DEP Quality Assurance Requirements for Sample Collection

Department of Environmental Protection

Standards and Assessment Section

Bureau of Assessment and Restoration Support

This course will….

- Help you navigate and use the DEP SOPs to your advantage.
- Give you an opportunity to expand on what you already know and ask questions.
- Provide hands-on training to improve technique.

This course will NOT….

- Act as a alternative to reading the SOPs.
- Make you an instant expert.

What does the DEP QA Rule require?

- Use DEP SOPs (revision date 12/3/08)
- Pre-approve alternative procedures
- Keep mandatory documentation
- Follow preservation & holding times
- Submit to audits

The SOPs are a valuable resource

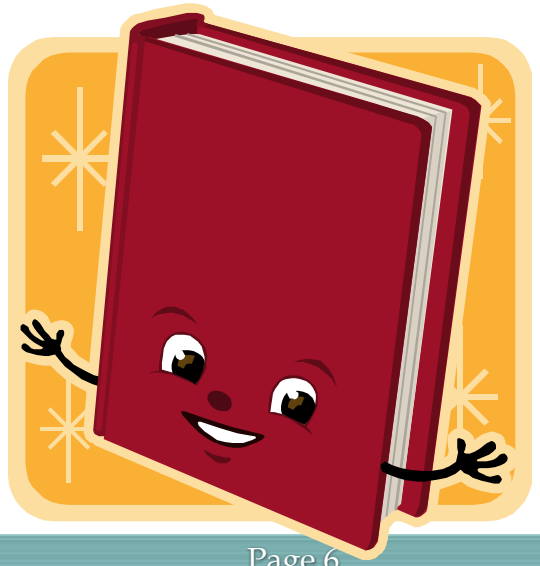
- Quick reference
- Clarify methods
- Example forms
- Tables

Where to find the SOPs:

http://www.dep.state.fl.us/water/sas/sop/sops.htm

eNewsletter

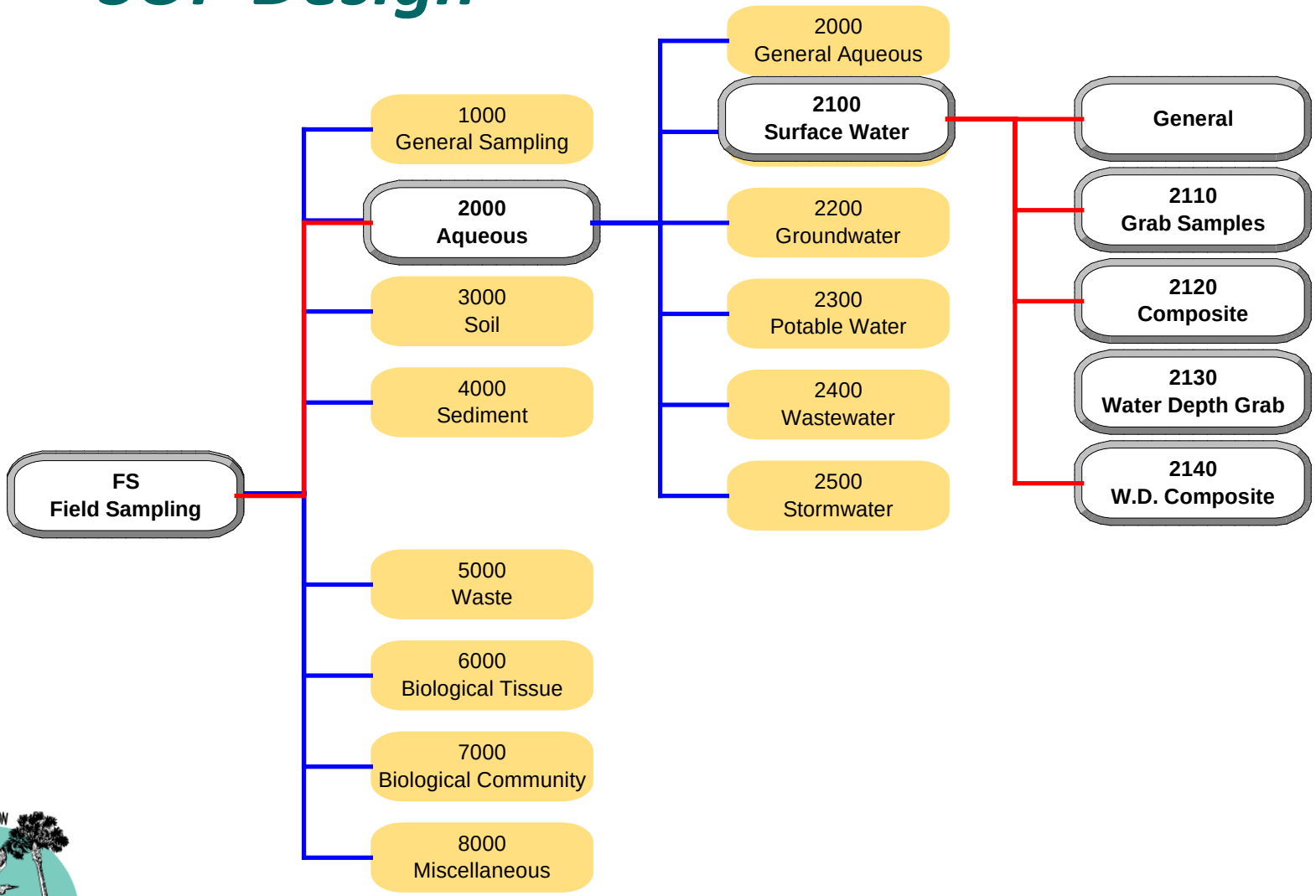
http://www.dep.state.fl.us/water/sas/training/listserv.htm



DEP SOP Naming Conventions

- FA Administrative & Quality Systems
- FC Field Cleaning
- FD Documentation
- FM Mobilization & Laboratory
- FQ Quality Control
- FS Sampling Procedures
- FT Field Testing

SOP Design


FS
Field Sampling
1000
General Sampling
2000
Aqueous
3000
Soil
4000
Sediment
5000
Waste
6000
Biological Tissue
7000
Biological Community
8000
Miscellaneous
2000
General Aqueous
2100
Surface Water
2200
Groundwater
2300
Potable Water
2400
Wastewater
2500
Stormwater
General
2110
Grab Samples
2120
Composite
2130
Water Depth Grab
2140
W.D. Composite

Quality Manual

Includes quality assurance polices and procedures for your specific organization or program

- **See requirements in FA 3300**

Auditing

You may be audited by DEP!

Find Checklists:

- FA 1000 appendix
- http://www.dep.state.fl.us/water/sas/qa/dr-audits.htm

General Considerations for Sampling

- Understand sampling and Data Quality Objectives
- Obtain a representative sample
- Maintain the integrity of the sample
- Documentation

FD 1000 Documentation

There are universal requirements as well as specifics for each type of documentation.

Some universal documentation requirements

- ✓ Sign or initial all documentation.
- ✓ Record enough information so that interpretations are not required.
- ✓ Do not erase or obliterate errors on records. Make corrections with a line through the error so that it is still legible. Initial the marked error and its correction.
- ✓ Clearly link documentation with the associated sample or measurement.
- ✓ Keep copies of all original documentation for a minimum of 5 years after project completion.

Good Documentation Habits

“When in doubt,

write it down”

- **Example forms:**

http://www.dep.state.fl.us/water/sas/qa/forms.htm

Sometimes cows happen.
Make sure it's documented.

