THE NIELSEN ENVIRONMENTAL E-SCHOOL

Catalog

The Environmental Sampling E-Course

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THE ENVIRONMENTAL SAMPLING E-COURSE

This intensive 32-module E-Course features comprehensive instruction on environmental sampling strategies, methods and equipment used for sampling soil, ground water, surface water, sediment and waste. The first 7 modules of this E-Course set the stage for the remainder of the course by providing discussions on key terminology used throughout the course and fundamental concepts that will be built upon in subsequent E-Course modules. Topics covered include preparation of effective multi-media environmental sampling and analysis plans; strategies implemented for sampling environmental media in three dimensions; field QA/QC practices; field equipment decontamination procedures; sample handling and shipment; and documentation of environmental sampling events to ensure defensible data. Field video segments are included in most of these modules.

Modules 8 through 17 cover topics specific to soil sampling, including the science behind soil sampling; selection and use of a variety of soil sampling equipment and methods (from hand augers and push-tubes to direct-push and sonic drilling); use of US EPA Method 5035B for soil sample collection and preservation; field sample analytical methods (including use of PIDs for headspace screening, and use of immunoassay, analyte-specific field kits, X-Ray fluorescence and field-portable gas chromatographs); and soil sample description and handling in the field. In the field video portions of these modules, students learn how to collect soil samples for site characterization, remedial design or post-closure purposes using direct-push, sonic drilling and hollow-stem auger drilling methods; how to describe and handle soil samples in the field; and how to correctly use the volumetric sampling methods and chemical preservation methods required by U.S. EPA Method 5035B for collection and preservation of soil samples for VOC analysis.

Modules 18 through 27 cover topics specific to ground-water sampling, including the science behind ground-water sampling; water-level measurement; selection and operation of purging and sampling devices; how to properly implement a variety of purging and sampling methodologies (including conventional purging and sampling, low-flow purging and sampling and no-purge sampling); how to measure field water-quality indicator parameters; and sample collection and pre-treatment (filtration and preservation) procedures. The field video portions of these modules focus on the field practices and procedures used to effectively prepare for and implement ground-water sampling events, including well inspections prior to and housekeeping during sampling; water-level measurement; methods for conventional sampling, low-flow purging and sampling, and no-purge sampling; field water-quality indicator measurement; and sample collection, filtration and preservation. Modules 28 through 32 cover the topics of surface water, sediment and waste sampling, including developing an understanding of aquatic systems and the connections between surface water and sediment; sampling strategies, methods and equipment used for surface water; sampling strategies, methods and equipment used for sediment; and sampling strategies, methods and equipment used for a variety of waste scenarios, including drums and other containers, stockpiles and waste piles, surface impoundments and lagoons, landfill leachate and other waste sources. In the video portions of these modules, students learn how to prepare for a sampling event and how to collect samples of surface water and sediment using a variety of available sampling equipment.

Total Number of E-Modules Included in This E-Course: 32

Total CEUs for This E-Course: 35.7 CEUs

Price (With Option for Professional Certification; Includes Study Guide and Certification Exam Fees): $2395.00

Price (Without Option for Professional Certification): $2095.00

E-MODULES INCLUDED IN THE ENVIRONMENTAL SAMPLING E-COURSE

E-Modules included in The Environmental Sampling E-Course are listed under specific topics covered in the E-Course. You may take the entire package of 32 E-Modules listed below, OR you may take any of the individual E-Modules separately. Detailed descriptions and outlines for the individual E-Modules are included below.

Price for Each E-Module is $159.00

Topic: Planning an Effective Environmental Sampling Program – The Sampling & Analysis Plan

Most environmental projects involve the investigation and characterization of a variety of interconnected environmental media, including soil, ground water, surface water and sediment. There is a tendency to view each of these media in an isolated manner, which can lead to difficulties in interpreting sampling results later. Writing an effective site-specific Sampling & Analysis Plan to address these issues is much more involved than just sitting at your desk and "cutting and pasting" procedures that may have been prepared for a variety of other sites – that approach is often doomed to failure. Having a written site-specific Sampling & Analysis Plan for all field personnel to follow is an essential component of technical and legal defensibility and data validation. This module focuses on why it is important to think three dimensionally and look at multiple media when developing a sampling plan for a site, and emphasizes the importance of looking at the big picture when planning either an effective "snapshot" sampling event or a long-term monitoring and sampling program. Field videos for this module cover planning and field preparation for environmental sampling events. Upon completing this module, you will understand why a lot more goes into conducting an environmental sampling program than simply grabbing whichever person is available in the office and telling them to go fill a series of sample bottles!

Module ES–01 (Total Length: 73 minutes)
Planning an Effective Environmental Sampling Program – The Sampling & Analysis Plan

- Think 3-D! Visualizing Behavior of Contaminants in Different Media
- Typical Components of an Environmental Sampling Program
- Preparation of a Site-Specific Sampling & Analysis Plan (SAP) – Why to Write One, What to Include, and What to Avoid
- Common Objectives of Environmental Sampling Programs
- Dealing with the "Analysis" Portion of the SAP – Both Field and Lab Components
- Selecting Appropriate Parameters and Analytical Methods
- Understanding the Difference Between PPM vs. PPB vs. PPT and How that Affects Field Procedures
- Field QA/QC Terminology
- Details of Media-Specific Standard Operating Procedures (SOPs) to Include in the SAP

Total CEUs for Module ES-01: 1.2 CEUs

Topic: Developing an Effective Environmental Sampling Strategy

Developing an effective environmental sampling strategy is a complex task that requires significant planning and forethought. Prior to selecting an appropriate strategy, it is essential to review as many background documents as possible about the site and its surroundings, to create an initial conceptual site model (CSM). With the preliminary CSM in place, you must then field-verify the details of your model by conducting a thorough site reconnaissance. There are many questions that must be asked and answered during site reconnaissance that will guide you through the development of an effective sampling strategy. **This topic is covered in two modules (ES-02 and ES-03)**. The first module walks you through the development of a CSM and demonstrates how to conduct an effective site reconnaissance. You will learn how to use information obtained during site reconnaissance to fine-tune the CSM and how information obtained in the field during site reconnaissance is used in the development of effective sampling strategies and selection of appropriate sampling procedures. This module also provides a detailed look at sample collection from the perspective of determining whether to collect discrete or composite samples. The second module covers the why, where and how, and the critical importance of collecting background samples, as well as the various strategies typically utilized to collect samples in three dimensions to satisfy project objectives. **While you may opt to take just one of the modules, it is strongly recommended that you take both modules in the prescribed order if you want comprehensive coverage of the subject.**

