GUIDELINES FOR SAMPLING

UST Section

North Carolina

Department of Environment and Natural Resources

Division of Waste Management

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Definitions

Action Level: the concentration of a contaminant that if exceeded may require further regulatory action such as cleanup or monitoring.

Aquifer: a permeable body of rock or sediment that stores and transmits groundwater in sufficient quantity to supply wells or springs.

Bedrock: any consolidated rock which is encountered in the place in which it was formed or deposited and which cannot be readily excavated without the use of explosives or heavy rock cutting equipment. Bedrock generally underlies soil or other unconsolidated, superficial material.

Cleanup Level: the concentration of a contaminant at which no further cleanup actions are required based on the risk of harm posed by the contaminant.

Closure: activities conducted during the permanent removal (or abandonment) of underground storage tank systems and not inclusive of corrective actions/remediation.

Confining Layer: a layer having very low hydraulic conductivity, in relationship to adjacent stratigraphic units, that restricts the movement of water into and out of an aquifer (e.g., dense, unfractured clay).

Confirmed Release: a release for which an analytical result for sampled media shows any contaminant level above the Method Detection Limit.

De minimus Concentration: amount of a regulated substance which does not exceed one percent of the capacity of the tank, excluding piping and vent lines.

Department: the North Carolina Department of Environment and Natural Resources.

Discharge: a release (See also Release.).

Division: the Division of Waste Management.

Ex Situ Soil: soil that has been excavated.

Free Product: any accumulation of a substance of greater than or equal to 1/8 inch (0.010417 foot) in contact with groundwater or perched on the water table, with a density less than or greater than water, and existing as a non-aqueous phase liquid (i.e., not dissolved in water).

Gross Contaminant Levels: levels of groundwater contamination for any contaminant (except ethylene dibromide, benzene and the aliphatic and aromatic carbon fraction classes) that exceed 50 percent of the solubility of the contaminant at 25 degrees Celsius or 1,000 times the groundwater quality standard or interim groundwater quality standard established in 15A NCAC 2L .0202, whichever is lower: and levels of groundwater contamination for ethylene dibromide and benzene that exceed 1,000 times the federal drinking water standard set out in 40 CFR 141.

Groundwater: those waters occurring in the subsurface under saturated conditions.

Hazardous Substance: a hazardous substance defined in Section 101 (14) of the Comprehensive Environmental Response Compensation and Liability (CERCLA) Act of 1980 (but not including any substances regulated as a hazardous waste under Subtitle C or any mixture of such substances and petroleum).

Hazardous Waste: discarded material which, due to its quantity, concentration, or physical or chemical characteristics, may cause or significantly contribute to an increase in mortality, irreversible or incapacitating reversible illness, or pose a substantial threat or potential hazard to human health or the environment when improperly treated, stored, transported, disposed or otherwise managed (Federal regulations define a waste as a hazardous waste if it exhibits a characteristic of a hazardous waste (40 CFR 261.20 through 261.24); has been listed as hazardous (40 CFR 261.31 through 261.33); or is a mixture containing a listed hazardous waste and a non-hazardous solid waste (unless the mixture is specifically excluded or no longer exhibits any of the characteristics of a hazardous waste).)

In Situ Soil: soil or fill material that is in the ground and has not been disturbed.

Land Application: the process of remediating contaminated soil by spreading soil over land. Land application may include remediating soil by natural biological methods, enhanced biological methods, or volatilization.

Maximum Soil Contaminant Concentration: the concentration of a soil contaminant at which no further cleanup actions are required based upon the risk of harm posed by the contaminant.

Method Detection Limit: the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte (40 CFR 136 Appendix B).

Minimum Reporting Limit: the minimum reporting limit that must be achieved by laboratories for target analyte results submitted to the UST Section; it is a reporting limit established by the UST Section for the target analytes required for each approved analytical method as an alternative to the detection limit indicated in the method description and is listed for each analyte in the *Guidelines for Sampling.*

Petroleum or Petroleum Product: crude oil or any fraction thereof which is liquid at standard conditions of temperature (60 degrees Fahrenheit) and pressure (14.7 pounds per square inch absolute), but excluding substances defined as a hazardous substance in Section 101 (14) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980.

Petroleum Contaminated Soil or Soil Containing Petroleum Products: any soil that has been exposed to petroleum products because of any emission, spillage, leakage, pumping, pouring, emptying, or dumping of petroleum products onto or beneath the land surface and that exhibits characteristics or

concentrations of typical petroleum product constituents in sufficient quantities as to be detectable by approved analytical procedures.

Receptor: any human, plant or animal, structure or surface water body that is or has the potential to be adversely effected by the release or migration of contaminants.

Release: any spilling, leaking, emitting, discharging, escaping, leaching or disposing into groundwater, surface water or subsurface soils. (Refer to statutes and regulations relevant to UST releases or to AST and surface releases.)

Responsible Party: a UST owner, UST operator, and/or landowner seeking reimbursement from the State Trust Fund, or any person who is responsible for a discharge or release of petroleum or a hazardous substance. (Refer to statutes and regulations relevant to UST releases or to AST releases and spills.)

