# New Jersey Department of Environmental Protection

# Site Remediation Program

# Technical Guidance for Investigation of Underground Storage Tank Systems

**DATE** **July 31, 2012**

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# TECHNICAL GUIDANCE FOR INVESTIGATION OF UNDERGROUND STORAGE TANK SYSTEMS

## 1. PURPOSE

The following section provides an overview of the purpose for technical guidance within the framework of Site Remediation in New Jersey as well as the specific purpose of guidance for remediation of Underground Storage Tank Systems.

### 1.1 Purpose for Technical Guidance

This technical guidance is designed to help the person responsible for conducting remediation to comply with the New Jersey Department of Environmental Protection (Department) requirements established by the Technical Requirements for Site Remediation (Technical Rules), N.J.A.C. 7:26E and Underground Storage Tanks, N.J.A.C. 7:14B. Because this technical guidance will be used by many different people that are involved in the remediation of a site, such as Licensed Site Remediation Professionals (LSRPs), Non-LSRP environmental consultants, and other environmental professionals, the generic term "investigator" is used to refer to any person that uses this technical guidance to remediate a contaminated site on behalf of a remediating party, including the remediating party itself.

The procedures for a person to vary from the technical requirements in regulation are outlined in the Technical Rules at N.J.A.C. 7:26E-1.7. Variances from a technical requirement or departure from technical guidance must be documented and adequately supported with data or other information. In applying technical guidance, the Department recognizes that professional judgment may result in a range of interpretations on the application of the technical guidance to site conditions.

This technical guidance supersedes previous Department guidance issued on this topic, pursuant to N.J.S.A. 26:10C-16, and was prepared with stakeholder input. The entire committee consisted of the following:

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## 1.2 Purpose of Technical Guidance for Investigation of Underground Storage Tank Systems

The purpose of this document is to provide technical guidance on the investigation of potential contamination at an Underground Storage Tank (UST) system pursuant to the Technical Requirements for Site Remediation. In particular, this document is intended to provide the following:

- Background for the need to investigate UST systems
- Approaches to achieve compliance with the UST system investigation requirements in the Technical Rule
- Recommendations for sampling frequencies to properly identify and delineate contamination from UST systems
- Assistance in the evaluation, approval, and use of an UST system investigation at Site Remediation Program sites
- Discussion of the investigation protocols for UST systems due to the unique issues for this type of area of concern (AOC)

## 2. OVERVIEW

This document provides the investigator with the technical guidance to complete an UST system assessment and site investigation including: assessment to determine the potential of the system to have discharged to the environment, sampling protocols to determine if contamination is present above an applicable Department remediation standard, and triggers to determine when a ground water investigation is warranted.

The remediation process requires that, when an UST system is suspected of having a release, further investigation of the UST is required. The first step of this process, after evaluating the UST system history, is the site investigation (SI). During a SI, sampling is conducted in areas where the highest contaminant concentrations are suspected to be present, to determine the type and concentration of the contaminants. If it is determined, through the SI, that contamination is present above the Department's remediation standards, then delineation of the contamination is required followed by a remedial action. In the case of UST systems, repair, replacement or closure is also required in accordance with N.J.A.C. 7:14B-8.1(a)3.

Contamination is delineated through a remedial investigation (RI). The purpose of the RI is to gather enough information about the contamination, the media and the site, to determine the appropriate course of action required to remediate/mitigate the contamination. For typical sites, a remedial action is conducted after the RI has been completed. However, with UST systems, the remedial action often takes place concurrently with the RI. As part of the remedial action, confirmatory sampling will normally be conducted to ensure that the contamination has been successfully remediated. However, if contamination has been satisfactorily delineated prior to the remedial action, depending on the remedy, confirmation sampling may not be necessary.

## 3. APPLICABILITY

Many underground storage tanks (USTs) are managed by the Underground Storage Tank regulations N.J.A.C. 7:14B. This regulation does specifically exempt certain "unregulated" USTs from the regulation. However, these exempted USTs are still required to comply with other Department regulations including but not limited to the "Administrative Requirements for the Remediation of Contaminated Sites" (ARRCs) [N.J.A.C. 7:26C], and the "Technical Requirements for Site Remediation", [N.J.A.C. 7:26E]. This document may be applied to all USTs when guidance is needed beyond that provided in the above regulations.