Module ES–02 (Total Length: 60 minutes)
Developing a Conceptual Site Model and Fine-Tuning it With Site Reconnaissance

- Developing a Preliminary Conceptual Site Model (CSM) Prior to Developing Your Sampling Strategy
- Types of Background Information to Review
- Conducting an Effective Site Reconnaissance
- Questions to Ask During Site Reconnaissance to Fine-Tune the CSM and Focus the Sampling Strategy
- Addressing Environmental Variability in the Field
- Evaluation of the Best Type of Sample to Meet Project Objectives – Grab (Discrete) Sampling vs. Composite Sampling
- Advantages and Limitations of Grab (Discrete) Samples vs. Composite Samples

Total CEUs for Module ES-02: 1 CEU

Module ES–03 (Total Length: 47 minutes)
Strategies for Three-Dimensional Sampling of Environmental Media

- Collecting Background Samples – Why, Where and How
- Determining Where to Collect Samples
    - Haphazard Sampling
    - Judgmental Sampling
    - Probability (Statistical) Sampling
    - Multi-Incremental Sampling
    - Search Sampling
    - Hybrid Sampling

Total CEUs for Module ES-03: 1 CEU

Topic: Field Equipment Decontamination Procedures for Multi-Media Environmental Sampling

During environmental sampling events, a wide variety of field equipment is used to collect samples from a multitude of media and to perform field analysis on a variety of media. It is a common practice to use most equipment on a portable basis, at more than one sampling location. This is certainly convenient, but introduces the potential for cross-contamination of sampling locations and individual samples, both of which will affect the representative nature of samples collected. To prevent this potentially very serious and costly problem, it is critical to implement thorough and effective field equipment cleaning protocols. Within this module, classroom presentations and four separate field videos discuss in detail field equipment cleaning protocols that apply to equipment used for sampling soil, ground water, surface water and sediment. Additionally, classroom discussions cover cleaning protocols for equipment used at a variety of waste management units (e.g. landfills, surface impoundments, drums, dumpsters, waste piles) and artifacts (e.g. flooring, ceiling tile, walls). Learn how decontamination procedures may vary according to the medium being sampled and by contaminants being analyzed in samples. Discover why a few of the “detergents” commonly used for field equipment cleaning should be avoided for some field applications because they may contain phosphates, and why others may introduce trace amounts of semi-volatile compounds if not diluted sufficiently. You will also learn important terminology such as the differences between portable, dedicated, designated and disposable field equipment.

Module ES–04 (Total Length: 103 minutes)
Field Equipment Decontamination Procedures for Multi-Media Environmental Sampling

- Purposes of Field Equipment Decontamination
- Considerations for Selection of an Effective Field Decontamination Protocol
- Discussion of ASTM Standards D 5088 and D 5608 on Field Equipment Decontamination
- Control Water – Understanding the Term and How it Affects Decon Water Selection for Various Media, Contaminants and Equipment
- Dedicated vs. Designated vs. Portable vs. Disposable Equipment – Understanding the Differences and Building Them Into Your Cleaning Protocols
- Unique Options for Cleaning Surface Water and Sediment Sampling Devices
- Problems Associated With Using Chemical Desorbing Agents
- QA/QC Elements of Equipment Cleaning Programs
- Avoiding Common Errors in the Field During Equipment Cleaning

Total CEUs for Module ES-04: 1.7 CEUs

Topic: Field Quality Assurance/Quality Control Practices for Multi-Media Environmental Sampling

You think your sampling team does a good job in the field, but how can you be sure, and have the confidence that the results they produce are valid and defensible? With large environmental sampling programs, it is not unusual to have more than one sampling team from more than one company in the field collecting samples from different (or sometimes the same) media. When this is the case, you want to make sure the data generated in the field and in the lab are comparable. How do you do that? With sound field QA/QC procedures! Learn how to ensure that your sampling practices are technically and legally defensible and how to prove to outside groups and auditors that the data being generated during a sampling event can be validated. This module explains in detail how to implement an effective field QA/QC program designed for a variety of media, how to select the most meaningful QC samples for liquid and solid samples, how to correctly collect the chosen QC samples, how many to collect, and how to interpret the results. Several field videos cover proper procedures for collection of quality control samples for water and soil.

Module ES–05 (Total Length: 63 minutes)
Field Quality Assurance/Quality Control Practices for Multi-Media Environmental Sampling

- Understanding the Difference Between Quality Assurance and Quality Control
- Why Field QA/QC is so Important and How Much QA/QC do You Need?
- Determining Which QC Samples Should be Used for Which Media and Why
- Selecting Parameters to Run on QC Samples
- Detailed Discussions of the Types of QC Samples to Incorporate Into an Environmental Sampling Event
    - QC Samples for Liquids (e.g. Surface Water, Ground Water)
    - QC Samples for Solids (e.g. Soil, Sediment)
    - How to Correctly Collect QC Samples for Various Media While Avoiding Common Errors in the Field
- Determining How Many QC Samples to Collect

Total CEUs for Module ES-05: 1.1 CEUs

Topic: Environmental Sample Handling and Shipment

Environmental sampling events frequently involve collecting samples of a variety of different media for off-site analysis in a fixed laboratory. Your samples may have been collected using the highest degree of care, but your job is still not complete – the samples need to get to the laboratory in good condition, on time and in compliance with shipping regulations. This module discusses options available for sample delivery to the laboratory, dealing with awkward environmental samples that pose shipping difficulties, and how to ship samples that are classified as being hazardous under shipping regulations. You will learn about tamper-proofing mechanisms that should be used in many projects to protect the physical and chemical integrity of samples and why U.S. EPA's definition of "hazardous" does not necessarily agree with shipping regulation definitions of hazardous. Learn why you need to know about IATA and DOT shipping regulations and why you need to be certified to ship hazardous environmental samples.

Module ES–06 (Total Length: 70 minutes)
Environmental Sample Handling and Shipment

- Options for Getting Samples to the Laboratory
- Preparing for Sample Shipment
- Discussion of ASTM Standard D 6911 on Packaging and Shipping Environmental Samples for Laboratory Analysis
- Mechanisms to Protect Samples From Tampering During a Sampling Event and Shipment to the Laboratory
- Understanding the Role of Chain-of-Custody Forms – Their Purpose, When and How They Should be Completed
- Special Problems Encountered When Shipping Soil and Sediment Samples
- Overview of DOT and IATA Shipping Regulations and How These Regulations Affect Getting Samples to the Laboratory
- How to Correctly Pack a Cooler Containing Uncontaminated Samples for Delivery
- What Happens to Samples When They Arrive at the Laboratory

Total CEUs for Module ES-06: 1.2 CEUs

Topic: Documentation of Environmental Sampling Events

Document… document… document! Paperwork is the part of a sampling event that sampling teams hate the most! This module explains in detail the various mechanisms available for documenting field activities, taken from the approach of ensuring that mechanisms are in place to make certain that field documentation that is both traceable and defensible. The three key options for field recordkeeping - written records, electronic records and audio-visual records - are discussed in detail in this module. This module is appropriate not only for sampling team members but also for regulatory personnel who may be involved in enforcement cases that require the collection of evidence for court cases.