Surface Water: all waters of the state as defined in G.S. 143-215.77 Article 21A, except for underground waters, such that "waters" shall mean any stream, river, creek, brook, run, canal, swamp, lake, sound, tidal estuary, bay, reservoir, waterway, wetlands or any other body or accumulation of water, surface or underground, public or private, natural or artificial, which is contained within, flows through, or borders upon this State, or any portion thereof, including those portions of the Atlantic Ocean over which this State has jurisdiction.

Soil or Regolith: a general term for the fragmental and unconsolidated geological material of highly varied character that nearly everywhere forms the surface of the land and overlies or covers bedrock. It includes rock debris of all kinds, volcanic ash, glacial till, alluvium, loess and eolian deposits, and vegetal accumulations.

Soil Scientist: an individual who is a Certified Professional in Soils through the NCRCPS (N.C. Registry of Certified Professionals in Soils) or a Certified Professional Soil Scientist or Soil Specialist by ARCPACS (American Registry of Certified Professionals in Agronomy, Crops and Soils) or a Registered Professional Soil Scientist by NSCSS (the National Society of Consulting Soil Scientist) or can provide documentation that he/she meets the minimum education and experience requirements for certification or registration by one or more of the organizations named in this Subparagraph or upon approval by the Director, an individual with a demonstrated knowledge of soil science.

Source Area: point of release or discharge.

Total Petroleum Hydrocarbons (TPH): the concentration of petroleum fuel contamination present.

Transmissivity: the ability of geologic material to transmit water.

Underground Storage Tank (UST): any one or combination of tanks (including underground pipes connected thereto) that is used to contain an accumulation of regulated substances, and the volume of which (including the volume of underground pipes connected thereto) is 10 percent or more beneath the surface of the ground (Refer to full definition in15A NCAC 2N .0203.).

UST System: an underground storage tank, connected underground piping, underground ancillary equipment, and containment system, if any.

Waste Oil: any used non-hazardous petroleum product (Crankcase oil is considered to contain non-hazardous petroleum product, therefore it is considered a waste oil, unless otherwise demonstrated.)

Water Table: the surface of the saturated zone below which all interconnected voids are filled with water and at which the pressure is atmospheric.

Acronyms

AFVR	Aggressive Fluid - Vapor Recovery
AST	Aboveground Storage Tank
ASTM	American Society for Testing and Materials
CAP	Corrective Action Plan
CAS	Chemical Abstracts Service Number
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CSA	Comprehensive Site Assessment
DENR	Department of Environment and Natural Resources
DWQ	Division of Water Quality
DWM	Division of Waste Management
EDB	Ethylene Dibromide (1,2 Dibromoethane)
EPA	The Environmental Protection Agency
FID	Flame Ionization Detector
GCL	Gross Contaminant Limit
HCl	Hydrochloric Acid
HNO_3	Nitric Acid
IAA	Initial Abatement Action
IAR	Initial Site Assessment Report
IATA	International Air Transport Association
L.G.	Licensed Geologist
LSA	Limited Site Assessment
MADEP	Massachusetts Department of Environmental Protection
MDL	Method Detection Limit
MMPE	Mobile Multi-phase Extraction
MRL	Minimum Reporting Limit
MSCC	Maximum Soil Contaminant Concentration
NC	North Carolina
NCAC	North Carolina Administrative Code
NCDA&CS	North Carolina Department of Agriculture & Consumer Services
NCGS	North Carolina General Statutes

NCS	Notice of Contaminated Site
NFA	No Further Action
NORR	Notice of Regulatory Requirements
NOV	Notice of Violation
NPDES	National Pollutant Discharge Elimination System
NRP	Notice of Residual Petroleum
OPHSCA	Oil Pollution and Hazardous Substances Control Act of 1978
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
P.E.	Professional Engineer
PID	Photo Ionization Detector
POTW	Publicly Owned Treatment Works
QA/QC	Quality Assurance/Quality Control
SAR	Soil Assessment Report
SCR/SCR	Soil Cleanup Report/Site Closure Request
SM	Standard Method
STF	State Trust Fund
SVE	Soil Vapor Extraction
SVOC	Semi-volatile Organic Compounds
SW	Solid Waste
TCLP	Toxicity Characteristic Leaching Procedure (EPA Method SW-846 1311)
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TPH-DRO	Total Petroleum Hydrocarbons - Diesel Range Organics
TPH-GRO	Total Petroleum Hydrocarbons - Gasoline Range Organics
UST	Underground Storage Tank
UVF	Ultraviolet Fluorescence
USGS	United States Geological Survey
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compounds

1.0 Purpose and Application of the Guidelines

The purpose of this document is to provide guidance on the sampling process for environmental monitoring associated with petroleum releases and releases from underground storage tank (UST) systems. Questions concerning the information presented in this document should be directed to the UST Section central office at 919-707-8171. Questions concerning a specific site should be directed to the UST Section regional office that is responsible for the county in which the site is located. The address, telephone number, and jurisdiction of each regional office are presented in Figure 1.

Requirements for environmental monitoring are described in 15A NCAC 2B .0500, 15A NCAC 2T and 15A NCAC 2L .0110. In conjunction with the *Guidelines for Sampling*, the following specific guidance documents for each type of monitoring activity are to be used: the *Guidelines for Site Check, Tank Closure, and Initial Response and Abatement for UST Releases*; the *Guidelines for Assessment and Corrective Action for UST Releases*, the *Guidelines for Initial Response and Abatement, Assessment, and Corrective Action for Non-UST Releases of Petroleum*, and the *Guidelines for Ex Situ Petroleum Contaminated Soil Remediation*. Electronic versions of the guidelines are available for download from the Division of Waste Management web site at http://portal.ncdenr.org/web/wm/ust. Electronic versions of the rules can be found on the Office of Administrative Hearings web page at http://ncrules.state.nc.us/ncadministrativ_/default.htm.

