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ENVIRONMENTAL SOIL AND GROUNDWATER SAMPLING

Procedures for Collecting Representative Data during Site Assessment Field Work

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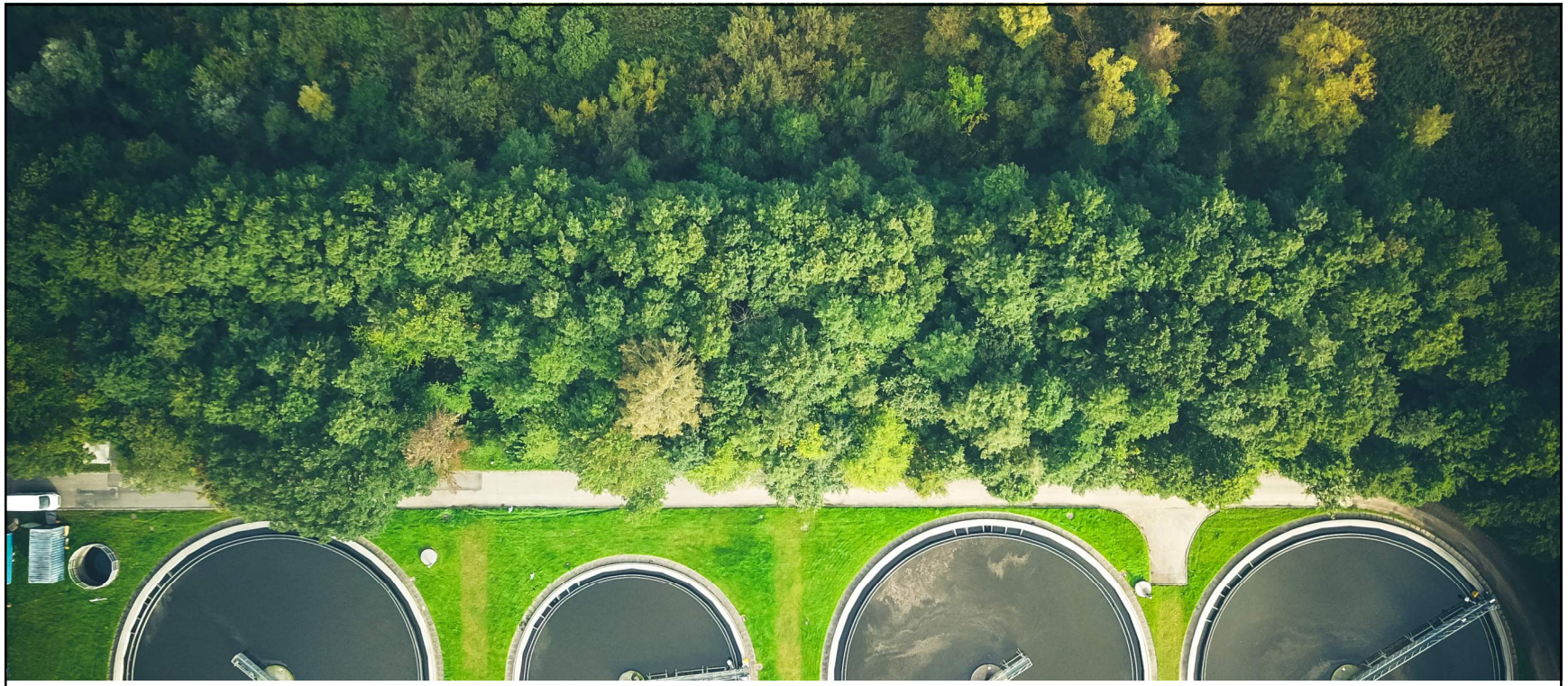

GROUNDWATER SAMPLING

Traditional and Current Methodologies, Key Factors for Success

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GROUNDWATER SAMPLING METHODS

Bailers

- Requires removal of 3 well volumes (PVC casing area x water column)
- Disturbs sediments, creating turbid samples

Inertial Check Valves (Waterra)

- Effective for remote locations with deep groundwater (more than 29 feet)
- Can be labor-intensive for high well purge volumes

Electric Submersible Pumps

- Rapid groundwater removal
- Produces non-turbid purge water

Peristaltic Pumps

- Low flow, preferred method for current site assessment practice
- Requires several pieces of equipment, bulky to transport

Bladder Pumps (Submersible, Pneumatic)