Module ES–07 (Total Length: 92 minutes)
Documentation of Environmental Sampling Events

- Detailed Discussion of the Secrets to Keeping Written Records
  - Types of Written Records to Address in the Sampling & Analysis Plan
  - Field Forms – Pros and Cons of Loose Forms
  - Site-Specific Bound Field Notebooks
  - What to Record and What Not to Record in Your Field Notes
  - Overview of ASTM Standard Guide D 6089 on Documentation of Environmental Sampling Events
  - Avoiding Common Errors in Recording Written Notes in the Field
  - Use of Error Codes in Field Notes When an Error is Made
- Electronic Recordkeeping
  - Advantages and Limitations of Electronic Information Recording
  - Managing E-Documents in the Field and in the Office
  - Think Twice Before Sending That E-Mail
- Audio-Visual Recordkeeping
  - Getting Written Approvals
  - Audio Recordings – Do's and Don'ts
  - The Great Debate: Digital vs. Print Film Cameras
  - Camera Lens Considerations
  - Video Cameras – to Use or Not to Use?

Total CEUs for Module ES-07: 1.5 CEUs

Topic: The Science Behind Soil Sampling

Soil sampling – as easy as digging a hole and grabbing some dirt, isn't it? No, it's not! **This series of 3 modules (ES-08, ES-09 and ES-10)** explores the nuances of soils and how they affect soil sample collection. **The first module (ES-08)** begins by explaining the importance of developing an understanding of the complexity of soils and their parent geologic materials, then addresses the correlation between site geology and contaminant movement through the unsaturated (vadose) zone and the saturated zone. With these fundamental concepts in place, discussions focus on how this complex relationship affects how and where soils should be sampled to ensure that objectives for both physical and chemical sample analysis can be met by the sampling program. This module then builds upon the concept of developing a detailed 3-dimensional view of subsurface materials, and walks you through everything that needs to be addressed when planning a soil sampling program, including defining what a representative soil sample is. **The second module (ES-09)** addresses the differences between conventional (multi-phased) site characterization and accelerated/expedited site characterization, and how to use accelerated site characterization methods to accomplish more comprehensive, cost-effective and efficient site characterization programs. **The third module (ES-10)** covers the use of a variety of site-characterization tools (direct-push, sonic drilling, cone penetration testing and field analytical methods) and concludes by addressing the questions of how many soil borings should be installed, at what depth intervals samples should be taken, and how many samples are enough for any given project. **While you may opt to take just one of these modules, it is strongly recommended that you take all three modules in the prescribed order if you want comprehensive coverage of the subject.**

Module ES–08 (Total Length: 59 minutes)
The Science Behind Soil Sampling – Part 1

- Understanding the Heterogeneous Nature of Soils and Their Parent Geologic Materials
- How Variations in Soil Type and Grain Size Affect the Movement of Water and Contaminants in the Vadose (Unsaturated) Zone and Saturated Zone
- Major Causes of Soil Heterogeneity
- Why it is Important to Understand the Complexity of Soil Samples and How That Complexity Affects Soil Sample Collection and Handling
- Planning a Soil Sampling Program
- Overview of Typical Soil Sampling Objectives
- Definitions of Representative Samples for Physical vs. Chemical Analysis at the Sample Scale and the Site Scale

Total CEUs for Module ES-08: 1 CEU

Module ES–09 (Total Length: 63 minutes)
The Science Behind Soil Sampling – Part 2

- The Conventional Environmental Site Characterization Approach: Multi-Phased Sampling
- Improved Approaches to Environmental Site Characterization: Accelerated and Expedited Site Characterization
- Cost and Efficiency Benefits of Accelerated/Expedited Site Characterization vs. Conventional Multi-Phased Sampling

Total CEUs for Module ES-09: 1.1 CEUs

Module ES–10 (Total Length: 49 minutes)
The Science Behind Soil Sampling – Part 3

- Methodologies and Technologies Used in Accelerated/Expedited Site Characterization
  - Direct-Push Technology
  - Sonic Drilling
  - Cone Penetration Testing
  - Field Analytical Methods
- Summary of Improved Site Characterization Using the Accelerated/Expedited Approach
- Determining How Many Boreholes to Install, What Depth Intervals to Sample, and How Many Samples to Collect

Total CEUs for Module ES-10: 1 CEU

Topic: Selection and Use of Soil Sampling Equipment

At least a dozen different kinds of soil sampling devices are available for you to use for the collection of soil samples – some can be manually deployed (simple and cost-effective, but limited to shallow depths), and others must be mechanically deployed (more complex and expensive, but with greater depth capability). Some devices can be used to collect depth-discrete samples, while others can be used for continuous sampling. Not all devices are suited to all field conditions, and some devices are better than others for collecting soil samples that are destined for either physical or chemical analysis. **This series of two modules (ES-11 and ES-12)** discusses the factors that affect the selection of an appropriate soil sampling device or method for prevailing site conditions and site-specific sampling objectives. These modules discuss in detail, using a comprehensive series of classroom and field videos, the options for hand-operated devices such as push tubes and hand augers, through mechanically deployed devices used in conjunction with portable drive sources, direct-push rigs and several different types of drilling rigs. The use of supplemental accessories such as sample retainers and liners is also discussed in detail. **While you may opt to take just one of these modules, it is strongly recommended that you take both modules in the prescribed order if you want comprehensive coverage of the subject.**

Module ES–11 (Total Length: 62 minutes)
Selection and Use of Soil Sampling Equipment – Part 1

- Factors Affecting the Selection of an Appropriate Soil Sampling Method
- Selecting a Sampling Device to Suit Site-Specific Field Conditions
- Overview, Applications & Limitations of Hand-Operated Devices (Push Tubes and Hand Augers)
- Overview, Applications and Limitations of Devices Used with Direct-Push Rigs for Discrete and Continuous Soil Sampling

Total CEUs for Module ES-11: 1 CEU

Module ES–12 (Total Length: 85 minutes)
Selection and Use of Soil Sampling Equipment – Part 2

