CT LABORATORIES

delivering more than data from your environmental analyses

Lab Guide for the Field

A quick reference guide for submitting environmental samples

CT Laboratories LLC
1230 Lange Court
Baraboo, WI 53913
608.356.2760

Introduction

Think of this Guide as a collection of “cheat sheets” - a quick reference of FAQs and issues that we get calls on all the time:

- What preservation is required for Alkalinity? What is the holding time?
- What’s your recommended cooler packing scheme?
- Do I really need to fill out everything on the chain-of-custody (COC) form?
- I ran short on bottles, need additional analyses or am able to obtain only limited sample volumes. What are my options?
- Milligrams per liter, parts per billion, percent: how does that go again?
- What are the differences between various means of sampling soils for VOCs analysis?
- What does VOCs stand for? (volatile organic compounds, *see acronyms listing on the back page*)
- Should I let the lab know ***if*** …..?

As always, if you have any questions or need more information, please contact your CT Laboratories Project Manager. They are here to help.

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1230 Lange Court – Baraboo, WI 53913
608.356.2760
www.ctlaboratories.com

Cooler Packing Tips

The following packing tips can help ensure that your samples arrive at the lab intact, uncompromised and within the 2 to 6 °C regulatory temperature range.

Before Packing:

- For sample labels, please use ballpoint pen – not water soluble ink (like some felt-tip markers) or pencil, which can rub off or smudge and blur beyond recognition.
- DO NOT use tape or extra labels on pre-tared bottles or cover up the pre-printed weight on the label.
- If samples are warm at time of collection, use an ice bath to pre-chill before packing in the cooler, if possible. The cooler's ice then only has to maintain the sample temperature.

Packing:

3 words: ICE, ICE, ICE

- At least 1/3 of the cooler should be taken up by ice – about 20-25 lbs. of ice for a large cooler. In warmer months, use more. Remember, ice is cheaper than resampling.
- Use "natural" ice. Never use dry ice – it can freeze the samples solid, compromising the sample integrity and causing containers to break, as well as being a safety hazard. Blue Ice packs don't maintain needed temperature well, and their use is not allowed by some regulatory agencies.
- Separate the sample containers from direct contact with the ice/melt water. Either bag the ice, bag the samples, or both. Bagged ice helps contain melt water.
- Sealing samples in ziplock baggies or bubble bags helps protect the containers from water intrusion, and cushion them against breakage.
- Avoid packing materials that absorb water, like paper or peanuts. They don't provide cushioning once they get soggy or start to decompose (and they are a BIG MESS to unpack in that condition).
- To help avoid breakage, glass containers (particularly larger ones, such as1-Liter ambers) should be packed upright, never laying on their side; and use ice or bubble bags to keep them isolated.

- The foam blocks we provide are designed to hold VOC vials – they provide cushioning and keep the vials upright.
- A large plastic/garbage bag (the “liner bag”) should be used to contain the cooler contents: samples, ice (melt water). Make sure to twist-tie, knot or otherwise seal it.
- Suggested packing scheme: Layer for cushioning and chilling. Start with your outer bag, then bubble wrap, ice, samples, ice (repeat as necessary).
- Don’t forget to pack your temperature blank along with all the other sample containers.
- **Place completed chain-of-custody in a ziplock bag to keep dry**. Taping the bag to the underside of the cooler lid is a good idea.

Sample Cooler Handling/Shipping Considerations

- This should go without saying, but please *do not use sample coolers for food storage.* (Yes, we've received someone's lunch by mistake).
- Excessive use of tape to seal coolers is not necessary; if you must use tape, a little will do. Your sealed liner bag will contain the cooler contents, and the buckle strap will keep the lid on (that's what it's there for - ***it is not a carrying handle!***).
- If security is an issue, use custody seals. Using tape to cover or sandwich custody seals protects them and makes it easier for us to remove them intact.
- Do not cover the CT Laboratories' cooler barcode label with tape, shipping labels, etc. ***It contains important, DOT mandated shipping information that must remain visible.***

Overnight Shipping (FedEx, etc.)

- Standard overnight shipping typically means delivery to the lab by 5:00 PM. Priority overnight shipments are delivered by 10:30 AM *Monday - Friday.*
- For Saturday delivery ***make sure you specify SATURDAY DELIVERY*** in your shipping software, on the air bill/label and with a sticker on the cooler. Better safe than sorry.
- We are normally staffed for Saturday **sample receipt**, but please inform your Project Manager in advance to expect a Saturday delivery for your project. *This is especially important if you are submitting short hold time samples (Nitrates, Hexavalent Chromium, Coliform, BODs, EnCores, etc.) or rush analyses.* Only limited analyses are scheduled for weekend shifts. We must arrange staff schedules to accommodate these samples.

Sample Drop-Off

- Samples may be dropped off at the lab Monday - Friday 8:00 AM - 5:00 PM with the following exceptions for Fridays:
- No BODs after 3:00 PM
- No Coliform, Orthophosphate, Hexavalent Chromium after 12:00 PM

Field and Laboratory Quality Control Samples

SAMPLE TYPE	PURPOSE	COLLECTION
Field Blank	To check for cross- contamination during sample collection	Use organic-free, deionized or distilled water (blank water)
Equipment or Rinsate Blank	To check field decontamination procedures	When decontaminating sampling equipment or using a bailer or other sample collection vessel. Use blank water to rinse water into sample containers
Trip Blank	To check contamination during sample handling and shipping	Prepared by the laboratory and shipped with sample bottles
Temperature Blank	Dedicated container to check sample receipt temperature at the laboratory	Either prepared by the laboratory and shipped with sample bottles or prepared in the field
Method Blank	To assess the preparation and analytical batch for potential contamination	Prepared by the laboratory
Matrix Spike (MS)	To assess the effect of sample matrix on precision and accuracy	Collect additional volume for a field sample to be designated as an MS/MSD (sample + MS + MSD = triple volume)
Matrix Spike Duplicate (MSD)	To assess the effect of sample matrix on precision and accuracy	
Field Duplicate	To check reproducibility of field and laboratory procedures. To indicate non- homogeneity	Treat original and field duplicate samples identically
Field Split	To check for inter laboratory reproducibility	Treat original and split samples identically; ship to separate laboratories
Laboratory Duplicate	To check analytical/instrument accuracy and precision	Prepared by the laboratory
Laboratory Spike or Laboratory Control Sample (LCS)	To check the performance of the analytical system	Prepared by the laboratory

Sample Submission Requirements

All samples submitted for analysis must be accompanied by a completed chain-of custody form or letter indicating the required analyses. For your convenience, chain of-custody forms can be obtained from the lab or downloaded from our website at ***www.ctlaboratories.com.*** Following are instructions and an example of a properly completed chain-of-custody form.