2.0 General Sampling Procedures

Sampling activities are associated with site checks; UST closures; initial release response and abatement activities; assessment and corrective actions; and soil remediation permitting. A systematic sampling approach must be used to assure that sample collection activities provide usable data. Sampling must begin with an evaluation of background information, historical data and site conditions. General sampling procedures are described in this section. The location, type and number of environmental samples for specific monitoring activities (e.g. closure, ex-situ soil remediation and assessment and corrective action) are described in the specific guideline documents for each type of activity. Activity and matrix specific sampling procedures are included in the appendices of this document.

2.1 Planning

Sampling activities should begin with planning and coordination. (See Appendix A for recommendations and suggestions on laboratory selection.) (See Appendix B for analytical reporting requirements that must be communicated to the laboratory in the selection process to ensure the laboratory can meet project specific needs.) The party contracting with the laboratory is responsible for effectively communicating reporting requirements and evaluating data usability as it relates to specific monitoring activities. Planning for sampling should address equipment and sampling containers as follows:

1. Equipment - Appropriate equipment must be selected based on the sampling source, the analytes of interest and the sampling procedure. The equipment construction must be consistent with the analytes or analyte groups to be collected (See Tables 11, 12, 13, 14 and 15). Equipment should be pre-cleaned before use in the field or equipment that has been certified clean by the vendor or laboratory should be used.

2. Dedicated Equipment Storage - All dedicated equipment (except dedicated pump systems or dedicated drop pipes) should be stored in a controlled environment. Equipment should be stored in an area that is located away from the sampling site. If equipment other than dedicated pumps or dedicated drop pipes are stored in monitoring wells, the equipment should be suspended above the formation water. The monitoring well should be securely sealed in order to prevent tampering between sampling events. All equipment (except dedicated pumps or drop pipes) should be decontaminated before use according to the applicable procedures outlined in Appendix C.

3. Sample Containers - The analyses to be performed on the sample determine the construction of sample containers. (See Tables 7 and 8 for acceptable sample container, preservation and hold time options for approved analytical procedures). All containers and lids should be inspected for flaws (cracks, chips, etc.) before use. Sampling kits for sample collection and transport may be purchased from some commercial laboratories. The kits include all the items needed (sample containers, shipping cartons, etc.) for collection and shipment of samples.

2.2 Sample Collection

1. Contamination Prevention
   a) Cross contamination or environmental contamination when collecting samples should be prevented.
      1. If possible, samples should be collected in sequence from the least contaminated sampling location (or background sampling location, if applicable) to the most contaminated sampling location.
      2. The ambient or background samples should be collected first, and stored in separate ice chests or separate shipping containers within the same ice chest (i.e. untreated plastic bags).
      3. Samples from flowing water should be collected in sequence from downstream to upstream.
   b) Highly contaminated samples (concentrated wastes, free product, etc.) or samples suspected of containing high concentrations of contaminants should not be stored or shipped in the same ice chest or shipping container with other environmental samples.
      1. These sample containers should be isolated by sealing them in separate, untreated plastic bags immediately after collecting, preserving, labeling, etc.
      2. A clean, untreated plastic bag should be used to line the ice chest or shipping container.
   c) All sampling equipment should be thoroughly decontaminated and transported in a manner that does not allow it to become contaminated. Arrangements should be made ahead of time to decontaminate any sampling or measuring equipment that will be reused when taking samples from more than one well. Field decontamination of sampling equipment will be necessary before sampling each well to minimize the risk of cross contamination. Decontamination procedures should be included in reports as necessary. (See Appendix C for decontamination procedures.) Sampling equipment and containers may be used that are certified pre-cleaned by the vendor or laboratory.

      When collecting aqueous samples, the sample collection equipment should be rinsed with a portion of the sample water before taking the actual sample. Sample containers do not need to be rinsed.

      Sample containers with pre-measured preservatives must not be rinsed. Also, sample containers used when collecting samples of petroleum hydrocarbons and oil and grease must not be rinsed
   d) All fuel-powered equipment should be placed away from, and downwind of, any site activities (e.g., purging, sampling, decontamination).
      1. If field conditions preclude such placement, the fuel source(s) should be placed as far away as possible from the sampling activities and the conditions described in the field notes.
      2. Fuel for vehicles and equipment should be handled prior to the sampling day. If such activities must be performed during sampling, the personnel must wear disposable gloves.
      3. All fuels should be dispensed downwind and well away from the sampling activities. Gloves and other protective equipment should be disposed of downwind, and well away from the sampling activities.
      4. If sampling at active gas stations, sample collection activities should stop during fuel deliveries.