- Overview, Applications and Limitations of Mechanically Assisted Devices (Split-Spoon Samplers, Thin-Wall Tube Samplers, Continuous Tube Samplers) Used with Drilling Rigs
    - Solid Stem Augers
    - Mud-Rotary Drilling
    - Sonic Drilling
    - Hollow-Stem Augers
- Pros and Cons of Using Soil Sample Liners and Sample Retainers

Total CEUs for Module ES-12: 1.4 CEUs

Topic: Soil Sample Handling and Processing Using U.S. EPA Method 5035B

Traditional methods of soil sample collection and handling for volatile organic compound (VOC) analysis are fraught with error and result in negative bias associated with data generated by laboratory analysis of these soil samples. **This series of two modules (ES-13 and ES-14)** explains why collecting soil samples for VOCs using "zero headspace" techniques is not valid and may, in fact, introduce significant bias and error; how conventional bulk matrix sampling practices can result in biased samples; and why laboratory subsampling of soil samples introduces error. Learn how proper implementation of U.S. EPA Method 5035B will result in collection and analysis of samples that much more accurately reflect in-situ field conditions and will result in much more accurate data. While Method 5035B is not a "new" method in the U.S., it is being increasingly adopted in countries other than the U.S. Unfortunately, both in the U.S. and Internationally the method is widely misunderstood and is often poorly implemented in the field. This series of two modules uses a comprehensive series of classroom and field videos to provide definitive guidance on what the intent of Method 5035B is, how to correctly implement both volumetric sampling methods and chemical preservation/extraction methods in the field, and how to avoid common field errors when implementing Method 5035B that can result in either negative or positive biases (or both) during sampling. Correct field procedures are illustrated through the use of "how-to" field videos. **While you may opt to take just one of these modules, it is strongly recommended that you take both modules in the prescribed order if you want comprehensive coverage of the subject.**

Module ES–13 (Total Length: 50 minutes)
Soil Sample Handling and Processing Using U.S. EPA Method 5035B – Introduction; Use of Volumetric Sample Collection Methods

- How Volatiles are Lost From Soil Samples
- Problems With Traditional Soil Sampling Methods for VOCs
- Limitations of Using Liners for VOC Sample Collection
- Objectives of Method 5035B
- Volumetric Sample Collection – How it Works, Equipment Options, Common Errors
- ASTM Standard Practice D 6418 for Using EnCore Samplers
- Advantages and Limitations of Volumetric Sample Collection Methods

Total CEUs for Module ES-13: 1 CEU

Module ES–14 (Total Length: 52 minutes)
Soil Sample Handling and Processing Using U.S. EPA Method 5035B – Use of Chemical Preservation/ Extraction Methods

- Chemical Preservation/Extraction Techniques for Low-Level Sample Preparation and Preservation
- Chemical Preservation/Extraction Techniques for High-Level Sample Preparation and Preservation
- Overview of U.S. EPA Method 3815 to Select High-Level or Low-Level Preservation Methods
- Advantages and Limitations of Chemical Preservation/Extraction Methods

Total CEUs for Module ES-14: 1 CEU

Topic: Field Sample Analysis Options for Soil Samples

Historically, field analysis of environmental samples has yielded numbers that, in many cases, were not regarded as being truly quantitative analytical data but were considered to be more qualitative in nature – a "yes/no" indicator of whether or not a chemical constituent was present. Over the past decade, there have been tremendous advances in the types and level of accuracy of field analytical tools available for the field chemist and non-chemist alike. In many cases, these new tools can provide quantitative data that can be used to accurately characterize the presence, absence and levels of specific contaminants in the subsurface. This module describes how to design an effective field analytical program from the non-chemist's perspective and provides guidance on how to ensure that data generated are both accurate and defensible. In-depth discussions are provided to address how to select the best parameters, analytical instruments and methods to meet the objectives of a field analytical program. This module also provides an overview of analytical instruments and methods available for volatile, semi-volatile and non-volatile contaminants commonly of interest in environmental site investigation and characterization programs.

Module ES–15 (Total Length: 78 minutes)
Field Sample Analysis Options for Soil Samples

- Problems with Historical Approaches to Field Sample Screening
- The Role of U.S. EPA's Triad Program and ITRC in Getting New Technologies Into the Field
- How to Ensure That Field Analytical Data Will be Accepted by Regulatory Agencies
- Field and Administrative Factors to Consider When Developing a Field Sample Analysis Program
- Common Objectives of Field Sample Analysis
- Selection Criteria for Choosing Field Analytical Instruments and Methods for the Non-Chemist
- Overview of Field Analytical Instruments and Methods for Volatile Compounds, Including Headspace Screening of Soil Samples
- Soil Sample Extraction and Field Analytical Methods for Semi-Volatile Compounds
- Direct Sample Analysis Methods for Non-Volatile Compounds Such as Metals

Total CEUs for Module ES-15: 1.3 CEUs

Topic: Soil Sample Collection, Description & Handling in the Field

During drilling of boreholes for site characterization and monitoring well installation, soil samples must be collected at the site to document site-specific geologic conditions in the subsurface. These soil samples are used to develop a detailed understanding of site hydrogeology, to determine the presence/absence of contamination, to determine the location, physical and chemical characteristics of target monitoring zones in which wells will be installed, and to design well screens and filter packs. **This series of two modules (ES-16 and ES-17)** uses a comprehensive series of classroom and field videos to provide instruction on the many factors that influence the collection of soil samples for both physical and chemical analysis, several dozen physical parameters that must be documented during soil sample description, several specific techniques for detailed physical soil sample description, and methods for proper handling of soil samples in the field during sampling events. **While you may opt to take just one of these modules, it is strongly recommended that you take both modules in the prescribed order if you want comprehensive coverage of the subject.**

Module ES-16 (Total Length: 65 minutes)
Soil Sample Collection, Description & Handling in the Field -- Planning and Preparation for Soil Sample Collection and Description; Describing Soil Samples in the Field (Part 1)

- Objectives of Soil Sample Description
- Important Principles Applied in Soil Sample Description
- Preparing for a Soil Sampling Event
    - Items to Discuss With the Drilling/Direct-Push Contractor Prior to Mobilizing to the Site
    - Equipment and Materials Recommended for Soil Sample Description and Handling
    - Checklists for Soil Sample Description in the Field
- Soil Classification Systems – USCS (ASTM Standards D 2487 and D 2488), USDA and Others
- Describing Soil Samples – 26 Physical Sample Descriptors to Record (Part 1)
    - Grain Size, Degree of Sorting, Particle Angularity/Roundness/Shape, Mineralogy, Density/ Consistency, Plasticity/Cohesiveness, Moisture Content, Color (Including Use of Munsell Soil Color Charts)