Rev. 4/2010 — CHAIN OF CUSTODY — Page _____ of _____

Company: XYZ Environmental
Project Contact: John Smith
Telephone: 608-555-5555
Project Name: City Landfill GWM
Project #: 2012.Q3.CL
Location: Baraboo, WI
Sampled By: John Smith

CT LABORATORIES
1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Lab Use Only
Place Header Sticker Here:

Program:
QSM RCRA SDWA NPDES
Solid Waste Other _____

PO #

Report To: John Smith
EMAIL: johnsmith @xyzenviro.com
Company: XYZ Environmental
Address: 999 South Drive
Baraboo, WI 53913
Invoice To:*
EMAIL: accounting @xyzenviro.com
Company: XYZ Environmental
Address: 999 South Drive
Baraboo, WI 53913

*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Client Special Instructions

Matrix:
GW - groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc./waste

ANALYSES REQUESTED

Turnaround Time
Normal RUSH*
Date Needed:
_____
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample ID Description	Filtered? Y/N	VOCs	SVOCs	PCBs	Chloride, Sulfate	TAL Metals	Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
						Fill in Spaces with Bottles per Test							
6/1/12	10:00	GW	G	GW-1	N	3	1	1			5		
6/1/12	10:30	GW	G	GW-2	N	3	1	1			5		
6/1/12	10:35	SW	G	SW-1	N				1	1	2		
6/1/12	13:05	SW	G	SW-2	N				1	1	2		
6/1/12	13:30			Trip Blank		1					1		

Relinquished By:	Date/Time	Received By:	Date/Time	Lab Use Only
	06/01/2012 16:45			Ice Present Yes No
Received by:	Date/Time	Received for Laboratory by:	Date/Time	Temperature _____
				Cooler # _____

Samples for multiple analyses taken at the same time can be written on the same line

Company: Name of Company submitting samples.

Project Contact: Person to be contacted if additional information is required.

Telephone: The contact's phone number.

Project Name: Project Name as it is to appear on analytical report.

Project Number: Your Project Number (if applicable).

Project Location: Provide location if a separate site or location for a multi-location project.

Sampled by: Name(s) of sampler(s).

Regulatory Program: Indicate the associated regulatory program (if applicable).

Turnaround Time: Indicate the turnaround time desired and due date.
Prior arrangements should be made with CT Laboratories if expedited turnaround is needed in order to allocate resources and to determine if desired time frame is feasible.

Mail to: Name and address to whom the report should be sent.

Invoice to: Name and address to whom the invoice should be sent.

Collection Date/Time: Date and time the sample was collected.

Grab/Comp: (if applicable) Was the sample a grab or composite?

Sample ID Description: Identify sample as it should appear on the analytical test report**.**

Filtered? Y/N: (if applicable) Was the aqueous sample filtered prior to preservation?
(report the parameter as "dissolved")

Matrix: The type of sample: Soil, Air, Sludge, Waste, Groundwater, Surface water, Wastewater, Drinking water.

Analysis Requested: List the analyte(s) and/or Method for each sample on the vertical line. For each sample, enter either an X or the number of bottles for that analysis.

Total # of Containers: Number of containers provided for each sample.

Preservation: Specify preservative used for each analysis requested, leave blank if none were used.

Lab ID #: *For laboratory use only*

Relinquished By: ***IMPORTANT***. Initially, the person collecting the samples should sign and date. This section is used each time the sample is transferred from one party to the next.

Received By: If custody is transferred from one party to the next.

Ice Present/Temperature/Cooler #: *for lab use only*

Soil Sampling for VOCs

The following is a comparison of different VOC soil collection techniques. This is a guide to assist in your project planning and preparation. Please consult your specific State or program requirements to select the appropriate collection/preservation method for your project and share this information with your laboratory project manager.

Low Level vs. High Level Analysis

The laboratory offers both low level (generally 5-500 ug/kg) and high level (>500) analysis of VOCs, based on project requirements. If low level is requested, a back-up sample should also be collected for high level analysis. Sampling/preservation options differ between the two.

High Level Sample Collection

EnCore® Samplers

Containers: (1) 5-gram EnCores plus 1 unpreserved container for % Solids

Hold Time: 48 hours to analysis or preservation; 14 days after preservation

Benefits: Minimal sample exposure in the field

Drawbacks: Short holding time; single use; "T" handle need to collect sample; sample matrix must be conducive to coring

Terra Core® High Level Kits

Containers: (2) 40-mL VOC vial with methanol plus 1 unpreserved container for % Solids

Hold Time: 14 days from collection

Benefits: Includes sampling T and containers; sealed in the field, not opened in the lab

Drawbacks: To prevent loss of both the preservative and the analytes, it is ***critical*** to wipe container threads before sealing vials and ship upright.

Because only 1 analysis can be done from each EnCore or TerraCore vial, an additional sample set must be collected for each Matrix Spike AND Matrix Spike Duplicate (MS/MSD) analysis.

See Pages 10/11 for EnCore® and Terra Core® Usage Instructions.

Methanol – Using a Balance

Containers: (1) 60-mL tared amber glass jar (add 25-35 grams of sample and 25 mL of methanol added to the container) plus 1 unpreserved container for % Solids

Hold Time: 14 days from collection

Benefits: Field preservation; lower-cost option
a balance is available from the lab, upon request—please reserve in advance

Drawbacks: Sample exposed to air during sampling process; to prevent loss of both the preservative and the analytes, it is ***critical*** to wipe container threads before sealing vials and ship upright. Not accepted by some regulatory programs.

Low Level Sample Collection

Terra Core® Low/High Level Kits *Option 1*

Containers: (2) 40-mL VOC vial with methanol, (2) 40-mL VOC vials with aqueous sodium bisulfate plus 1 unpreserved container for % Solids

Hold Time: 14 days from collection

Benefits: Includes sampling T and containers; field preservation for both low and high level analysis; sealed in the field, not opened in the lab

Drawbacks: To prevent loss of both the preservative and the analytes, it is ***critical*** to wipe container threads before sealing vials and ship upright. Sodium bisulfate can create effervescence (foaming) in soils containing carbonate, interfering with the analysis. Options include only high level analysis or DI water kits (see below) to be frozen at the lab upon receipt.

