THE NIELSEN ENVIRONMENTAL E-SCHOOL

Catalog

The Complete Ground-Water Monitoring E-Course

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THE COMPLETE GROUND-WATER MONITORING E-COURSE

This comprehensive 29-module E-Course covers everything from optimizing monitoring well placement to environmental drilling technologies to monitoring well design, construction and development to the most up-to-date methods and practices for sampling ground water from monitoring wells.

In the first 14 modules of this E-Course, instructors focus on the elements that comprise an effective ground-water monitoring program; the importance of establishing monitoring program objectives, data needs and uses; factors that influence optimal monitoring well location and monitoring system design, including site-specific geology, hydrogeology and geochemistry; collecting existing information to create an initial conceptual site model; using accelerated site characterization methods and modern technologies to efficiently develop a detailed understanding of site geology, hydrogeology and geochemistry; refining the conceptual site model to optimize positioning of wells and well screens; drilling methods available for characterizing sites and installing boreholes, wells and multi-level monitoring systems; soil sample description and handling in the field; well design techniques to ensure sediment-free ground-water samples; and monitoring well construction and development methods.

The substance of more than a dozen ASTM Standard Guides and Practices for environmental site characterization, environmental drilling and direct-push methods, monitoring well design and construction and well development is covered in this portion of the E-Course. In the field video portions of these modules, students learn how various advanced site characterization methods, including discrete and continuous soil sampling, discrete ground-water sampling and profiling, remote-sensing methods (including soil electrical conductivity profiling, soil hydraulic conductivity profiling and direct VOC detection), and cone penetration testing can be used to develop a detailed understanding of subsurface conditions. Additional video segments focus on how direct-push technology and sonic drilling can be used to collect soil samples install small-diameter monitoring wells.

In the next 15 modules of this E-Course, instructors focus on ground-water sampling issues. In modules 15 through 17, students learn about a number of important issues, including what factors influence the successful implementation of ground-water sampling programs; how to prepare and implement effective ground-water sampling and analysis plans; how to update existing sampling protocols in response to changes in technology and field practices; how to develop an effective field equipment decontamination program; and how to implement good field practices and incorporate strong field QA/QC protocols to ensure both precision and accuracy in ground-water sampling events. The field video portions of these modules focus on well inspection and housekeeping prior to sampling, field equipment decontamination practices, and how to properly collect field QA/QC samples.

In modules 18 through 29, instructors focus on the science behind ground-water sampling (uses of water-level data, water-level measurement methods, sources of bias and error in water-level measurement, sources of bias and error in ground-water sample collection, and factors affecting the representative nature of ground-water samples); selection and operation of purging and sampling devices; how to implement various purging and sampling methodologies (including conventional purging and sampling, low-flow purging and no-purge sampling); field water-quality indicator parameter measurement; sample collection and pre-treatment procedures (filtration and preservation); handling and shipment of ground-water samples (with discussions of DOT and IATA shipping regulations); and documentation of sampling events to ensure defensibility of data and records.

The substance of more than a dozen ASTM Standard Guides and Practices on these topics is covered in this portion of the course. The field video portions of these modules focus on all of the field practices and procedures used to effectively implement ground-water sampling events, including operation of a variety of ground-water sampling pumps, methods for conventional sampling, low-flow purging and sampling, and no-purge sampling; water-level measurement; measurement of field water-quality indicator parameters; sample collection, filtration and preservation; and sample packaging and shipment.