2. Filling Out Sample Labels - At a minimum, the label or tag must identify the sample with the sample identification (sample ID), date of collection, method of analysis requested, collector, and preservative(s). Additional information (i.e., a location identification code) may be included on the tag or label. The label should be filled out before placing it on the vial/bottle. The label should be placed on the bottle before you collect the sample. The following information should be printed legibly on the label with indelible ink:
   a) Date and Time of sampling
   b) Method of Analysis required [i.e., VOCs (EPA 8260B), Metals (SM 3030C)]
   c) Sample collector
   d) Preservative used, if any (i.e., HCl, $Na_2S_2O_3$, HNO_3, ice, etc.)
   e) Sampling location and site name

3. Sample Collection Order - Unless field conditions justify other sampling sequences, collect samples in the following order:
   a) Volatile Organics and Volatile Inorganics
   b) Extractable Organics, Petroleum Hydrocarbons, Aggregate Organics and Oil and Grease
   c) Total Metals
   d) Inorganic Non-metallic, Physical and Aggregate Property, and Biological samples
   e) Microbiological samples

NOTE: *If the pump used to collect groundwater samples cannot be used to collect volatile or extractable organic samples. Then the volatile and extractable organics should be collected after withdrawing the pump and tubing.*

4. Composite Samples - Composite samples should not be collected unless required by permit. Samples will be composited as a means of reducing sample handling and analytical costs. Composite samples are prepared differently depending on the analysis required and the relative tendency of the contaminant analyzed to vaporize.

Composite sampling is used for soil samples collected for soil remediation permitting. Samples collected for volatile organic analysis cannot be dried, ground or mixed if they are to reflect the concentrations found in the soil. The methanol preservation technique, or one of the alternative high-level preservation techniques outlined in Appendix E, followed by methanol extraction, is required to preserve primary samples to be composited and analyzed for volatiles analysis (i.e. TPH GRO or SW-846 8260B).

If compositing is required, the following procedures should be used:

a) Container(s) should be labeled as unmixed composite (i.e. for TPH DRO, SW-846 8270D or metals), or as primary samples to be composited by the laboratory (i.e. for TPH GRO or SW-846 8260B).
b) Sampling points from which to collect each aliquot should be selected.
c) Using the appropriate sampling technique, equal aliquots (same sample size) should be collected from each location and placed in an approved sample container (See Table 7).
d) An appropriate preservation option should be used and selected in coordination with the analytical laboratory.
e) The laboratory should be notified that the sample is a composite sample.

f) Aliquots of soil samples for semi-volatile or metals analysis should not be mixed before containerizing. The laboratory should be notified that the sample is an unmixed composite sample, and should be requested to thoroughly mix the sample before sample preparation or analysis.
g) When collecting soil samples for volatiles analysis, the six primary samples collected for each composite sample must be collected and preserved in **separate** VOA vials. The laboratory should be notified that the primary samples are to be methanol-extracted individually and representative portions of the methanol extracts composited by the laboratory for analysis.

NOTE: *Collection and preservation options for composite soil samples requiring volatiles analysis are provided in Appendix E. Unless otherwise approved by the UST Section, all volatiles soil samples for ex-situ soil remediation must be grab samples collected as primary samples in* ***separate*** *containers and must* ***not*** *be composited in the field before being submitted to a DWQ Certified Laboratory.*

2.3 Health and Safety

All local, state and federal requirements relating to health and safety should be implemented. All local, state and federal requirements pertaining to the storage and disposal of any hazardous or investigation-derived wastes should be complied with. (Investigation-derived waste is defined as water, soil, drilling mud, decontamination wastes, discarded personal protective equipment, etc. from site investigations, exploratory borings, piezometer and monitoring well installation, refurbishment, abandonment and other investigative activities.)

The UST Section recommends wearing protective gloves when conducting all sampling activities. Gloves serve to protect the sample collector from potential exposure to sample constituents; minimize accidental contamination of samples by the collector; and preserve accurate tare weights on pre-weighed sample containers. They must be worn unless:

- The sample source is considered to be non-hazardous.
- The samples will not be analyzed for trace constituents.
- The part of the sampling equipment that is handled without gloves does not contact the sample source.

Gloves must not come into contact with the sample or with the interior or lip of the sample container. Clean, new, unpowdered and disposable gloves must be used. Various types of gloves may be used as long as the construction materials do not contaminate the sample or if internal safety protocols require greater protection. Materials potentially present in concentrated effluent can pass through certain glove types and be absorbed through the skin. Vendor catalogs provide information about the permeability of different gloves and the circumstances under which the glove material might be applicable. The powder in powdered gloves can contribute significant contamination. Powdered gloves are not recommended unless it can be demonstrated that the powder does not interfere with the sample analysis.

Gloves should be changed after preliminary activities, such as pump placement; after collecting all the samples at a single sampling point; or if torn or used to handle extremely dirty or highly contaminated surfaces. All used gloves should be properly disposed of as investigation derived wastes.

All investigation-derived waste (IDW) should be properly managed so contamination is not spread into previously uncontaminated areas. Investigation-derived waste includes all water, soil, drilling mud, decontamination wastes, discarded personal protective equipment, etc. from site investigations, exploratory borings, piezometer and monitoring well installation, refurbishment, abandonment, and other investigative activities. All investigation-derived waste that is determined to be RCRA-regulated hazardous waste must be managed according to the local, state and federal requirements.

IDW that is not a RCRA-regulated hazardous waste but is contaminated above the Department's Soil Cleanup Target Levels or the state standards and/or minimum criteria for ground water quality must be properly disposed of.