Terra Core® Low/High Level Kits *Option 2*

Containers: **(**2) 40-mL VOC vial with methanol, (2) 40-mL VOC vials with DI water plus1 unpreserved container for % Solids

Hold Time: 48 hours to preservation by freezing for water vials, 14 days for methanol

Benefits: Includes sampling T and containers; sealed in the field, not opened in the lab

Drawbacks: Short hold time to preservation by freezing at the laboratory

EnCore® Samplers

Containers: **(**3) 5-gram EnCores plus 1 unpreserved container for % Solids

Hold Time: 48 hours to analysis or preservation; 14 days after preservation

Benefits: Minimal sample exposure in the field

Drawbacks: Short holding time; single use; "T" handle needed to collect sample; sample matrix must be conducive to coring

Because only 1 analysis can be done from each EnCore or TerraCore vial, an additional sample set must be collected for each Matrix Spike AND Matrix Spike Duplicate (MS/MSD) analysis.

See Pages 10/11 for EnCore® and Terra Core® Usage Instructions.

Other Options—High or Low Level

4 oz Packed Jar

Containers: (1) 4 oz amber glass jar with a Teflon lined cap

Hold Time: 14 days from collection

Benefits: Single container; useful for non-homogeneous samples that will not fit into other sampling containers

Drawbacks: Sample exposed to the air multiple times w/ probable loss of VOCs; container threads must be wiped clean to provide tight seal. Not accepted by many regulatory programs.

Soil Sampling for VOCs

Terra Core® Sampling Procedures

With the plunger seated in the handle, push the TerraCore into freshly exposed soil until the sample chamber is filled. A filled chamber will contain approximately 5 grams of soil.

Wipe all soil or debris from the outside of the TerraCore sampler. The soil plug should be flush with the mouth of the sampler. Remove any excess soil that extends beyond the mouth of the sampler.

Rotate the plunger that was seated in the handle top 90º until it is aligned with the slots in the body. Place the mouth of the sampler into the 40mL VOC vial containing the appropriate preservative and extrude the sample plug by pushing the plunger down. *Only 1 sample plug should be placed in each vial.* Quickly place the lid back on the VOC vial. *When capping the VOC vial, be sure to wipe any soil or debris from the vial threads.*

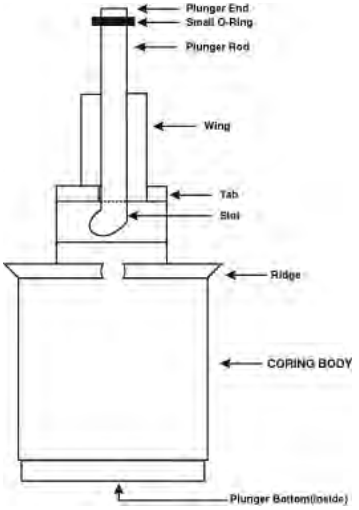
Repeat for any remaining vials and the % solids container in the kit for that sample point.

It is not necessary to label each container individually. If you place them back into the sponge block and seal in a zip-lock bag with a sample label affixed to the outside of the bag.

You must use a new TerraCore handle for each sample point—they are not cleanable or reusable.

Make sure you pack the sponge blocks upright in the cooler.

Soil Sampling for VOCs



EnCore® Sampling Procedures

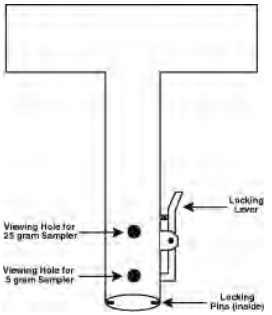
EnCore® Samplers are for single use and cannot be cleaned or reused.

EnCore® Samplers require your own separate T-Handles and/or Extrusion Tools (not provided by the lab).

Hold coring body and push plunger rod down until small o-ring rests against tabs. Depress locking level on T-handle. Place coring body, plunger end first, into open end of T-handle, aligning the slots on coring body with locking pins on T-handle.

Turn T-handle with T up and coring body down. Using T-handle, push sampler into soil until coring body is full (small o-ring will be centered in T-handle viewing hole). Remove sampler from soil. Wipe excess soil from coring body exterior.

Cap coring body while it is still on T-handle. Push cap over flat area of ridge and twist to lock cap in place. *Cap must be seated to seal sampler.*



Remove the capped sampler by depressing locking lever on T-handle while twisting and pulling sampler from T-handle.

Lock plunger by rotating extended plunger rod fully counter-clockwise until wings rest firmly against tabs.

Attach completed label (from EnCore Sampler bag) to cap on coring body.

Return full EnCore to zipper back. Seal bag and place in cooler on ice.

Remember, sample must be delivered to the lab to be preserved within 48-hours of collection.

Aqueous Sampling for VOCs

40-milliliter clear glass vials with Hydrochloric Acid

- Fill the vials in a location which is free from volatile organic analytes. Avoid places with gasoline, cleaning products, or solvents present at the sampling point.
- Fill the vials so there is no air present. This is known as “zero headspace” in the vial.
- The VOC vials contain a strong acid solution, 1:1 Hydrochloric Acid, so care should be taken when opening and filling the vials.
- All (3) 40-ml glass vials need to be filled.

If you need to collect a sample from a tap it is best to use the tap nearest the well. Flush the tap for approximately 5 minutes prior to sampling.

Open the tap so that a slow flow comes from the faucet (something just more than a dribble); fill the vial so that the water runs down the glass on the inside of the vial to eliminate the introduction of air bubbles *(Figure 1*).

Fill the vial so that a positive meniscus (a slight overfilling such that the water extends above the edge of the opening) forms at the mouth of the vial *(Figure 2)*. Carefully cap the vial so the cap displaces a slight amount of water, excluding any air. It is critical that the sample vials do not contain any air bubbles once they are capped. Invert the vials to ensure there is no air trapped in the sample vial *(Figure 3)*.

If bubbles are present, open the sample and add additional water to eliminate the bubble. Some sample matrices (such as those high in carbonate or sediment) can cause effervescence and create gas upon contact with the Hydrochloric Acid, which may not allow for the zero headspace needed to properly analyze the sample. Should this happen, note it on the chain of custody form to ensure proper handling at the lab.

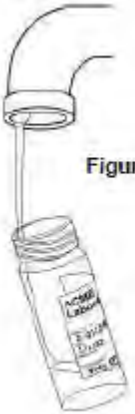


Figure 1


Figure 2


Figure 3

Multi-Increment Soil Sampling

For Method 8330B Explosives and other analytes

There are many considerations in designing and implementing a MIS project. It is imperative that you discuss project objectives and options with your client, regulator AND laboratory.

