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Project Summary

Characterization of Hazardous Waste Sites—A Methods Manual: Volume III. Available Laboratory Analytical Methods

Russell H. Plumb, Jr.

A manual of available analytical procedures was prepared as Volume 3 of the report, *Characterization of Hazardous Waste Sites—A Methods Manual.* This volume provides bench-level guidance for the preparation of hazardous waste, water, soil/sediment, biological tissue, and air samples, and suitable methods that can be used to analyze the resultant digests/extracts for 244 of the 359 substances listed in the Resource Conservation and Recovery Act (RCRA) permit regulations. Each sample preparation procedure and analytical method for the 929 analyte-matrix combinations that have been accumulated in this volume is classified as either *evaluated* or *available* based on the availability of precision and accuracy data.

This Project Summary was developed by EPA's Environmental Monitoring Systems Laboratory, Las Vegas, NV, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

The RCRA regulations concerned with the proper handling and disposal of hazardous wastes specify 359 chemical substances of concern. The bench-level guidance needed to implement the regulations should cover the topics of collection, preparation, and analysis of samples from diverse and complex matrices such as wastes, water, soil/sediment, biota, and air. However, existing analytical manuals are frequently dedicated to a single sample matrix (usually water) and normally provide detailed guidance on the use of analytical procedures for only 50 to 125 substances. This manual is an expansion of these earlier efforts and provides guidance on the preservation and preparation for more sample matrices, as well as analytical methods for more analytes.

This project is part of a larger effort to prepare guidance manuals summarizing available information on hazardous waste site characterization, including preliminary site assessment, sample collection, and sample analysis.

Organization of the Manual

Volume 3 of *Characterization of Hazardous Waste Sites—A Methods Manual* contains analytical procedures that are available for chemical characterization of samples obtained in hazardous waste site investigations. The text of this volume is divided into three chapters. Chapter 1 provides background information on the development of this manual and a discussion of the format used to present each analytical procedure. Chapter 2 is divided into two main parts: the first provides guidance for handling and fractionation of hazardous waste samples in the laboratory and the second provides a protocol for general sample characterization, identifying potentially unsafe conditions that may be encountered when certain samples are analyzed (i.e., pres-

ence of strong oxidants, evolution of potentially toxic gases, and/or extreme pH values). Chapter 3 presents analytical procedures for specific analytes.

A search of the literature, including both existing manuals and professional journals, was instituted to identify available methods. The search focused on methods for the analysis of hazardous waste, water, soil/sediment, biological tissue, and air samples for any of the 359 compounds listed in the RCRA regulations. A procedure was considered suitable for inclusion if the following criteria were met:

- A demonstrated need exists for the procedure.
- Detailed sample preparation guidance is provided for a specific sample matrix.
- The analytical procedure is adequately described.
- Precision and accuracy information is available to define the expected performance of the procedure.

The first criterion was satisfied if the analyte was listed in Appendix VIII of the RCRA regulations.* The second criterion was considered to have been met if detailed sample preparation guidance (including digestion and/or extraction, and sample extract cleanup) was available. The third requirement was satisfied if sufficient information on instrument operation (warm-up time, instrument calibration, and operating conditions) was located. The last criterion was satisfied if method performance data were available from one or more laboratories.

The search produced 929 analyte-matrix combinations that fulfilled the criteria (163 analytes in waste, 244 analytes in water, 203 analytes in soil/sediment, 217 analytes in biological tissue, and 102 analytes in air). These methods are presented in 24 analytical sections that are grouped as follows:

Section 1-9:	Organic Analytical Procedures
Section 10-18:	Inorganic Analytical Procedures
Section 19-24:	Sample Screening and Characterization Procedures

The organic sections provide detailed procedures for the determination of volatile organic compounds, acid-extractable compounds, base/neutral compounds, pesticides and PCBs, organophosphorus pesticides, organonitrogen pesticides, phenyl acetic acids, dioxin, and polynuclear aromatic hydrocarbons. The inorganic sections provide detailed procedures for elemental determination by atomic absorption and inductively coupled plasma emission spectroscopy, and procedures for mercury, methyl mercury, arsenic, selenium, cyanide, sulfide, and ammonia. Analytical methods in the screening section provide guidance for the determination of oxidant capacity, reductant capacity, acidity, alkalinity, conductivity, and percent moisture content.

A standard format was developed for presenting the information on sample preparation and the use of each analytical procedure. This approach permits analytical research needs to be identified in several ways. Each method is classified as *evaluated* or *available* based on the amount of precision and accuracy data that was located. Methods classified as *available* are usable, but a need exists for a more extensive performance evaluation of the procedure. Research needs are further identified by reserving sections whenever sample preparation guidance could not be located for a particular analyte-matrix combination. Sections identified in this manner indicate a need for either a more extensive literature search, a performance evaluation of an existing procedure, or a methods development and evaluation effort. Finally, information on sample preservation and preparation is presented in a flowchart associated with each analytical section. Gaps in these flowcharts identify needs for specific performance evaluations.

This volume will require periodic updating as additional analytical procedures are located, as new methods are developed and evaluated, and as additional performance data become available to update the classification of methods already included.

*U.S. Environmental Protection Agency, "Hazardous Waste and Consolidated Permit Regulations," Federal Register, 40 CFR Part 261, May 19, 1980, pp. 33084-33133.

Russell H. Plumb, Jr., is with Lockheed Engineering and Management Services Company, Las Vegas, NV 89114.
***Werner F. Beckert** is the EPA Project Officer (see below).*
The complete report, entitled "Characterization of Hazardous Waste Sites, A Methods Manual: Volume III. Available Laboratory Analytical Methods," (Order No. PB 84-191 048; Cost: $47.00, subject to change) will be available only from:
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone: 703-487-4650
The EPA Project Officer can be contacted at:
Environmental Monitoring Systems Laboratory
U.S. Environmental Protection Agency
P.O. Box 15027
Las Vegas, NV 89114

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Center for Environmental Research
Information
Cincinnati OH 45268