BLAB Water Field Form 031306.doc

SITE NAME: Water Pond DATE: 01/01/2006 TIME 1200 (military) EST CST DEPTH^: 1 ft (m) FIELD ID: 1234ab

SAMPLING TEAM MEMBERS	WQ MEASUREMENTS	DOCUMENTATION	SAMPLE COLLECTION	PRESERVATION	PRESERVATION CHECK
Holly Sample			✓		✓
Mark Metric	✓	✓			
John Gather				✓	

SAMPLING EQUIPMENT

- ✓ Sample Container
- Pole
- Pump ID#: _____
- Tubing type: _____
- Other _____
- Other

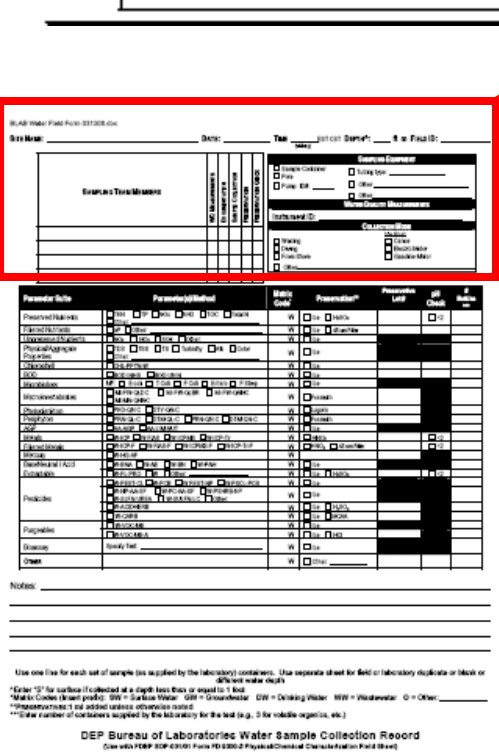
WATER QUALITY MEASUREMENTS

Instrument ID: A4567

COLLECTION MODE

- ✓ Wading
- Diving
- From Shore
- Other _____

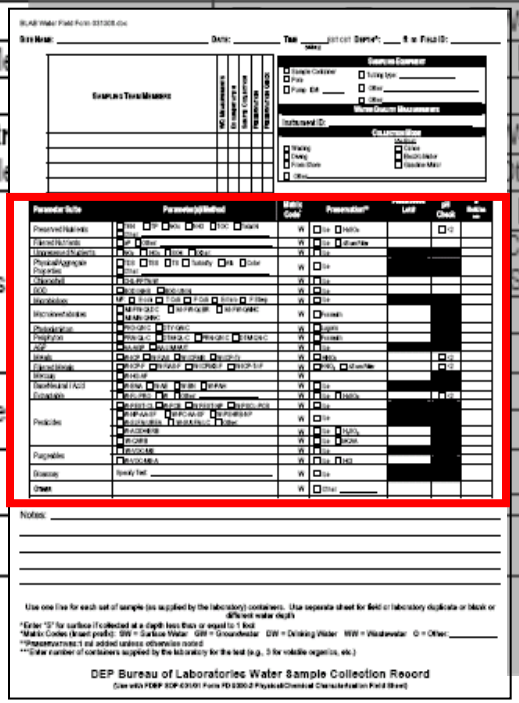
Via Boat
- Canoe
- Electric Motor
- Gasoline Motor



DEP Bureau of Laboratories Water Sample Collection Record

➢ **Details about sample method, samplers, and site**

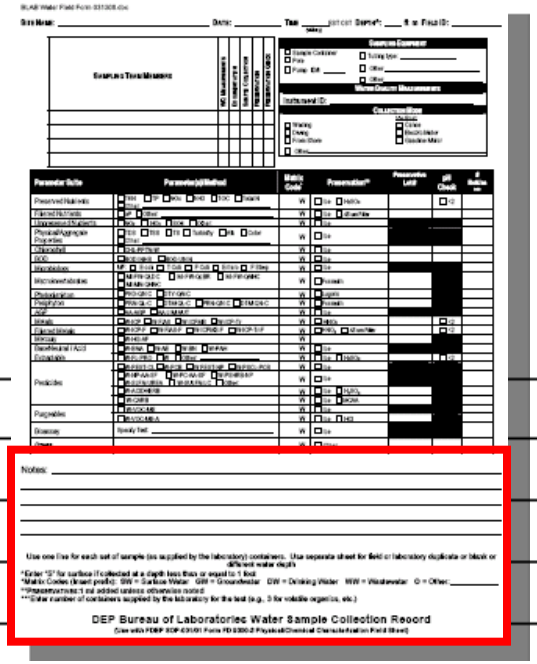
Parameter Suite	Parameter(s)/Method	Matrix Code*	Preservation**	Preservative Lot #	pH Check	# Bottles ***
Preserved Nutrients	☑ TKN ☑ TP ☑ NOx ☑ NH3 ☐ TOC ☑ Total N ☐ Other:	W	☑ Ice ☑ H_2SO_4		☑ <2	1
Filtered Nutrients	☐ oP ☐ Other:	W	☐ Ice ☐ .45 um Filter			
Unpreserved Nutrients	☐ NO_2 ☐ NO_3 ☐ SO4 ☐ Other:	W	☐ Ice			
Physical/Aggregate Properties	☐ TDS ☐ TSS ☐ TS ☐ Turbidity ☐ Alk ☐ Color ☐ Other:	W	☐ Ice			
Chlorophyll	☑ CHL-PPTN-W	W	☑ Ice			1
BOD	☐ BOD-INHB ☐ BOD-UNIN	W	☐ Ice			
Microbiology	MF: ☐ E coli ☑ T Coli ☑ F Coli ☐ Entero ☐ F Strep	W	☑ Ice			2
Macroinvertebrates	☐ MI-FW-QLDC ☐ MI-FW-QLBR ☐ MI-FW-QNNC ☐ MI-MN-QNNC	W	☐ Formalin			
Phytoplankton	☐ PKD-QN-C ☐ DTY-QN-C	W	☐ Lugol's			
Periphyton	☐ PRN-QL-C ☐ DTM-QL-C ☐ PRN-QN-C ☐ DTM-QN-C	W	☐ Formalin			
AGP	☐ AA-AGP ☐ AA-LIM-NUT	W	☐ Ice			
Metals	☐ W-ICPMS ☐ W-ICP-Tr	W	☐ HNO_3		☐ <2	
Filtered Me	☐ W-ICPMS-F ☐ W-ICP-Tr-F	W	☐ HNO_3 ☐ .45 um Filter		☐ <2	
Mercury		W				
BaseNeutr	☐ W-BN ☐ W-PAH	W	☐ Ice			
Extractable	Other:	W	☐ Ice ☐ H_2SO_4		☐ <2	
Pesticides	☐ W PEST-NP ☐ W-PSCL-PCB	W	☐ Ice			
	C-AA-SF ☐ W-PSHRB-NP	W	☐ Ice			
	SULFN-LC ☐ Other:					
		W	☐ Ice ☐ H_2SO_4			
		W	☐ Ice ☐ MCAA			
Purgeable		W	☐ Ice			
		W	☐ Ice ☐ HCl			
Bioassay		W	☐ Ice			
OTHER		W	☐ Other:			



DEP Bureau of Laboratories Water Sample Collection Record

➢**Specific information by parameter**

➢Notes and footer for clarification



Notes: _____

Use one line for each set of sample (as supplied by the laboratory) containers. Use separate sheet for field or laboratory duplicate or blank or different water depth

^Enter "S" for surface if collected at a depth less than or equal to 1 foot

*Matrix Codes (Insert prefix): **SW** = Surface Water **GW** = Groundwater **DW** = Drinking Water **WW** = Wastewater O = Other:_____

PRESERVATIVES:1 ml added unless otherwise noted**

***Enter number of containers supplied by the laboratory for the test (e.g., 3 for volatile organics, etc.)

DEP Bureau of Laboratories Water Sample Collection Record

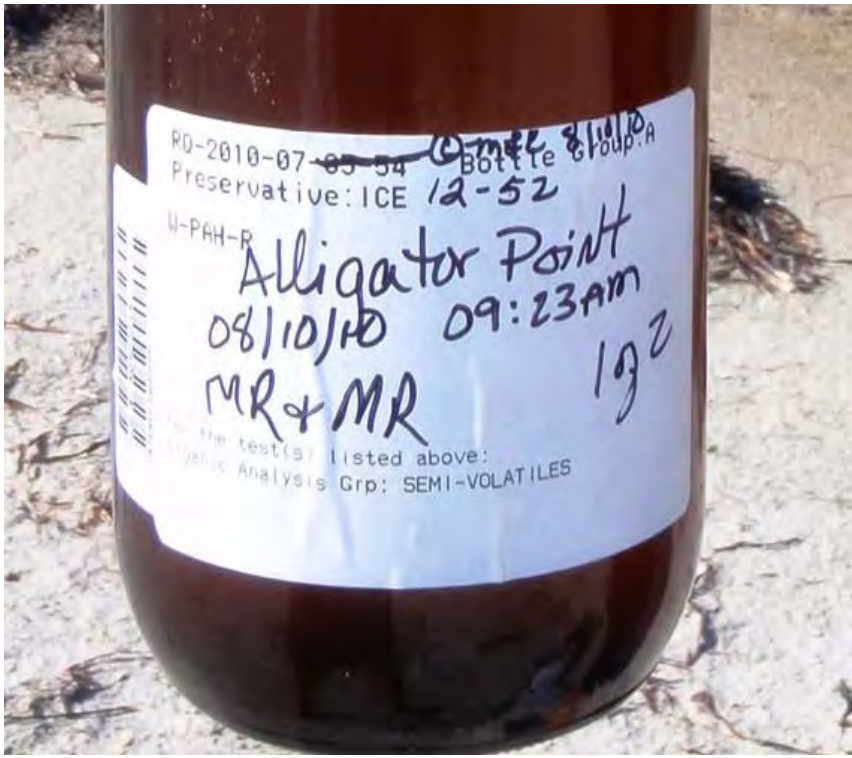
(Use with FDEP SOP-001/01 Form FD 9000-3 Physical/Chemical Characterization Field Sheet)

Link bottles to records

- Unique bottle ID

Also,

- Site
- Date
- Time
- Sampler Initials
- Numbered if multiples (e.g. 1 of 2, 2 of 2)



Label, preserve to ≤6 C with wet ice and complete field notes.