- Low flow, preferred method for current site assessment practice
- Requires decontamination between monitoring wells

GROUNDWATER SAMPLING METHODS

Bailers (Traditional)

- Limited Applicability
- Bail 3X Well Volume
- Disturbs Water Column, Sediments
- Turbid Samples
- Dedicated Equipment for each Monitoring Well

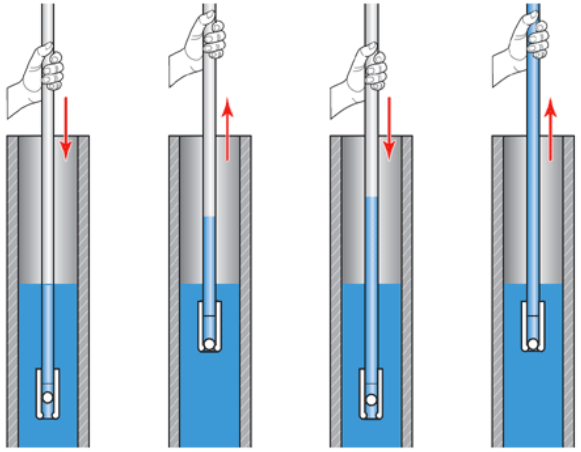
(Canpipe, 2025)

GROUNDWATER SAMPLING METHODS

Inertial Check Valves (Waterra)

- Requires Manual Force to Operate
- Easily Transported
- Moderate Groundwater Purge Rates
- No Depth Limitation (Up to 200 feet)
- Dedicated to Each Monitoring Well

(Solinst Canada Ltd., 2025)



(Solinst Canada Ltd., 2025)

(ECT Manufacturing, Inc., 2025)

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(The Nevada Independent, Nevada News Bureau, Inc. 2025)

EPA LOW STRESS (LOW FLOW) PROCEDURE

Current Groundwater Sampling Practice

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EPA LOW STRESS (LOW FLOW) PROCEDURE

Applicability and General Scope

- Standard Approach for Site Assessment/Remediation Industry
- Minimizes Groundwater Disturbance (low turbidity)
- Designed to minimize Hydraulic Stress by Minimizing Drawdown within Monitoring Wells during Purging
- Produces Groundwater Samples More Representative of Aquifer Conditions, Compared to Traditional Methods (Bailer, Inertial Pump)
- Requires an Array of Equipment, including Multi-Parameter Water Quality Meter with Flow-Through Cell and Separate Turbidity Meter, Pump and Accessories (Peristaltic, Bladder or Submersible)
- Geochemical Parameters are Monitored in Purge Water to confirm Equilibrium Conditions between the Monitoring Well Void and the Aquifer
- Adequate for VOCs, SVOCs, Dissolved Gases, Pesticides, PCBs, Metals, other Inorganics or Naturally-Occurring Analytes
- A Current, Detailed EPA Guidance Document Exists for Sampler or Project Manager Reference, which is Periodically Updated by the EPA