Total Number of E-Modules in This E-Course: 29

Total CEUs for This E-Course: 32.5 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 COMPLETE GROUND-WATER MONITORING E-COURSE

E-Modules included in The Complete Ground-Water Monitoring E-Course are listed under specific topics covered in the E-Course. You may take the entire package of 29 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: Optimizing Monitoring Well Placement

One of the most challenging questions faced at the start of a ground-water monitoring program is "what are the most effective locations for this site's ground-water monitoring wells and well screens?" **This in-depth series of 5 separate modules (GWM-01, GWM-02, GWM-03, GWM-04 and GWM-05)** addresses all of the myriad elements that must be evaluated to answer this seemingly simple question. Covered in detail are subjects including: ground-water monitoring program and monitoring system design elements; establishing monitoring program and monitoring system objectives; monitoring program and monitoring system data needs and uses (all in **GWM-01**); assembling and evaluating important site-specific and regional existing information; types and sources of existing information **(GWM-02)**; using existing information to prepare an initial conceptual site model (CSM) **(GWM-03)**; conducting a detailed 3-dimensional environmental site characterization program (approaches, tools and methods) **(GWM-04)**; refining the initial CSM; and selecting optimum monitoring point locations in 3 dimensions **(GWM-05)**. Field videos are included within several of these modules to explain the field methods used in environmental site characterization. **While you may opt to take just one or two of these modules, it is strongly recommended that you take all 5 modules in the prescribed order if you want comprehensive coverage of the subject.**

Module GWM–01 (Total Length: 63 minutes)
Ground-Water Monitoring Program and Monitoring System Design Elements; Establishing Monitoring Program and Monitoring System Objectives, Data Needs & Uses

- Major Elements of Ground-Water Monitoring Programs
- Steps to Follow for Effective Monitoring System Design
- Optimizing Monitoring Point Placement – the Process
- Common Monitoring Program and Monitoring System Objectives
- Data Requirements for Designing an Effective Ground-Water Monitoring System

Total CEUs for Module GWM-01: 1.1 CEUs

Module GWM–02 (Total Length: 70 minutes)
Assembling and Evaluating Important Existing Information (Part 1); Types and Sources of Existing Information

- Collecting and Evaluating Information on Important Factors Affecting Well Placement (Continued on Next Module)
    - Geographic and Climatic Conditions
    - Regional and Site-Specific Geologic Conditions
    - Regional and Site-Specific Hydrogeologic and Geochemical Conditions
    - Former and Current Land Uses; History, Types, Locations and Sources of Releases

Total CEUs for Module GWM-02: 1.2 CEUs

Module GWM–03 (Total Length: 53 minutes)
Assembling and Evaluating Important Existing Information (Part 2); Using Existing Information to Prepare an Initial Conceptual Site Model

- Collecting and Evaluating Information on Important Factors Affecting Well Placement (Continued From Prior Module)
    - Types and Characteristics of Contaminants
    - Locations of Potential Receptors and Exposure Pathways
    - Anthropogenic Influences on Ground-Water Flow
- Developing the Initial Conceptual Site Model
    - Identifying Probable Ground-Water and Contaminant Movement Pathways in 3 Dimensions
    - Identifying Data Gaps That Need to be Filled

Total CEUs for Module GWM-03: 1.0 CEUs

Module GWM–04 (Total Length: 78 minutes)
Conducting a Detailed 3-Dimensional Environmental Site Characterization Program – Approaches, Tools and Methods

- Limitations of Conventional Approaches to Environmental Site Characterization
- Principles and Advantages of Accelerated/Expedited Site Characterization
- Discussion of ASTM Standards D 6235 and E 1912 on Expedited and Accelerated Environmental Site Characterization
- Designing a Site Characterization Program to Fill Data Gaps in the Initial Conceptual Site Model
- The Importance of Continuous Sampling, Subsurface Geologic, Hydrogeologic and Geochemical Profiling, and 3-D Subsurface Visualization
- Selecting the Tools and Technologies to Produce the Data Required to Optimize Locations for Long-Term Monitoring Wells

Total CEUs for Module GWM-04: 1.3 CEUs

Module GWM–05 (Total Length: 40 minutes)
Refining the Conceptual Site Model; Selecting Optimum Monitoring Point Locations in 3 Dimensions