From the lab's perspective, some of the critical choices include:

- Analytes/methods: explosives, metals, SVOCs, PAHs, PCBs, Pesticides?
- Number of increments and sample mass: individually jarred increments or bulked bags?
- Air dry or process as is?
- Include or exclude non-sample components: sticks, leaves, rocks?
- Exclude to what particle size?
- Grinding options: ring & puck mill, ball mill, mortar & pestle?
- Grinding blank options: Analyze individually or composite and analyze1 per batch?
- Rotary sample splitter vs. manual subsampling

Your CT Laboratories Project Manager is available to work with you to define these project components.

There are many work groups and other resources currently working on this evolving topic. The documents and links below can help you obtain more information about both laboratory and field sample collection and design issues.

- DoD Environmental Data Quality Workgroup: Guide for Implementing EPA SW-846 Method 8330B. http://denix.osd.mil/edqw/documents.cfm
- ITRC Interstate Technology & Regulatory Council: Incremental Sampling Methodology Resources & Links. http://itrcweb.org/ism-1
- USACE EM-CX: Interim guidance for the implementation of Increment Sampling (IS) of Soil for the Military Munitions Response Program, Environmental and Munitions Center of Expertise Interim Guidance Document (IGD) 09-02. http://www.hnd.usace.army.mil/oew/interimguid.aspx

USDA Soil Sampling Guidelines

USDA regulates the shipping of soils from within certain restricted areas of the country, as well as from outside of the continental United States. The most current map of these areas is dated October 2009, and is found on page 16. Handling of soils from these areas must follow the USDA requirements on both the project's field sampling/shipping side as well as the laboratory's end.

CT Laboratories must provide a regulated soil kit (containing a copy of our USDA Permit to Receive Soil, Compliance Agreement and USDA PPQ Form 550) to the client prior to sampling. The field sampler or designated field person is personally responsible for the care and custody of the samples until they are properly transferred or dispatched to the laboratory. Sample labels or tags must be completed for each sample, and contain the sampling location, date, time, and sampler's name.

All sample containers must be accompanied by proper documentation. At a minimum, this documentation includes:

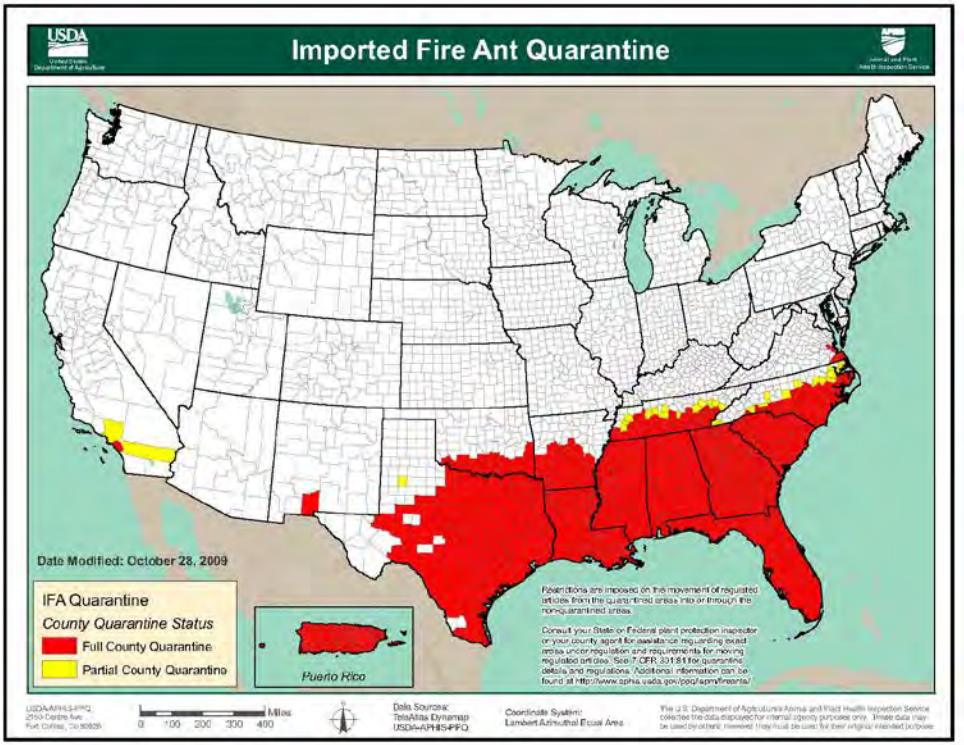
- a properly completed chain of custody (CoC)
- a copy of CT Laboratories' Soil Permit
- a copy of the Compliance Agreement
- PPQ Form 550

The client's field personnel or other representative must notify CT Laboratories prior to shipment to ensure that the permit holder will be available to take custody of the samples.

Transfer of Custody and Transport/Shipment
Shipping containers must be sturdy and leak-proof to preclude spillage or escape of pests in transit. The container must be secured with a custody seal made in such a manner that visually shows a break, destruction or change in nature if the seal is tampered with. The cooler's shipping label must be addressed exactly as appears on the Soil Permit and Compliance Agreement, and a copy of the PPQ Form 550 must be clearly displayed.

Samples must be properly packaged for shipment. For samples requiring temperature preservations, sufficient ice should surround samples to ensure ice is present when the samples reach the lab. Internal packaging should be in place to ensure container integrity and compliance with shipping regulations.

The original CoC will accompany the samples, with a copy retained by the field personnel. Shipped samples are to be considered restrictive and are shipped via bonded common carriers (UPS, FedEx, etc.). The mode of shipping should be noted in the "remarks" section of the CoC. The person relinquishing the samples signs, dates and note the time in the first "Relinquished by" section of the form. The shipping document (air bill, etc.) will serve as documentation of custody possession. The COC and the Soil Permit should be placed in a waterproof container (ziplock bag, etc.) directly in the cooler.



PPQ Form 550

U.S. DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
PLANT PROTECTION AND QUARANTINE
4700 RIVER ROAD, UNIT 133
RIVERDALE, MD 20737-1236

SOIL SAMPLES
RESTRICTED ENTRY

The material contained in this package is
imported under the authority of 7 CFR 330.300.

For release without treatment if addressee is
Currently listed as a USDA_APHIS inspected facility.

PPQ FORM 550 (APR 2008)

TCLP / SPLP Analysis

Sample matrix (soil, ash, solid, oil, solvent, aqueous or a mixture) as well as the compounds / analyses needed determine the type and number of containers needed for TCLP/SPLP samples.