FQ 1000 Quality Control Samples

- Required
- Sampling QC Blanks

- Optional
- Duplicates or Replicates
- Split Samples

- Your DEP SOP tells you which analytes require QC blanks to be taken.

What are blanks for?

Monitor sampling environment, container/equipment cleaning, preservatives, analyte-free water, and storage and transport conditions.

Why use blanks?

- Show that samples have not been contaminated by the sampling process
- Ensure that samples are representative of the sampling source and not biased by a contamination error

Field Blanks

Analyte-free water collected directly into a sample bottle at the sampling site.

Equipment Blanks

Analyte-free water collected by rinsing the sampling equipment at the sampling site.

Collect *before* using pre-cleaned equipment

Trip Blanks (VOCs Only)

VOC vials filled with analyte-free water accompany the real VOC samples through the entire sampling trip.

- **Remain unopened** until analysis
- Min. 1 vial per VOC cooler, and trip.

Blank Collection Frequency

- Equipment & Field Blanks
  - **Minimum of 1 blank <u>annually</u>** for each *required* analyte/matrix combination
  - **5%** of total number of samples collected for each combination *over the life of the project* as applicable
- Trip Blanks
  - Trip blanks each trip for VOCs only
  - Trip blank(s) in each transport container

QC Blanks

Handle blanks <u>exactly like</u> the associated environmental samples!

*Which Analytes Do **Not** Require Blanks?*

- Microbiological (All Types)
- Toxicity (All Bioassays)
- Field Parameters (pH, Cond, DO, TRC)
- Radon
- Algal Growth Potential
- Biological Community
- Physical and Aggregate Properties
- Biochemical Oxygen Demand

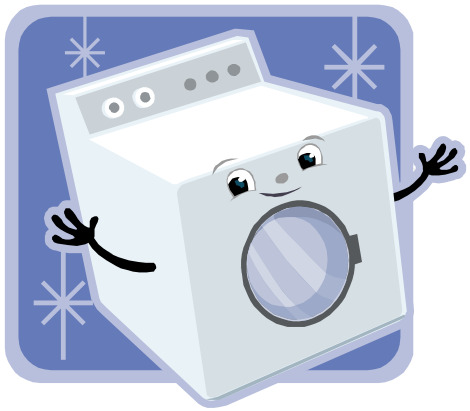
Questions so far?





"Performance-Based" Cleaning

- Demonstrate effective cleaning with blanks



Cleaning to meet a set of specifications rather than following a rigid, required procedure

Field Planning and Mobilization

- Important considerations:
- Sample from least to most contaminated point.
- Work from downstream to upstream in flowing waters.
- Table FM 1000-1 Lists Data Qualifier Codes
- General Field Equipment Checklists

FS 1000 General Sampling Procedures

Important information for all types of sampling

- Useful tables:
  - Sample Preservation, Holding Times & Container Types
  - Construction Materials & Approved Sampling Equipment

FS 2000 General Aqueous Sampling

- Collection, Filtration and Preservation Procedures
- Instructions for Specific Analyte Groups

What about Wearing Gloves?

- Required For:
  - Hazardous samples
  - Trace analyses
  - Handling sample contact equipment
- Change Gloves :
  - Between sampling points or sources
  - If glove is torn or becomes contaminated
- Don’t touch sample, lip or interior of sample container or cap with gloves
- Properly dispose of used gloves

FS 2100 Surface Water Sampling

- Sampling representativeness
- Autosampler deployment
- Common manual sampling procedures
  - Direct grab sample
  - Intermediate sampling devices
  - Depth sampling

Sampling Strategies for Surface Water and Wastewater Locations

- Collect
  - Least to most contaminated
    - Downstream to upstream
    - Bow of the boat
  - Upwind and away from fuel sources
  - Upstream and away from body
  - Don’t suspend bottom material into water column
  - Sample water before collecting sediments
- Consider:
  - Location relative to artificial structures
  - Permit-specific sampling points
  - Flow characteristics of sample source
  - Heterogeneity or homogeneity of sample source

Your sample should be **REPRESENTATIVE** of the water body you are sampling

Be sure there is nothing happening in the sampling process to **CONTAMINATE** the samples

- Cross-contamination
- Equipment cleaning

Grab Samples

A snapshot in time

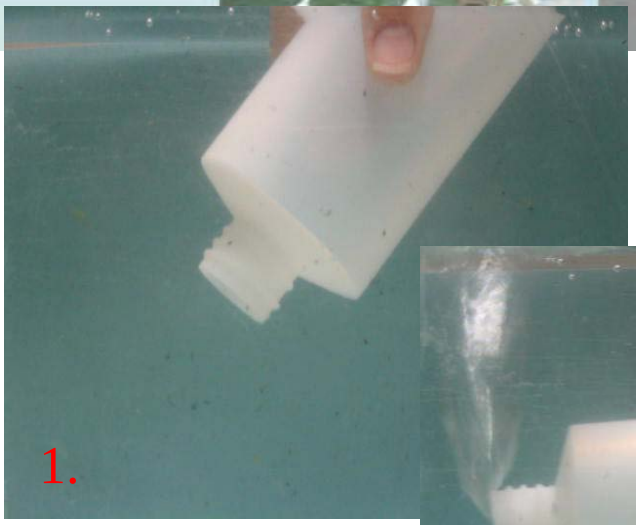
Discrete sample collected over a period of time not exceeding 15 minutes

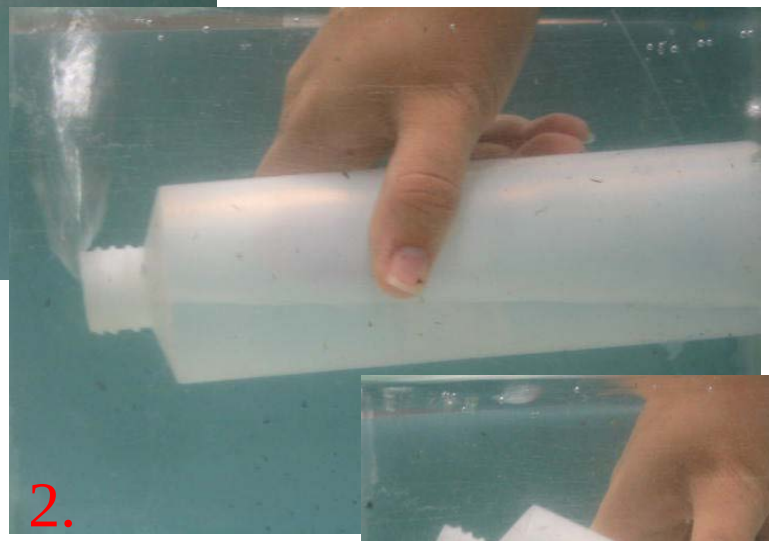
- Grab samples can be collected for most analytes

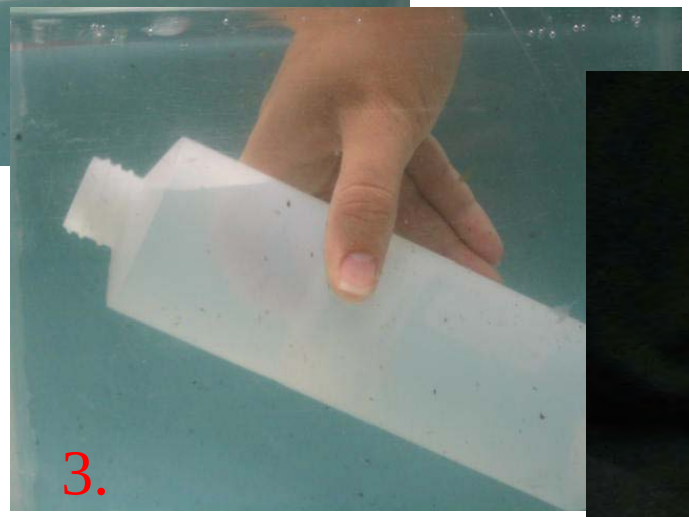




Direct Grab Technique







Leave Head space

- Avoid skimming
- Collect Within 1st foot
- May use pole extension

Grabs Using Sample Container

Direct grab is preferred….

