Field Sampling Procedures Manual (FSPM) Updates: Chapters 5 - 13

February 29, 2024

Contaminated Site Remediation & Redevelopment (CSRR)

Moderators

Taylor Dobson

Co-Moderator
DEP/CSRR Training Committee

Kyle Kuebler

Co-Moderator
DEP/CSRR Training Committee

Continuing Education Credits (CECs)

CSRR

Site Remediation Professional Licensing (SRPL) Board

has approved **3.5 Technical CECs** for this training session

Attendance Requirements:

- Participants must be logged-in for the entire session and answer 3 out of 4 poll questions (randomly inserted in the presentation)
- Please notify us (via Chat/Questions function) of any issues with answering poll questions immediately to maintain CEC eligibility

CECs: What's the Process?

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Since the SRPL Board has approved CECs for the course:

- NJDEP compiles a list of participants eligible for CECs and provides the list to the Licensed Site Remediation Professional Association (LSRPA)
- LSRPA will email eligible participants a link to an LSRPA webpage with certificate access instructions
- Certificates are issued by the LSRPA after paying a *$25 processing fee*

Test Your Knowledge

EXAMPLE WEBINAR
QUIZ SLIDE

Test Poll

EXAMPLE WEBINAR QUIZ SLIDE

Why are you here today?

A. Earn CECs
B. Learn more about ECCC
C. Learn more about CSRR

Communication

Questions Function

- Ask any questions you have for the presenters at any time during the presentation (these will be addressed during the questions segments)
- If a question isn't addressed during a question segment of the presentation, it will be answered after the presentation
- Questions should be brief and general (no case-specific questions)

Remember!

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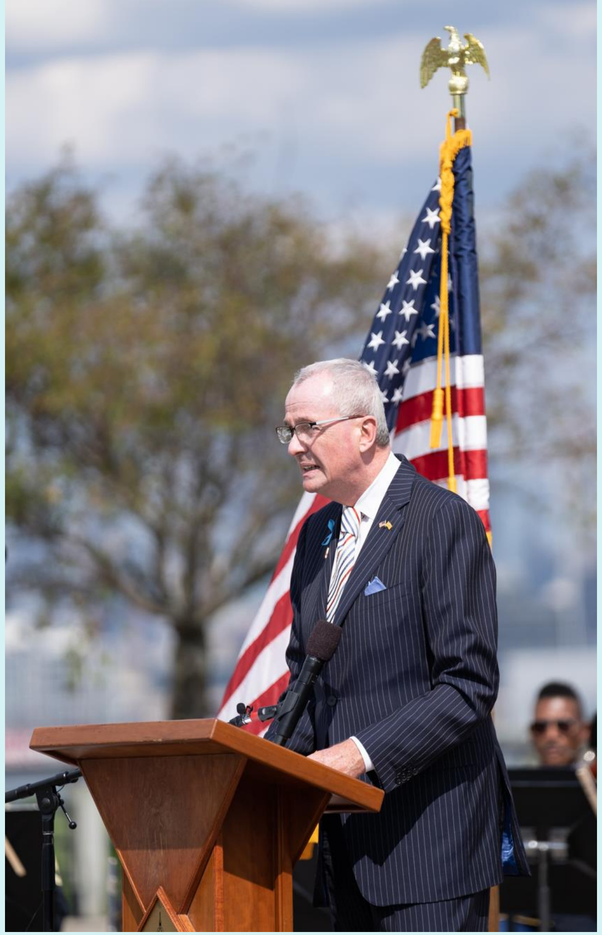
Please fill out the Course Evaluation here:

https://www.surveymonkey.com/r/HXP8LSW

Your Job in this Training

- Participate!
  - Complete polls
  - Ask questions
- Provide feedback via the course evaluation



Thank you!

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February 29, 2024

NJDEP Field Sampling Procedures Manual Training

NJSRPLB Course # 2024-012

LSRPs - 3.5 Technical CECs
NJ Professional Engineers - 3.5 CPCs
NY Professional Engineers and Geologists - 3.5 PDHs

NJ Licensed Site Remediation Professionals Association

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UPCOMING LSRPA COURSES & EVENTS

- **March 5, 2024 – Women in Environmental, Construction, Architecture, and Engineering Professions**

  Panelists: Sue Boyle, Senior On Call Consultant, GEI & Former Executive Director of NYC Brownfield Partnership, BCONE, and LSRPA
  Schenine Mitchell, USEPA, Brownfields Program Coordinator
  Mimi S. Raygorodetsky, Principal, Langan

- **March 12, 2024 – LSRPA Virtual Member Regulatory Roundtable**

  Unmanned Aerial Systems (UAS) Applications for Environmental Assessments, Due Diligence & Remediation Planning

  Instructors: James J. Heiser, President, DPK Consulting
  Golky Barrios, UAS Operations Manager, DPK Consulting
  Moderator: Kassidy Klink, PG, LSRP, Nova Group, GBC, Peak Environmental Division

- **March 19, 2024 – Remediation Funding Source and Financial Assurance Training for Environmental Practitioners**

  Instructors: Jennifer MacLeod, NJDEP, Remediation Funding Source Coordinator
  Vincent Fasanella, NJDEP, Financial Assurance Coordinator
  Christopher Venezia, LSRP, ESA Environmental Consultant

Visit LSRPA.org for details and registration

UPCOMING LSRPA COURSES & EVENTS

- **March 27, 2024 – Aspiring Professionals Series:**
  Life of a Project / Project Management Presentation

  Instructor: Andrew Wadden, LSRP, HDR
  Moderator: Ted Toskos, Jacobs

- **April 16 & 18, 2024 – LSRPA Hazardous Waste Operations and Emergency Response 8 Hour Refresher Training**

  Instructor: David Sweeney, LSRPA, Assistant Executive Director

Visit LSRPA.org for details and registration


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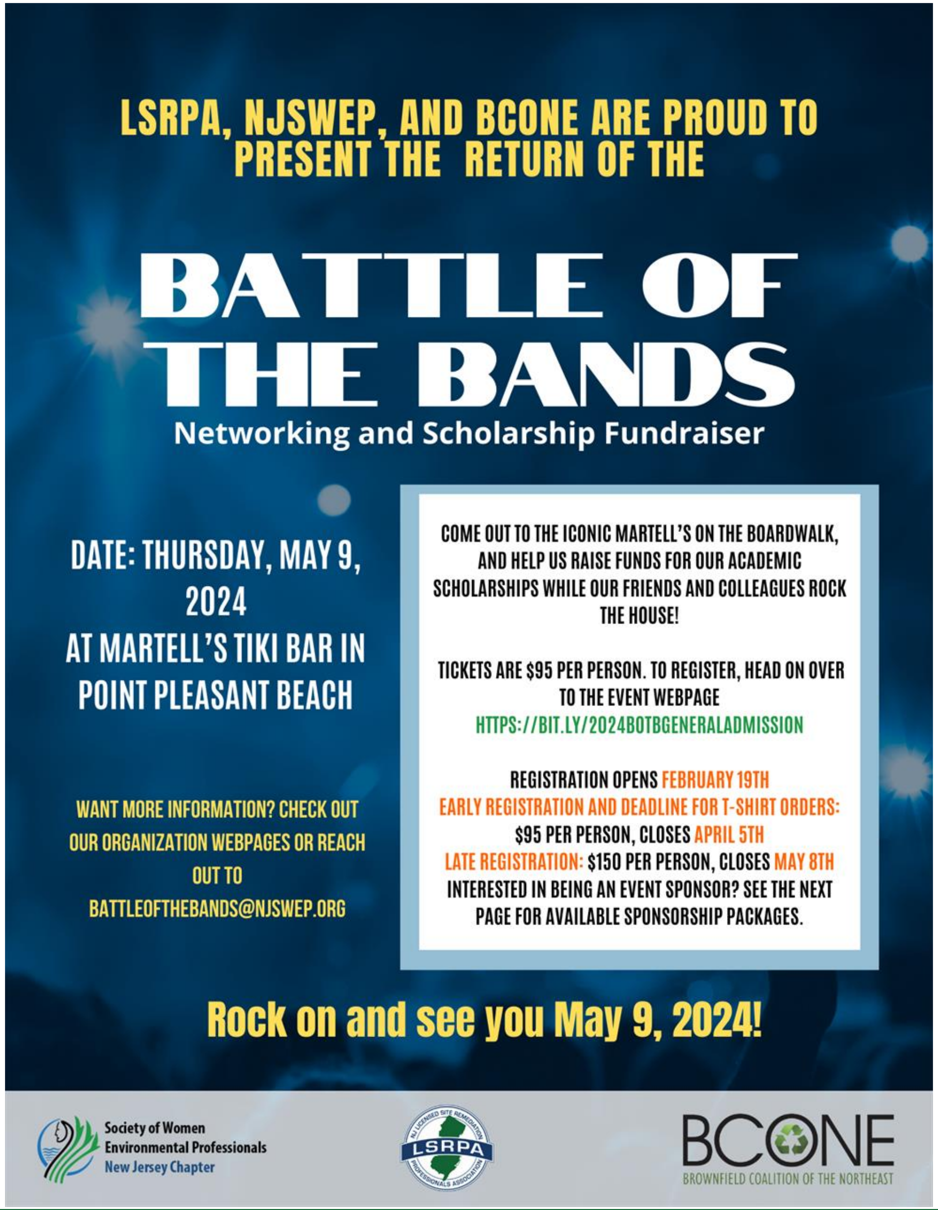
APRIL 3 & 4, 2024


LSRPA, NJSWEP, AND BCONE ARE PROUD TO PRESENT THE RETURN OF THE
BATTLE OF THE BANDS
Networking and Scholarship Fundraiser
DATE: THURSDAY, MAY 9, 2024
AT MARTELL'S TIKI BAR IN POINT PLEASANT BEACH
WANT MORE INFORMATION? CHECK OUT OUR ORGANIZATION WEBPAGES OR REACH OUT TO BATTLEOFTHEBANDS@NJSWEP.ORG
COME OUT TO THE ICONIC MARTELL'S ON THE BOARDWALK, AND HELP US RAISE FUNDS FOR OUR ACADEMIC SCHOLARSHIPS WHILE OUR FRIENDS AND COLLEAGUES ROCK THE HOUSE!
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HTTPS://BIT.LY/2024BOTBGENERALADMISSION
REGISTRATION OPENS FEBRUARY 19TH
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THANK YOU!

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Field Sampling Procedures Manual (FSPM) Updates: Chapters 5 – 13 Introduction

February 29, 2024

Crystal Pirozek, Environmental Specialist
Bureau of Site Management

Committee Members

CSRR

NJDEP

Crystal Pirozek, Chair

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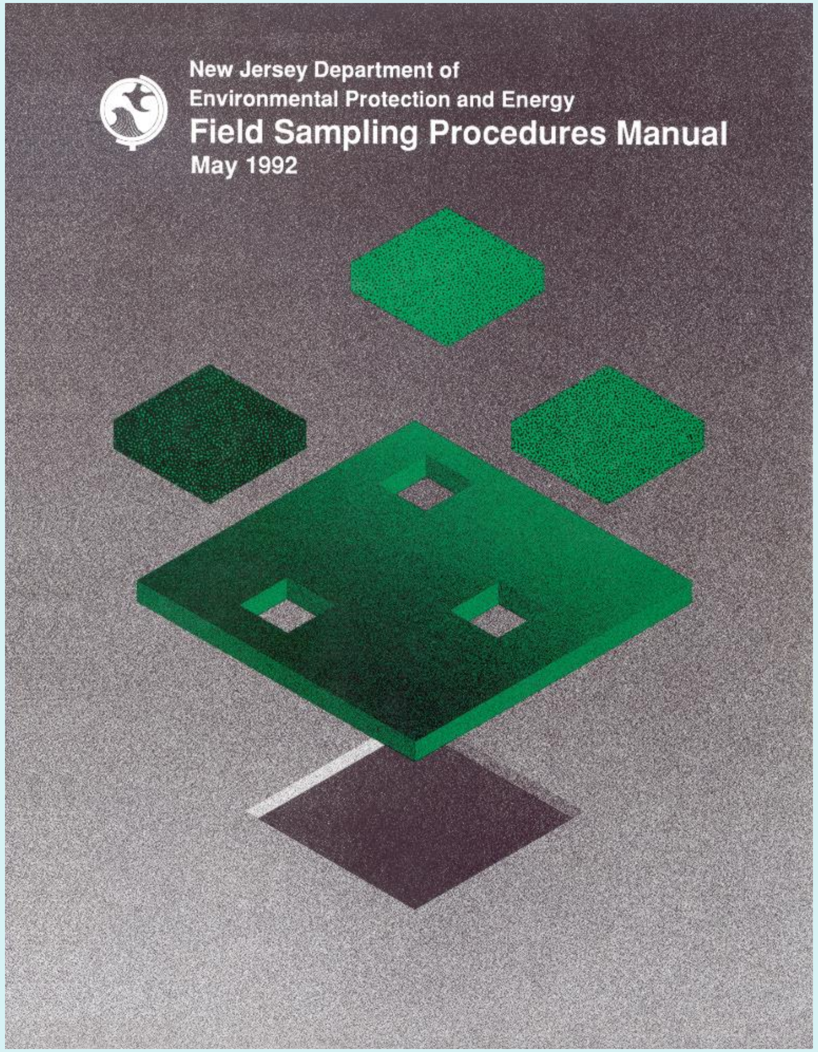
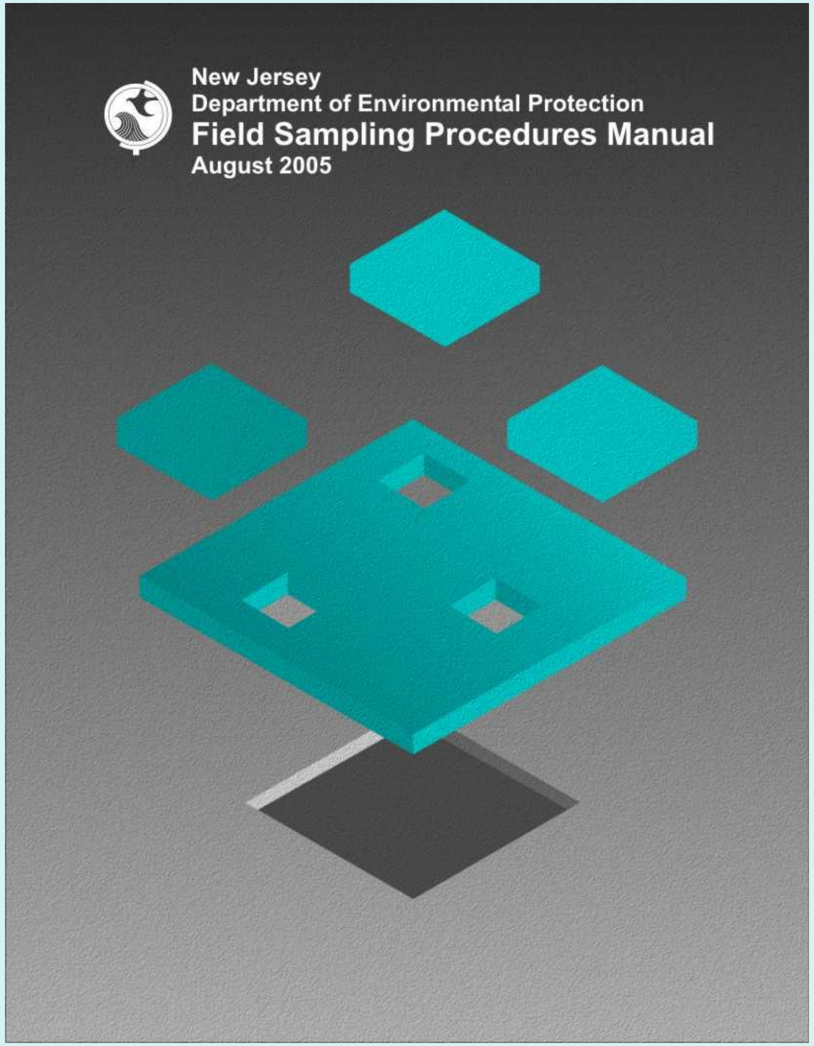
Dan Cooke, CDM Smith
Eileen Snyder, Alpha Analytical, Inc.
Heather Steffe, Arcadis

History: FSPM 1992 Version



- Original document
- Created to promote accuracy and consistency
- Discusses how environmental samples are collected and analyzed

FSPM 2005 Update



- Complete rewrite of the manual
- First electronic copy

Other FSPM Updates

- Multiple updates since 2005
  - Mostly minor text and clarification updates
  - Last update was in 2011
  - Full list of updates

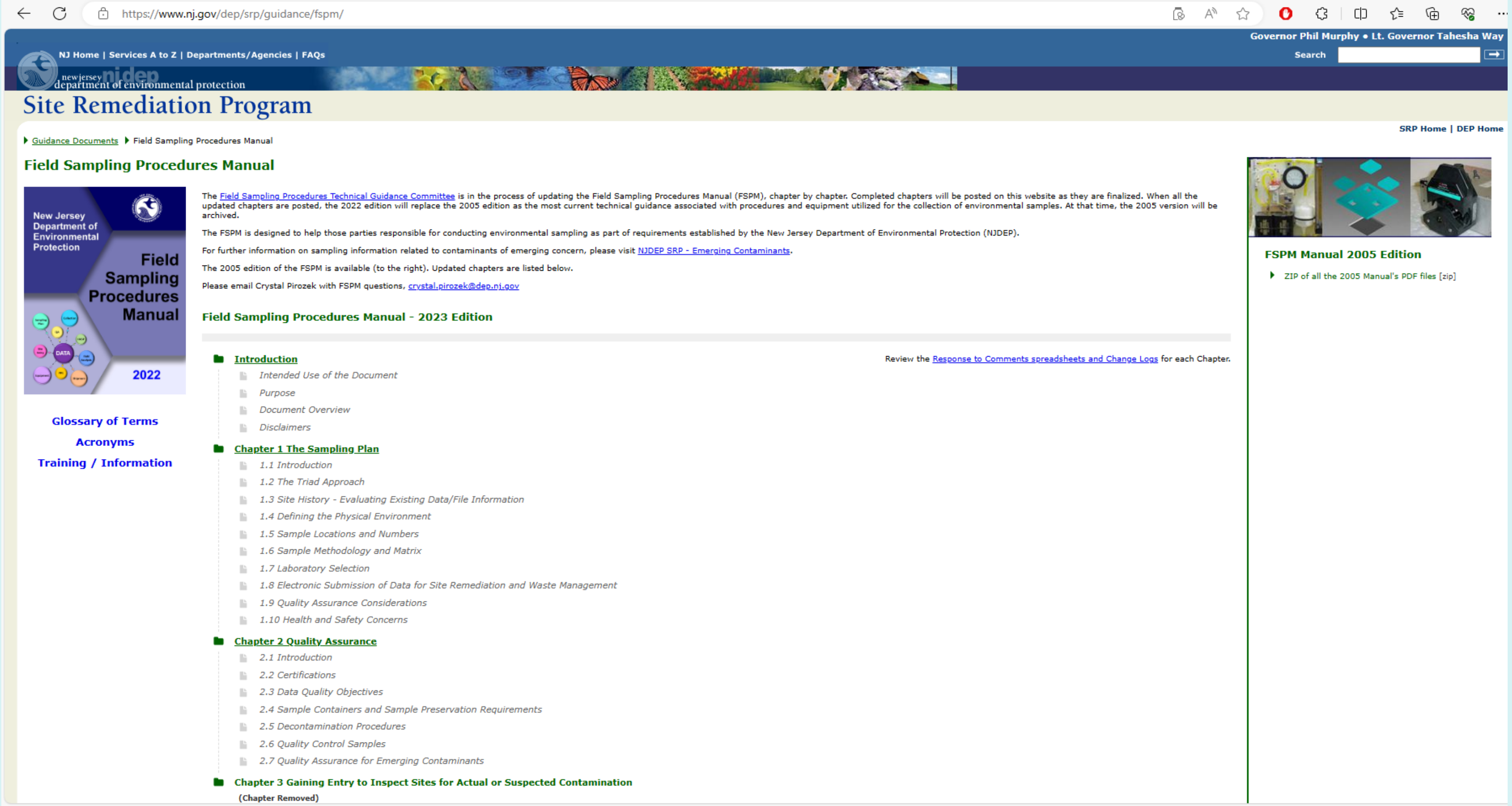
    https://www.nj.gov/dep/srp/guidance/fspm/updates.htm

FSPM Current Version

- Committee convened in the Fall of 2017
- Every chapter will be updated

FSPM Webpage

https://www.nj.gov/dep/srp/guidance/fspm/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Guidance Documents ▸ Field Sampling Procedures Manual

Field Sampling Procedures Manual

New Jersey Department of Environmental Protection

Field Sampling Procedures Manual

2022

Glossary of Terms

Acronyms

Training / Information

The Field Sampling Procedures Technical Guidance Committee is in the process of updating the Field Sampling Procedures Manual (FSPM), chapter by chapter. Completed chapters will be posted on this website as they are finalized. When all the updated chapters are posted, the 2022 edition will replace the 2005 edition as the most current technical guidance associated with procedures and equipment utilized for the collection of environmental samples. At that time, the 2005 version will be archived.

The FSPM is designed to help those parties responsible for conducting environmental sampling as part of requirements established by the New Jersey Department of Environmental Protection (NJDEP).

For further information on sampling information related to contaminants of emerging concern, please visit NJDEP SRP - Emerging Contaminants.

The 2005 edition of the FSPM is available (to the right). Updated chapters are listed below.

Please email Crystal Pirozek with FSPM questions, crystal.pirozek@dep.nj.gov

Field Sampling Procedures Manual - 2023 Edition

Review the Response to Comments spreadsheets and Change Logs for each Chapter.

- Introduction
  - Intended Use of the Document
  - Purpose
  - Document Overview
  - Disclaimers
- Chapter 1 The Sampling Plan
  - 1.1 Introduction
  - 1.2 The Triad Approach
  - 1.3 Site History - Evaluating Existing Data/File Information
  - 1.4 Defining the Physical Environment
  - 1.5 Sample Locations and Numbers
  - 1.6 Sample Methodology and Matrix
  - 1.7 Laboratory Selection
  - 1.8 Electronic Submission of Data for Site Remediation and Waste Management
  - 1.9 Quality Assurance Considerations
  - 1.10 Health and Safety Concerns
- Chapter 2 Quality Assurance
  - 2.1 Introduction
  - 2.2 Certifications
  - 2.3 Data Quality Objectives
  - 2.4 Sample Containers and Sample Preservation Requirements
  - 2.5 Decontamination Procedures
  - 2.6 Quality Control Samples
  - 2.7 Quality Assurance for Emerging Contaminants
- Chapter 3 Gaining Entry to Inspect Sites for Actual or Suspected Contamination
  (Chapter Removed)

FSPM Manual 2005 Edition

- ZIP of all the 2005 Manual's PDF files [zip]

FSPM Webpage

- Additions to the webpage
  - Glossary
  - Acronyms

Update Process

- The workgroup assigned to each chapter went through the entire chapter and made changes and updates
- The document was then given to the entire committee to review
- The document then went to the stakeholders and NJDEP for review
- All comments received were reviewed and discussed, and the finalized chapter posted to the NJDEP website

Technical Justification

CSRR allows for deviations from all technical guidance documents including the FSPM

If you choose to deviate from this guidance you should document:

- That your method is equally protective
- Any special site-specific circumstances

Disclaimer

- The use of equipment names is just for informational purposes and does not constitute an endorsement
- The sampling technologies are provided as examples and are not all inclusive

FSPM Chapters

Introduction

Chapter 1 The Sampling Plan

Chapter 2 Quality Assurance

Chapter 3 Emerging Contaminants

Chapter 4 Site Entry Activities

Chapter 5 Sampling Equipment

Chapter 6 Sample Collection

Chapter 7 Field Analysis

Chapter 8 Geophysical Techniques

Chapter 9 Soil Gas Surveys

Chapter 10 Documentation

Chapter 11 Sample Shipment

Chapter 12 Radiological Assessment

Chapter 13 Personnel Protection

Chapters 1, 2, and 4

- Chapters 1, 2, and 4 posted for use and trained in March 2022
- Copy of that training can be found under the training tab in the FSPM website

Chapter 3: Contaminants of Emerging Concern

- Chapter 3: Contaminants of Emerging Concern is back from external review and should be posted next month for use

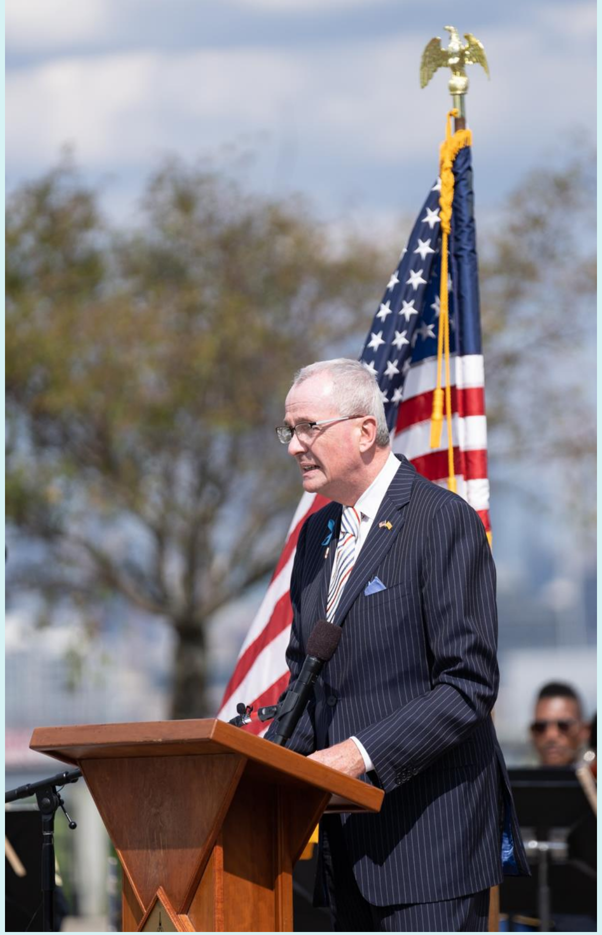
Chapters 5 and 6 Workgroup

Crystal Pirozek, NJDEP
Paul Bauer, NJDEP
Greg Giles, NJDEP
Scott Mathew, NJDEP
Catherine Jedrzejczyk, NJDEP
Lee Lippincott, NJDEP
John Dotterweich, NJDEP
Victor Poretti, NJDEP

John Bracken, Verdantas LLC
Kari Brookhouse, BSI
Daniel Cooke, CDM Smith
Heather Steffe, Arcadis

Posted for use November 2022



Thank you!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FSPM Chapter 5: Sampling Equipment

February 29, 2024

Catherine Jedrzejczyk, Research Scientist, Bureau of Water Resources and Geoscience
Greg Giles, Geologist, Bureau of Ground Water Pollution Abatement

Chapter 5: Sampling Equipment

5.1 Introduction

5.2 Decontamination Procedures

5.2.1 Eight-Step Decontamination Procedure for Aqueous and Non-Aqueous Sampling Equipment– Laboratory Only

5.2.2 Three-Step Equipment Decontamination Procedure Non-Aqueous Matrix Only– Laboratory and Field

5.3 Aqueous and Other Liquid Sampling Equipment

5.3.1 Ground Water Sampling Equipment

5.3.2 Wastewater Sampling Equipment

5.3.3 Surface Water and Liquid Sampling Equipment

5.3.4 Containerized Liquid Sampling Equipment

5.4 Non-aqueous Sampling Equipment

5.4.1 Soil Sampling Equipment

5.4.2 Sediment and Sludge Sampling Equipment

5.4.3 Containerized Solids and Waste Pile Sampling Equipment

5.1 Construction material of sampling equipment and supplies

- The selection of appropriate sampling equipment should consider
  - Sample type
  - Matrix
  - Physical location of the sample point
  - Other site-specific conditions
  - Compatibility of the material being sampled with the composition of the sampling equipment
- Table 5.1 Materials of Construction for Ground Water Sampling Equipment

5.1 Negative Bias

- It is the responsibility of the sample collector to make sure that samples are collected with as little negative bias (bias that underestimates analyte concentrations) as possible
- Actions that should be taken to minimize negative bias include, but are not limited to:
  - following manufacturer's instructions
  - using sampling equipment appropriate for the contaminant(s) being tested
  - implementing sampling procedures appropriate for the contaminant(s) being tested
- A sampling material's adsorption/desorption capacity becomes more important the lower the contaminant concentration, and the lower the pertinent Ground Water Quality Standards (GWQS) concentration. At low levels, the effect of adsorption or desorption could change the interpretation of the data (i.e., exceedance vs no exceedance)
  - This issue should be discussed in documents where HDPE or LDPE is used, and the sampling data are presented

5.1 Documentation

- If samples are collected using a procedure or device that is not discussed in the manual, documentation on how the samples were collected should accompany the sampling results in reports submitted to the NJDEP
- Include details about the sampling device and sample collection process such as
  - make and model of the sampling device
  - composition of the sampling device
  - volume of sampling device
  - manufacturer’s instructions
  - published studies about the sampling device
  - depth in water column of sample collection
  - total volume purged prior to sample collection
  - residency time of sampling device in the water column
  - purge rate
  - maximum well draw-down produced prior to sampling
- Inappropriate application of a sampling device, or failure to provide adequate supporting documentation, can result in rejection or downgrade (i.e., lowering of data to screening quality) of the data by the NJDEP

Chapter 5.2 Decontamination

- Sections were moved from Chapter 2 and edited for clarity
  - Decontamination procedures
    - The Eight-Step Decontamination Procedure (aqueous and non-aqueous sampling equipment)
    - The Three-Step Decontamination Procedure (non-aqueous sampling equipment only)
    - Decontamination Procedures Using Heat (for use primarily on aqueous sampling equipment)
    - The USGS Decontamination Procedure for Low Level Contamination
    - General Decontamination Considerations
  - Disposal of Investigation-Derived Waste (IDW)

Chapter 5 - Investigation Derived Waste (IDW)

- What is Investigation Derived Waste (IDW)?

- Soil, water, and personal protective equipment (PPE) generated during remedial activities

- Chapter 5 – pages 17-20 (soil and water)
- Chapter 6 – pages 11-12 (general IDW)
- Chapter 6 – pages 131-132 (water)

- Language on how to handle the storage and disposal of site-related IDW should be in the sampling plan

Chapter 5 - Investigation Derived Waste (IDW)

- PPE - disposable gloves, booties, Tyvek, and contaminated equipment
- Soil generated from soil sampling, soil borings, well installation and decontamination of people and equipment
- Water generated from well installation, well development, well sampling, and decontamination activities

Chapter 5 - Groundwater IDW 5.2.5.6.1

Options for disposal of water generated from well sampling activities:

- Discharge to ground at the well location
- Transport the water to an onsite location where like soil contamination has been documented or where first water is contaminated with like contaminants
- Discharge the water to a local stormwater or sanitary sewer system. This option would require water quality documentation and approval from the respective municipality or utility

5.2.5.6.1 Ground Water IDW

Discharge Ground Water IDW to ground

- N.J.A.C. 7:14A-7.5 allows for water associated with well installation, development, and sampling to be discharged to ground via a permit-by-rule
- There is no volume limit for the discharge. No written approval from NJDEP is required

5.2.5.6.1 Ground Water IDW

The discharge to ground should not result in the following:

- Discharging water containing product to the ground
- Discharging contaminated water from a lower aquifer to a non-impacted water-table aquifer without treatment
- Discharging contaminated water to clean soils at concentrations that would results in the development of contaminated soil, unless the water is treated first

5.2.5.6.1 Ground Water IDW

- Where it is determined that the water is contaminated at concentrations that restrict its discharge to ground, a portable treatment system may be used to improve the water quality to allow for the water to be discharged to ground

Examples of field treatment for Volatile Organic Compounds (VOCs)

- Bubble aeration
- Tray aeration air stripping
- Activated carbon

5.3 Aqueous and Other Liquid Sampling Equipment

5.3.1 Ground Water Sampling Equipment

5.3.1.1 Submission of Well Purging Information

5.3.1.2 Purge Sampling Equipment

5.3.1.3 No-Purge (Passive) Sampling Equipment

- Grab
- Diffusion
- Accumulation/sorption

Direct push technologies for groundwater sampling are also discussed in this section

5.3.2 Wastewater Sampling Equipment

5.3.3 Surface Water and Liquid Sampling Equipment

5.3.4 Containerized Liquid Sampling Equipment

5.3.1.1 Submission of Well Purging Information

- Well purging field data for all well sampling results should be included in all reports submitted to NJDEP
- Added to this chapter for emphasis before discussion of purging equipment
- To be further discussed in Chapter 6

5.3.1 Ground Water Sampling Equipment

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Purge Sampling Equipment

- Negative Pressure Pumping Equipment (Vacuum)
    - Suction-lift Pumps (e.g., diaphragm, surface-centrifugal and peristaltic)
- Positive Pressure Pumping Equipment
    - Bladder Pump
    - Variable Speed Submersible Centrifugal Pump (e.g., Grundfos pump)
    - Gear Pump (e.g., Fultz pump)
    - Reciprocating Piston Pump (e.g., Bennett pump)
    - Inertial Pump (e.g., Waterra pump and tubing with foot check valve)
    - Packers (accessory deployed in conjunction with pumps)
    - Bottom Fill Bailer
    - Double Check Valve Bailer

Figure 5.5 Fultz Pump. Illustration published with permission of Fultz Pumps, Inc.

No-Purge (Passive) Sampling

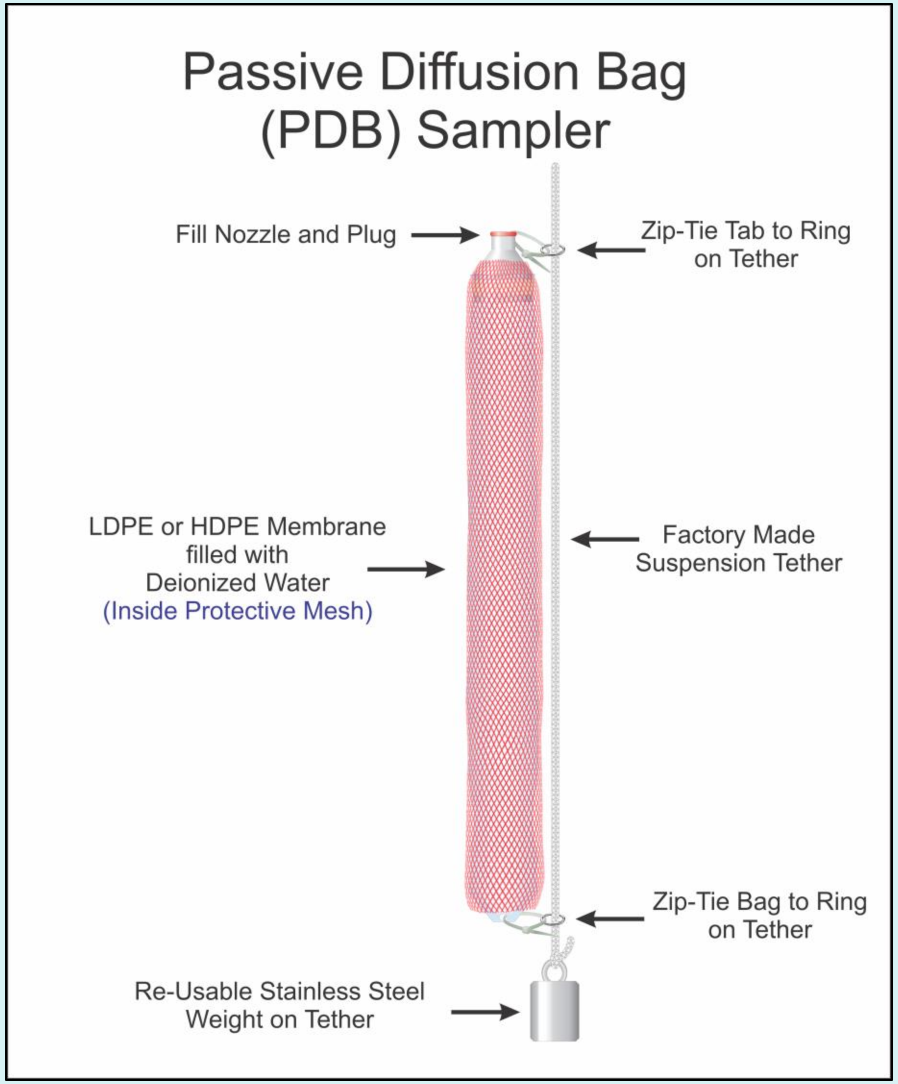
What is no-purge sampling?