Solid Matrices - Solid samples (soil, ash, rags, filters, grease, paints, waste oils) will not filter through a 0.6-0.8 um glass fiber filter. What analyses do you need? If you only need Metals, use plastic containers; for organic analytes (Pesticides, Semivolatiles, Volatiles), you must use glass.

Try to submit 300-500 grams of sample (to establish the appropriate extraction fluid and perform the leaching procedure). For additional analyses as part of a Waste Protocol, refer to the *Container, Preservation and Holding Time Requirements* for minimum sample volumes for those analyses.

Liquid Matrices - Is it a single or multi-phase sample? If single phase, is it aqueous? If aqueous and contains <0.5% solids, it is equivalent to a TCLP extract. If non-aqueous with <0.5% solids, it will be analyzed by the appropriate prep and analytical method. Multiphasic samples require each phase to be analyzed separately, with the combined results calculated using the volume ratio of each phase.

For known aqueous samples with no visual solids please collect the following:

TCLP Metals = (1) 500-mL unpreserved plastic
TCLP Organics = (1) 1-Liter unpreserved amber glass bottle
TCLP Organics and Metals = (2) 1-Liter unpreserved amber glass bottles

Aqueous samples with solids present must be evaluated on a sample by sample basis. Sufficient sample is needed to meet the liquid and solid portions of the method. Consult your Project Manager.

For unknown liquid samples with no visual solids please collect the following:

TCLP Metals = (1) 500-mL unpreserved plastic bottle (if a solvent, use glass jar)
TCLP Organics = (1) 1-Liter unpreserved amber glass bottle
TCLP Organics and Metals = (2) 1-Liter unpreserved amber glass bottles

Other things to consider…..
The TCLP Leaching procedure takes a minimum of 20 hours. Samples must then be digested/ extracted and then analyzed. ***If Rush TAT is needed, advance notice is required for scheduling.*** You can have your results reported two ways. Compounds with detects *below* the established TCLP Regulatory Limit can be reported either as < (TCLP Limit) or with the actual value.

The 20X Rule. What is it???? Some disposal companies accept regular total (unleached) analysis. The results are compared to the TCLP Regulatory Limits, and if the total result is less than 20 times the TCLP Limit, it is assumed that a TCLP result would be below the TCLP Limit. *For example:*

The TCLP Regulatory Limit for Lead is 5 mg/L (ppm). A soil sample analyzed for Lead using the standard digestion and analytical methods shows results of 78 mg/kg (ppm). Since the total result of 78 ppm is less than 100 ppm (20 X the TCLP Limit), it is assumed that this sample would not exceed the TCLP Limit if the TCLP Leaching procedure was performed. *Note that if your total value is more than 20X the TCLP limit, you will probably need to have a TCLP analysis performed.*

Total Petroleum Hydrocarbons (TPH)

Clients are often confused about what to ask for when they are required to submit a sample for “TPH”. There are numerous methods for quantitation of petroleum hydrocarbons, and they go by many names.

Hydrocarbons are ***generally*** split into two ranges: **GRO** (Gasoline Range Organics or Volatile Hydrocarbons) and **DRO** (Diesel Range Organics or Semivolatile/ Extractable Hydrocarbons). *It should be noted that these are merely carbon ranges, and, for example, detection of GRO compounds does not necessarily imply that gasoline is present.* Other ranges include: RRO, ORO, and ERO. These are usually heavier ranges on the SVOC extraction side. Several states have specific methods that analyze and report the ranges separately, such as Wisconsin, Massachusetts, Alaska, and Washington. Some States or programs analyze and report a total result.

GRO samples are generally analyzed on a purge-and-trap system with a GC equipped with a PID/FID in series. The main petroleum hydrocarbon of interest is gasoline, with emphasis on Benzene, BTEX, or PVOC (petroleum volatile organic compounds). DRO samples are extracted and analyzed by GC-FID. Many States define what petroleum hydrocarbons can be analyzed as DRO, but generally they range from mineral spirits (early) to “fluids” and “oils” (late).

Reported results are determined in two ways, depending on the method or program requirements. The first involves a calibration curve made directly from petroleum products. Quantitation windows are established for each petroleum hydrocarbon. The area within that window is summed, and a result is calculated using the standard that best matched the sample chromatogram. This method allows gasoline to be quantitated against a gasoline calibration curve, and motor oil to be quantitated against a motor oil curve. The drawback is that petroleum hydrocarbon formulations differ; there will probably be a bias when comparing results between laboratories.

The second method uses a specified “component” standard. With this method, the calibration curve will be consistent from lab to lab. One example of a component standard is the WIGRO method standard, comprised of 10 individual analytes (MTBE, Benzene, Toluene, Ethylbenzene, m-, p- & o-Xylenes, 1,2,4- and 1,3,5-Trimethylbenzene and Naphthalene). The quantitation window is established 0.1 minutes before the retention time of MTBE and 0.1 minutes after that of naphthalene.

Bottom Line - You need to know your objectives for the data and the requirements of your particular State or regulatory program. Contact your CT Laboratories Project Manager for assistance; they can at least steer you in the right direction.

Container, Preservation and Holding Time Requirements

The tables on the following pages contain information regarding methods commonly employed in performing environmental analyses. It is not intended to be inclusive of all possible analytical methods or matrices. To the best of our knowledge, the information provided is current as of January 2012.

Unless otherwise noted, all samples must be kept refrigerated/iced during transportation and storage.

A note on "other" matrices (sediment, waste, tissue): zip-lock/plastic is acceptable for many analyses. However, glass is required for others. Please consult your project manager regarding your particular project needs.

Minimum Volume or Weight – under certain circumstances, a limited quantity of sample may be available during collection. The specified volumes or weights indicate a basic minimum needed to complete the analysis or preparation. Collecting a "minimum" amount of sample is not recommended if it can be avoided.

Parameter/Analytes with similar container type/preservation can often be "grouped" in the same container. In certain instances, the container size may need to be larger to accommodate this grouping. For example:

- Analyte lists vary significantly between programs and projects. Please verify your requirements with your project manager. We will gladly provide our "standard" lists for various analyses.
- The nitrogen series (nitrate + nitrite, total kjeldahl nitrogen, ammonia), total phosphorus and COD can be analyzed from a single 250-mL plastic bottle preserved with sulfuric.
- BOD, alkalinity and anions can be analyzed from a single 1-liter unpreserved plastic bottle. In certain cases (i.e., high BOD sample), total suspended solids can also be included with this grouping.
- For soil samples: metals, % solids and anions can be analyzed from a single 4-oz plastic unpreserved specimen cup.
- Many semivolatile organic analyses can be performed from one soil sample jar: PAHs, PCBs, Pesticides and TPH can all be analyzed from one 9-oz. jar. This only applies to samples with sufficient mass and sample homogeneity. Samples that are "light" (such as ash) will likely require additional containers to meet minimum volumes. Samples with gravel or wood present will be "subsampled" to remove these materials.