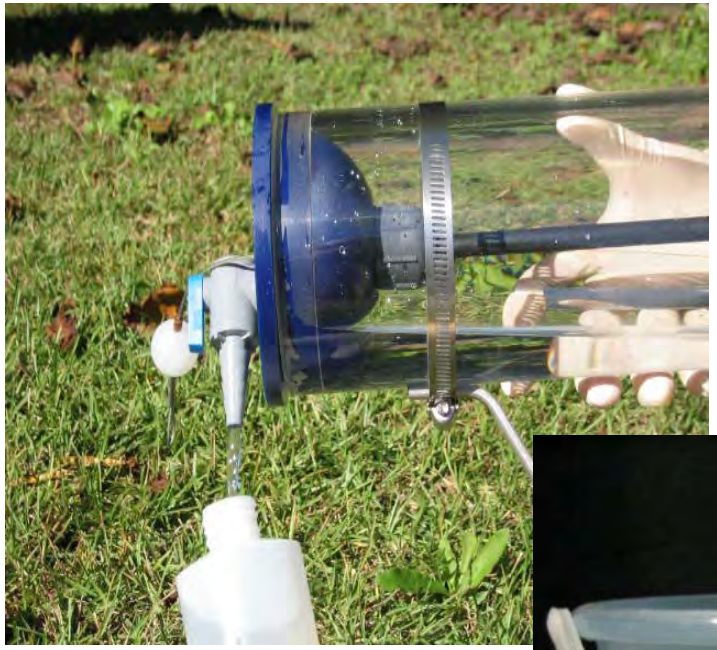
But some samples may not conform:

- Using pre-preserved containers
- Depth sampling

FS 2110 & FS 2430

Intermediate Devices

Equipment selection depends on project objectives and analyte groups….

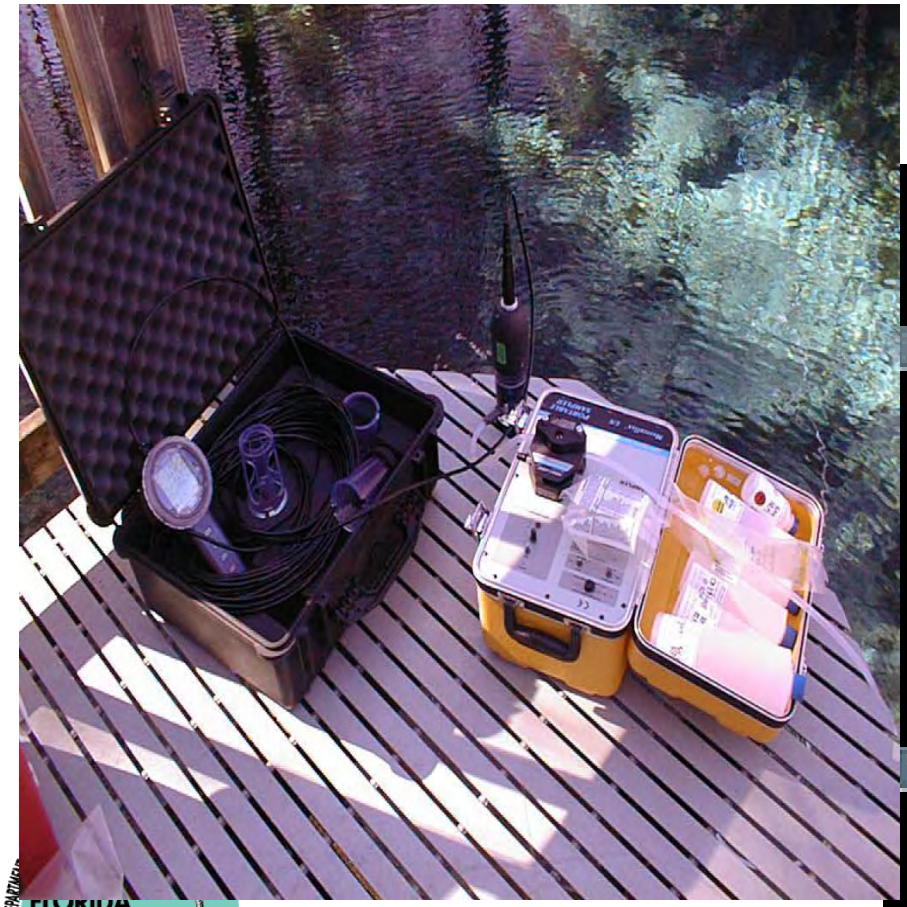


Depth Sampler

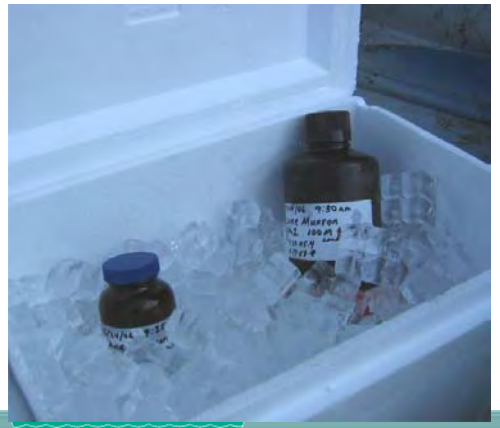
Other Intermediate Devices

Other types of sampling equipment

Pump and tubing



Composite



What about Preservation?

- Dechlorinate and/or filter (if applicable) **before** preserving
- Preserve per tables FS 1000-4 through FS 1000-8
- Preserve immediately (**within 15 minutes of collection**)
- Use ice to keep samples @ 6°C
- Check pH of pH-preserved samples (see check frequencies in FS 2000) with **narrow range pH paper** (including pre-preserved containers)
- Don't dip pH paper into the sample
- pH checks not required for VOCs
- Carry and add extra preservative if required by pH check
- Avoid excess preservative (can dilute sample or cause analytical problems)
- Use refrigeration or ice for automatic samplers

Instructions for specific analyte groups:

- **Collecting VOC Samples**
- **Sampling for Hydrocarbons (Oil &Grease, TRPH, FL-PRO)**
- **Sampling for Bacteria**
- **Sampling for Cyanide**

Collecting VOC Samples

- Teflon-coated silicone cap liner (septum)
- Prevent contamination from fuel sources
- Do not open VOC vial until ready to fill
- No aeration or agitation of sample
- Reduce flow from pumps or faucets to ≤100 mL/min
- Dechlorinate per SOP instructions and restrictions
- Do not overfill pre-preserved vials
- Do not pour sample into vial cap
- No headspace in VOC vial after collection
- Do not re-open vials to refill or to remove bubbles (≤ 5mm total bubble diameter OK)

Sampling for Hydrocarbons (Oil &Grease, TRPH, FL-PRO)

- Do not skim surface of water (unless required by sampling plan)
- Do not pre-rinse bottles with sample
- Do not use automatic samplers
- Preserve with sulfuric or hydrochloric acid and chill

Sampling for Bacteria

- Collect last (short holding time)
- Sterilized containers required
- Use dechlorinating agent (if applicable)
- Thoroughly rinse any intermediate devices
- Keep fingers away from container opening
- Don’t underfill or overfill whirlpaks
- Close whirlpaks securely
- Cool immediately with wet ice

Composite Sample

A sample collected over time, taken either by continuous sampling or by mixing discrete samples. Composite samples reflect the average characteristics during the compositing period

Indicated Uses:

- Continuous flow
- Limited analytical capacity
- Average analyte concentration over time
- Calculating mass/unit time loadings
- Correlating concentration data with flow
- Reducing sampling errors and hazard exposure using autosamplers
- Unattended sampling with autosamplers

Most Common Composite Types

- Time
  - Discreet aliquots collected in 1 container at constant time intervals
    - Use if flow rate varies less than ±10% of the average flow rate
  - Manual or automatic collection
- Flow Proportional
  - Collect with:
    - Automatic sampler & flow measuring device
    - Semi-automatically w/ flow chart & automatic sampler
    - Manually
  - Methods:
    - Collect constant volume @ time intervals proportional to stream flow
    - Collect volume proportional to flow @ constant time interval

General Sampling Questions?