- A sampling technique using a device specifically designed to obtain a sample of limited volume within the well intake interval without well purging prior to sample collection
  - Acquires a sample from a discrete location without inducing active media transport (no to little purge). The sampling relies on the sampling device being exposed to media in ambient equilibrium during the sampler deployment period
  - Sometimes called passive or point source sampling
  - Should only be used after the contaminants of concern and the specific zone(s) of contaminant flow in the well intake interval have been identified

5.3.1 Ground Water Sampling Equipment

No-Purge (Passive) Sampling Equipment

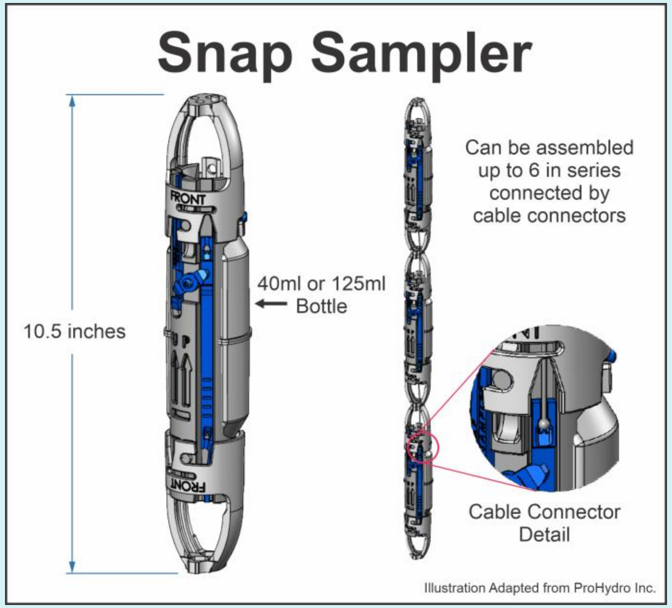
- Grab Sampling Technologies
  - HydraSleeve
  - Snap Sampler
  - Syringe Sampler
- Diffusion Sampling Technologies
  - Passive Diffusion Bag Sampler (PDB)
  - Nylon Screen Passive Diffusion Sampler (NSPDS)
  - Regenerated Cellulose Dialysis Membrane (RCDM) Sampler
  - Dual Membrane Passive Diffusion Bag Sampler
  - Rigid Porous Polyethylene Sampler (RPPS)
  - Peeper Sampler
- Accumulation/Sorption Sampling Technologies
  - AGI Universal Sampler (Gore™ Sorber)



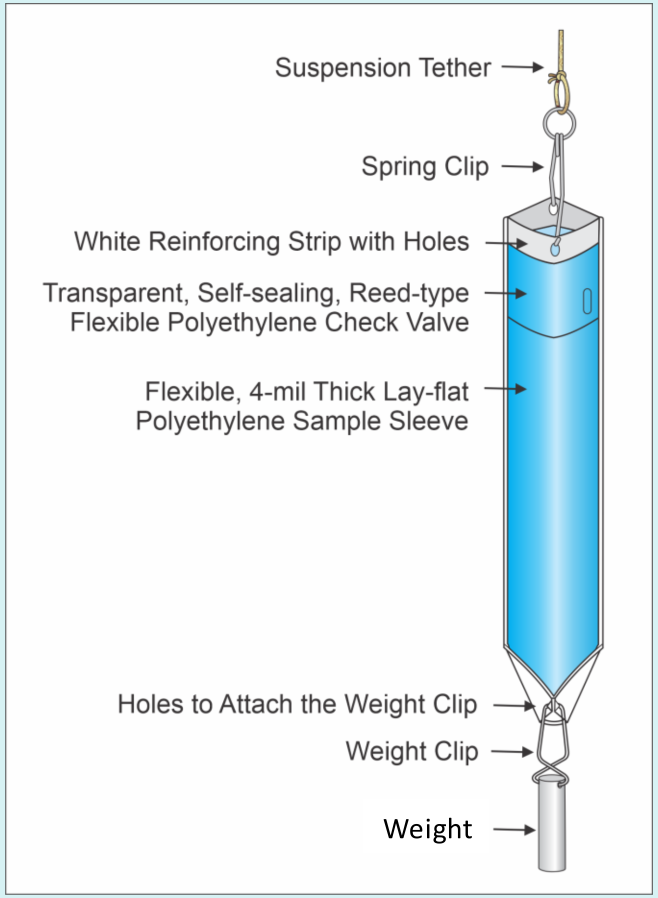
5.3.1.3 No-Purge Sampling Equipment

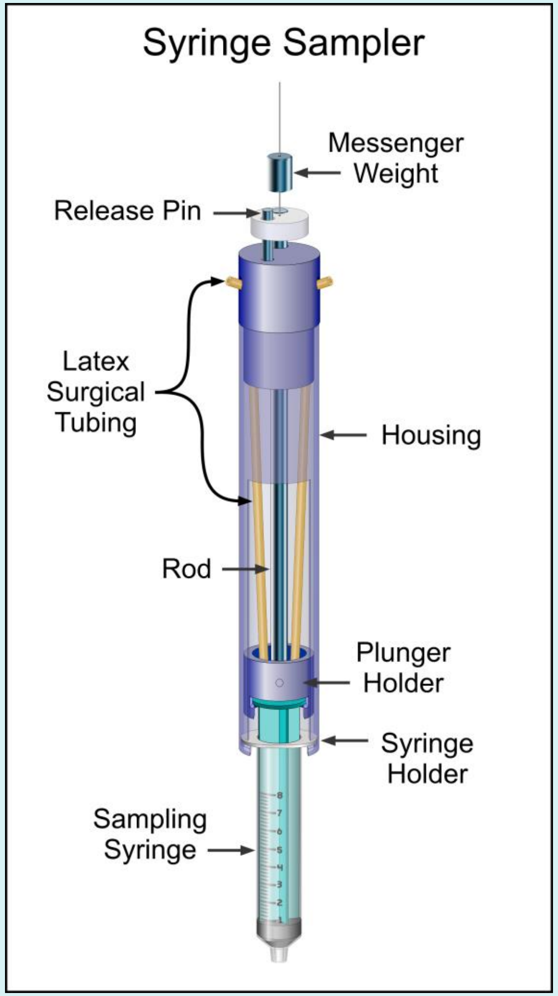
Grab Sampling Technologies

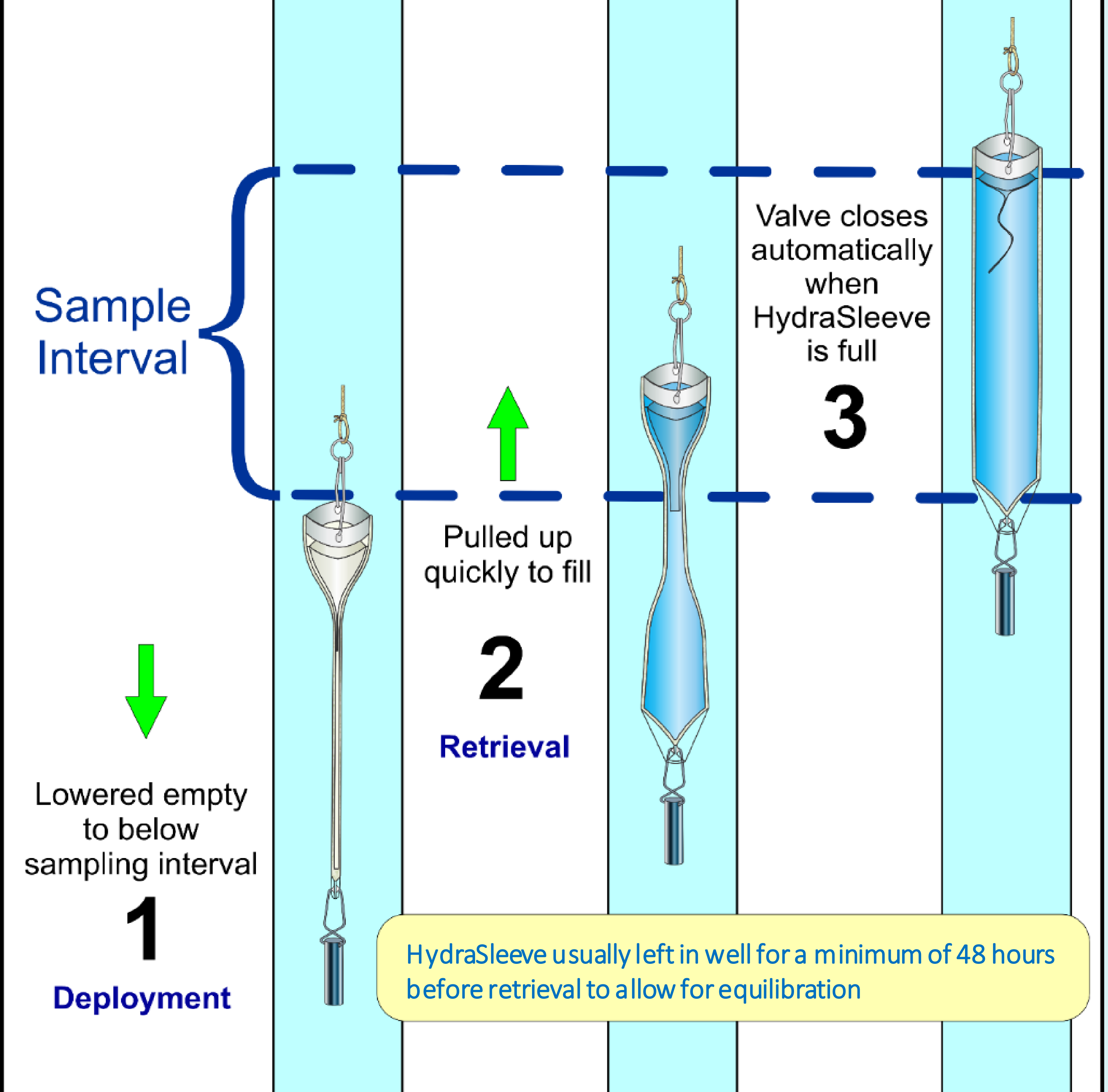
- HydraSleeve
- Snap Sampler
- Syringe Sampler



HydraSleeve





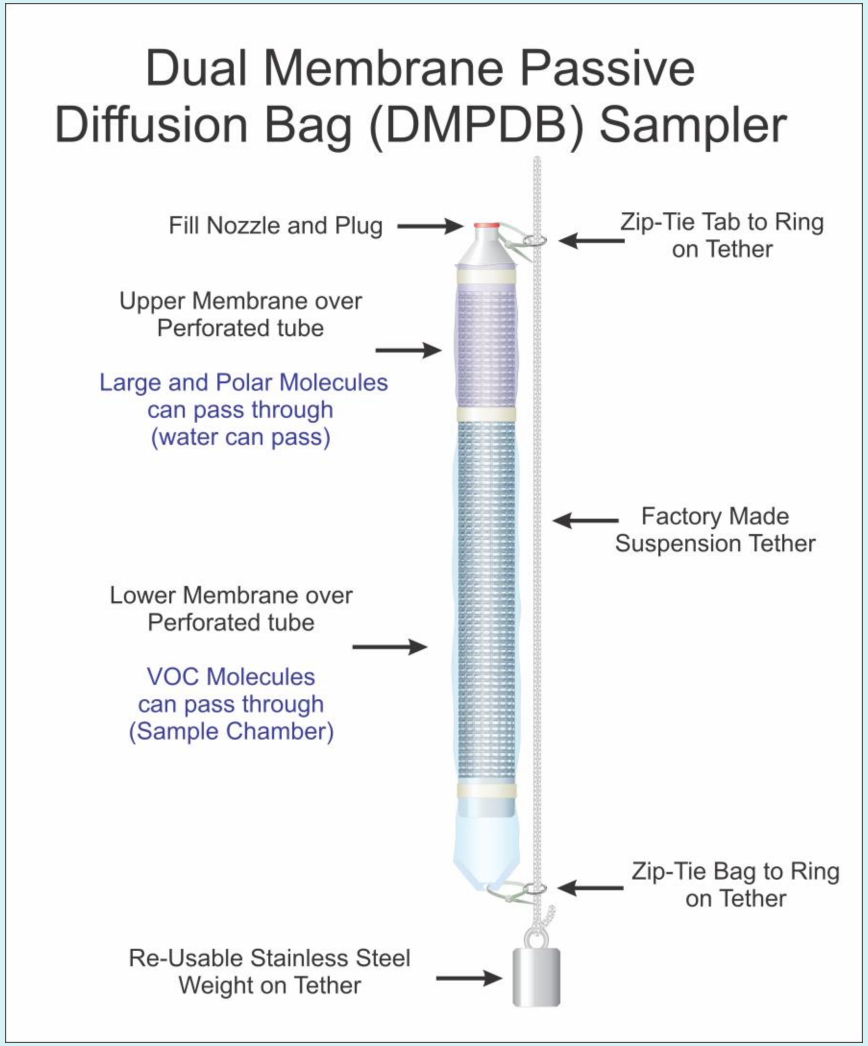


Sample Interval
Lowered empty to below sampling interval
1
Deployment
Pulled up quickly to fill
2
Retrieval
Valve closes automatically when HydraSleeve is full
3
HydraSleeve usually left in well for a minimum of 48 hours before retrieval to allow for equilibration

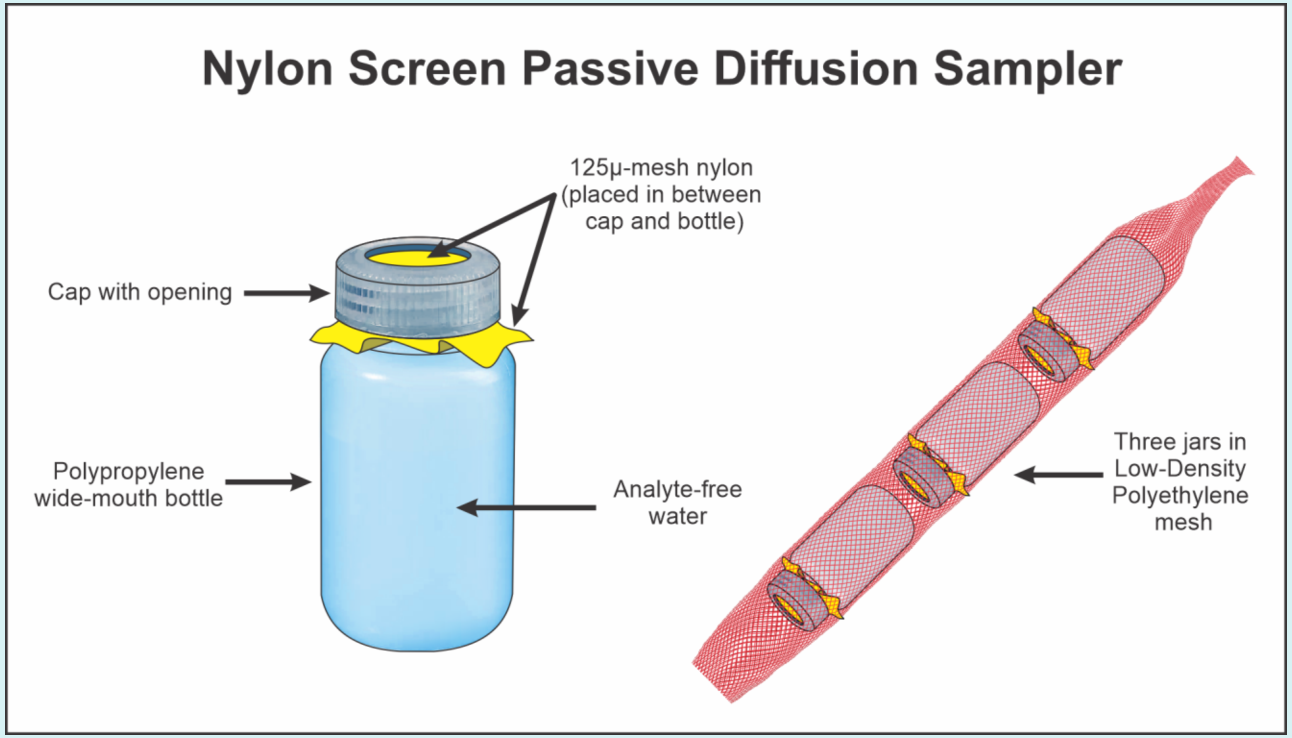
5.3.1 Ground Water Sampling Equipment

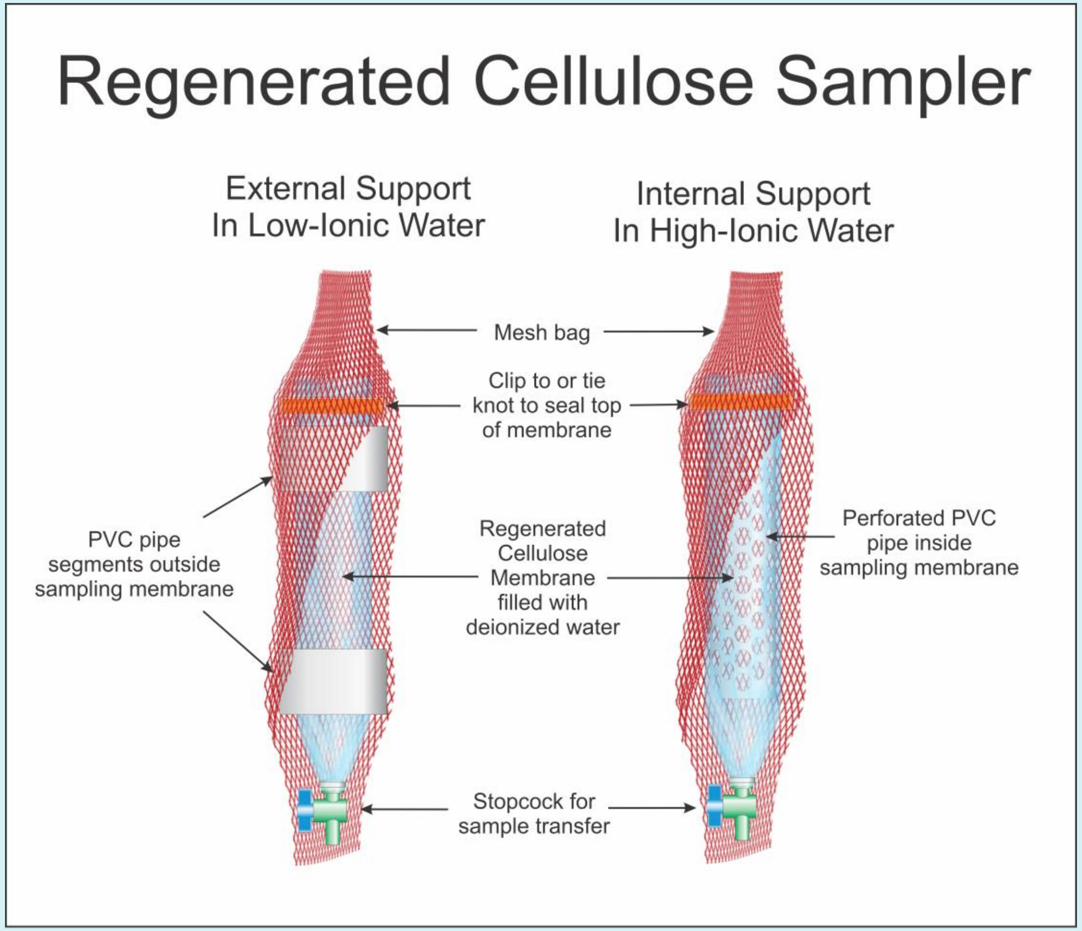
No-Purge (Passive) Sampling Equipment

- Diffusion Sampling Technologies
  - Passive Diffusion Bag Sampler (PDB)
  - Nylon Screen Passive Diffusion Sampler (NSPDS)
  - Regenerated Cellulose Dialysis Membrane (RCDM) Sampler
  - Dual Membrane Passive Diffusion Bag Sampler
  - Rigid Porous Polyethylene Sampler (RPPS)
  - Peeper Sampler



5.3.1 Ground Water Sampling Equipment





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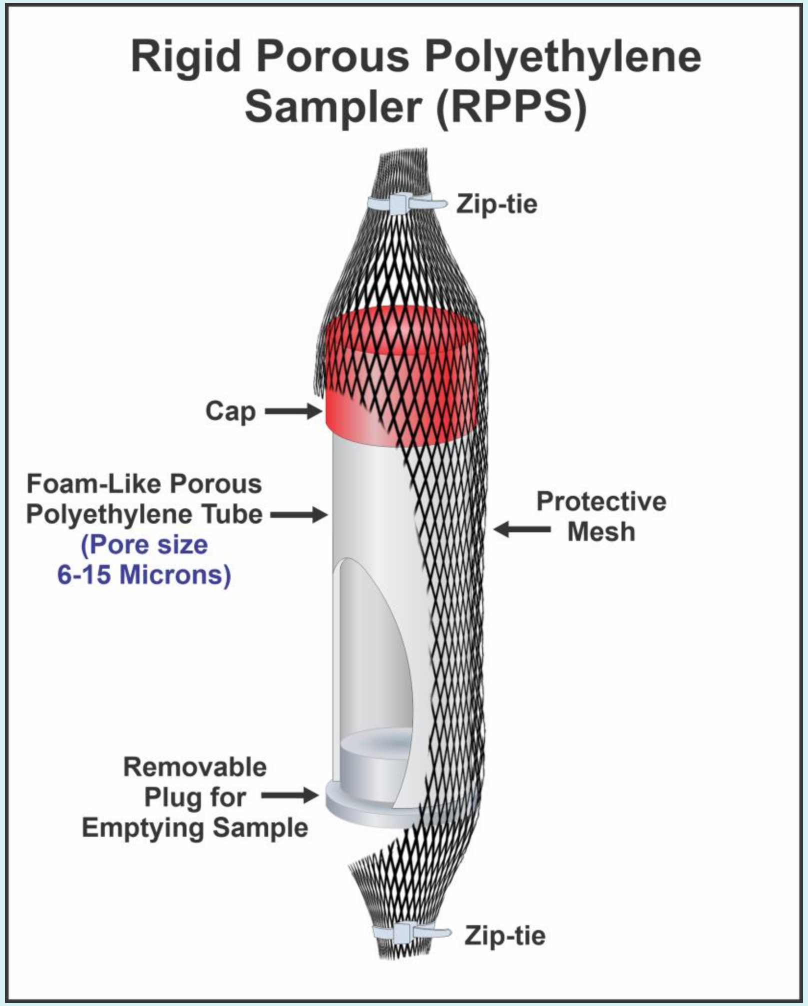
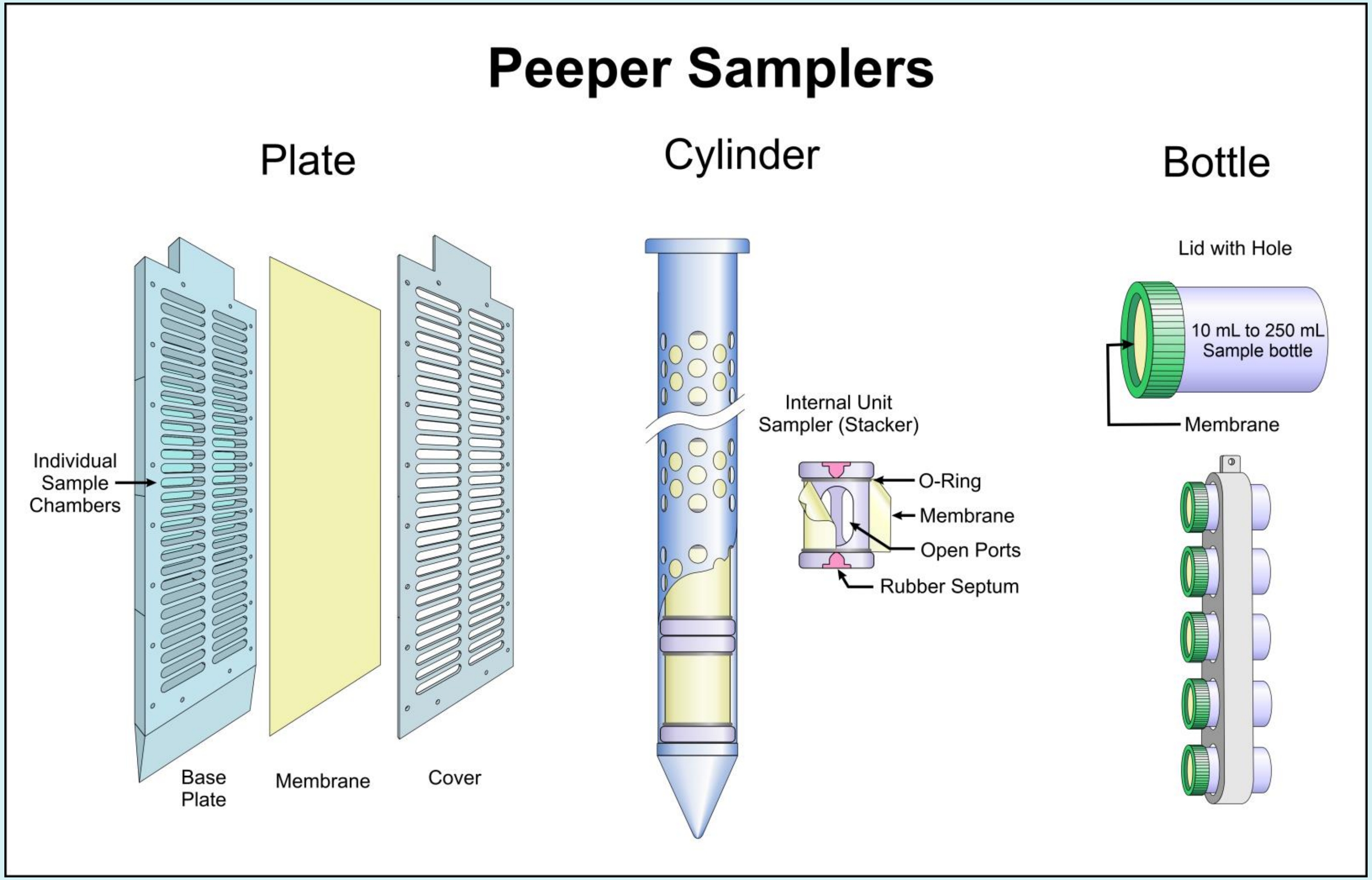


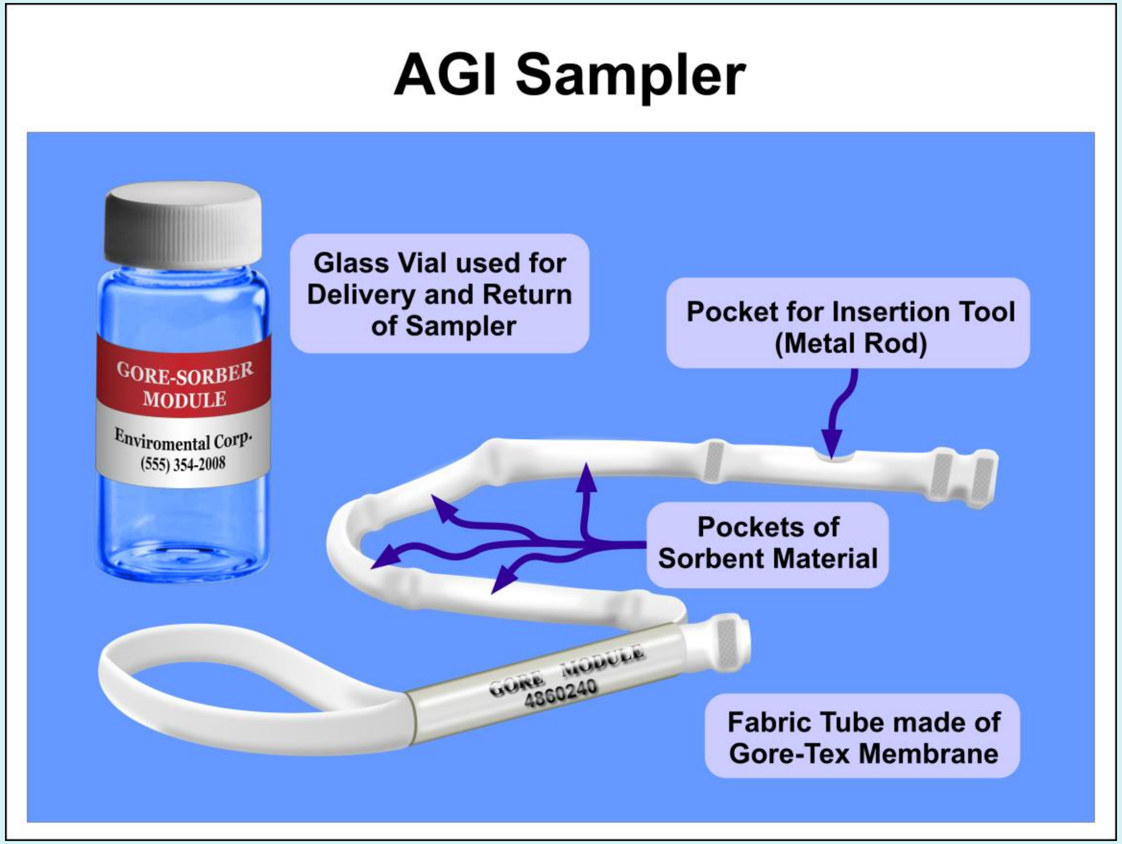


5.3.1 Ground Water Sampling Equipment

No-Purge (Passive) Sampling Equipment

- Accumulation/Sorption Sampling Technologies
  - AGI Universal Sampler
    - (formerly known as Gore™ Sorber)

- Screening level data only
- Samples are a time-integrated representation of conditions at the sampling point over the entire deployment period



5.3.1 Direct Push Technologies for Ground Water Sampling

- Application: Able to obtain vertical profile information (i.e., multiple depth discreet samples) from the same borehole
- All downhole equipment should be properly decontaminated using heat between each use and sample collection tubing should not be reused
- Operators must have boring certification in good standing from the Bureau of Water Systems and Well Permitting and all permit approvals must be on-site
- Extreme caution must be taken to ensure that communication between various water bearing zones within the same boring does not take place
- Where the borehole extends to a depth greater than 25 feet, the borehole must be properly sealed. For boreholes less than 25 feet deep, sealing with grout is recommended in areas of contamination since driven boreholes do not generate soil cuttings

5.3.2 Wastewater Sampling Equipment

- Manual Sampling
- Automatic Sampling

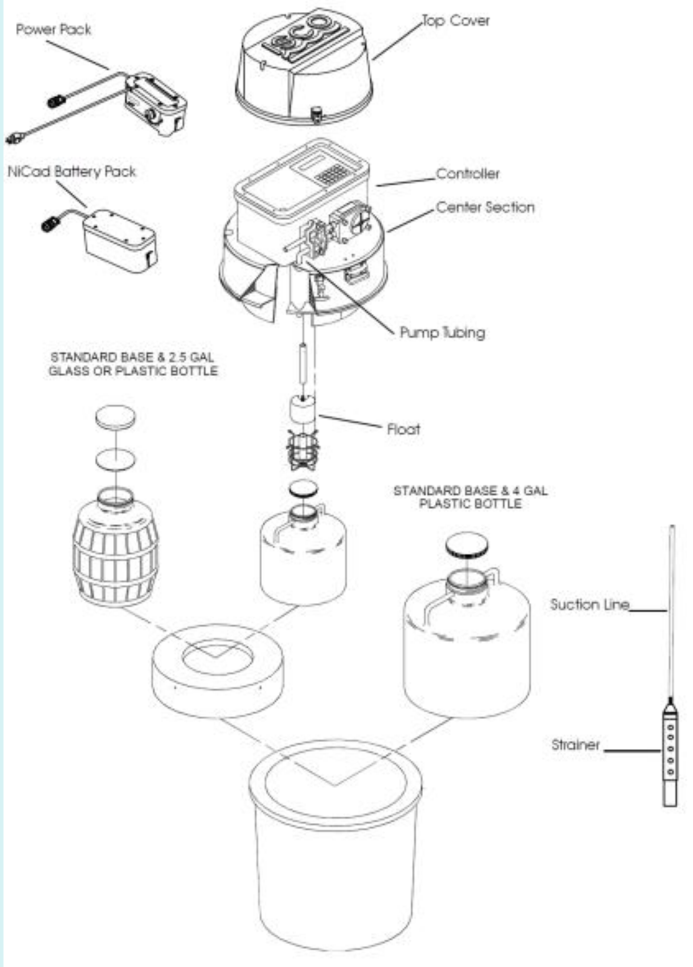
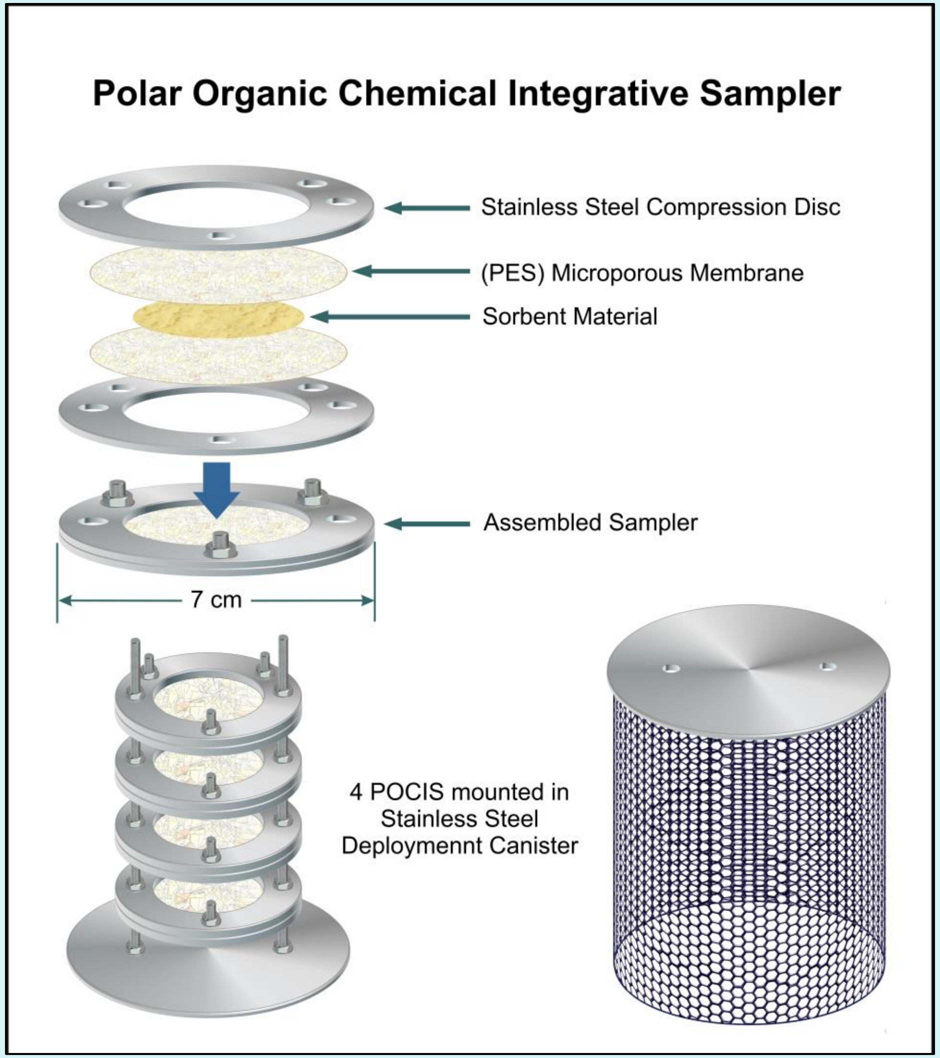


Figure 5.19 ISCO® 3700 Series Sampler for composite collection. Illustration published with permission of Teledyne ISCO.

5.3.3 Surface Water and Liquid Sampling Equipment

- Laboratory Cleaned Sample Bottle
- Pond Sampler
- Weighted Bottle Sampler
- Wheaton Dip Sampler
- Kemmerer Depth Sampler/Van Dorn Sampler
- Other Water Bottle Samplers
- VOC Sampler
- Bacon Bomb Sampler
- Polar Organic Chemical Integrative Sampler (POCIS)
- Continuous Water-Quality Monitors
- Continuous Low-Level Aquatic Monitoring (CLAM)
- Churn Splitter
- Sample Collection and Preservation Chamber



5.3.4 Containerized Liquid Sampling Equipment

- COLIWASA (Composite Liquid Waste Sampler)
- Open Tube Thief Sampler
- Stratified Thief Sampler

Figure 5.28 Coliwasa

Figure 5.29 Open Tube Thief Sampler

5.4 Non-aqueous Sampling Equipment

CSRR

5.4.1 Soil Sampling Equipment

- Scoop/Trowel
- Bucket Auger
- Soil Coring Device
- Split Spoon Sampler
- Shelby Tube Sampler
- En Core® Sampler
- Power Auger
- Direct Push Technology for Soil Sampling

5.4.2 Sediment and Sludge Sampling Equipment

Benthic Grab Samplers

- Ponar Dredge
- Ekman Grab Sampler
- Box Corer
- Shipek
- Van Veen Grab
- Petersen Grab

Sediment Core Samplers

- Hand Corer
- Russian Peat Borer
- Split Core Sampler
- Gravity Corer
- Vibracorer
- Sediment Sieve

Sludge Samplers

- Lidded Sludge/Water Sampler
- Liquid Grab Sampler
- Swing Jar Sampler
- Sludge Judge

Containerized Solids and Waste Pile Sampling Equipment

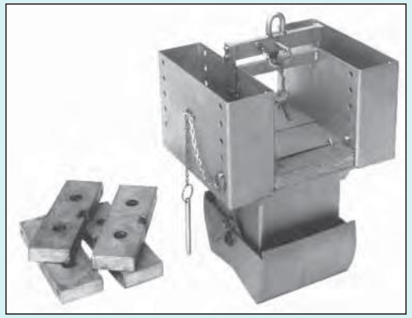
- Grain Sampler
- Waste Pile Sampler
- Sampling Trier

5.4 Non-aqueous Sampling Equipment

Tables

Table 5.3 General Characteristics of Selected Grab and Core Samplers (Sediment)

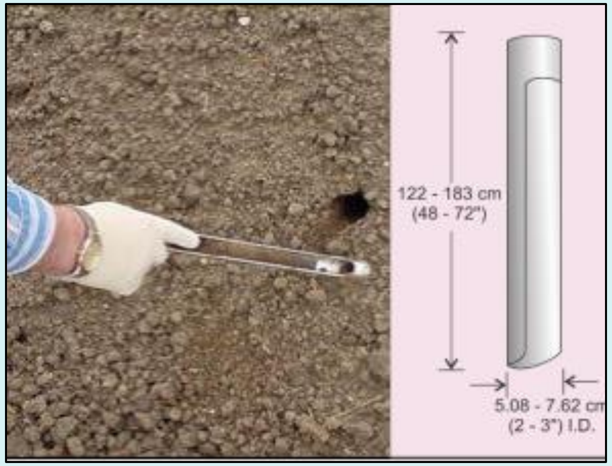
Table 5.4 Samplers Recommended for Various Types of Waste



Box Corer

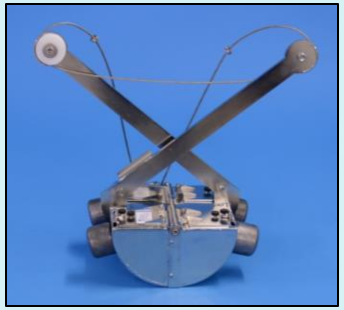
Shiptek Grab Sampler

Ponar Dredge

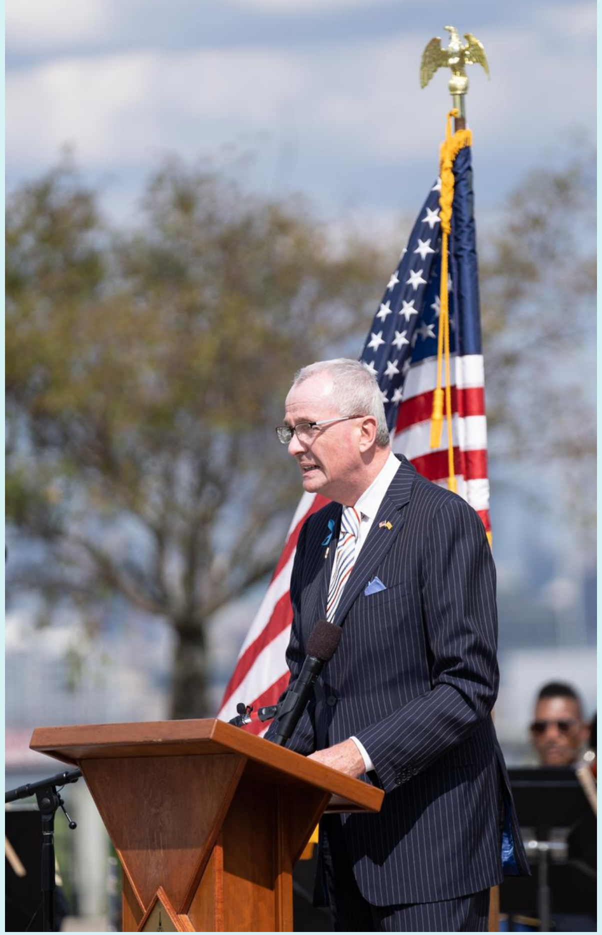


Waste Pile Sampler

Peterson Grab



Van Veen Grab

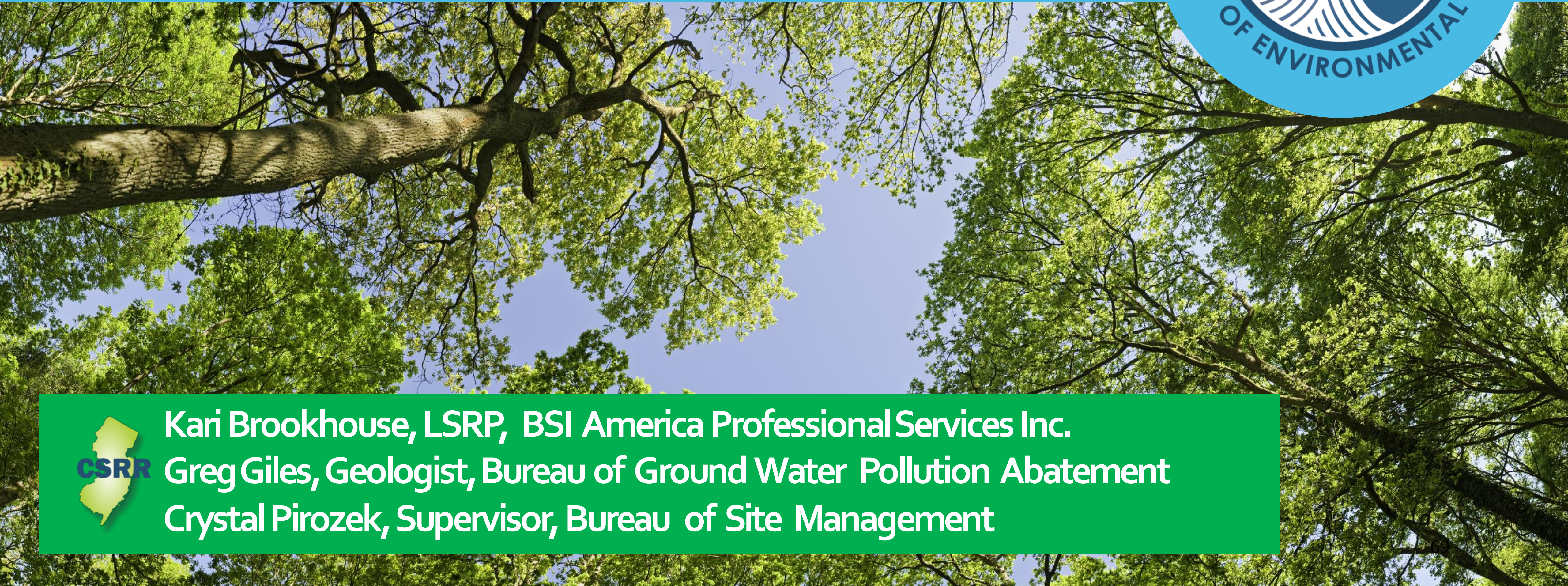


Thank you!

