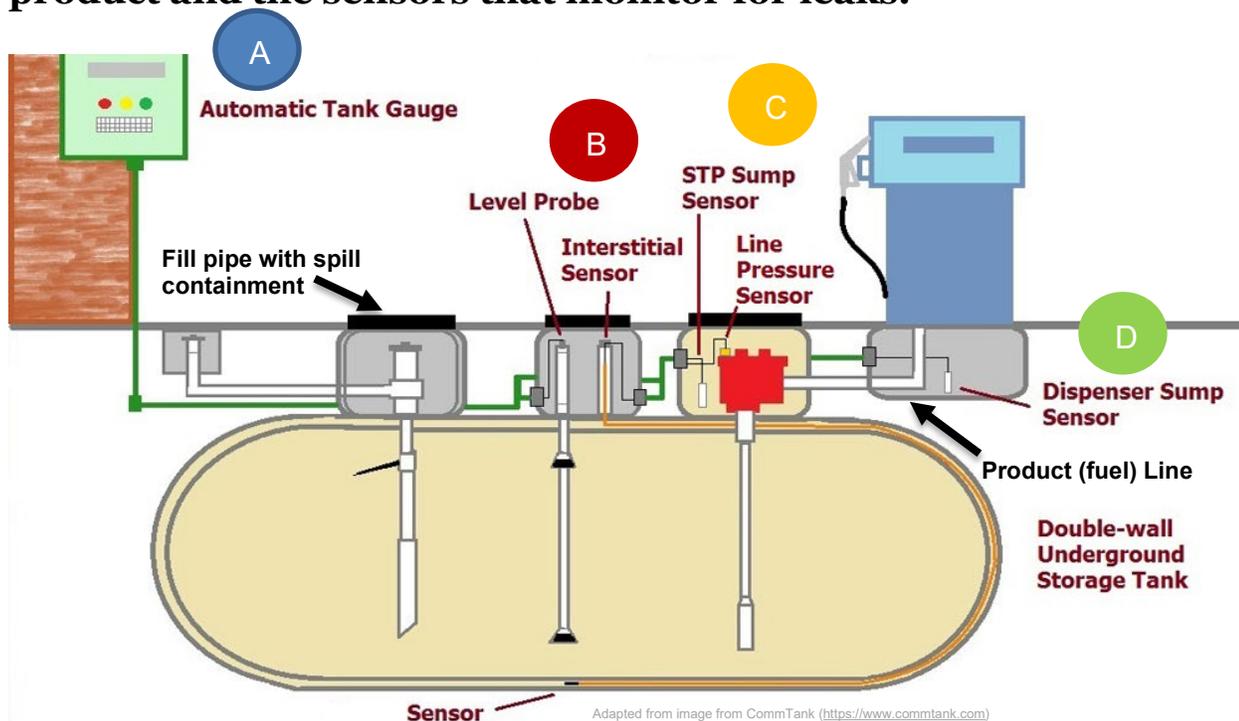


Property Owner and Community Definition Reference Guide

The purpose of this document is to provide an overview of Underground Storage Tanks (UST) systems and common remediation techniques. It also provides definitions for frequently used acronyms and terms, and important reference tables to help understand leaking underground storage tanks

Photo by [Juan Cruz Mountford](#) on Unsplash

Underground Storage Tank (UST) systems have features that monitor and gauge the integrity of the tanks. Georgia's Underground Storage Tank Management Program (USTMP) has a team of regulatory compliance officers who inspect the condition and review the mandatory testing of the tank's monitoring system and work with the industry to ensure tank systems are up to date with state and federal requirements. Below is a diagram of a typical underground storage tank used to store petroleum product and the sensors that monitor for leaks.



A Automatic Tank Gauge is an electronic device connected to sensors that are permanently installed in the UST system and helps facilities manage tank status. ATG systems can monitor the product level and temperature in the tank to detect leaks.

B Level Probe monitors product level and **Interstitial Sensors** are used to check the space between double-walled tank for leaks.