FS 2400 Wastewater Sampling

- Composite vs. grab samples
- Autosampler deployment
- Common manual sampling procedures
  - Similar to surface water techniques
- Sampling from spigots
- Biosolids sampling
- Cryptosporidium & Giardia

FS 2450 Cryptosporidium and Giardia Wastewater Sampling

- Use EPA method 1623
- Follow bacteriological sampling restrictions in FS 2005

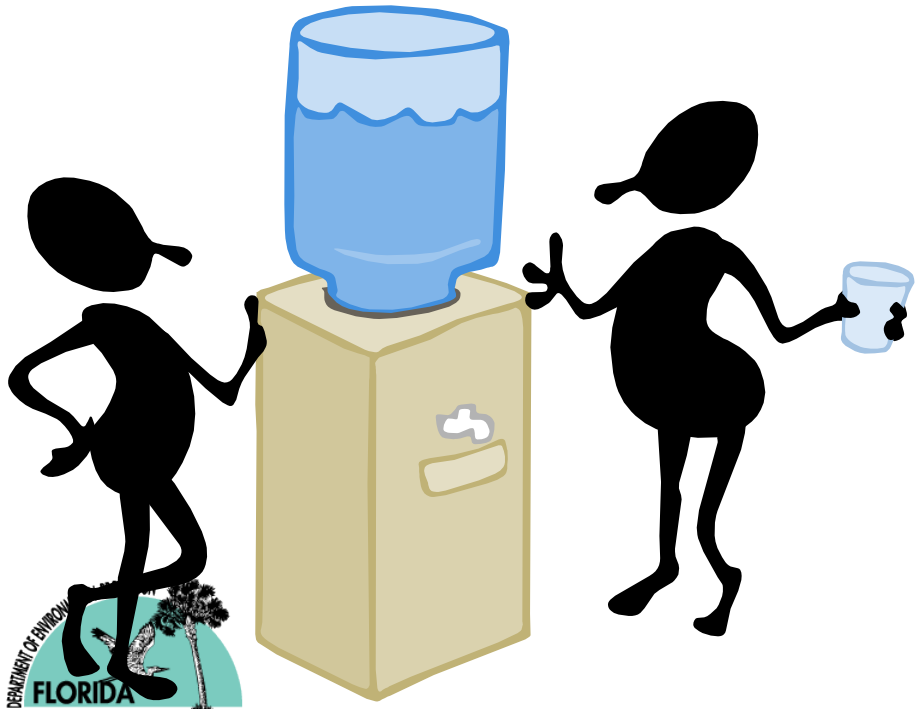
FS 2440: Biosolids

Important considerations for:

- sampling techniques and containers
- safety precautions
- transporting infectious waste

FS 2300 Drinking Water

Important considerations for:



- Drinking Water Wells
- Lead and Copper Rule
- Supply Systems
- Microbiologicals

Taking Samples

Sampling VOCs

Reduce flow to ≤100 mL/min

Lead and Copper Rule

- Collect from kitchen or bathroom
- Use cold water tap
- Do not use system for six hours before sampling
- Collect first flush into sample container
- Acid-preservation may be delayed up to 14 days

Wastewater or Drinking Water Questions?

FS 2200 Groundwater Sampling

- Equipment Selection
- Measuring Water Level in Monitoring Wells
- Calculating Required Purge Volume
- Placement of Purging Devices in the Well
- Stabilization Parameter Measurement
- Purging Completion Criteria
- Purging & Sampling Techniques for Monitoring Wells
- Purging & Sampling Wells with Installed Plumbing
- Purging & Sampling Remediation Installations

Typical Private Supply Wells with Pressure Tanks

Large Public Use and

Municipal Supply Wells

Monitor Wells

Purging & Sampling Groundwater

Specifications to ensure:

Representative sample

- Collect fresh formation (aquifer) water

No Contamination

- Proper placement of purging devices

Appropriate equipment

- Bailers are not recommended

Proper purging completion

- Stable field measurements per SOP

General Purging Procedures

- Avoid dropping anything to the bottom of well
- Ensure proper pump or tubing placement in well and record placement depth
- Measure water level frequently during purging and stabilize drawdown with pump rate
- Purge required minimum volumes
- Measure parameters at proper frequency
- Satisfy purge completion criteria

Purging Completion Criteria

Use a flow-through container to measure stabilization parameters

- Three consecutive Measurements
  - Temperature: ± 0.2° C
  - pH: ± 0.2 Standard Units
  - Specific Conductance: ± 5.0% difference
  - Dissolved Oxygen: ≤ 20% Saturation
  - Turbidity: ≤ 20 NTU

- Or: Three Consecutive Measurements:
  - Temperature: ± 0.2° C
  - pH: ± 0.2 Standard Units
  - Specific Conductance: ± 5.0% of reading
  - Dissolved Oxygen: ± 0.2 mg/L or ±10%, whichever is greater
  - Turbidity: ± 5 NTU or ±10%, whichever is greater

Purging Microwells and Screen Points

Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: Joiner C&D Facility	SITE LOCATION: Milton, Florida	
WELL NO:	SAMPLE ID:	DATE: 10/ /2009

PURGING DATA

WELL DIAMETER (inches):	TUBING DIAMETER (inches): 0.5	WELL SCREEN INTERVAL DEPTH: feet to feet	STATIC DEPTH TO WATER (feet):	PURGE PUMP TYPE OR BAILER: Submersible

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (feet – feet) X gallons/foot = gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= gallons + (gallons/foot X feet) + gallons = gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet):	FINAL PUMP OR TUBING DEPTH IN WELL (feet):	PURGING INITIATED AT:	PURGING ENDED AT:	TOTAL VOLUME PURGED (gallons):

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or µS/cm	DISSOLVED OXYGEN (circle units) mg/L or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP** = Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: SIS Team 2	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT:	SAMPLING ENDED AT:
PUMP OR TUBING DEPTH IN WELL (feet):	TUBING MATERIAL CODE: HDPE	FIELD-FILTERED: Y N Filtration Equipment Type:	FILTER SIZE: ____ µm
FIELD DECONTAMINATION: PUMP Y N	TUBING Y N (replaced)	DUPLICATE: Y N	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
	1	AG	1L	Na2SO4, Ice			1,4-Dioxane		
	2	AG	1L	Ice			BNAs		
	1	PE	1L	Ice			Cl, SO4, TDS		
	1	PE	1L	HNO3, Ice			Hg, ICPMS, ICP		
	1	PE	125ml	H2SO4, Ice			NH3, NO2NO3		
	2	AG	1L	Ice			Pest NP		
	2	AG	1L	Ice			PSCL-PCB		
	1	PE	125ml	ZnAc-NaOH			Sulfide		
	4	CG	40ml	HCl, Ice			VOCs		

REMARKS:

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)
pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: February 12, 2009

WELL DIAMETER (inches): 2	TUBING DIAMETER (inches): 0.5	WELL SCREEN INTERVAL DEPTH: 65 feet to 75 feet	STATIC DEPTH TO WATER (feet): 6.46	PURGE PUMP TYPE OR BAILER: Submersible

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH − STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)

= (75 feet − 6.46 feet) X 0.16 gallons/foot = 11.2 gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)

= gallons + (gallons/foot X feet) + gallons = gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 8	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 28	PURGING INITIATED AT: 0834	PURGING ENDED AT: 0924	TOTAL VOLUME PURGED (gallons): 20

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or µS/cm	DISSOLVED OXYGEN (circle units) mg/L or % saturation	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe) ORP
0834	0	0	0.4	25.92	7.41	24.89	561	9.9 0.82	0.86	Clear	−151
0852	7.2	7.2	0.4	25.62	7.25	24.22	563	2.2 0.18	0.80	Clear	−171
0856	1.6	8.8	0.4	25.25	7.33	24.14	549	2.0 0.17	0.74	Clear	−180
0903	2.8	11.6	0.4	25.07	7.36	24.16	543	1.9 0.16	0.71	Clear	−183
0910	2.8	14.4	0.4	24.95	7.38	24.18	543	1.9 0.15	0.70	Clear	−188
0917	2.8	17.2	0.4	24.98	7.39	24.20	544	2.0 0.17	0.71	Clear	−186
0924	2.8	20.0	0.4	25.01	7.37	24.22	545	1.9 0.16	0.71	Clear	−184

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING IN SIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0005; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