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

FSPM Chapter 6: Sample Collection

February 29, 2024



Kari Brookhouse, LSRP, BSI America Professional Services Inc.
Greg Giles, Geologist, Bureau of Ground Water Pollution Abatement
Crystal Pirozek, Supervisor, Bureau of Site Management

Chapter 6: Sample Collection

6.1 Introduction

6.2 Soil Sampling

6.3 Rock Core Sample Collection

6.4 Direct Push Technology Considerations

6.5 Sampling Containerized Material

6.6 Waste and Beneficial Reuse Pile Sampling

6.7 Surficial Sampling

6.8 Surface Water and Sediment Sampling

6.9 Ground Water Sampling

6.10 Biological Sampling Procedures

6.11 Toxicity Test (Bioassay) Sampling

Chapter 6 Overview

- Site conditions, sample matrix, and analytes to be assessed will often dictate the type of sampling equipment and method used
- Chapter 6 provides both general steps to be followed regardless of sample matrix and an overview of how to sample the various matrices using a variety of equipment and sampling methods
- Please note this is not an exhaustive list but covers current industry trends
- Each section within Chapter 6 also provides links to resources for additional information

Sections 6.2 & 6.3

6.2 Soil Sampling -

- Log soils after sample collection to minimize loss of volatiles
- Collect soil core temps for certain drilling methods that have the potential to increase heat as there is a potential impact to sample integrity and note the soil core temp on the soil log
- Drill adjacent hole for additional material as needed to ensure enough soil volume for analytical methods
- Collection of VOCs from hand cleared holes using high pressure air or water not recommended

6.3 Rock Core – Added Sonic Drilling Method (6.3.1.3)

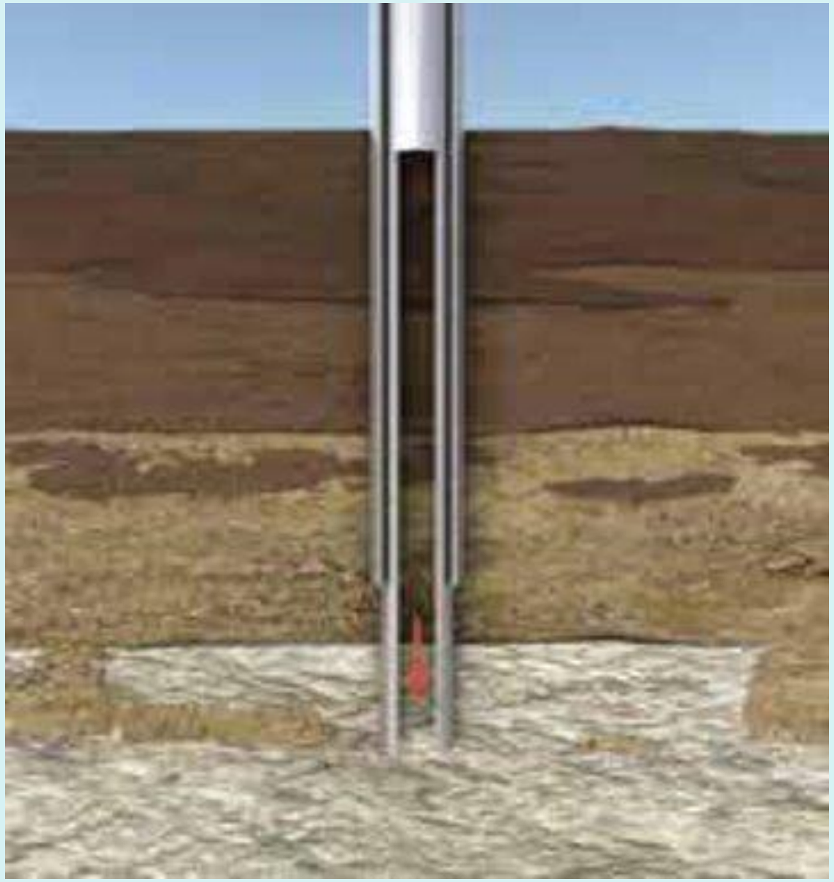
- Sonic drilling method is a dual casing advancement technique employing an inner (primary) core barrel and related drilling casing, and an outer over-ride (secondary) cutter head and associated drill casing

Section 6.4

6.4 Direct Push

- Direct Push technology allows for the collection of segmented soil cores
- Allows for the ability to visually determine geological data
- High pressure, hot water (100° C) cleaning is recommended to decontaminate direct push sampling equipment and maintain confidence that data are not influenced by unwanted variables
- Details regarding the use of Sonic drilling to collect soil samples, including ways to mitigate the potential for temperature increases, has been added to Section 6.4.1. When collecting samples from a Sonic core, it is recommended to use a rigid inner liner to hold the core together during removal from the core barrel

Additional site characterization techniques, many of which use direct push technology, have been added to Chapter 7



Section 6.5

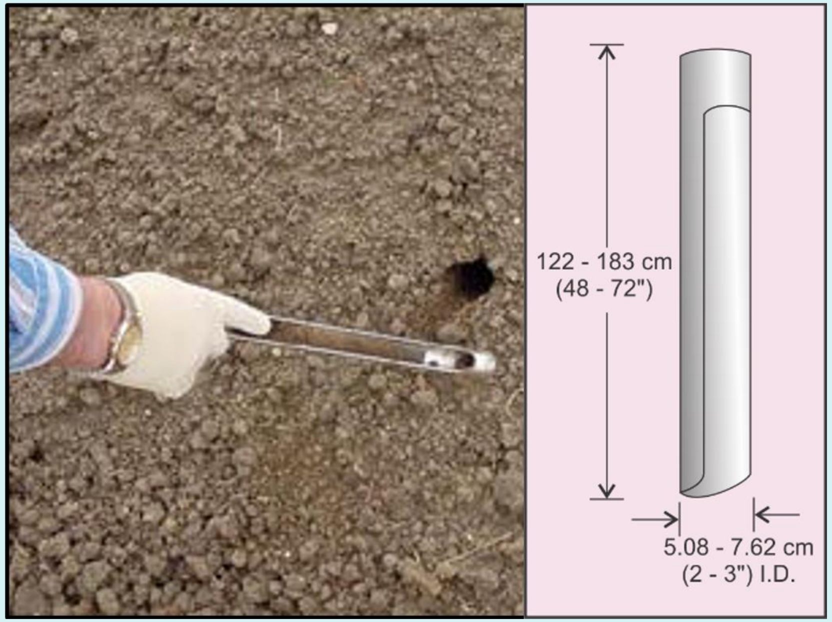
6.5 Sampling Containerized Material

- Container type could vary from a drum to a tanker truck
- Health & Safety (H&S) are of utmost importance
- Container staging, identification, and opening are all issues to be considered

Sections 6.6 & 6.7

6.6 Waste and Beneficial Reuse Pile Sampling

- Variability of piles does not allow for outline of exact procedures
- Consider size and shape, material characteristics
- Tools available for pile sampling:
    - scoop or trowel
    - waste pile sampler
    - sampling trier
    - soil auger
    - grain sampler
    - split spoon sampler
    - soil coring device
    - mixing bowl
    - sieve



6.7 Surficial Sampling

- Applies to assessment of potential contaminants on various surfaces, e.g., floor, counters, rather than soil, water, or air

Section 6.8

6.8 Surface Water and Sediment Sampling

- No procedural changes, predominantly revised to align with NJDEP Ecological Evaluation Technical Guidance
- Health & Safety are a priority when working near water, (6.8.1) "Personal safety associated with surface water and sediment sample collection will always be the first priority when selecting the appropriate equipment and related procedures to use."
- Things to consider when preparing a sampling plan include:
  - Water body's physical characteristics (e.g., size, depth, and flow), and water quality
  - For non-flowing water also consider temperature, different temps at different depths may require multiple samples
  - Non-aqueous samples should be accompanied by laboratory-analyzed total organic carbon (TOC), pH and particle grain size for each sample
  - Sampling should proceed from downstream locations to upstream locations. If surface water and sediment samples will be collected during the same sampling event, they must be co-located
  - Decontaminate or dispose of the sampling device before taking the next sample

Ground Water Sampling – Section 6.9 Definition of "Well Intake Interval"

- The phrase "Well Intake Interval" means the depth interval where ground water can enter the well
- This phase includes the portion of the well screen or open borehole that is above the water table
- This phrase replaces the terms "well screened interval" and "well bedrock open borehole interval" in Section 6.9 where both situations apply

Ground Water Sampling – Section 6.9

Observations in ground water testing results used to update this section:

- How you sample (the sampling method) can affect your sample results
- When you sample (changes in depth to water, generally linked to seasonal changes) can affect your sample results
- Where you sample (the depth of sample collection in the well) can affect your sample results

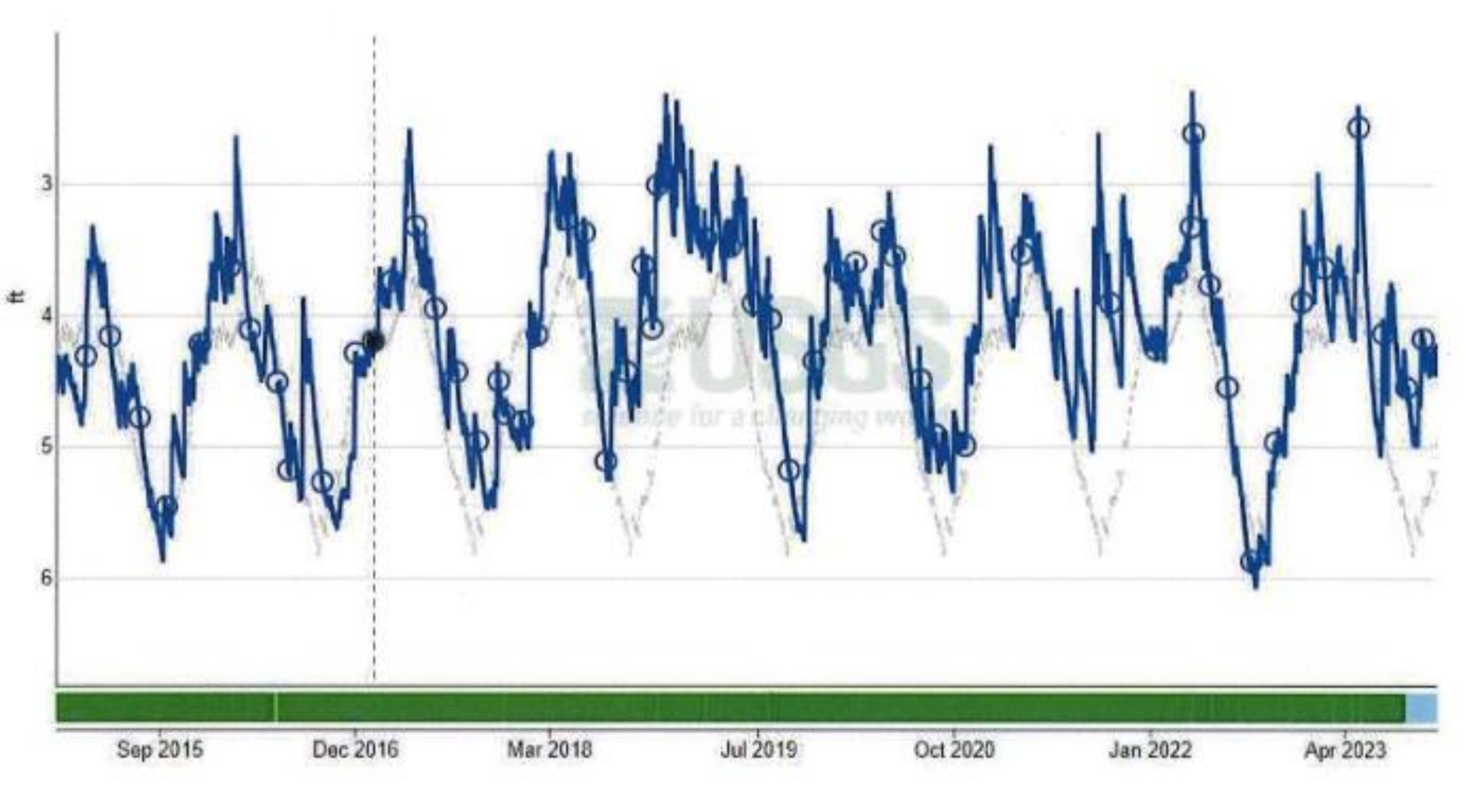
Ground Water Sampling – Section 6.9

Table 1
Summary of Historical Ground Water Results

Well Information	Sampling Date	Sample Method	Depth (ft)	PCE (µg/l)	TCE (µg/l)	1,1-DCE (µg/l)	cis 1,2-DCE (µg/l)	trans-1,2-DCE (µg/l)	VC (µg/l)	Ben. (µg/l)	Tol. (µg/l)	Ethyl. (µg/l)	Xyl. (µg/l)	MTBE (ug/l)	TICs (µg/l)	Total VOCs & TICs (µg/l)
NJDEP GWQS				1	1	1	70	100	1	1	1000	700	1000	70	100/500	NA
MW-3 Unit Monitored: Overburden Screened Interval 12-27' Total Depth 27'	2/14/2013	3-Volume		**123**	**54.3**	ND	**2,030**	ND	ND	ND	ND	ND	ND	ND	200	2,440
	3/14/2013	3-Volume		**305**	**131**	ND	**1,610**	8.1	ND	ND	ND	ND	ND	ND	ND	2,080
	6/11/2013	3-Volume		**157**	**119**	ND	**2,020**	11.5	**12.0**	**3.2**	ND	ND	ND	ND	187	2,610
	7/15/2013	3-Volume		**143**	**147**	ND	**2,160**	ND	**10.0**	ND	ND	ND	ND	ND	ND	2,490
	8/27/2013	3-Volume		**185**	**265**	ND	**2,860**	9.3	**8**	**4.8**	ND	ND	ND	ND	ND	3,470
	9/9/2014	3-Volume		**2**	**5**	ND	**722**	2.3	**16**	ND	ND	ND	ND	ND	48.2	807
	11/20/2014	3-Volume		**1.84**	**6.57**	ND	**304**	ND	**27.3**	ND	ND	ND	ND	ND	709.0	2,570
	1/23/2015	3-Volume		**4.64**	**5.59**	ND	69	ND	**ND**	ND	ND	ND	ND	ND	102	1,080
	8/17/2016	PDB		ND	**1.01**	ND	11	1.0	ND	ND	ND	ND	ND	ND	49	127
	11/14/2016	PDB		ND	**1**	ND	5	ND	ND	ND	ND	ND	ND	ND	38	100.0
	3/8/2017	PDB		ND	ND	ND	2	ND	0.81	ND	ND	ND	ND	ND	5.3	58.4
	6/8/2017	PDB		ND	ND	ND	5	0.74	2.26	ND	ND	ND	ND	ND	16.8	41.1
	3/6/2019	PDB	17	ND	0.7	ND	4	0.35	**5.75**	0.4	ND	ND	ND	ND	ND	37.2
	3/6/2019	PDB	24	ND	ND	ND	**101**	1.81	**194**	**2.1**	ND	ND	ND	ND	6.6	328
	3/24/2020	3-Volume		**37.8**	**41.2**	ND	**526**	2.03	**133**	ND	ND	ND	ND	2.8	31	774
	6/16/2020	3-Volume		**16.0**	**26.5**	ND	**523**	3.59	**ND**	ND	ND	ND	ND	ND	258	827
	8/16/2022	3-Volume		**7.33**	**4.72**	ND	**104**	0.9	**119**	0.6	ND	ND	ND	1.7	133	371.0

Ground Water Sampling – Section 6.9

A comparison of depth to water and season

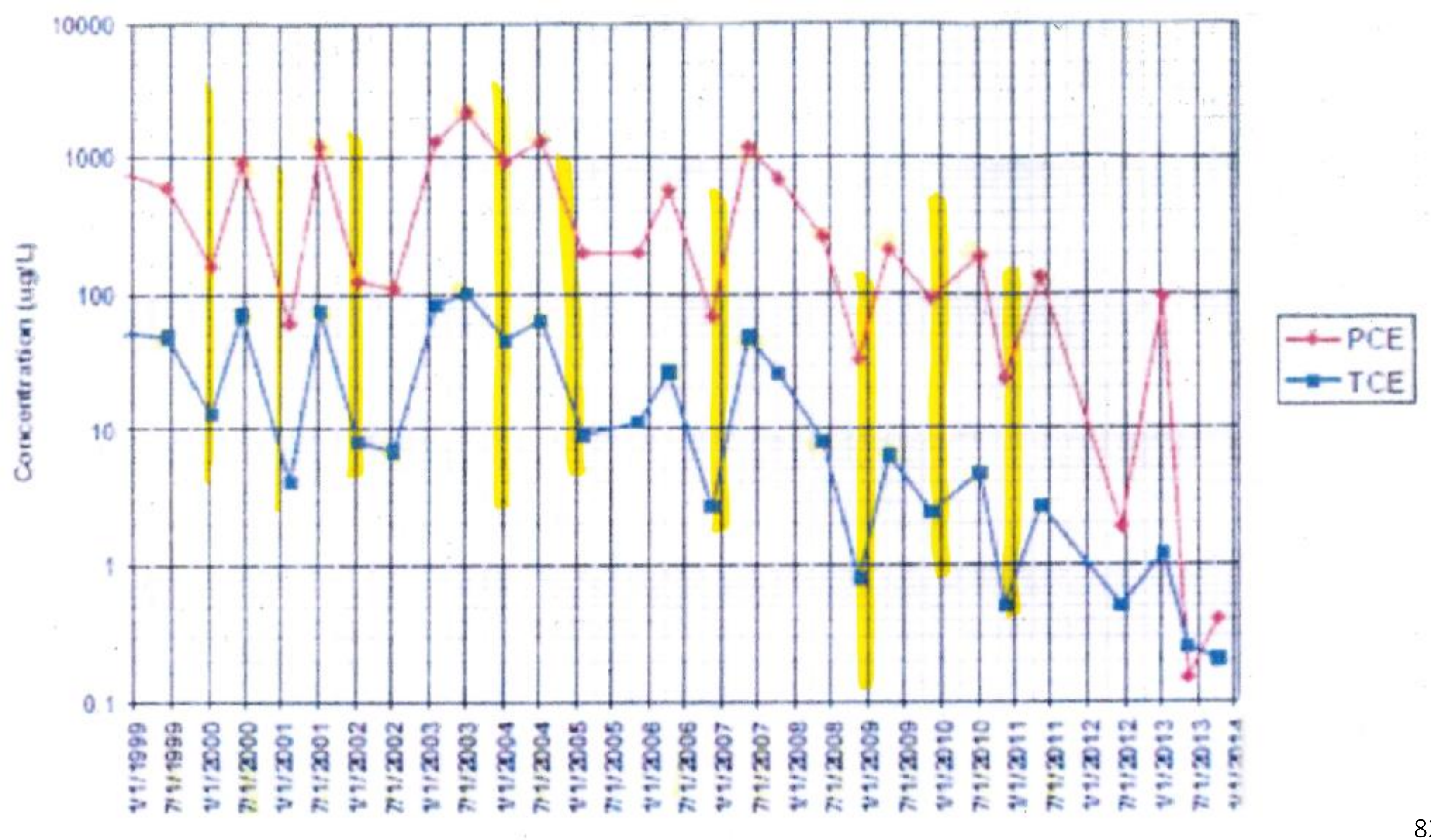


Ground Water Sampling – Section 6.9

- Seasonal changes in depth to water are common
- Significant changes in the depth to water can occur during shorter periods of significant drought or precipitation
- This issue mainly affects water table wells
- Wells installed in areas of higher ground frequently have a greater variation in depth to water than wells installed in low lying areas

Ground Water Sampling – Section 6.9

Changes in Tetrachloroethylene (PCE) and Trichloroethylene (TCE) with season



Ground Water Sampling – Section 6.9

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Table 1
Summary of Historical Ground Water Results

Well Information	Sampling Date	Sample Method	Depth (ft)	PCE (µg/l)	TCE (µg/l)	1,1-DCE (µg/l)	cis 1,2-DCE (µg/l)	trans-1,2-DCE (µg/l)	VC (µg/l)	Ben. (µg/l)	Tol. (µg/l)	Ethyl. (µg/l)	Xyl. (µg/l)	MTBE (ug/l)	TICs (µg/l)	Total VOCs & TICs (µg/l)
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	3/14/2013	3-Volume		305	131	ND	1,610	8.1	ND	ND	ND	ND	ND	ND	ND	2,080
	6/11/2013	3-Volume		157	119	ND	2,020	11.5	12.0	3.2	ND	ND	ND	ND	187	2,610
	7/15/2013	3-Volume		143	147	ND	2,160	ND	10.0	ND	ND	ND	ND	ND	ND	2,490
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	11/14/2016	PDB		ND	1	ND	5	ND	ND	ND	ND	ND	ND	ND	38	100.0
	3/8/2017	PDB		ND	ND	ND	2	ND	0.81	ND	ND	ND	ND	ND	5.3	58.4
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	3/6/2019	PDB	17	ND	0.7	ND	4	0.35	5.75	0.4	ND	ND	ND	ND	ND	37.2
	3/6/2019	PDB	24	ND	ND	ND	101	1.81	194	2.1	ND	ND	ND	ND	6.6	328
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	8/16/2022	3-Volume		7.33	4.72	ND	104	0.9	119	0.6	ND	ND	ND	1.7	133	371.0

Documenting Depth of Sample Collection – 6.9.3.1

- The depth of sample collection may affect your sample results
- Sample depth information should be from ground surface
- Sample collection depths should be listed on the field sampling sheets
- Where sampling results are presented in tables, it is recommended that the sample results be linked to their depth of collection
- Example language: MW-1 (22-24’)

Ground Water Sampling – Section 6.9

Documentation of sampling date, method, and depth

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Table 1
Summary of Historical Ground Water Results

Well Information	Sampling Date	Sample Method	Depth (ft)	PCE (µg/l)	TCE (µg/l)	1,1-DCE (µg/l)	cis 1,2-DCE (µg/l)	trans-1,2-DCE (µg/l)	VC (µg/l)	Ben. (µg/l)	Tol. (µg/l)	Ethyl. (µg/l)	Xyl. (µg/l)	MTBE (ug/l)	TICs (µg/l)	Total VOCs & TICs (µg/l)
NJDEP GWQS				**1**	**1**	**1**	**70**	**100**	**1**	**1**	**1000**	**700**	**1000**	**70**	**100/500**	**NA**
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	3/8/2017	PDB		ND	ND	ND	2	ND	0.81	ND	ND	ND	ND	ND	5.3	58.4
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Ground Water Sampling - Policy - 6.9.1.4

- It is recommended that well information should be brought to the well during sampling events (e.g., depth to water, well yield, etc.)

- DEP recommends the first two sampling events for a well be performed by the Volume Averaged method

- To account for seasonal variation, the requested second sample should be collected a minimum of 90 days after the first sample

Ground Water Sampling – Policy 6.9.1.4

CSRR

- When a well is being sampled for well or site close-out purposes, (i.e., sampling results intended to be used to justify an aspect of site closure or abandonment of a specific well), it is recommended the well be sampled using the Volume Averaged method

- Aside from initial and final well sampling, other sampling methods can be used

- It is recommended that temporary well point sampling be performed by the Volume Averaged method when possible

Ground Water Sampling – Policy 6.9.1.4

- Where volatile organic compounds are a contaminant of concern and the well has never been tested by the Volume Averaged method, the NJDEP recommends that a Volume Averaged sample be collected during the next sampling event

- NJDEP is recommending that a Volume Averaged sample be collected so that the data can be compared to the results of other sampling methods

Ground Water Sampling – Policy 6.9.1.4

- If only sampling for turbidity sensitive compounds, the recommendation to use Volume Averaged sampling during the first two sampling events, and the closeout sampling event does not apply

- In this situation sampling methods that may reduce sample turbidity, such as Low Flow, grab, or passive sampling may be used at any time

Ground Water Sampling – Policy 6.9.1.4

- It is recommended that the collection of the Water Quality Indicator Parameters (WQIPs) be performed during the first two sampling events for a given well. Based on the above statement, the first two rounds of Volume Averaged sampling should include the measurement of the WQIPs

- When electrically powered submersible pumps are used for the collection of ground water samples that will be analyzed for temperature sensitive compounds (e.g., VOCs), the water temperature of the discharge should be monitored and recorded

Ground Water Sampling – Policy 6.9.1.4

- **Where the well contains more than 5 feet of water column in the well intake interval, it is recommended that the water quality in the well be vertically profiled during the first round of sampling conducted by a method other than the Volume Averaged method**
- Where a change in sampling method results in contaminant concentration changes beyond normal analytical variation, NJDEP recommends the sampling method that produces the highest contaminant concentration be used in subsequent sampling

Ground Water Sampling – Policy 6.9.1.4

- Where the sample results will not be used to make a regulatory decision (i.e., initial exceedance determination or well close-out), sampling methods other than Volume Averaged can be used, **even if they generate lower contaminant concentrations**

- **Where a sampling method is being used that has been documented to produce a lower contaminant concentration, that observation should be footnoted on tables of groundwater results. The footnote should be well-specific**

Well Sampling Decision Tree

- If unsure what sampling is recommended by the Department, the Well Sampling Decision Tree in the FSPM is a useful resource (Figure 6.10)

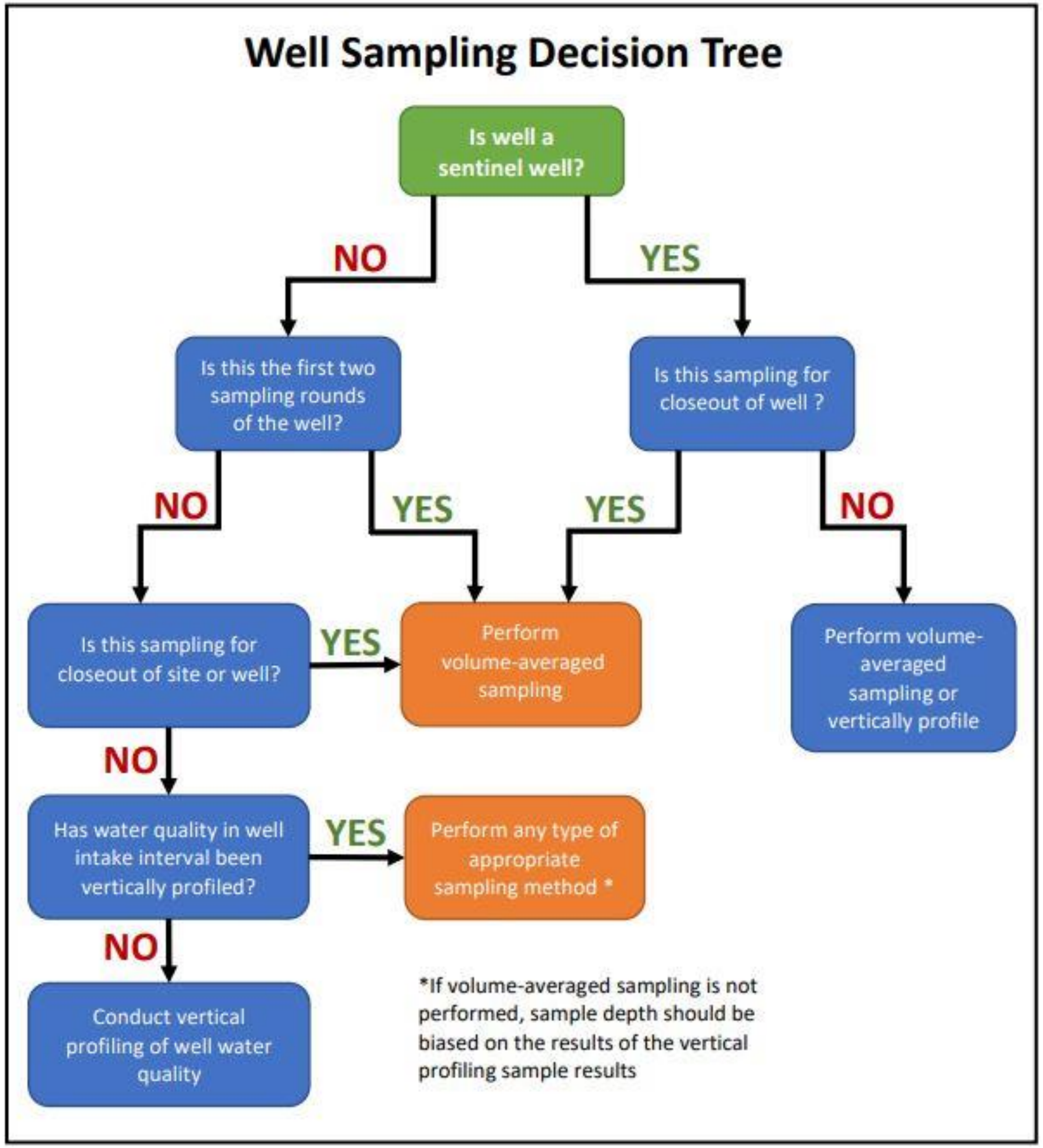


Figure 6.10 Well sampling Decision Tree

Ground Water Sampling – Technical Considerations 6.9.3

- Well Drawdown Issues – 6.9.3.2
- Turbidity – 6.9.3.4
- Assessment of Well Yield – 6.9.3.5
- Collection of Water Quality Parameters (WQIPs) – 6.9.3.6

Well Drawdown Issues – 6.9.3.2

- The lower the well recharge rate, the greater the susceptibility of the well to develop drawdown issues during well purging
- Drawdown of the water level in the well intake interval can result in a loss of volatile organic compounds (VOCs)
- The greater the drawdown in the well intake interval, the greater the potential loss of VOCs

Well Drawdown Issues – 6.9.3.2

- Limit drawdown by knowing the recharge rate of the well
- Use purging equipment that has pumping capabilities appropriate for the recharge rate of the well
- Monitor and record drawdown during well purging so changes to the purging process can occur before levels of undesirable drawdown develop

Turbidity – 6.9.3.4

- Turbidity in your ground water sample can impart a positive bias on the testing results of turbidity sensitive compounds
- The greater the turbidity, the higher the potential bias
- When sampling for turbidity-sensitive compounds, monitor and record the turbidity of the purge water, especially at the time of sample collection
- The turbidity measurement at the time of sample collection should be keyed to the sample results of the turbidity sensitive compounds

Turbidity – 6.9.3.4

To address turbidity issues:

- Consider re-developing the well
- Purge the well at lower flow rates to reduce water level drawdown and hydrologic stress on the well
- Consider using a no purge sampling method

Assessment of Well Yield – 6.9.3.5

- Determine the sustained well recharge rate of each well. The more accurate the determination, the better
- The degree of accuracy needed increases with decreasing well recharge rate
- Determine the well recharge rate before the well is sampled
- Recommend this testing occur during well development or shortly thereafter
- The well yield for each well should be tabulated and supplied to sampling crews
- Recommend well yield information be included in tables of well information

Collection of Water Quality Indicator Parameters (WQIPs) – 6.9.3.6

- Measurement of the WQIPs is recommended for the **first two sampling rounds** of each well (e.g., conductivity, dissolve oxygen (DO), oxidation reduction potential (ORP), pH, and temperature). This recommendation links the measurement of the WQIPs to the first two rounds of Volume Averaged sampling
- Measurement of the WQIPs is a critical component of the Low Flow method, so the WQIPs need to measured whenever that method is used
- Per N.J.A.C. 7:18, the samplers must be certified to measure certain WQIPs, such as DO, pH, and temperature

Test Poll #1

Test Poll #1

How, when, and where you sample ground water can impact your sampling results.

A. True

B. False

Test Poll #1

How, when, and where you sample ground water can impact your sampling results.

A. True

B. False

Vertical Profiling – 6.9.5

- Recommended by DEP to determine if there is contaminant stratification in the well intake interval
- The profiling should be performed **prior** to using any sampling method other than Volume Averaged sampling on a given well
- It only needs to be performed once on a given well before using a sampling method other than Volume Averaged

Vertical Profiling – 6.9.5

- The depth of sample collection should be documented
- **The rationale for the chosen sampling depths should be discussed in the report that contains the sampling results**
- Where contaminant concentration variation is detected, it is recommended that future sampling be biased to the depth showing the higher results
- Where future sampling does not target the highest concentration, this action should be documented, and an explanation provided

Vertical Flow – 6.9.5.5

- Samples from lower yielding wells, and wells with longer well intake intervals, may produce samples with similar results even if the contamination concentrations outside the well are stratified. This could be due to mixing of the water in the well during sampling, or vertical flow of water within the well intake interval
- Where profile testing results show similar concentrations, evaluation of the well for vertical flow should be considered
- The longer the well intake interval, the higher the probability for vertical flow in the well
- Vertical flow could be sign that the well intake interval is intersecting zones of different hydrostatic pressure

- Methods to assess vertical flow within the well:
  - Heat pulse flow meters
  - Salt slug testing (conductivity tracing)

Use of Polyethylene Tubing – 6.9.6.3.1

Preferences in Tubing Quality

Table 6.14 – Ground Water Sampling Tubing		
Type	**Description**	**Preferred Use**
PTFE (polytetrafluoroethylene) (e.g., Teflon®) tubing	A transparent, chemically inert and non-toxic material that features unmatched chemical resistance and a surface that facilitates the flow.	Teflon tubing is preferred when sampling for VOCs, due to its very low absorption rate.
TLPE (Teflon Lined Polyethylene)	Polyethylene tubing with a thin internal lining of Teflon for added chemical compatibility on the inside surface where water contacts tubing.	Similar uses to PTFE, but TLPE is less expensive.
HDPE (High Density Polyethylene)	A thermoplastic made from the monomer ethylene. Molecularly structured, reducing capacity for absorption/desorption of contaminants.	HDPE is less flexible than LDPE but has better absorption/desorption properties. HDPE preferred over LDPE for sampling.
LDPE* (Low Density Polyethylene)	A thermoplastic made from the monomer ethylene. Amorphous composition facilitates absorption/desorption of contaminants.	Acceptable for purging. Not preferred for decision making sampling due to absorption/desorption issues.
Flexible Elastomer Tubing	Flexible elastomer tubing consisting of a variety of plastic compounds.	Silicone and Tygon® are common types of flexible elastomer tubing. Silicone tubing can be used in the rollers of peristaltic pumps. Tygon is sometimes used for wastewater sampling and with automatic samplers.

