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USGS Water-Quality Sampling: Standard Protocols and Procedures

Background

The U.S. Geological Survey (USGS) collects the data necessary for the accurate assessment and wise management of our Nation's surface-water and groundwater resources. The reliability, timeliness, and impartiality of the data we collect are relied on by our sister Federal agencies, State agencies, water regulators and managers, and other public and private sectors. Providing a scientific analysis of the data, and the context in which the data can be properly understood, are fundamental to protecting and managing our water resources and are needed to address questions that are vital to human and environmental health, such as:

- Is our water of acceptable quality for drinking? swimming? irrigation?
- Is water quality improving or worsening?

- What is causing stream pollution or the deterioration of an aquatic habitat?
- How does the quality of one water body compare with others across the State or the country?

Being able to answer such questions involves understanding complex relations among historical and existing environmental factors, and also requires an understanding and knowledge of the data-collection field methods that were used.

Why document sampling practices?

The USGS develops, documents, and mandates the use of scientifically sound, quality-assured field methods—protocols, procedures, and recommended practices—for the collection of water-quality data. These methods are documented in the *National Field Manual for the Collection of Water-Quality Data* (see reverse page).

Documenting our methods in a citable reference serves as the basis for maintaining a highly trained and competent work force and enables the USGS to:

(1) Maintain continuity and understanding of the science-based and field-tested methods required to accomplish data-collection objectives.

(2) Support consistency in the implementation of these methods in order to produce data that are nationally comparable and transferable.

(3) Minimize data bias and apply practices that result in data that are reproducible within acceptable limits of variability.

Revisions to the NFM are ongoing, incorporating up-to-date technical and scientific advances to keep the manual current with emerging data needs.

Who uses the *National Field Manual* (NFM)?

While the standard protocols and procedures for USGS water-quality sampling and data collection are developed and documented specifically to be used by USGS personnel, users of the NFM also include a broad spectrum of the public and private sectors, including Federal, State, and local agencies; academia and other educational institutions; professional consultants; environmental advocacy groups and volunteer organizations; and scientists and interested parties throughout the international community.

Teaching sampling procedures in Abu Dhabi, United Arab Emirates.

USGS protocols and procedures

- Promote and enhance the comparability of water data collected by numerous organizations.
- Help to standardize, document, and verify data quality.
- Help avoid costly duplication of effort and facilitate sharing of data and resources.
- Provide guidelines that are relevant to informed decision making about the assessment, protection, and management of the Nation's water resources.

National Field Manual for the Collection of Water-Quality Data

This field manual (the "NFM") is published online (http://pubs.water.usgs.gov/twri9A/) to be publicly accessible and readily available for reference, review, and comment. The NFM provides the foundation for water-quality training and field practices for USGS personnel and establishes protocols for the use of science-based, clean sampling procedures (to parts per billion). In addition, the NFM describes the use of quality-assurance measures that address questions such as:

- What is the appropriate equipment for my sampling location and objectives? When should I use acids or solvents to clean equipment? How should I dispose of cleaning solutions? How do I collect a discharge-weighted sample?
- Should the well be purged before sampling? For how long? Using what equipment? Using what method?
- What quality-control samples should I collect for *E. coli?* How do I sample for *Giardia?*
- How do I collect samples for CFC analysis? What are the holding times for VOC and nutrient samples?

Chapters of the NFM

1 Preparations for Water Sampling
- Sampling-site selection
- Sampling in streams or wells
- Data records (electronic and paper)

2 Selection of Equipment
- Sample-collection equipment
- Sample-processing equipment
- Surface water, groundwater
- Equipment maintenance

3 Cleaning of Equipment
- Decontamination procedures
- Assessing the efficacy of the cleaning process.

4 Collection of Water Samples[1]
- Preventing sample contamination
- Isokinetic depth-integration sampling
- Well purging (high and low flow)
- Types/use of quality-control samples

5 Processing of Water Samples
- Composite samples and subsamples
- Sample filtration and preservation
- Solid-phase extraction of pesticides
- Analyte-specific sampling

6 Field Measurements
- Guidelines and criteria
- Temperature
- Dissolved oxygen (DO)
- Specific electrical conductance (SC)
- pH
- Reduction-oxidation potential (Eh/Redox)
- Alkalinity and acid neutralizing capacity
- Turbidity
- Multiparameter instruments

7 Biological Indicators
- Five-day biochemical oxygen demand
- Fecal indicator bacteria
- Fecal indicator viruses
- Protozoan pathogens
- Algal biomass indicators
- Cyanobacteria in lakes and reservoirs

8 Bottom-Material Samples
- Site selection
- Sampling and processing equipment
- Sampling and processing methods

9 Safety in Field Activities
- Policies and job hazard analyses
- Transportation (road, water, air)
- Surface-water and groundwater sites
- Chemical use, storage, disposal
- Protections in polluted water
- Storms, floods, earthquakes, fire
- Hazards from plants and animals

[1]USGS protocols for use of continuous monitors for water-quality sampling can be accessed at *http://pubs.usgs.gov/tm/2006/tm1D3/.*

For additional information see *http://water.usgs.gov/owq/.*