Total CEUs for Module ES-16: 1.1 CEUs

Module ES-17 (Total Length: 85 minutes)
Soil Sample Collection, Description & Handling in the Field -- Describing Soil Samples in the Field (Part 2); Handling Soil Samples in the Field

- Describing Soil Samples – 26 Physical Sample Descriptors to Record (Part 2)
  - Sedimentary Features, Presence of Macropores, Redox Conditions, Organic Matter, Degree of Weathering, Carbonate Content, and Other Descriptors
- Handling Soil Samples During the Sampling Event
  - Samples Used for Physical Analysis
  - Samples Used for Chemical Analysis

Total CEUs for Module ES-17: 1.4 CEUs

Topic: The Science Behind Ground-Water Sampling

Have you ever wondered if there is a better method than you are currently using for collecting more representative water-level data and ground-water samples from your wells? Ever thought about all of the various sources of bias and error in water-level measurement and sample collection procedures and wondered how each could affect the data in your sampling program? **This series of two modules (ES-18 and ES-19)** provides an in-depth discussion of how water-level measurement and ground-water sampling protocols have evolved over the years and how, through decades of research, modern sampling methods (when implemented properly) can yield vastly improved field data and more representative ground-water samples. Learn how to anticipate and avoid the many potential sources of bias and error that may occur in water-level measurement and ground-water sampling programs, and what factors can affect the representative nature of the samples you collect. Field videos are included within the first module to explain how to collect ground-water level measurements using several different methods. **While you may opt to take just one of these modules, it is strongly recommended that you take both modules in the prescribed order if you want comprehensive coverage of the subject.**

Module ES-18 (Total Length 80 minutes)
The Science Behind Ground-Water Sampling (Part 1): Defining Sampling Objectives; Accuracy, Precision & Bias; Uses of Water-Level Data; Water-Level Measurement Methods; Sources of Bias and Error in Water-Level Measurement

- Objectives and Purposes of Ground-Water Sampling
  - Collection of Representative Water-Level Data
  - Collection of Representative Water Chemistry Data
- The Importance of High-Quality Data in Ground-Water Sampling
  - Accuracy, Precision and Bias
- Ground-Water Level Data
  - Uses of Water-Level Data
  - General Methods for Water-Level Measurement
  - Water-Level Measurement Methods
  - Recognizing and Avoiding Sources of Bias and Error in Water-Level Measurement

Total CEUs for Module ES-18: 1.3 CEUs

Module ES-19 (Total Length: 70 minutes)
The Science Behind Ground-Water Sampling (Part 2): Sources of Bias and Error in Ground-Water Sampling; Factors Affecting the Representative Nature of Ground-Water Samples

- Sources of Bias and Error in Ground-Water Sampling
  - Purging Practices, Field Parameter Measurement, Ground-Water Sample Collection
- Definition of a “Representative” Sample
- Conditions Under Which Ground Water Typically Occurs
- Factors Affecting the Representative Nature of Ground-Water Samples
  - Sampling Point Placement, Design, Installation and Development
  - Formation and Well Hydraulics Between and During Sampling Events
  - Chemistry of the Water Column Above and Within the Well Screen
  - Well Purging and Sampling and Associated Issues

Total CEUs for Module ES-19: 1.2 CEUs

Topic: Selection and Operation of Ground-Water Purging and Sampling Devices

There are a lot more useful and appropriate purging and sampling device options available than the bailer! Learn what types of sampling devices are appropriate for a variety of analytical parameters, and which devices should never be used for some parameters. **This series of two modules (ES-20 and ES-21)** uses a comprehensive series of classroom and field videos to provide a detailed discussion of a wide range of devices available for purging and sampling ground-water monitoring wells, including their principles of operation, operational characteristics, materials of construction, and limitations. The discussions provide a framework for evaluating any device to determine its suitability and appropriateness for site-specific and individual well-specific applications. Field videos are included within each module to explain the operation and use of a variety of sampling devices. **While you may opt to take just one of these modules, it is strongly recommended that you take both modules in the prescribed order if you want comprehensive coverage of the subject.**

Module ES-20 (Total Length: 42 minutes)
Selection and Operation of Ground-Water Purging & Sampling Devices (Part 1) -- Sampling Device Selection Criteria; Sampling Device Impacts on Sample Chemistry; Operational Characteristics and Limitations of Grab Samplers, Suction-Lift Pumps & Electric Centrifugal Submersible Pumps

- Purging and Sampling Device Selection Criteria
- Discussion of ASTM Standard D 6634 on Selection of Purging and Sampling Devices for Ground-Water Monitoring Wells
- Impacts of Sampling Devices on Sample Chemistry
- Overview of Available Sampling Devices - Operational Characteristics and Limitations
    - Types of Devices Available
- Grab Samplers
- Peristaltic and Suction-Lift Pumps
- Electric Centrifugal Submersible Pumps

Total CEUs for Module ES-20: 1 CEU

Module ES–21 (Total Length: 55 minutes)
Selection and Operation of Ground-Water Purging & Sampling Devices (Part 2) -- Operational Characteristics and Limitations of Positive Displacement Pumps (Gear-Drive Electric Submersible Pumps, Double-Acting Piston Pumps, Gas-Drive Pumps and Bladder Pumps) and Inertial-Lift Devices

- Overview of Available Sampling Devices - Operational Characteristics and Limitations (continued)
    - Types of Devices Available
- Positive Displacement Pumps
    - Electric Gear-Drive Submersible Pumps
    - Double-Acting Piston Pumps
    - Bladder Pumps
    - Gas-Drive Pumps
- Inertial-Lift (Tubing/Check Valve) Devices

Total CEUs for Module ES-21: 1 CEU

Topic: Conventional Purging and Sampling Practices

Since regulatory programs mandating ground-water monitoring and sampling at a variety of sites first started in the 1970s, a number of different approaches for collecting ground-water samples from monitoring wells have been implemented. Some of the “conventional” purging and sampling practices first used in the 1970s (like well-volume purging and sampling and purging a well to dryness) continue to be implemented today, even though it has been repeatedly demonstrated through decades of research that these methods are rarely, if ever, capable of producing representative samples. This module discusses how these practices are implemented, and how these and other practices are applied to both high-yield wells and low-yield wells that tend to go dry during purging. Discussions are provided to document the limitations that research has found with these purging and sampling practices. If you are still purging 3 to 5 well volumes as a purging strategy or if you are still purging wells to dryness then returning in 24 hours to sample (or if you are overseeing projects where these techniques are being used), then this is a module you should not miss! Field videos are included within this module to explain the practices and procedures used in conventional purging and sampling.