Sampling of Low Yield Wells – 6.9.6.4

- Defined by NJDEP as a well that has a recharge rate of less than 100 mL/min
- These wells are difficult to purge without causing undesirable amounts of drawdown due to their low recharge rate
- Long residence times of the water in the well may lead to water in the well having higher dissolved oxygen levels and lower VOC levels than the surrounding formation water

Sampling of Low Yield Wells – 6.9.6.4

- Confirm that the well has a sustained recharge rate less than 100 mL/min and that the well was adequately developed. Provide supporting documentation
- Modification of a sampling method may be needed
- Consider using grab or passive methods
- DEP recommends collecting samples by different methods during the same sampling event (e.g., collect passive sample followed by a grab sample followed by a low flow sample). Compare results and use method producing the higher result during future sampling

The Different Sampling Methods

- Volume Average
- Low Flow
- No purge
  - Grab – e.g., Snap Sampler and Hydrasleeve
  - Passive – e.g., Polyethylene Diffusion Bag (PDB)

Volume Averaged Sampling – 6.9.6.5.1

- Volume Averaged sampling is a method where typically a minimum of 3 well volumes of water is purged from the well prior to sample collection
- The sample collected may represent a larger section of the aquifer because of the greater volume of water removed from the well
- This method generates the most purge water
- Pump depth and water level drawdown in the well should be monitored and recorded
- NJDEP recommends the same pump and tubing be used for purging & sample collection

Volume Averaged Sampling

- Where the water level is above the well intake interval, actions should be taken to make sure that the sample does not contain stagnant casing water
- Drawdown to the top of the well intake interval is acceptable in this situation
- Where the casing water is isolated or removed, the purge volume can now be recalculated based on the volume of water in the well intake interval

Low-Flow Purging and Sampling – 6.9.6.5.2

This method involves purging the well at a relatively low flow rate that minimizes sample turbidity

The WQIPs are measured and recorded during purging. When variation of the WQIPs has stabilized, the sample can be collected. The stabilization criteria for each parameter is defined in the manual

- Lower potential for drawdown issues due to lower pumping rate
- Lower potential for turbidity issues since it should induce less stress on the well intake interval
- Generates less purge water

Low-Flow Purging and Sampling – 6.9.6.5.2

- The sample may represent a smaller area of the well intake interval than a Volume Averaged sample
- It is recommended the water quality in the well be vertically profiled before use of the method
- The method is not recommended for initial or closeout sampling of a well unless only sampling for turbidity-sensitive compounds

No Purge – Grab Sampling 6.9.6.5.3

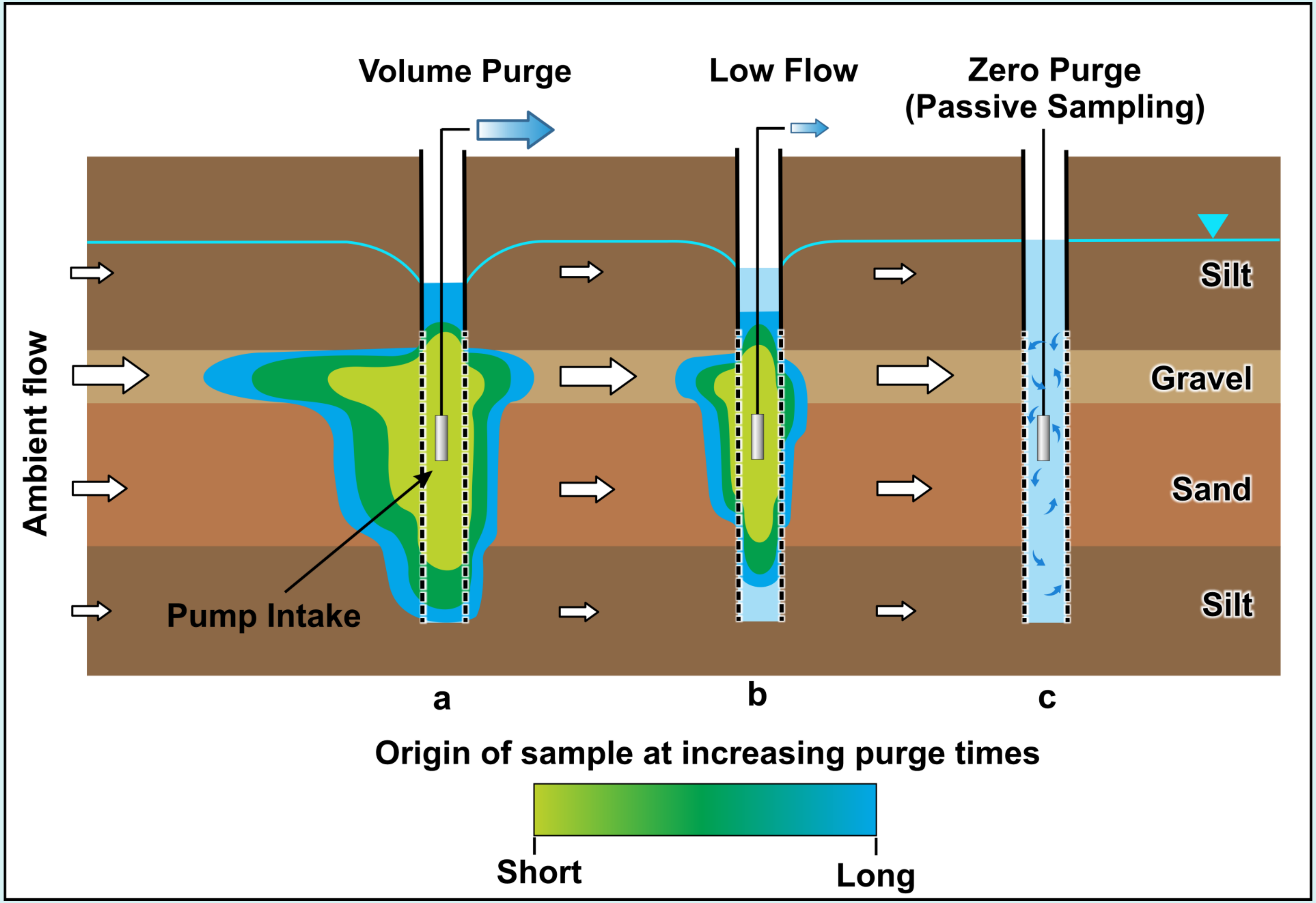
- This method generates no purge water
- The sample only represents the depth/zone of the collected water
- It is recommended the water quality in the well be vertically profiled before use of the method
- Due to the limited zone of capture by these devices, these devices are not recommended for initial or closeout sampling of a well, unless only sampling for turbidity-sensitive compounds

Passive Sampling – 6.9.6.5.3.1

- A type of grab sample dominated by the use of thin-membrane diffusion bags
- To be detected, the contaminant of concern must be able to cross the device membrane
- There is no purging, so the device only picks up contamination directly in contact with it
- The sampling devices are filled with laboratory-supplied clean water prior to deployment
- Use requires the device to be placed in the well at least two weeks prior to device retrieval. Certain compounds or devices may require longer deployment periods

Passive Sampling – 6.9.6.5.3.1

- The sampling device should be placed in the well intake interval
- The sampling device must remain completely submerged when in the well
- It is recommended that the water quality in the well be vertically profiled before use of the method
- Due to the small zone of capture by these devices, they are not recommended for initial or closeout sampling of a well unless only sampling for turbidity-sensitive compounds


Volume Purge
Low Flow
Zero Purge
(Passive Sampling)
Ambient flow
Silt
Gravel
Sand
Silt
Pump Intake
a
b
c
Origin of sample at increasing purge times
Short
Long

Temporary Well Points – 6.9.6.6

- Advances in sampling equipment size has rendered the 1994 NJDEP Alternate Ground Water Sampling Techniques Guide obsolete. NJDEP no longer supports the well construction methods in that document
- Guidance on temporary well points is now taken from the updated FSPM
- The 2018 revision of the well construction regulations (N.J.A.C. 7:9D) now allows for temporary wells to be installed for up to 72 hours before abandonment

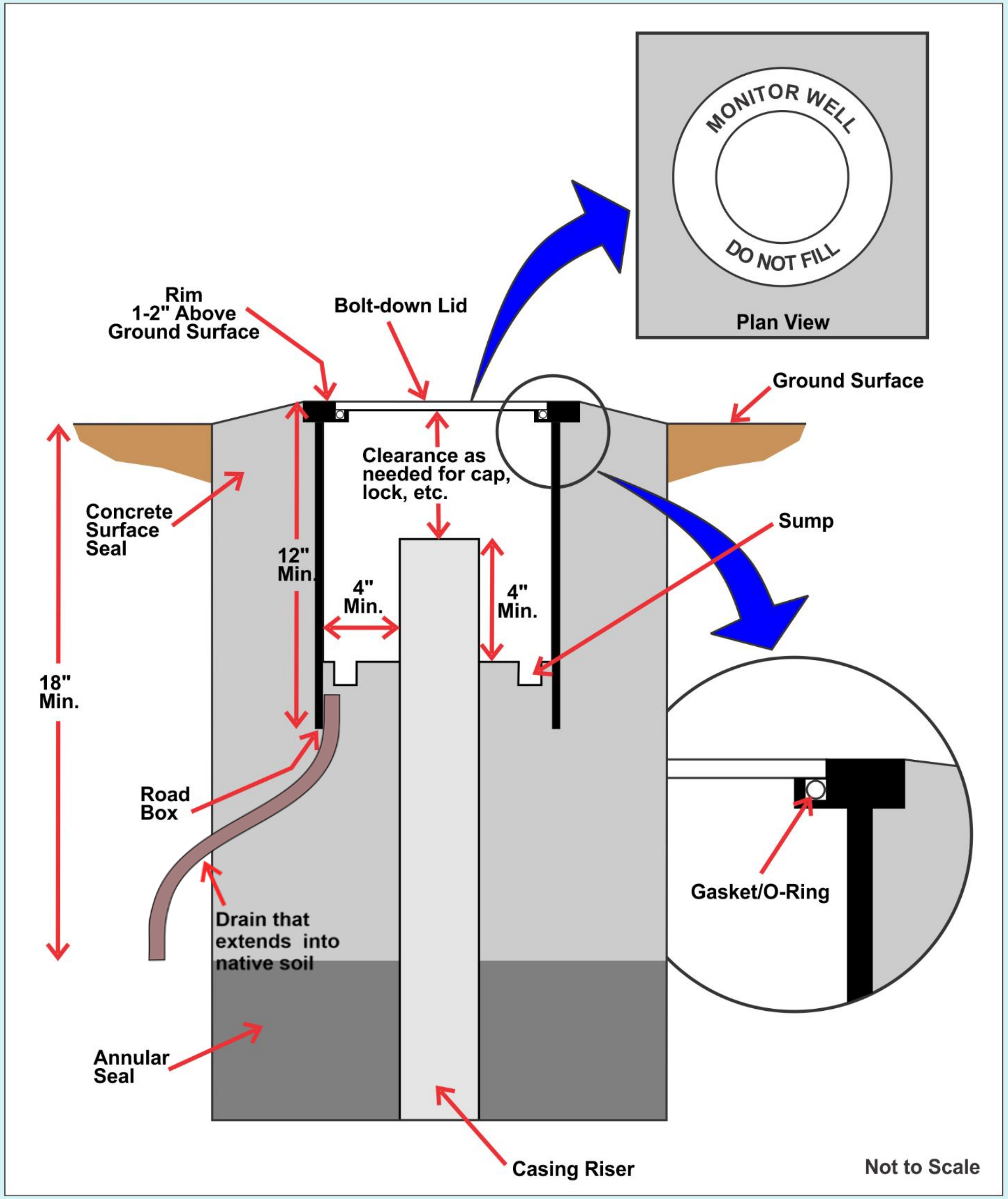
Temporary Well Points - 6.9.6.6

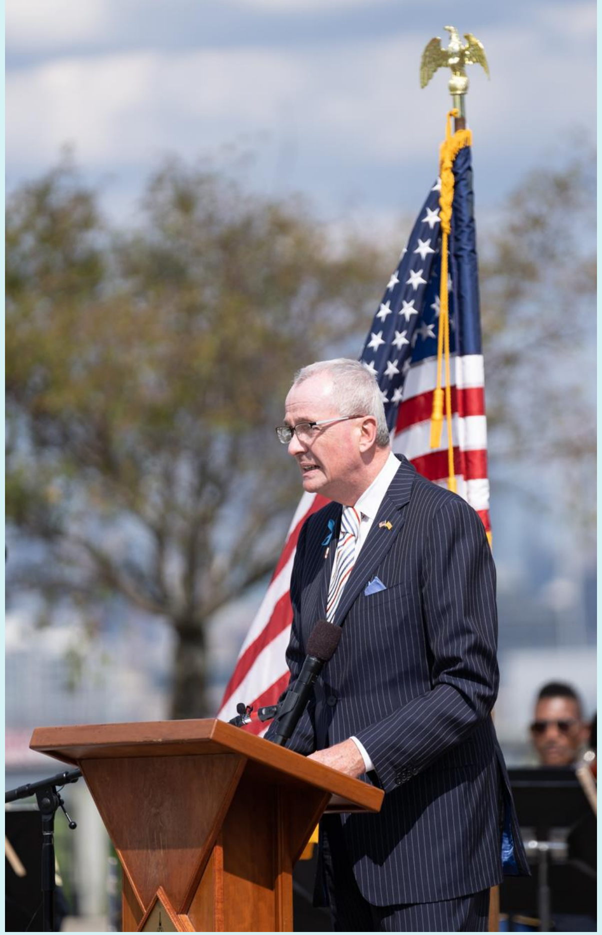
- NJDEP recommends that measures be taken to develop temporary well points prior to sampling
- NJDEP recommends temporary well points be sampled by the Volume Averaged method where possible
- Sample depths should be biased based on existing site information
- When used for delineation purposes, samples should be collected following the guidance for vertical profiling

FSPM Ground Water Sampling 6.9

Appendix 6.1 – Monitoring Well Construction and Installation (Figure A.6.3)

Figure modified to show the addition of a drain that directs water from inside the flush-mount box to the surrounding soils





Thank you!

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FSPM Chapter 7: Field Analysis

February 29, 2024

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Posted for use December 2023

Chapter 7 Overview

Chapter 7 focuses on:

- Streamlining the collection of data in the field
- The role of, application of, and choosing the appropriate field analytical instrumentation
- Quality assurance requirements for the data collection

Chapter 7 Field Analysis

CSRR

7.1 Introduction

7.2 Role of Field Instruments According to the NJDEP Technical Requirements for Site Remediation, N.J.A.C. 7:26E

7.3 Application of Field Instruments to Acquire Data

7.4 Choosing Appropriate Field Analytical Instruments for Contaminant Investigation

- 7.4.1 Considerations When Selecting Field Analytical Instruments
- 7.4.2 Listing Limitations and Interferences for Selected Field Analytical Instruments

7.5 Field Screening Instruments/Characterization Tools

- 7.5.1 Field Detection of Volatile Organic Compounds (VOCs)
- 7.5.2 Field Detection of Semi-Volatile Organic Compounds (SVOCs)
- 7.5.3 Field Detection of Polychlorinated biphenyls (PCBs) and Polycyclic aromatic hydrocarbons (PAHs)
- 7.5.4 Field Detection of Metals
- 7.5.5 Field Detection of Hydrocarbons

7.6 Data Quality Levels for Implementation of Field Analytical Methods

7.7 Quality Assurance Requirements

- 7.7.1 Preliminary or Field Screening Data (Data Quality Level 1)
- 7.7.2 Effective Data or Field Analysis Data (Data Quality Level 2)

Chapter 7 Key Updates

CSRR

Field Instruments/Characterizations Tools have been updated

- Portable Gas Chromatograph (GC)
- Organic Vapor Analyzers (OVA)
- Photoionization Detector (PID)
- Flame Ionization Detector (FID)
- Membrane Interface Probe (MIP)
- Petroleum Hydrocarbon Analyzer
- Assay Test Kits
- Polychlorinated Biphenyl (PCB) Analyzers
- X-Ray Fluorescence (XRF) Analyzer
- Laser Induced Florescence (LIF)
- Dye-enhance LIF (Dye LIF)
- Optical Image Profiler (OIP)
- Tar-specific Green Optical Screening Toot (TarGOST®)
- Ultra Violet Optical Screening Tool (UVOST®)

Chapter 7 Key Updates

CSRR

Hand-Held Units

PID

Portable GC

XRF

FID

OVA

Chapter 7 Key Updates

Hand-Held Units

Advantages:

- Mobile
- Light Weight
- Quick Results
- Wide Range of Sensitivity
- Wide Range of Chemicals

Limitations:

- Rental cost
- Field Analysis to laboratory analytical results are not always comparable
- Battery Life
- Weather durability
- Semi Quantitative and Qualitative Results

Chapter 7 Key Updates

Field Analyzers and Assay Kits

Total Petroleum Hydrocarbon (TPH)/Petroleum Hydrocarbon Analyzer (PHA) Kits

Chapter 7 Key Updates

Field Analyzers and Assay Kits

PCB Kits

Chapter 7 Key Updates

CSRR

Field Analyzer and Assay Kits

Advantages:

- Provides field results in relatively short timeframe
- Reduces the amount of laboratory analytical samples to evaluate remediation goals
- Allows for field decisions to expedite site investigations and remediation and waste disposal
- Relatively easy to use with training
- Kits are relatively inexpensive per tube kit vs laboratory analysis

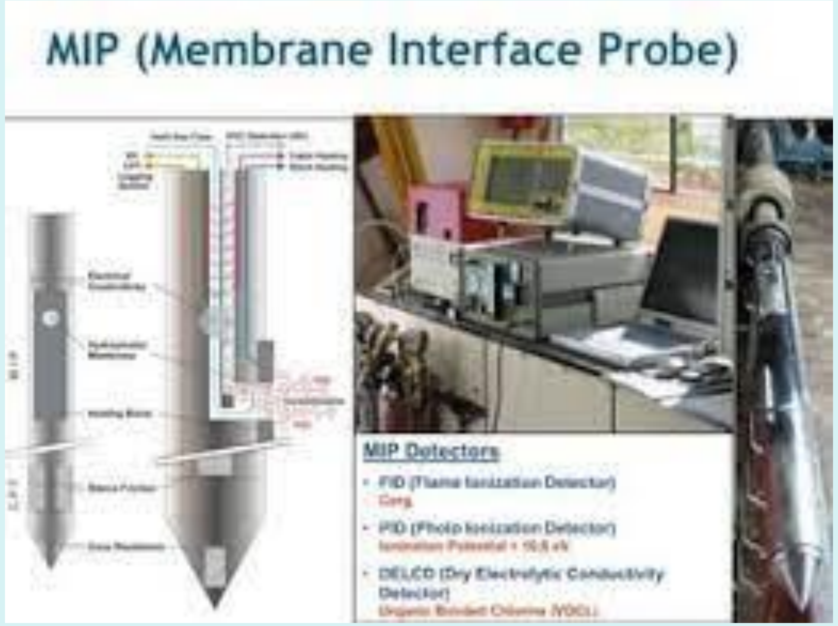
Limitations:

- Assay requires extraction and is not an instantaneous reading/measurement
- Requires purchasing test kits which are expendable and have a shelf life
- Kits are temperature sensitive
- Kits have some reagents that are photosensitive
- Data collected is for screening purposes and typically does not replace laboratory analytical data as point of compliance for regulatory purposes
- Assay kits require analyzer to provide testing results in the field
- Kits have a minimum detection limit that may not meet project goals

Chapter 7 Key Updates

Direct Sensing Equipment for Field Detection of Hydrocarbons

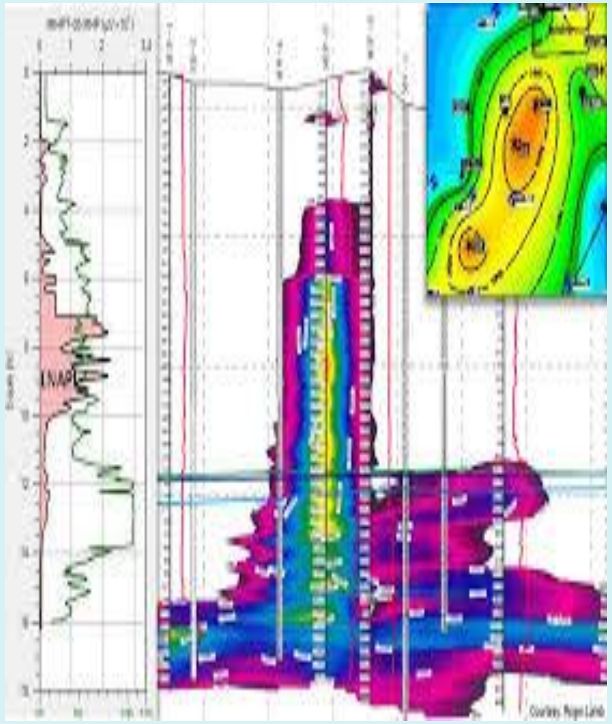
- MIP
- LIF
- DyeLIF
- OIP
- TarGOST®
- UVOST®

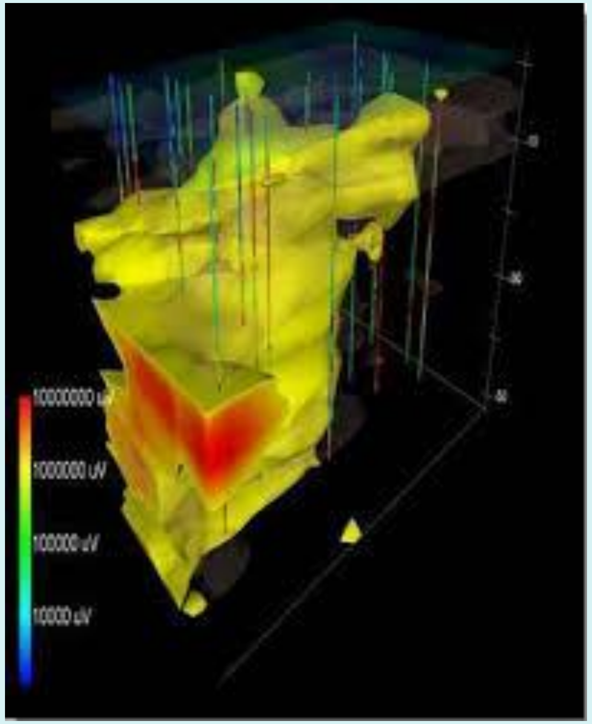


Chapter 7 Key Updates

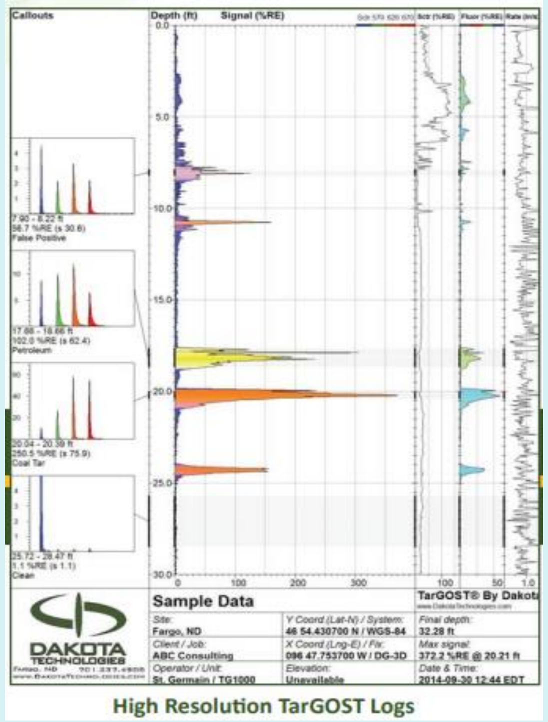
Direct Sensing Equipment Outputs

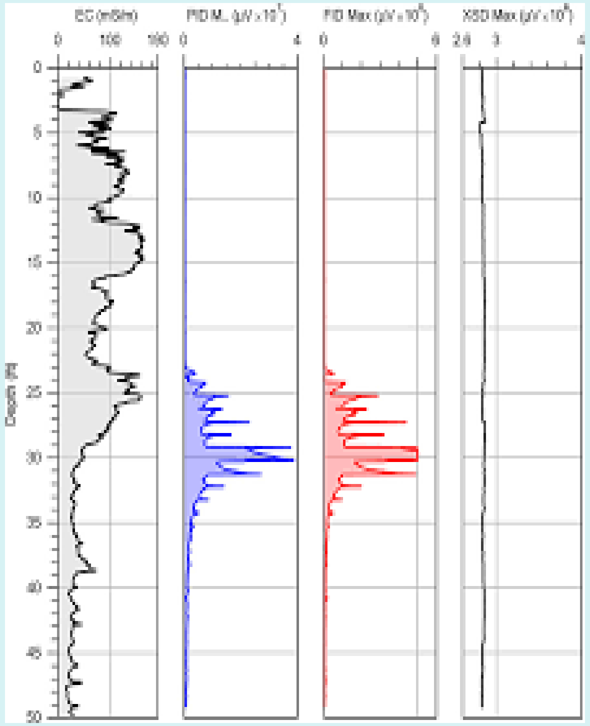
2D/3D Models





Graphs





Chapter 7 Key Updates

CSRR

Direct Sensing Equipment

Advantages:

- Real-time data/readings
- Detects in soil, groundwater, Non-Aqueous Phase Liquid (NAPL)
- 3D results/Graphical Outputs
- Wide Range of Sensitivity
- Can be combined with other direct-push tools to provide additional direct read results

Limitations:

- Field equipment cost/rental
- Lithology
- Requires experience operating and understanding equipment
- Range of contaminants
- Semi Quantitative and Qualitative Results
- Equipment availability
- Requires space/staging area/work zone

Chapter 7 Key Updates

CSRR

Data Quality Objective (DQO) Levels and Classifications

- Preliminary or Field Screening Data (DQO Level 1) – PID, FID, etc.
    - Screening data
    - Typically not compound specific or quantitative
- Effective Data or Field Analytical Data (DQO Level 2) – Portable GC, XRF, etc.
    - Data is “effective” when a portion is verified by lab analysis
    - Verified data generated via EPA-approved methods

Chapter 7 Key Updates

Data Quality Objective (DQO) Levels and Classifications

- Meticulous or Definitive Data (DQO Level 3) – Lab Analyzed Samples
  - Methods used determines identity and concentrations
  - Data generated with approved lab methods and QA/QC deliverables per N.J.A.C. 7:26E
- State of the Art Data
  - Methods developed specifically for a particular site

Chapter 7 Key Updates

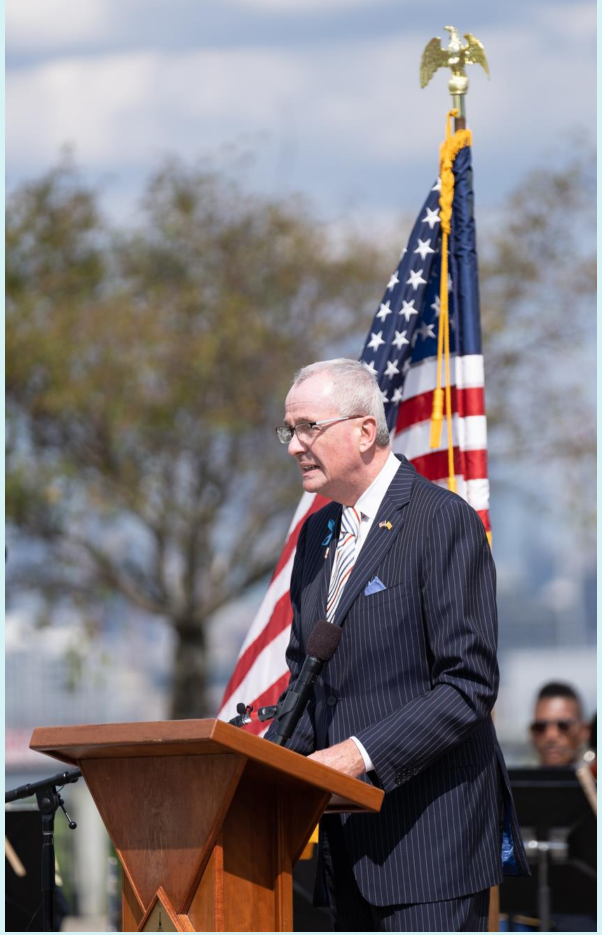
Quality Assurance Requirements

- DQO Level 1
  - Screening data should only be considered indicator
  - QC limited to calibration, maintenance logs, etc.
- DQO Level 2
  - Effective data are intended for rapid contaminant delineation
  - Field analysis can be semi-quantitative and semi-qualitative
  - Data can achieve high degree of reproducibility when QA/QC is conducted
    - QA deliverables includes calibration curves, field dups, blanks, non-conformance summary, etc.

Chapter 7 Key Updates

Quality Assurance Requirements

- DQO Level 3
  - Definitive data is intended to generate most reliable data practicable
  - Laboratory methods are supported with full or reduced lab data deliverables in accordance with N.J.A.C. 7:26E Appendix A
- State-of-the-Art
  - Methods are developed for a particular site or contaminant
  - Method(s) may have variable deliverable requirements
  - Method(s) will be proposed by the laboratory or person performing the analysis and evaluated by NJDEP for each method proposed



Thank you!

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FSPM Chapter 8: Geophysical Techniques

February 29, 2024

Mike Gagliano, Geologist
Bureau of Water Resources and Geoscience

Chapter 8 Geophysical Techniques

8.1 Introduction

8.2 Ground Penetrating Radar (GPR)

8.3 Magnetometer

8.4 Gravimetry

8.5 Electrical Resistivity

8.6 Induced Polarization (IP)

8.7 Electromagnetics

8.8 Very-low Frequency (VLF) Electromagnetics

8.9 Seismic

8.10 Borehole Geophysical Methods

Chapter 8 Overview

CSRR

- The use of geophysical techniques for the investigation of contaminated sites can provide a rapid and cost-effective option for remediation activities
- Chapter 8 details different geophysical techniques, and the advantages and limitations of each

Chapter 8 Key Updates

- Advancement of the equipment from analog to digital
- Commercial based processing software
- Accurate handheld and integrated GPS
- Unit changes

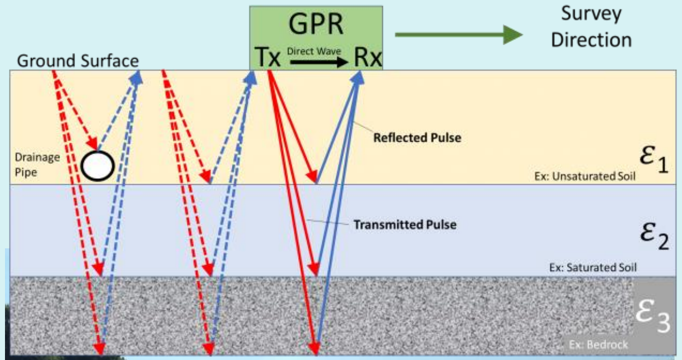
Chapter 8.1: Introduction (Applications)

- Locating anthropogenic objects:
  - Underground storage tanks (USTs)
  - Utilities
  - Wells
  - Septic
  - Landfills
- Ground water and surface water investigations
- Aquifer mapping
- Contaminant plume mapping
- Saltwater intrusion
- Geologic mapping
- Remediation monitoring

Chapter 8.1: Introduction (Tool/Method Selection)

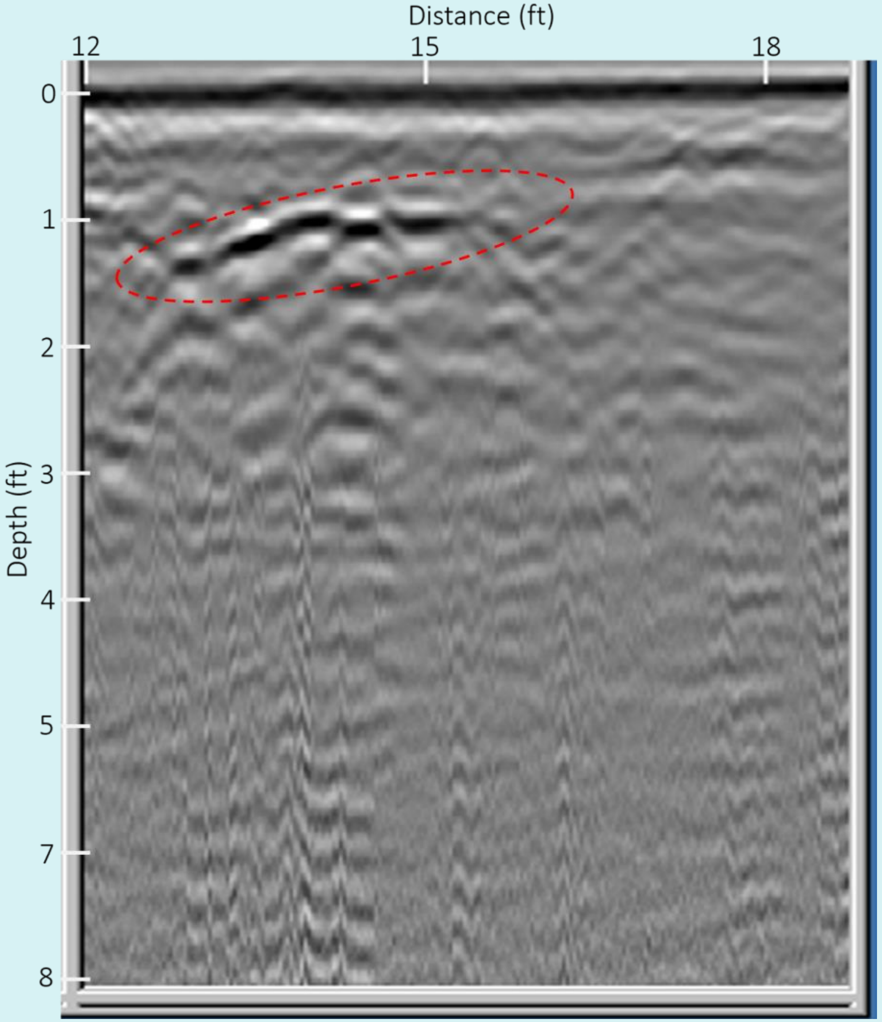
- Target
- Geology
- Site infrastructure
- Time

Chapter 8.2: Ground Penetrating Radar (GPR)



- **Principle**: GPR operates on the principle of sending electromagnetic pulses into the ground and measuring the reflections to create subsurface images
- **Data Processing**: Raw GPR data undergoes signal processing to filter noise and enhance features
- **Depth of Investigation**: Dependent on the frequency of the antenna, with higher frequencies providing better resolution but shallower penetration
- **Applications**: Utility mapping, USTs, contaminant mapping, archaeology
- **Limitations**: GPR may face challenges in penetrating certain materials like clay or conducting surveys in highly conductive environments

Chapter 8.2: Ground Penetrating Radar (GPR)



Test Poll #2

Test Poll #2

Ground Penetrating Radar (GPR) can be used to…

A. Map utilities
B. Find USTs
C. All of the Above
D. None of the Above

Test Poll #2

Ground Penetrating Radar (GPR) can be used to…

A. Map utilities
B. Find USTs
C. All of the Above
D. None of the Above

Chapter 8.3: Magnetometer

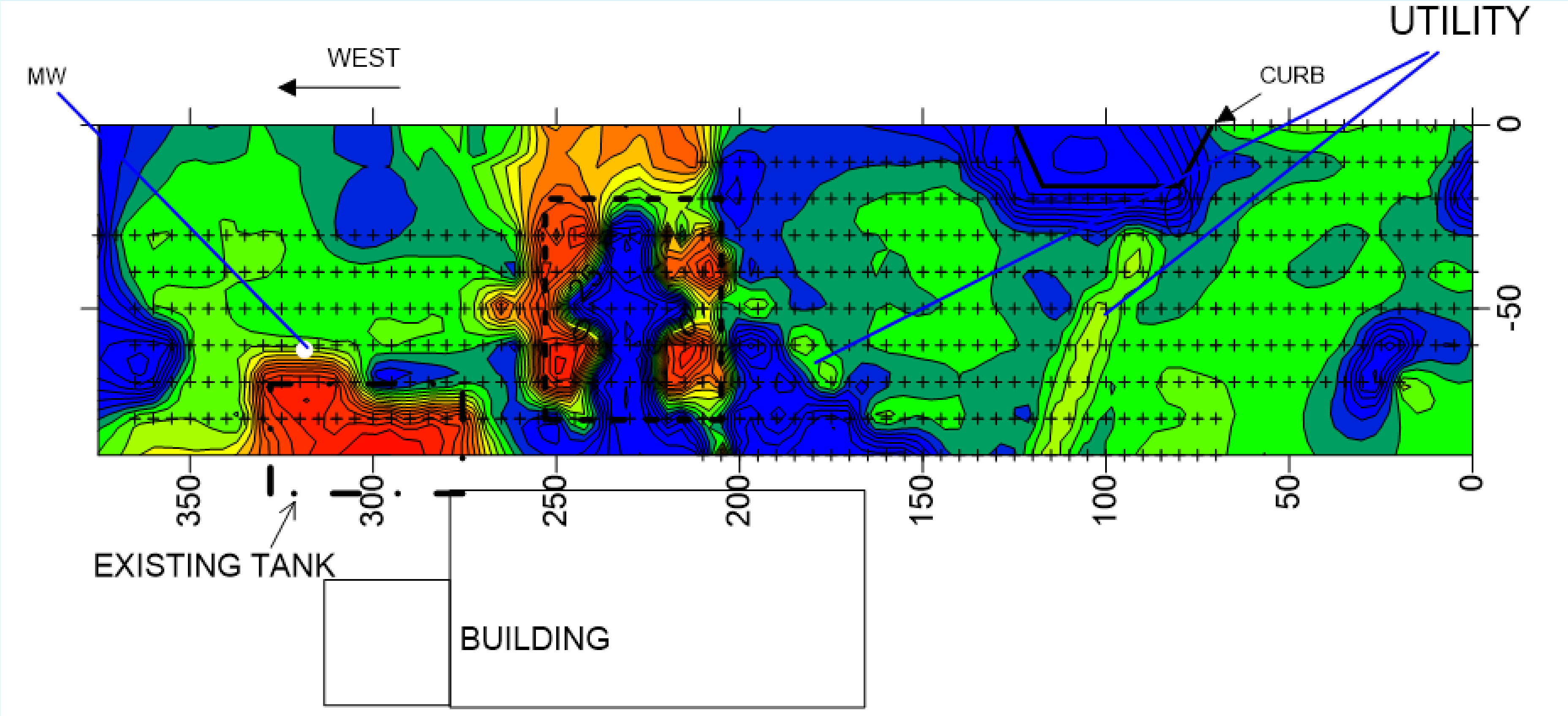
- **Principle**: Magnetometers are instruments designed to measure the strength and direction of magnetic fields in their vicinity

- **Data Processing**: The data should be corrected for diurnal variations of the magnetic field. Data points that coincide with surface metals or infrastructure should be noted or removed. After these corrections are made, the record should be plotted in profile form

- **Applications**: Can indicate the presence of magnetic subsurface features, such as USTs, ferrous utilities, archaeological artifacts, or unexploded ordnances (UXO)

- **Limitations**: External magnetic interference, such as from power lines or ferrous objects, can affect magnetometer readings. Filtering and compensation techniques are employed to reduce noise

Chapter 8.3: Magnetometer



Chapter 8.4: Gravity

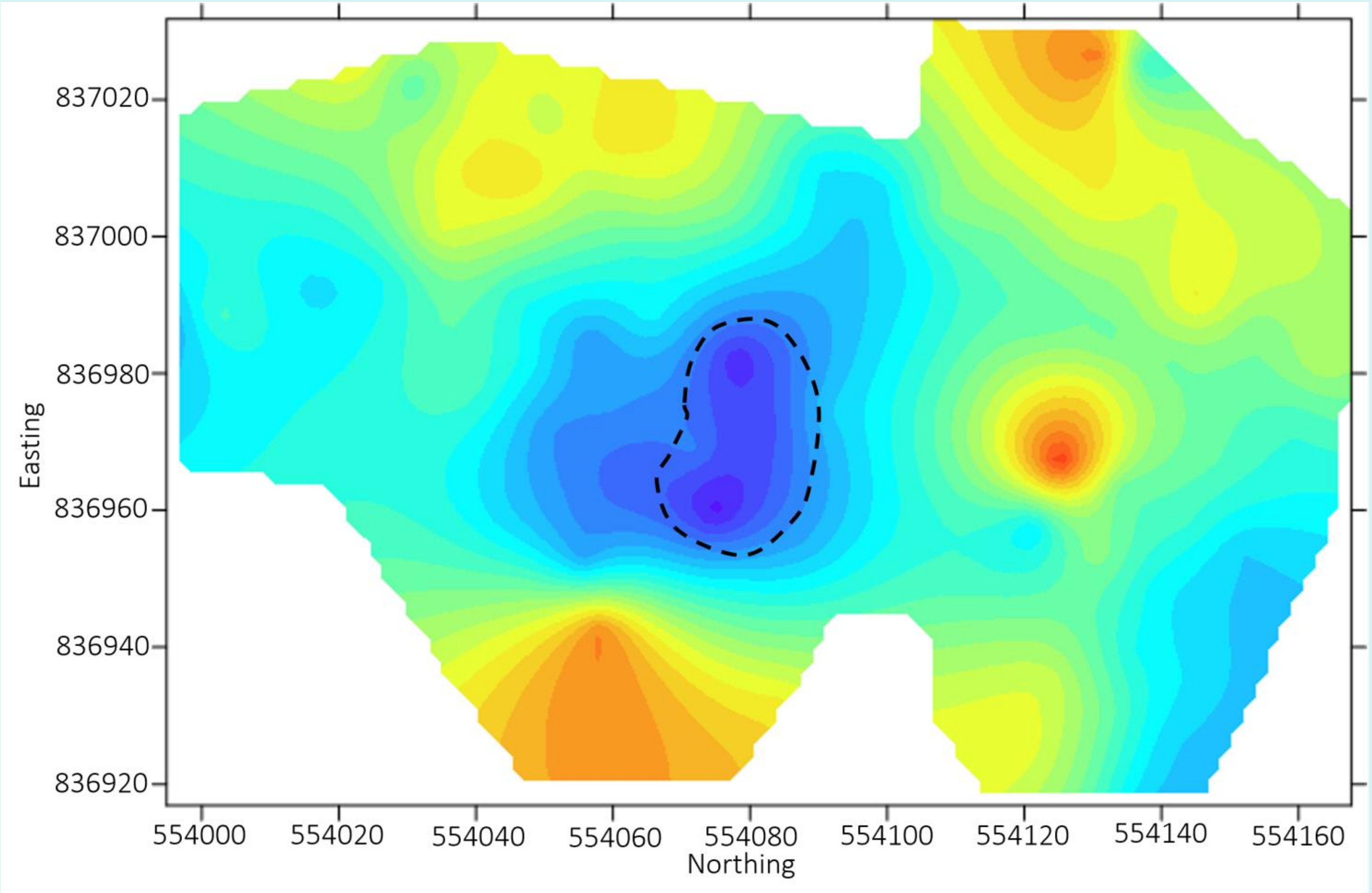
- **Principle**: The gravity method involves measuring the gravitational acceleration at a specific location on the Earth's surface