The "*Guidelines for Assessment and Corrective Action for UST Releases*" should be consulted for information regarding the disposal of drill cuttings/mud and purged well water as a result of field environmental investigations. Under 15A NCAC 2T .0113(a)(10) [Waste Not Discharged to Surface Waters – Permitting by Regulation], "drilling muds, cuttings and well water from the development of wells" are deemed permitted in accordance with NCGS 143-215.1(d), and thus no individual Division permit need be issued. If the drill cuttings/mud or purged well water is contaminated with hazardous waste, contact the DWM Hazardous Waste Section (919 707-8200) for disposal options. Figures 4 and 5 are decision flow diagrams with guidance on the proper disposal for drill cuttings/mud and purged well water that result from field investigations and/or cleanup operations.

All containers holding IDW should be maintained in good condition and inspected periodically for damage. All containers holding IDW must have all required labeling (DOT, RCRA, etc.) clearly visible.

2.4 Preservation, Holding Times and Container Types

1. Samples must be preserved by one of the options indicated in Appendix E for soils, Appendix F, G or H for water and Appendix I for air. (See Table 7 for soils preservation and Table 8 for water preservation.) The holding times and preservation options listed in the above-referenced tables or Appendices supersede those in individual analytical methods.

2. The preservation protocols in the referenced tables require immediate preservation. "Immediate" is defined as "within 15 minutes of sample collection." All preservation must be performed onsite unless samples can be transported to the laboratory within 15 minutes of collecting the sample. The preservation options for volatiles soil samples for the inhibition of biodegradation are an exception. These options are detailed in Tables 7 and 8 and in Appendix E.

3. 24-hour composite water samples are the exception to the "15-minute" criterion. If the sample requires thermal preservation, the automatic sampler must be able to maintain the required temperature by packed ice or refrigeration. When chemical preservation is also required, the preservation process must begin within 15 minutes of the last collected sample.

4. The pH of samples must be checked at these recommended intervals:

a) During the first sampling event at a particular site, all samples must be checked that are pH adjusted except volatile organics. and
b) During subsequent visits to a particular site, at least one sample must be checked per parameter group that must be pH-adjusted.

2.5 Sample Storage and Transport

1. Samples for transport must be stored carefully to prevent samples from breaking and to maintain a temperature of approximately 4 degrees Celsius (°C). Samples must be placed on ice immediately and transported to a N.C. DWQ-certified laboratory as soon as possible. Unnecessary handling of sample containers should be avoided. Heating (room temperature or above, including exposure to sunlight) or freezing of the sample containers should be avoided. The time between sample collection and delivery to a laboratory should be minimized. The collector must insure that the analytical holding times of samples can be met by the laboratory (See Tables 7 or 8).

2. A complete chain-of-custody (COC) form must be maintained to document all transfers and receipts of the samples. Be sure that the sample containers must be labeled with the sample location, site name and/or well number, sample identification, the date and time of collection, the method of analysis to be performed, the preservative added, the sampler's initials and any other pertinent information for sample identification. The labels should contain a unique identifier (i.e., unique well numbers) that can be traced to the COC form. The details of sample collection must be documented on the COC. The COC must include the following:

a) A description of each sample (including QA/QC samples) and the number of containers (sample location and identification);
b) Signature of the sampler;
c) The date and time of sample collection;
d) The analytical method to be performed;
e) The sample type (i.e., water or soil);
f) The regulatory agency (i.e., NCDENR/DWM – UST Section);
g) Signatures of all persons relinquishing and receiving custody of the samples; and dates and times of custody transfers.

3. Samples should be packed so that they are segregated by site, sampling location or by sample analysis type. Samples should be segregated in coolers by site as much as possible. If samples from multiple sites fit in one cooler, they may be packed in the same cooler with the associated field sheets and a single COC form for all. For safety, coolers should be packed so that a maximum weight of 50 pounds is not exceeded. Additional coolers should be used as necessary. All sample containers should be placed in plastic bags (segregated by analysis and location) and then completely surrounded by ice. Good packing practices include:

a) Prepare and place trip blanks in an ice filled cooler before leaving for the field.
b) Segregate samples by analysis and place in sealable plastic bags.
c) Pack samples carefully in the cooler placing ice around the samples.
d) Review the COC. The COC form must accompany the samples to the laboratory. **The trip blank(s) must also be recorded on the COC form.**

e) Place completed COC form in a waterproof bag, sealed and taped under the lid of the cooler. Secure shipping containers with strapping tape to avoid accidental opening.
f) For COC samples, a tamper-proof seal may also be placed over the cooler lid or over a bag or container containing the samples inside the shipping cooler. "COC" or "EMERG" shall be written in indelible ink on the cooler seal to alert sample receipt technicians to priority or special handling samples. The date and sample handler's signature must also be written on the COC seal.
g) Deliver the samples to the laboratory or ship by commercial courier.

NOTE*: If transport time to the laboratory is not long enough to allow samples to be cooled to ≤ 6° C, a temperature reading of the sample source must be documented as the field temperature on the COC form. A downward trend in temperature will be adequate even if cooling to ≤6° C is not achieved. The field temperature should always be documented if there is any question as to whether samples will have time to cool to ≤6° C during shipment. Thermometers must be calibrated annually against an NIST traceable thermometer and documentation must be retained.*

2.6 Laboratory Reports

Results of analyses must be included in the laboratory analytical report. (See Appendix A for details (Selecting a Laboratory).) All compounds analyzed using a certified method must be reported. All soil sample analytical results must be reported on a dry weight basis. (See Appendix B (Analytical Reporting Requirements) for information to be communicated to the DWQ certified laboratory selected to analyze these samples.) Analytical reporting requirements are also included as an attachment to soil remediation permits. This information should be provided to the laboratory selected to analyze these samples. The laboratory report must include the seven required report elements outlined in Appendix B.