- Graphics Useful for Depicting Subsurface Conditions
- Identifying Target Monitoring Zones for LNAPLs, DNAPLs and Dissolved-Phase Contaminants
- Plotting Areal Distribution of Wells or Multi-Level Monitoring Systems
- Selecting Vertical Positions and Lengths of Well Screens or Sampling Ports
- Summary of Ground-Water Monitoring System Design

Total CEUs for Module GWM-05: 1.0 CEUs

Topic: Environmental Drilling Technology for Site Characterization and Monitoring Well Installation

There are more than a dozen different drilling methods that may be used to drill boreholes to collect soil samples for site characterization and install monitoring wells, but which method is most appropriate for your project? **This series of 2 modules (GWM-06 and GWM-07)** provides a detailed discussion on how to effectively evaluate and select the best drilling method for anticipated site conditions that will meet site-specific project objectives. Each of the most commonly used drilling methods is described in detail with respect to their operational characteristics and their applications and limitations for environmental site characterization and monitoring well installation. Field video is included at the end of the first module to explain the principles and practices employed in sonic drilling. **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 GWM–06 (Total Length: 74 minutes)
Factors to Consider in Selecting a Drilling Method; Descriptions, Applications and Limitations of Casing Advancement Drilling Methods

- Differences Between Environmental Drilling and Other Drilling
- Factors to Consider in Selecting a Drilling Method
    - Geologic Conditions Expected During Drilling; Ability to Recognize Subsurface Conditions; Sample Retrieval Capability; Presence and Type of Contaminants; Potential for and Degree of Formation Damage; Ability to Meet Well Installation Requirements; Logistical and Budgetary Constraints
- Casing Advancement Drilling Methods – Descriptions, Applications and Limitations
    - Driving; Cable Tool; Odex/Tubex; Sonic Drilling

Total CEUs for Module GWM-06: 1.2 CEUs

Module GWM–07 (Total Length: 65 minutes)
Descriptions, Applications and Limitations of Fluid Circulation Drilling Methods and Hollow-Stem Augers

- Fluid Circulation Methods
    - Direct Mud Rotary; Reverse-Circulation Rotary; Air Rotary; Air Rotary With Casing Driver; Down-the-Hole Hammer; Dual-Tube Reverse-Circulation Rotary
- Hollow-Stem Auger
- Preferred Methods for Environmental Drilling

Total CEUs for Module GWM-07: 1.1 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 to document site geologic conditions. 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 2 modules (GWM-08 and GWM-09)** 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 to aid in 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 GWM–08 (Total Length: 65 minutes)
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 -- Sample Locators and Physical Sample Descriptors
- 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 GWM-08: 1.1 CEUs

Module GWM – 09 (Total Length: 59 minutes)
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 GWM–09: 1.0 CEU

Topic: Ground-Water Monitoring Well Design and Construction

If you think there is a simple cookbook, one-size-fits-all approach to building monitoring wells that will consistently produce sediment-free, representative ground-water samples, you're dead wrong! **This series of 4 modules (GWM-10, GWM-11, GWM-12 and GWM-13)** will demonstrate why this is true by covering the complex topic of monitoring well design and construction from the bottom (the well screen) to the top (surface completion) and everything in between. These modules discuss myriad topics, including: the objectives and purposes of monitoring wells, sources of chemical interference in well construction, selection and installation of well casing and screen materials, and methods for joining well casing and screen **(GWM-10)**; optimizing well diameter, types and designs of well screens, naturally developed wells versus filter-packed wells, selecting filter-pack grain size and well-screen slot size, optimizing well screen length, and options for monitoring multiple target monitoring zones **(GWM-11)**; selection and installation of filter-pack materials and selection and installation of effective annular seal materials **(GWM-12)**; and surface protection for monitoring wells, alternate well completions, and direct-push well installation **(GWM-13)**. Learn how to correctly design and build a monitoring well that will meet site-specific objectives and that will produce representative, sediment-free samples for the life of the monitoring program. Learn how to avoid common errors in well design that end up costing you time and money later. Field video is included at the end of the final module to explain how to install a monitoring well using direct-push technology. **While you may opt to take just one or two of these modules, it is strongly recommended that you take all 4 modules in the prescribed order if you want comprehensive coverage of the subject.**