Please note analyte-specific footnotes following each table section.

Metals

Parameter/Analyte	Method(s)	Matrix	Container/Preservative Minimum volume	Hold Time
Metals (ICP) Aluminum Antimony Arsenic Barium Beryllium Boron Cadmium Calcium Chromium Cobalt Copper Iron Lead Lithium Magnesium Manganese Molybdenum Nickel Potassium Selenium Silver Sodium Strontium Sulfur Thallium Tin Titanium Tungsten Vanadium Zinc	200.7, 6010C	Drinking Water	1-L Pl, HNO3	6 months
		Water	250-mL Pl, HNO3	
		Solid	250-mL PL or 4-oz Pl, none	
		Wipes	4-oz Gl jar w/ cotton wipe saturated with DI water	
Metals (GFAA) Antimony Arsenic Lead Selenium Silver Strontium Thallium	200.9, 7010	Drinking Water	1-L Pl, HNO3	
		Water	250-mL Pl, HNO3	
		Solid	250-mL PL or 4-oz Pl, none	
		Wipes	4-oz Gl jar w/ cotton wipe saturated with DI water	

Parameter/Analyte	EPA Method(s)	Matrix	Container/Preservative Minimum volume	Hold Time Extraction/ Analysis
Mercury	245.2, 7470A	Water	250 mL Pl, HNO3	28 days
		Drinking water	1-L Pl, HNO3	
	7471B	Solid	4-oz Pl cup, none	
Mercury (low level)		Water	250-mL ultra-clean Gl, none	28 days
Hardness	6010C, 2340B	Water	250-mL Pl, HNO3	6 months
Hexavalent Chromium	3060A, 7196A	Water	125-mL Pl, none **min volume = 50 mL**	**24 hours**
		Soil	4-oz Pl cup, none **min sample = ~15 g**	30 days

Abbreviations:

Preservatives

HCl = Hydrochloric Acid

H_2SO_4 = Sulfuric Acid

HNO_3 = Nitric Acid

Containers

A = Amber

Gl = Glass

Pl = Plastic

L = Liter

General Chemistry Analytes

Parameter/Analyte	Method(s)	Matrix	Container/Preservative Minimum volume	Hold Time
Alkalinity (carbonate, bicarbonate)	310.2	Water	125-mL Pl, none **min volume = 50 mL**	14 days
Ammonia Nitrogen	350.1, 350.2	Water	250-mL Pl, H2SO4 **min volume – 50 mL**	28 days
		Solid	4-oz Pl cup, none **min sample = ~15 g**	28 days
Anions (bromide, chloride, fluoride, nitrate, nitrite, ortho-phosphate, sulfate)	300.0, 9056A	Water	125-mL Pl, none **min volume = 50 mL**	48 hours to 28 days
	9056A	Solid	4-oz Pl cup, none **min sample = ~15 g**	28 days
BOD – 5 day (total, soluble, carbonaceous)	5210B	Water	1-liter Pl, none **min volume = 500 mL**	48 hours
		Sludge	250-mL Pl, none **min sample = ~15 g**	48 hours
Bromide (see also “anions”)	300.0, 9056A	Water	125-mL Pl, none **min volume = 50 mL**	28 days
Chloride (see also “anions”)	300.0, 9056A	Water	125-mL Pl, none **min volume = 50 mL**	28 days
	9056A	Solid	4-oz Pl cup, none **min sample = ~15 g**	28 days
COD	410.4	Water	125-mL Pl, H2SO4 **min volume = 50 mL**	28 days
Coliform (total)	9223	Water	Fill above line on bottle	*State dependent* WI-30 hrs
Coliform (fecal)	9222D	Solid	Fill above line on bottle	*State dependent* WI-30 hrs
Cyanide (amenable, weak & dissociable)	4500G/I,335.4, 9010,9012A	Water	250-mL Pl, NaOH **min volume = 100 mL**	14 days
Cyanide (reactive)	D5049	Water	500-mL Pl, none **min volume = 50 mL**	14 days
Cyanide (total, reactive)	D5049, 9012A	Solid	4-oz Pl cup, none	14 days
Flashpoint	1010	Water Solid NAPL	250-mL Pl, none 4-oz Pl cup, none 9-oz glass jar, none	10 days 10 days 10 days
Fluoride (see also “anions”)	300.0, 9056A	Water	125-mL Pl, none **min volume = 50 mL**	28 days
	9056A	Solid	4-oz Pl cup, none **min sample = ~15 g**	28 days
Free Liquids	9095B	Solid	4-oz Pl cup, none	180 days

Parameter/Analyte	Method(s)	Matrix	Container/Preservative Minimum volume	Hold Time
Hardness (see also "metals")	6010C/2340B	Water	250-mL Pl, HNO3 **min volume = 75 mL**	6 months
Hexavalent Chromium	7196A	Water	125-mL Pl, none **min volume = 50 mL**	**24 hours**
		Solid	4-oz Pl cup, none **min sample = ~15 g**	30 days
Ignitability	1030	Solid	4-oz Pl cup, none	none
Nitrate (see also "anions")	300.0, 353.2, 9056A	Water	125-mL Pl, none **min volume = 50 mL**	**48 hours**
	353.2, 9056A	Solid	4-oz Pl cup, none **min sample = ~15 g**	28 days
Nitrite (see also "anions")	300.0, 353.2, 9056A	Water	125-mL Pl, none **min volume = 50 mL**	**48 hours**
	353.2, 9056A	Solid	4-oz Pl cup, none **min sample = ~15 g**	28 days
Nitrate + Nitrite	300.0, 353.2, 9056A	Water	125-mL Pl, H2SO4 **min volume = 50 mL**	28 days
	353.2, 9056A	Solid	4-oz Pl cup, none **min sample = ~15 g**	28 days
Nitrogen, Organic Total	350.1, 351.2	Water	250-mL Pl, H2SO4 **min volume = 100 mL**	28 days
		Solid	250-mL Pl or 4-oz Pl	28 days
Nitrogen, Total	351.2, 300.0	Water	250-mL Pl, H2SO4 **min volume = 75 mL**	28 days
	351.2, 9056A	Solid	250-mL Pl or 4-oz Pl	28 days
Nitrogen, Total Kjeldahl	351.2	Water	250-mL Pl, H2SO4 **min volume = 50 mL**	28 days
		Solid	250-mL Pl or 4-oz Pl	28 days
Oil & Grease	1664A	Water	1-L amber glass, HCl	28 days
Organic Carbon	415.1, 9060A	Water	125-mL Pl, H_2SO_4 **min volume = 50 mL**	28 days
	Lloyd Kahn	Solid	4-oz Pl cup, none **min sample = ~15 g**	14 days
Ortho-phosphate (see also "anions")	300.0, 365.1, 9056A	Water	125-mL Pl, none **min volume = 50 mL**	**48 hours**
pH	150.1, 9040C, 9041A, 4500H	Water	125-mL Pl, none **min volume = 50 mL**	ASAP
	9045D	Solid	4-oz Pl cup, none	ASAP
Phosphorus	365.1, 365.4	Water	125-mL Pl, H_2SO_4 min **volume = 50 mL**	28 days
		Solid	4-oz Pl cup, none	

