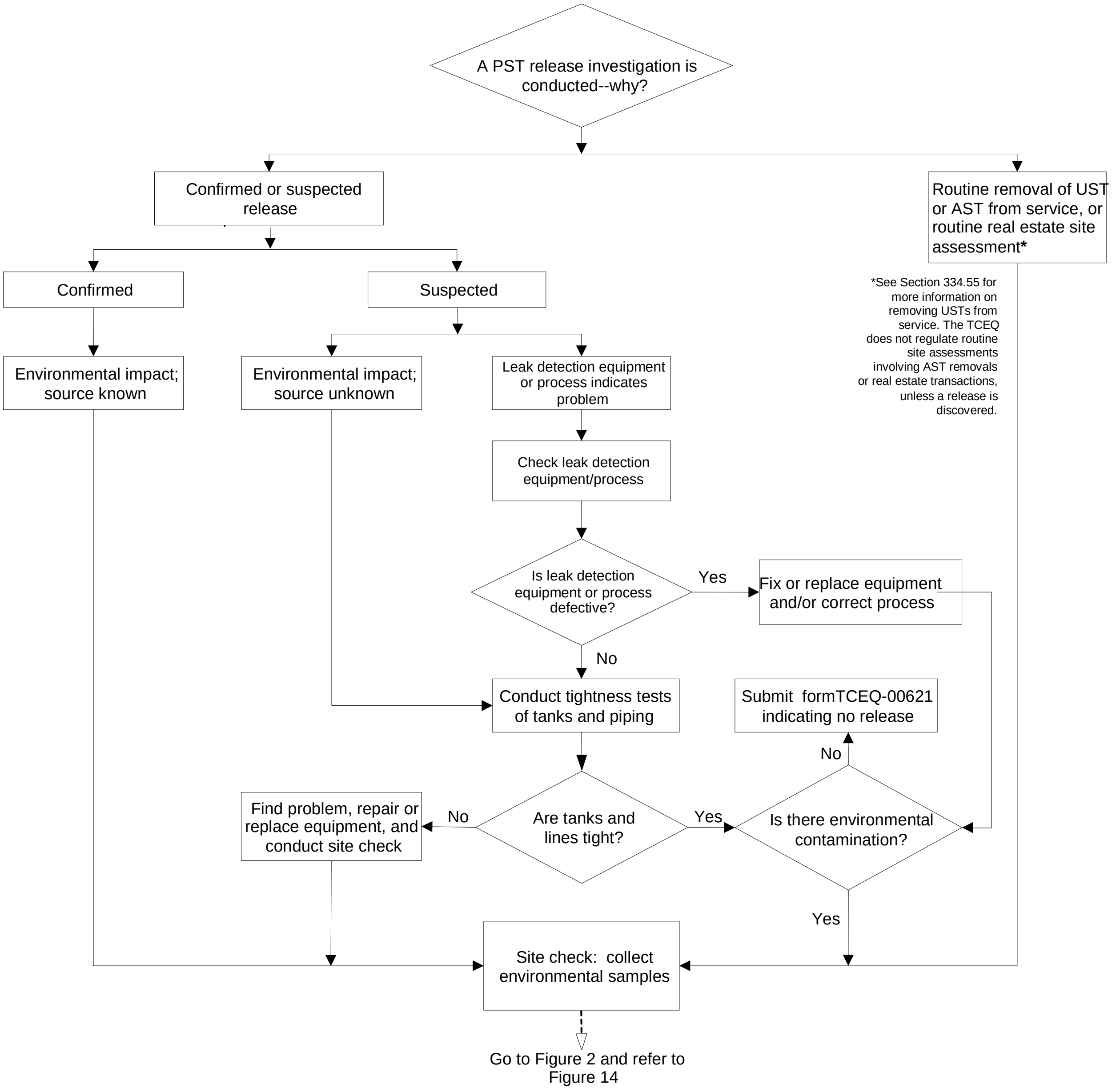
Release Investigation

The investigation of a suspected PST release entails the collection of environmental-media samples [30 TAC 334.74(2)], and permanent removal of a UST from service also entails the collection of such samples to indicate whether a release has occurred [30 TAC 334.55(c)]. Samples may also be collected as part of a routine site assessment for a real estate transaction (property transfer or refinancing) or when removing an AST from service.

While the TCEQ does not have the same detailed technical specifications for AST operation and removal as it does for USTs, a release from an AST requires corrective action under Chapter 334, and the extent of the requirements will depend upon the tank characteristics. Additionally, an owner or operator who seeks written concurrence that no release has occurred from the TCEQ must ensure that the release investigation follows this guidance.

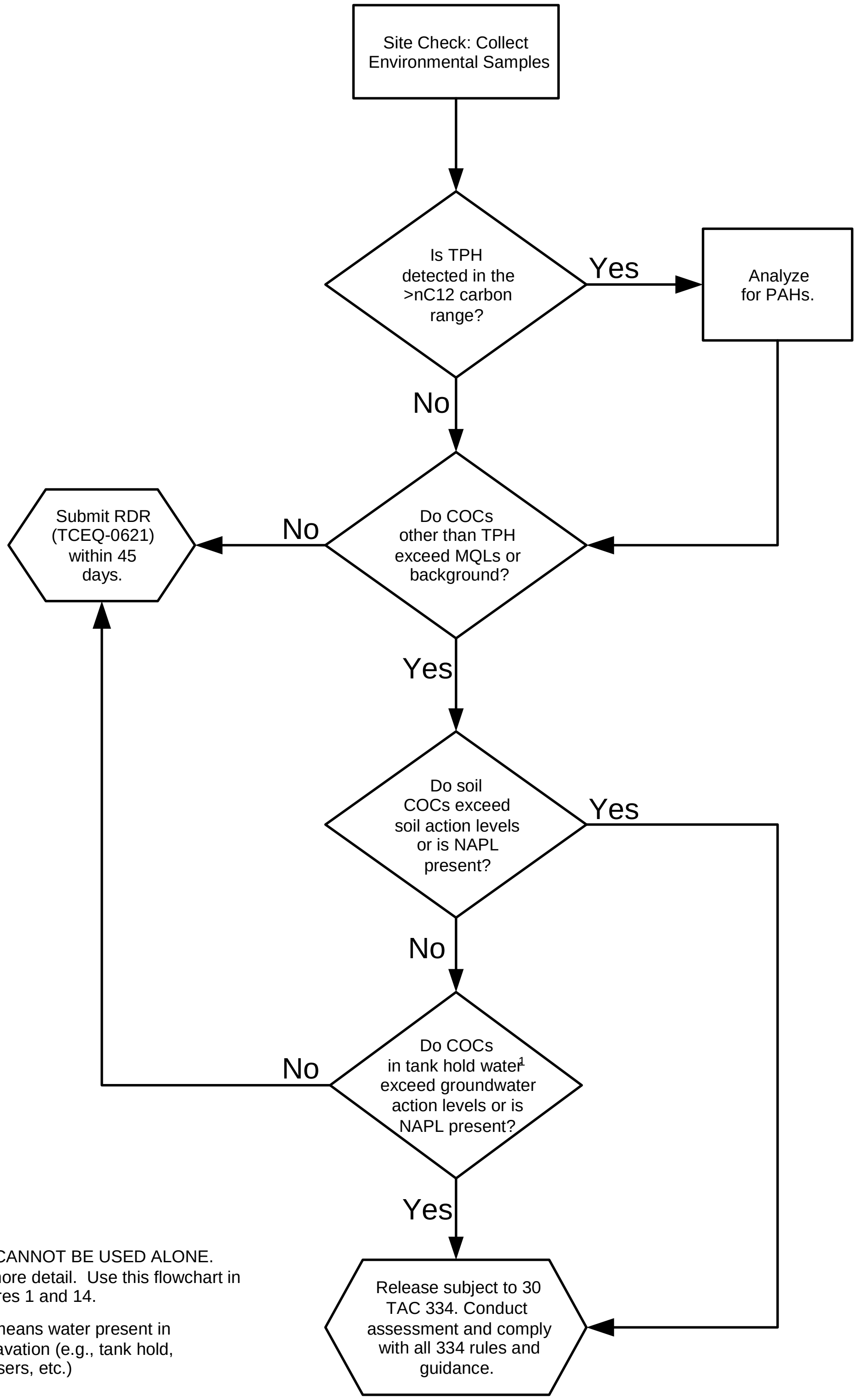
Figures 1 and 2 show the general process for investigating and reporting suspected and confirmed releases and for reporting releases discovered during routine tank closures or site assessments.

Figure 1. PST Release Investigation—Initial Steps



For an HTML version of the process depicted in this flowchart, go to <tceq.texas.gov/goto/rg411charts>.

Figure 2. PST Release Investigation—Release Reporting



THIS FLOWCHART CANNOT BE USED ALONE. Refer to the text for more detail. Use this flowchart in conjunction with Figures 1 and 14.

[1] "Tank hold water" means water present in any part of the excavation (e.g., tank hold, pipe chase, dispensers, etc.)

For an HTML version of the process depicted in this flowchart, go to <tceq.texas.gov/goto/rg411charts>.

Suspected and Confirmed Releases

A release is *suspected* when:

- a release from a source is indicated, but no environmental evidence is found, or
- environmental evidence of a release is found, but the source is unknown.

A release is *confirmed* when there are both environmental evidence and a known source.

Suspected Releases

Evidence

A release is suspected when:

- a PST system exhibits unusual operating conditions (for example, erratic dispenser behavior, sudden loss of product, or appearance of tank water);
- release-detection monitoring triggers an alarm or otherwise indicates a potential problem; or
- released product in the environment is directly observed (for example, sheen on surface water, or product or vapors in a utility conduit), but the source is unknown.

What Action to Take

Investigate suspected releases to determine whether an actual release has occurred, or to identify an unknown source. Investigation may include checking and repairing equipment, tank- and piping-tightness tests, or environmental sampling, also known as a “site check.” See also 30 TAC 334.74.

If only the system equipment or monitoring method or device is at fault, repair or otherwise address these items.

Report suspected releases to the agency within 24 hours of discovery, and fully investigate them within 30 days of discovery (Section 334.74).

If no environmental contamination is found after making repairs, testing the tanks and lines, or conducting sampling, complete a Release Determination Report Form (TCEQ-00621) to indicate this outcome, and submit it to the agency within 45 days of the initial suspected release.

If environmental contamination is found at any step in the investigation of a suspected release or if the source of a previously discovered release is identified, then the suspected release becomes a *confirmed release*.

Confirmed Releases

Evidence

A confirmed release occurs when environmental contamination is present, and the source of the contamination is known, as demonstrated in the following examples:

- Product (NAPL) is discovered in observation wells, the tank hold, or in other portions of the PST system.
- Analytical results of samples collected during a routine removal of a tank system from service or during a routine real-estate transfer assessment show contamination.
- Environmental contamination is found in the course of investigating a suspected release, or the source of a previously discovered unknown release is identified.