- **Data Processing**: Gravity data undergo inversion techniques to create subsurface density model. Gravity measurements are affected by the elevation of the measurement point. The free-air correction is applied to account for the change in gravitational acceleration with height above sea level. The Bouguer correction compensates for the gravitational effect of subsurface masses

- **Applications**: Karst/sinkhole detection, subsurface mapping, mineral exploration, petroleum exploration, and studying the structure of the Earth's crust

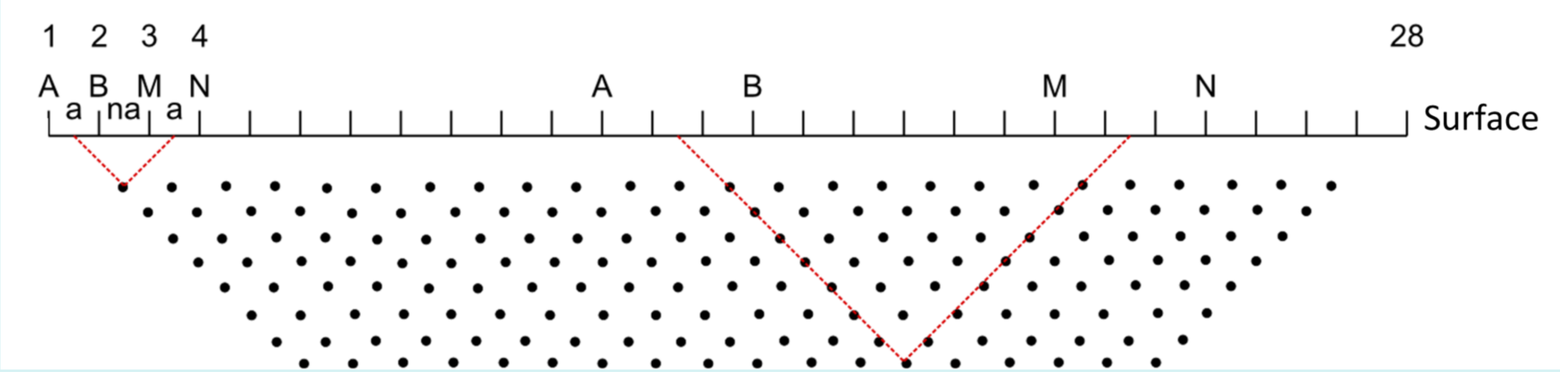
- **Limitations**: Each station must be precisely surveyed for elevation and latitude, which can be costly and time consuming. Processing is also computationally intensive. Gravity meters require precise calibration

Chapter 8.4: Gravity

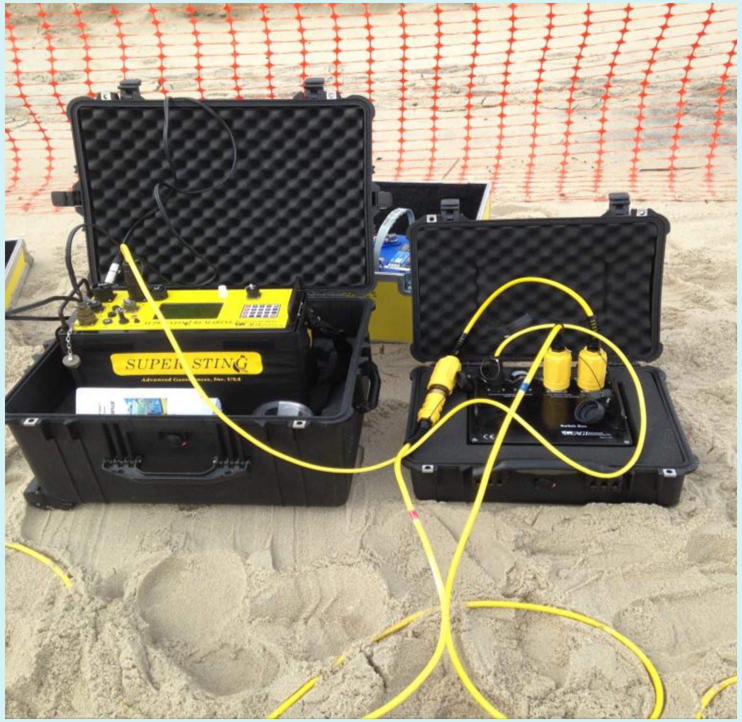


Chapter 8.5: Electrical Resistivity

- **Principle:** Electrical resistivity tomography (ERT) is used to map and image subsurface structures based on variations in subsurface electrical resistivity. ERT involves injecting a controlled electric current through current electrodes into the ground and measuring resulting electrical potentials at potential electrodes. Differences in resistivity values of subsurface materials, influenced by composition, porosity, and moisture content, are used to construct a resistivity model representing a cross-sectional view of the subsurface



Chapter 8.5: Electrical Resistivity



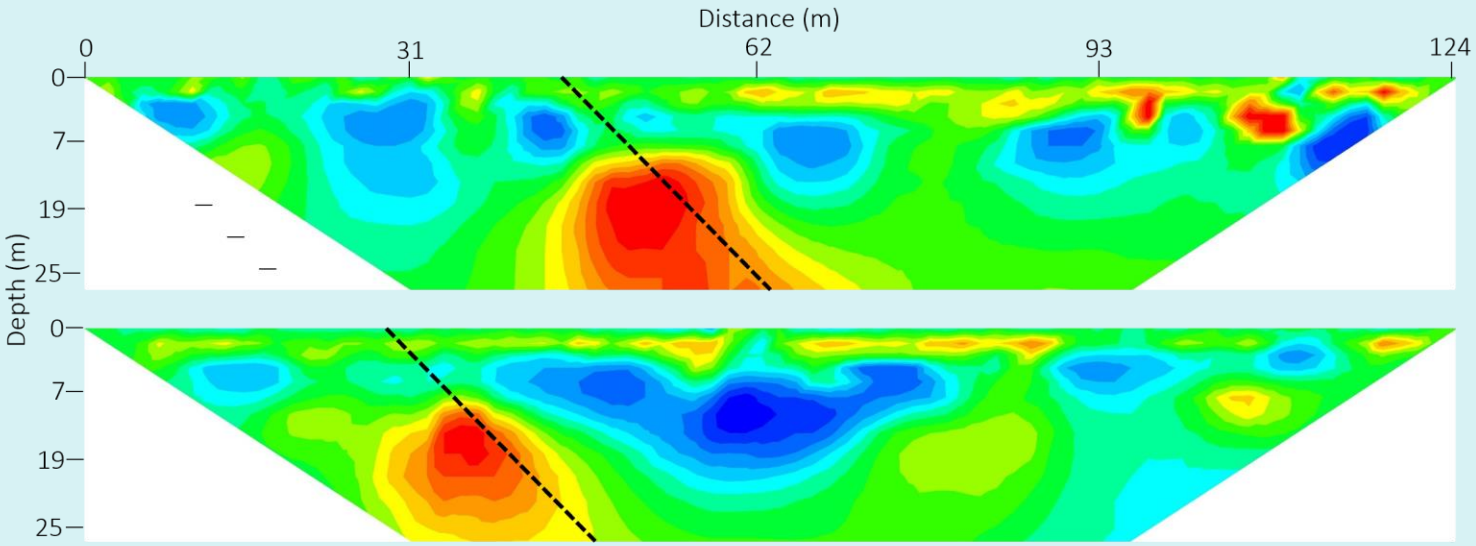
- **Data Processing**: The software uses a forward and inverse modeling procedure to create a synthetic data set based on measured apparent resistivity

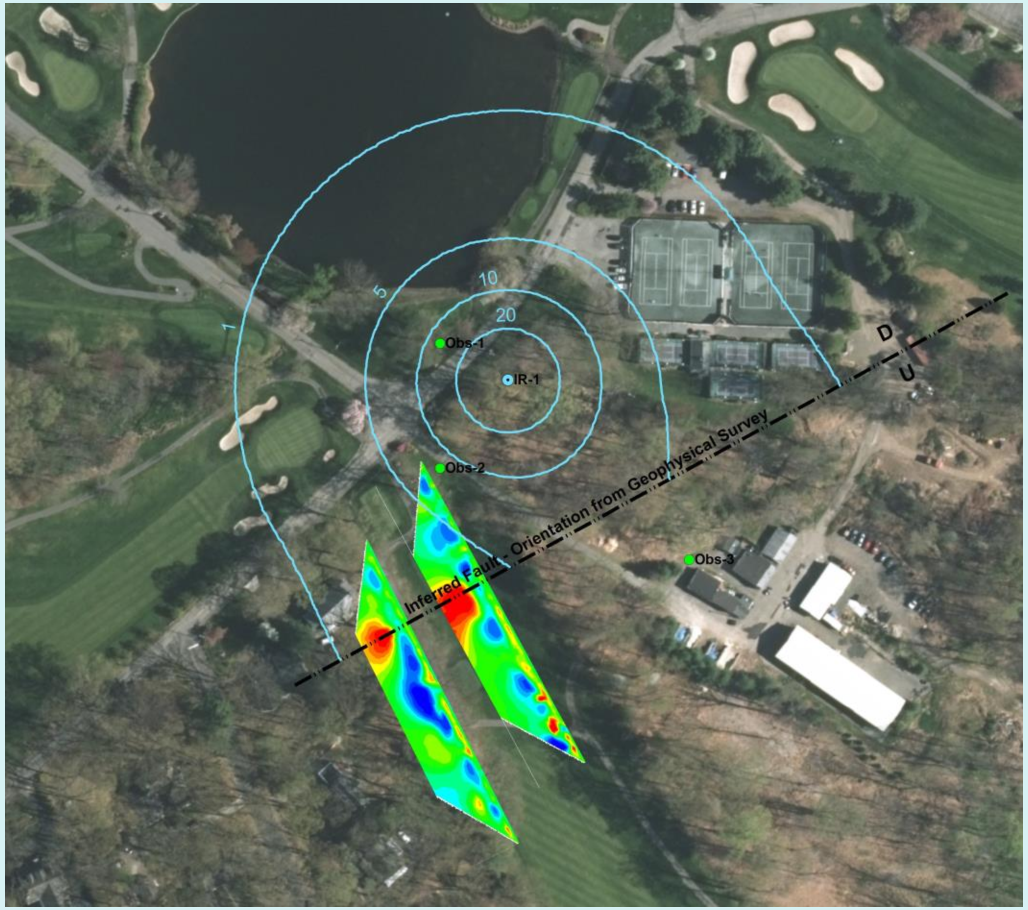
- **Depth of Investigation**: Approximately 20%-25% of the array length. Larger electrode spacings provide better depth but lower resolutions

- **Applications**: Ground water characterization, salt-water intrusion, karst/sinkhole investigations, archeology, fault identification, remediation monitoring

- **Limitations**: Arid soil, overhead or buried power lines, weather (recent rain), inversions are non-unique

Chapter 8.5: Electrical Resistivity





Chapter 8.6: Induced Polarization (IP)

- **Principle**: Induced polarization is based on the ability of certain materials to store electrical charge temporarily when subjected to an electric current

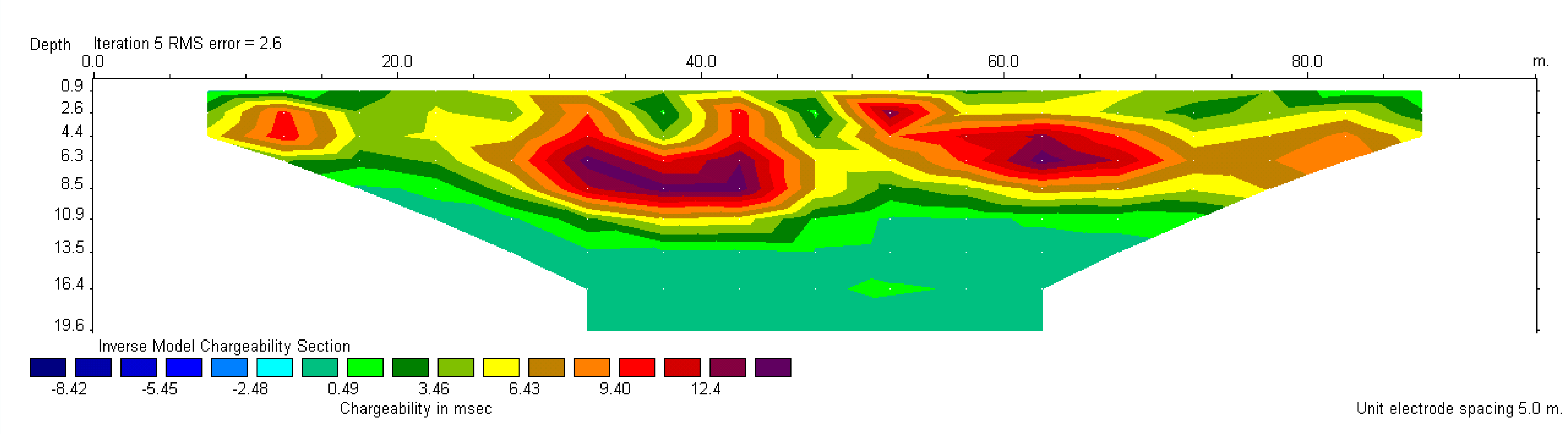
- **Data Processing**: Interpretation of IP data involves inversion techniques to create models of subsurface chargeability and resistivity distribution. These models help identify geological features

- **Depth of Investigation**: IP is effective for shallow investigations, typically up to a few hundred meters

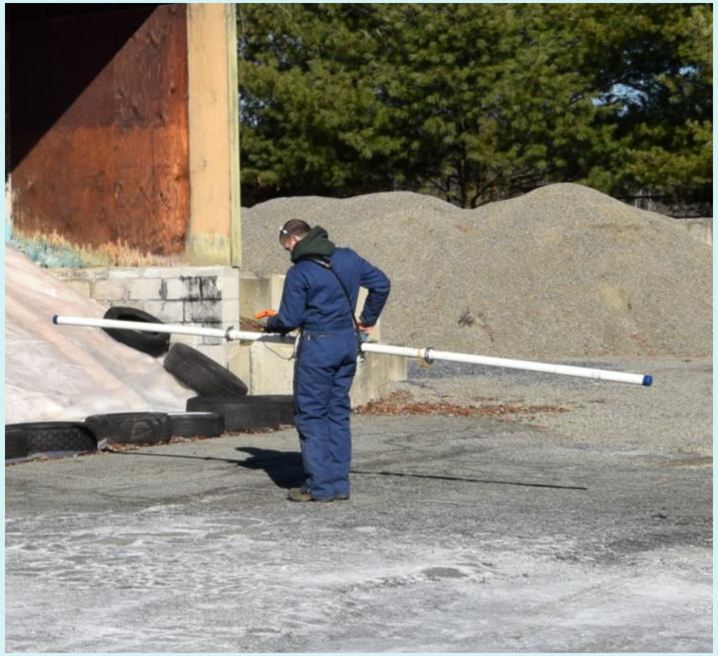
- **Applications**: Mapping clays, contaminants, hydrogeological boundaries, mineral exploration

- **Limitations**: Challenging to collect, process and interpret. Generally, need high signal to noise. Long collection times due to stacking

Chapter 8.6: Induced Polarization (IP)

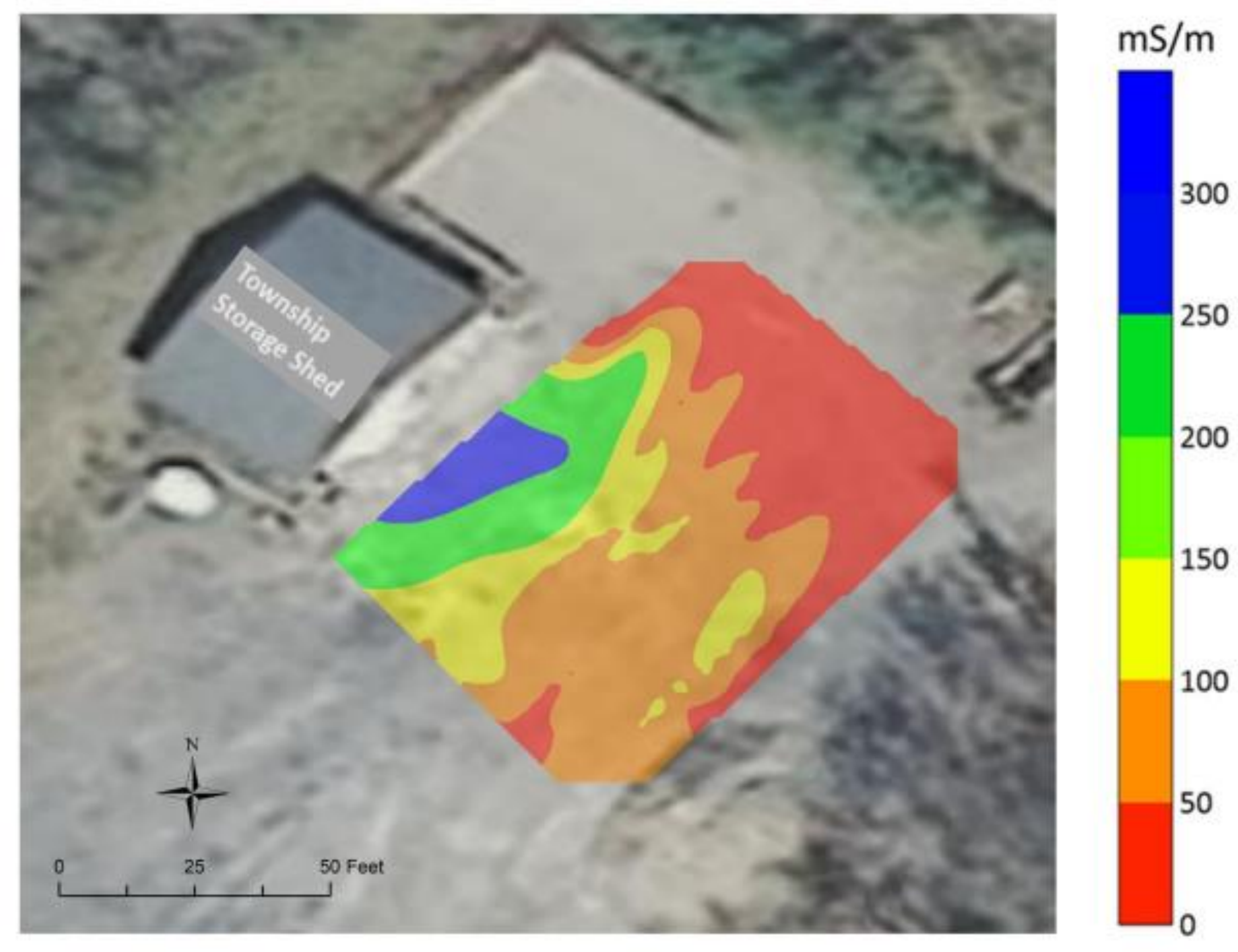


Chapter 8.7: Electromagnetics (EM)



- **Principle**: The EM method uses electromagnetic waves for subsurface exploration. These waves are typically induced by transmitting alternating current through a transmitter coil or loop
- **Data Processing**: EM data can be presented as a contour plot of apparent conductivity or inversion techniques applied to generate a subsurface model
- **Depth of Investigation**: Approximately 150% the intercoil spacing when coils are horizontal, 75% the intercoil spacing when coils are vertical
- **Applications**: Locating UXO, utilities, drums, tanks, mapping soil and ground water salinity, mapping contaminant plumes, time lapse monitoring
- **Limitations**: Generally shallow depth, less reliable in high conductivity environments

Chapter 8.7: Electromagnetics (EM)



Chapter 8.8: Very Low Frequency

- **Principle**: VLF method uses electromagnetic waves in the frequency range of 3 kHz to 30 kHz. These waves are generated from transmitters set up for military communications

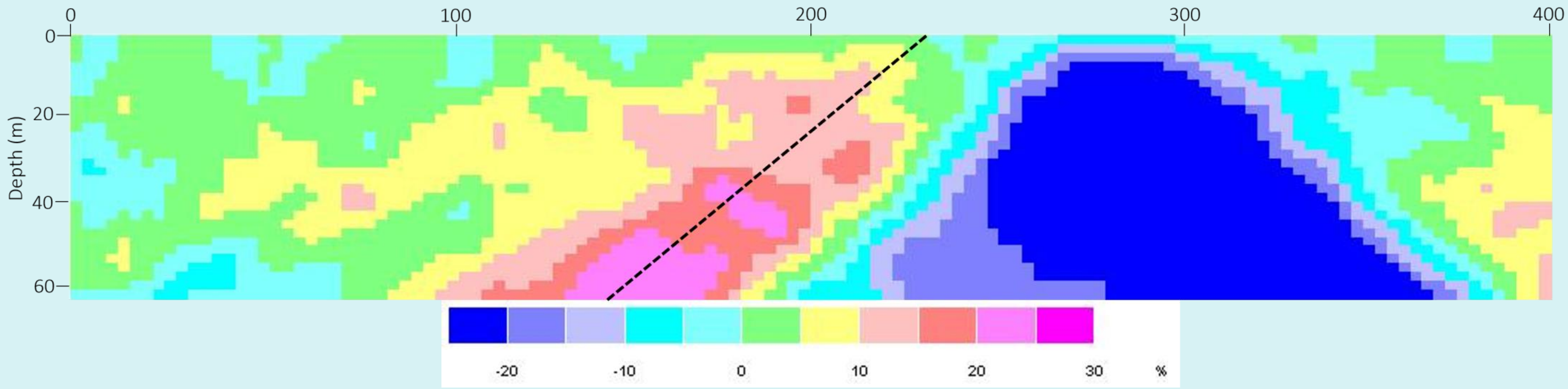
- **Data Processing**: The conductor is located horizontally at the inflection point marking the crossover from positive tilt to negative tilt and the maximum in field strength

- **Depth of Investigation**: VLF method is effective for shallow investigations, typically up to a few hundred meters

- **Applications**: VLF is particularly useful for mapping conductive bodies, such as mineral deposits, ground water, and geological structures with contrasting conductivity

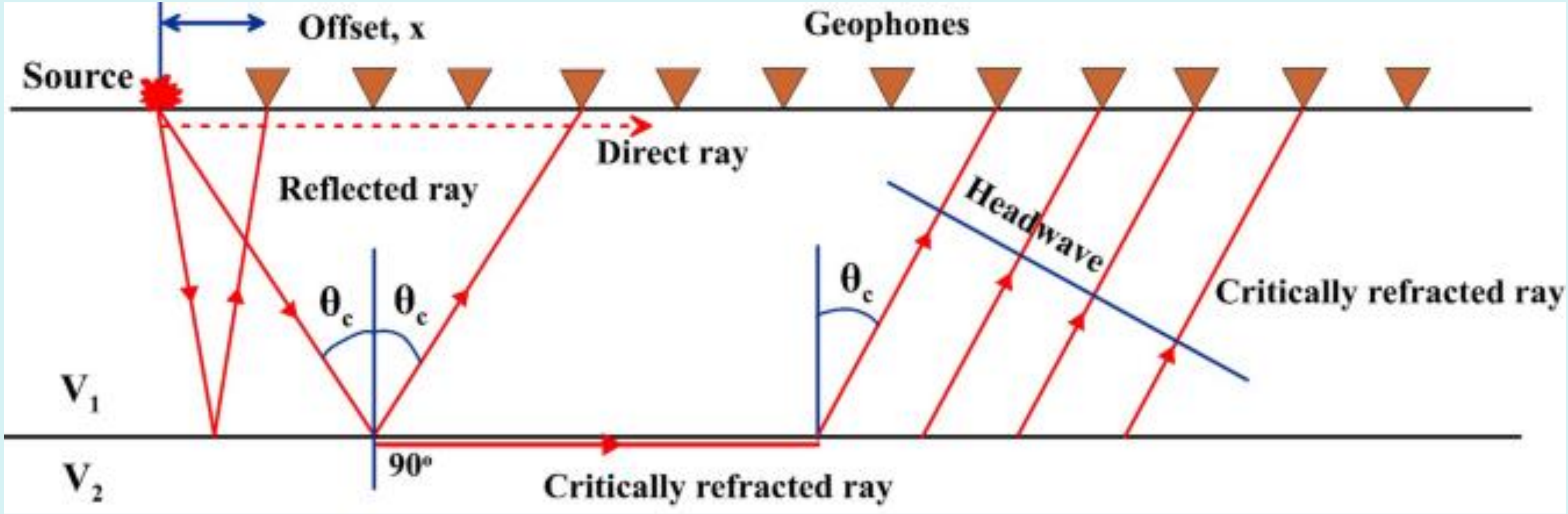
- **Limitations**: Limited depth in highly conductive bodies, the frequency results in anomalies from unwanted sources (creeks, marsh edges, topographic highs)

Chapter 8.8: Very Low Frequency



Chapter 8.9: Seismic

Principle: Seismic surveys involve the generation and detection of seismic waves. Seismic waves are typically generated using controlled sources such as sledgehammers, weight drops, vibrators, or explosive charges. Seismic waves undergo reflection and refraction at subsurface interfaces with different acoustic properties and the analysis of these reflections and refractions provides information about the subsurface structure



Chapter 8.9.3: Seismic Refraction Method

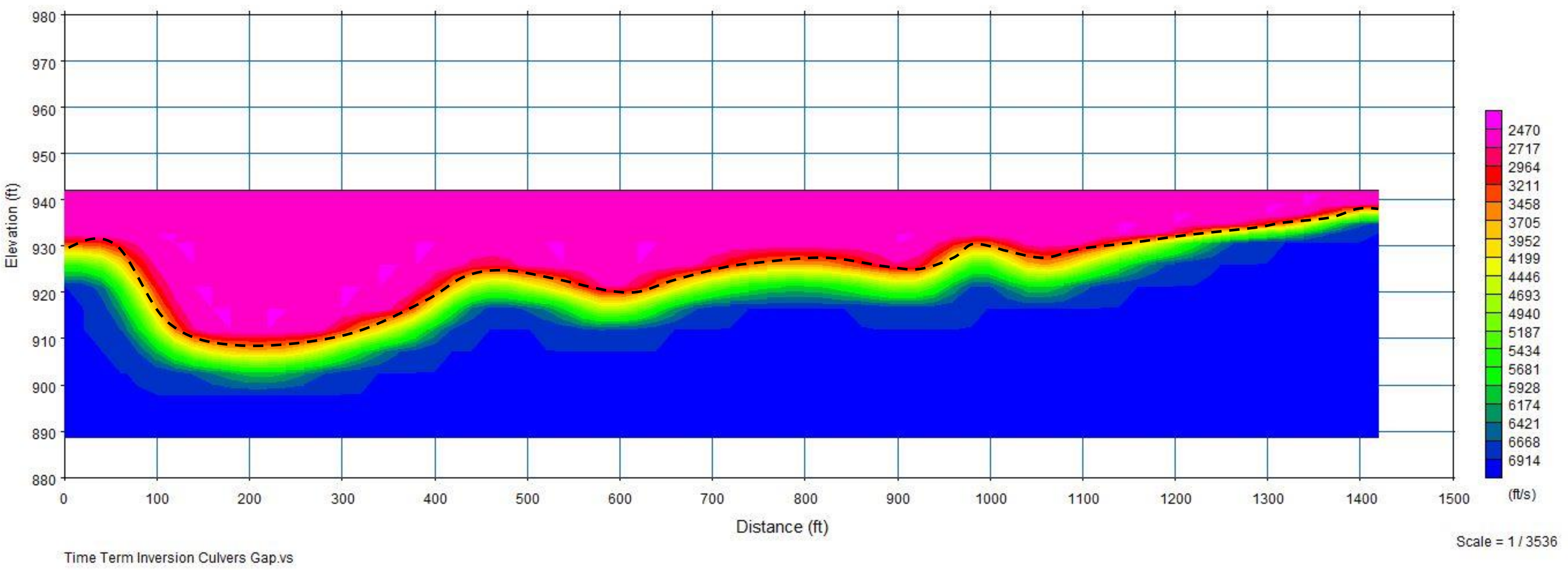
- **Data Processing**: The first arrival times of these seismic waves are picked, and velocity analysis is performed, revealing the apparent seismic velocity of subsurface layers. An inversion of the data can then be performed to generate a model of the subsurface

- **Depth of Investigation**: Typically, 25% of the distance of the spread cable, however in practice this is also limited by the seismic source

- **Applications**: Depth to water table, depth to bedrock, karst/sinkhole mapping, and mapping faults/fractures

- **Limitations**: Limited depth, difficulty resolving thin and/or dipping layers, assumed velocity increase with depth

Chapter 8.9.3: Seismic Refraction Method



Chapter 8.9.4: Seismic Reflection Method

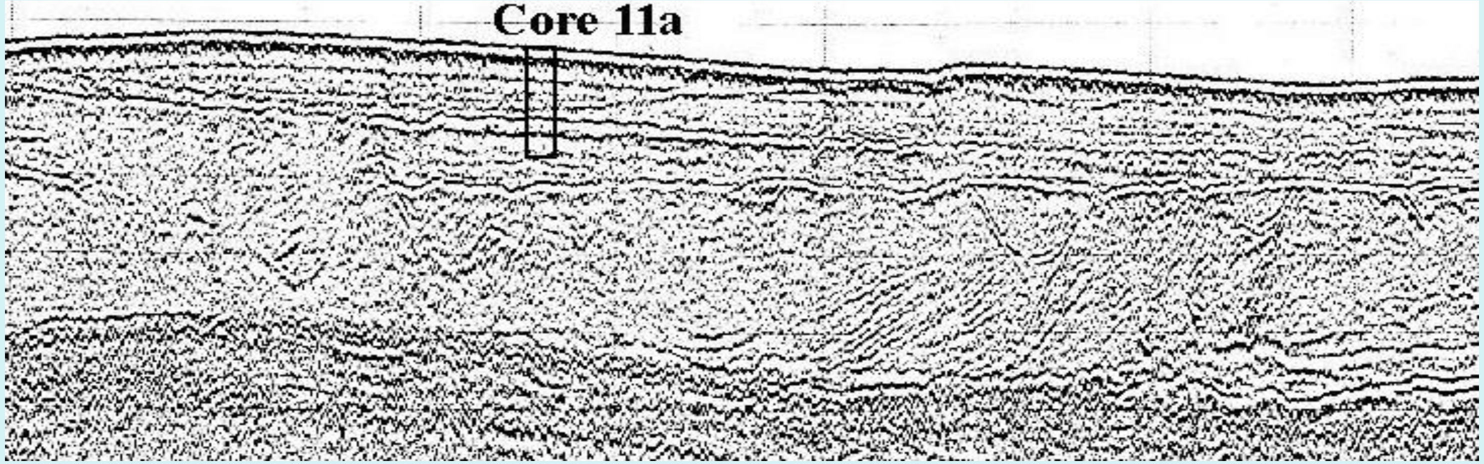
- **Data Processing**: The recorded seismic traces undergo a series of processing steps, including stacking, filtering, and migration, to enhance the quality and resolution of subsurface images. Velocity analysis is crucial for accurately positioning subsurface reflections, and corrections are applied for factors such as topography and near-surface conditions

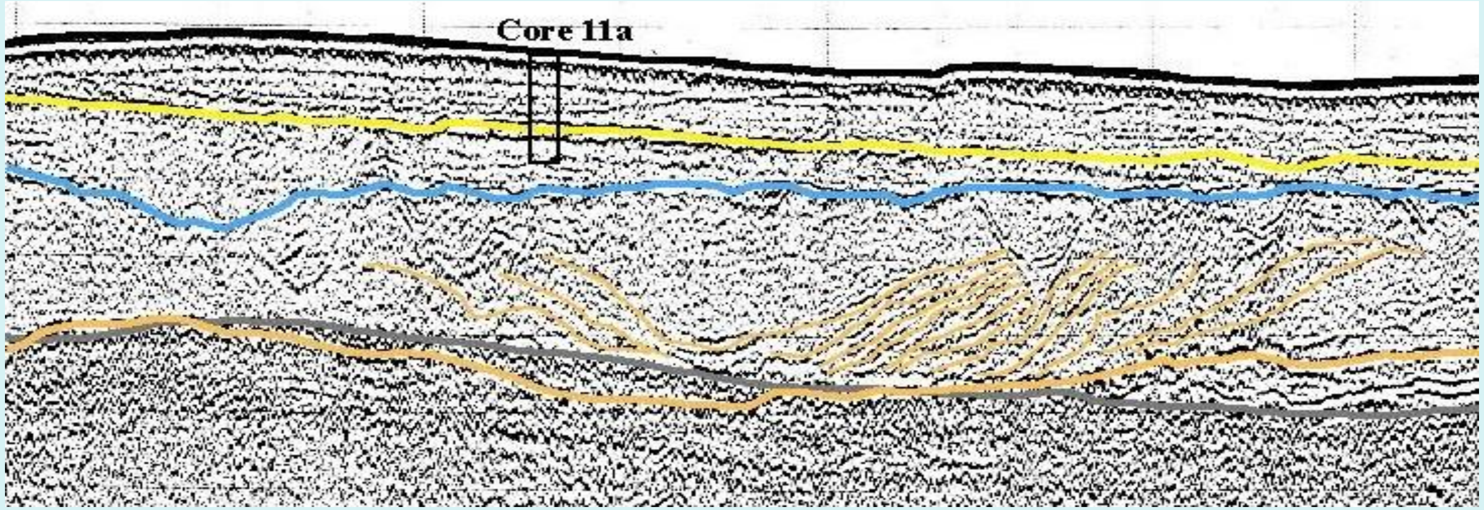
- **Depth of Investigation**: No practical limit

- **Applications**: Determining geologic structures and stratigraphy, karst/sinkhole mapping, and coal/mineral/hydrocarbon exploration

- **Limitations**: Data intensive processing, non-horizontal structures can be difficult to resolve, typically cannot resolve the upper 20 meters of the profile

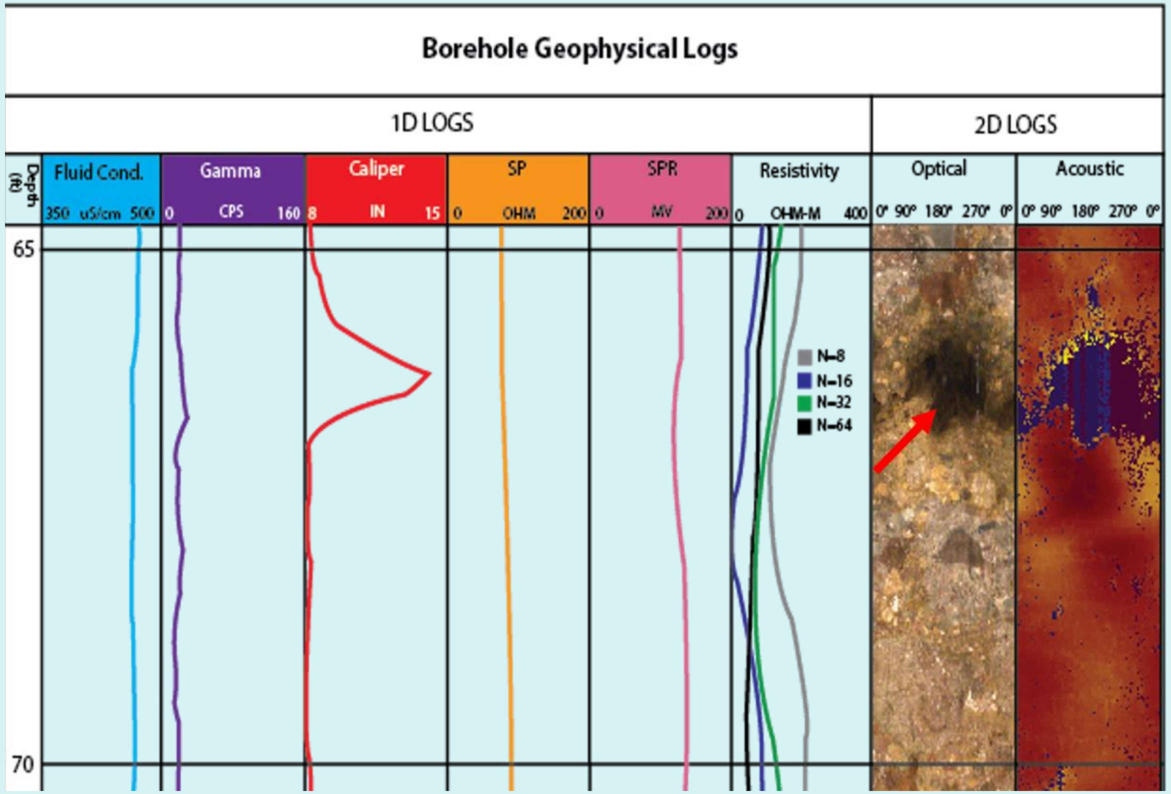
Chapter 8.9.4: Seismic Reflection Method