Module GWM–10 (Total Length: 58 minutes)
Objectives and Purposes of Monitoring Wells; Sources of Chemical Interference in Well Construction; Selection of Well Casing and Screen Materials; Methods for Joining Well Casing and Screen

- Discussion of ASTM Standard D 5092 on Ground-Water Monitoring Well Design and Construction
- Objectives and Purposes of Monitoring Wells
- Potential Sources of Chemical Interference in Drilling and Well Construction
- Selection of Well Casing and Screen Materials
    - PVC and Other Plastics
    - Mild Steel, Carbon Steel, Galvanized Steel
    - Stainless Steel
- Types of Joints Used for Casing and Screens

Total CEUs for Module GWM-10: 1.0 CEU

Module GWM–11 (Total Length: 63 minutes)
Optimizing Well Diameter; Types and Designs of Well Screens; Selecting Filter Pack Material Size and Well-Screen Slot Size; Optimizing Well Screen Length; Options for Monitoring Multiple Target Monitoring Zones

- Factors Influencing Selection of Well Diameter
- Types and Designs of Well Screens
    - Machine-Slotted Casing
    - Continuous-Wrap, Wire-Wound (V-Wire) Screens
- Principles of Proper Well Intake Design
- Selecting the Proper Filter Pack Grain Size
- Determining Optimal Well-Screen Slot Sizes
- Step-by-Step Filter-Pack and Well-Screen Design for Site-Specific Conditions
- Importance of Selecting an Appropriate Well Screen Length
- Negative Issues Associated With Long Well Screens
- Options for Monitoring Multiple Target Monitoring Zones
    - Multiple Vertically Spaced Short-Screened Wells (Well Clusters)
    - Multiple Completions in a Single Borehole (Well Nests)
    - Multiple-Screened Wells
    - Multi-Level Monitoring Systems

Total CEUs for Module GWM-11: 1.0 CEU

Module GWM–12 (Total Length: 52 minutes)
Selection and Installation of Filter-Pack Material Type; Selection and Installation of Effective Annular Seal Materials

- Selection and Installation of Filter-Pack Materials
    - Characteristics of an Appropriate Filter-Pack Sand
    - Techniques for Filter-Pack Installation
- Pre-Packed Well Screens – Advantages and Limitations
- Selection and Installation of Annular Seal Materials
    - Bentonite Materials
        - Bentonite Pellets, Chips, Granules and Grout
    - Neat Cement Grouts
        - ASTM C-150 Portland Cement
        - Cement Additives and Their Properties

Total CEUs for Module GWM-12: 1.0 CEU

Module GWM–13 (Total Length: 47 minutes)
Surface Protection for Monitoring Wells; Alternate Well Completions; Direct-Push Well Installation

- Surface Protection Measures
    - At-Grade and Below-Grade Completions
    - Above-Grade Completions
- Alternative Well Completions
    - Telescoping Well Completions
    - Bedrock Completions
- Direct-Push Well Installation
    - Proper Installation Techniques for Direct-Push Wells With Pre-Packed Well Screens

Total CEUs for Module GWM-13: 1.0 CEU

Topic: Ground-Water Monitoring Well Development

The well is installed, the surface completion is finished but the well is still not ready to sample. Development is a critical step following construction of monitoring wells that is often short-changed or, sometimes, not implemented at all when new wells are installed at a site. This can result in a detrimental impact on the ability of the new well to yield representative ground-water samples – from the perspective of ensuring adequate flow toward and into the well, volume of water available for sampling, and formation-quality ground-water samples. This module debunks many of the myths and misunderstandings associated with well development. Learn what types of development methods are available, which work well and which don't work well, which methods should never be used in monitoring wells, and why some wells should not be developed.