3.0 References

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Figure 1
Regional Office Locations and Map

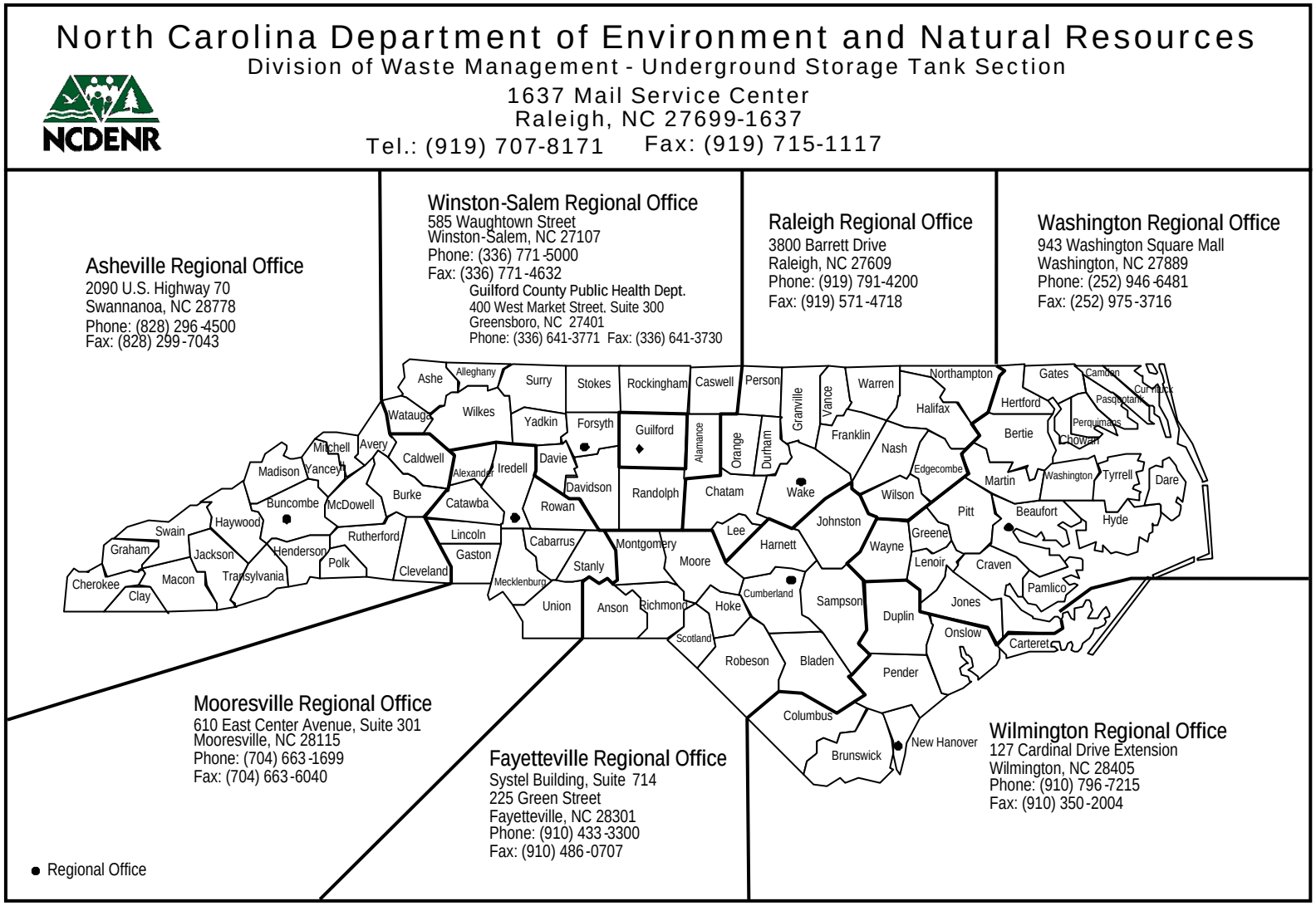
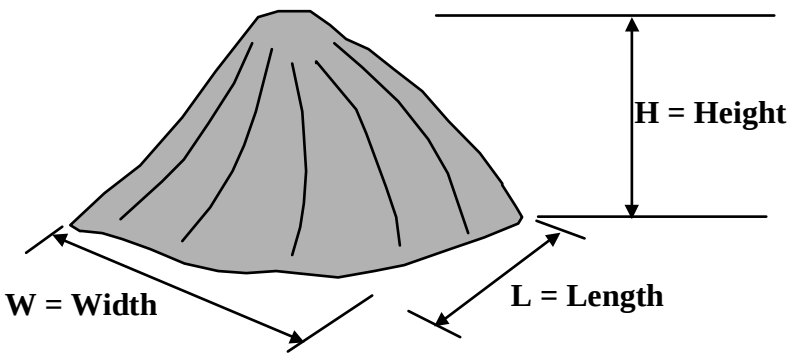
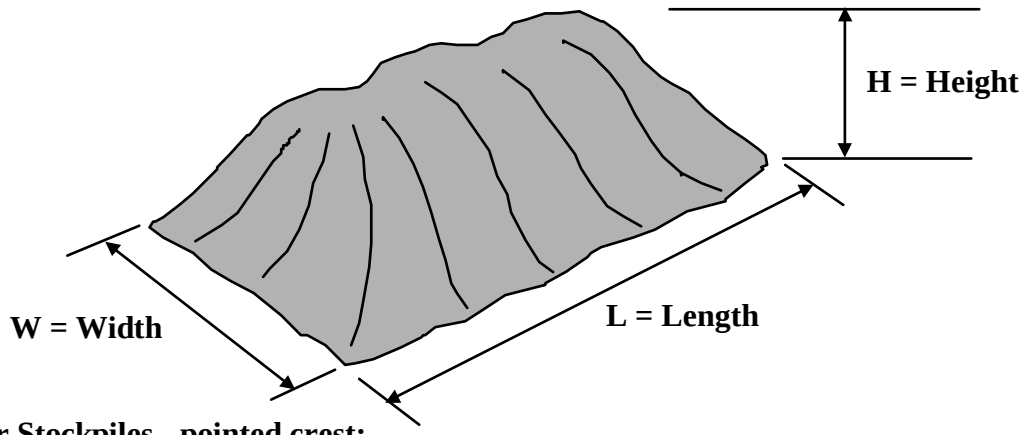