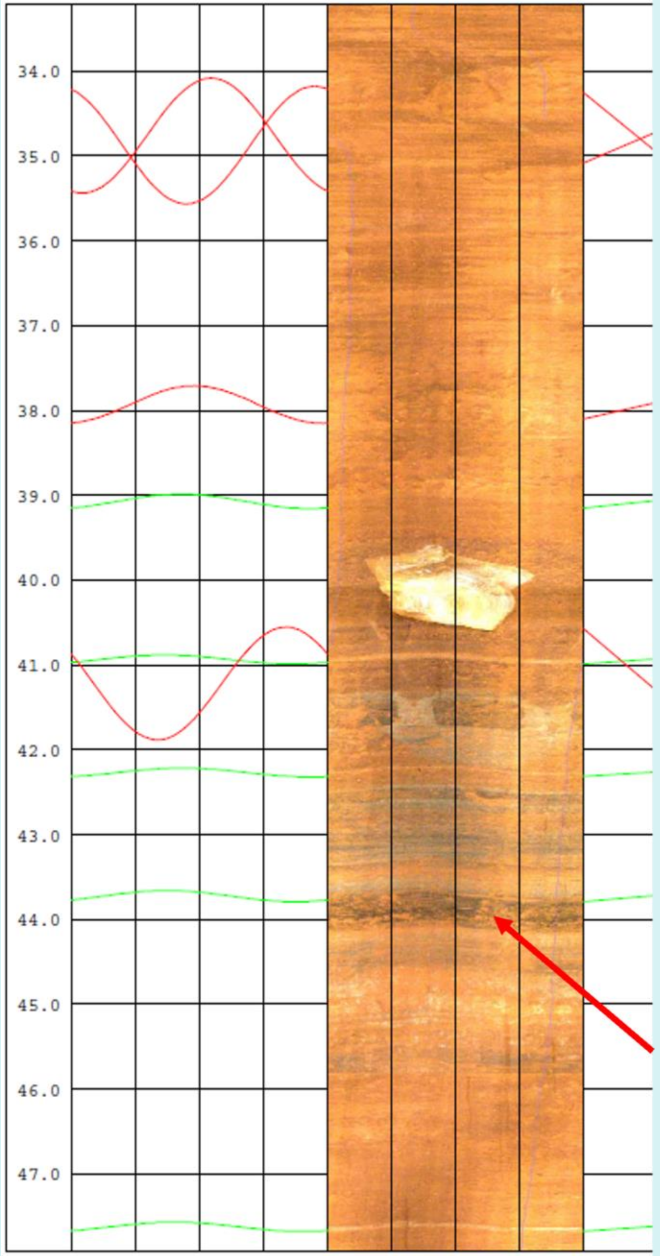




Chapter 8.10: Borehole Geophysics

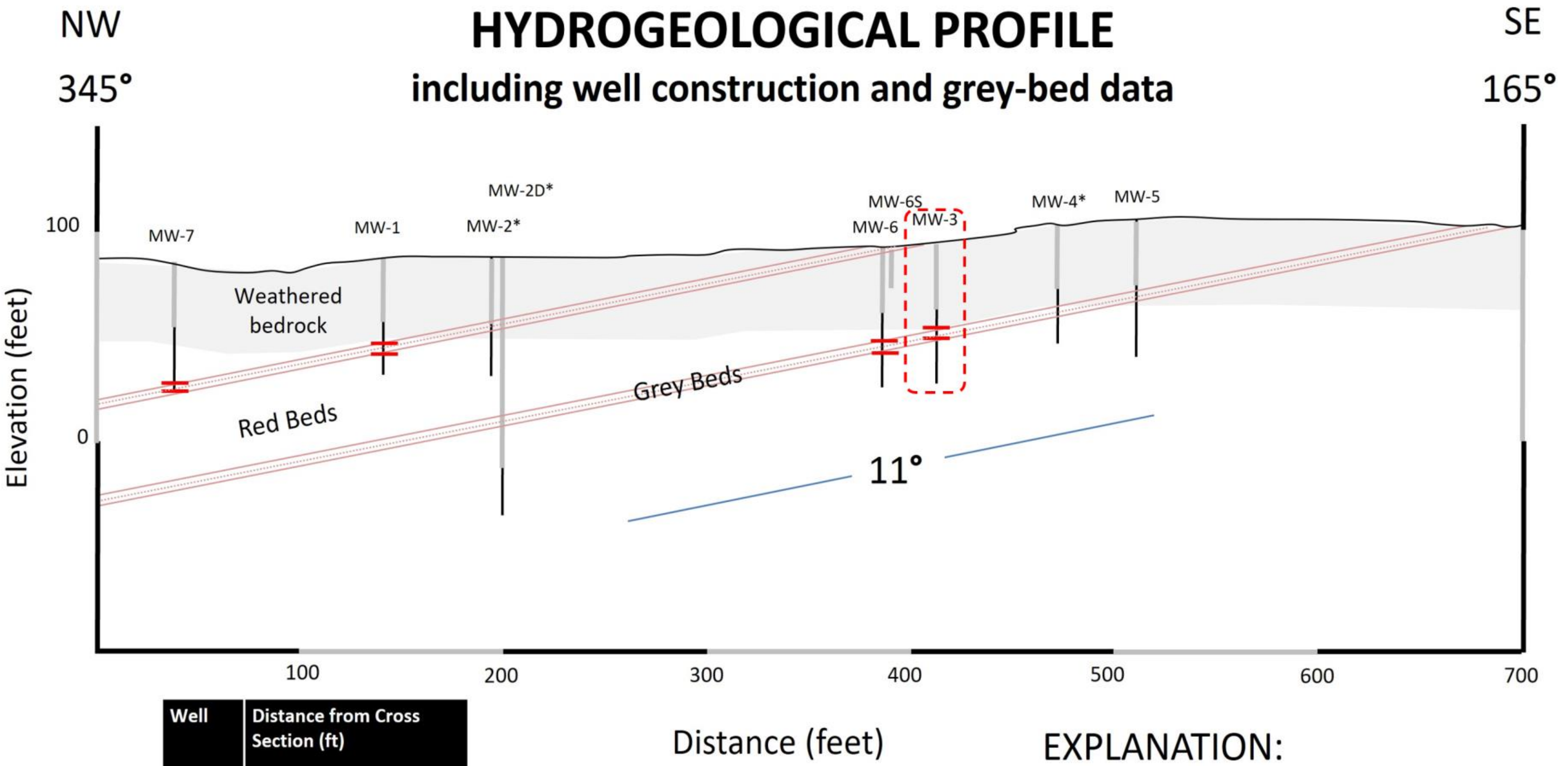
- **Common borehole tool suite:**
  - Gamma (natural, active source)
  - Caliper
  - Electrical resistivity
  - Spontaneous potential
  - Induction/Electro Magnetic (EM)
  - Fluid conductivity/temperature
  - Sonic
  - Optical televiewer
  - Acoustic televiewer





HYDROGEOLOGICAL PROFILE

including well construction and grey-bed data

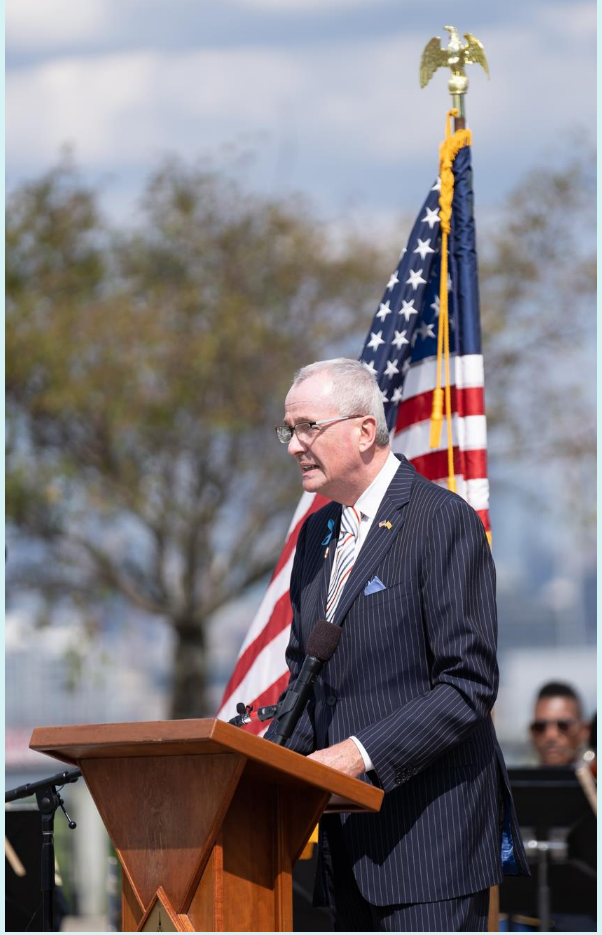


Well	Distance from Cross Section (ft)
MW-1	7.99
MW-2	309.41*
MW-2D	303.43*
MW-3	82.89
MW-4	131.5*
MW-5	61.13
MW-6	22.06
MW-6S	22.97
MW-7	13.97

*wells located more than 100 ft from the cross section line

EXPLANATION:

- Well
- Casing
- Grey Beds in OBI record
- Grey Beds



Thank you!

NEW JERSEY • DEPARTMENT OF ENVIRONMENTAL PROTECTION

FSPM Chapter 9: Soil Gas Surveys

February 29, 2024

Carla Maccaroni, Environmental Specialist
Tyler Lucas, Environmental Specialist
Bureau of Environmental Measures and Site Assessment

Chapter 9: Soil Gas Surveys

- **9.1 Introduction**
- **9.2 Vapor Transport Theory**
- **9.3 Soil Gas Generation and Movement**
  - 9.3.1 Biological Decomposition
  - 9.3.2 Chemical Reactions
  - 9.3.3 Physical Decomposition
  - 9.3.4 Transport Mechanisms
    - 9.3.4.1 Molecular Effusion
    - 9.3.4.2 Molecular Diffusion
    - 9.3.4.3 Convection
- **9.4 Site Characteristics**
  - 9.4.1 Chemical and Physical Properties of the Contaminant
    - 9.4.1.1 Concentration
    - 9.4.1.2 Partitioning
    - 9.4.1.3 Vapor Pressure
    - 9.4.1.4 Microbial Degradation
  - 9.4.2 Geologic Factors
    - 9.4.2.1 Soil Permeability
    - 9.4.2.2 Thickness of the Unsaturated Zone
    - 9.4.2.3 Barriers and Conductive Zones
  - 9.4.3 Hydrologic and Hydrogeologic Properties
    - 9.4.3.1 Water Table Oscillations
    - 9.4.3.2 Background Water Quality
    - 9.4.3.3 Rainfall, Barometric Pressure and Wind
- **9.5 Investigation Sampling Designs**
  - 9.5.1 Grids
  - 9.5.2 Transect Lines
  - 9.5.3 Biased
  - 9.5.4 Random
  - 9.5.5 Combined
  - 9.5.6 Vertical Profiling
  - 9.5.7 Sample Spacing
  - 9.5.8 Sampling Frequency

Chapter 9: Soil Gas Surveys

- **9.6 Active Sample Collection Methodologies**
  - 9.6.1 Ground Probes
  - 9.6.2 Permanent Soil Gas Probes
  - 9.6.3 Materials of Construction
  - 9.6.4 Purge Rates and Volume
- **9.7 Passive Sample Collection Methodologies**
  - 9.7.1 Sorbents
    - 9.7.1.1 AGI Sampler (formerly Gore-Sorber)
    - 9.7.1.2 Beacon Soil Gas Sampler™
    - 9.7.1.3 Sample Depths
    - 9.7.1.4 Sample Spacing
    - 9.7.1.5 Sample Exposure Time
    - 9.7.1.6 Multiple Surveys
    - 9.7.1.7 Data Interpretation
  - 9.7.2 The Emission Isolation Flux Champer
- **9.8 Soil Gas Sample Containers**
  - 9.8.1 Gas Sample Bags
  - 9.8.2 Glass Bulbs
  - 9.8.3 Syringes
  - 9.8.4 Stainless Steel Canisters
  - 9.8.5 Sorbents
- **9.9 Analytical Methodologies**
  - 9.9.1 Detector Tubes
  - 9.9.2 Direct Reading Instruments (DRI)
  - 9.9.3 Portable Gas Chromatographs (GC)
  - 9.9.4 Gas chromatography/Mass Spectroscopy (GC/MS)
- **9.10 Quality Assurance/Quality Control**
- **9.11 Soil Gas Data Interpretation**
- **9.12 Data Reporting**

- Very minor changes from 2005
- Removed from 2005 FSPM Ch 9.6 Health and Safety

9.1: Introduction

- Soil Gas Sampling is a screening tool used to identify and evaluate the extent of VOCs in the subsurface
- Used to assess vapors in the pore space of the soil, typically 1-3 ft. below grade surface
- Assesses the presence, composition, possible source(s), and distribution of contaminants in the subsurface
- A more cost-effective way for the location of installation of soil borings and monitoring wells
- Not a substitute for the investigation and delineation of VOCs in lieu of soil borings and monitoring wells
- Two types of soil gas survey: Active and Passive
  - Active: Volume of soil gas collected from vadose zone into a sample container (Tedlar air bag, summa canister, syringe). Mostly, a type of grab sample
  - Passive: Uses sorbent materials (such as activated carbon) placed within the vadose zone, vapors absorbed overtime using ambient flows of vapors through the subsurface. A composite sample

9.2: Vapor Transport Theory

- Subsurface contamination by VOCs may produce a concentration gradient in soil gas that decreases from the direction away from the source/body of contamination
- Detected in unsaturated (vadose) zone when it moves upward from the saturated zone, via capillary fringe
- Source may also be present in the vadose zone
- Concentrations of VOCs in soil gas is a function of their concentration in ground water, aqueous solubility, soil and subsurface characteristics, degradation, and vapor pressures
- There are vertical and horizontal concentration gradients from VOCs in the subsurface

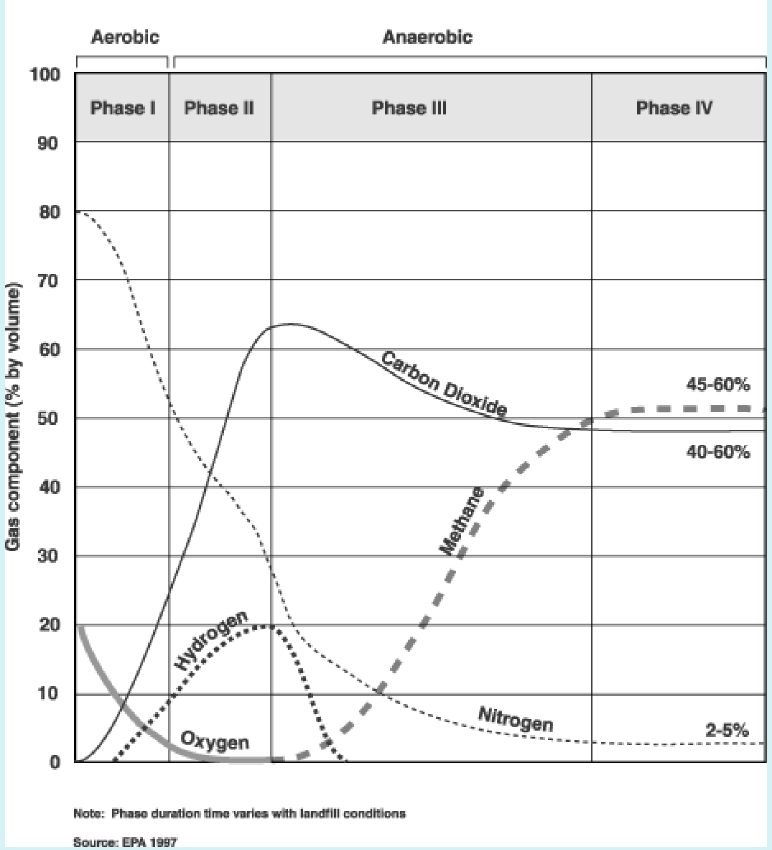
9.4 Site Specific Characteristics

- The type of contaminant spilled and its components, along with any breakdown products must be evaluated to determine the best compounds for detection in the vadose zone that will represent the contaminant source and plume

Table 9.1 Typical Landfill Gas Components[2]

Compound	Percent by Volume
Methane	45-60
Carbon Dioxide	40–60
Nitrogen	2-5
Oxygen	0.1-1
Ammonia	0.1-1
Sulfides	0-1
Hydrogen	0-0.2
Carbon Monoxide	0-0.2
Trace Compounds Toluene, Dichloromethane, Ethyl Benzene, Acetone, Vinyl Acetate, Methyl Ethyl Ketone, Xylenes, 1,1-Dichloroethane, PFAS, Trichloroethylene, Benzene, 1,4-Dioxane	0.01-0.6

- Typical concentrations in a Phase IV landfill. Gas is produced at a stable rate in Phase IV, typically for about 20 years; however, gas will continue to be emitted for 50 or more years after the waste is placed in the landfill



https://www.atsdr.cdc.gov/hac/landfill/html/ch2.html

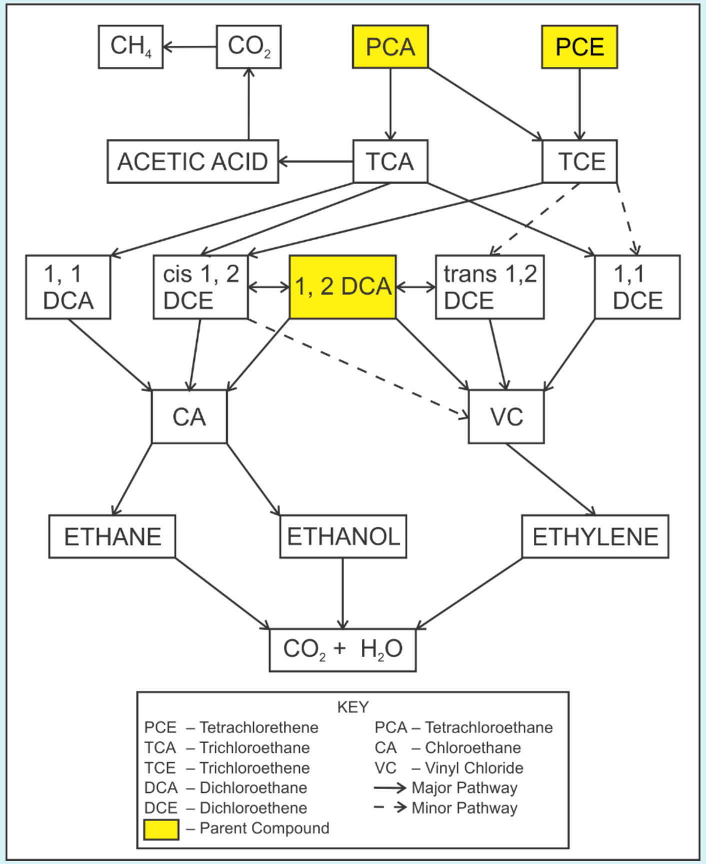
9.4.1 Chemical and Physical Properties of the Contaminant

CSRR

- **9.4.1.3: Vapor Pressure**
  - Pressure exerted by a vapor that is in equilibrium with its liquid phase and is a measure of the relative volatility of a contaminant. Ground water contaminants with high vapor pressures will diffuse readily into the soil horizons and are therefore excellent targets for soil gas analysis. Those compounds with vapor pressures of 1mm Hg at 20°C or higher are the best target analytes for soil gas analysis

- **9.4.1.4: Microbial Degradation**
  - The conversion of a contaminant to mineralized end products (CO_2, H_2O, and salts) through the metabolism of living organisms. The resistance of a compound to biodegradation can be a limiting factor to the applicability of a soil gas survey at a site. Degradation can reduce the amount of contaminant, especially non-halogenated hydrocarbons, particularly C5 and higher
  - Limits the effectiveness of a soil gas survey in cases where the ground water is deeper than 25 feet or shallower than 5 feet. Soil gas probe should be driven within 5 feet of the ground water table to obtain a reliable soil gas signal

9.4.1 Chemical and Physical Properties of the Contaminant



- The stability of halogenated compounds is related to the number and type of halogens
- Solvents having 3-4 chlorines will degrade slowly, so there is little impact on their detectability in the soil gas. These compounds include PCE and TCE
- Dichloro compounds (Dichloroethylene (DCE), Dichloroethane (DCA)) are produced as the first breakdown products of primary chlorinated compounds and they tend to degrade faster than their primary solvents
- Vinyl chloride, which has one chlorine, and a second stage degradation product, is the least stable chlorinated solvent in soil gas. Therefore, vinyl chloride is seldom detected in soil gas over a contaminated ground water plume and is an unreliable indicator of ground water contamination

9.4.2 Geologic Factors

- **9.4.2.1: Soil Permeability**
  - Measure of the ease at which a gas or liquid can move through rock, soil, or sediment
  - Related to grain size and amount of water in soil
    - Clay and water reduce pore space and severely limit soil gas movement
  - Heterogeneous soils across a site can lead to poor delineation and misinterpretation of contaminants due to interference from different soil conditions
- **9.4.2.3: Barriers and Conductive Zones**
  - Barriers: obstructions (manmade or natural). Asphalt, cement/concrete, landfill caps, clay layers, perched water, frozen soil, etc.
  - Conductive Zones: areas where soil gas vapors and gases will preferentially move since vapors will move along the path of least resistance to gas movement
  - Natural (buried former stream beds, and gravel lenses and fractures) or manmade (bedding around pipelines and utilities)

9.4.3 Hydrologic & Hydrogeologic Properties

- **9.4.3.1 Water Table Oscillations**
  - Changes in depth of the water table can have a large impact on the vertical transport of contaminants. Movement of contaminated water "smears" across the sediments, increasing the surface area of contamination
  - A significant water level increase followed by a decline will have a greater effect of introducing VOCs into the vadose zone than other types of water table fluctuations

- **9.4.3.2: Background Water Quality**
  - The presence of other contaminants can increase the difficulty of delineating a particular contaminant in question
  - Several plumes may exist that are partially or completely overlapping from different discharges

9.4.3 Hydrologic & Hydrogeologic Properties

- **9.4.3.3 Rainfall, Barometric Pressure and Wind**
  - Rainfall has a short-term effect on soil gas measurements. Even in heavy rains, if the soils are normally unsaturated, the rain will not produce a saturated condition for more than an hour.
  - Soils high in silts and clays, with a shallow water table (<6 ft.) are not recommended for soil gas sampling
  - Low barometric pressure and winds will increase the out-gassing of soil vapors in the soil pores at or near the surface (upper 1%) and will not influence samples collected several feet below the surface.
    - Barometric pressure changes can affect soil venting discharge rates and soil gas probes where an air conduit exists to the subsurface. (Ex. Passive vents on a landfill and "burping")
  - Key: acquire all the samples in the shortest period possible under the same meteorological conditions
    - reduces the effects of meteorological changes and therefore, a greater confidence in the correlation of results can be made

Test Poll #3

Test Poll #3

Grain size and the amount of water in soil can impact how soil gas moves in the subsurface.

A. True

B. False

Test Poll #3

Grain size and the amount of water in soil can impact how soil gas moves in the subsurface.

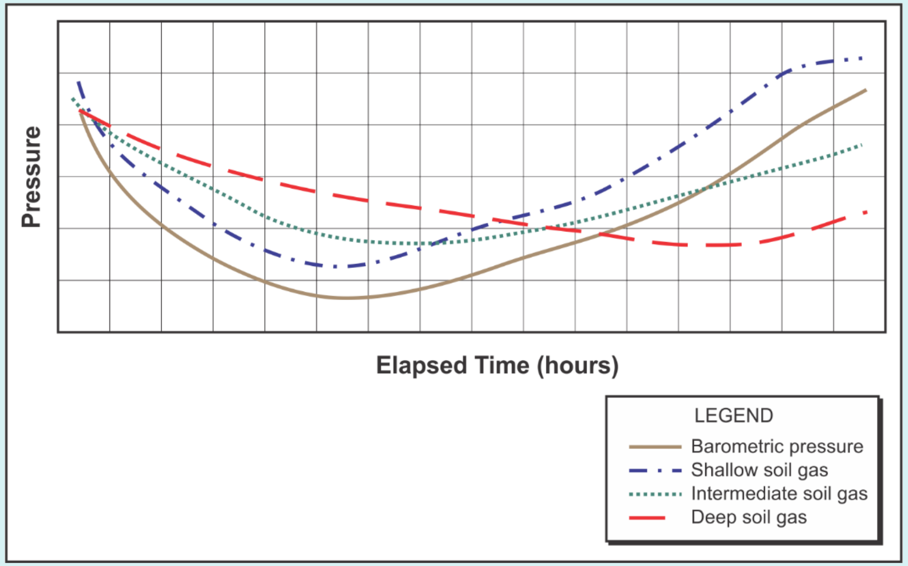
A. True

B. False

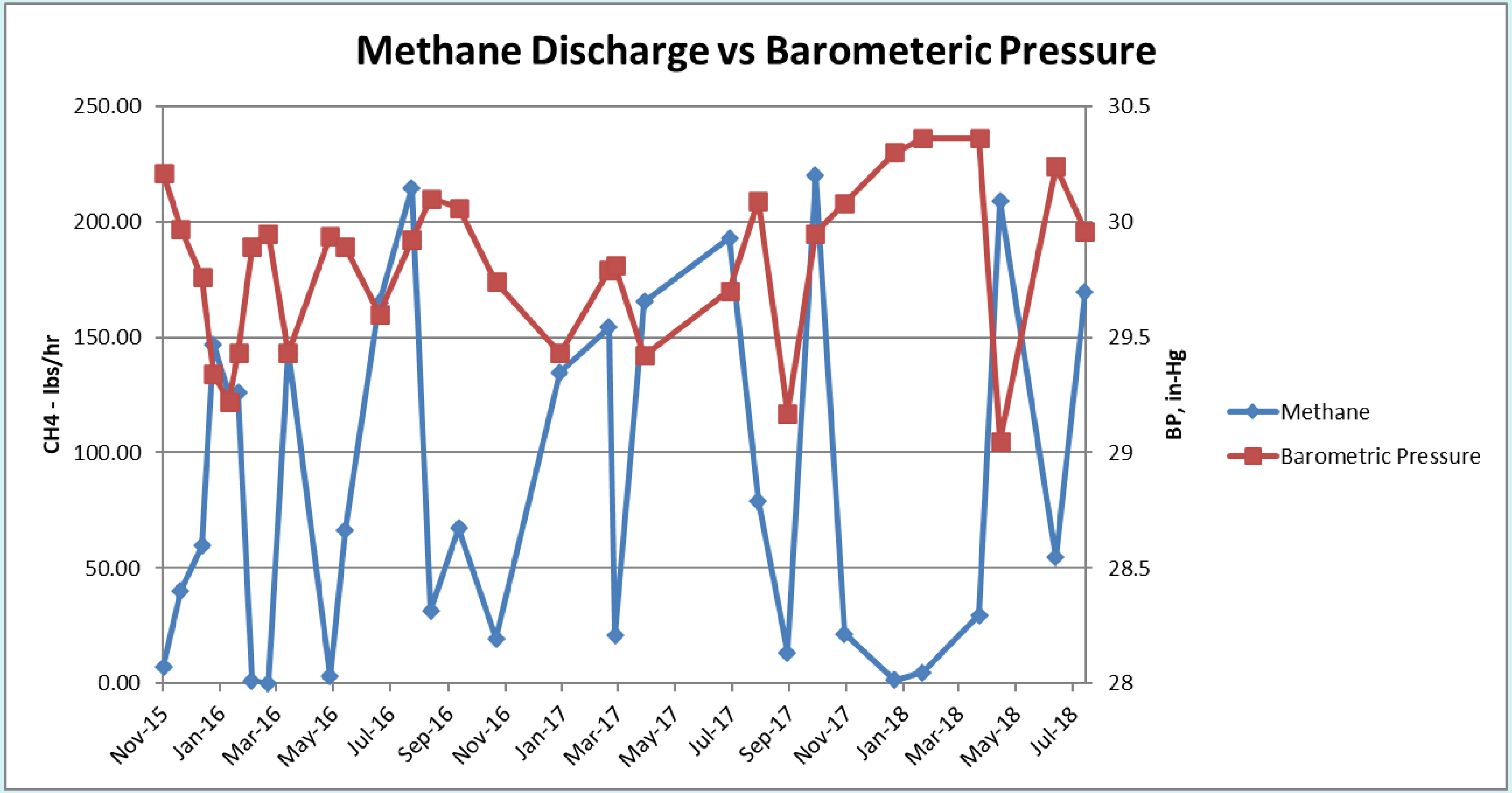
9.6 Active Sample Collection Methods

- **9.6.4 Short Circuiting**
  - Important to have a good annular seal
  - A poor seal will lead to ambient air moving down the annulus and lead to non-representative results

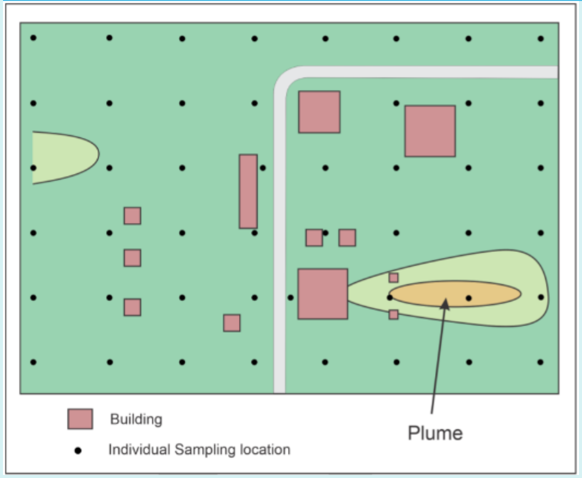
- **9.6.5 Pressure Measurements**
  - Measurements must be made prior to obtaining a gas sample
  - Correlation between pressure measurements from soil gas wells at various depths with atmospheric pressure oscillations. These oscillations in barometric pressure occur twice daily due to solar and lunar gravitational forces (atmospheric tides), with high pressures at 10:00 a.m and 10:00 p.m. and low pressures at 4:00 a.m. and 4:00 p.m. The deeper the interval the greater the lag time for the change in pressure

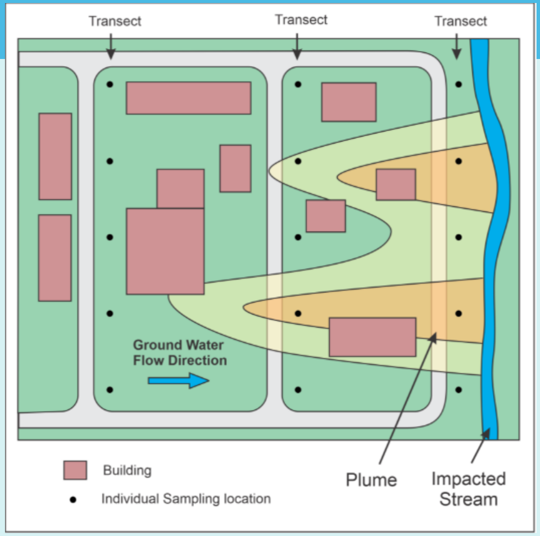


9.4.3 Hydrologic & Hydrogeologic Properties



9.5 Investigation Sampling Designs





- **Grids**
  - Sampling points set on perpendicular lines at equal distances along the line from each other

- **Transect Lines**
  - For transect lines sampling points are placed on a line between the impacted area and a suspected source area(s) of contamination
  - Quickly find source area(s) of contamination
    - Further sampling methods are then used to pinpoint the exact source(s) of contamination

- **Biased**
  - Sample points placed near a suspected source in an area of contamination to find "hot spots"

- **Random**
  - Grid pattern using a random number generator is used to designate which areas are targeted for sampling
  - Used in areas where no information is known, or no contamination is suspected

- **Combined**

9.5 Investigation Sampling Designs

- **9.5.7 Sampling Spacing**
  - For small 1- to 2-acre UST sites, spacing can be 10-50 feet between samples. On large industrial sites or landfills, spacing can be as large as 400-500 feet
  - Sample spacing should be at a minimum of 2 to 3 times the depth to ground water. If two sample locations have two to three orders of magnitude difference in concentration, samples should be collected between the two points
  - Soil gas sampling is not a high-resolution technique for contamination delineation

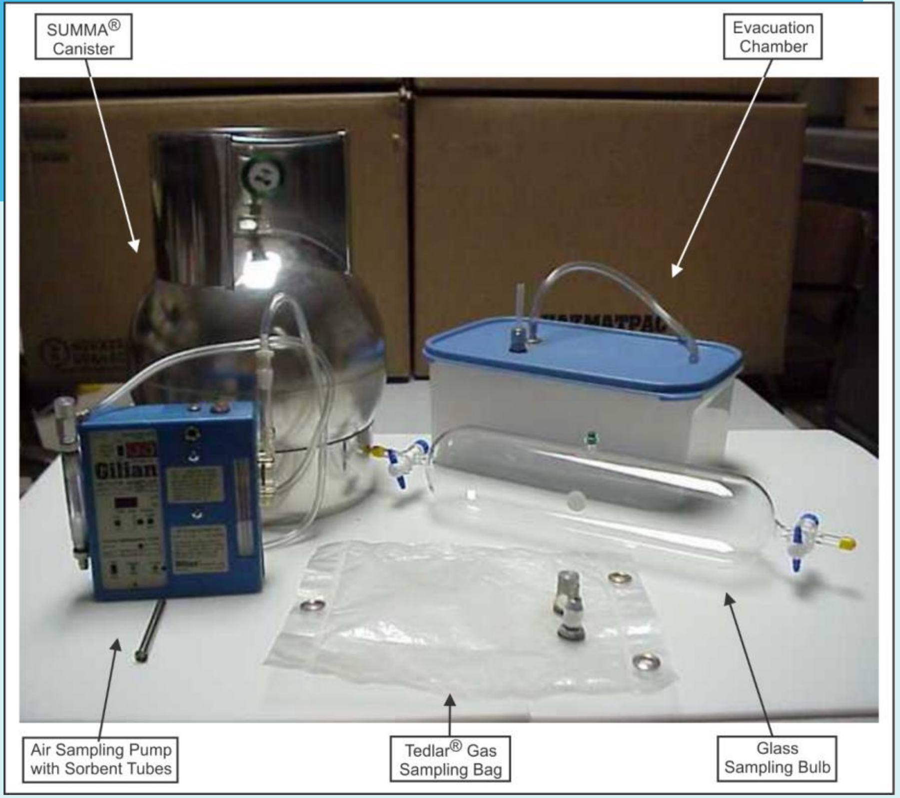
9.5 Investigation Sampling Designs

- **9.5.8 Sampling Frequency**
  - Depends on objective and the results of the soil gas survey
  - For initial site screening only one round of sampling may be required to find potential VOC sources with possibly a second round of sampling for further delineation or exploration
  - Soil gas monitoring programs using permanent probes at landfills and UST sites may use a quarterly or monthly program sampling frequency
  - A greater frequency can be used for monitoring remediation activities or monitoring the migration of explosive landfill gasses near buildings

9.6 Active Sample Collection Methods

- Active sample collection methods involve "pulling" a vapor sample through a temporary or permanent probe to a collection or analytical device, such as Tedlar air bag or stainless-steel canister
- Gives a snapshot of the soil gas conditions at a particular time and depth. This method allows for rapid soil-gas sample collection and analysis from target depths

Active Soil Gas Sample Containers



- **Gas Sample Bags**
  - (Tedlar, Teflon, metal-coated, etc.) using an evacuation chamber
  - Leak check, and sorption of contaminants is possible
  - Short holding times (<3 to 24 hours)
- **Glass Bulbs**
  - Inert, but easily breakable
  - Short holding times (<24 hours)
- **Syringes**
  - Easy to clean and replace. Potential sorption and leakage from plunger
  - Holding time of minutes
- **Stainless Steel Cannisters**
  - Can be used with a pump system and pre-evacuated
  - Collected based on vacuum pressure
  - Sample lines must be purged prior to sample collection
  - Holding times of 14 days

9.6 Active Sample Collection Methods

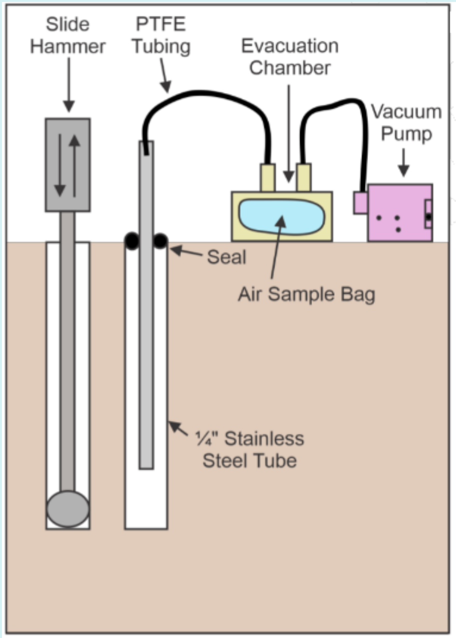


Figure 9.6 Passive Placed Probe

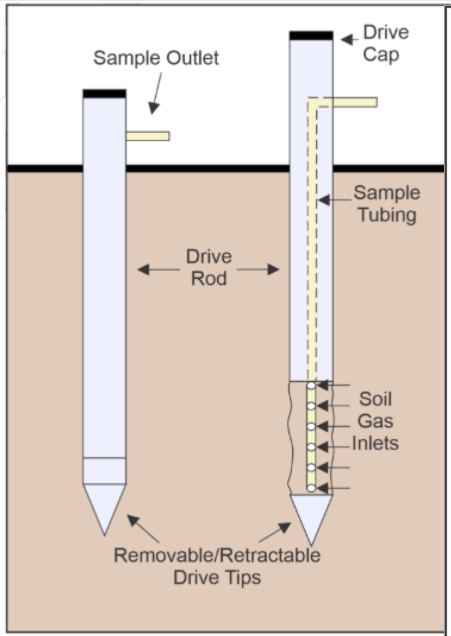
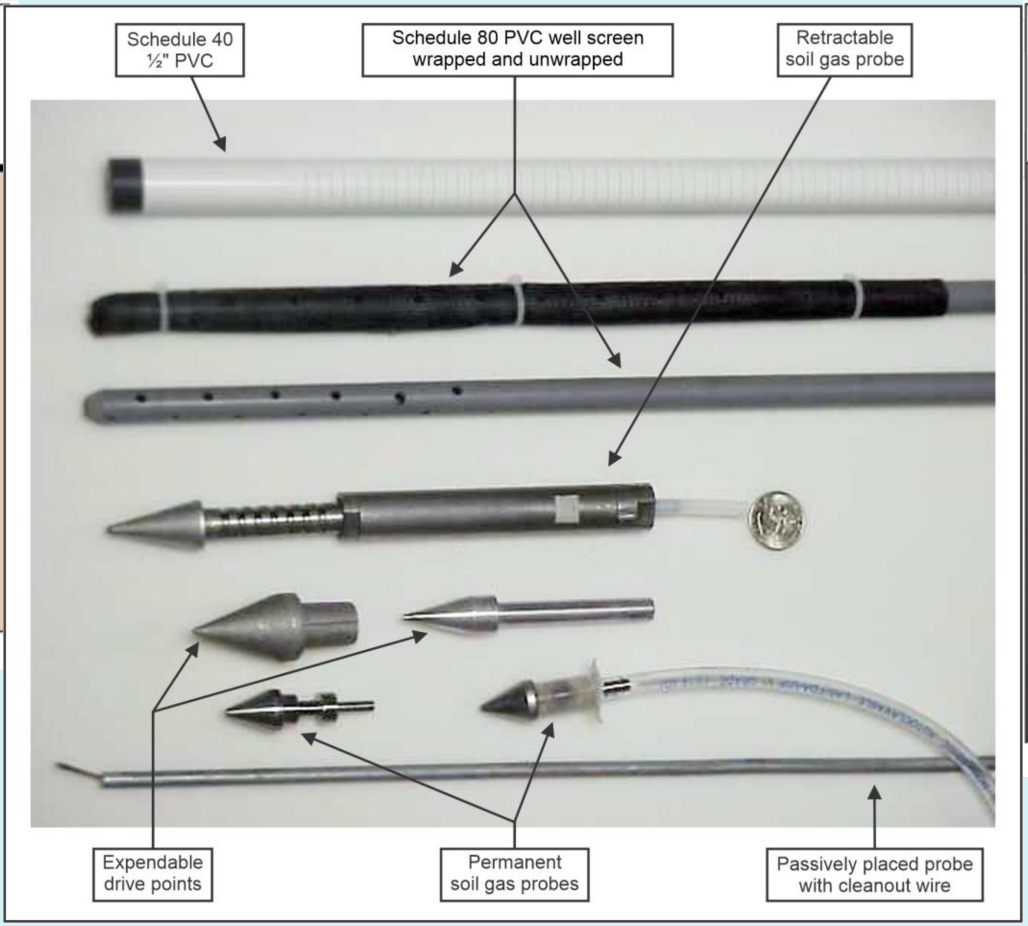