C STP (Submersible Turbine Pump) Sensor detects product leaked from the STP head and its DW piping connections, or surface runoff water that has infiltrated the containment sump. Liquids found here or in the Dispenser Sump (D) should be managed as wastewater.

D Under Dispenser Containment (UDC) Sump is the liquid tight containment pit that provides access to piping, connectors, and valves under the fuel dispensers. It catches the product if there is a break or leak in the line from the dispenser or the piping under it. The dispenser sump sensor monitors the presence of leaked product from under the dispenser component.

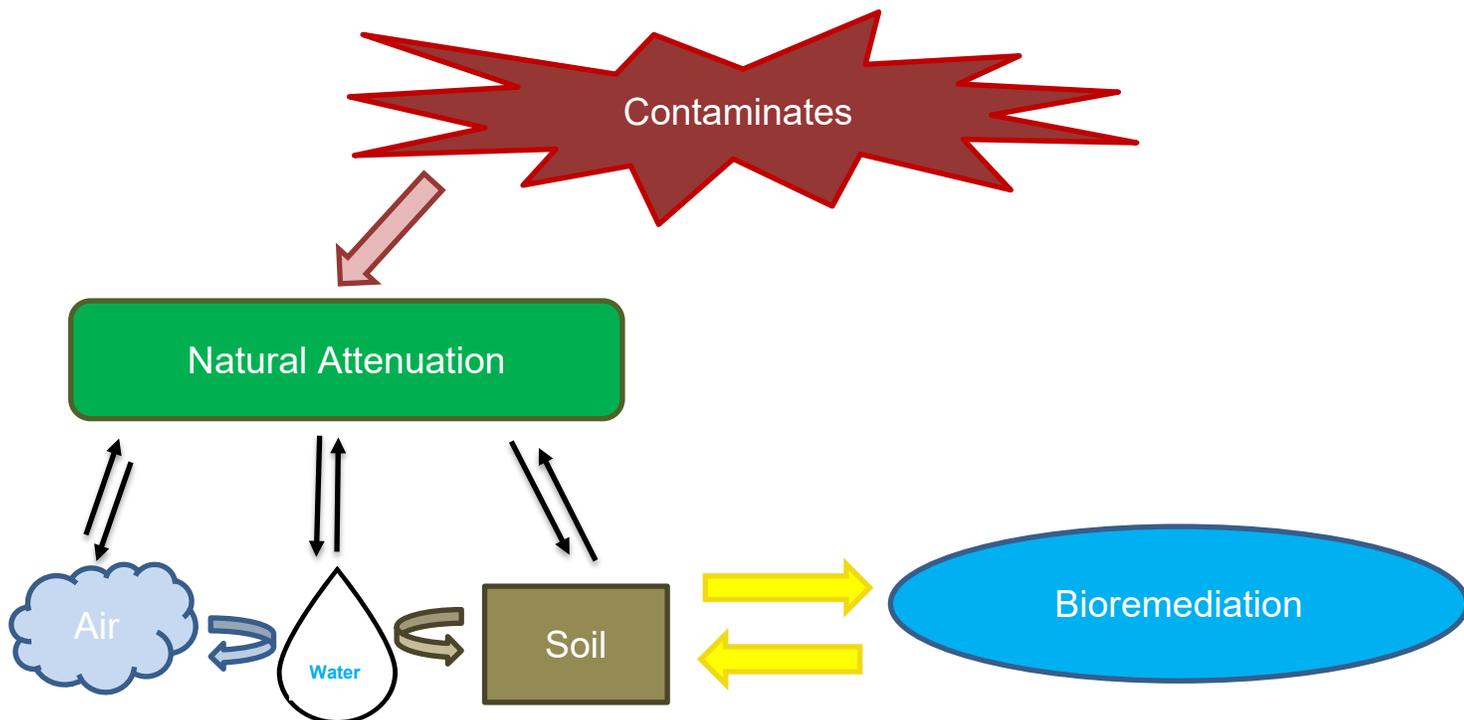
Even though measures are taken to monitor the integrity of UST systems, sometimes leaks occur. If there is a release, an investigation is completed to assess the extent and radius of petroleum contamination. The radius of the contamination is referred to as the “plume.” There are various methods used to clean up petroleum sites. The methods of clean up are referred to as “remediation systems.” These systems are placed at the source site to remove petroleum contaminants from the soil and/or groundwater. Below are common techniques in remediation.