What Action to Take

Unless directed otherwise by the agency, owners and operators must do the following when a release is confirmed:

- Stop the release and take action to prevent further movement of the contaminants into the environment.
- Monitor and mitigate any fire or safety hazards posed by vapors or NAPL.
- Take the leaking system out of service until it can be repaired.
- Remove NAPL (if present) to the extent practicable.
- Report the release to the agency within 24 hours.

Removing an Underground Storage Tank from Service

A UST can be permanently removed from service in one of the following ways:

- physical removal of the UST from the site
- abandonment in place
- carrying out a permanent change in service

An owner or operator who intends to permanently remove a UST system from service must ensure that the procedures used minimize any threat to human health, safety, and the environment. Also, the procedures used should be in compliance with TCEQ PST rules (Chapter 334, Subchapters A, C, D, and I), industry standards, and other federal, state, and local governmental regulations.

Things to Prepare in Advance

The registered contractor must submit a completed Construction Notification Form (TCEQ-00495) to the TCEQ Registration and Self-Certification Team at least 30 days in advance of any pending tank-removal activity. The owner, operator, or designated agent (owner-operator) should also call the appropriate TCEQ regional office 24 to 72 hours before initiating construction. (To locate the appropriate regional office, visit <www.tceq.texas.gov/goto/region-maps>.) This advance notice allows agency personnel to inspect the construction as their schedule permits. The owner-operator must also notify and obtain necessary permits from local governments such as the city and the county, or the local and state fire marshals.

Physical Removal

Underground storage tank systems can be removed only by qualified UST contractors with a valid Class B license and registered with the TCEQ. However, the owner-operator ultimately is responsible for knowledge of and compliance with all applicable federal, state, and local governmental regulations. A current list of registered contractors may be obtained at <www2.tceq.texas.gov/lic_dpa/> or by calling the TCEQ Occupational Licensing Section at 512-239-6133.

The program suggests taking the following steps before removal of a UST. These steps do not require TCEQ notification and do not require the use or presence of a registered UST contractor or licensed UST on-site supervisor.

- Locate all underground and aboveground utilities.
- Remove any pavement over USTs.
- Remove soil and backfill down to the top of the UST.
- Relocate affected objects and structures, such as driveway canopies.
- Assemble enough plastic sheeting—6 mm polyethylene is recommended—to be placed both under and over any excavated soil or backfill, to prevent the movement of contamination into underlying soil or groundwater, into the air as vapor, or off-site.
- Determine whether you’re likely to encounter groundwater or bedrock, so you can plan accordingly.

The following guide describes the steps to take for a routine UST removal. Detailed requirements appear at 30 TAC 334.55.

Tank Preparation

Remove all regulated substances and accumulated sludges or residues from the tank, piping, and ancillary equipment in accordance with accepted industry practices. Leave vent lines in place. Be aware that product, sludges, residues, and wash water may be classified as hazardous waste; proper disposal of any of these substances must comply with all TCEQ and federal regulations.

Purge the tank of all flammable vapors in accordance with accepted industry procedures. Local fire or building codes may require verification by local authorities of proper purging before work proceeds. Once the tank has been completely purged of all flammable vapors, all holes and openings must be properly plugged or capped, except for one vent hole with a ⅛-inch diameter at the top of the tank. Before removal of the tank, all connected piping and other ancillary equipment must be emptied, disconnected, and properly plugged, capped, or removed.

Tank Removal

Physically remove the tank from the ground. After removal, a tank must be transported from the site within 24 hours, unless prior approval of a longer on-site storage period has been obtained from the appropriate TCEQ regional office.

Store tanks on-site for 24 hours or less, in a designated area. The tanks should be an adequate distance from known ignition sources, and clearly identified with appropriate barriers and warning signs to restrict access by unauthorized people.

On-site storage of removed tanks for more than 24 hours, and off-site storage for any period of time, is allowed only in locked, securely fenced, or similarly restricted areas where unauthorized people will not have access.

No later than 24 hours after removal, all removed tanks (regardless of condition) must be legibly and permanently labeled (in letters at least 2 inches high) with the following information:

- the former contents (e.g., gasoline),
- a flammability warning, if applicable, and
- a warning that the tank is unsuitable for the storage of human or animal drinking water or food products.

Residual vapor levels in any removed tank must be maintained at nonexplosive and non-ignitable levels at all times.

Sampling

After the tanks are removed, native soil in the tank hold, pipe chases, dispenser, and remote fill-pipe area (if present), and the backfill must be checked (sampled) for the presence of a release. Collect environmental samples of soil or tank-hold excavation water (or both) from any excavated areas as soon as possible after first exposure to the atmosphere. Please see Sampling Requirements for more detailed information.

Tank Transportation

The methods and procedures used for the handling and transporting of any removed underground storage tanks and tank parts must always be protective of human health, safety, and the environment, and conform to all applicable federal, state, and local regulations.

Tank Storage, Disposal, and Reuse

Removed tanks and parts of tanks that have been emptied, thoroughly cleaned of all substances and residues, and permanently purged of vapors may be appropriately disposed of by scrapping, junking, or reuse for a purpose unrelated to the underground storage of regulated substances (as long as it is not storage of food or water for humans or animals).

Regardless of where a tank is stored, no later than 10 days after its removal from the ground, all residual liquids or vapors must be permanently removed to render the tank non-ignitable and nonexplosive.

Remember: people are killed every year by the explosion of flammable substances (sludges, liquids, vapors) left in tanks.

Backfilling after Removal

For safety, backfill the excavated areas to grade as soon as possible after the tank system is removed. Backfill material from the original excavation may be used; however, be aware that replacing contaminated material into the excavation may trigger issuance of an LPST ID number if any of the exposure routes are open. See “Sampling Requirements” for more information.

Abandonment in Place

Procedures for abandonment in place are similar to those for removal from the ground, except there is no physical removal of the tank system. Tanks must be emptied, cleaned out, purged, and filled with a solid inert material, such as sand, cement, gravel, or concrete. Typically, this will require excavation to the top of the tank and removal of a portion of the tank top to allow the cavity to be filled completely with the solid inert material. The filled tank and associated piping must be disconnected and capped or sealed to prevent future use. After proper abandonment in place, determine if a release has occurred. See “Release Determination and Reporting” for more information.

Permanent Change in Service

A permanent change in service can occur when a UST system storing regulated substances is converted to a system storing materials other than regulated substances. As part of the change in service, the owner-operator must determine if a prior release has occurred. Refer to “Release Determination and Reporting,” below.

Report a Registration Change to the TCEQ

Within 30 days after a UST has been removed or abandoned in place, or its status has changed to exempt or excluded, Section 334.7 requires that the tank owner-operator give written notice to the TCEQ that such a change has occurred. The required forms for updating registration changes are the UST Registration and Self-Certification Form (TCEQ-00724) and the Aboveground Storage Tank Registration Form (TCEQ-00659).

Release Determination and Reporting

As previously mentioned, an owner-operator permanently removing an underground storage tank system from service must determine whether a release of a stored regulated substance has occurred.

Begin with a visual, olfactory, and field-instrument vapor survey to check for obvious signs of a release—including stained soil, presence of product, odors, high vapor readings, and any holes or cracks in piping or the tank from corrosion. Collect soil samples if indications of contamination are present. Whether there are obvious indications or not, one of the two following methods must also be used to determine whether there was a release:

1. A comprehensive site assessment, as defined in Subsection 334.56(c). Conduct a comprehensive site assessment according to industry standards, utilizing qualified contractors or environmental professionals licensed by the TCEQ, such as RCASs, CAPMs, or LOSSs. Current lists of RCASs, CAPMs, and LOSSs are available at <www2.tceq.texas.gov/lic_dpa/> or by calling the TCEQ Occupational Licensing Section at 512-239-6133. Qualified personnel should sample for releases where contamination is most likely to be present. Refer to “Sampling Requirements” for more information.
2. A review of the records of continual operation—for the entire life of the UST system—one or more of the following external release monitoring or detection systems operated in accordance with 30 TAC 334.50(d)(5–10): vapor monitoring, groundwater monitoring, interstitial monitoring for double-walled UST systems, monitoring of UST systems with secondary containment barriers, statistical inventory reconciliation with inventory control, or alternative release-detection methods, as previously approved by the TCEQ.

Assemble and submit documentation of tank removal and release determination—including the details of all excavation, removal, and sampling activities—to the TCEQ using the PST Program’s Release Determination Report form (TCEQ-00621). Follow the timetable shown in Table 1.

Owner-Operator Records

The owner-operator must keep a record of the removal in a secure location, either on the premises of the facility or at an alternate site. Regardless of where it is kept, the record must be readily accessible for reference and use by the UST system operator and readily available for inspection by TCEQ personnel. This record must identify:

- the prior location of the tank;
- the date of removal;

Table 1. PST Release Reporting Schedule—Summary

Time Frame	**Scenario or Description**	**Required Report or Form**[1]
Within 24 hours of suspecting a release	Report all suspected releases to the TCEQ (30 TAC 334.72).	PST Program Incident Report form (TCEQ-20097)
Within 30 days of suspecting a release[2]	Conduct system test, site check, or other approved procedure to investigate and confirm suspected release (30 TAC 334.74).	
Within 45 days of suspecting a release[2]	Report investigation of a suspected release where ultimately, no release was found (30 TAC 334.74(3)).	PST Release Determination Report form (TCEQ-00621)
Within 24 hours of release confirmation	Report all confirmed releases to the TCEQ (30 TAC 334.76).	PST Program Incident Report form (TCEQ-20097)
Within 20 days of release confirmation[2]	Report a confirmed release, whether above or below action levels (30 TAC 334.77(b)).	PST Release Determination Report form (TCEQ-00621)
Within 45 days of release confirmation[2]	Conduct site assessment and submit report (30 TAC 334.78(c)).	Assessment Report Form (TCEQ-00562)

[1] another format may be approved or required by the agency
[2] another schedule may be approved or required by the agency

- any substance previously stored;
- the method of conditioning the tank for removal;
- methods of handling, transporting, storing, and disposing of the tank;
- the names, addresses, and telephone numbers of the individuals conducting the activities; and
- all information regarding any known releases from the tank.

This record must be maintained for as long as any UST remains in service at the facility, or for five years after the permanent removal of the last (or only) UST from service.

Assessments at Preexisting LPST Sites

Tank removals and assessments at preexisting LPST sites (whether open or closed) should be conducted according to the guidelines in this document. If contamination is discovered, it may be part of the preexisting release, or it may be a new release. Report information on new releases according to Table 1 and this guide.

To document that contamination is not a new release, supply the following information:

- *The regulatory history of the site.* Describe when and why all pre-existing LPST ID numbers were originally issued, and include the media affected (soil, groundwater). List all dates of closure (if closed), and supply copies of the TCEQ LPST-site closure letters (if any).
- *The operational history of the site.* Include a map showing the locations of all tank systems, past and present. Include the tank holds, the individual tanks, the piping, and the dispensers installed at the site. Describe the substances they contained, the dates they were installed, the years they were in operation, and the dates they were taken out of service.
- A comparison and contrast of the new and preexisting laboratory analytical data relative to contaminant locations, concentrations, and extent. Discuss the affected media (soil, groundwater) and the presence or absence of NAPL. If the LPST site has been closed, discuss why you think the closure conditions and any assumptions made at the time of original closure are still valid.