Module ES–22 (Total Length: 51 minutes)
Conventional Purging and Sampling Practices for High-Yield and Low-Yield Wells – Well-Volume Purging; Purging to Stabilization of Water-Quality Indicators; Purging to Dryness, Then Sampling

- Objectives of Conventional Purging
- Discussion of ASTM Standards D 6452 on Purging Ground-Water Monitoring Wells and D 4448 on Sampling Ground-Water Monitoring Wells
- Comparison of Conventional Strategies for Purging High-Yield Wells
- Problems With Conventional Purging Methods for High-Yield Wells
- Placement of Purging Devices Within the Water Column
- Conventional and Improved Approaches to Sampling Low-Yield Wells

Total CEUs for Module ES-22: 1 CEU

Topic: Low-Flow Purging and Sampling and No-Purge Sampling

Traditional ground-water sample collection methods, including well-volume purging and sampling and purging a well to dryness, are subject to significant sources of bias and error that commonly result in either over- or under-estimation of actual sample concentrations and poor precision and accuracy. It is thus exceedingly important to use more up-to-date methods, like low-flow purging and sampling and no-purge sampling, which have been demonstrated by many field research studies to produce higher quality samples so all stakeholders can have much higher confidence in sample analytical results. **This series of two modules (ES-23 and ES-24)** comprehensively covers the topics of low-flow purging and sampling and the newer methodology referred to as no-purge sampling, and explains why and how low-flow purging and sampling and no-purge sampling always produce dramatically improved and more consistent sampling results and significant cost savings. Field videos are included within these modules to help explain the practices and procedures required to implement low-flow purging and sampling and no-purge sampling. **While you may opt to take just one of these modules, it is strongly recommended that you take both modules in the prescribed order if you want comprehensive coverage of the subject.**

Module ES–23 (Total Length: 58 Minutes)
Practices and Procedures for Low-Flow Purging and Sampling

- Fundamental Concepts – What it is, How it Works
- Discussion of ASTM Standard D 6771 on Low-Flow Purging and Sampling
- Requirements for Equipment and Flow Rates
- Well Hydraulics During Low-Flow Purging and Sampling
- Procedures Used and Avoiding Common Errors in the Field
- Dedicated vs. Portable Equipment Considerations
- Advantages and Limitations of Low-Flow Purging and Sampling

Total CEUs for Module ES-23: 1 CEU

Module ES–24 (Total Length: 40 minutes)
Practices and Procedures for No-Purge Sampling

- Fundamental Concepts – What it is, How it Works
- Understanding the Concept of Equilibrated Grab Samplers
- Equipment Used for No-Purge Sampling
- Procedures Used for No-Purge Sampling
- Advantages and Limitations of No-Purge Sampling

Total CEUs for Module ES-24: 1 CEU

Topic: Field Parameter Measurement During Well Purging

Measurement of field water-quality indicator parameters is a fundamental component of most conventional purging and all low-flow purging and sampling approaches to collecting ground-water samples from monitoring wells. This module explains how to correctly measure the most common water-quality indicator parameters (including pH, specific conductance, dissolved oxygen and redox potential) and physical parameters (temperature and turbidity) used in conjunction with purging wells to ensure the collection of accurate data. You will learn which parameters to measure to achieve sampling program objectives and how to identify when field data do not make sense, and what the cause(s) may be. Field videos are included in this module to explain the practices and procedures used for field parameter measurement.

Module ES–25 (Total Length: 71 minutes)
Field Water-Quality Indicator Parameter Measurement During Well Purging

- Parameters Traditionally Measured and Why They May Not All be Meaningful
- Which Are the Most Meaningful Parameters to Measure During Purging and Why
- Turbidity – to Measure or Not to Measure During Purging?
- How and Where to Measure Field Water-Quality Parameters
- Instrument and Sensor Options for Field Water-Quality Data Measurement
- Common Problems in Field Parameter Measurement and Solutions to Those Problems
- Evaluating the Need to Measure Field Parameters During No-Purge Sampling

Total CEUs for Module ES-25: 1.2 CEUs

Topic: Ground-Water Sample Pre-treatment – Filtration and Preservation

Ground-water sample chemistry, by nature, will change within seconds as samples are brought from in-situ conditions (within the ground-water system, where it is at higher pressure and stable pH and temperature relative to atmospheric conditions) to the surface. When these changes occur, the representative nature of the sample is compromised. **This series of 2 modules (ES-26 and ES-27)** discusses in detail the sample pre-treatment methods, including sample filtration and preservation, that must be implemented in the field at the time of sample collection (not later, in the laboratory) to protect the physical and chemical integrity of the samples from the time the sample container is filled to the time it is extracted or analyzed in the laboratory. Upon completing these modules, you will know how to recognize and avoid several significant but common sources of error associated with field filtration and preservation of ground-water samples. Field videos are included within each module to explain the practices and procedures used in filtration and preservation of ground-water samples. **While you may opt to take just one of these modules, it is strongly recommended that you take both modules in the prescribed order if you want comprehensive coverage of the subject.**

Module ES–26 (Total Length: 51 minutes)
Ground-Water Sample Filtration

- Field Filtration of Ground-Water Samples
    - Objectives and Purposes of Sample Filtration
    - Naturally Occurring vs. Artifactual Turbidity in Samples
    - Filtration Methods Available for Ground-Water Samples
    - Discussion of ASTM Standard D 6564 on Field Filtration of Ground-Water Samples
    - Which Parameters Should and Which Should Not be Filtered
    - Filter Preconditioning – What it is, Why and How it Should be Done

Total CEUs for Module ES-26: 1 CEU

Module ES–27 (Total Length: 40 minutes)
Ground-Water Sample Preservation

- Physical and Chemical Preservation of Ground-Water Samples
    - Objectives and Purposes of Sample Preservation
    - Physical Sample Preservation – Things You Never Thought of as Sample Preservation
    - Chemical Preservation of Samples – When, Where and How it Should be Done
    - Overview of ASTM Standard D 6517 on Field Preservation of Ground-Water Samples
    - Elements of QA/QC for preservation of samples

Total CEUs for Module ES-27: 1 CEU

Topic: Overview of Aquatic Systems and Sampling Strategies and Devices for Surface Water