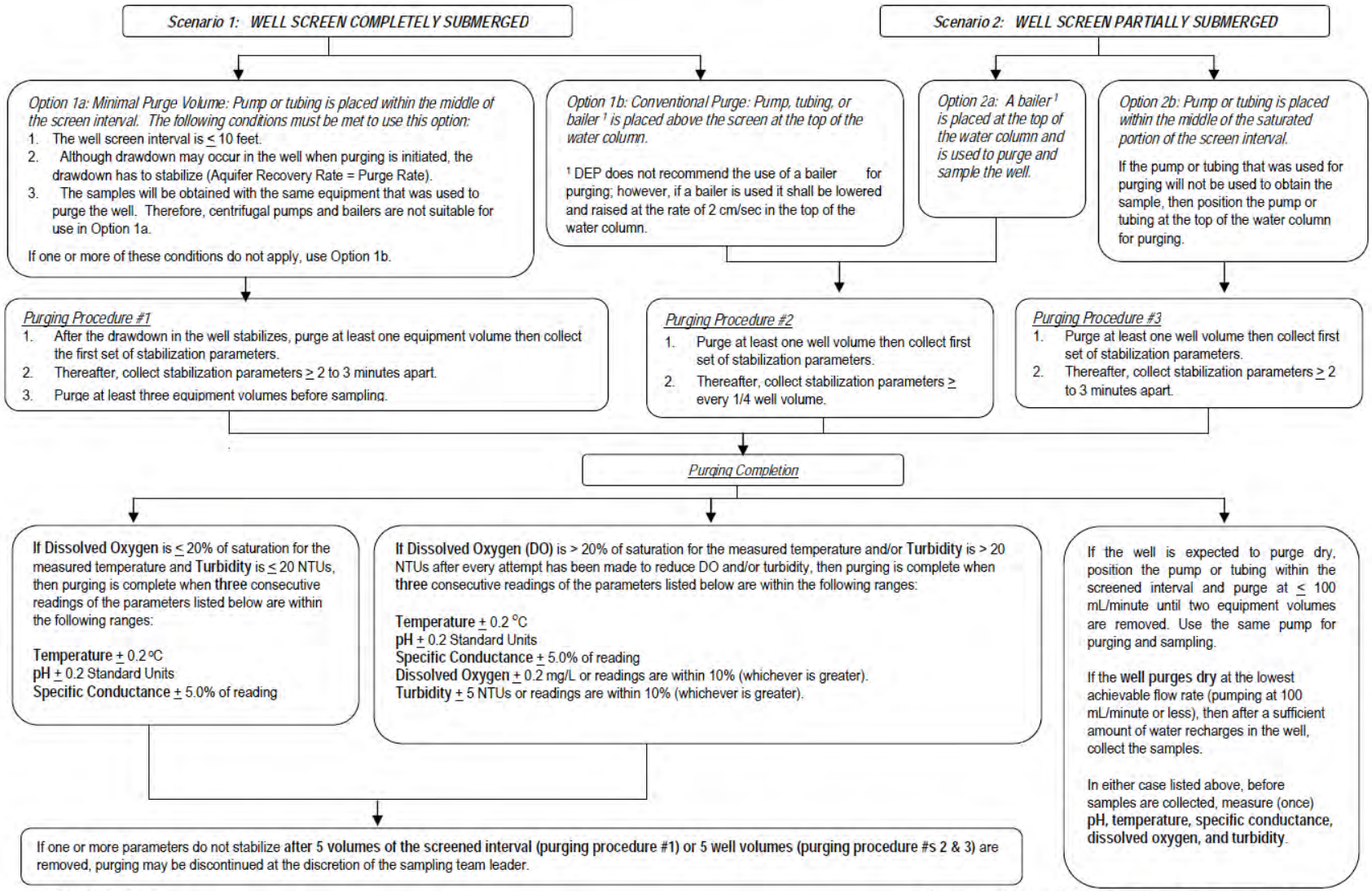
SAMPLED BY (PRINT) / AFFILIATION: SIS Team 2	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT: 0925	SAMPLING ENDED AT: 0945
PUMP OR TUBING DEPTH IN WELL (feet): 28	TUBING MATERIAL CODE: HDPE	FIELD-FILTERED: Y N Filtration Equipment Type:	FILTER SIZE: ____ µm
FIELD DECONTAMINATION: PUMP Y N	TUBING Y N (replaced)	DUPLICATE: Y N	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			
	1	AG	1L	Na2SO4, Ice	1.2 gr	3	1,4-Dioxane		
	2	AG	1L	Ice			BNAs		
	1	PE	1L	Ice			Cl, SO4, TDS		
	1	PE	1L	HNO3, Ice	1	2	Hg, ICPMS, ICP		
	1	PE	125ml	H2SO4, Ice	1	2	NH3, NO2NO3		
	2	AG	1L	Ice			Pest NP		
	2	AG	1L	Ice			PSCL-PCB		

Groundwater Scenarios

Important considerations for:

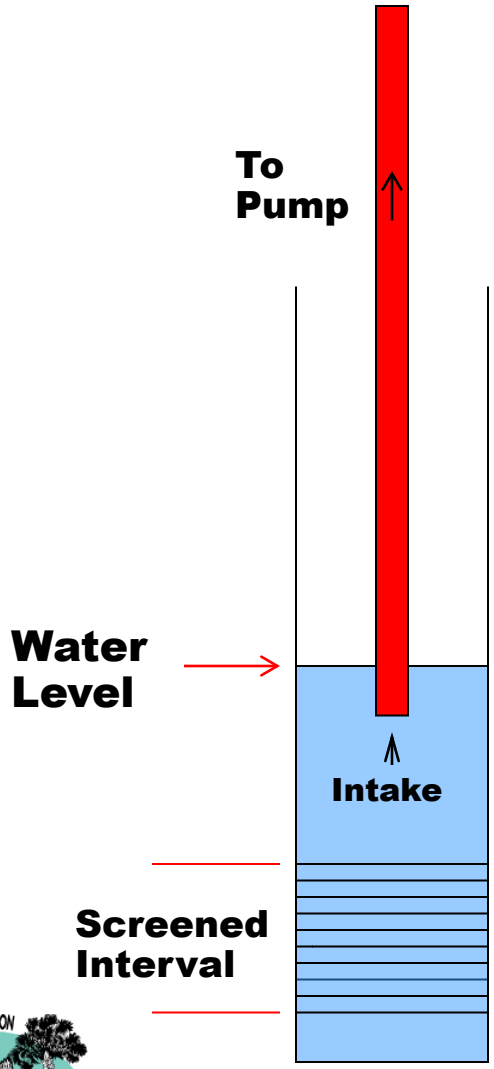
- Low-Recharge Wells
- Can’t achieve purging completion criteria
- Time between purging and sampling
- Wells with installed plumbing
- Use decision tree in FS2200



Revision Date: March 31, 2008 (Effective 12/3/08)