## 4. ASSESSMENT of UNDERGROUND STORAGE TANKS (USTs)

An underground storage tank (UST) system is an Area of Concern (AOC). When an UST is suspected of a release, when it is to be closed, removed, or when it is to be temporarily taken out of service pursuant to N.J.A.C. 7:26E and/or N.J.A.C. 7:14B, an investigation may be required. To conduct the appropriate site investigation (SI) activities, an assessment of the UST system is needed. An UST assessment should provide the following:

- description of the UST system including number of USTs, location and sizes, along with the location of any associated piping
- materials of construction of USTs and associated piping
- any associated leak detection methods and recordkeeping
- depth to bottom of USTs
- approximate depth to ground water (if available)
- age of the UST system
- types of products stored in the UST(s) over the life of the tank(s) with duration each product was stored
- any net product loss and amounts
- records of tank testing
- type and depth of UST overburden and surface material (i.e., concrete, asphalt)
- type of product pumps (American suction, European suction or pressurized if applicable)
- if any part of the UST system has been replaced or repaired and purpose of replacement or repair
- reported discharges (releases) from the system
- remedial activities that have occurred as a result of previous UST system releases
- cause and source of any release in accordance with N.J.A.C. 7:14B-8.3

The above information should be used to assist in determining the sample/boring frequency, locations, and analytical parameters for the UST investigation/closure.

## 5. UST Investigation procedures

The following sections offer general technical guidance on how to conduct an investigation for USTs under specific scenarios. The guidance applies to typical situations encountered. Sampling should be conducted based on the Soil Investigation Technical Guidance and the Groundwater

Investigation Technical Guidance as well as the guidance provided below. In cases where site-specific considerations differ from the scenarios presented below, professional judgment should be used to determine the appropriate sampling protocols that will be effective to identify a discharge from the UST/UST system.

For all the situations indicated below, analytical parameters should be selected based on history of the tank's contents and in accordance with the Technical Requirements for Site Remediation N.J.A.C. 7:26E-2.1 (c) through (e). If the history of the Tank contents is unknown or unclear, then, in accordance with N.J.A.C. 7:26E-2.1(c)ii, initial sampling parameters are to include Target Compound List plus TICs/Target Analyte List (TCL + TICs/TAL), hexavalent chromium, petroleum hydrocarbons, and pH, which may be scaled back once the contaminants of concern (COCs) are fully characterized. When analyzing for petroleum products in accordance with N.J.A.C. 7:26E-2.1(a)6, the latest version of the Protocol for Addressing Extractable Petroleum Hydrocarbons should be used to evaluate the EPH data.

## 5.1 Investigation procedures for USTs Remaining in Service

There are several instances when a site investigation (SI), in accordance with N.J.A.C. 7:26E-3.3 through 3.12, of an UST system is required along with the submission of a SI report, in accordance with N.J.A.C. 7:26E-3.13. The below bullet list provides some examples of when a site investigation is required by regulation:

- N.J.A.C. 7:14B-7.2(b) when the assessment of a suspected release from an UST requires further confirmation; or
- N.J.A.C. 7:14B-7.4 when there is information indicating that a facility may be a source of a discharge, and an unknown source investigation is required; or
- N.J.A.C. 7:14B-9.1(c)1 when an UST is temporarily taken out of service for a period of more than 1 year; or
- N.J.A.C. 7:14B-9.4 when the substance being stored in an UST is changed from a regulated to an unregulated substance.
- An ISRA triggering event will require and entire site environmental investigation including an assessment of all underground storage tanks used to contain a hazardous substance or hazardous waste.

When a Site investigation for an UST will be conducted and the UST will remain in service, the following site investigation protocol is recommended:

5.1.1 Prior to conducting any intrusive activities around an UST system, all safety precautions should be taken as recommended by the New England Interstate Water Pollution Control Commission publication "Tank Closure without Tears: An Inspector's Safety Guide".

5.1.2 The below table recommends the number of borings to be conducted based on tank capacity/length:

**Table 1 – In Service UST Sampling Frequency**

| Total Tank Capacity (Gallons) | Approximate Tank Length (Feet) | Recommended Number of Boring Locations per Tank |
|---|---|---|

| Total Tank Capacity (Gallons) | Approximate Tank Length (Feet) | Recommended Number of Boring Locations per Tank |
|---|---|---|
| 56-2,000 | to 10' | 4 |
| 2,001-10,000 | to 30' | 6 |
| 10,001-25,000 | to 40' | 8 |
| 25,000+ | to 40'+ | 10 |

5.1.3 Borings should be conducted within two feet of the sides of the tank if possible. One boring should be located at each end of the tank with additional locations equally distributed along the length of the tank on both sides. Borings do not need to be conducted between tanks that are immediately adjacent to each other in a tank field.