Parameter/Analyte	Method(s)	Matrix	Container/Preservative Minimum volume	Hold Time
Phenolics	420.1, 9066	Water	1-L amber glass, H_2SO_4 **min volume = 200 mL**	28 days
		Solid	4-oz glass jar, none	10 -28 days
Phosphate	9056A	Solid	250-mL Pl or 4-oz Pl **min sample = ~15 g**	28 days
Residue, Total	2540C	Water	250-mL Pl, none **min volume = 50 mL**	7 days
Solids, Settleable	2540F	Water	1-L Pl, none	7 days
Solids, Total Dissolved	160.1, 2540C	Water	1-L Pl, none **min volume = 50 mL**	7 days
Solids, Total	2540B	Water	1-L Pl, none **min volume = 50 mL**	7 days
Solids, Total or Percent	2540B, 8000C	Solid	4-oz Pl cup, none **min sample = ~15 g**	7 days
Solids, Total Suspended	2540M	Water	1-L Pl, none **min volume = 500 mL**	7 days
Solids, Total Volatile	160.4	Water	1-L Pl, none **min volume = 500 mL**	7 days
		Solid	4-oz Pl cup, none **min sample = ~15 g**	7 days
Solids, Volatile Suspended	160.2, 160.4, 2540D	Water	1-L Pl, none **min volume = 500 mL**	7 days
Specific Gravity	2710F	Water	125-mL Pl, none	none
		Solid	4-oz Pl cup, none	
Sulfate) (see also “anions”)	300.0, 9056A	Water	125-mL Pl, none **min volume = 50 mL**	28 days
	9056A	Solid	4-oz Pl cup, none **min sample = ~15 g**	28 days
Sulfide	376.1, 9034	Water	500-mL Pl, NaOH+ZnAc **min volume = 250 mL**	7 days
Sulfide (reactive)	D4978	Solid	4-oz Pl cup, none	none
Sulfide (acid volatile)	821 R 91	Solid	8-oz glass jar, none	14 days
Volatile Fatty Acids	9056M	Water	40-mL Gl vial w/ teflon lid, none	28 days

Preservatives

HCl = Hydrochloric

H_2SO_4 = Sulfuric Acid

HNO_3 = Nitric Acid

Containers

Acid A = Amber

Gl = Glass

Pl = Plastic

L = Liter

Organic Analytes

Parameter/Analyte	Method(s)	Matrix	Container/Preservative Minimum volume	Hold Time Extraction/ Analysis
Petroleum / Fuels Analysis				
Total Petroleum Hydrocarbons (TPH)[1]	8015B, Mod. 8015, State specific	Water	1-L Amber Gl, none	See TPH notes
		Solid	4-oz Gl jar, none	
Fingerprint Analysis of Petroleum Hydrocarbon Product	Mod. 8015B	Product	4-oz Gl jar, none	14 / 40 days
Diesel Range Organics (DRO)	8015B	Water	1-L amber Gl, none	7 / 40 days
		Solid	4-oz Gl jar, none	14 / 40 days
DRO – Wisconsin	WDNR DRO	Water	1-L Amber Gl, HCl	7 / 40 days
		Solid	60-mL tared Amber Gl, with 25-35 g unpreserved sample	Add solvent w/l 10 days / 47 days
Gasoline Range Organics (GRO)	8015B	Water	**3** 40-mL VOC vials, HCl	14 days
		Solid	4-oz Gl, zero headspace	14 days
GRO – Wisconsin	WDNR GRO	Water	**3** 40-mL VOC vials, HCl	14 days
		Solid	60-mL tared Amber Gl, with 25-35 g sample / Methanol	21 days
Volatile Organic Compounds[2] (VOCs)				
VOCs – standard list	8260C	Water	**3** 40-mL VOC vials, HCl **OR** **3** 40-mL VOC vials, none	14 days 7 days
		Solid	60-mL tared A Gl, Methanol **or** 25g Encore sampler **or** Terra Core sampler **or** 4-oz Gl jar, zero headspace	See VOC notes
VOCs including 2-Chloroethyl vinyl ether	8260C	Water	**3** 40-mL VOC vials, none	7 days
VOCs including Acrolein and Acrylonitrile	8260C	Water	**3** 40-mL VOC vials, pH 4-5 **3** 40-mL VOC vials, none	14 days 7 days
VOCs – Low Level Analysis	8260C	Water	**5** 40-mL VOC vials, HCl **or** **5** 40-mL VOC vials, none	14 days 7 days
		Solid	60-mL tared A Gl, Methanol **or** 5g Encore sampler **or** Terra Core sampler **or** 4-oz Gl jar, zero headspace	See VOC notes
VOCs – SDWA List	524.2	Drinking	**3** 40-mL VOC vials, HCl	14 days