Ground Water Sampling Flow Chart

Conventional Purge



Intake placed at the top of water column

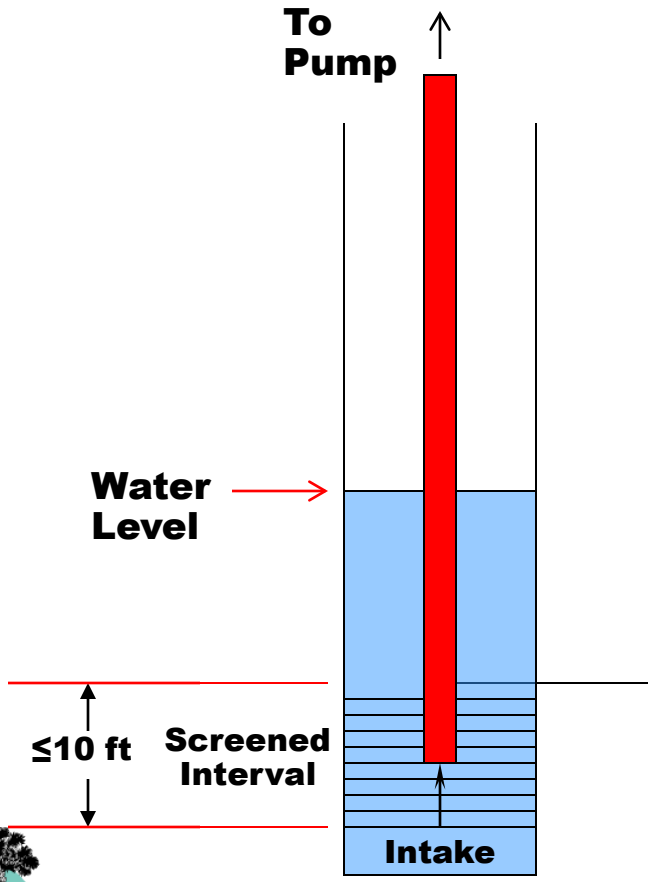
Calculate well volume

Purge one well volume

Measure stabilization parameters no sooner than each ¼ well volume interval

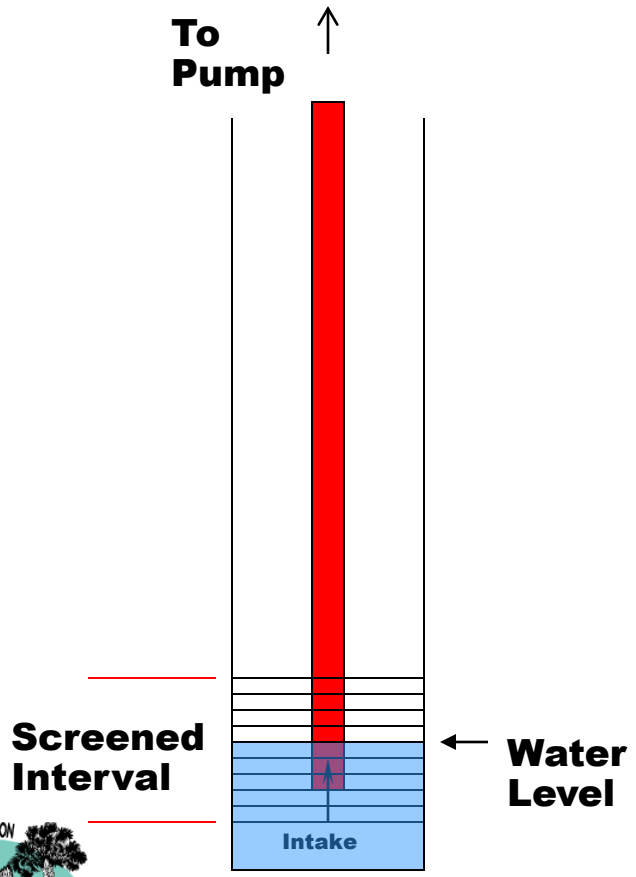
Purge at least 1½ well volumes

Minimized Purge Volumes



- Well screen length ≤10 feet
- Configuration used for both purging and sampling
- Intake or pump placed at mid-screen
- Calculate equipment volume
- Purge one equipment volume
- Measure stabilization parameters
- Collect additional measurements no sooner than every 2 minutes
- Purge a minimum of 3 equipment volumes

Partially Submerged Screen



- Intake placed at ½ distance between top of water column and bottom of screen
- Calculate well volume
- Purge one well volume
- Measure stabilization parameters
- Collect additional measurements no sooner than every 2 minutes

Maximum (Default) Purge Volumes When Purging Completion Criteria Can't Be Achieved

- 5 well volumes only if
  - Stabilization measurements fail
  - Proper techniques verified

- One fully dry purge (only for low recharge at < 100 mL/min pump rate)





Purging and Sampling Low-Recharge Wells

- Minimize equipment volume
- Use thick-walled tubing
- Use same equipment for purging and sampling
- Place intake at mid-screen depth
- Purge < 100 mL/min
- Purge 2 equipment volumes
- Measure parameters just before sampling
- Keep pump at the purge position
- Keep pumping rate the same (unless purged dry)
- Collect samples immediately after purging (or after dry recharge)

Maximum Time Between Purging & Sampling

- Dry-purge wells sampled immediately after sufficient recharge & parameter measurement
- Re-measure parameters > 1 hour after purging
- Re-purge if parameters > 10% of original
- All samples collected within 6 hours of purging

Collecting Organic Samples With Peristaltic Pumps

- The "trap method" for extractable organics – *now optional*
  - Through pump head assembly with no more than 1-foot length of new silicone tubing

<u>"Straw" Technique for VOCs</u>

- Use pump to fill downhole tubing with sample
- Remove downhole tubing from well (and pump) without losing sample
- Reverse-pump (or drain) sample into VOC vial without turbulence or aeration
  - Reduce flow rate to ≤100 mL/min for VOC collection

Purging & Sampling Wells with Installed Plumbing

- Purge and sample from tap between well head and pressure tank or at point closest to pump
- Remove hoses, aerators and filters between sample tap point and pump, if possible
- Purge volume of pressure tank, lines and spigot
- For intermittently pumping systems, flush stagnant volume of system until stabilization is achieved per FS 2212, section 3
- Reduce flow to ≤ 500 ml/min (≤ 100 mL/min for VOCs)
- Collect samples directly into sample containers

Groundwater Questions?

FS 3000 Soil Sampling

General Considerations:

- Base equipment selection on sample type and analytes of interest
- Sampling locations should allow a representative portion of the soil to be collected with minimal disturbance
- Signs of improper waste disposal or spills
  - Locations where natural vegetation is stressed or dead
  - Surficial soil staining
- Differences in soil types may affect background samples (e.g., sands vs. clays)
- Sediments generally occur under water

Composite Soil Sampling

- Design composite scheme per project objectives
- Select sampling points for each aliquot or sub-sample
- Record the amount of each aliquot
- Recommended:
  - Do not mix sample aliquots before containerizing
  - Request mixing of unmixed composite sub-samples by lab

Soil Volatile Organic Compounds (VOCs)

- Reference for Soil Sample Collection and Laboratory Preparation
  - EPA Method 5035
  - Required reference document

- FS 3000, Section 5
  - Clarifies and modifies EPA 5035

Volatile Organics: Soil Procedures

- Minimize exposure to air
  - Collect sample directly from the sample source
- Sample Collection Devices
  - Must fit tightly against the mouth of the VOC vial or be small enough to be inserted into the vial
  - Disposable plastic syringes
    - Cut syringe end off for core sampling
    - Use only once
  - Commercially supplied specialty sampling corers
  - EnCore or equivalent self-sealing corers

Volatile Organics: Soil Procedures

- Pre-weighed sample vials with pre-measured volume of liquid and stir bar
  - Keep vial exterior clean
  - Avoid evaporation or spillage of vial liquid
  - Discard leaking or spilled vials
  - Use the supplied vial label
  - DO NOT apply any additional labels to the vial
  - Do not interchange vial caps or septa
  - Extrude the sample directly into the sample vial
  - Cap and seal vial immediately after collection


EnCore

Soil VOCs: Preservation

- Table FS 1000-7
- Sodium bisulfate preservative (EPA 5035) NOT recommended
- Chill to 4° C
- Analyze within 48 hours or freeze
  - Freeze vial samples as collected
  - Extrude Encore samples into pre-weighed vials with measured water volume and stir bar prior to freezing
- Freezing of the sample extends the holding time to 14 days

FS 3100: Surface Soil Sampling

Ground surface to depth of 12 inches
(prescribed depth per project objectives)

- Remove leaves, grass and surface debris from the area to be sampled
- Collect VOC samples per FS 3000, section 5
- Use appropriate equipment for non-VOC soil samples
- Transfer the sample to the sample container
- Clean the outside of the sample container
- Chill to 4° C per Tables FS 1000-6 & 1000-7

FS 3200: Subsurface Soil Sampling

Depths >12 inches

- Select equipment based on application for minimal sample disturbance
- Sampling Equipment Recommendations
  - Core Barrel
  - Split Spoon Sampler
  - Shovels and Diggers
  - Backhoe
  - Bucket Augers and Hollow Corers
  - Direct Push Technologies
  - Shelby Tube Sampler

Soil Sampling Questions?

FS 4000 Sediment Sampling

- Sediments generally occur under water
- For some projects, recently exposed sediment may be sampled
- Collect surface water samples before beginning sediment sampling.

Sediment Collection Basics

- Soil sampling equipment is generally not applicable.
- Sediment sampled with scoop, corer, or dredge
- When selecting the appropriate sampling equipment, consider sampling location, depth of water and sediment, sediment grain size, water velocity, and analytes of interest.
- Direct collection with appropriate equipment may be appropriate in shallow water or for exposed sediment.

Define Objectives

- Sampling locations depend upon the project objectives.
  - Sediment as an adjunct to surface water samples;
  - Sediment samples for compositing to determine water or sediment quality in a system;
  - Sediment samples above and below an outfall to document degradation due to a point source discharge; or
  - Sediment samples if stressed shore vegetation or visible surface water contamination is evident.

Other SOP Considerations

- Refer to Table FS 4000-1 and FS 1000, Table FS 1000-3, for selection of sampling equipment and construction.
- For selection of appropriate sample containers, see FS 1000 Table FS 1000-6.
- For cleaning requirements for sample containers, equipment and utensils, see FC 1100 and FC 1300.
- For documentation requirements, see FD 1000.
- For preservation and holding time requirements, see FS 1000 Table FS 1000-6.

Procedures: Scoops

- Most useful around the margin or shore of the water body or by wading in shallow waters.
- Stand facing the direction of flow and approach the location from the downstream direction.
- Take precautions not to disturb the bottom prior to scooping.
- Scoop the sample in the upstream direction of flow.
- Transfer sample to the appropriate sample container(s), using a clean non-reactive utensil.
- Label, preserve to 6 C with wet ice.

Corers

- Cores preserve historical sediment layering.
- Water displacement is minimal (minimizes the shock wave produced by other equipment such as dredges).
- Good for sampling fine sediments in static waters, especially those containing trace organics and metals.
- Corer diameter, grain size and sample consistency will determine if the sample will remain in the corer upon withdrawal.
- Sample washout can be a problem: must prevent it.