5.1.4 If borings cannot be conducted within two feet of the tank, due to the presence of bedding gravel, concrete pads, utilities or due to safety considerations, it is recommended that borings be conducted as indicated above but no further than five feet from the sides and ends of the tank. In addition, a ground water sample should be collected in the expected downgradient ground water flow direction within ten feet of the tank to assist in confirming the absence/presence of a discharge.

5.1.5 Soil borings should be evaluated in the field for contamination pursuant to the general soil screening guidelines in the Department's Field Sampling Procedures Manual (FSPM). Screening should begin at the ground surface and extend several feet below the depth of the tank bottom or to the top of bedrock, whichever is encountered first.

5.1.6 Soil samples should be collected from the following six-inch depth intervals for each boring:

- From the interval that exhibits the highest field screening readings and/or where the greatest visual impact is noted. The soil sample should be collected from this interval whether or not ground water is present.

- If there is no indication of contamination (i.e. no elevated readings or visual staining noted):

    - When no ground water is present, the soil sample should be collected from the zero to six-inch depth interval below the bottom of the tank bedding material.

    - If any portion of the tank is located at or below the known or estimated high water table the sample should be collected as follows:

        i. When the density of the current/former tank contents is/was less than 1 g/mL (LNAPL), collect the soil sample from the zero to six inch depth interval above the high water table;

ii. When the density of the current/former tank contents is/was greater than 1 g/mL (DNAPL), collect the soil sample from the zero to six-inch depth interval below the bottom of the tank bedding material; and

iii. When the UST contains/contained a mixture of substances with densities both less then and greater then 1g/mL, or when the tank contents is unknown for any point in time, collect soil samples as indicated i. and ii. above.

5.1.7 In accordance with N.J.A.C. 7:26E-3.5, all potentially contaminated areas of concern shall be evaluated to determine if they have potentially contaminated ground water. This evaluation should be conducted based on the criteria provided in section 2.3 of the Department's Ground Water Technical Guidance. If it is determined that the UST system has potentially contaminated ground water, then ground water sampling shall be conducted in accordance with N.J.A.C. 7:26E-3.5 and the Department's Ground Water Technical Guidance.

## 5.2 Investigation procedures for USTs undergoing closure

USTs are to be closed in accordance with all applicable ordinances and regulations, including but not limited to N.J.A.C 7:14B-9. For all USTs undergoing closure:

- If the tank contents are unknown, a sample of product or residue remaining in the tank should be collected and analyzed using an appropriate analytical method to identify the tank contents. The method used should be indicated within the Quality Assurance Project Plan required pursuant to N.J.A.C. 7:26E-2.2.

- Any physical evidence of a discharge (or lack thereof) should be documented. This documentation should include a written description and photographic depiction of the condition of the tank system (i.e., cracks, holes or tank corrosion) as well as the excavation.

- The type and quantity of any product spilled along with the remedial action taken to mitigate the spill if a discharge from the tank system occurs during closure should be documented.

5.2.1 For USTs being removed, samples should be collected as follows:

- Samples should be collected the same day as the tank removal.

- The floor and sidewalls of the excavation should be examined for any physical evidence of soil contamination as follows:

    - For tanks containing volatile organic compounds (VOCs) including but not limited to No. 2 fuel oil, diesel fuel, gasoline, kerosene, jet fuel or waste oil, field screen soil from bottom and sidewalls of the excavation as the soil is excavated. The objective of this approach is to bias sampling locations to the areas of highest contamination. If no

elevated field screening readings or visual staining is noted, select the sample locations based on professional judgment.

- For tanks containing non-volatile organic compounds including but not limited to No. 4 or No. 6 fuel oil, examine the excavation for physical evidence of a discharge, such as soil discoloration and odor and bias these areas for sample collection. If no elevated field screening readings or visual staining is noted, select the sample locations based on professional judgment.