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FIELD APPLICATION

Well Development

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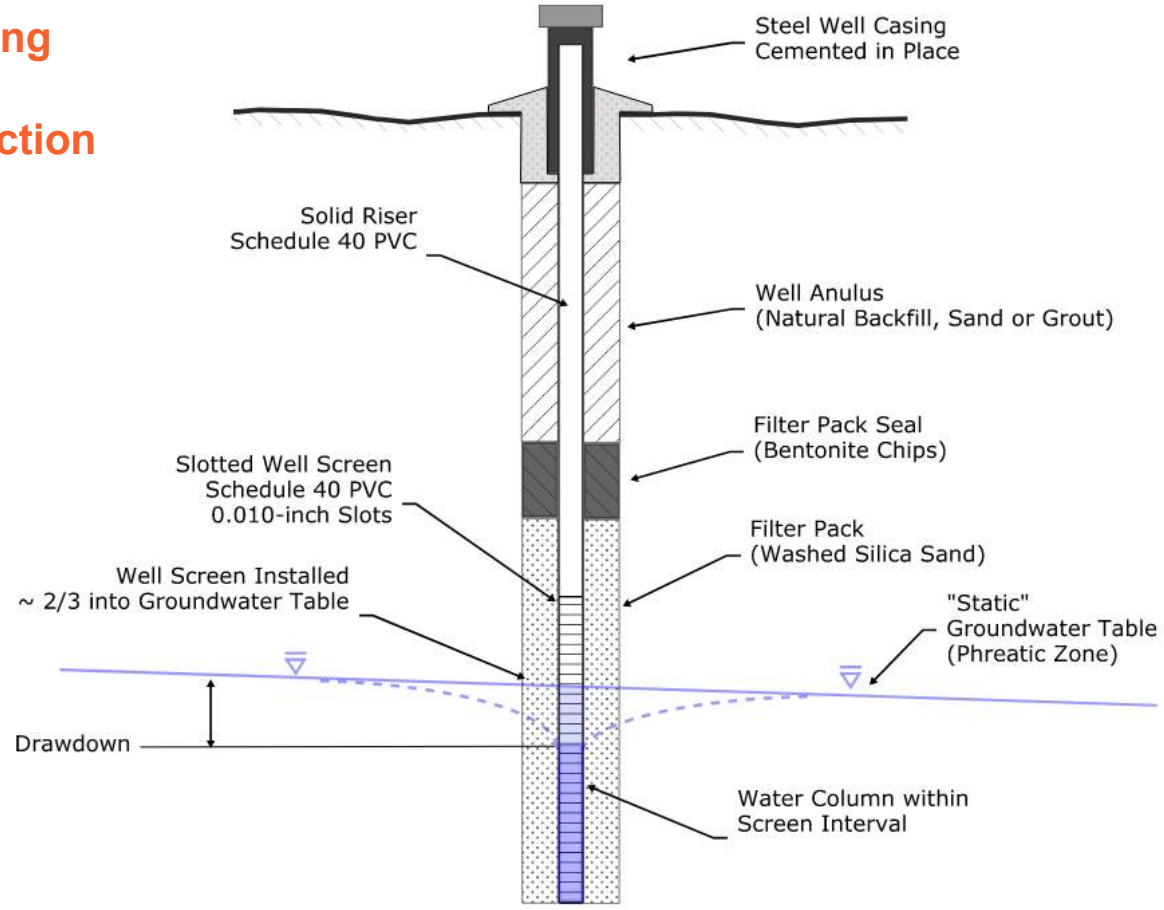
EPA LOW STRESS (LOW FLOW) PROCEDURE

Monitoring Well Construction



(Tighe & Bond, Inc. 2025)

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FIELD APPLICATION

Temporary Wells

EPA LOW STRESS (LOW FLOW) PROCEDURE

Materials List

- Padlock Keys, Tools for Opening Well
- Site Plan
- Water Level Meter
- Groundwater Sampling Field Log
- Dedicated Tubing
- Pump and Power Source
- Purge Bucket
- Multiparameter Water Quality Meter and Flow-Through Cell
- Turbidity Meter and T-Valve
- Graduated Vessel
- Laboratory-Supplied Sample Containers and Cooler
- Laboratory Chain of Custody

EPA LOW STRESS (LOW FLOW) PROCEDURE

(Activated Carbon Depot, 2025)

Water Level Meter

- Water Level Measurements Collected from PVC Rim
- Measurements in 0.01-Foot Increments (1/100th FT)
- Audible Beep and Light when Probe Contacts Water
- Measure Static Water Level, Drawdown, Total Well Depth (After Sampling)

(ENVIRO-EQUIPMENT, INC, 2025)

Interface Meter

- Measure LNAPL or DNAPL
- Audible Solid Beep and Light when Probe contacts product
- Intermittent Beep when Probe Contacts Water

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FIELD APPLICATION

Significant Contamination

- Use Conceptual Site Model (CSM) during field sampling procedures
- Where are the “source” contamination areas?
- Collect groundwater samples from least-contaminated areas to most-contaminated areas

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EPA LOW STRESS (LOW FLOW) PROCEDURE

Kosmos Scientific de México, S.A. de C.V.

HORIBA Scientific, Inc.

