Purpose and Background

Sound science must be the basis for environmental decisions. The need to collect data that is sufficient yet limited to that necessary to make purposeful decisions is emphasized. This course begins by describing the laws that govern the need for environmental soil, air and water sampling and progressively narrows the focus to needs driven by unique project and site characteristics. The principles governing defensible investigations are emphasized, as are versatile solutions to sampling problems. This course introduces environmental laws; the environmental data quality objective process; sampling theory; the measurement of errors; the role of both statistics and judgement in decision-making; selection of sampling tools; sampling for average hotspots and to compare populations; geostatistics; cost-efficient sampling; sampling various media; sample plan design; and methods for interpreting laboratory and field data. Included are discussions and examples of discrete and incremental sampling, applied statistics, both surface and subsurface contaminant transport, dimensional analysis, ecological and human health risk assessment, quality control, and data usability. Also, examples are presented that demonstrate sound sampling practices, presentation, interpretation and decision making for uncontrolled dump sites, abandoned mines, military facilities, power substations, manufacturing facilities and Brownfields sites. Costs saving methods are emphasized. Typical data needs and investigations associated with CERCLA remediation and removal actions and Brownfields sites are presented and discussed. Learning will be facilitated by classroom exercises.

1 The Data Quality Objective Process is commonly used to develop plans for environmental data collection. Its implementation reasonably ensures data quality and quantity sufficient to make defensible decisions.

Seminar Instructor

Mark Gemperline, Ph.D., P.E., M.ASCE, is the founder of MCG Geotechnical Engineering Inc. He is a registered environmental engineer in eight states and has served as an expert on several CERCLA enforcement actions, designed numerous characterization plans, and authored papers on sampling theory, remediation methods, and contaminant transport. His knowledge and skills were acquired by coursework at three universities, teaching at two universities, practicing thirty years as a civil and environmental engineer for the Bureau of Reclamation and eight years as president of MCG Geotechnical Engineering Inc. Experiences include planning and design, site characterization, risk evaluation, site stabilization, remediation and restoration of hazardous waste sites including a wide range of CERCLA, EE/CA, RCRA, NEPA and Brownfields activities. Experience includes risk, business, project management, program and resource management; contaminant fate analysis; surface and subsurface characterization; geotechnical, hydraulic and hydrologic analyses; team leading; presentation of seminars and workshops; report preparation; research and forensics; and providing both academic teaching and on-the-job training. Co-recipient of a 2005 Department of Interior, Office of Environmental Policy and Compliance, Environmental Achievement Award.
Summary Outline

Day 1—BASICS

Introduction to Sampling for Environmental Decisions
- Requirements of Law, Policy and Ethics
- The Influence of Precedent, Science, Risk Management and Funding on Sample Plan Designs
- Interdisciplinary Roles in Environmental Decision-Making and Sample Plan Development
- The Characterization and Decision Making Paradigm
- Course Objectives and Outline

Environmental Laws and Related Concerns
- Brief History of Environmental Laws
- Sampling and Decision-making Consequences

Decision Making
- Decision Makers
- Types of Decisions
- Basis for Decisions
- Perception and Judgement

Basic Statistical Concepts and Decisions
- Statistics for Sampling
- Hot Spots and Cold Spots
- Comparing Populations
- Representative Sampling
- Cost Efficient Sampling Practices

Laboratory Analyses
- For RCRA
- For CERCLA
- Special Analytical Needs
- Representative Subsampling

Analytical Screening Technologies
- Roles of Screening Technologies
- Inorganic Elements and Compounds
- Organic Compounds
- PCBs and Other Dioxin-Like Compounds

Human and Ecological Risk Assessment and Associated Data Needs
- Human Risk Assessment Concepts
- Ecological Risk Assessment Concepts
- Associated Data Needs

Common Engineering Concerns and Associated Data Needs
- Contaminant Transport (surface and subsurface)
- Stormwater Management
- Wetland Design
- Buried Pipe and Utilities
- Site Safety and Stability
- Structural Evaluations
- Cleanup Technologies

Day 2—APPLICATION

Data Quality Objective Process
- Brief History of the DQO Process
- Process Steps
- The Role of Conceptual Models for Chemical Distributions and Risk
- Anticipating Engineering Analyses and Data Needs
- Defensibility is in the Details
- Observational Approach to Site Characterization

Quality Assurance and Quality Control
- Quality Assurance and Quality Control Defined
- Establishing Measurable Performance Requirements
- Timeliness
- Corrective Actions
- Laboratory and Field Data Verification
- Data Usability Evaluation
- Peer Review

Detailed Example – Remedial Action at an Uncontrolled Dump Site
- Project Description
- Remedial Investigation and Feasibility Study
- Litigation
- Remedial Design
- Remediation and Cleanup Verification
- Restoration

Other Examples
- Former Arms and Munitions Facility
- Active Arms and Munitions Plant
- Decommissioned Power Substation
- Radium Contaminated Storage Facility Remediation
- Uranium and Gold Mines
- Power Substation
- Athletic Field

Exercises
### Objectives

- Gain basic knowledge of the concerns that define data needs
- Develop a working knowledge of the statistics most commonly utilized in environmental decision-making
- Understand the roles of data, perception and judgement in environmental decision-making
- Learn common sample plan designs and sampling techniques for common needs and various media
- Learn the Data Quality Objective Process and its application and important role in sample plan development and defensible decision-making
- Learn to adapt to site specific site conditions and data needs by the directed study of case histories
- Apply new knowledge in classroom exercises

### Who Should Attend?

- Project managers
- Program managers
- Civil and Environmental Engineers
- Environmental Professionals
- Environmental Regulators and Policy Makers
- Cost/schedule practitioners
- Contract administrators
- Professionals involved in a management/ control related function

### Seminar Benefits

This course is designed for those who want to learn the basic principles and practices used to create and implement defensible environmental sampling programs. It provides both practical review and realistic consideration of the multidisciplinary aspects of planning, characterization, risk management and quality management. The knowledge gained will result in attendees understanding how to create economic sampling plans that provide data to facilitate decisions of understood and acceptable quality.

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