There is more to surface-water sampling than simply submerging the empty sample container into a river or lake! The importance of implementing correct sampling strategies and methods for surface-water sampling is often overlooked in environmental site investigation and characterization programs. **This series of two modules (ES-28 and ES-29)** introduces you to some of the important and unique terminology associated with sampling surface-water systems. It also reviews why it is important to understand how aquatic systems behave, how they are hydraulically connected to ground-water systems and why it is important to incorporate surface-water sampling into ground-water sampling programs at many sites. **The first module (ES-28)** discusses a variety of objectives of surface-water sampling projects, discusses in depth the many details that need to be considered when designing an effective surface-water sampling event, provides guidance on determining when to collect discrete vs. composite samples, and explains why taking vertical profiles with multi-parameter sondes can be an important part of determining where samples should be collected. Field videos in this module explain how to plan and prepare for a sampling event. **The second module (ES-29)** describes in detail the operational characteristics and applications of a variety of surface-water sampling devices, from pond samplers or "dippers" to depth-discrete sampling devices like Kemmerer samplers and Van Dorn bottles. Field videos in this module explain the use of a wide variety of sampling devices for collecting representative samples from surface-water bodies under a variety of field conditions. **While you may opt to take just one of these modules, it is strongly recommended that you take both modules in the prescribed order if you want comprehensive coverage of the subject.**

Module ES–28 (Total Length: 41 minutes)
Overview of Aquatic Systems and Sampling Strategies for Surface Water

- Overview of Terminology Unique to Surface-Water Sampling
- Common Objectives of Surface-Water Sampling Programs
- Grab Samples vs. Composite Samples
- Understanding "Lake Turnover" and Why it is Commonly Monitored
- Sampling Strategies for Shallow Surface-Water Systems
- Sampling Strategies for Deep Surface-Water Systems
- Common Difficulties Encountered in Establishing Background Sampling Locations

Total CEUs for Module ES-28: 1 CEU

Module ES–29 (Total Length: 55 minutes)
Overview of Surface-Water Sampling Devices

- Overview of Devices Available for Sampling Surface-Water Sampling
- General Selection Criteria for Surface-Water Sampling Devices
- Devices Used for Depth-Discrete Sampling
- Devices Used for Composite Sampling

Total CEUs for Module ES-29: 1 CEU

Topic: Overview of Sampling Strategies and Sampling Devices for Sediment

Sediments are an important component of any aquatic system. Sediment sampling is typically conducted at the same time as surface-water sampling because of the obvious physical connection between the two media. However, as is the case with soil samples, there are a number of unique features of sediment samples that must be considered when designing a sediment sampling program. This module discusses how the complexity of sediment samples affects where and how we collect sediment samples. It introduces terminology unique to sediment sampling and describes a number of common objectives of sediment sampling programs. A variety of manually deployed and mechanically deployed devices used for collection of shallow surface sediment grab samples and depth-discrete samples, and the applications and limitations of these devices are discussed in detail. Upon completion of this module, you will understand why sediment sampling is such hard work and why sampling device selection is more involved that choosing something that looks good in a catalog!

Module ES-30 (Total Length: 57 minutes)
Overview of Sampling Strategies and Sampling Devices for Sediment

- What is Sediment?
- Understanding the Complexities of Sediment Samples
- The Three Fundamental Layers of Sediment Systems
- Common Objectives of Sediment Sampling Programs
- Surface Grab Samples vs. Core Samples
- Where Should Sediment Samples be Collected?
- Selection Criteria for Sediment Sampling Devices
- Overview of Surface Sediment Grab Sampling Devices
- Advantages and Limitations of Surface Sediment Grab Sampling Strategies
- Overview of Sediment Coring Devices – Manual and Mechanical
- Advantages and Limitations of Sediment Coring Strategies

Total CEUs for Module ES-30: 1 CEU

Topic: Waste Sampling Strategies and Methods

The reason that many environmental sampling programs are implemented is that you are working at sites where some type(s) of waste(s) or hazardous materials have been used or managed over some period of the site's operational life. Some of the waste management units we encounter at these sites have been well engineered and managed, and some not. There are many different kinds of waste management units that fall under a wide range of local, state and federal regulatory programs. Consequently, it is important to develop an understanding of how waste materials are released into the environment by these various waste management units, to enable development of the best sampling strategies for characterizing the waste materials in storage (or released to the environment), and for sampling the environmental media impacted by the release. **This series of two modules (ES-31 and ES-32)** provides a comprehensive look at waste sampling from start to finish. **The first module (ES-31)** examines how releases of waste materials occur, why waste sampling is important, and special health and safety considerations that need to be addressed for sampling hazardous materials. This module also provides in-depth discussions of how to design an effective sampling strategy and how to select appropriate sampling devices for drums, tanks and other containers (including rolloffs). **The second module (ES-32)** provides a similar discussion for developing sampling strategies and selecting appropriate sampling devices for landfills and dumps; waste piles and stockpiles; and lagoons, basins, pits and surface impoundments. In addition, artifactual sampling is discussed for situations where building materials may need to be sampled as part of a site investigation or closure. **While you may opt to take just one of the modules, it is strongly recommended that you take both modules in the prescribed order if you want comprehensive coverage of the subject.**

Module ES-31 (Total Length: 56 minutes)
Waste Sampling Strategies and Methods -- Planning a Waste Sampling Program; Sampling Strategies and Devices for Drums, Tanks and Other Containers

- Short-Term Releases vs. Long-Term Releases to the Environment – Why Understanding How a Contaminant Was Released to the Environmental is Critical in Developing a Sampling Plan
- Common Objectives of Waste Sampling
- Special Planning Issues for Waste Sampling
- Special Health & Safety Considerations
- Sampling Device Selection Criteria – Why Perspectives Change for Waste Sampling
- Sampling Device Options for Liquid Samples
- Sampling Device Options for Solid Materials
- Types of Waste Management Units That May Require Sampling
- Drum, Tank, Container and Dumpster/Roll-Off Sampling Strategies and Precautions
- Advantages and Limitations of Drum Sampling Devices for Liquids and Solids

Total CEUs for Module ES-31: 1 CEU

Module ES-32 (Total Length: 40 minutes)

Waste Sampling Strategies and Methods -- Sampling Strategies and Devices for Dumps and Landfills; Stockpiles and Waste Piles; Lagoons, Basins and Pits; Artifactual Sampling

- Media Typically Impacted by Dumps and Landfills
- Methods for Accessing Leachate for Sampling
- Devices for Sampling Leachate
- Selecting Locations for Leachate Sampling
- Stockpiles vs. Waste Piles – Why it is Important to Understand How the Pile Was Created
- Media Potentially Impacted by Stockpile or Waste Pile Operations
- Sampling Strategies and Devices for Stockpiles and Waste Piles
- Precautions for Working on or Around Stockpiles or Waste Piles
- Understanding How Lagoons, Basins, Pits and Surface Impoundments are Used at Sites and Why Engineering Design Information is Important in Developing a Sampling Strategy
- Media Impacted by Operation of Surface Impoundments
- Sampling Strategies and Devices for Surface Impoundments
- Understanding What is Meant by Artifactual Sampling
- Objectives of Artifactual Sampling
- Sampling Strategies for Surface Contaminants vs. Penetrating Contaminants
  Unique Sampling Methods and Devices Used for Artifactual Sampling

Total CEUs for Module ES-32: 1 CEU

If you have any questions, do not hesitate to e-mail us at:
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Meet Your E-Training Instructors

David M. Nielsen, C.P.G., C.G.W.P., P.Hg.