Monitored Natural Attenuation

The most common type of remediation is Monitored Natural Attenuation. Natural attenuation refers to the process of contamination breakdown and absorption into the Earth without human interference. Natural occurring processes breakdown the chemical components of petroleum product so that they can be absorbed into the earth at levels that cannot be detected.

The process is called biodegradation and occurs when microorganisms decompose a substance into its fundamental elements or a new compound. The process can be anaerobic (not requiring oxygen) or aerobic (requiring oxygen) biodegradation.

Visit US EPA for “A Citizen’s Guide to Monitored Natural Attenuation”
https://www.epa.gov/sites/production/files/2015-04/documents/a_citizens_guide_to_monitored_natural_attenuation.pdf



Dual Phase Extraction (DPE)

This remediation technique extracts contaminants in groundwater and soil vapor by using a high-vacuum system. It can be referred to as multi-phase extraction (MPE), vacuum-enhanced extraction or bio slurping and is an in-situ (on-site) method. The system uses high-vacuum pumps to remove the contaminants from the groundwater and subsurface vapors. The contaminants are treated and collected for disposal or released back into the environment once cleaned (where permissible). Dual phase extraction also enhances the natural biodegradation or breakdown of petroleum by increasing the oxygen levels in the unsaturated zone of the subsurface.

Typical Multi-Pump DPE System

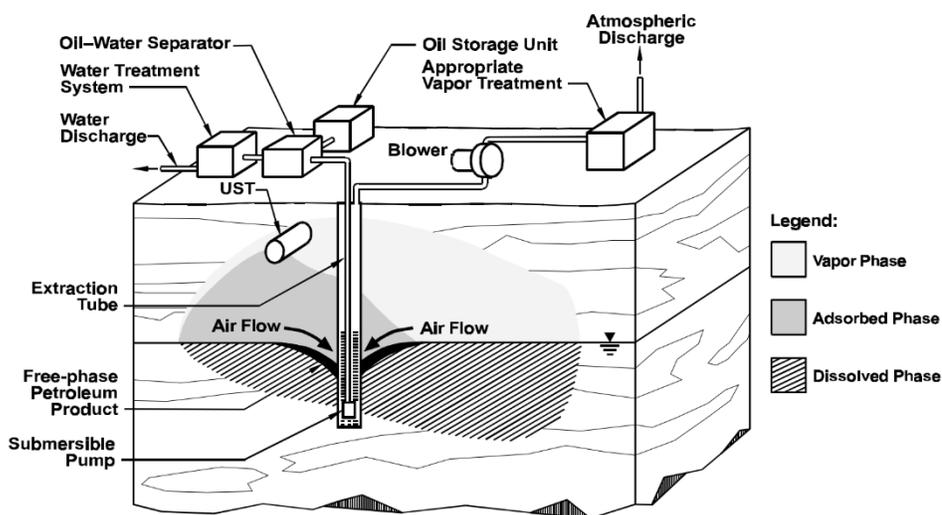


Image from USEPA (<https://www.epa.gov/>)



Photo of truck mounted DPE

Image from GAEPD USTMP

Air Sparging

This remediation technique is also referred to as in-situ air stripping and is often used in combination with Soil Vapor Extraction (SVE). Large volumes of air are pumped by a compressor into “injection” wells which are drilled through the contaminated groundwater soil below the water table. As the air is pumped through, air bubbles are formed. These air bubbles carry vapor contaminants through the groundwater and into the water table. Soil Vapor Extraction can then be used to pull the mixture of air and vapors out of the ground.