Figure 9.7 Drive Ground Probe



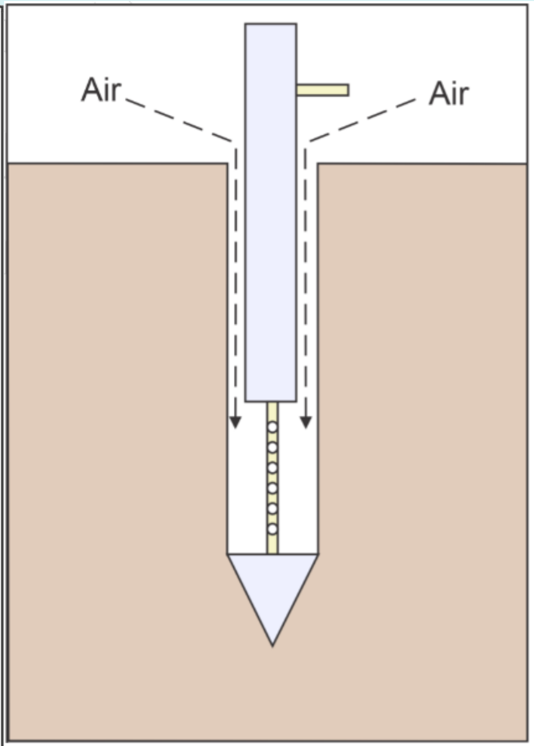


Figure 9.8 Ground Probes Ambient Air Short Circuiting

9.6 Active Sample Collection Methods

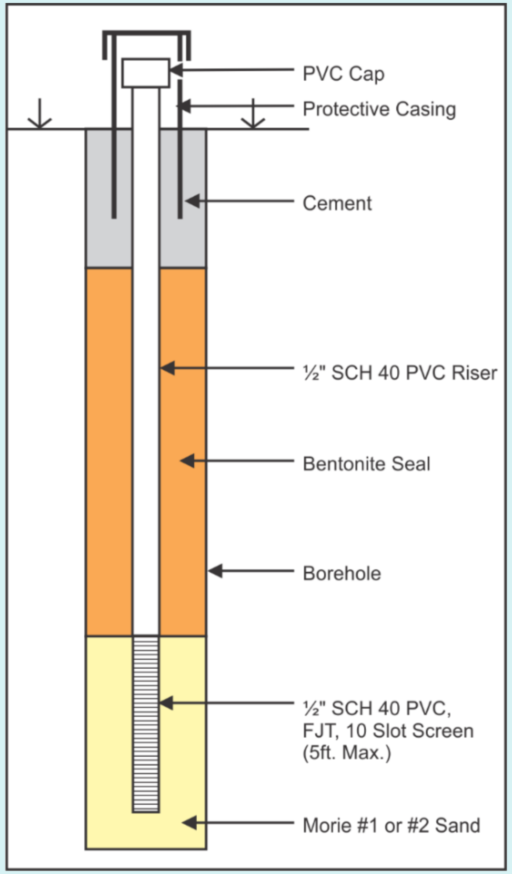
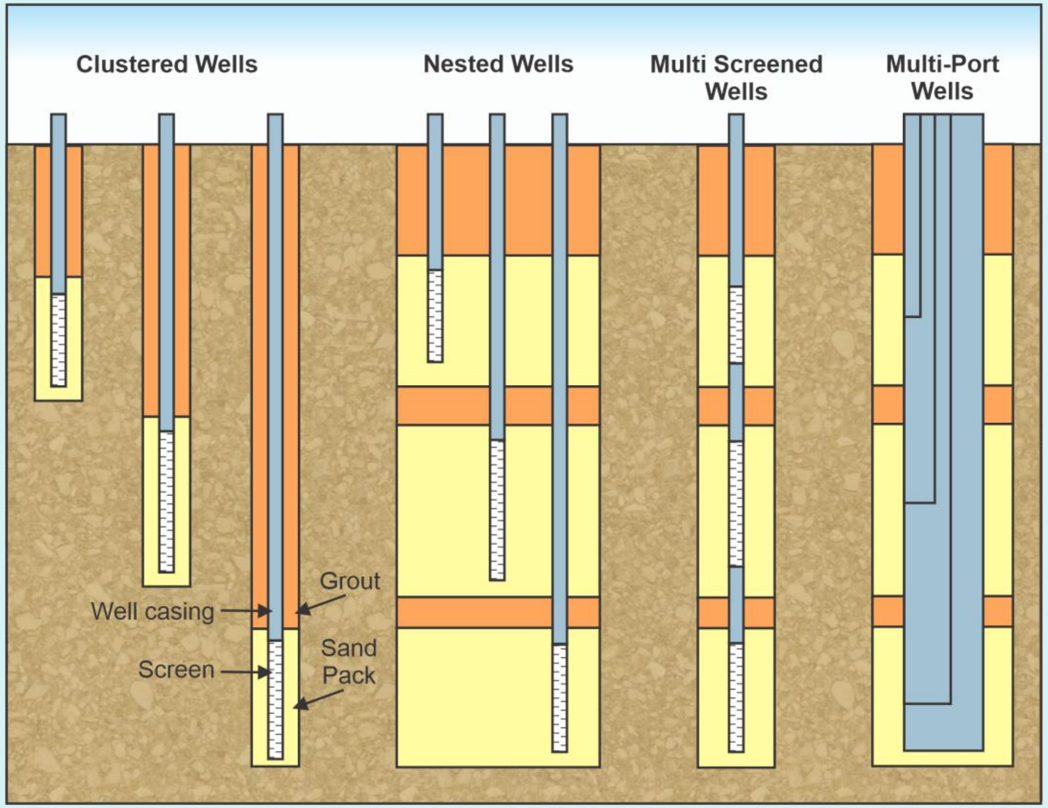


Figure 9.11 Ball Valve for Soil Gas Well, *Photographed by C. Van Sciver*



9.7 Passive Sample Collection Methods

- **9.7.1 Sorbents**
  - Passive sorbent sample collection utilizes diffusion and adsorption for soil gas collection onto a sorbent collection device over time
  - The principal of passive sorbent sample collection relies on the sorbent reducing the concentration of contaminants around the sampler over time. This creates a concentration gradient that decreases toward the sampler. This concentration gradient sustains the movement of vapors toward the sampler

9.7 Passive Sample Collection Methods

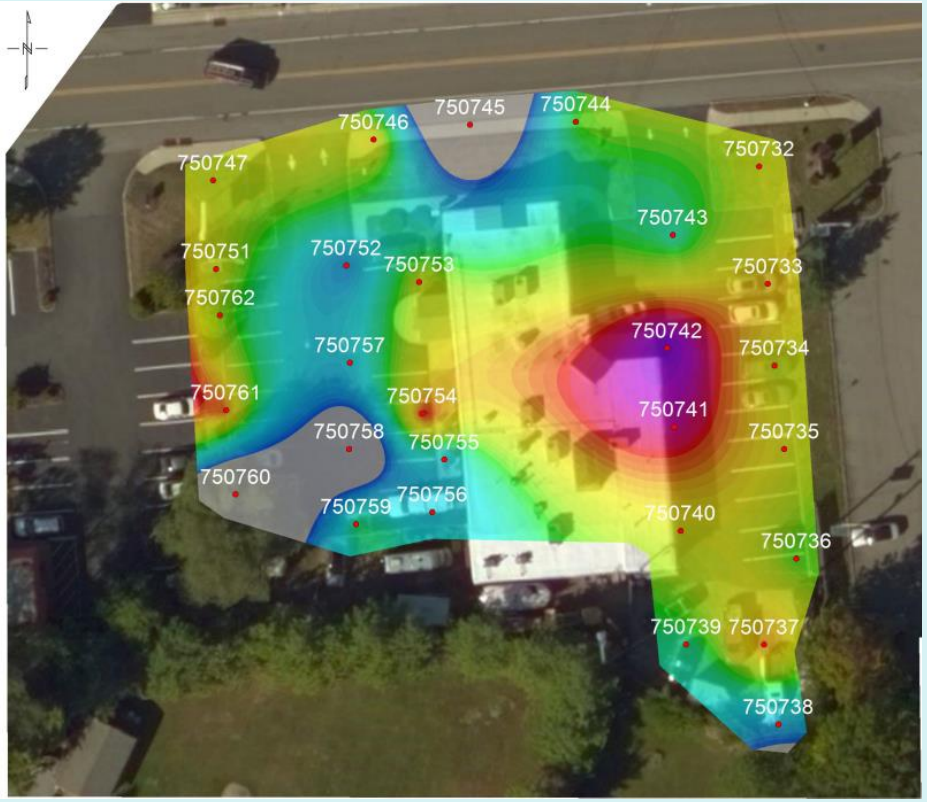
- **9.7.1.1 AGI Sampler (Formerly Gore-Sorber)**
  - The Amplified Geochemical Imaging (AGI) Sampler (formerly Gore-Sorber) passive sampler is constructed of a hollow polytetrafluoroethylene (ePTFE) cord, used for insertion and retrieval of the sampler. The cord contains smaller ePTFE tubes that contain the granular adsorbent material. The granular sorbent material consists of various polymeric and carbonaceous adsorbents selected for their affinity to a wide variety of compounds
  - This design prevents impact to the sorbers from soil particles and water vapor

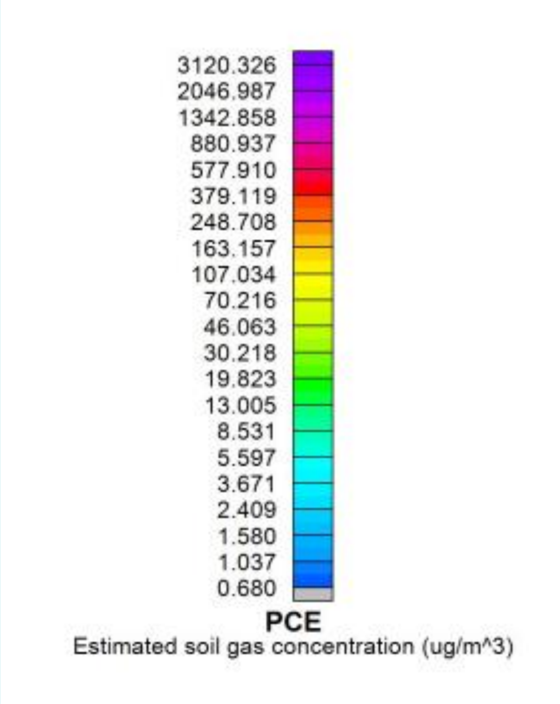
AGI Survey Kit

AGI Passive Sampler

9.7 Passive Sample Collection Methods

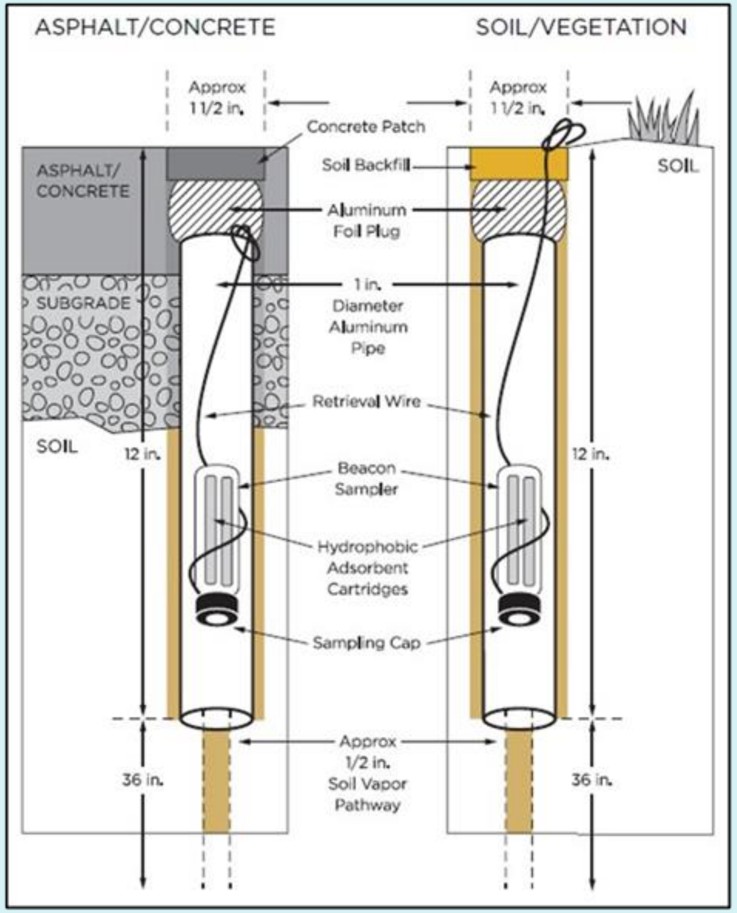
- **9.7.1.1 AGI Sampler (Formerly Gore-Sorber)**
  - Example Case





9.7 Passive Sample Collection Methods

- **9.7.1.2 Beacon Soil Gas Sampler™**
  - The Beacon Soil Gas Sampler™ provided in BeSure Kits™ consists of two sets of hydrophobic adsorbent cartridges sealed in a 7ml screw top borosilicate glass vial that is pre-wrapped with a length of retrieval wire
  - The adsorbents used are chosen to concurrently target a broad range of compounds from the lighter VOCs, e.g., vinyl chloride, to the heavy semi-volatile organic compounds (SVOCs), e.g., polycyclic aromatic hydrocarbons (PAHs), with the system calibrated to target over 100 compounds
  - Figure 9.15 Passive sorbent sampler (*Illustration by Beacon Environmental)*



9.7 Passive Sample Collection Methods

- **9.7.1.2 Beacon Soil Gas Sampler™**

  - To install a Beacon Sampler™, the solid shipping cap is removed and replaced with a sampling cap that allows for the free transfer of compounds onto the adsorbent. A small diameter hole is then advanced to a typical depth of 1 to 3 feet and the sampler is lowered into the upper portion of the hole, which is then sealed in the ground by plugging the hole with aluminum foil and collapsing the upper two inches of soil above this foil plug

  - For locations covered by asphalt or concrete surfacing, an approximately 1" diameter hole is drilled through the surfacing to the underlying soils, and the upper portion of the hole is sleeved with a sanitized metal pipe provided in the kit. After the sampler is installed inside the metal pipe, the hole is patched with an aluminum foil plug and a thin concrete patch to protect the sampler from surface runoff and ambient air

9.7 Passive Sample Collection Methods

- **9.7.1.3 Sample Depths**
  - It is recommended that Passive Soil Gas Samplers be placed in holes created to a depth of 1 to 3 feet. This allows for the use of hand tools for the installation of the samplers
  - Deeper installations will require more time and sample retrieval from deeper depths is difficult. Shallow installations should be avoided due to affects from changing weather, off-gassing from pore spaces in the near surface and biologic degradation of contaminants in the near surface
- **9.7.1.4 Sample Spacing**
  - The size of the site, the objectives of the sampling and the amount of funds available will determine the sample spacing. The range of sample spacing for environmental investigations is 25-75 feet
  - Smaller sample spacing should be used if the objective is to locate areas that are likely sources of contamination. Larger sample spacing should be used in suspected non-contaminated areas or a broad screening of a large area

9.7 Passive Sample Collection Methods

- **9.7.1.5 Sample Exposure Time**
  - Samplers should be exposed to the soil gas vapors for about 3-14 days depending on the type of sampler, soil characteristics, contaminant concentrations and the compounds of interest. This will allow the samplers to reach equilibrium with the soil gas environment to provide for a representative sample
- **9.7.1.6 Multiple Surveys**
  - In some site investigations, the results of the soil gas survey may warrant returning to the site and collecting additional samples. This may be due to requiring further delineation in contaminated areas, sampling beyond the initial site sampling area or confirming results that were not expected
  - In these cases, it is desirable to tie in two or more soil gas surveys together. To accomplish this, several new samplers are placed in locations of prior samplers
- **9.7.1.7 Data Interpolation**
  - The soil gas data will delineate the nature and extent of subsurface contamination. The soil gas data at one location can be compared relative to the soil gas data from other sample locations in the survey
  - The mass levels will show patterns of the spatial distribution indicating areas of greatest subsurface impact. These areas can then be targeted for further investigation

9.9 Analytical Methodologies

- Method to analyze consistent with collection methodology and objectives of investigation
- Sensitivity (ppb, ppm, percent)
- Selectivity (which method for specific compounds) (TO-15, EPA 3C, EPA 25C, etc.)
- Cost

- **9.9.1 Detector Tubes**
  - Inexpensive, but other gases and humidity may bias sample

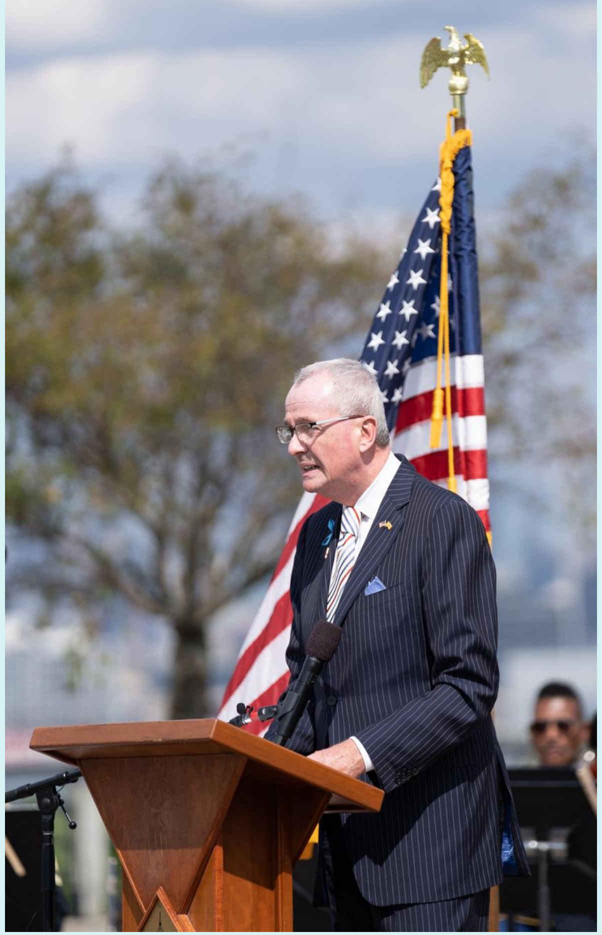
- **9.9.2 Direct Reading Instruments**
- FIDs, PIDs, Combustible Gas Analyzers
  - Beware of limitations and the sensitivities of the meters, refer to user manual

- **9.9.3 Portable Gas Chromatographs (GC)**
  - Responses are recorded as a function of time required for the sample to pass through the column. The sample response is compared to the response of a known standard to determine the contaminant identity and concentration
  - Sub ppb sensitivity

- **9.9.4 Gas Chromatograph/Mass Spectroscopy (GC/MS)**

9.11 Soil Gas Data Interpretation

- Soil gas measurements approximate the contaminant(s) of interest in the subsurface
- There are site and compound specific considerations when interpreting soil gas data
  - For instance; VOCs can be altered or eliminated by biological or chemical transformations
  - Microbial degradation of TCE by sequential dehalogenation to cis-1, 2-DCE, trans-1, 2-DCE and vinyl chloride or the reduction of organic hydrocarbons to methane and carbon dioxide by oxidation
- Soil gas data is not a 1:1 relationship match with ground water contours
- Be aware of volume per volume (ppmv, ppbv) or mass per volume (ug/L, or mg/m^3)



Thank you!

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

Questions?

FSPM Chapters 5-13 Training

February 29, 2024

Break

FSPM Chapter 10: Documentation

February 29, 2024

Lee Lippincott, Research Scientist
Bureau of Risk Assessment

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Posted for use December 2023

Chapter 10 Documentation

10.1 Introduction

10.2 Field Data Sheets/Logs

10.3 Field Notes

10.4 Documenting Sampling Locations

10.5 Photo-Documentation

10.6 Sample Collection Paperwork

10.6.1 Sample Labels

10.6.2 Chain of Custody/Sample Analysis Request

Chapter 10 Key Updates

- Chapter was updated to include all current information
- Chapter was updated to account for digital field notes and photographs
- Sample collection was updated

Chapter 10 Overview

- Proper documentation of all site activities is a crucial part of the field investigation process
- Documentation must be maintained (CRADLE TO GRAVE) to document the progress of the remedial activities on site and to trace the possession and handling of samples from the time of collection through analysis and disposition
- Chapter 10 details the proper documentation needed for field work

Chapter 10.3 Field Notes

- Field notes are an integral form of data in a qualitative site assessment, particularly for sites that use observations as a data generation method
- Field notes are
  - descriptive
  - reflective
  - analytical
  - versatile

10.3 Field Notes

- Upon Receipt of a Field Notebook, enter your name, site address, and phone number on the inside front cover
- Staff may dedicate field books to a specific site if a long-term project, and/or use one general field book for all their tasks
  - Field books should be given a specific designation (site name and book volume number for site specific field books
- If field book is not paginated, staff should number all pages in order prior to its use

10.3 Field Notes

- Names of personnel present and organization
- The sample event date and time
- Weather conditions
- Field measurements such as PID readings, pH, temperature, etc.
- Sample station location designations, sample container numbers, etc.

10.3 Field Notes

- Specific sample location information, such as description of location, depths of sample, tide conditions, soil conditions, water color/conditions, etc.
- Out of the ordinary events, such as equipment failure, damage to monitoring wells or evidence of tampering, observations of gross contamination, odors, etc.
- Information the field staff believe may be useful or pertinent at a later date

10.3 Field Notes

There are several reasons for taking field notes. These include:

- To provide a record of conditions of a site at a specific time, such as an inspection
- To document specific activities at a site
- Noting information in the field for its use, such as
    - recording low flow well field parameters for comparison purposes to determine stabilization

10.3 Field Notes

CSRR

Several additional reasons for taking field notes include:

- To allow the re-creation of an event by persons not at the site (for comparing data of different events or finding sample locations for long term monitoring)
- To provide a means of reviewing the activities at a site if quality concerns with data collected during the site visit are encountered during data review
- To document a site visit
- Additional information is available at https://www.epa.gov/sites/default/files/2015-06/documents/Logbooks.pdf

Chapter 10 Field Notes Example

CSRR

QA/ progress ground water sampling from wells MW-3, MW-6, MW-4, MW-8, MW-9, peri pump YSI 556 – lab to Pace Fairfield, V. Villa onsite

Well	TD	DTW	Eff	3-S vols	pumped/off	total
MW-3	24.28	8.1		8.09 gals.	09:40 → 10:22	8.5 gals
MW-6	19.7	7.4		6.15 gals.	10:45 → 11:30	6.5 gals
MW-8	18.4	6.8		5.8 gals.	13:08 → 13:40	6.25 gals
MW-4	23.85	11.6		6.125	12:03 → 12:40	6.25 g
MW-9	18.8	9.75		4.55 gals.	14:00 → 15:02	4.5 gals

Pre Purge

Well	pH	Cond	DO	Temp	ORP
MW-3	7.76	0.856	5.60	11.70	-7.3
MW-6	7.86	0.325	3.97	11.01	-190
MW-8	8.13	0.263	5.68	10.70	82.3
MW-4	7.83	0.940	5.89	11.63	32.7
MW-9	8.36	0.677	6.20	9.92	90.2

Post Purge

Well	pH	Cond	DO	Temp	ORP	DTW
MW-3	8.03	0.878	4.13	11.75	-15.8	9.05
MW-6	8.11	0.339	3.87	10.66	7.5	8.78
MW-8	8.21	0.281	5.55	10.59	17.0	8.10
MW-4	7.96	1.018	3.64	11.77	-30.7	11.55
MW-9	8.14	0.669	5.65	9.88	104.9	10.55

Sampling

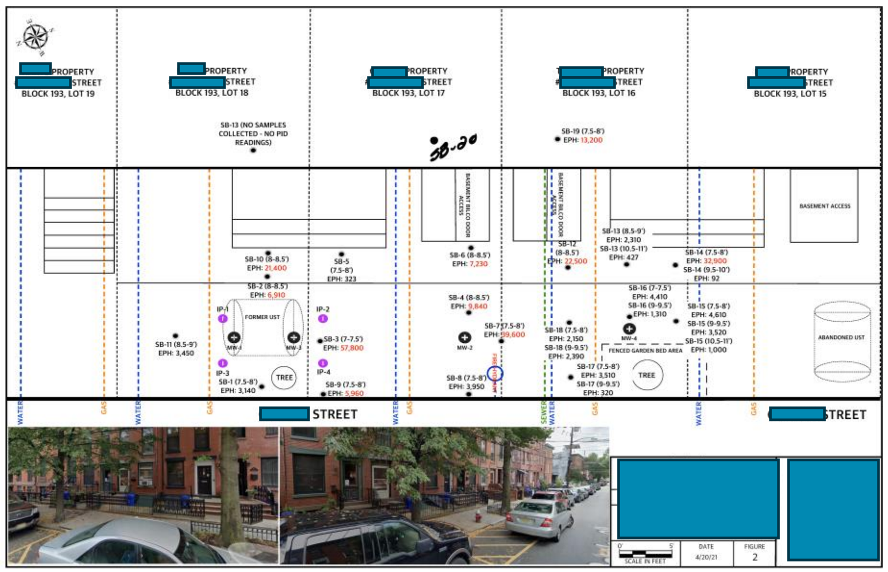
Well	pH	Cond	DO	Temp	ORP	DTW
MW-3	8.26	0.882	3.88	11.84	-61.5	8.2
MW-6	7.64	0.349	3.53	10.90	-19.6	7.5
MW-8	8.01	0.283	3.84	10.56	9.8	7.00
MW-4	7.97	1.017	2.96	11.79	-32.4	11.55
MW-9	8.31	0.667	4.33	9.69	113.1	10.85

Sampling times ~

Well	time	params.	Observations
MW-3	10:30	VOCs+15, BN+15, 5m	trace odor w/ bacterial flocks
MW-6	11:35	SAA	trace odor, no sheen
MW-8	13:45	SAA	trace odor, no sheen
MW-4	12:45	SAA	Sheen, odor, no f.p.
MW-9	15:10	SAA	clear, no odor/sheen poor recharge

Flow 653,360 gals on treat system.
Sorbent materials are ok.

Chapter 10 Electronic Field Notes example



[redacted]

R. Zape, D. Sadreck on site

Will use Concrete coring drill with hand augers to access subsurface soils below basement floor

- Screening all soils with photo ionization detector and visual and olfactory observations

SB-20 (through basement floor) prior to completion of borehole photodocument basement area
Ms. Colmes son in law? cleaned access steps for us sweeping out leaf debris - photodocument of the cleaning bilco doors in one section for removal - not individual doors

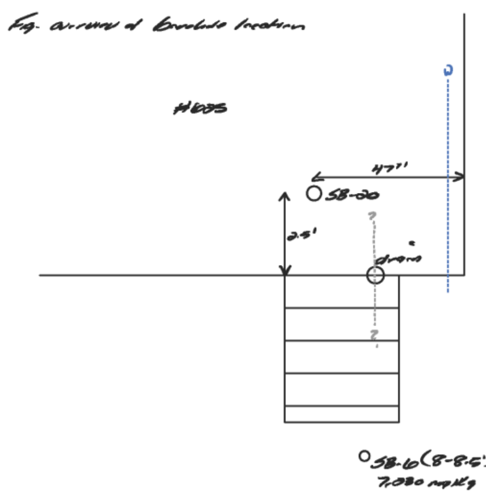
SB-20 using hand auger w/ 6-inch bucket
Concrete is 3.5" - 51" from outside grade to floor or 4.25'

all depths relative to floor in basement

0-3.5" Concrete
3.5" -> 9.5" br to grey br sandy silt, dry no PID reads
9.5" -> 12.0" rock obstruction @ 9.5" -> 12" clear with hammer drill, recover sm no PID
1-1.5' rec full bucket - br sandy silt, moist, no odor or PID reads
1.5-2' rec full buck - br sandy silt, same moisture, no PIDs
2-2.5' rec full buck - br sandy silt, trace rock frags, no PID reads
2.5-3' rec full - grey-br sandy silt, moist, no PID reads
3-3.5' rec full - grey-br sandy silt, moist, no PID reads
3.5-4' rec full - grey-br sandy silt, trace rock frags, no PID
4-4.5' rec full - dark grey sandy silt, moist 0.7 ppm PID - trace red
4.5-5' rec full - dark grey clayey silt, wet, no PID readings
5-5.5' rec full - sm, wet, no PID reads
5.5-6' rec full (9.75 - 10.25' bg) dk grey wet clayey silt, peat layer @ tip, no PID reads

* no PID reads throughout borehole
* collecting SB-20 (4-4.5') or 8.25-8.75 to evaluate horizon from previous borehole SB-6 @ 10:30 am for EPH

properly abandon borehole and patch with fast hydraulic cement - sample placed on ice in cooler for DTC



Test Poll #4

Test Poll #4

Field notes should include…

A. Weather conditions
B. Sample event date & time
C. Names of personnel present
D. All of the above

Test Poll #4

Field notes should include…

A. Weather conditions
B. Sample event date & time
C. Names of personnel present
D. All of the above

Chapter 10
Field logs are different from field notes

Field logs can be generated by the NJDEP or LSRP or EPA for EPA lead sites. There will be some overlap between the notes and logs

Unlike field notes, field logs provide:

- Specific quantitative measurement information to the regulatory authority programs and LSRP deliverables to the authorities
- Information for approval of the remedial strategy for a site
- Identify information gaps that delay a regulatory decision that may not be documented in the field notes
- Documentation of the current condition of the contaminant source(s)

10.2 Field Data Sheets/Logs

Importance

- Good documentation is critical for the purpose of both providing a legally defensible record of the field program, and to maintain and transmit data for future assessment and interpretation

Definition

- Field logs are the primary legal record and source of documentation for site activities. They record summaries of all field activities so that an average person can understand the chain of actions, events, and decisions

10.2 Field Data Sheets/Logs

- Some field activities have specific forms for taking notes, or specific projects may require specialized forms to assist in data organization
- If forms are used, a field notes entry must be made with reference to the forms used during that event
- At the end of the day, the total number of forms used during that day's activity(s) must be indicated in the field notes

10.2 Field Data Sheets/Logs

Chapter 6 provides examples of some field data sheets/logs

- Daily Calibration Sheet for Field Analysis
- Low Flow Ground Water Sampling Log
- Monitoring Well Information in Support of Pump Intake Depth Placement
- Volume-Averaged Sampling Field Sheet
- Checklist for the Submission of Sampling Data for Passive Diffusion Bag (PDB) Samplers

- The example data sheets/logs provided are not required to be used; however, the information requested should be recorded
- The completed field data sheets/logs should be provided to the NJDEP during each document submittal

LOW FLOW GROUND WATER SAMPLING LOG

Site: ______ Date: ______
Project ID: ______ Weather: ______
Sampling Personnel: ______
Well ID: ______ Well Permit Number: ______

WELL INFORMATION

Well Depth from Well Log: ______ Measured Total Depth: ____ Static Depth to Water: ______ Well Material and Diameter: ______ Screen/Open Borehole Interval: ______ Pump Intake Depth: ______ Head Space (PPM): ______

PURGE INFORMATION

Time Purge Start/Stop: ______/______ Flow-through Cell Volume: ______ Pump Type and ID: ______ Purge Rate: ______
Tubing Material: ______ Cell volume / purge rate =
Tubing Diameter (Inner): ______ Flow-through Cell Turnover Time: ______ Total Purge Volume: ______ (Calculated reading collection interval) Water Quality Meter(s) type and serial number: ______

SAMPLING INFORMATION

Sample ID: ______ Sample Time: ______ # of Bottles Collected: ______ Bottle Preservatives: ______ Analysis: ______ QAQC Samples: ____

Time	Depth to Water (ft/bmp)	Purge Rate (ml/min)	Temperature (ºC)	pH (standard units)	ORP/Redox	Specific Conductivity (µS/cm)	DO (mg/L)	Turbidity (NTU)
Stabilization Criteria			±3%	±0.1	±10 mV	±3%	±10%	±10% if >1

Indicator parameters have stabilized when 3 consecutive readings are with: ±0.1 for pH; ±3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; and ± 10% for Dissolved Oxygen and Turbidity.

ADDITIONAL INFORMATION: (notes, problems encountered, maintenance required, unusual color/odor, etc.)

______

Chapter 10.2 Field Data Sheets/Logs

NJDEP maintains a library of guidance manuals on its website at
https://www.nj.gov/dep/srp/guidance/

Examples of some of the relevant guidance pertaining to this chapter:

- Soil Investigation Technical Guidance:
  https://www.nj.gov/dep/srp/guidance/#si_ri_ra_soils
- Quality Assurance Project Plan Technical Guidance:
  https://www.nj.gov/dep/srp/guidance/#analytic_methods
- NJDEP Low Flow Purging and Sampling Guidance (2003) Forms
  https://www.nj.gov/dep/srp/guidance/lowflow/

10.4 Documenting Sampling Locations

- Sampling location points must be documented for purposes of future sampling in an approved geographically referenced format when submitting analytical results for those samples and integration into a Geographical Information System (GIS)
- Survey Grade Global Positioning System (GPS) are common equipment with accurate position determination; however, if GPS is not available a fixed reference point can be used
  - A fixed reference point should be chosen at each site to act as a stationary location from which all sampling points can be measured using a compass and measuring tape
  - Please be sure to adequately document sample locations and the fixed reference point so that the locations can be transferred to the appropriate reporting format
  - GIS Guidance: https://www.nj.gov/dep/srp/gis/guidance-documents.html

10.5 Photo-Documentation

For each photograph taken, several items should be noted in the field notes:

- Date
- Time
- Photographed by (signature)
- Name of site
- General direction faced and description of the subject taken
  (note GPS coordinates if collected)
- Important characteristics noted and photographed
  (e.g., presence of product, groundwater, or bedrock)

10.5 Photo-Documentation

Date:

SET-MH Vegetation Survey - Field Data Sheet

SET or MH ID:

Survey area or arm length:

Photo #s:

presence	perc_cover	max_ht	max_ht_est
list species present within survey area; this list also includes "bare ground", "thatch", "water", "wrack", "microtopography" and "other" categories if relevant	*report the percent cover*	*meters; maximum height of the plant species; report actual measurements or measured estimates, if beyond reach*	*was maximum height estimated, or measured?*

10.6 Sample Collection Paperwork

- Sample container labels
- Sample cooler custody seals
- Field data sheets/logs
- Chain of Custody logs (including forms specific to media, e.g., vapor intrusion chain of custody)
- Sample analysis request forms
  - i.e., Project Communication Form contained in the Analytical QA/QC documents of 2014

10.6.1 Sample Labels

Sample labels are an important part of proper documentation as their use

- Provide a unique identification of the sample and its location
- Have all information necessary to complete chain-of-custody forms
    - should include the well or sample number, parameter sampled, date, time sampled, sampler's initials, preservative, and site name or location
- Sample containers can be pre-labeled with the sample ID and the test parameter prior to sampling
- Secondary containment (e.g., bagging samples) is important to protect the sample identity, for cross-contamination, and exposure to ice

10.6.1 Sample Labels

Nano Electrochemical Treatment PROJECT SAMPLE
SAMPLE TYPE: 500ml Leachate Samples
ANALYSIS: LC/MS
SAMPLE DATE:12/07/2023 TIME:_ ______
Source: WWTP
Sampler NAME: Lee Lippincott
WITNESS:
Preserved YES NO

- When naming sample locations, it is important to keep the naming convention consistent throughout the site and over time (e.g., MW1, MW-1, MW01, MW 1 are not the same naming convention)

10.6.2 Chain of Custody/Sample Analysis Request

CSRR

New Jersey Department of Environmental Protection
Sample Chain of Custody and Sample Analysis Request Form

Laboratory Information

Name of Laboratory: ______________ Individual Preparing Sample Bottles and Shipping Container(s)
Address: ______________ Name: ______________
Title: ______________
Time/Date Sample Shipping Container Sealed: ______________ Laboratory Affixed Seal Number: ______________

NJDEP Information

Division: ______________ Bureau: ______________ Phone: ______________ Job Number: ______________

Requested Analysis

NJDEP Field Sample Number	Time/Date Sampling Start	Time/Date Sampling Stop	Parameter	Method	Preserv.	Container Volume	Container Quantity	Matrix
Ex: MW1	14:00/ 9/25/23	14:05/ 9/25/23	TCL VOCs	8260D	HCL	40 ml	3	water

Preservative Added: (*Check One*) ☐ Laboratory ☐ Field ☐ Unpreserved
Contract Number: ______________ Task Number: ______________ Report Format: ______________

Sample Chain of Custody

Relinquished	Received	Time/Date	Reason for Change of Custody
XXXXXXXXXXXXXXXX			Break Seal/Sample

Individual Resealing Shipping Container: Name: ______________ Title: ______________
Time/Date Sample Shipping Container Resealed: ______________ NJDEP Affixed Seal Number: ______________
Time/Date Sample Shipping Container Opened: ______________
Time/Date Internal Chain of Custody Initiated on NJDEP Form 077 (Internal Chain of Custody): ______________

Distribution: ☐ Original (*Sent with Report*) ☐ Contractor Spare, Retain with Report File
☐ Sample Custodian ☐ NJDEP Sampling Personnel

Cross out blank lines at the end of the COC, 24-hour clock should be used, preservative type listed, initial any corrections.