David M. Nielsen is President of Nielsen Ground-Water Science, Inc., the parent company of The Nielsen Environmental E-School and The Nielsen Environmental Field School. He is a Certified Professional Geologist (AIPG #5040), a Professional Hydrogeologist (AIH #991), a Certified Ground-Water Professional (AGWSE #179) and a Certified/Licensed/Registered Professional Geologist in 7 states (AK, AR, DE, FL, IN, SC, TX). He has 40 years of experience in ground-water and environmental consulting, training and research. He has managed ground-water contamination investigations, environmental site assessments, ground-water monitoring and sampling programs, petroleum hydrocarbon spill investigations and remedial projects across the U.S. David was one of the primary instructors for Princeton Groundwater's Groundwater Pollution and Hydrology Course for 12 years, and he has also developed curriculum for and instructed: undergraduate, graduate and continuing education courses in ground-water science at Wright State University; Technology Transfer workshops on Environmental Site Characterization and Ground-Water Monitoring and Sampling for the U.S. EPA; Waste Management, Inc.'s Landfill University; and a one-year Hydrogeologic Training Program for the Environmental Response Division of the Michigan Department of Environmental Quality. He has instructed more than 500 ground water and environmental science short courses and workshops for consulting firms, regulatory agencies, industrial concerns, the Department of Defense, the U.S. EPA, trade and professional organizations, educational institutes and universities in the U.S., England, Canada, Australia, Guatemala and Mexico.

David is former Chairman of ASTM Subcommittee D-18.21 on Ground-Water and Vadose Zone Investigations, a consultant to the U.S. EPA Science Advisory Board, a member of the U.S. Department of Defense SERDP/ESTCP Peer Review Panel, and an advisor to the U.S. Department of Energy National Advanced Drilling and Excavation Technology Program. He is the editor and a contributing author for *The Practical Handbook of Environmental Site Characterization and Ground-Water Monitoring* (First and Second Editions; 1991 and 2006), *The Essential Handbook of Ground-Water Sampling* (2007) and *Technical Guidance on Low-Flow Purging and Sampling and Minimum-Purge Sampling* (2002). He is also a member of AIPG, the Association of Ground Water Scientists and Engineers, the American Institute of Hydrology and the Association of Engineering Geologists. He served for 12 years as Editor of *Ground-Water Monitoring and Remediation* and served for 12 years on the Wright State University Geology Department's Board of Counselors. He holds B.A. and M.S. degrees in geology from Miami University (1974) and Bowling Green State University (1977) respectively. Prior to co-founding The Nielsen Environmental Field School and Nielsen Ground-Water Science, Inc., he managed regional offices for two geoscientific and engineering consulting firms, served as Director of Research and Education for the National Ground Water Association and worked for state environmental agencies in Massachusetts, West Virginia and Ohio.
David has also written guidance documents on direct-push technology and ground-water sampling for the U.S. EPA Superfund program, and reviewed dozens of technical reports for the U.S. EPA's Environmental Technology Verification (ETV) program. He is the recipient of the Outstanding Service Award of the Association of Ground Water Scientists and Engineers, The Outstanding Achievement Award of ASTM, and a 4-time recipient of ASTM's Special Service Award.

Meet Your E-Training Instructors

Gillian L. Nielsen, C.E.S., C.G.W.M.S.

Gillian Nielsen is Vice President of Nielsen Ground-Water Science, Inc. the parent company of The Nielsen Environmental E-School and The Nielsen Environmental Field School. She is also Chairman of the International Certification Program for Environmental Samplers and Specialists. She has 37 years of International experience as an environmental and ground-water consultant and trainer. During her professional career she has developed, managed and implemented ground-water monitoring and sampling programs, soil gas monitoring investigations, multimedia environmental sampling programs, RCRA compliance audits, environmental site assessments and remediation programs at hazardous and non-hazardous waste sites in the U.S. and Canada. She has also played a key role in the development and management of corporate standard operating procedures as well as health and safety procedures and policies.

Gillian specializes in developing and instructing a wide variety of field practice-oriented training programs for private industry, consulting firms, state and Federal regulatory agencies, universities, professional and trade associations. She has lectured extensively and taught hundreds of field courses on the topics of ground-water monitoring and sampling, environmental sampling and field sample analysis, design and implementation of soil gas investigations and RCRA compliance throughout the U.S. as well as Canada, England, Guatemala, Mexico and Australia. Gillian also conducts 8-hour health and safety refresher training courses for clients across the U.S. who are involved in environmental contamination investigation and remediation projects. In addition to training, she works closely with industry and consulting firms as a consultant conducting audits of field investigation activities, negotiating with PRPs and regulatory agencies, developing corporate standard operating procedures and health and safety plans and providing technical reviews of site investigation reports. She also works closely with environmental instrumentation companies in the evaluation of new equipment and in development of new instrumentation.

Gillian was a 16-year member of the Editorial Board of *Ground-Water Monitoring and Remediation* and a member of the ASTM Subcommittee D-18.21 task group on ground-water sampling. She is the recipient of Ground Water Publishing Company's Outstanding Service Award for her work on the editorial board of the journal *Ground-Water Monitoring and Remediation* and has received several Standards Development Awards from ASTM. She has authored a number of scientific papers and written many ASTM Standards dealing with ground-water sampling, soil-gas monitoring, field analysis of environmental samples, and field decontamination procedures, and was a contributing author for first (1991) and second (2006) editions of *The Practical Handbook of Environmental Site Characterization and Ground-Water Monitoring* as well as *Technical Guidance on Low-Flow Purging and Sampling and Minimum - Purge Sampling* (2002). She is also a co-editor and contributing author of the text *The Essential Handbook of Ground-Water Sampling*, published in January 2007. Gillian frequently provides technical reviews of state and Federal regulatory agency technical guidance documents. Gillian holds B.Sc. degrees in geography (hydrology) and biology (aquatic) from Trent University in Ontario Canada.