Corer (and liner) Materials

- Stainless steel, glass, PE, PP or Teflon
  - extractable organics
  - volatile organics
  - petroleum hydrocarbons and oil & grease
- PVC, acrylic, stainless steel, glass,
- PP, PE, Teflon OK for
  - inorganics
  - Metals
- Corers can also be fitted with liners:
  - if a complete core is desired that has not been in contact with the atmosphere.
  - if the coring device is not constructed of the proper material (e.g., PVC) and one of the analytes requires a sampler of inert construction.

Procedures: Corers

- Fit leading edge of the corer with a nosepiece or core catcher that keeps the sample from slipping back out of the corer.

OR

- Fit the top or back end with a check valve which creates negative pressure on the back of the sample as it is being pulled from the substrate (prevents surface water from washing out the top portion of the sample).
- Rotate core around its axis (do not rock the coring device back and forth).
- Upon withdrawal from the water surface, place a cap on the bottom to prevent the sample from sliding out.

Dredges

- Most common devices used in freshwater are the Ekman, Peterson, and Ponar. Heavier oceanographic dredges are used in marine and estuarine waters.

Refer to Table FS 4000-1 for additional types of dredges.

- Ponar is dredge of choice for hard or rocky substrates, in deep water bodies or streams with fast currents.
- Ekman is good in soft, mucky sediments.

Modified Van Veen grab

Ponar Grab -

Standard and Petite

Ekman Grab

Compositing Sediment

- It may be appropriate to composite sediment aliquots to get a representative sample of an area.
- Collect equal aliquots from each location and place in sample container.
- Record weight or volume of each aliquot
- Combine in sample container *without* mixing
- Request that sample be thoroughly mixed in laboratory before prep and analysis

Sediment Sampling

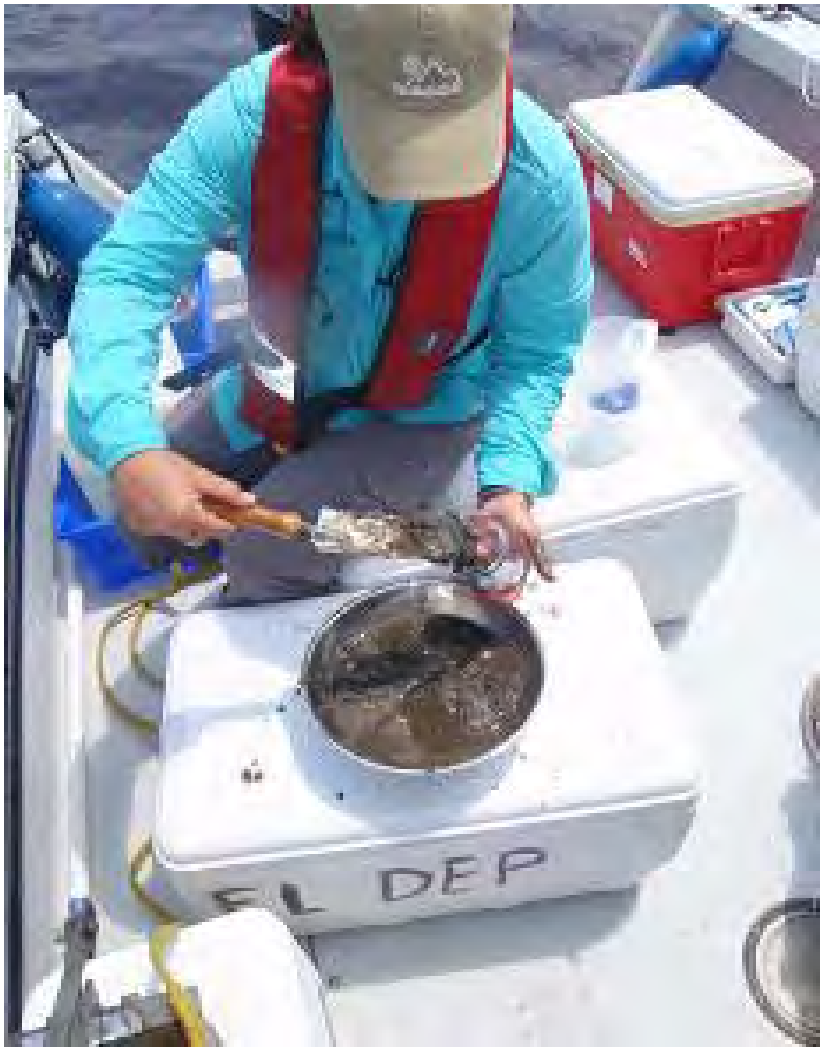
- Rinse and collect intermediate equipment with analyte-free water (Equipment blank).
- Rinse equipment three times with sampling site water prior to collecting next sample, or
- Perform more rigorous cleaning

Sediment Sampling

- Pull the dredge to the surface.
- Carefully place the dredge into a Stainless Steel pan
- Open the top of the dredge flap
- Collect the sample with a clean non-reactive utensil from the top layer

Sediment Sampling

- Transfer sample to the appropriate sample container(s), using a clean non-reactive utensil.



Sediment Questions?

FS 8200 Clean Sampling for Ultratrace Metals in Surface Water

FS 8200 Clean Sampling for Ultratrace Metals in Surface Water

- "Clean hands/dirty hands" sampling
- Ultra-trace detection levels and methods
- Protection of sample against contamination
- "Mindset" and technique

Selecting a Lab for Analysis

- EPA Method 1631 E (mercury)
- Clean room, lab area or hood required
- Contamination control is essential
- Extra analytical cost!
- Evaluate laboratory experience

Sample Collection

- Adapted from EPA 1669
- “Performance-based” concept
- Verify performance with blanks & other QC

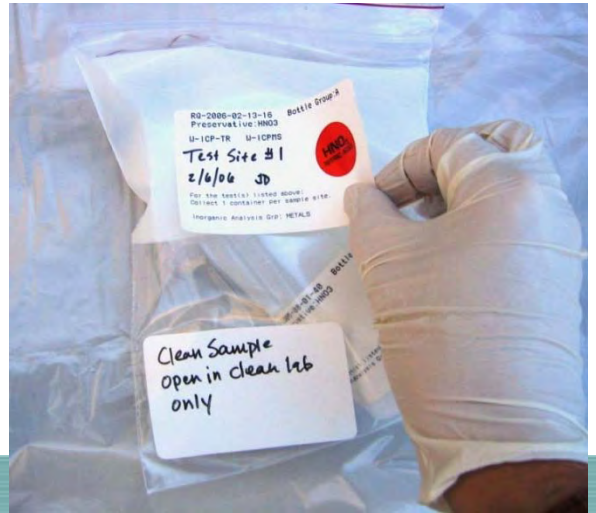
- Sampling team practice recommended

Contamination Issues

- Laboratory environment, materials, reagents, techniques and other samples
- Source of analyte-free water for field blanks and equipment blanks
- Sampling equipment and sample containers
- Sampling personnel and clothing
- Ambient sampling environment
- Sampling techniques

Avoiding Contamination

- Prepare equipment in clean room, clean bench, glove box, etc.
- Minimize time between cleaning and use
  - See FS 8222 cleaning procedures
- Use plastic containers & bags to store/transport
  - Avoid:
    - Pyrex, Kimax, methacrylate, polyvinylchloride, nylon, Vycor or rubber
    - Highly colored plastics, containers with pigmented markings, paper cap liners
  - Wrap cleaned pump tubing ends
- Non-talc gloves are required
  - Wear multiple pairs



Sampling Equipment

- Use fluoropolymers (e.g., FEP or PTFE)
- Use pre-cleaned equipment
  - Field-based cleaning not recommended
- All pre-cleaned items wrapped for field use
- Sample Containers: Use glass, fluoropolymers, conventional or linear polyethylene, polycarbonate or polypropylene
- Sampling Containers: Fill w/ 0.1% HCl if stored

On-site Precautions

- All equipment and supplies in covered storage until use
- Keep hands and equipment away from contamination sources
- Adhere to “clean hands/dirty hands” protocols
- Change gloves when needed
- Collect directly into sample container
- Collect least contaminated source first

Clean Hands/Dirty Hands

Designate one person as “clean hands” and one as “dirty hands”

“Dirty hands” only touches outside surfaces, while “Clean hands” handles the sample.

Clean Hands/Dirty Hands

Sample Preservation & Transport

- Protect bagged samples from contamination during transport and storage
- Isolate or segregate samples as needed
- Add preservative upon return to lab
- Max of 48 hours on ice prior to preservative

Ultra-Trace Questions?