Hanna Instruments, Inc. 2025)

(Eco-Rental Solutions, LLC 2025)

Multiparameter Water Quality Meter

- Calibrated Meters Available from Rental Companies
- Requires Use of Flow-Through Cell
- Sonde (sensor) is fitted into Flow-Through Cell
- Purge Water is Pumped through Flow-Through Cell

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EPA LOW STRESS (LOW FLOW) PROCEDURE

Peristaltic Pump

- Electrical, Requires 12V DC Battery
- Forces Water Through Tubing via Peristalsis
- Maximum Head Differential of 29 Feet
- Dedicated Tubing, No Need to Decontaminate
- Pump Rate of 50 ml/min to 400 ml/min

Forestry Suppliers, Inc. 2025

Bladder Pump

- Pneumatic
- Can Use Air Cannisters or Electrical Air Pump
- Maximum Head Differential of 180 Feet
- Not Dedicated, Must be Decontaminated
- Pump Rate of 10 ml/min to 600 ml/min

ENVIEQ, Inc. 2025

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EPA LOW STRESS (LOW FLOW) PROCEDURE

(ENVIRONMENTAL HOLDINGS PTY LTD, 2025)

Electric Submersible Pumps

- Can be Used for Low Flow Sampling, though Less Common in New England (shallow groundwater)
- Requires Decontamination between Monitoring Wells
- High Groundwater Purge Rates
- Requires Generator and Control Box (Vehicle Accessible Applications)
- Pump Rate of 50 ml/min to several L/min

(Pine Environmental Services LLC, 2025)

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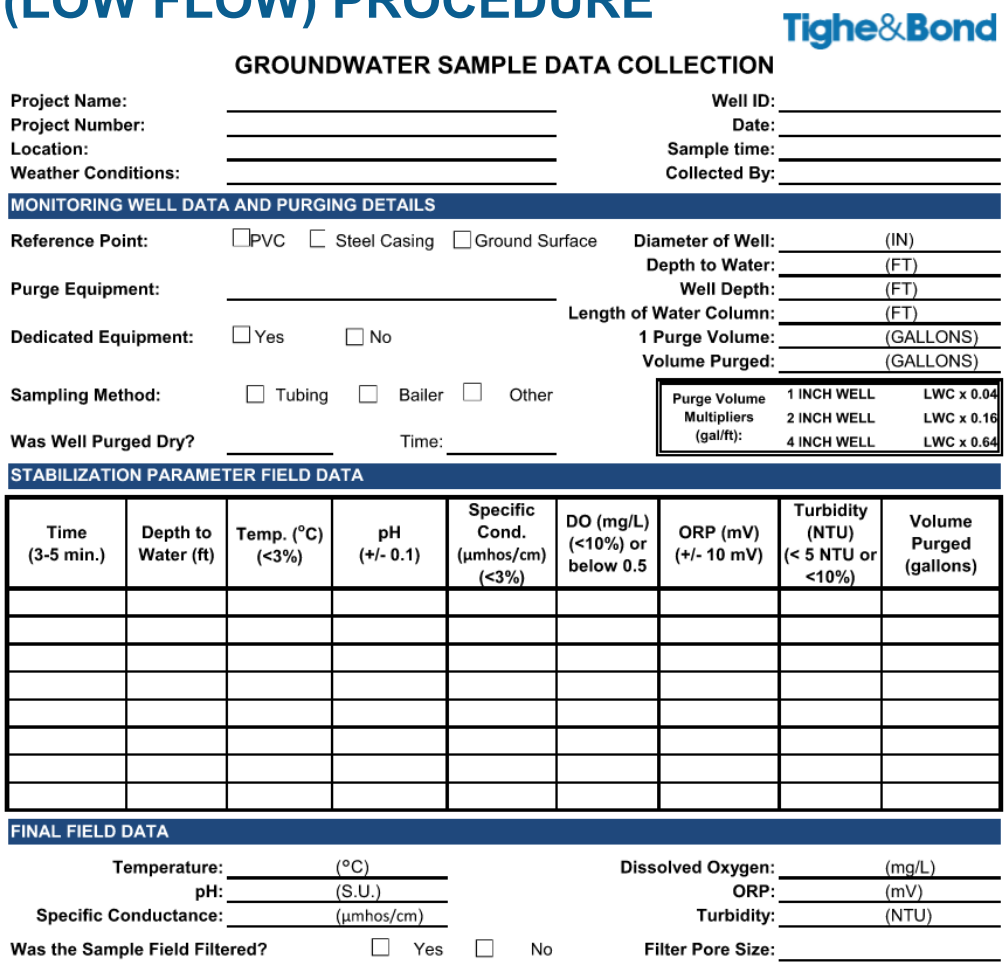
EPA LOW STRESS (LOW FLOW) PROCEDURE