If contamination is present and it is found to be part of the known, preexisting contamination, the site will continue to be subject to corrective action under the previous LPST ID number. If the TCEQ determines that a new release has occurred, it will assign a new LPST ID number. Please note that the TCEQ reserves the right to review responsible-party status based on the relevant facts, statute, and rules.

You can expedite TCEQ review and possible concurrence (if concurrence is appropriate) with any assertion that contamination is not a new release by supplying the following up front:

- old and new site maps depicting historical soil-contamination locations and concentrations,
- tables summarizing analytical data, both old and new,
- groundwater-contaminant concentration and potentiometric surface maps if groundwater is or was contaminated, and
- preexisting-LPST-site closure letters (if any).

Release-Reporting Schedule

If visual observation or sample analysis indicates that a release of a regulated substance has occurred, complete the incident-report form (TCEQ-20097) and contact the TCEQ PST Program by phone, fax, or e-mail within 24 hours of the release discovery (see the contact information at the beginning of this document). You must follow up on the initial TCEQ notification by submitting the Release Determination Report form (TCEQ-00621) according to the schedule shown in Table 1. Sites that do not receive an LPST number have no additional reporting requirements.

Sampling Requirements

The Importance of Representative Samples

The importance of collecting samples that are representative of site conditions cannot be overstated. Since gasoline and some of the other common PST substances consist largely of volatile organic compounds (VOCs), special care in collecting samples is required. The agency strongly recommends collection of soil VOC samples using EPA method SW-846 5035. If you use this method, use the version modified (and preferred) by the TCEQ, available at:

<www.tceq.texas.gov/goto/analytical-methods>

Only discrete grab samples can be used for release determinations. Sample compositing is not allowed, because samples composited in the field may not yield results that are representative of site conditions.

When and Where to Collect Samples

Samples collected during release determination at a PST site must be obtained as soon as possible after the soil (or water) is exposed to the atmosphere. Any water present in the tank hold must be sampled. Samples taken from preexisting tank-hold observation wells may be used instead of sampling water in the open excavation. Whether the tank-hold water or observation-well water is true groundwater is not relevant to release determination at this point.

If, for safety reasons, a backhoe is used to collect soil samples in a tank hold during a tank removal, the same standard applies: immediately upon removal from the excavation, collect discrete grab samples from 1 foot into the (relatively) unexposed soil in the backhoe bucket.

Always collect samples at locations where contamination is most likely to be present. In selecting sample types, locations, and analytical testing methods, consider the nature of the stored substance, the type of initial release detection alarm or cause for suspicion (if any), the type of backfill, the depth to groundwater, and any other factors appropriate for identifying the presence and source of a release. Because a tank system can fail at any point, the entire system—fill pipes, tanks, piping, and dispensers—must be carefully assessed.

Always give preference to collecting discrete samples of soil in areas where:

- there are obvious visual, olfactory, or field instrument indications that contamination is present and
- the tank or piping material may have failed (leaked), such as at corrosion holes or cracks.

In general, always sample the tank hold, piping trenches, dispenser areas, and backfill. If there is a remote fill pipe, sample that area as well. Sampling locations for a typical UST site are shown in Figure 12. Descriptions of default sampling areas and how many samples should be collected at each location are detailed in Table 2 and Figures 3–11.

Tank Hold

Locations for tank-hold samples depend upon the size (length) and number of tanks in the system, and whether bedrock, a concrete slab, or water is present. If water is not present in the tank hold, collect grab samples of native soil from approximately 1 foot into the floor of the tank hold. The number of floor samples depends on the length of the tanks, as shown in Table 2.

If there are concrete slabs or “deadman” anchors in the bottom of the tank hold, sample native soil at the edges of the slabs and anchors, at locations based on the number and lengths of tanks (Table 2), to the extent possible.

If bedrock is present in the tank-hold floor or walls, first try to obtain samples from the floor or walls, depending on the presence or absence of water. If the bedrock is completely unweathered and samples cannot be collected, sample native soil from 1 foot into the sidewalls, immediately above the soil-bedrock interface. Include in the release-determination report the depth below ground surface from which samples were collected, and describe the width, length, and approximate numbers of any bedrock fractures present.

If water is present in the tank hold, collect soil samples from immediately above the soil-water interface, 1 foot into the sidewalls, according to Table 2. Note in the RDR the depth below ground surface from which the sidewall samples were collected. If water is present over only a portion of the tank-hold floor, collect samples according to “water present” and “water not present” in Table 2, as appropriate. Also, sample any water present in the open tank hold or in tank-hold observation wells.

Include photographs of the excavated tank-hold bottom and walls in the release report to the TCEQ to document the conditions encountered.

Figures 3–7 illustrate the recommended sampling locations for tanks of various sizes, with and without water in the tank hold.

Piping Trenches

Studies from various sources, including the EPA, have shown that piping is the most common source of UST leaks. Therefore, before sampling, use as-built drawings, remote sensing, or excavation to locate all piping. Completely expose the piping, if possible, to better see where the joints, bends, and connectors are located. Collect grab samples from native soil under the piping, approximately 1 ft below the trench bottom, in locations such as elbows (where the piping changes direction), connectors, and joints, and adjacent to any corrosion holes or other evidence of potential contamination.

Table 2. PST Soil and Water Sample Numbers and Locations

Tank Hold[a b]

Water Not Present[c]

Length of Tank (ft)	Minimum Number of Soil Samples per Tank	Minimum Sample Locations
≤ 5	1	Under the fill port
5–20	2	Under tank ends
> 20	3	Under the fill port and tank ends—if the port is within 3 ft of a tank end, collect a third sample from the middle of the tank instead

Water Present[c]

Length of Tank (ft)	Minimum Number of Soil Samples per Tank	Minimum Soil Sample Locations	Minimum Number of Water Samples[c]
≤ 10 (single tank)	2	Immediately above the soil-water interface, at tank ends	1
> 10 (single tank or multiple tanks)	4	Immediately above the soil-water interface at 4 walls of tank hold	1

Piping Trenches

Recommend that all piping be exposed. Collect one discrete grab sample from native soil under each connector, elbow, bend, etc. Collect at least 1 grab sample per 20 linear feet of trench.

Dispensers

Take one discrete grab sample per dispenser. Collect samples from native soil below piping under the dispenser, on the supply side. If two dispensers are located within 5 ft of each other, collect one sample in between, at the midpoint.

Backfill

Take one discrete grab sample for each 50 cu yd of backfill. All backfill types must be sampled, including pea gravel. Also, sample backfill to be disposed off-site according to the requirements of the receiving facility.

Sampling Locations for Tank Systems Remaining in Place[d]

Tank hold: Beginning at one corner, drill and sample one boring every 25 linear ft (approx.) around the tank-hold excavation boundary, within 3–5 ft of tanks (Fig. 11). Angle borings in toward tanks, if possible. Boring total depths must be 1 ft deeper than the bottom of the tank-hold excavation. Collect two samples from each boring as follows: Collect one sample from the interval with the greatest visual, olfactory, or field-screening-instrument indication of contamination; or, if no indication, (1) immediately above the water table if groundwater is encountered, or (2) between the tank midpoint and the total depth. Collect a second sample at the total depth. Install and sample temporary or permanent monitoring wells if groundwater is encountered.

Piping trenches and dispensers: Same as above, except at depths relative to pipe-chase excavations.

[a] The locations in this table are primarily for UST systems; however, the same general locations can be used for routine AST system removals and routine environmental site assessments. Always give priority to sampling in areas displaying obvious visual, olfactory, or field instrument indications of contamination.

[b] Discrete grab samples are required for all sampling. Collect tank-hold, pipe-chase, dispenser, and remote-fill-port samples from 1 ft into native soil. Any water present in the tank hold must be sampled. Tank-hold monitoring wells, if present, may be sampled instead of open tank pit water.

[c] "Water present" in this case means water that completely covers the floor of the tank hold. If water covers only a portion of the floor, sample according to "water present" in the areas where there is water, and according to "water not present" in the areas where there is no water.

[d] Tank systems may be abandoned in place [30 TAC 334.55(c)]. Also, environmental site assesments may be conducted at properties where tanks will remain active.

Figure 3. Tank-Hold Sampling: No Water Present, Tanks up to 5 ft in Length

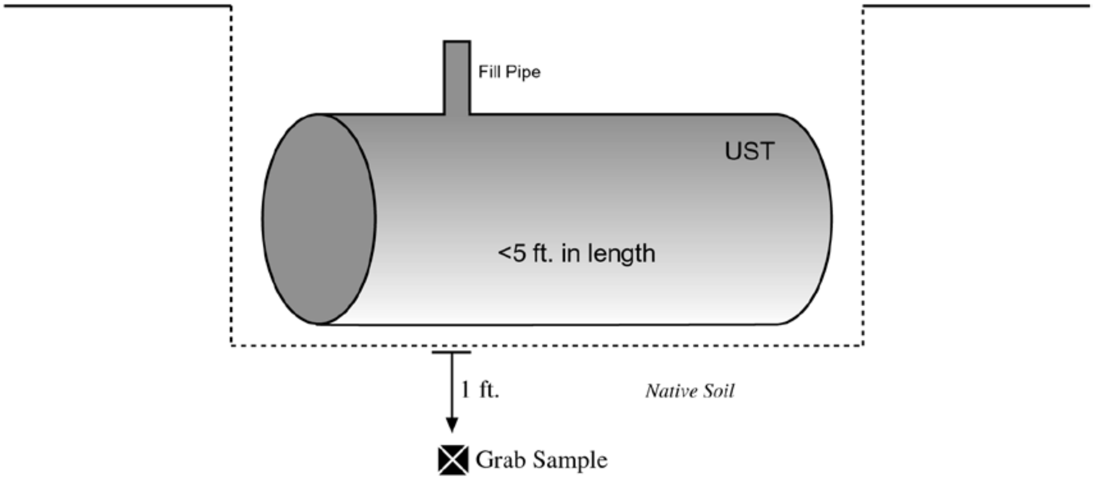


Figure 4. Tank-Hold Sampling: No Water Present, Tanks between 5 ft and 20 ft in Length

