

# STANDARD METHODS OF THE U.S. GEOLOGICAL SURVEY FOR WATER-QUALITY SAMPLING

The U.S. Geological Survey (USGS), a science agency within the U.S. Department of the Interior, is mandated to provide the information needed for accurate assessment, protection, and wise management of the Nation's water resources. To fulfill this mandate, the USGS collects, and assists others in collecting, the data needed to determine the quality and quantity of our surface and subsurface water bodies. The reliability and timeliness of such data are fundamental to maintaining and protecting our human and environmental health, and are designed to address such questions as:

- Is our water of acceptable quality for drinking or swimming, for irrigation or aquatic habitat?
- Is water quality getting better or worse?
- What is causing the pollution or deterioration of a given lake, stream, or aquifer?
- Are regulatory requirements being met?
- How does the quality of one water body compare with other waters across the state or country?

## **CHALLENGES TO ENVIRONMENTAL MONITORING**

These questions, while vital to human and environmental health, are not readily answered. Addressing them requires identifying appropriate measurements, taken at appropriate locations, and using appropriate techniques. To meet these requirements, a monitoring design is needed that is based on a clearly articulated purpose and data-quality objectives and that is supported by sound plans for data management and analysis. Moreover, the techniques used and site conditions encountered must be sufficiently documented to (a) ensure that the body of data collected is internally consistent, and (b) determine whether the data are comparable to and compatible with other potentially relevant information.

## **DATA COMPARABILITY AND COLLABORATION**

Consistent and comparable water-quality monitoring data are needed for describing the status and trends of a water resource; addressing existing and emerging water-quality issues; determining compliance with health standards; and combining the information gathered by different agencies. The USGS and USEPA, through the National Water Quality Monitoring Council, are working with other public and private Organizations to facilitate data sharing by identifying and documenting standardized field and laboratory methods.

One outcome of this collaboration is development of a National Environmental Methods Index, a clearinghouse of environmental monitoring methods (see [www.nemi.gov](http://www.nemi.gov)).



## **SAMPLING PROTOCOLS**

The USGS maintains the *National Field Manual for the Collection of Water-Quality Data* (NFM) as a Web-based guidance to provide water-quality data collectors with current protocols and state-of-the-art methods for environmental monitoring (<http://pubs.water.usgs.gov/twri9A/>).

### **Purpose:**

- (1) Establish and communicate sound science-based data-collection methods;
- (2) Encourage consistency in the use of these methods, to produce data that are nationally comparable;
- (3) Provide techniques that minimize data bias and, when properly applied, that result in data that are reproducible within acceptable limits of variability.

Water-quality monitoring is used to help water-resource managers understand and avert potential negative effects of anthropogenic and natural stresses on water resources. The monitoring that is required to examine these issues requires use of [sampling protocols](#) to help ensure the scientific validity and relevance of the water data collected.

## **National Field Manual for the Collection of Water-Quality Data**

This Web-based report series is used by the USGS for informing and training its field personnel in the collection of water-quality data. The “NFM” emphasizes the use of science-based decisions and quality assurance by field personnel. These reports prescribe protocols and standards that:

- Promote and enhance the comparability of water data
- Help ensure and document data quality.
- Help to avoid costly duplication of effort and facilitate sharing of data and resources.
- Provide guidelines that are relevant to making informed and effective decisions about the assessment, protection, and management of the Nation’s water resources.

### Report:

#### A1 Preparations for Water Sampling

- Sampling site selection
- Streams and wells
- Data records, electronic and paper

#### A2 Selection of Equipment

- Sample-collection equipment
- Sample-processing equipment
- Surface water, ground water
- Equipment maintenance

#### A3 Cleaning of Equipment

- Decontamination procedures
- How to assess the efficacy of the cleaning process.

#### A4 Collection of Water Samples

- Isokinetic depth-integration
- Well purging: high flow, low flow
- Types/use of quality-control samples
- Preventing sample contamination
- Quality assurance

#### A5 Processing of Water Samples

- Composite samples and subsamples
- Sample filtration
- Solid-phase extraction of pesticides
- Sample preservation
- Sample handling and shipping
- Analyte-specific sampling considerations.
- Quality assurance

#### A6 Field Measurements

- Temperature
- Dissolved-oxygen concentrations
- Specific electrical conductance
- pH, reduction-oxidation potential
- Alkalinity and acid neutralizing capacity
- Turbidity
- Multiparameter Instruments

Visit <http://pubs.water.usgs.gov/twri9A>



#### A7 Biological Indicators

- Biochemical oxygen demand (5-day BOD)
- Fecal indicator bacteria in water
- Fecal indicator viruses in water
- Protozoan pathogens in water
- Algal biomass indicators

#### A8 Bottom Material Samples

- Site selection
- Sampling and processing equipment
- Sampling and processing methods.

#### A9 Safety in Field Activities

- Official policies, regulations, requirements
- Watercraft, aircraft, land vehicles
- Surface-water and ground-water sites
- Use of chemicals
- Contact with contaminated water
- Exposure to environmental hazards
- Contact with wildlife and plants