Groundwater Sampling Field Log

- Static Groundwater Level
- Purge Rates (ml/min) for drawdown equilibrium
- Geochemical Parameters (5 min)
- Three consecutive readings within specified criteria
- Separate Turbidity Readings
- Collect sample following aquifer-well equilibrium



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GROUNDWATER SAMPLE DATA COLLECTION

Project Name: _____ Well ID: _____
Project Number: _____ Date: _____
Location: _____ Sample time: _____
Weather Conditions: _____ Collected By: _____

MONITORING WELL DATA AND PURGING DETAILS

Reference Point: ☐ PVC ☐ Steel Casing ☐ Ground Surface
Purge Equipment: _____
Dedicated Equipment: ☐ Yes ☐ No
Sampling Method: ☐ Tubing ☐ Bailer ☐ Other
Was Well Purged Dry? _____ Time: _____

Diameter of Well: _____ (IN)
Depth to Water: _____ (FT)
Well Depth: _____ (FT)
Length of Water Column: _____ (FT)
1 Purge Volume: _____ (GALLONS)
Volume Purged: _____ (GALLONS)

Purge Volume Multipliers (gal/ft):		
	1 INCH WELL	LWC x 0.04
	2 INCH WELL	LWC x 0.16
	4 INCH WELL	LWC x 0.64

STABILIZATION PARAMETER FIELD DATA

Time (3-5 min.)	Depth to Water (ft)	Temp. (°C) (<3%)	pH (+/- 0.1)	Specific Cond. (µmhos/cm) (<3%)	DO (mg/L) (<10%) or below 0.5	ORP (mV) (+/- 10 mV)	Turbidity (NTU) (< 5 NTU or <10%)	Volume Purged (gallons)

FINAL FIELD DATA

Temperature: _____ (°C)
pH: _____ (S.U.)
Specific Conductance: _____ (µmhos/cm)
Was the Sample Field Filtered? ☐ Yes ☐ No

Dissolved Oxygen: _____ (mg/L)
ORP: _____ (mV)
Turbidity: _____ (NTU)
Filter Pore Size: _____

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EPA LOW STRESS (LOW FLOW) PROCEDURE

Low-Flow (Minimal Drawdown) Ground-Water Sampling

- EPA Guidance Document Available Online
- Last Revised September 2017

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION I

LOW STRESS (low flow) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUNDWATER SAMPLES FROM MONITORING WELLS

Quality Assurance Unit
U.S. Environmental Protection Agency – Region 1
11 Technology Drive
North Chelmsford, MA 01863

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WHAT TO LOOK OUT FOR

Non-Ideal Conditions

- Well purged dry/turbid samples
- Geochemical parameters not equilibrating (practical/time constraints)

Trip Blanks, Equipment Blanks, Duplicate Samples

- Required? Implemented?

Field Filtering

- Private Wells are not filtered!
- “Drinking Water” vs. “Waste” analyses

Laboratory Quality Control Narratives

- Laboratory Log In Sheet
- RCP/MCP CAM Compliance Checklists

Low Flow Tubing

- Teflon/lined recommended for VOCs
- Teflon not recommended for PFAS

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WHAT TO LOOK OUT FOR

Sample Preservation

Table 1
Recommended Containers, Preservation, Storage, & Holding Times
For Water and Wastewater

Description	Method	Matrix	Sample Container[1]	Preservative[2]	Prep/Analysis Holding Time	Volume
Volatile/Semivolatile Analyses						
EDB, DBCP	504.1, 8011	H_2O	G (b) Tef Sep	Cool $\leq 6^0$ C, 75µL $Na_2S_2O_3$ Solution	14 days	40 ml [3,4]
Haloacetic Acids	552.2	H_2O	AG(a) Tef Cap	Cool $\leq 6^0$ C, NH4Cl	14 days	250 ml[3,4]
GCMS-Purgeables	524.2	H_2O	G (b) Tef Sep	Cool $\leq 6^0$ C Ascorbic acid & HCl to pH<2 [2,5]	14 days	40 ml [4,12]
GCMS-Purgeables	524.2- THMs only	H_2O	G (b) Tef Sep	Cool $\leq 6^0$ C $Na_2S_2O_3$ Solution	14 days	40 ml [4,12]
GCMS-Purgeables	624, 8260C	H_2O	G (b) Tef Sep	Cool $\leq 6^0$ C HCl to pH<2 [2,5]	14 days [5]	40 ml [4,12]
GCMS-Acrolein, Acrylonitrile, 2-Chloroethylvinyl ether	624	H_2O	G (b) Tef Sep	Cool $\leq 6^0$ C [2]	3 days[13]	40 ml [4,12]
GC-Pesticides	608, 8081B	H_2O	AG (a) Tef Cap	Cool $\leq 6^0$ C [2, 14]	7/40 days [6]	I L [3,4]
GC- PCBs	608, 8082A	H_2O	AG (a) Tef Cap	Cool $\leq 6^0$ C [2, 14]	1yr/1 yr [16]	I L [3,4]