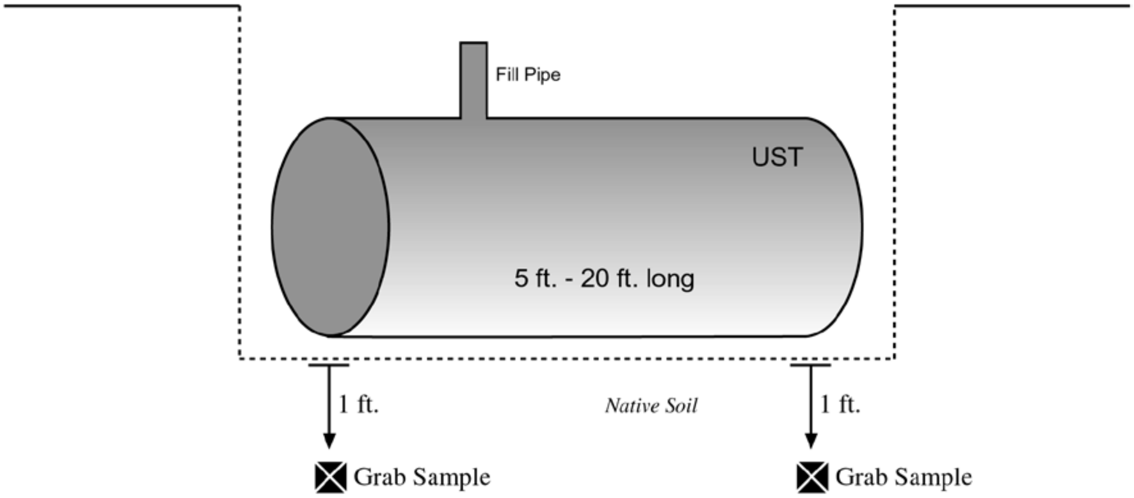


Figure 5. Tank-Hold Sampling: No Water Present, Tanks Greater than 20 ft in Length

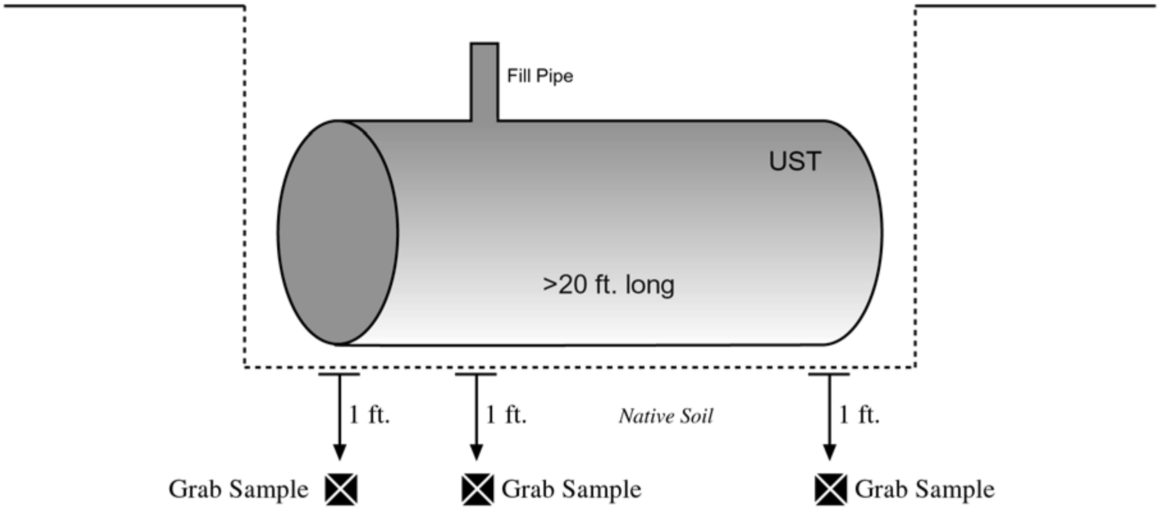


Figure 6. Tank-Hold Sampling: Water Present (Cross-Section)

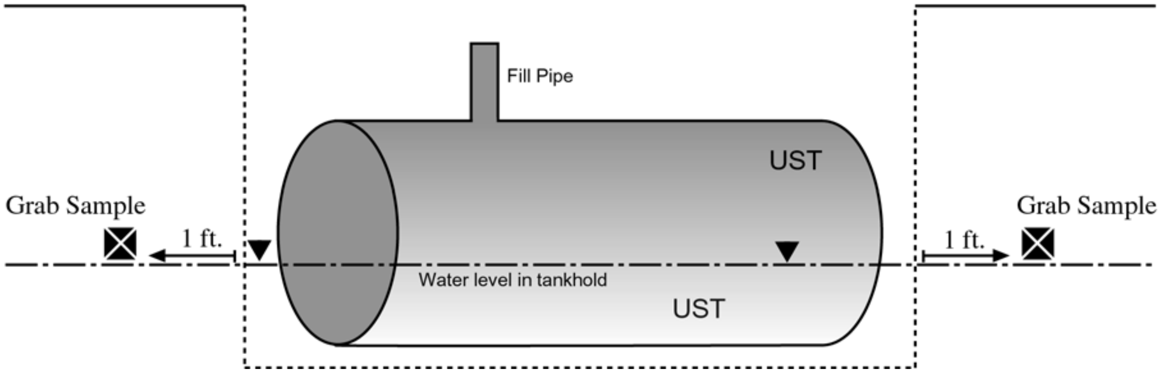
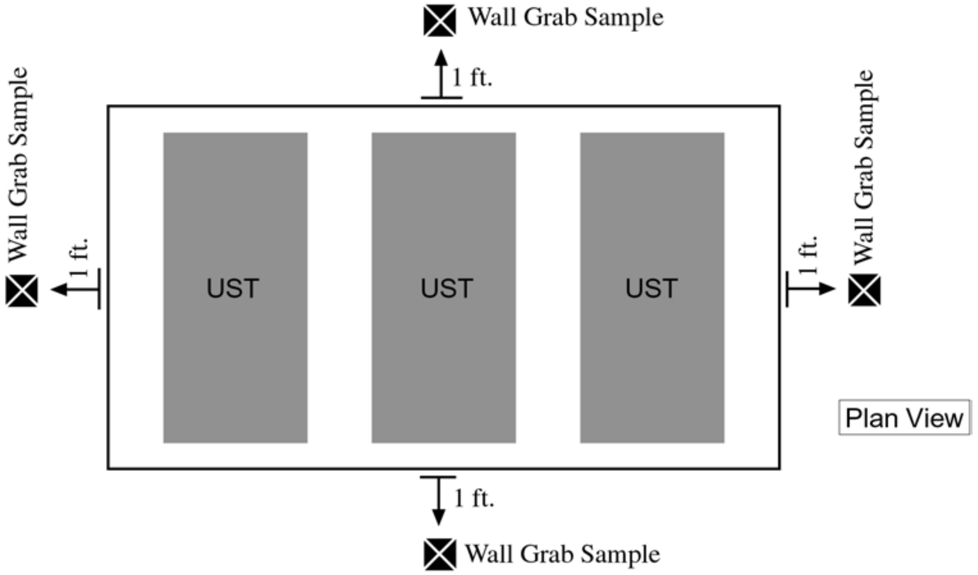


Figure 7. Tank-Hold Sampling: Water Present (Plan View)



Collect at least one native soil sample per 20 ft of piping. For any dispenser located over a tank with no remote fill port, you do not have to collect separate piping samples. If a piping run contains more than one product line, or if lines are within 5 ft of each other, collect only one sample for every 20 linear feet of the piping group. Figures 8 and 9 show locations for the required sampling of piping runs.

Dispensers

Collect one sample from the supply side of each dispenser, 1 ft into the native soil under the dispenser piping. For dispensers located within 5 ft of each other, you only need to collect one sample, halfway between the two dispensers. For dispensers located directly over the tank hold, you do not have to collect separate dispenser samples. Figure 10 shows the locations of required dispenser samples.

Backfill

Sample backfill at the rate of one discrete grab sample per 50 cu yd of backfill. Collect the grab samples from at least a 1 ft depth into the backfill stockpile, in areas where appearance, smell, or a field-instrument reading potentially indicates contamination. Note that backfill of all types (for example, pea gravel, sand, fill dirt) must be characterized by sampling.

Backfill to be disposed of off-site must also be characterized according to the requirements of the disposal facility’s permit. Meeting those requirements is between you and the facility; however, after disposal is complete, you must include the waste manifests signed by the receiving facility in your RDR.

Figure 8. Pipe-Trench Sampling (Cross-Section)

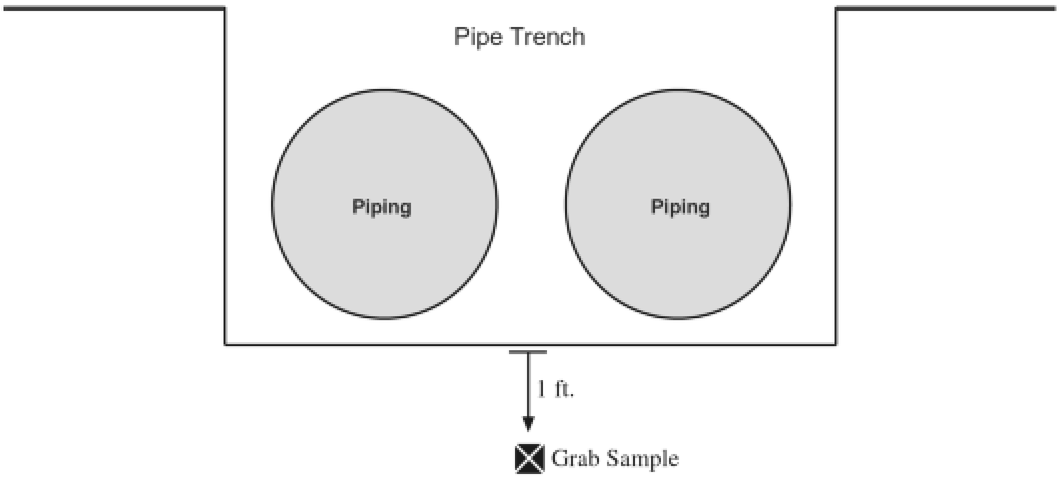


Figure 9. Pipe-Trench Sampling (Plan View)