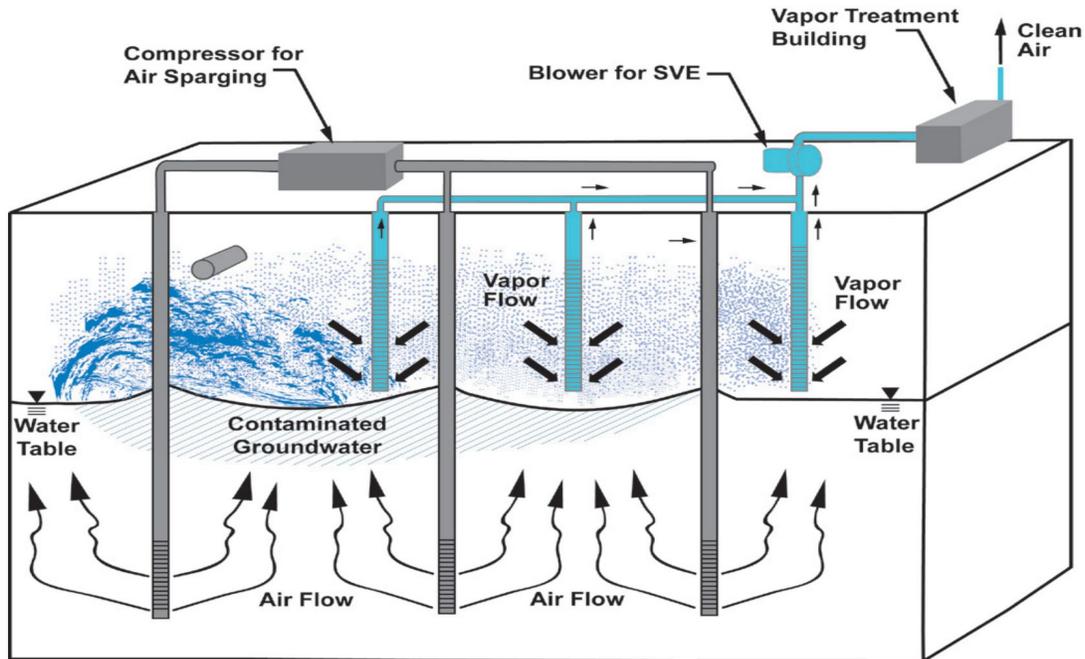


Image from USEPA (<https://www.epa.gov/>)

The following photos show where the underground piping for SVE, water pumping and air sparging turns up to the surface to connect with the remediation pipe manifold, as well as groundwater and product recovery.

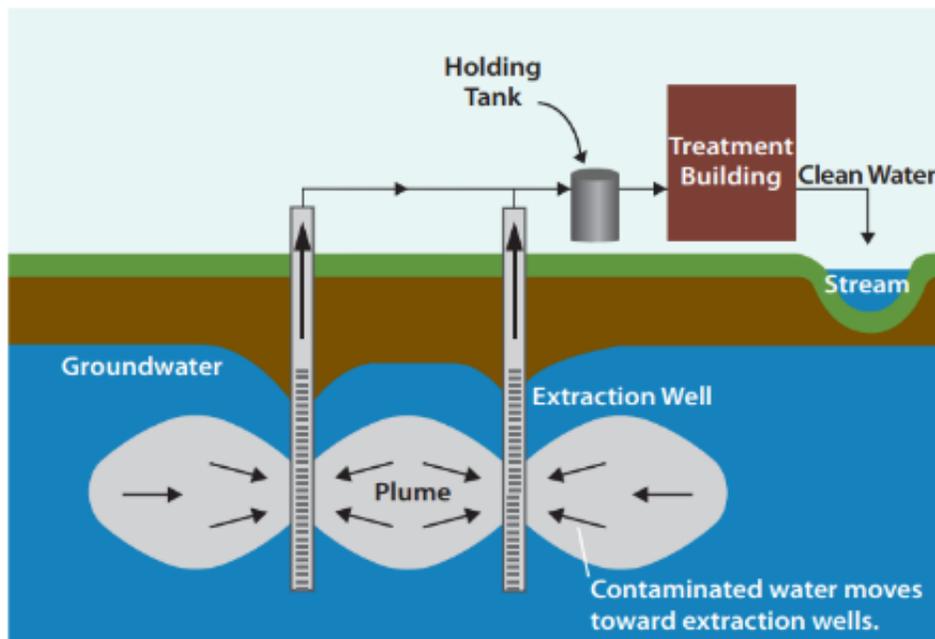


Images from ATLAS. Reprinted with permission.