Module GWM–14 (Total Length: 47 minutes)
Ground-Water Monitoring Well Development – Objectives, Applications, Methods and Procedures

- Discussion of ASTM Standard D 5521 on Development of Ground-Water Monitoring Wells
- Objectives and Purposes of Well Development
- Applications, Advantages and Limitations of Various Development Methods
- When and How Long to Develop Monitoring Wells
- Which Parameters to Monitor to Confirm Effective Well Development
- When Not to Develop Monitoring Wells

Total CEUs for Module GWM-14: 1.0 CEU

Topic: Planning and Executing a Successful Ground-Water Sampling Event

The ground-water monitoring wells are installed and developed and you are finally ready to sample! Or are you? This module discusses in great detail all of the issues that need to be considered and documents that need to be in place prior to setting out to collect ground-water samples. Learn why it is critical to prepare and follow a written, site-specific Sampling and Analysis Plan. If you are an emergency response team member or regulatory enforcement staff, learn what alternative approach you would need to take to conduct a sampling event. Learn why you need to understand the terms accuracy, precision, bias and defensibility. Field videos are included within this module to explain well inspection and good housekeeping practices that should be employed during a ground-water sampling event.

Module GWM–15 (Total Length: 76 minutes)
Planning and Executing a Successful Ground-Water Sampling Event

- Components of a Ground-Water Sampling Event
- Sampling Event Planning and Preparation
- Discussion of ASTM Standard D 5903 on Planning and Preparing for a Ground-Water Sampling Event
- What to Include in a Sampling and Analysis Plan (SAP)
- Objectives and Purposes of the SAP
- SAP Design Options
- Making the SAP User-Friendly for the Sampling Team
- Addressing the Analysis Portion of the SAP
    - Lab Analysis
    - Field Analysis
- Understanding the Significance of PPM vs. PPB vs. PPT and How That Affects Field Practices
- Standard Operating Procedures (SOPs) to Include in the SAP
- Timing of Ground-Water Sampling Events
- Office Preparation for Ground-Water Sampling Events

Total CEUs for Module GWM-15: 1.3 CEUs

Topic: Field Equipment Decontamination Procedures

It is a common practice to use a variety of field equipment that travels from well to well during a ground-water sampling event. Portable equipment such as water-level gauges, flow cells, analytical instruments and multi-parameter sondes are examples of some equipment that is used in each monitoring well, even in situations where dedicated pumps are used. And, of course, where portable pumps are used, the pump (and, in many

cases, the discharge tubing) will also travel from well to well. To avoid the potentially very serious and costly problem of monitoring well cross-contamination, it is critical to implement thorough and effective field equipment cleaning protocols. This module discusses in detail field equipment cleaning protocols that apply to drilling, soil sampling and ground-water sampling field equipment. Learn 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. Field videos are included within this module to explain the practices and procedures used in decontamination of field equipment used in ground-water sampling events.

Module GWM–16 (Total Length: 99 Minutes)
Field Decontamination Procedures for Ground-Water Sampling Equipment

- Objectives 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
- Problems Associated With Using Chemical Desorbing Agents
- QA/QC Elements of Equipment Cleaning Programs
- Verifying the Effectiveness of Field Decontamination Efforts

Total CEUs for Module GWM-16: 1.7 CEUs

Topic: Field Quality Assurance/Quality Control Practices

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? 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. In the real world, a lot of attention is placed on ensuring that laboratory data are defensible and can be validated, but the same is not always true for field work. The only way to have confidence in your ability to validate results of a sampling event is to have a strong field Quality Assurance/Quality Control program in place. This module explains in detail how to implement an effective field QA/QC program, exactly what elements should be included in field QA/QC programs, and the importance of collecting a variety of field QC samples. Field videos are included within this module to explain how to properly collect field QC samples during a ground-water sampling event.