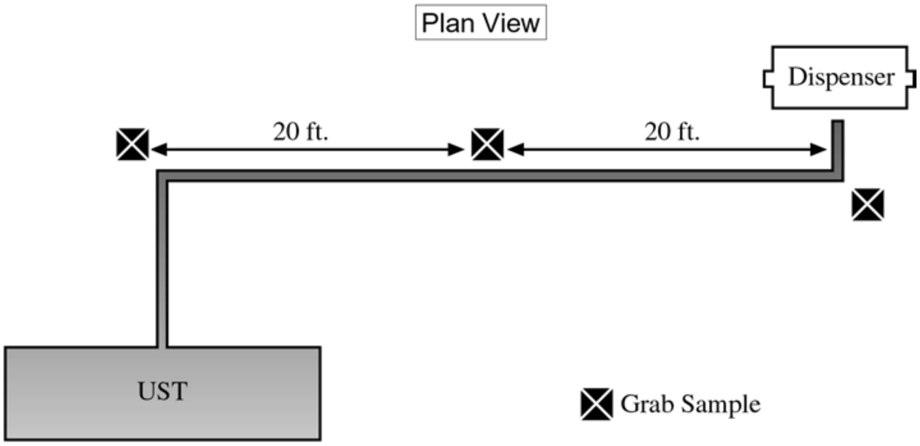
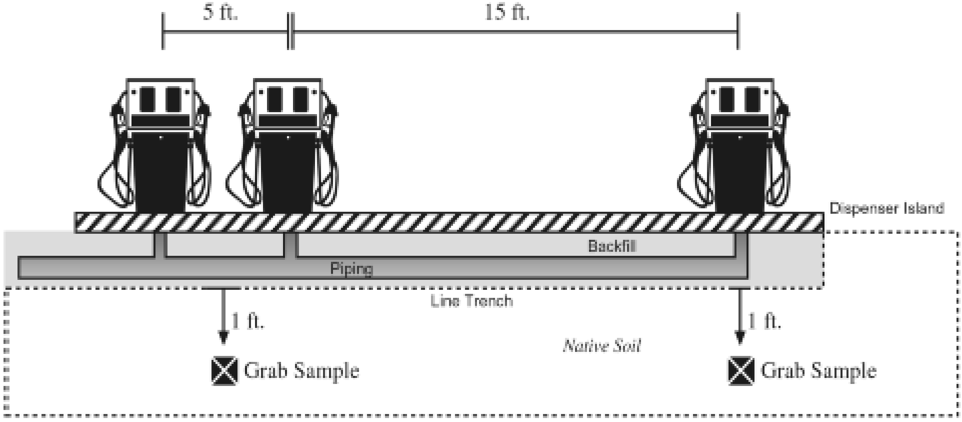


Figure 10. Dispenser Sampling



Pile backfill removed from the tank hold or other parts of the tank system on plastic sheeting—6 mm polyethylene is recommended—while you wait for receipt of analytical results or off-site disposal. If the backfill will remain on-site for longer than 24 hours, or if precipitation is likely, cover the backfill stockpile with the plastic sheeting and anchor it securely in place until the backfill is either returned to the excavation or disposed of off-site.

Backfill may be returned to the tank hold if concentrations are below action levels. Contaminated backfill may be returned to the tank hold if (1) no open exposure pathway exists and (2) SPLP testing shows that contamination from soil remaining in place is not likely to leach unacceptably into groundwater in the future. Whether exposure pathways are open can often be determined by evaluating site features such as surface cover and utility locations; therefore, a full 500 ft receptor survey generally is not required. If conditions (1) and (2) above are not satisfied, contaminated backfill should be disposed of off-site, unless the native soil or groundwater is affected and the release determination results in the issuance of an LPST number for the site. In that situation, contaminated backfill returned to the tank hold will be considered in the site assessment and can be addressed during remediation.

Groundwater

Measure for the presence of a release where contamination is most likely, taking into account the nature of the stored substance, the type of backfill, the depth to groundwater, and other factors appropriate for identifying the presence and the source of the release.

The TCEQ strongly recommends that, before any release-related investigation, you assemble information on local groundwater conditions (for example, depth to water, formation type). Sources of this information may include:

- UST tank-hold observation wells (if any),

- TCEQ regional inspectors familiar with the area,
- state records on adjacent LPST sites or nearby water wells,
- water-well drillers familiar with the area,
- local county extension agents,
- city utility offices,
- USGS topographic maps, and
- published regional or local groundwater reports. The Texas Water Development Board and the Texas Bureau of Economic Geology are often good sources of this type of information.

If water is in the tank hold—even if you do not believe it to be groundwater—collect a representative sample as soon as possible after it is exposed to the atmosphere, and have it analyzed for the appropriate COCs. You may sample preexisting tank-hold observation wells, if any, instead of collecting open-excavation water samples. If analytical results for the tank-hold water exceed a groundwater action level, you must then collect a representative groundwater sample from a well installed in the uppermost water-bearing zone.

To obtain a groundwater sample representative of *in situ* conditions, install a monitoring well (temporary or permanent) or well point that is appropriately screened and sand-packed across the zone of concern. Develop the well or well point to minimize turbidity, and purge it properly before collecting samples. The wells or well points can be of any diameter and can be installed by direct-push methods or by other methods, such as the use of a hollow-stem auger.

The length of screen used generally should be 10 feet or less. If a longer screen is used, explain the need. Position the screen at the vertical location within the water column that is most likely to intercept the contaminants of concern—typically at or near the top of the water table for PST contamination. Take care to:

- seal off the outside of the well or well point at the ground surface to prevent intrusion of surface runoff, and
- drill and install the sampling point so as to prevent contamination from upper zones being dragged vertically downward.

The TCEQ recommends the use of a low-flow pump to purge the well before sampling and, if the sample has turbidity exceeding 10 NTUs, filtering the groundwater samples with pores 10 micrometers or larger. The purpose of low-flow sampling and filtering is to minimize turbidity and to ensure collection of a representative sample.

Note that use of a vacuum truck is not an acceptable method of purging before sampling.

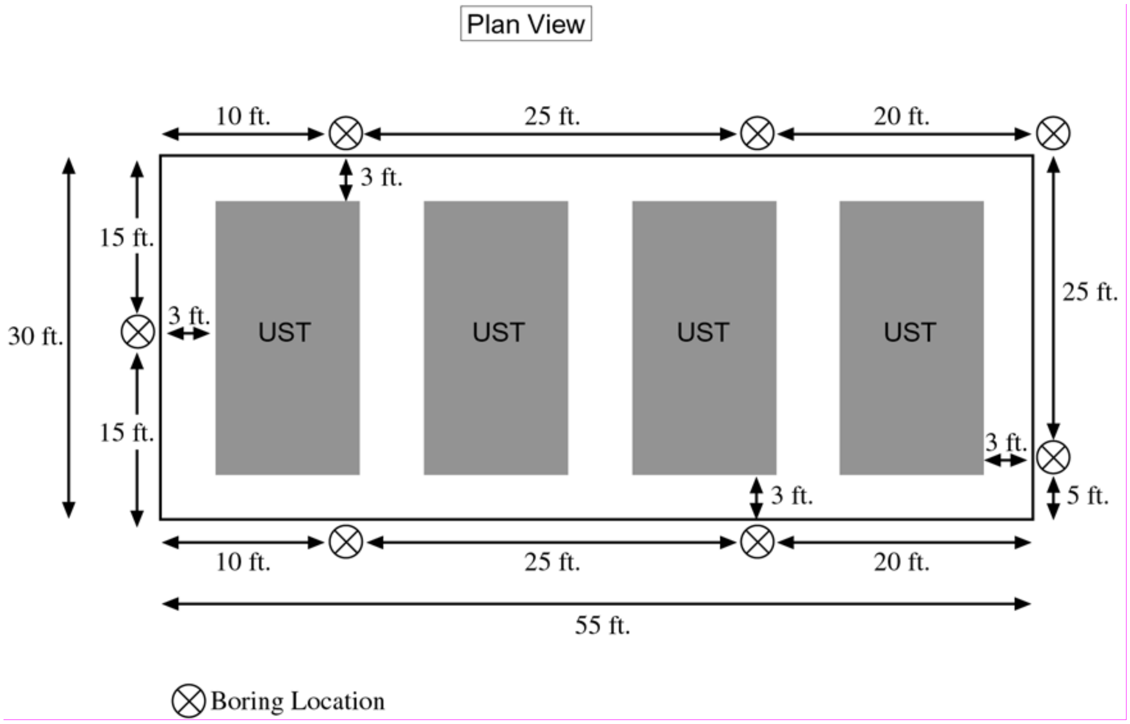
Sampling at Tank Systems Remaining in Place

Tank systems may be abandoned in place and may also remain operational during both change-in-service activities and real estate assessments. These situations affect the areas that may be easily sampled.

For tank systems that remain in place, start soil borings at one corner of the tank hold and install them about every 25 feet around the tank-hold perimeter, as shown in Figure 11. Locate the borings within 3 to 5 feet of the tanks, and angle them in, toward and under the tanks, if possible. Drill and sample piping trenches and dispenser islands in a similar manner.

The total boring depths must be about 1 foot lower than the bottom of the tank hold, pipe chase, or dispenser excavation. Collect two samples from each tank-hold boring: the first at the interval with the highest indication of contamination (staining, odors, field instrument reading). If no obvious contamination is present, collect a sample from just above the soil-water interface if water is present; or between the midpoint of the maximum tank diameter and total depth (TD). Collect a second sample at boring TD. If water is encountered, at least one well or other sampling point must be installed, developed, purged, and sampled.

Figure 11. Tank-Hold Sampling for Tank Systems Remaining in Place



Analytical Requirements

General

The PST Program has established requirements for responsible parties to demonstrate that analytical data they submit to the program for release determination are of known and documented quality and were generated by a laboratory accredited for standards of the National Environmental Laboratory Accreditation Conference (NELAC) under the Texas Laboratory Accreditation Program as required in 30 TAC 25. Following these requirements established by the PST Program facilitates the TCEQ's determination of whether a release has occurred, and confirms that the data used in decision making were generated by a NELAC-accredited laboratory. Under the PST program, the responsible party is responsible for the quality of data it submits and must demonstrate an understanding of its usability.

Sample Handling, Analysis, and Reporting

Table 3 summarizes the sample analyses, preservatives, and holding times required for the most common PST COCs. The COCs to be analyzed depend on the type of regulated substance stored or released, and on the environmental medium (soil or water). If the potential release source or substance is unknown (e.g., when previously unknown tanks are discovered during an assessment), samples must be analyzed for the full suite of VOCs to ensure identification of all possible COCs.

Analytical methods other than those methods listed may be acceptable. Call the TCEQ's PST Program at 512-239-2200 to obtain approval of any alternate methods before you mobilize for the field sampling event.

In addition to the standard laboratory method holding times listed in Table 3, the TCEQ requires all soil and water samples collected for a demonstration of regulatory compliance (such as release determination) to be received by the laboratory within two days of sample collection, unless this requirement is waived in writing by the TCEQ prior to collection. For additional information, refer to the July 31, 2003, TCEQ Remediation Division Interoffice Memorandum (IOM-073103), *Sample Handling and Preservation Procedures and the Collection Procedures for Groundwater Samples* (applicable to both soil and water samples), available at:

<www.tceq.texas.gov/goto/pst-downloads>

Custody Seals for PST-Program Samples

Each transport shuttle containing samples must be sealed with two custody seals bearing the printed site name and date, and the signature of the person maintaining custody of the samples. The seals should be placed perpendicular to the opening of the shuttle, as shown in Figure 13. After the custody seals are in place, packing tape should be wrapped over them and around the circumference of the shuttle.