Visit US EPA for “A Citizen’s Guide to Soil Vapor Extraction and Air Sparging” at https://www.epa.gov/sites/production/files/2015-04/documents/a_citizens_guide_to_soil_vapor_extraction_and_air_sparging.pdf

Pump and Treat

This common remediation technique allows groundwater to be pumped from “extraction” wells to an above-ground treatment system or facility designed to remove petroleum contaminants. Once the groundwater is treated and cleaned it is released through discharge pipes back into the environment.



Example of a Pump and Treat System with Two Extraction Wells.

Image from USEPA (<https://www.epa.gov/>)

Visit US EPA for “A Citizen’s Guide to Pump and Treat” at

https://www.epa.gov/sites/production/files/2015-04/documents/a_citizens_guide_to_pump_and_treat.pdf

Over excavation

Over excavation is the least common form of remediation used and involves the removal of a large section of soil around the parameter of a leaking UST system. This technique is used for releases that are contained to a small area and when a tank will be permanently closed or removed. Samples are collected and tested from the pit wall and below the tank to ensure all contaminants have been removed. The pit is then filled with clean soil.



Photo of tank removal

Image from GAEPD USTMP



Photo of over excavation in progress.

Image from GAEPD USTMP

Understanding the acronyms used in research, forms and reports can be overwhelming. Below are the most common acronyms that you may encounter in your interactions with environmental documents and consultants.

Common Acronyms:

ACL	Alternate Concentration Limit
AOC	Area of Concern
AOPC	Area of Potential Concern
BDL	Below Detection Limit
Bgs	below ground surface
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes (common chemicals of petroleum)
CAP	Corrective Action Plan
COC	Chemical of Concern
CFR	Code of Federal Regulation
EPA	Environmental Protection Agency (federal)
EPD	Environmental Protection Division (state)
FP	Free Product
GRBCA	Georgia Risk-based Corrective Action
GW	Groundwater
ISWQS	In Stream Water Quality Standard
LPB	Land Protection Branch
LUST	Leaking Underground Storage Tank
MCL	Maximum Contaminant Level
MTBE	Methyl tertiary-butyl Ether
MW	Monitoring Well
NAPL	Non-Aqueous Phase Liquid
ND	Non-detect
NFA	No Further Action
NSR	No Significant Risk
PAHs	Polynuclear Aromatic Hydrocarbons
Pb	Lead
RO	Responsible Owner
RAR	Risk Analysis Report
RBTL	Risk-based Threshold Level
RP	Responsible Party
RW	Recovery Well
(S-1, S-2,)	Indicates the Soil Category
SISR	Site Investigation Summary Report
SSTL	Site Specific Threshold Level
UST	Underground Storage Tank
VI	Vapor Intrusion

Understanding the terms and definitions used in the investigation of a petroleum release will provide you a better grasp of how your property may be impacted by contamination and how it will be assessed.

Definitions of Common Terms:

Area of Contamination (AOC) – The parcel of land containing the UST system where a petroleum release occurred and if applicable, beyond this parcel of land’s property boundary, the area **within** the known petroleum contaminated soil, groundwater and/or free product plume(s). The location of the soil, groundwater and/or free product plume is not dependent upon the location of property boundaries.

AOC Site Specific Threshold Level (AOC SSTL) – This term is used in the Georgia Risk-based Correction Action Model (GRBCA) that USTMP project officers or environmental consultants use. The risk-based threshold level calculated with site specific data for an individual chemical of concern (COC) that will provide adequate protection of human health and/or the environment.

Area of Potential Contamination (AOPC) - Excluding the UST facility property footprint where the petroleum release occurred, the AOPC includes any location **outside** the area of the known petroleum contaminated soil, groundwater and/or free product plume(s). The location of the soil, groundwater and/or free product plume is not dependent upon the location of property boundaries.