- If a release is identified, a boring should be installed at each former tank location (these borings should be installed after the excavation has been backfilled preferably during the point when the ground water sample is being collected). Conduct soil sampling as follows:

  - Begin screening at the bottom of the former excavation and extend the boring to a depth of ten feet below the bottom of the excavation or to the top of bedrock, whichever is encountered first. Screen soil borings for contamination pursuant to the general soil screening guidelines in the soil investigation technical guidance document and the FSPM, and;

  - Collect a soil sample from the six-inch depth interval which exhibits the highest field screening readings or where visual staining is noted. If no elevated field screening readings or visual staining is noted, select the sample location based on professional judgment.

5.2.1.1 For USTs that are removed and no ground water is encountered in the excavation, soil samples should be collected as follows:

- Collect one sample from the centerline of the tank footprint for each five feet of tank length or fraction thereof. Distribute sample locations equally along the centerline of the tank footprint, and collect samples in the zone that is from zero to six inches below the bottom of the tank invert. If bedrock is encountered, collect the samples zero to six inches above the bedrock or refer to section 5.1.7 if insufficient soil is present to collect a sample. Samples should be biased to locations of elevated field screening readings and/or visual staining. For tanks that are 5 feet or less in length, one sample collected along the centerline equidistant from each end of the tank is recommended when no elevated field screening reading and/or no visual staining is noted.

- If the excavation is enlarged, additional soil samples should be collected in accordance with section 6.3.1 of the Department's Soil Sampling Technical Guidance document.

5.2.1.2 For USTs that are removed and ground water is encountered in the excavation, soil samples should be collected as follows:

i. When the density of the tank contents is/was less then 1 g/mL (LNAPL), collect soil samples zero to six inches above the high water table with one sample collected for every 30 linear

feet of each sidewall, a minimum of one sample per sidewall. Samples should be biased to locations of elevated field screening readings and/or visual staining;

ii. When the density of the tank contents is/was greater then 1 g/mL (DNAPL), samples should be collected at a frequency of every 5 feet along the centerline of the tank footprint with samples taken within 2.5 feet from each end of the tank. Samples should be biased to locations of elevated field screening readings and/or visual staining. For tanks that are 5 feet or less in length, only one boring along the centerline of the tank is generally needed; and

iii. When the UST contained a mixture of substances with densities both less than and greater than 1g/mL or the content of the tanks is unknown, collect soil samples per i. and ii. above.

5.2.1.3 For USTs being removed which are installed on a concrete pad, sampling should be conducted as follows:

i. If there is no evidence of cracks or compromises in the pad, collect one sample for every 30 linear feet of each side of the pad and within two feet of the pad, with a minimum of one sample per side. In accordance with N.J.A.C. 7:26E-2.1(b)1ii, all samples shall be biased to locations of elevated field screening readings or visual staining; and

ii. If there is evidence of cracks or compromises in the pad, collect additional samples below the pad biased to the location of the cracks or compromises with the greatest deterioration; or

iii. If ground water is encountered in the excavation, collect the soil samples as indicated in section 5.2.1.2 above.

**5.2.2** Pursuant to N.J.A.C. 7:14B-9.2(e), an UST may be abandoned in place if there is no contamination detected above remediation standards, or when there is evidence of a discharge but removal is not feasible. If the UST is to be abandoned in place in accordance with N.J.A.C. 7:14B-9.2(e), the following sampling protocols are recommended:

- If any portion of the tank is located within the water table, collect soil samples in accordance with the portion of section 5.1.6 above that discusses collection of samples when ground water is present.

- If the tank is not located within the water table collect soil samples as follows:

    - Conduct soil borings through the bottom of the tank. Conduct one soil sample boring for each 5 feet of tank length, or fraction thereof;

    - Install one boring within 2.5 feet from each end of the tank, with additional borings equally distributed along the center line of the tank;

    - Collect one sample from the centerline of the tank footprint for each five feet of tank length or fraction thereof. Distribute sample locations equally along the centerline of the

tank footprint, and collect samples in the zone that is from zero to six inches below the bottom of the tank invert. If bedrock is encountered, collect the samples zero to six inches above the bedrock. Samples should be biased to locations of elevated field screening readings and/or visual staining. For tanks that are 5 feet or less in length, one sample collected along the centerline equidistant from each end of the tank is recommended when no elevated field screening reading and/or visual staining is noted.