Field ID Number

New Jersey Department of Health
Environmental and Chemical Laboratory Services
PO Box 361, Trenton, NJ 08625-0361
Phone: 609-530-2820
ORGANIC AND INORGANIC CHEMISTRY SAMPLE SUBMITTAL
(See Instructions)

Lab Sample Number (For Lab Use Only)

AGENCY INFORMATION

Submitting Agency	Send Results To	Agency No.	Project Name
Street Address	Final Report Option ☐ Tier 1 ☐ Tier 2 Electronic Report Option ☐ EDD ☐ E-2	Would you like copies of the internal chain of custody forms sent with your report? ☐ Yes ☐ No	Project Code Memo Number
City, State, Zip Code	Phone	Fax	Email

SAMPLE INFORMATION

Sample Point/Station ID Number/Water Facility ID	Collection Date (YY/MM/DD) __ __ / __ __ / __ __	**Sample Type**
Sampling Site/Facility/Supply/Location/Sampling Point ID	Coll. Time (24h) Start __ __ __ __ Coll. Time (24h) End __ __ __ __	**Non-Potable:** ☐ Stream/Surface ☐ Ground Water ☐ Private Well ☐ Septic ☐ Ocean/Saline ☐ Sediment ☐ Tissue ☐ Sewage: ☐ Raw ☐ Effluent ☐ Industrial: ☐ Raw ☐ Effluent
Waterbody Name	Sample Retention Retain? ☐ No ☐ Yes Duration ______	**Potable:** ☐ Groundwater Rule ☐ Source ☐ Confirmation ☐ Raw ☐ Finished ☐ Private Well ☐ At Source ☐ Flushed ☐ 1st Draw ☐ Lead Source Line ☐ Surface H_2O Intake ☐ Distribution System
Municipality/County	Type of Sampling Event ☐ Regular ☐ Compliance ☐ Repeat ☐ Non-Regulatory ☐ Other	**Fraction:** ☐ Total ☐ Dissolved
Sampling Point Street Address	If Repeat or GWR, List Original Lab Sample No. Sample Collector	**Other:** ☐ ______
PWSID	Trip #	**Priority:** ☐ Routine ☐ Priority ☐ Emergency

FIELD INFORMATION

Air Temp °C	Water Temp °C	Stream Flow-CFS
Weather Conditions	Sample pH (Field)	Gage Height-Ft.
Preserved in: ☐ Field ☐ Lab Date: __ __ / __ __ / __ __ Time: __ __ __ __	DO (mg/l) DO% Sat	Spec.Cond. (µS/CM) Salinity (ppm)
Chlorine Residual	Sample Depth Ft.	Tide Stage
Comments/Field Checks	Barometric Pressure (mmHg)	Turbidity (NTU)

ANALYSIS REQUESTS

Metals
☐ Ag .... Silver ☐ Mg ..... Magnesium
☐ Al .... Aluminum ☐ Mn ..... Manganese
☐ As .... Arsenic ☐ Mo ... Molybdenum
☐ B .... Boron ☐ Na .... Sodium
☐ Ba .... Barium ☐ Ni .... Nickel
☐ Be .... Beryllium ☐ Pb .... Lead
☐ Ca .... Calcium ☐ Sb .... Antimony
☐ Cd .... Cadmium ☐ Se .... Selenium
☐ Co .... Cobalt ☐ Si .... Silica
☐ CR-T ..... Chromium ☐ Tl .... Thallium
☐ Cu .... Copper ☐ U .... Uranium
☐ Fe .... Iron ☐ V .... Vanadium
☐ K .... Potassium ☐ Zn .... Zinc

Preferred Methodology
☐ EPA 200.7 / 200.9 ☐ EPA 200.8

Residues
☐ Total Suspended Solids (TSS)
☐ Total Solids (TS)
☐ Total Dissolved Solids (TDS)
☐ Settleable Solids (SS)
☐ Total Volatile Solids (TVS)

General
☐ Alkalinity ☐ Fluoride by IC
☐ Bromide by IC ☐ Hardness
☐ Chloride ☐ MBAS
☐ Chloride by IC ☐ Odor
☐ Chromium, Hexavalent ☐ pH
☐ Chromium, Hexavalent by IC ☐ Phenols (PW)
☐ Color ☐ Phenols (NPW)
☐ Conductance ☐ Sulfate by IC
☐ Cyanide ☐ Sulfate Lachat
☐ Dissolved Oxygen ☐ Turbidity
☐ Fluoride

Mercury
☐ Mercury by EPA 245.1
☐ Low Level Mercury EPA 1631E

Nutrients
☐ Nitrite ☐ Nitrite + Nitrate
☐ Total Phosphorus ☐ Ortho Phosphorus
☐ Ammonia ☐ Total Kjeldahl Nitrogen (TKN)
☐ Nitrate (Calculated)
☐ Nitrogen, Total (Calculated)

Organics (Drinking Water)
☐ EPA 504.1 - EDB, DBCP,123TCP
☐ EPA 505 - Chlordane
☐ EPA 505 - Toxaphene
☐ EPA 507 - N and P containing Pesticides
☐ EPA 515.3 - Chlorinated Acid Herbicides
☐ EPA 524.2 - Purgeables
☐ EPA 525.2 - Liquid-Solid Extractables
☐ EPA 531.1 - N-Methylcarbamoyloximes and N-Methylcarbamates

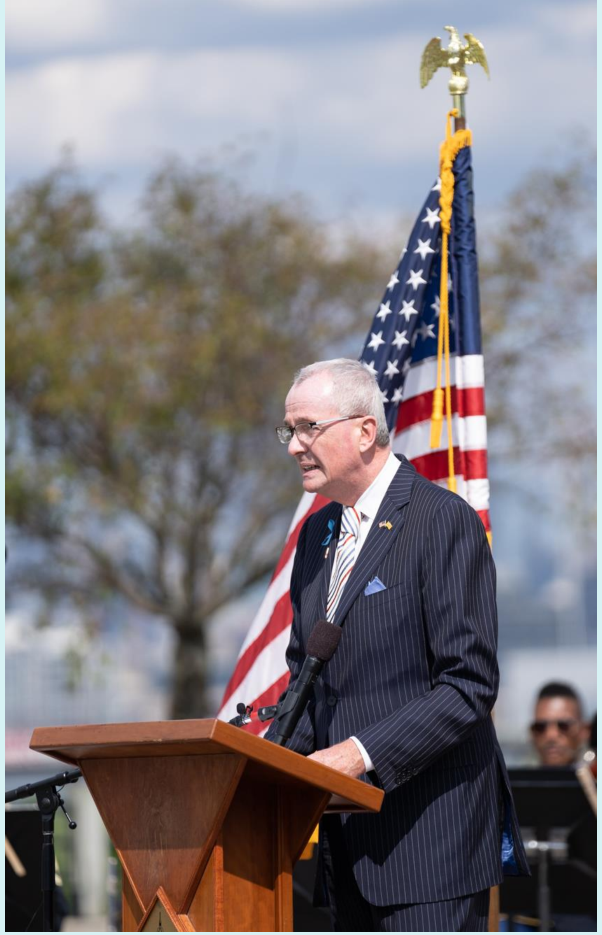
Organics (Non-Potable Water)
☐ EPA 624 – Purgeables
☐ EPA 625 - Base/Neutral and Acid Extractables

Demands
☐ Total Organic Carbon (TOC)
☐ Dissolved Organic Carbon (DOC)
☐ Chemical Oxygen Demand (COD)
<u>Suggested Dilutions</u>
☐ BOD5 ☐ BOD20 ____ ____ ____
☐ CBOD5 ☐ CBOD20 ____ ____ ____

Other
☐ ______________ ☐ ______________ ☐ ______________

Relinquished By:	Affiliation:	Received By:	Affiliation:	Date/Time	Reason for Custody Change
Name (Print):		Name (Print):			
Signature:		Signature:			
Name (Print):		Name (Print):			
Signature:		Signature:			

CHEM-44
FEB 16



Thank you!

NEW JERSEY • DEPARTMENT OF ENVIRONMENTAL PROTECTION

FSPM Chapter 11: Sample Shipment

February 29, 2024

Crystal Pirozek, Environmental Specialist
Bureau of Site Management
Contaminated Site Remediation & Redevelopment

Chapter 11: Sample Shipment

11.1 Introduction

11.2 Definitions

11.3 Training

11.4 Shipper's Responsibility

11.5 Hazard Classes

11.6 Packing

11.7 Marking and Labeling

11.8 Documentation

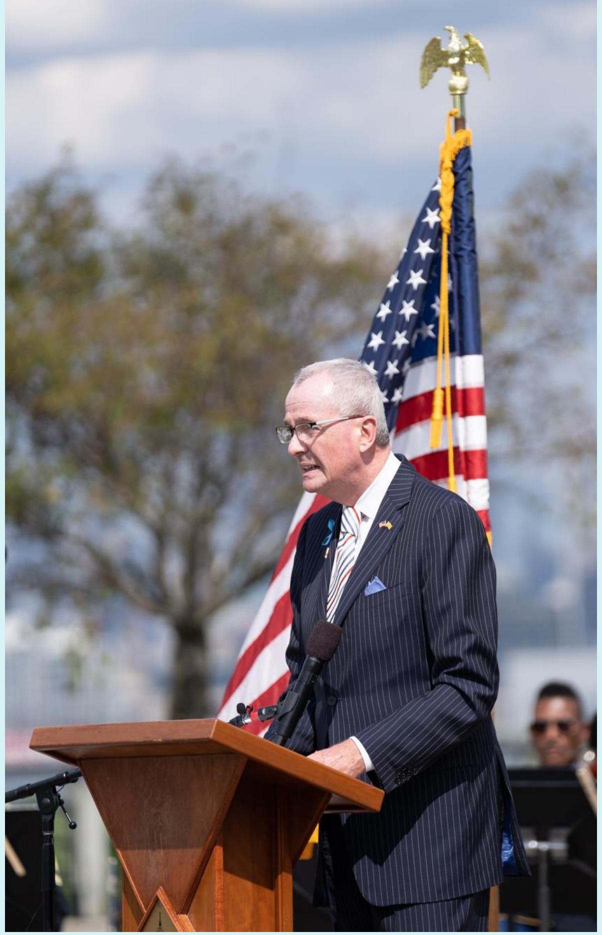
11.9 Preservation of Samples Relative to Dangerous Goods Shipment

Chapter 11 Overview

Chapter 11 focuses on the packaging, labeling, placarding, and shipment requirements for samples collected from hazardous materials and hazardous wastes

Chapter 11 Key Updates

- Updated the weblinks and list of referenced documents in Chapter 11
- Added clarification on sample shipment done by commercial laboratories using their ground couriers
- Clarified the difference between non-hazardous sample shipment (discussed in Chapter 2) vs. hazardous sample shipment procedures (discussed in Chapter 11)
- Clarified the definition of dangerous goods vs. hazardous materials and provided specific references for both

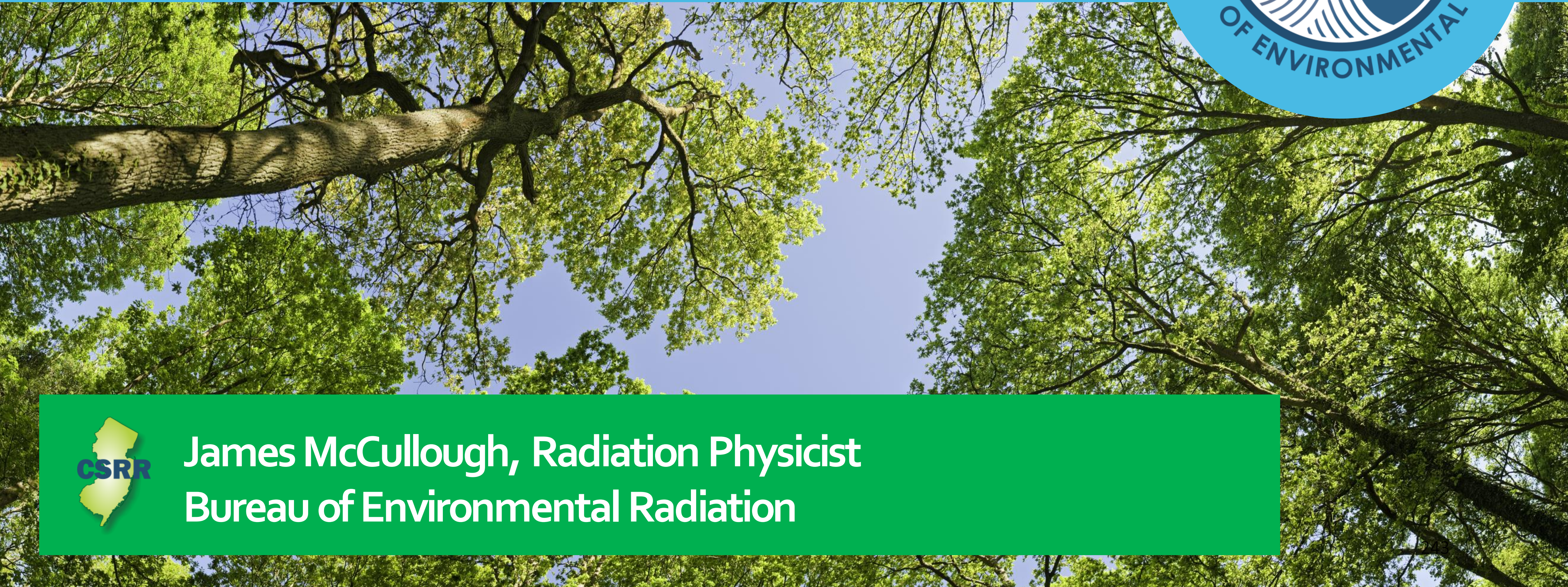


Thank you!

NEW JERSEY • DEPARTMENT OF ENVIRONMENTAL PROTECTION

FSPM Chapter 12: Radiological Assessment

February 29, 2024



James McCullough, Radiation Physicist
Bureau of Environmental Radiation

Chapter 12 Radiological Assessment

12.1 Introduction

12.2 Categories of Radioactive Materials

12.3 Applicability

12.4 Oversight

12.5 The Planning Stage (Data Life Cycle)

12.6 Site Identification/Historical Site Assessment

12.7 The Scoping Survey
- 12.7.1 Identify Contaminants
- 12.7.2 Establish the Derived Concentration Guideline Levels (DCGLs)
- 12.7.3 Classify the Area by Contamination Potential
- 12.7.4 Determine Background
- 12.7.5 Perform the Survey
- 12.7.6 Document the Scoping Survey Results

12.8 The Characterization Survey
- 12.8.1 Determination of Lateral and Vertical Extent of Contamination
- 12.8.2 Determine Background
- 12.8.3 Classify the Area by Contamination Potential
- 12.8.4 Document the Characterization Survey Results

12.9 The Remedial Action Support Survey

12.10 The Final Status Survey

Chapter 12 Overview

Chapter 12 provides guidance on conducting and documenting radiological surveys and sampling episodes for demonstrating compliance with N.J.A.C. 7:28-12, *Remediation Standards for Radioactive Materials*

Includes specific references to Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) which, along with this FSPM, is referenced in N.J.A.C. 7:28-12, *Remediation Standards for Radioactive Materials*

Chapter 12 Key Updates

- Definitions specific to radiological assessment and related guidance were updated and moved to the FSPM Glossary of Technical Terms (https://www.nj.gov/dep/srp/guidance/fspm/manual_edition/2022/fspm_glossary.pdf)

- Section 12.2 describes several categories of radioactive materials regulated by NJ

- Section 12.3 describes applicability of N.J.A.C. 7:28-12, *remediation standards for radioactive materials*

Chapter 12 Key Updates

Section 12.4 Oversight

- Discusses relevant sections of N.J.A.C. 7:26C *Administrative Requirement for the Remediation of Contaminated Sites*, LSRP oversight and submission of workplans and reports to the Department

- Bureau of Environmental Radiation contact, website and relevant references are also included

Chapter 12 Key Updates

Text throughout the document was revised to provide clearer or updated guidance and references for investigators

- 12.8.1, *Determination of Lateral and Vertical Extent*, includes
  - Expanded discussion of core scanning & sampling
  - New DataMiner report developed to provide a comprehensive list of certified laboratories, parameters, matrices, and analytical methods
    - Access at https://njems.nj.gov/DataMiner/
    - Select Report Category “Certified Laboratories” and run the report titled “Radiological Lab Certifications”

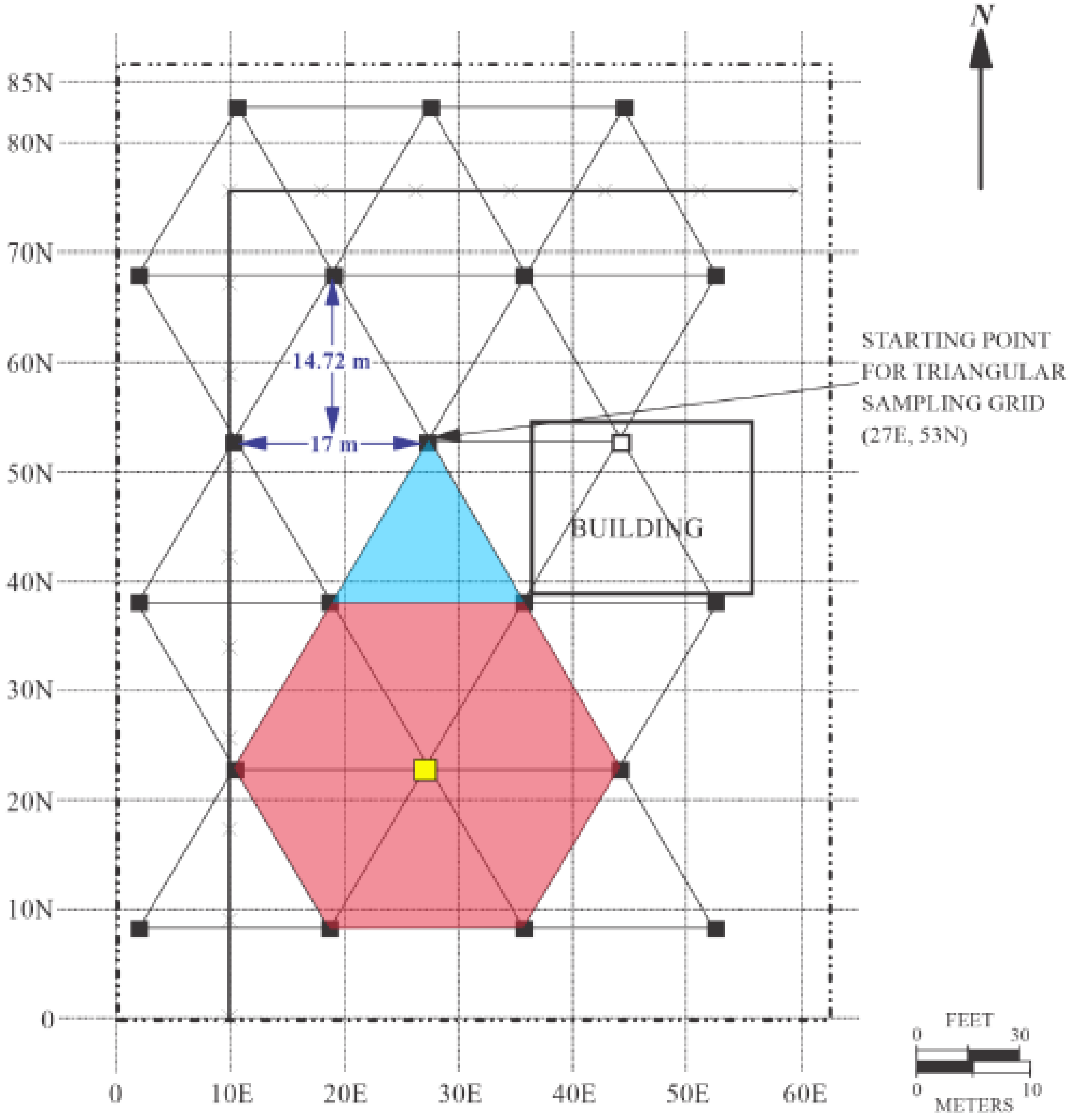
Chapter 12 Key Updates

The new Figure 12.2 shows an example of a random start triangular grid measurement pattern and was included to demonstrate the distinction between two different **$DCGL_{EMCs}$** referenced in guidance

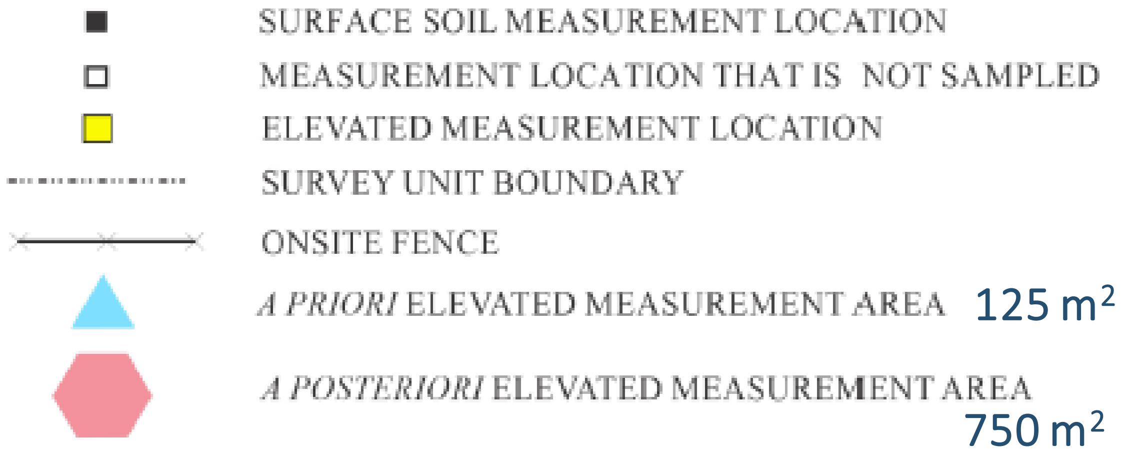
Derived concentration guideline level (DCGL) is a derived, radionuclide-specific activity concentration within a survey unit corresponding to the release criterion (regulatory limit expressed in dose or risk)

Elevated Measurement Comparison (EMC) is an assessment of elevated results which exceed the survey unit wide DCGL

New Figure 12.2 *Example of a Random Start Triangular Grid Measurement Pattern*



Added to show areas assumed in both the *a priori* systematic grid area and *a posteriori* elevated measurement areas



Example: Area Factor for *a priori* $DCGL_{EMC}$

Table 12.2 Outdoor Area Dose Factors									
Nuclide	Hot Spot Area (m^2)								
	1	3	10	30	100	300	1000	3000	10,000
Ra-226, Po-210	26.5	11.9	5.6	3.9	2.8	2	1	1	1

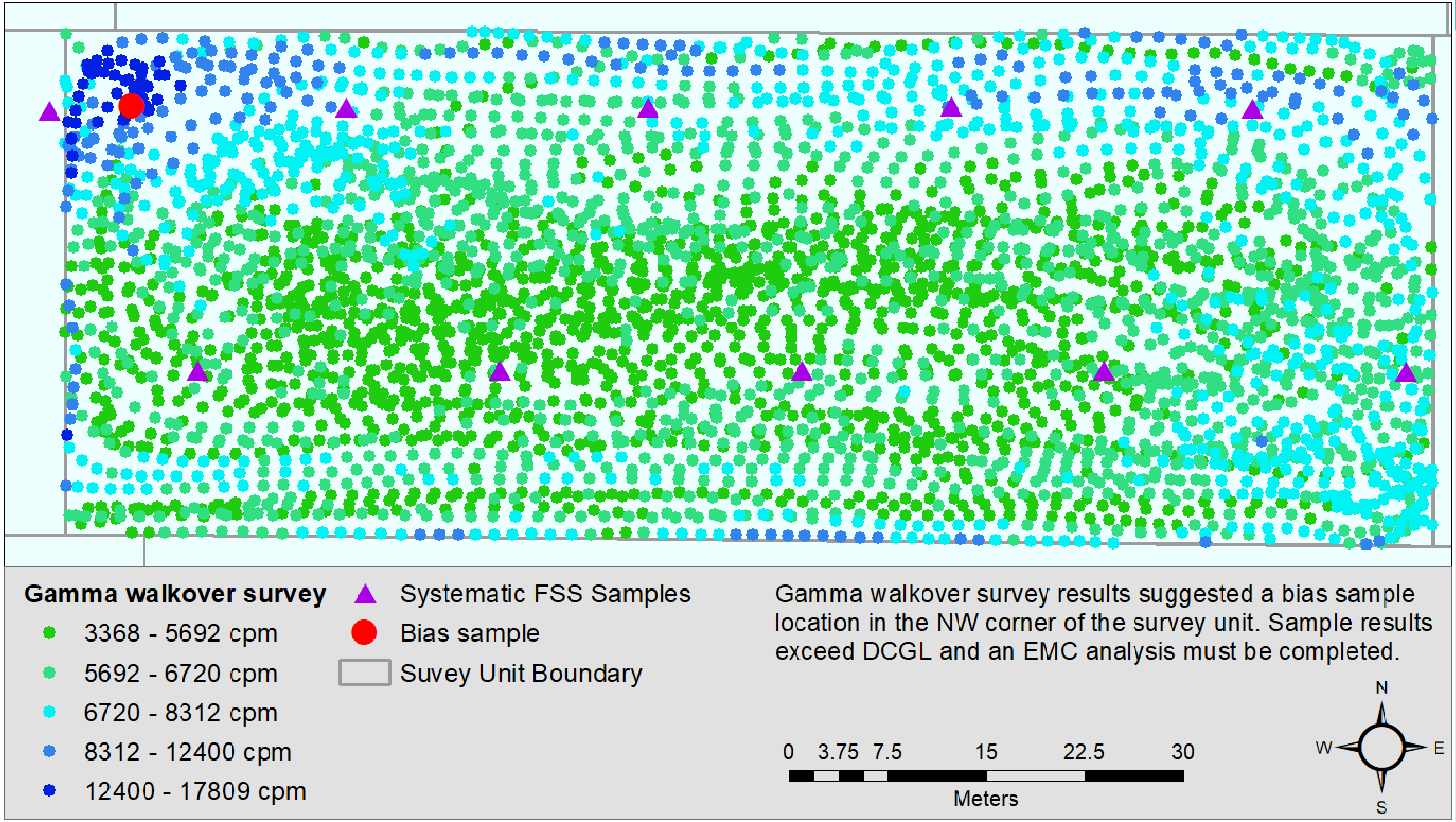
- Assume the Ra-226 DCGL is 7 pCi/g, and the area between planned systematic grid locations is 125 m^2
- *A priori* $DCGL_{EMC}$ = (Area Factor)(DCGLW) = (2.7)(7) = 18.9 pCi/g
- The scanMDC of field detection equipment and methods must be less than the *a priori* $DCGL_{EMC}$

Example: Area Factor for *a posteriori* $DCGL_{EMC}$

Table 12.2 Outdoor Area Dose Factors									
Nuclide	Hot Spot Area (m^2)								
	1	3	10	30	100	300	1000	3000	10,000
Ra-226, Po-210	26.5	11.9	5.6	3.9	2.8	2	1	1	1

- Assume the elevated measurement location (EML/hot spot) represents the larger 750 m^2 area
- Area factor for a posteriori DCGLEMC would be only 1.3
- $DCGL_{EMC}$ = (Area Factor)(DCGLW) = (1.3)(7) = 9 pCi/g
- If the elevated result exceeds this, the hot spot fails without further review

Refining EML Area



If the EML concentration is less than the a posteriori $DCGL_{EMC}$

- Survey units with an elevated area must also demonstrate compliance with MARSSIM equation 8-2 (unity rule) which account for dose contributions from both the survey unit and any hot spots

$$\frac{\delta}{DCGL_W} + \frac{(\text{average concentration in elevated area} - \delta)}{(\text{area factor for elevated area})(DCGL_W)} < 1$$

Where δ represents the survey unit mean

- See MARSSIM chapter 8 for more detailed discussion

MARSSIM Equation 8-2 expanded for a survey unit with two radionuclides of concern and two hot spots

$$\frac{\delta}{DCGL_W} + \frac{C_{EMC} - \delta}{(DCGL_{EMC})} = \frac{\delta}{DCGL_W} + \left[\frac{C_{EMC_{\#1}} - \delta}{(AF_{EMC_{\#1}})(DCGL_W)}\right] + \left[\frac{C_{EMC_{\#2}} - \delta}{(AF_{EMC_{\#2}})(DCGL_W)}\right]$$

$$= \left[\frac{(Mean\ Concentration\ of\ Ra226\ in\ Survey\ Unit)}{(Ra226\ DCGL_W)} + \frac{(Mean\ Concentration\ of\ Th232\ in\ Survey\ Unit)}{(Th232\ DCGL_W)}\right]$$

$$+ \left[\frac{(Mean\ Concentration\ of\ Ra226\ in\ Elevated\ Area\ 1) - (Mean\ Concentration\ of\ Ra226\ in\ Survey\ Unit)}{(Ra226\ Area\ Factor for\ Elevated\ Area\ 1)(Ra226\ DCGL_W)}\right.$$

$$\left. + \frac{(Mean\ Concentration\ of\ Th232\ in\ Elevated\ Area\ 1) - (Mean\ Concentration\ of\ Th232\ in\ Survey\ Unit)}{(Th232\ Area\ Factor for\ Elevated\ Area\ 1)(Th232\ DCGL_W)}\right]$$

$$+ \left[\frac{(Mean\ Concentration\ of\ Ra226\ in\ Elevated\ Area\ 2) - (Mean\ Concentration\ of\ Ra226\ in\ Survey\ Unit)}{(Ra226\ Area\ Factor\ for\ Elevated\ Area\ 2)(Ra226\ DCGL_W)}\right.$$

$$\left. + \frac{(Mean\ Concentration\ of\ Th232\ in\ Elevated\ Area\ 2) - (Mean\ Concentration\ of\ Th232\ in\ Survey\ Unit)}{(Th232\ Area\ Factor\ for\ Elevated\ Area\ 2)(Th232\ DCGL_W)}\right] < 1$$

Future Developments

MARSSIM Revision 2 Working Group

- Proposed Revision 2 in 2022 and currently reviewing comments received over the public comment period

  https://www.epa.gov/radiation/multi-agency-radiation-survey-and-site-investigation-manual-marssim

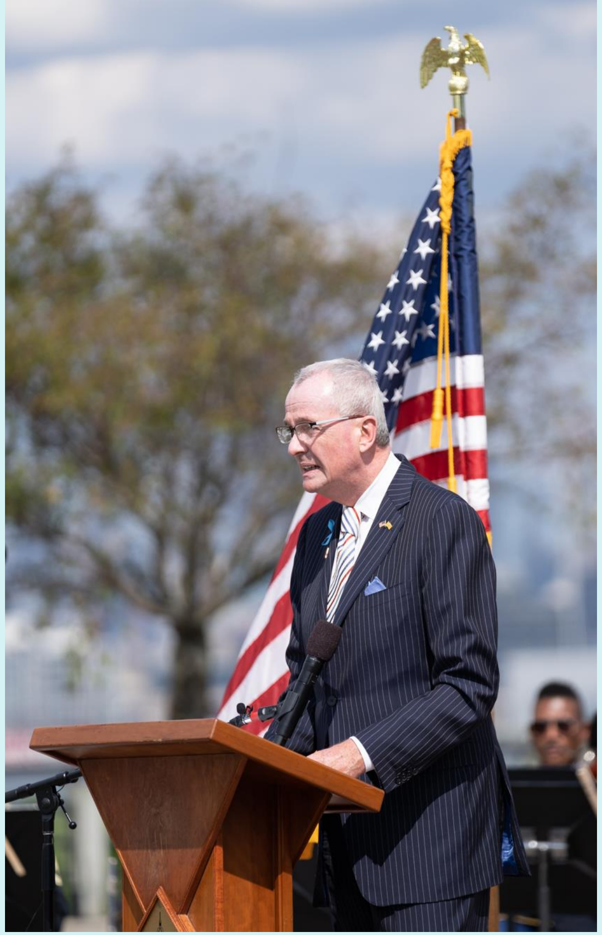
U.S. Nuclear Regulatory Commission

- Consolidated Decommissioning Guidance NUREG 1757 three volume set. Volume 2, Characterization, Survey, and Determination of Radiological Criteria – Final Report (Revision 2, July 2022)

  https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1757/index.html

- Draft Interim Staff Guidance (ISG), DUWP–ISG–02: Radiological Survey and Dose Modeling of the Subsurface To Support License Termination

  https://www.federalregister.gov/documents/2023/10/19/2023-23114/draft-interim-staff-guidance-radiological-survey-and-dose-modeling-of-the-subsurface-to-support



Thank you!

FSPM Chapter 13: Personnel Protection

February 29, 2024

Omar Minnicks, LSRP, EWMA LLC

Chapter 13: Personnel Protection

13.1 Introduction

13.2 Project Planning

13.3 Personal Protective Clothing and Equipment Use

13.4 Selection of Protective Clothing and Accessories

- 13.4.1 Other Considerations
- 13.4.2 Special Conditions
- 13.4.3 Ensembles/Level of Protection

13.5 Selection of Respiratory Equipment

- 13.5.1 Self-Contained Breathing Apparatus (SCBA)
- 13.5.2 Supplied-Air Respirators (SARs)
- 13.5.3 Combination SCBA/SAR
- 13.5.4 Air-Purifying Respirators

13.6 Heat Stress and Other Physiological Factors

- 13.6.1 Monitoring
- 13.6.2 Prevention
- 13.6.3 Other Factors

13.7 Personal Contamination Reduction Considerations

- 13.7.1 Steps in Doffing Disposable PPE
- 13.7.2 Doffing Reusable PPE
- 13.7.3 Low Level Contamination
- 13.7.4 Investigation Derived Waste

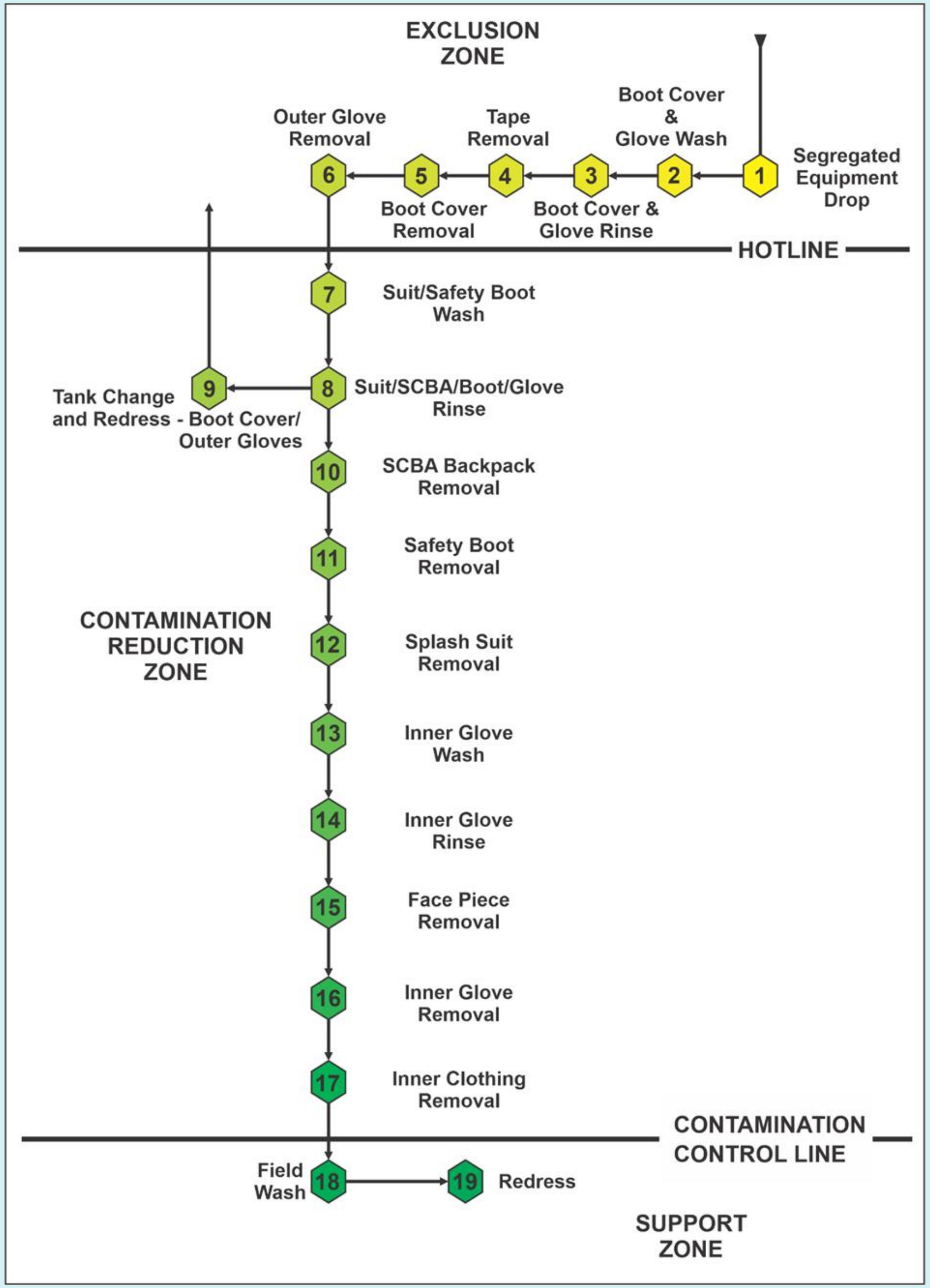
Chapter 13 Overview

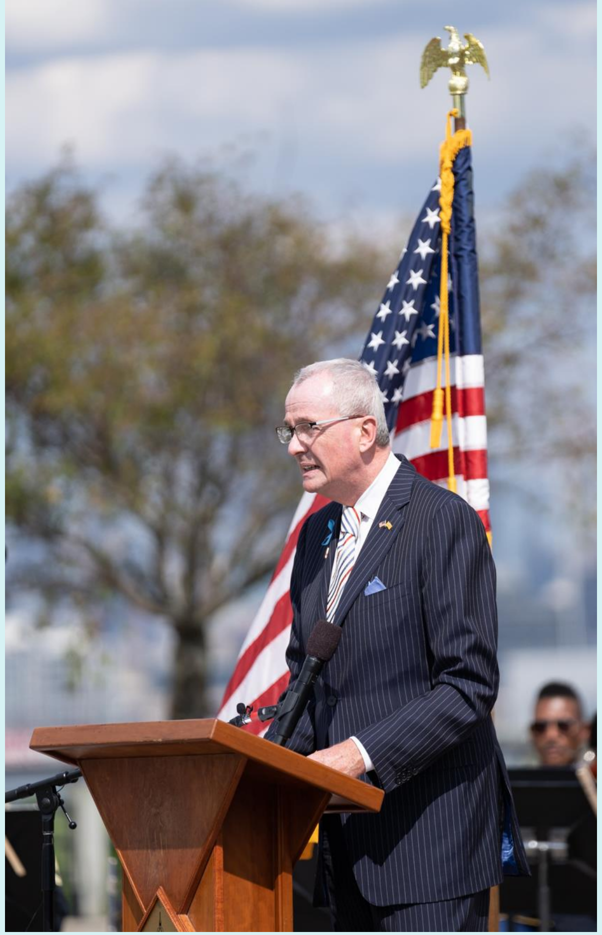
- For adequate protection and prevention of contaminant exposure to workers at hazardous waste sites in all phases of investigation, personal protective equipment should be utilized as required by a site-specific health and safety plan (HASP), and personnel contamination reduction practices must be implemented
- Chapter 13 details PPE, physiological factors, and personal contamination reduction that should be considered while onsite

Chapter 13 Key Additions and Updates

- OSHA PPE and Eye and Face Protection regulations
- Links to the NJDEP technical guidance manual webpage
- Project planning section
- Personal contamination reduction strategies
- Detailed information on donning and doffing PPE
- Section on how to address investigation derived waste with an IDW Plan
- Links to the OSHA website

Maximum Decontamination Area Layout for Level B Protection





Thank you!

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Questions?

Reminders!

- Questions not answered today will be answered via email in the coming weeks
- Please fill out the Course Evaluation here:

  https://www.surveymonkey.com/r/HXP8LSW
- Look out for an email from the LSRPA for CEC certificate access
- Slides and presentation will be posted on the CSRR Training page