

Quality Assurance for Water Quality Monitoring

Purpose and Outline

Course offered by: DWR

Instructor: Revital Katznelson, Ph.D.

The course is taught during two consecutive days (2 meetings, 7.5 hours each)

Course objectives:

1. Teach basic concepts in data quality and monitoring design, provide tools and resources to assist participants with the planning of a sound monitoring Project, and enhance ability of participants to integrate quality assurance and data management into the project planning and data collection processes.
2. Implement the Quality Assurance/Quality Control Program called for in DWR policy by providing the appropriate training to persons involved in the collection of water-related data. Create a cadre of skilled operators who can deliver monitoring data that are defensible in court and are acceptable by agencies such as the U.S. Environmental Protection Agency, the U.S. Geological Survey, the U.S. Bureau of Reclamation, the State Water Resources Control Board, and the State Water Contractors.

Intended audience:

The course is offered to all the Departments, Divisions, Districts, and Field Divisions operators performing measurement activities within DWR. Participants are expected to have some technical background (preferably in biology, ecology, and/or chemistry), understanding of processes that affect water quality, and understanding of a watershed as a functional drainage unit.

Targeted skills:

- Know and implement quality assurance and documentation practices that are designed to affect, check, record, and report the quality of monitoring data;
- Find guidance materials, tools, and other resources that can support work on a specific Project needs;
- Communicate with technical experts effectively to design a monitoring study which will yield useable and reliable data of known quality; and
- Develop a Monitoring Plan and a Quality Assurance Project Plan for the Project.

Teaching methods:

Delivery of course materials as frontal presentations (lectures) will be frequently augmented by Socratic question-and-answer discussions (to promote discovery learning) and by group exercises.

Course topics:

Monitoring resources at the National and the State level

This presentation will introduce the Monitoring Framework developed by the National Water Quality Monitoring Council (NWQMC). The Framework, its historical context, and its components will be discussed, including the relationship between the overall goal, the six major steps of the monitoring effort (monitoring objective, sampling design, data collection, data management, data interpretation, and reports), and the three overarching concepts of collaboration, communication, coordination. This topic will also introduce the groups developed by NWQMC, including the Method and Data Comparability Board and its National Environmental Methods Index (NEMI), the Water Quality Data Elements (WQDE), and the Sensors QA Initiative workgroups. The role of the Surface Water Ambient Monitoring Program (SWAMP) in California, and the resources offered by this Program including the SWAMP Advisor (a web-based expert system for generation of SWAMP-compatible Quality Assurance Project Plans) will also be discussed

Good Data made tangible

The interactive discussion will set the stage for understanding and naming of concepts to be introduced during the course. It will compile and examine different aspects of data quality, including data usability, reliability, validity, and measurement quality. Additional course items will elaborate on the concept of representativeness and on the different aspects of data comparability, i.e. on the real meaning behind “comparable with Program X” (e.g., “comparable with SWAMP”).

The basics of scientific measurements

This question-and-answer sequence will proceed while several participants perform simple hands-on activities that trigger discussion of the sources of measurement error, measurement precision and accuracy, as well as resolution, detection limit, and other aspects of data quality. The discussion will then tie these concepts to a practical set of actions designed to affect, check, record, and report the quality of the data.

An overview: Steps, Tasks and Roles in a typical monitoring Project

This presentation will break the entire monitoring process into a rational sequence of manageable tasks, and highlight the complementary roles of project personnel (e.g., the Field Operator, Project Leader, etc.). It will include a brief review of the major steps and functions and provide examples of actions done at each step. It will also provide a brief introduction of the planning tools that will be discussed later in the course.

Study Planning Tools Part 1: A systematic measurements planning tool

This presentation will introduce a systematic planning tool for environmental sample collection and analysis efforts when one is dealing with multiple study questions and ensuing lines of inquiry. The tool is known as ‘the Measurement Core Loop’, a major component of the SWAMP Advisor. The five steps for each line of inquiry will be discussed.

- (a) formulate a specific question,
- (b) select characteristic to measure to answer that question,
- (c) select quality objectives (QOs) that are adequate to answer the question,
- (d) select Measurement Systems that can achieve the desired QOs, and
- (e) define requirements for quality checks and state the desired outcomes.

Study Planning Tools Part 2: Tailoring monitoring design to study intent

This activity will be introduced in a short presentation about sampling design approaches (i.e., Probabilistic, deterministic, or non-deliberate) and about tailoring the design to address the study question (i.e., the monitoring intent). After the presentation, several small groups of participants will be given a case study (or bring their own) and use templates to communicate the intent and the design they recommend for that case. The class will re-convene for group summaries.

Study Planning Tools Part 3: Quality Assurance at the Dataset level

This presentation will highlight how the concepts of hypothesis testing are applied to statistical comparisons done with monitoring data for trend analysis, regulatory decision making, and evaluation of the effectiveness of management measures implemented to reduce pollution. Topics include the four variables (power, confidence level, minimum detectable difference, and # of observations) as applied to different monitoring needs, and the impact of variability.

Study Planning Tools Part 4: Project logistics & Planning Documents

This section demonstrates how the products of labor and budget spreadsheet tools and the components prepared earlier in the course are compiled to generate the Project’s planning documents, Monitoring Project Plan and Quality Assurance Project Plan (QAPP).

Managing data for validation, retrieval, interpretation, and presentation

This presentation provides a review of the data quality management process and briefly discusses the four major function of a data management system, the relationship between project planning and the ultimate use of the data, and the tools being created for data sharing within DWR, State, and National data exchange networks.