Figure 12. Typical Sampling at Tank System Removal (Plan View—No Water Present)

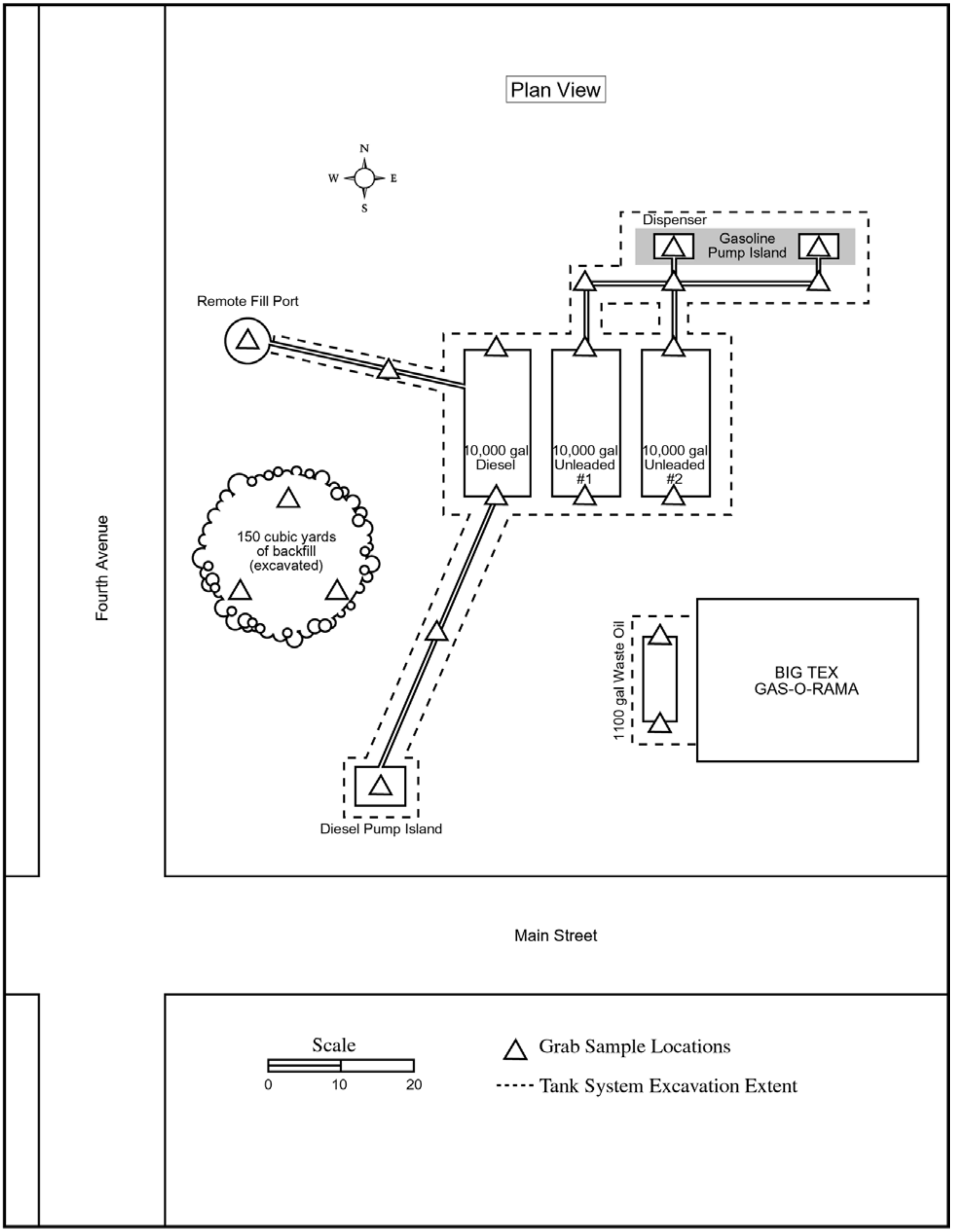
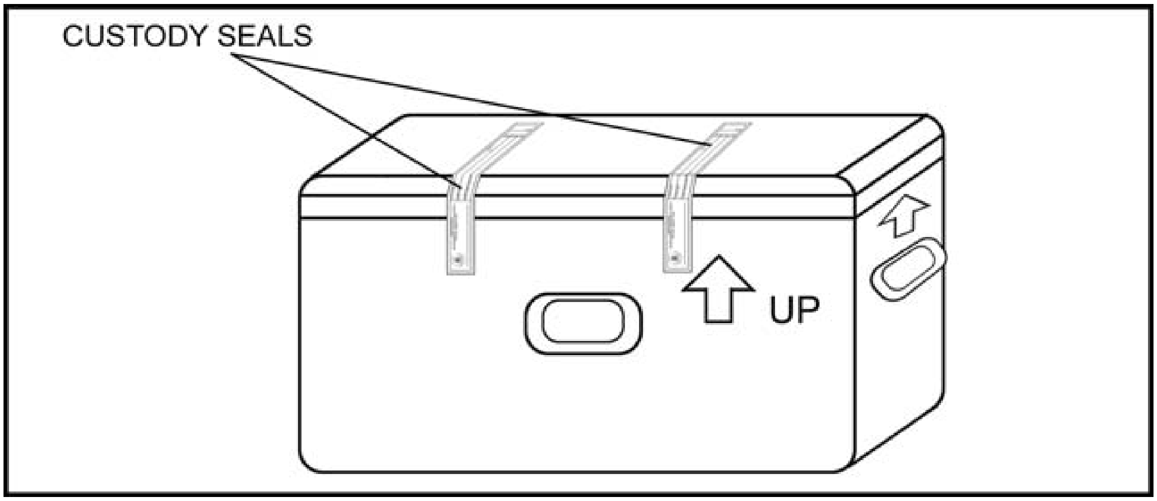


Figure 13. Placement of Custody Seals



Before You Mobilize to the Field

Important Analytical Terms

The responsible party is responsible for the quality of the data submitted to the TCEQ; therefore, the agency highly recommends that both the responsible party and his or her representative (RCAS, CAPM, LOSS) who will be dealing with the samples and laboratory become familiar with the following three terms:

- The *method detection limit* (MDL) is the minimum concentration at which the laboratory can detect a chemical in a clean, unadulterated laboratory-grade sample.
- The *method quantitation limit* (MQL) is the lowest concentration of a COC the lab can detect and quantify under standard analytical method conditions. The MQL is defined as the lowest non-zero standard in the laboratory's initial calibration curve.
- The *sample detection limit* (SDL) is the lab's MDL for a specific COC in a particular sample, after adjustments for sample-specific factors such as moisture content or dilution.

Key Items to Discuss with Your Lab

Discuss the following with your laboratory before field mobilization:

- Using the information in Tables 3 and 4, determine the number of samples you will be collecting from each sample location. Give the laboratory a list of the types of analyses you will request and the number of samples you will send for each analysis. Normally, based on that information, the laboratory will furnish you the appropriate number of coolers, sample jars, and custody seals needed in the field. Submitting this list to the laboratory well before it receives the samples is especially important for samples to be analyzed for PAHs. Some laboratories need advance notice to allow them to prepare the instrumentation for the PAH analysis.

During these discussions, keep in mind that water and soil samples for TPH analysis are held for 14 days maximum, whereas water samples for PAH analysis are held for only 7 days maximum. If you are to collect samples for TPH analysis with subsequent analysis for PAHs in the sample with the highest TPH, the water TPH and water PAH samples need to be shipped to the laboratory as soon as possible to allow it adequate time to run the TPH analyses, to identify the sample to be analyzed for PAHs, and to run the PAH analysis.

- Advise the laboratory that the sample analyses need to meet the requirements in this publication and specifically that the action levels differ significantly from action levels of other programs—for example, the Texas Risk Reduction Program. Give the laboratory a copy of the action levels it must meet with the analytical method it proposes to use. The MQLs for those analytical methods used must be less than or equal to the action levels or else the most sensitive standard available method must be used for the COC. For the methods it will use, verify that the laboratory has validated them at the MQLs needed for the project, and confirm that the laboratory is NELAC accredited under the Texas Laboratory Accreditation Program for each method to be used to generate the data for each analyte in each environmental matrix if those data are to be used by the TCEQ in making decisions.
- Nondetected results for any COC must be reported as less than the value of the SDL—for example "< 0.005 mg/kg" when the SDL is 0.005 mg/kg. Do not use nominal terms, such as "ND," when reporting nondetected results for COCs. All detected and nondetected results will be compared to the PST Program action levels.
- To determine that no release has occurred, all detected results and SDLs must be less than the PST action levels. Special laboratory actions may be needed when:
    - a COC is not detected at the site, but one or more of the SDLs exceed the action levels, a "no release" determination cannot be made, and special laboratory action is required to lower the SDLs of all nondetected results to less than action levels; or
    - a COC is detected at the site at concentrations less than the PST action level, but one or more of the SDLs exceed the action levels, a "no release" determination cannot be made, and special laboratory action is required to lower the SDLs of all nondetected results to less than action levels.
- All COCs with analytical responses greater than the MDL must be reported as having been detected. For detected results greater than the MDL but less than the MQL, the laboratory should estimate the concentration of the COC in the

Table 3. Summary of PST Constituents and Analytical Methods for Soil Samples

Substance Stored[a]	**Constituents**	**Analytical Methods**[a,b]	**Preservative**	**Holding Time**[c]	**Comments**
Gasoline, diesel, jet fuels, and nos. 1, 2, and 4 fuel oils	BTEX and MTBE	8021 or 8260	Cool to < 6°C.	14 days	Method 8260 is preferred—but not required—for initial release characterization.
	TPH	TX1005	Cool to < 6°C immediately upon collection. Hold at –12°C at lab before and after extraction.	Extract within 14 days of collection. Analyze within 14 days of extraction.	Report the results of the following ranges: $n\mathrm{C}_{6}$–$n\mathrm{C}_{12}$ > $n\mathrm{C}_{12}$–$n\mathrm{C}_{28}$ > $n\mathrm{C}_{28}$–$n\mathrm{C}_{35}$ $n\mathrm{C}_{6}$–$n\mathrm{C}_{35}$
	PAHs if TPH greater than $n\mathrm{C}_{12}$ is detected[d]	8310 or 8270[e] (if applicable)	Cool to < 6°C.	Extract within 14 days of collection. Analyze within 40 days of extraction.	If analytical interference is observed or suspected, sample extract should undergo cleanup—for example, using Method 3611.
Waste oil or unknown petroleum products	VOCs (including BTEX and MTBE)	8260	Cool to < 6°C.	14 days	Include all solvent-type volatile chemicals and BTEX and MTBE in the initial 8260 analyses. Other methods, such as Methods 8011 or 8021, can be used during corrective action.
	TPH	TX1005	Cool to < 6°C immediately upon collection. Hold at –12°C at lab before and after extraction.	Extract within 14 days of collection. Analyze within 14 days of extraction.	Report the results of the following ranges: $n\mathrm{C}_{6}$–$n\mathrm{C}_{12}$ > $n\mathrm{C}_{12}$–$n\mathrm{C}_{28}$ > $n\mathrm{C}_{28}$–$n\mathrm{C}_{35}$ $n\mathrm{C}_{6}$–$n\mathrm{C}_{35}$
	PAHs if TPH greater than $n\mathrm{C}_{12}$ detected[d]	8310 or 8270[e] (if applicable)	Cool to < 6°C.	Extract within 14 days of collection. Analyze within 40 days of extraction.	If analytical interference is observed or suspected, sample extract should undergo cleanup—for example, using Method 3611.
Hydraulic fluid, lubricating oils, no. 6 fuel oil	TPH	TX1005	Cool to < 6°C upon collection. At lab, hold at –12°C at lab.	Extract within 14 days of collection. Analyze within 14 days of extraction.	Report the results of the following ranges: $n\mathrm{C}_{6}$–$n\mathrm{C}_{12}$ > $n\mathrm{C}_{12}$–$n\mathrm{C}_{28}$ > $n\mathrm{C}_{28}$–$n\mathrm{C}_{35}$ $n\mathrm{C}_{6}$–$n\mathrm{C}_{35}$
	PAHs if TPH greater than $n\mathrm{C}_{12}$ is detected[d]	8310 or 8270[e] (if applicable)	Cool to < 6°C.	Extract within 14 days of collection. Analyze within 40 days of extraction.	If analytical interference is observed or suspected, sample extract should undergo cleanup—for example, using Method 3611.