Figure 2 (copy)
Volumes of Stockpiles

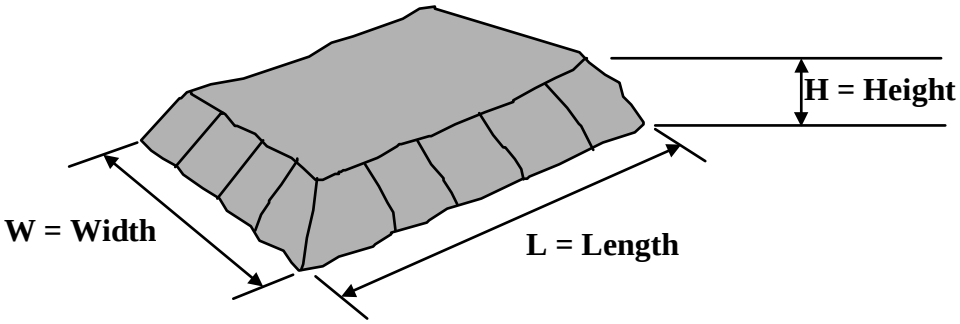
L > W > H



<u>Conical Stockpiles:</u>
Volume = (H x L x W)/3



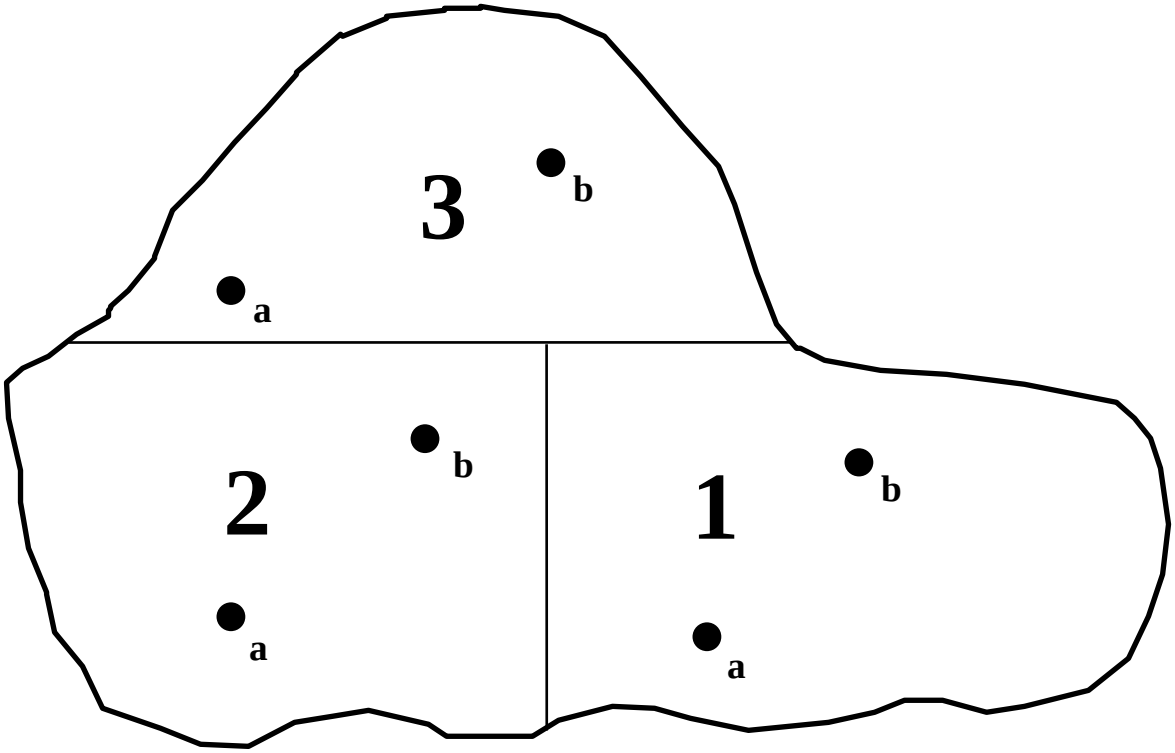
<u>Rectangular Stockpiles - pointed crest:</u>
Volume = (H x L x W)/2



<u>Rectangular Stockpiles - flat topped:</u>
Volume = H x [(L x W) - (2 x H x W)]

Note: These equations have been simplified for ease of calculation.

