Techniques of Water-Resources Investigations

Book 9
Handbooks for Water-Resources Investigations

National Field Manual for the Collection of Water-Quality Data

Chapter A6. FIELD MEASUREMENTS

Edited by
F.D. Wilde

USGS
science for a changing world

U.S. DEPARTMENT OF THE INTERIOR
GALE A. NORTON, *Secretary*

U.S. GEOLOGICAL SURVEY
P. PATRICK LEAHY, *Acting Director*

For additional information write to:
Chief, Office of Water Quality
U.S. Geological Survey
12201 Sunrise Valley Drive
Mail Stop 412
Reston, VA 20192
This report is accessible online at http://pubs.water.usgs.gov/twri9A/

Foreword

The mission of the Water Resources Discipline of the U.S. Geological Survey (USGS) is to provide the information and understanding needed for wise management of the Nation's water resources. Inherent in this mission is the responsibility to collect data that accurately describe the physical, chemical, and biological attributes of water systems. These data are used for environmental and resource assessments by the USGS, other government agencies and scientific organizations, and the general public. Reliable and quality-assured data are essential to the credibility and impartiality of the water-resources appraisals carried out by the USGS.

The development and use of a *National Field Manual* is necessary to achieve consistency in the scientific methods and procedures used, to document those methods and procedures, and to maintain technical expertise. USGS field personnel use this manual to ensure that data collected are of the quality required to fulfill our mission.

(signed)

Robert M. Hirsch
Associate Director for Water

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Chapters of Section A: *National Field Manual for the Collection of Water-Quality Data*

FIELD MEASUREMENTS

National Field Manual for the Collection of Water-Quality Data

Chapter A6.

Note:

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ABSTRACT

The *National Field Manual for the Collection of Water-Quality Data (National Field Manual)* provides guidelines and standard procedures for U.S. Geological Survey (USGS) personnel who collect data used to assess the quality of the Nation's surface-water and ground-water resources. Chapter A6 presents procedures and guidelines for the collection of data on air and water temperature, and on dissolved-oxygen concentrations, specific electrical conductance, pH, reduction-oxidation potential, alkalinity, and turbidity in water.

Each chapter of the *National Field Manual* is published separately and revised periodically. Newly published and revised chapters are posted on the World Wide Web on the USGS page "National Field Manual for the Collection of Water-Quality Data." The URL for this page is http://pubs.water.usgs.gov/twri9A (accessed August 6, 2005).

INTRODUCTION

As part of its mission, the U.S. Geological Survey (USGS) collects data needed to assess the quality of our Nation's water resources. A high degree of reliability and standardization of these data are paramount to fulfilling this mission. Documentation of nationally accepted methods used by USGS personnel serves to maintain consistency and technical quality in data-collection activities. The USGS "Techniques and Methods" and "Techniques of Water-Resources Investigations" (TWRI) report series document scientific methods used by USGS personnel.

TWRIs are grouped under major subject headings called books. The Book 9 series, Handbooks for Water-Resources Investigations, is designed for field use and was developed to summarize, from other TWRIs and references, techniques for planning and conducting specialized work in water-resources investigations. The *National Field Manual for the Collection of Water-Quality Data (National Field Manual)* is Section A of Book 9 The *National Field Manual* is comprised of individually published chapters Chapter numbers are preceded by an "A" to indicate that the report is part of the *National Field Manual*.

TWRI Book 9, Chapter A6 on field measurements includes procedures, techniques, and guidelines for planning and conducting specialized work in water-resources investigations. Sections and other chapters of the *National Field Manual* are referred to in this report by the abbreviation "NFM" and the chapter and (or) section number. For example, general information on temperature measurements is covered in section 6.1 of Chapter A6 "Field Measurements" and is cited here as NFM 6.1.

PURPOSE AND SCOPE

The *National Field Manual* provides guidelines and standard procedures to be used by USGS personnel for field activities related to water-quality data collection and analysis. This manual is targeted specifically toward data collectors in order to (1) establish and communicate scientifically sound methods and procedures, (2) encourage consistent use of field methods for the purpose of producing nationally comparable data, and (3) provide methods that minimize biasing the data and, when properly applied, that result in data that are reproducible within defined limits of variability.

Data collectors must have formal training and field apprenticeship in order to correctly implement the procedures described in this report. The information provided in Chapter A6 is to be used in conjunction with *Water Temperature—Influential Factors, Field Measuement, and Data Presentation* by H.H. Stevens, Jr., J.F. Ficke, and G.F. Smoot (Techniques of Water-Resources Investigations of the U.S. Geological Survey, Book 1, Chapter D1, 1975), and *Guidelines for Collection and Field Analysis of Ground-Water Samples for Selected Unstable Constituents* by W.W. Wood (Techniques of Water-Resources Investigations, Book 1, Chapter D2, 1981).

It is impractical to provide guidance that would encompass the entire spectrum of data-collection objectives, site characteristics, environmental conditions, and technological advances related to water-quality studies. The fundamental responsibility of field personnel is to select methods that are compatible with the scientific objective for the field work and to use procedures that are consistent with USGS standard procedures to the extent possible. Under some circumstances, data collectors may have to modify standarad procedures. **Whenever a standard procedure is modified or an alternative procedure is used, a description of the procedure used and supporting quality-assurance information are to be reported with the data.**

FIELD MANUAL REVIEW AND REVISION

Chapters of the *National Field Manual* will be reviewed, revised, and reissued periodically to correct any errors, incorporate technical advances, and address additional topics. Please send comments or corrections to: NFM-QW, USGS, 412 National Center, Reston, VA 20192 (or send electronic mail to nfm-owq@usgs.gov). Newly published and revised chapters will be posted on the World Wide Web on the USGS page "National Field Manual for the Collection of Water-Quality Data." The URL for this page is http://pubs.water.usgs.gov/twri9A (accessed August 6, 2005). This page also contains a link to the NFM "Comments and Errata" page that chronicles revisions to each chapter.

ACKNOWLEDGMENTS

This *National Field Manual* responds to advances in technology and science and to the developing needs for water-quality monitoring through an ongoing process of review and revision. In the course of time, the expertise of numerous scientists has been tapped to provide scientifically sound guidance to personnel who collect and report field-measurement and field-analytical water-quality data. Our greatest debt of gratitude goes to the following early authors, editors, and reviewers of this field manual, without whom this project could not have succeeded: D.B. Radtke, J.D. Davis, J.B. Kurklin, R.T. Iwatsubo, K.A. Pearsall, I.M. Collies, and the analysts of the USGS National Water Quality Laboratory.

Special appreciation is due our colleagues and collaborators from the Hach and Hydrolab Companies, In-Situ Incorporated, and YSI Incorporated, who have given of their time and expertise.

It also is imperative to acknowledge the rich resources that formed the foundation of this "Field Measurements" chapter, as well as other *National Field Manual* chapters. The authors and editors have relied on the broad spectrum of colleague expertise found in unpublished USGS and U.S. Environmental Protection Agency training and field manuals and technical memorandums, in addition to the references cited at the end of each section of Chapter A6.

This chapter has achieved publication and maintained its quality through the talent, ingenuity, and dogged persistance of the following colleagues: G.J. Allord, E.A. Ciganovich, I.M. Collies, C.M. Eberle, B.B. Palcsak, Celso Puente, L.J. Ulibarri, and Chester Zenone.

Many thanks go to T.L. Miller, D.A. Rickert, and S.K. Sorenson, whose encouragement, faith, and practical support have been the force behind our ability to produce and maintain a national field manual for water-quality studies.