AOPC Site Specific Threshold Level (AOPC SSTL) - This term is used in the Georgia Risk-based Correction Action Model (GRBCA) that USTMP project officers or environmental consultants use. The risk-based threshold level calculated with site specific data for an individual COC that will provide adequate protection of human health and/or the environment.

Chemicals of Concern (COCs) - Specific elements of petroleum product(s) and/or additives that have been identified for the evaluation in the risk assessment process by the USTMP. The COC hierarchy in selecting the maximum concentration for a petroleum release is as follows: Benzene, MTBE, Ethyl benzene, Toluene, Xylenes and Naphthalene.

Clean Soil – Soil that has not been negatively impacted by a petroleum release. For the purpose of evaluating petroleum vapor intrusion (VI) inclusion screening, soil that contains < 0.1 mg/kg benzene concentration.

Corrective Action Plan-Part A (CAP-Part A)- CAP-Part A is designed to identify the source area, radius of contamination, potential receptors, and establish sampling data used to determine the next course of action.

Corrective Action Plan-Part B (CAP-Part B)- CAP-Part B is required if petroleum contaminants present in the soil and/or groundwater exceed one or more of the thresholds as established in GUST Rule 391-3-15.09(3). CAP-Part B comes after a completed CAP-Part A and successful delineation.

Contaminated Soil – Soil that has been negatively impacted by a petroleum release. For the purpose of evaluating petroleum VI inclusion screening, soil that contains ≥ 0.1 mg/kg benzene concentration.

Delineation-Defines the boundary between contaminated (dirty) soil and clean soil. This technique is used to find the area of contamination, how far horizontally and vertically it goes.

Ephemeral (stormwater) Stream* - A feature that carries only stormwater in direct response to precipitation, with water flowing only during and shortly after large precipitation events. An ephemeral stream may or may not have a well-defined channel, the stormwater is the primary source of water and the aquatic bed is always above the water table. An ephemeral stream typically lacks the biological, hydrological and physical characteristics commonly associated with the continuous or intermittent movement of water. *NOTE: “water table” refers to the seasonal high-water table in riparian zone soil adjacent to the stream.*

Exposure Pathway (or Pathway) - The course a COC takes from the source area to an exposed organism. Each exposure pathway includes a release source, a point of exposure (or exposure point) and an exposure route.

Exposure Route - The contact mechanism (i.e., ingestion, inhalation, dermal absorption) by which COC enters an organism. More than one contact mechanism may transfer a COC to an organism.

Free Product (FP) - The measurable thickness of light, non-aqueous phase petroleum liquid (LNAPL) in a well or on the surface of a water body, or the USTMP target groundwater benzene concentration defining free product conditions.

GRBCA– The Georgia Risk-based Corrective Action Model used to evaluate each petroleum release site and compare maximum soil and groundwater concentrations to published applicable Risk-based Threshold Levels (RBTLs) and/or site specific, calculated groundwater Site Specific Threshold Levels (SSTLs) at all petroleum release sites. These results, when compared to any evaluated receptors, determines the receptor most at risk and on that basis, recommends the groundwater Alternate Concentration Limits (ACLs) for approval.

Groundwater-water held underground in the soil or in pores and crevices in rocks.

Intermittent Stream* - A well-defined channel that contains water for only part of the year, typically during winter and spring when the aquatic bed is below the water table. The flow may be heavily supplemented by stormwater runoff. An intermittent stream often lacks the biological, hydrological and physical characteristics commonly associated with the continuous movement of water.

Monitored Natural Attenuation (MNA)- Natural process of remediation for treating some dissolved groundwater contaminants. Also, can be referred to as “bioremediation.”

Municipal Water Supply - Public drinking water system where treated water is supplied by a local water authority and connected to a service address by a water meter (municipal tap). “City water” is a synonym for a public drinking water system.

Non-Public Water Supply Withdrawal Point – Private water well or spring that has fewer connections than the minimum Public Drinking Water System connections and usually supplies a single-family residence or farm.