(Table footnotes appear on following page.)

[a] For release determination by the PST Program, the MQLs for the analytical methods used should be less than or equal to the action levels, or else the most sensitive standard available method must be used for the COC. The MQL for a chemical is the lowest nonzero standard used in the laboratory’s initial calibration curve, as described in Method SW846-8000.

[b] EPA SW-846 methods, except where noted. The latest version of the method online at <www.epa.gov/epawaste/hazard/testmethods/sw846/online/index.htm> should be used for the analyses.

[c] Holding times assume preservation as noted, unless otherwise indicated.

[d] The MQLs for TPH must be less than or equal to 50 mg/kg (soil) for each carbon range (i.e., nC_6–nC_{12}, > nC_{12}–nC_{28}, and > nC_{28} to nC_{35} or nC_{36}). Analytical responses detected above the laboratory's method detection limit (MDL) (i.e., observed above the MDLs and meeting the qualitative identification criteria specified either in the analytical method used, or in the laboratory's standard operating procedure) should be reported as detected results. If the response is detected below the MQL but above the MDL, the results should be reported at the concentration estimated by the laboratory and flagged with a qualifier (e.g., *J*) to indicate that the value reported is an estimate.

[e] Method 8270 using select ion monitoring or a low-level PAH approach is recommended because it minimizes false-positive detections of PAHs. Regardless of the method used, the MQL of the method must be less than or equal to the respective PST Program action level or else the most sensitive standard available method must be used for the COC.

Table 4. Summary of PST Constituents and Analytical Methods for Water Samples

Substance Stored[a]	Constituents	Analytical Methods[a,b]	Preservative[c]	Holding Time[d]	Comments
Gasoline, diesel, jet fuels, and nos. 1, 2, and 4 fuel oils	BTEX and MTBE	8021 or 8260	Cool to < 6°C and adjust pH to < 2 with H_2SO_4, HCl, or solid $NaHSO_4$.	14 days.	Method 8260B is preferred—but not required— for initial release characterization.
	TPH	TX1005	Cool to < 6°C and adjust pH to < 2 with H_2SO_4, HCl, or solid $NaHSO_4$. Hold extract at –12°C.	Extract within 14 days. Analyze within 14 days of extraction.	Report the results of the following ranges: nC_6–nC_{12} > nC_{12}–nC_{28} > nC_{28}–nC_{35} nC_6–nC_{35}
	PAHs if TPH greater than nC_{12} is detected[5]	8310 or 8270[6] (if applicable)	Cool to < 6°C and use amber glass sample containers.	Extract within 7 days of collection. Analyze within 40 days of extraction.	If analytical interference is observed or suspected, sample extract should undergo cleanup—for example, using Method 3611.
Waste oil or unknown petroleum products	VOCs (including BTEX and MTBE)	8260	Cool to < 6°C and adjust pH to < 2 with H_2SO_4, HCl, or solid $NaHSO_4$.	14 days.	Include all solvent-type volatile chemicals and BTEX and MTBE in the initial 8260 analyses. Other methods, such as 8011 or 8021, can be used during corrective action activities.
	TPH	TX1005	Cool to < 6°C and adjust pH to < 2 with H_2SO_4, HCl, or solid $NaHSO_4$. Hold extract at –12°C.	Extract within 14 days. Analyze within 14 days of extraction.	Report the results of the following ranges: nC_6–nC_{12} > nC_{12}–nC_{28} > nC_{28}–nC_{35} nC_6–nC_{35}
	PAHs if TPH greater than nC_{12} detected[e]	8310 or 8270[6] (if applicable)	Cool to < 6°C and use amber glass sample containers.	Extract within 7 days of collection. Analyze within 40 days of extraction.	If analytical interference is observed or suspected, sample extract should undergo cleanup—for example, using Method 3611.
Hydraulic fluid, Lubricating oils, no. 6 fuel oil	TPH	TX1005	Cool to < 6°C and adjust pH to < 2 with H_2SO_4, HCl, or solid $NaHSO_4$. Hold extract at –12°C.	Extract within 14 days of collection. Analyze within 14 days of extraction.	Report the results of the following ranges: nC_6–nC_{12} > nC_{12}–nC_{28} > nC_{28}–nC_{35} nC_6–nC_{35}
	PAHs if TPH greater than nC_{12} is detected[e]	8310 or 8270[f] (if applicable)	Cool to < 6°C and use amber glass sample containers.	Extract within 7 days of collection. Analyze within 40 days of extraction.	If analytical interference is observed or suspected, sample extract should undergo cleanup—for example, using Method 3611.

(Table footnotes appear on following page.)

[a] For release determination by the PST Program, the MQLs for the analytical methods used should be less than or equal to the action levels, or else the most sensitive standard method available method must be used for the COC. The MQL for a chemical is the lowest nonzero standard used in the laboratory's initial calibration curve, as described in Method SW846-8000.

[b] EPA SW-846 methods, except where noted. The latest version of the method online at <www.epa.gov/epawaste/hazard/testmethods/sw846/online/index.htm> should be used for the analyses.

[c] The water sample protocols summarized in the table assume the water has no residual free chlorine. For water samples **with** residual chlorine (e.g., collected from a public chlorinated supply), free chlorine must be removed by the appropriate addition of $Na_2S_2O_3$.

[d] Holding time assumes preservation as noted, unless otherwise indicated.

[e] The MQLs for TPH must be less than or equal to 5 mg/L (water) for each carbon range (i.e., nC_6–nC_{12}, > nC_{12}–nC_{28}, and > nC_{28} to nC_{35} or nC_{36}). Analytical responses detected above the laboratory's method detection limit (MDL) (i.e., observed above the MDLs and meeting the qualitative identification criteria specified either in the analytical method used, or in the laboratory's standard operating procedure) should be reported as detected results. If the response is detected below the MQL but above the MDL, the results should be reported at the concentration estimated by the laboratory and flagged with a qualifier (e.g., *J*) to indicate that the value reported is an estimate.

[f] Method 8270 using select ion monitoring or a low-level PAH approach is recommended because it minimizes false-positive detections of PAHs. Regardless of the method used, the MQL of the method must be less than or equal to the respective PST Program action level, or else the most sensitive standard method must be used for the COC.

environmental sample, report the estimated value, and qualify the value with a flag such as *J* to indicate that it is an estimate.

- All reported results must reflect sample-specific factors such as percent moisture for soils, the effects of laboratory preparations and cleanups, dilutions, and any other laboratory adjustments. For example, the results for soils **must** be reported on a dry-weight basis.
- Ask the laboratory to report preliminary data you can use as soon as possible after the analysis to compare detected and nondetected results to the action levels. If any SDLs are greater than their corresponding action levels, or if there are any other irregularities that may affect data usability, you can work with the laboratory, within the remaining holding time for the samples, to resolve the problem (see “Lab Analysis Problems—What to Do”).

Analyzing for PAHs and Interpreting the Data

When TPH is detected in the $> nC_{12}$ range, analyze the sample with the highest concentration of TPH $> nC_{12}$ for PAHs. Use an analytical method capable of achieving MQLs below the action levels for the PAHs or use the most sensitive standard method available for the COC. The analytical methods capable of achieving MQLs below the action levels for PAHs are SW846-8270 low-level PAH analysis, SW846-8270 SIM, or SW846-8310. The laboratory should be able to achieve MQLs below the action levels for the PAHs in water and soils. *Note:* SW846-8310 is prone to false positives, indicating one or more PAHs is present in the sample when the PAHs are not present. If the laboratory uses SW846-8310, it is recommended the laboratory perform confirmation analyses to verify the presence of the PAHs by using a dissimilar column or detector from that used in the original analysis or a definitive method such as SW846-8270 SIM.

When interpreting PAH data, keep in mind the following: PAH compounds are large plate-like molecules with low to very low solubility in water and high to very high values for log K_{oc}. These chemical and physical parameters respectively indicate PAHs have little affinity for water but do have an affinity for the organic fraction in soil, so the nature of PAHs is to adhere to the soil when released into the environment. The PAHs will not move readily through the soil under environmental conditions. In a TPH-contaminated soil, the PAHs are much more soluble in the TPH and tend to travel with the TPH as it moves on and through the soil and in water.

In using laboratory results for PAHs, keep in mind the following: PAHs are some of the most widespread organic pollutants and are most prevalent in soot and urban runoff. In addition to their presence in fossil fuels, they are also created, or formed, by incomplete combustion of fossil fuels, carbon-containing fuels, and biomass such as wood and coal, and are also components of coal tars used in wood treatment, asphalts, and some asphalt-sealant mixtures. PAHs generally travel together through the environment—if you see one you should expect others. Carcinogenic PAHs comprise a very small percentage by weight of fresh fuel, for example, the benzo(*a*)pyrene at 0.0008 weight percent in diesel. The noncarcinogenic PAHs comprise relatively higher weight percents, for example, the smallest PAH, naphthalene, at 0.8 weight percent. PAHs slowly to very slowly degrade relative to other hydrocarbons in the TPH, thus they become more prominent as the fuel weathers. When more than two PAHs are detected and the sample detection limit (SDL) for one or more of the other nondetected PAHs exceeds the action levels, the data user should assume the nondetected PAHs reported at SDLs exceeding the action levels are likely present in the sample. When no PAHs are detected in the sample but the SDLs for all of the PAHs exceed the action levels, the data user should assume PAHs are present in the sample at concentrations exceeding one or more of the action levels. To demonstrate compliance when no PAHs are detected in the sample and the SDLs are less than or equal to 0.0002 mg/L for most of the PAHs, the data user can use the SDLs reported for all of the PAHs.

What to Submit to the TCEQ

Table 5 summarizes two of the analytical data items that must be included with the Release Determination Report form (TCEQ-00621) to facilitate the TCEQ's review of whether a release has occurred.

These items are discussed in more detail below.