- If contamination is detected above the most stringent remediation standard for any environmental medium, the tank should be removed pursuant to N.J.A.C. 7:14B-9, and sampling should be conducted pursuant to 5.2 and 5.2.1 above. If contamination is detected and tank removal is not feasible, the investigator must comply with N.J.A.C. 7:14B-9.2(e) which indicates the requirements for abandoning an UST in place.

### 5.3 UST ground water investigation during closure

In accordance with N.J.A.C. 7:26E-3.5, ground water sampling is required during closure of an UST when there is a potential that ground water has been contaminated. The potential that ground water has been contaminated is based on the considerations within section 2.3 of the Departments Ground Water Technical Guidance document.

In addition, if soil sampling cannot be conducted in accordance to any of the above sections, because it may cause damage to an adjacent structure or is otherwise impracticable, it is recommended that ground water sampling be conducted.

If it is determined that ground water sampling is needed or desired, it is to be conducted in accordance with N.J.A.C. 7:26E-3.5(a) and as recommended in the Department's Ground Water Technical Guidance document. Typically, the first step in a ground water investigation for an UST system, is to obtain a ground water sample from within ten feet of the tank in the expected downgradient ground water flow direction.

## 6. Reuse of Excavated Soils

Soil excavated to access UST systems may be reused within the excavation that it was taken from without sample analysis if there is no physical evidence of a discharge as determined by using the methods specified in section 5 above.

Any soil excavated due to a discharge from the tank system where there is a desire for the material to be reused should follow the Department's Alternative and Clean Fill Guidance for SRP Sites to determine its' acceptability for reuse.

## 7. Piping & Associated Loading/Unloading Areas

Sample all above-grade and below-grade piping associated with the USTs, including fill ports, and dispensers in accordance with section 3.6.2 within the Department's Soil Sampling Technical Guidance Document.

# Appendix A

# Acronyms

## ACRONYMS

| | |
|---|---|
| AOC | area of concern |
| ASTM | American Society for Testing and Materials |
| CERCLA | Comprehensive Environmental Response, Compensation and Liability Act |
| CSM | conceptual site model |
| DNAPL | dense non-aqueous phase liquid |
| DQO | data quality objective |
| ESC | ecological screening criteria |
| ESNR | environmentally sensitive natural resources |
| FSPM | Field Sampling Procedures Manual |
| GIS | Geographic Information Systems |
| HASP | Health and Safety Plan |
| ITRC | Interstate Technology and Regulatory Council |
| LSRP | Licensed Site Remediation Professional |
| MEC | munitions and explosives of concern |
| MPPEH | material presenting a potential explosive hazard |
| N.J.A.C. | New Jersey Administrative Code |
| NJDEP | New Jersey Department of Environmental Protection |
| N.J.S.A. | New Jersey Statutes Annotated |
| PA | Preliminary Assessment |
| PAH | polycyclic aromatic hydrocarbons |
| RAWP | Remedial Action Work Plan |
| RI | Remedial Investigation |
| SI | Site Investigation |
| TCL/TAL | target compound list/target analyte list |
| USEPA | United States Environmental Protection Agency |
| UST | underground storage tank |
| VOC | volatile organic compound |

# Appendix B

# References

References:

New England Water Pollution Control Commission, 1988. Tank Closure without Tears: An Inspector's Safety Guide, May 1988

American Petroleum Institute, 1996. Closure of Underground Petroleum Storage Tanks, API Recommended Practice 1604, Third Edition. March 1996

NJDEP, 2005 amendments 2009, Field Sampling Procedures Manual, August 2005

Connecticut DEP, 2006. Guidance for Design of Large-Scale On-Site Wastewater Renovation Systems, February 2006

NJDEP, 2010 – Protocol for Addressing Extrtactable Petroleum Hydrocarbons, August 2010.

NJDEP, 2011 – Alternative and Clean Fill Guidance for SRP Sites, December 2011

NJDEP, 2012. - Administrative Requirements for the Remediation of Contaminated Sites, N.J.A.C. 7:26C, May 2012

NJDEP, 2012. - Underground Storage Tanks, N.J.A.C. 7:14B, May 2012

NJDEP, 2012. - Technical Requirements for Site Remediation, N.J.A.C. 7:26E, May 2012

NJDEP, 2012 – Ground Water Technical Guidance: Site Investigation, Remedial Investigation, Remedial Action Performance Monitoring, April 2012