Nonresident - The human receptor that is a commercial worker at a petroleum release site or an offsite structure. An onsite, nonresident is typically a retail gas station employee. An offsite nonresident is a commercial/industrial employee at an adjacent or nearby business. The term does not include excavation worker.

Offsite - Any properties located outside the legal property boundary of the parcel where the petroleum release occurred.

Onsite - The legally defined parcel of land where the petroleum release occurred.

Perennial Stream* - A well-defined channel that contains water year-round during a year of normal precipitation with the aquatic bed located below the water table for most of the year. Groundwater is the primary source of water for a perennial stream, but it also carries stormwater runoff. A perennial stream exhibits the typical biological, hydrological and physical characteristics commonly associated with the continuous movement of water.

Public Access Spring – A spring that supplies free, untreated water to patrons from a defined public location. Such springs are not common, and patrons typically use containers to fill and transport spring water for domestic consumption. Local utilities or municipalities may periodically monitor water quality from this type of spring.

Public Water Supply Withdrawal Point – Water well, surface water intake or spring that supplies water to a Public Drinking Water System.

Public Drinking Water System - As defined by the Georgia Rules for Safe Drinking Water (Chapter 391-3-5, as amended), provides piped water for human consumption to at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year.

Point of Exposure - The point(s) at which an individual or population has or may have come in contact with a COC originating from a petroleum release. The distance from the source to the AOC and/or AOPC receptor will be applied during fate and transport evaluation.

Receptor - Persons, structures, utilities, surface waters (water supply intake, organisms and recreation), water supply wells, and/or ecologically sensitive areas/habitats that are or may be adversely affected by a petroleum release. A receptor may be located within an AOC or AOPC.

Release Point - The identified and specific location responsible for the petroleum release investigation. This location will be a specific UST component that failed or had a spill or overfill. If the release point is unknown or cannot be identified (i.e., historical release

lacking records, routine UST system closure, etc.), evaluate the UST system for how it is or was spatially located on the UST site.

Remediation- the action of remedying something, in particular of reversing or stopping environmental damage. Also, can be referred to as “clean-up.”

Resident - A human child or adult residing in an AOC or AOPC. A resident child is **always** included with a resident adult. Therefore, “Resident” in the GRBCA Process is inclusive of an adult and child.

Risk Analysis Report (RAR) - The GRBCA Workbook publishes the Risk Analysis Report, which is a very detailed, technical report to help guide consultants and staff to make informed decisions for the impacted parcel. The report compares the published and applicable soil and groundwater RBTLs and/or groundwater SSTLs at all UST sites that have had a petroleum release or establishes determines if a risk of exposure does not exist because an exposure pathway is not complete.

Risk-based Threshold Level (RBTL) - Toxicological and chemical property specific, calculated concentration for an individual COC that provides adequate protection of human health and/or the environment. The RBTL for each COC is a conservative value that establishes safe exposure levels for a resident, nonresident, surface water organism, and/or recreation.

Site Specific Threshold Level (SSTL) - Using site specific data, the calculated concentration for an individual COC that provides adequate protection of human health and/or the environment. The SSTL for each COC is a conservative value that calculates safe exposure levels for a resident, non-resident and/or surface water organism, and/or recreation.

Surface Water- water that collects on the surface of the ground.

TPH- Total Petroleum Hydrocarbon

*Adapted from North Carolina Division of Water Quality - Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11

The following table outlines the Groundwater & Surface Water Chemicals of Concern (COCs) that are sampled during a release event. It is categorized by the different petroleum products found at various UST facilities.