Module GWM–17 (Total Length: 69 minutes)
Field Quality Assurance/Quality Control Practices for Ground-Water Sampling Events

- Understanding the Difference Between Quality Assurance and Quality Control
- Why Field QA/QC is so Important
- How much QA/QC do You Need?
- Typical Components of a Field QA/QC Program for Ground-Water Sampling
- Detailed Discussions of the Types of QC Samples to Incorporate Into a Ground-Water Sampling Event
    - Which QC Samples to Include for Ground-Water Sampling Events and Why
    - How to Correctly Collect QC Samples for Ground Water While Avoiding Common Errors in the Field

Total CEUs for Module GWM-17: 1.2 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 2 modules (GWM-18 and GWM-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 GWM-18 (Total Length 80 minutes)
The Science Behind Ground-Water Sampling (Part 1): Objectives of Ground-Water Sampling; The Importance of High-Quality Data; Uses of Water-Level Data; Water-Level Measurement Methods and Procedures; Recognizing and Avoiding 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
  - Sources of Bias and Error in Water-Level Measurement

Total CEUs for Module GWM-18: 1.2 CEUs

Module GWM–19 (Total Length: 70 minutes)
The Science Behind Ground-Water Sampling (Part 2): Sources of Bias and Error in Ground-Water Sampling; Conditions Under Which Ground Water Occurs; 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 GWM-19: 1.2 CEUs

Topic: Selection and Operation of Ground-Water Purging & 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 2 modules (GWM-20 and GWM-21)** provides 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 discussion will 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 GWM–20 (Total Length: 42 minutes)
Purging and Sampling Device Selection Criteria; Operational Characteristics, Applications 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 GWM-20: 1.0 CEU

Module GWM–21 (Total Length: 58 minutes)
Operational Characteristics, Applications and Limitations of Positive Displacement Pumps (Gear-Drive Electric Submersible Pumps, Double-Acting Piston Pumps, Bladder Pumps and Gas-Drive Pumps) and Inertial-Lift Pumps

- 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) Pumps

Total CEUs for Module GWM-21: 1.0 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 GWM–22 (Total Length: 51 minutes)
Conventional Purging and Sampling Practices for High-Yield and Low-Yield Wells

- 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 GWM-22: 1.0 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 (GWM-23 and GWM-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 GWM–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 GWM-23: 1.0 CEU

Module GWM–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 GWM-24: 1.0 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 GWM–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 GWM-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 (GWM-26 and GWM-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 GWM–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 GWM-26: 1.0 CEU

Module GWM–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 GWM-27: 1.0 CEU

Topic: Ground-Water Sample Handling and Shipment

Samples are collected and now you are ready to get them to the laboratory so they can be analyzed. You have a vested interest in ensuring that the samples arrive at the laboratory on-time and in one piece. As a sampling team member, if you are the one presenting the samples to an outside group for delivery to the lab, you are referred to as the sample "shipper" and, as such, you are taking on the responsibility of ensuring that samples are delivered in compliance with applicable shipping laws. That is a critical fact that many samplers are unaware of. This module discusses issues associated with delivery and shipment of both uncontaminated and hazardous samples from the field to the laboratory. While this module will not certify you to ship hazardous substances, it will give you an awareness of regulatory requirements, which include training. Field videos are included within this module to explain proper practices and procedures for ground-water sample handling and shipment.

Module GWM–28 (Total Length: 66 minutes)
Ground-Water 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
- 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 GWM-28: 1.1 CEUs

Topic: Sampling Event Documentation

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 your field documentation 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 GWM–29 (Total Length: 92 minutes)
Documentation of Ground-Water 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 D 6089 on Documenting a Ground-Water Sampling Event
  - Avoiding Common Errors in Recording Written Notes in the Field
  - Use of Error Codes in Field Notes When an Error is Made
- Electronic Records
  - 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 GWM-29: 1.5 CEUs

If you have any questions, do not hesitate to e-mail us at:
info@envirofieldschool.com.

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.