Parameter/Analyte	Method(s)	Matrix	Container/Preservative Minimum volume	Hold Time Extraction/ Analysis
BTEX, BTEX + MTBE	8020A, 8260C	Water	**3** 40-mL VOC vials, HCl **or** **3** 40-mL VOC vials, none	14 days 7 days
		Solid	60-mL tared A GI, Methanol **or** 5 or 25g Encore sampler **or** Terra Core sampler **or** 4-oz GI jar, zero headspace	See VOC notes
PVOC, PVOC + Naphthalene	8020A, 8260C	Water	**3** 40-mL VOC vials, HCl **or** **3** 40-mL VOC vials, none	14 days 7 days
		Solid	60-mL tared A GI, Methanol **or** 5 or 25g Encore sampler **or** Terra Core sampler **or** 4-oz GI jar, zero headspace	See VOC notes
		Solid	60-mL tared Amber GI, with 25-35 g sample / Methanol	14 days 21 days (WI)
Benzene, BTEX, VOC as Gasoline	NIOSH 1500 or 1501	Air	Charcoal Tube, none	14 days @ 5° C
Semivolatile Organic Compounds				
SVOCs – standard list	8270D, 8270 SIM	Water	1-L Amber GI, none	7 days / 40 days
		Solid	4-oz GI, none	14 days / 40 days
Polyaromatic Hydro-carbons (PAHs, PNAs)	8310, 8270D, 8270 SIM	Water	1-L Amber GI, none	7 days / 40 days
		Solid	4-oz GI, none	14 days / 40 days
PCBs	8082A,	Water	1-L Amber GI, none	7 days / 40 days
		Solid	4-oz GI, none	14 days / 40 days
	8082A	Oil	4-oz GI, none	14 days / 40 days
		Wipes	4-oz GI w/ 4x4" cotton gauze pad, moistened w/ Hexane	14 days / 40 days
Chlorinated Pesticides	8081B,	Water	1-L Amber GI, none	7 days / 40 days
		Solid	4-oz GI, none	14 days / 40 days
Phenols	8270D, 8040	Water	1-L Amber GI, none	7 days / 40 days
		Solid	4-oz GI, none	14 days / 40 days

Parameter/Analyte	EPA Method(s)	Matrix	Container/Preservative Minimum volume	Hold Time Extraction/ Analysis
Other Organic Compounds				
Explosives	8330A/B, 8095	Water	1-L Amber Gl, none	7 days / 40 days
		Solid	4-oz Gl, none ^	14 days / 40 days
	Mod. 8330A/B	Wipes	4-oz Gl jar with 4x4" cotton gauze pad moistened w/ Acetonitrile	14 days / 40 days
Nitroglycerin	Mod. 8332	Water	1-L Amber Gl, none	7 days / 40 days
		Solid	4-oz Gl, none ^	14 days / 40 days
Dissolved Gases – Methane, Ethane, Ethylene	RSK-175, Mod. 8015B	Water	**(3)** 40-mL VOC vials, HCl Shipped inverted	14 days
Dissolved Gases – Carbon Dioxide	Mod. 8015B	Water	**(3)** 40-mL VOC vials, none Shipped inverted	7 days

1. Total Petroleum Hydrocarbons (TPH) can refer to numerous test methods and the analysis of many different Petroleum Hydrocarbons and/or boiling point ranges. If you are unsure which TPH range and/or test you need performed, please contact your CT Laboratories Project Manager.

2. Volatile Organic Compounds (VOCs) - There are numerous methods, lists and sampling options associated with VOCs. The required sampling container and hold times will be dependent on the method specified, State in which the sample is collected and/or the regulatory program being followed. If you are unsure which container should be used, please contact your CT Laboratories Project Manager.

Minimum volumes:
* minimum sample volume = 30 grams
^ minimum sample volume = 10 grams

Abbreviations:

HCl = Hydrochloric Acid	A = Amber
H_2SO_4 = Sulfuric Acid	Gl = Glass
HNO_3 = Nitric Acid	Pl = Plastic
	L = Liter

Concentration Units Conversion Chart

Liquids

									% w/v
1	ng/L	1	ppt	0.001	ug/L	0.001	ppt	0.0000001	%
1	ug/L	1	ppb	0.001	mg/L	0.001	ppm	0.0000001	%
10	ug/L	10	ppb	0.01	mg/L	0.01	ppm	0.000001	%
100	ug/L	100	ppb	0.1	mg/L	0.1	ppm	0.00001	%
1,000	ug/L	1,000	ppb	1	mg/L	1	ppm	0.0001	%
10,000	ug/L	10,000	ppb	10	mg/L	10	ppm	0.001	%
100,000	ug/L	100,000	ppb	100	mg/L	100	ppm	0.01	%
1,000,000	ug/L	1,000,000	ppb	1000	mg/L	1000	ppm	0.1	%
10,000,000	ug/L	10,000,000	ppb	10,000	mg/L	10,000	ppm	1	%
100,000,000	ug/L	100,000,000	ppb	100000	mg/L	100000	ppm	10	%

Solids

									% w/w
1	ug/kg	1	ppb	0.001	mg/kg	0.001	ppm	0.0000001	%
10	ug/kg	10	ppb	0.01	mg/kg	0.01	ppm	0.000001	%
100	ug/kg	100	ppb	0.1	mg/kg	0.1	ppm	0.00001	%
1,000	ug/kg	1,000	ppb	1	mg/kg	1	ppm	0.0001	%
10,000	ug/kg	10,000	ppb	10	mg/kg	10	ppm	0.001	%
100,000	ug/kg	100,000	ppb	100	mg/kg	100	ppm	0.01	%
1,000,000	ug/kg	1,000,000	ppb	1000	mg/kg	1000	ppm	0.1	%
10,000,000	ug/kg	10,000,000	ppb	10,000	mg/kg	10,000	ppm	1	%
100,000,000	ug/kg	100,000,000	ppb	100000	mg/kg	100000	ppm	10	%

ng	nanogram	ppt	parts per trillion
ug	microgram	ppb	parts per billion
mg	milligram	ppm	parts per million
L	Liter	%	percent
kg	kilogram	w	weight
		v	volume

Acronyms and Abbreviations

°C	Degrees Celsius
BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
COC	Chain of Custody
CVA	Cold Vapor Absorption
DOT	Department of Transportation
DRO	Diesel Range Organics
EB	Equipment Blank
EPA	United States Environmental Protection Agency
FB	Field Blank
FLAA	Flame Atomic Absorption
FID	Flame Ionization Detector
GC	Gas Chromatograph
GFAA	Graphite Furnace Atomic Absorption
GRO	Gasoline Range Organics
ICP	Inductively Coupled Plasma
LCS	Laboratory Control Sample
MTBE	Methyl tert-butyl ether
MS/MSD	Matrix Spike/Matrix Spike Duplicate
PAH	Polyaromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PID	Photoionization Detector
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RL	Reporting Limit
SPLP	Synthetic Precipitation Leaching Procedure
SDWA	Safe Drinking Water Act
SVOC	Semivolatile Organic Compounds
TAT	Turnaround Time
TCLP	Toxicity Characteristics Leaching Procedure
TPH	Total Petroleum Hydrocarbons
VOC	Volatile Organic Compounds

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