Product Released	COCs to Sample			
	Groundwater		Surface Water ^{†††}	
	Drinking Water (Ingestion)	Non-Drinking Water (Vapor Inhalation)	Public Water Supply Withdrawal Point* (Ingestion)	Perennial Water Body** (Direct Exposure)
Gasoline	Benzene Ethyl benzene Toluene Total Xylenes MTBE Naphthalene	Benzene Ethyl benzene Toluene Total Xylenes MTBE Naphthalene	Benzene Ethyl benzene Toluene Total Xylenes	Benzene Ethyl benzene Toluene
Diesel/ Jet Fuel/ Kerosene	Benzene Ethyl benzene Toluene Total Xylenes MTBE Naphthalene 1-Methylnaphthalene 1,2,4-Trimethylbenzene Benzo(a)pyrene TEQ [†]	Benzene Ethyl benzene Toluene Total Xylenes MTBE Naphthalene	Benzene Ethyl benzene Toluene Total Xylenes Benzo(a)pyrene TEQ [†]	Benzene Ethyl benzene Toluene Naphthalene 1-Methylnaphthalene 1,2,4-Trimethylbenzene Benzo(a)pyrene TEQ [†]
Used Oil	D/JF/K (above) Lead, Total	D/JF/K (above)	D/JF/K (above) Lead, Total	D/JF/K (above) Lead, Total
Aviation Fuel/ Leaded Gasoline/ Unknown^{††}	Benzene Ethyl benzene Toluene Total Xylenes MTBE Naphthalene EDB ^{***†} EDC [†] 1-Methylnaphthalene 1,2,4-Trimethylbenzene Benzo(a)pyrene TEQ [†] Lead, Total	Benzene Ethyl benzene Toluene Total Xylenes MTBE Naphthalene EDB [†] EDC [†]	Benzene Ethyl benzene Toluene Total Xylenes Naphthalene EDB ^{***†} EDC [†] Benzo(a)pyrene TEQ [†] Lead, Total	Benzene Ethyl benzene Toluene Naphthalene EDC Benzo(a)pyrene TEQ [†] 1-Methylnaphthalene 1,2,4-Trimethylbenzene Lead, Total

[†]Benzo(a)pyrene Total Equivalent Quotient (TEQ). See Appendix B, Section 2.9 for TEQ determination details

^{††}COCs to sample for all leaded aviation fuels, all leaded racing fuels and sites with historical leaded gasoline storage

^{†††}COCs to be sampled **only** at surface water receptor

*GA EPD MCLs (Rule 391-3-5-.18);

**GA EPD In Stream Water Quality Standards (Rule 391-3-6-.03). See REFERENCE 4C for additional clarification of this category

***EDB drinking water samples are analyzed by EPA Method 8011

BTEX, MTBE, Naphthalene, 1,2,4-Trimethylbenzene (TMB) EDB (non-drinking water) and EDC are analyzed by EPA method 5030C/8260C

1- Methylnaphthalene are analyzed by EPA Method 8270C. Lead, Total are analyzed by EPA Method 200.8

The following table outlines the Soil Chemicals of Concern (COCs) that are sampled during a release event. It is categorized by the different petroleum products found at various UST facilities.

COCs to Sample	
Product Released	Soil COCs to Sample
Gasoline	Benzene Ethyl benzene Toluene Total Xylenes MTBE Naphthalene
Diesel/ Jet Fuel/ Kerosene	Benzene Ethyl benzene Toluene Total Xylenes MTBE Naphthalene 1-Methylnaphthalene 1,2,4-Trimethylbenzene Benzo(a)pyrene TEQ TPH (Aliphatic Medium) *
Aviation Fuel/ Leaded Gasoline	Benzene Ethyl benzene Toluene Total Xylenes MTBE EDB, EDC Naphthalene 1-Methylnaphthalene 1,2,4-Trimethylbenzene Benzo(a)pyrene TEQ Lead, Total
Used Oil	Diesel/Kerosene Jet Fuel/ TPH (Aliphatic High) * Lead, Total
Unknown	Aviation Fuel TPH (Aliphatic Medium) * TPH (Aliphatic High) *

*TPH soil COC analyzed during UST system or component closures only

BTEX, MTBE, Naphthalene, 1, 2, 4-TMB, EDB and EDC are analyzed by EPA method 5030C/8260C

1 -Methylnaphthalene and Benzo(a)pyrene are analyzed by EPA Method 8270C

TPH Aliphatic Medium (C12-C18) and TPH Aliphatic High (C19-C32) are analyzed by EPA Method 8015C

Lead, Total is analyzed by EPA Method 6010C/3050B