THE NIELSEN ENVIRONMENTAL E-SCHOOL

Catalog

The Ground-Water Monitoring Well Design, Construction and Development E-Course

Designed & Instructed By:
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THE GROUND-WATER MONITORING WELL DESIGN, CONSTRUCTION AND DEVELOPMENT E-COURSE

The key to the success of any ground-water monitoring program is the effective placement, drilling, design, construction and development of ground-water monitoring wells. Ground-water monitoring wells and monitoring well networks must be designed based on site-specific hydrogeologic and geochemical conditions, to monitor site-specific compounds of interest so that ground-water sampling teams will be able to collect representative samples for field and laboratory analysis. Using proper well design, construction and development techniques is also important from the standpoint of ensuring that monitoring wells will continue to produce representative ground-water samples for their planned lifespan, which may be 30 or more years.

This comprehensive 14-module E-Course covers everything from optimizing monitoring well placement and monitoring system design to environmental drilling to proper methods for design, construction and development of ground-water monitoring wells. In the first 9 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 modern site characterization methods and technologies to develop a detailed understanding of site geology, hydrogeology and geochemistry; refining the conceptual site model to optimize positioning of wells and well screens; environmental drilling methods available for characterizing sites and installing boreholes, wells and multi-level monitoring systems; and soil sample collection, description and handling.

The last 5 modules of this E-Course focus on practices used in monitoring well design, construction and development to ensure sediment-free samples, including establishing objectives of monitoring wells; sources of chemical interference in monitoring wells; selection of well casing and screen materials; optimizing well diameter; types and designs of well screens; the importance of selecting the proper well screen length to meet monitoring program and sampling objectives; options available for monitoring multiple zones or formations, including multi-level monitoring systems; selecting filter-pack materials and well-screen slot sizes (including use of pre-packed screens); selecting and installing annular seal materials and surface protection measures; designing and installing wells using direct-push technology; and selecting and using appropriate well-development methods.

The substance of more than a dozen ASTM Standard Guides and Practices for environmental site characterization, environmental drilling, monitoring well construction and well development is covered in this 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, remote sensing methods (including soil electrical conductivity, soil hydraulic conductivity profiling and direct VOC detection), and cone penetration testing can be used along with other information to develop a detailed understanding of subsurface conditions. Additional video segments focus on how to collect soil samples and install small-diameter monitoring wells using direct-push methods and sonic drilling.

Total Number of E-Modules in This E-Course: 14

Total CEUs for This E-Course: 15 CEUs

Price (With Option for Professional Certification; Includes Study Guide and Certification Exam Fees): $1695.00

Price (Without Option for Professional Certification): $1495.00

E-MODULES INCLUDED IN THE GROUND-WATER MONITORING WELL DESIGN, CONSTRUCTION AND DEVELOPMENT E-COURSE

E-Modules included in The Ground-Water Monitoring Well Design, Construction and Development E-Course are listed under specific topics covered in the E-Course. You may take the entire package of 14 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

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.