Laboratory Data Package

The following items must be included in the data package supplied by the laboratory:

1. Completed field chain-of-custody form(s) including:
   a. date and time of sample collection
   b. date and time custody is relinquished from the field
   c. date and time of sample receipt by the laboratory
   d. temperature of samples as received by the laboratory
   e. field identification number for each sample

Table 5. Items to Include in the Release-Determination Report

Item	Description	Who Generates
Laboratory data package	Legible field chain-of-custody forms, sample receipt documentation, certificates of analysis including QA/QC sample analysis, list of MQLs, and laboratory case narrative (see additional information below).	Laboratory
Data review summary	Discussion as to whether the data are of sufficient quality to meet the program and project objectives. Documents that the laboratory data package was reviewed.	Responsible party or representative independent of the laboratory

2. Cross-reference between the field identification number and the laboratory identification number assigned to each sample.
3. Analytical test reports (certificates of analysis) for each environmental sample, including:
    a. the information listed in NELAC Standard 5.13 (available at <www.nelac-institute.org/standards.php>)
    b. the analytical data reported as (1) the measured or estimated concentration for detected results, and as (2) less than the SDL for nondetected results
4. QA/QC data, including:
    a. Test reports for laboratory blank samples and laboratory control samples.
    b. The surrogate recovery data for each environmental, laboratory control, and laboratory blank sample, as applicable to the analytical method used. Include the percent recovery and the laboratory's quality control limits for surrogate recovery for the method used. The surrogate recovery data can be submitted in the data package on a standard form used by the laboratory, or on the test report for each sample.
    c. Matrix spike / matrix spike duplicate (MS/MSD) sample results, if the sample used for the MS/MSD analysis was from the site of concern. The MS/MSD results should include the percent recovery and relative percent difference for the COC in the environmental medium.
    d. Laboratory duplicates, if performed by the laboratory.
    e. A list of the MQLs. Note that a new list of MQLs does not necessarily have to be generated for each sample analysis—the list can be a copy of the laboratory’s standard analyte list with current MQLs for the analytical method.
5. A laboratory case narrative, or laboratory review checklist, that:
    a. documents the laboratory’s technical review of all of the data it generated;
    b. notes any problems or anomalies observed in the receipt, handling, preparation, or analysis of the samples;
    c. discusses possible effects any such problems may have on the quality of the data generated for each sample; and
    d. certifies the laboratory is NELAC accredited under the Texas Laboratory Accreditation Program for the analytes, matrices, and methods reported in the data package, except as noted by the laboratory.

Data Review Summary

The responsible party (or the responsible party's representative independent of the laboratory) prepares the data review summary. The summary is prepared by first reviewing the laboratory data package and associated case narrative, or laboratory review checklist, for any problems in the analytical data. Evaluate the quality control parameter data. Compare the detected and nondetected results to the action levels. Overall, the review should focus on whether the data can be used to demonstrate that a release has not occurred.

Discuss—at a minimum—the following items in the data review summary:

- Were any problems or anomalies observed in the data by the lab or by the person?
- What actions (if any) did the lab take to resolve problems or anomalies?
- Is the quality of the data sufficient for making a release determination?

Lab Analysis Problems—What to Do

One of the most common laboratory data problems the PST Program encounters is when the SDL, for a COC reported as "nondetected," exceeds the applicable PST Program action level. When that happens, it is not possible to determine whether there has been a release that requires action on the part of the TCEQ and the responsible party. This problem is illustrated in the following example:

> A groundwater sample is collected during a routine tank removal and is analyzed within proper holding times for benzene. The laboratory analyzes the sample on an instrument with an MQL of 0.001 mg/L and an MDL of 0.0005 mg/L. The laboratory reports benzene as not detected in the sample at an SDL of < 0.050 mg/L. Since the laboratory's MDL is 0.0005 mg/L, the "nondetected" result of < 0.050 mg/L for benzene indicates the laboratory diluted the sample by 100 times. That 100-fold dilution raised the SDL from 0.0005 mg/L to the 0.05 mg/L. The action level for benzene in groundwater is 0.005 mg/L, which is lower than the SDL of 0.05 mg/L. Since the presence or absence of benzene in the 0.005 to 0.05 mg/L range is not known, a determination of "no release" cannot be made.

Elevated SDLs could result from sample interferences or lab problems (or both). If TPH is detected in the carbon range of concern, for example, nC_6–nC_{12}, and all the individual COCs in that carbon range—for example, the BTEX—are not detected, but the SDLs are elevated, the problem may be due to sample interferences. In this case, direct the lab to take the following steps to achieve a lower SDL:

- Reevaluate the chromatogram.
- Reanalyze the sample using the same method, giving attention to the qualitative aspects of the analysis.
- Reanalyze the sample using a different method, such as gas chromatography–mass spectrometry in the select ion-monitoring mode (GC/MS-SIMs).
- Clean the sample (if possible) and reanalyze with a focus on lowering the SDL.

If TPH is not present in the carbon range of concern, the elevated SDLs may result from lab problems. For example, if the SDLs for BTEX exceed the action level, but no TPH is found in the C_6–C_{12} range, then the elevated SDLs are likely caused by problems in the laboratory or the presence of non-petroleum contaminants in the sample. Therefore, advise the lab to:

- review its analytical processes to determine the cause of the elevated SDLs;
- submit a revised test report with an explanation of the problem and the corrective action taken; and
- resample and analyze the sample with the improved process.

Otherwise, consider the SDL results to be the detected concentrations. Take actions to remediate the release, and collect confirmation samples to demonstrate that the concentrations remaining at the site do not exceed the PST ALs. Include in the release-determination report a discussion of the actions taken.

Table 6 and Figure 14 contain information that can help you work with your lab to resolve any data problems encountered. If the problems cannot be resolved, resampling and reanalysis may ultimately be required to finalize the release determination.

Note: most analytical data problems can be avoided via good communication with your lab prior to field mobilization.

Table 6. TCEQ Response Matrix for Analytical Data Issues in PST Release-Determination Submissions

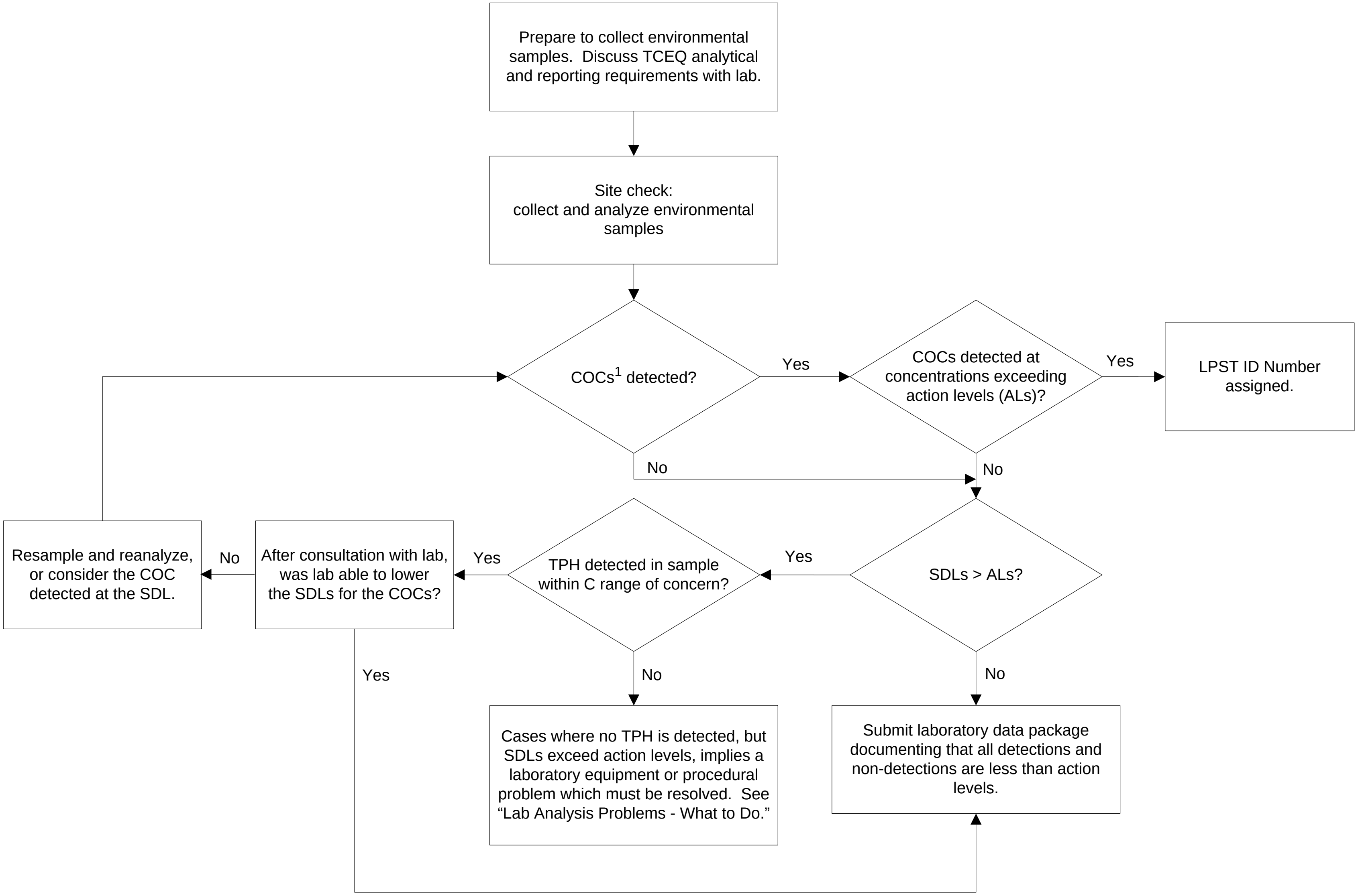
Any NDs[a] greater than AL(s)	**Any Ds[a] Greater than AL(s)**	**Actions to Take on Analytical Data Issues[b]**	**Release?**	**Actionable Release?[c]**	**LPST Number Assigned?**	**Type of Letter Issued by the TCEQ**
N	N	None	N	N	N	NFA
N	Y	None	Y	Y	Y	LAD
Y	Y	None	Y	Y	Y	LAD
Y	N	Elevated SDLs could be due to sample interferences. Work with lab to resolve. Refer to Lab Analysis Problems—What to Do.	Unknown[d]	Unknown[d]	Unknown[d]	NOD

[a] NDs = Nondetected results reported as less than the sample detection limit. Ds = Detected results.
[b] Addressing other deficiencies in the RDR submission may also be required.
[c] “Actionable” means a TCEQ action is triggered, such as issuing an LPST ID number.
[d] Release status unknown.

Abbreviations:

AL = Action level
NFA = No further action
COC = Chemical of concern
NOD = Notice of deficiency
LAD = Limited assessment directive
SDL= Sample detection limit
NA = Not applicable

Figure 14. Release reporting—analytical considerations.



1 "COCs" as used in this figure refers only to individually identifiable chemical compounds (not TPH).

For an HTML version of the process depicted in this flowchart, go to <tceq.texas.gov/goto/rg411charts>.