(Eurofins USA, 2025)

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WHAT TO LOOK OUT FOR

Data Quality Objectives

- What is the Goal?
- Not All Samples Are the Same!

Assessment

Remediation

Risk Characterization

- Reporting Limits (sensitivity)
- Analytical Methodology
- Sample Collection, Handling, Preservation
- Are you measuring remediation project outcomes?
- Or human exposures?

(Dreamstime.com, 2025) KG0

WHAT TO LOOK OUT FOR

Sample Log-in Checklist

- Typically provided in laboratory report, near the end
- Identifies common deficiencies in sample preparation, handling and preservation
- Generally indicates overall quality of work by sampler

Login Sample Receipt Checklist

Client: Tighe & Bond — Job Number: 620-25530-1

Login Number: 25530 — **List Source: Eurofins Rhode Island**
List Number: 1
Creator: [redacted]

Question	Answer	Comment
Radioactivity either was not measured or, if measured, is at or below background	N/A	
The cooler's custody seal, if present, is intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	N/A	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time (Excluding tests with immediate HTs)..	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	True	
If necessary, staff have been informed of any short hold time or quick TAT needs	True	
Multiphasic samples are not present.	True	

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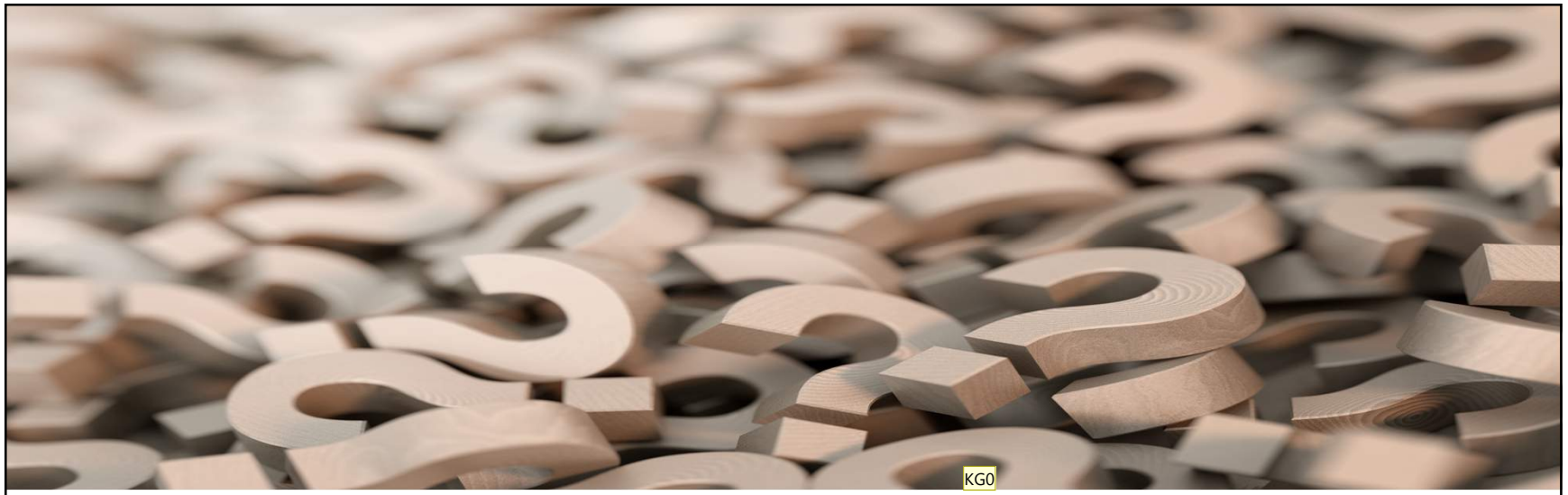

QUESTIONS?