Figure 3 (copy)
Soil Stockpile Sampling Map (Example)



Stockpile Type: Rectangle, Flat-topped

Volume = 4 x [(21 x 11) - (2 x 4 x 11)] = 572 cubic yards

where:					
	Height (maximum)	=	12 feet	=	4 yards
	Length (maximum)	=	63 feet	=	21 yards
	Width (maximum)	=	33 feet	=	11 yards

Composite Samples	3 Primary Samples per core	Sample Depths
1	core 1a	1’, 4’, 7’
	core 1b	1’, 5’, 8’
2	core 2a	2’, 6’, 10’
	core 2b	1’, 4’, 7’
3	core 3a	1’, 3’, 5’
	core 3b	2’, 5’, 8’

Note: ***Each composite sample contains six primary samples, three from core “a” and three from core “b.”***

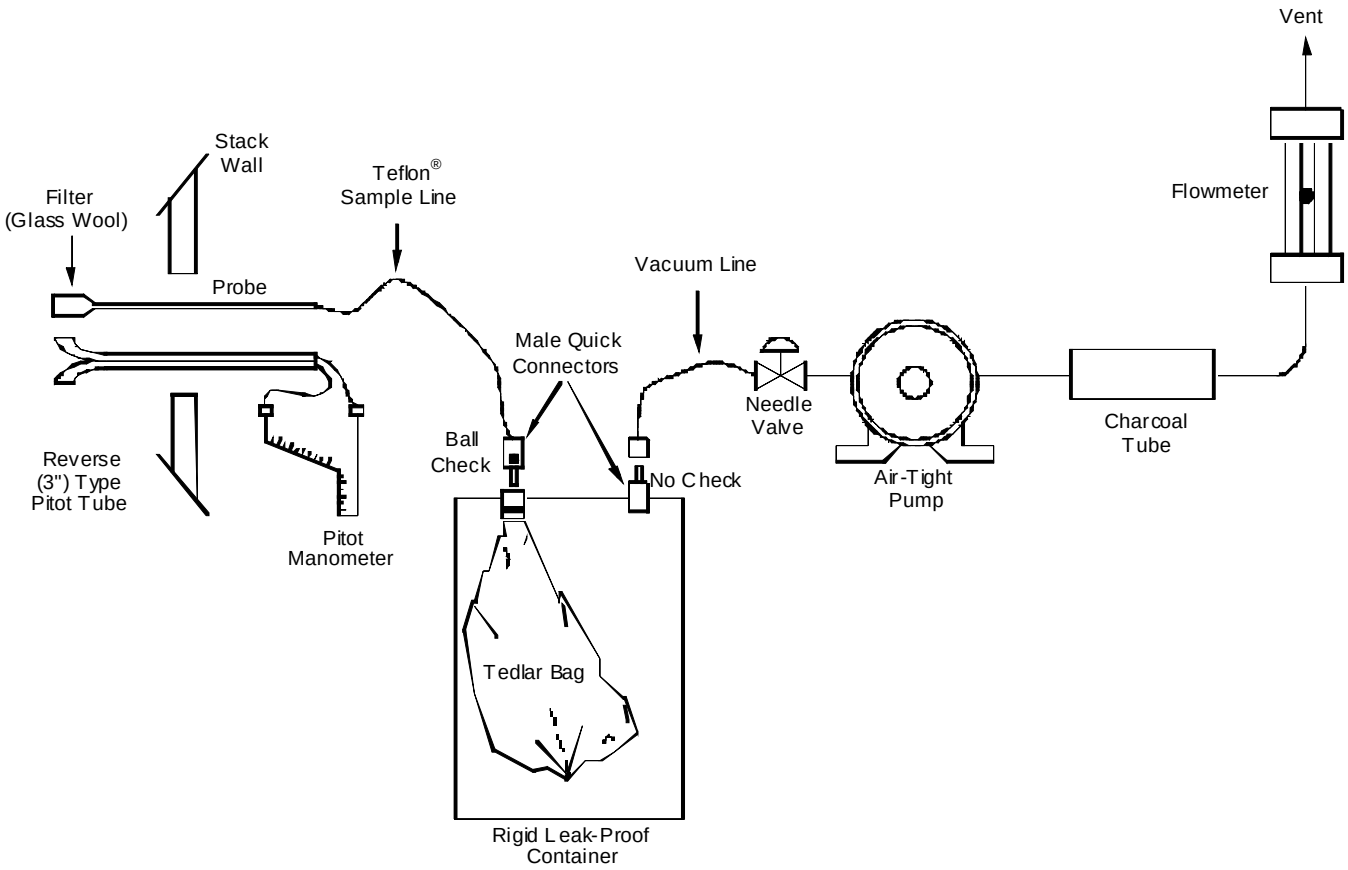



Figure 4
EPA Method 18 Integrated Bag Sampling Train