Chemical and Biological Characterization of Municipal Sludges, Sediments, Dredge Spoils, and Drilling Muds

Lichtenberg/Winter/Weber/Fradkin

EDITORS

ASTM STP 976
Chemical and Biological Characterization of Municipal Sludges, Sediments, Dredge Spoils, and Drilling Muds

James J. Lichtenberg, John A. Winter, Cornelius I. Weber, and Larry Fradkin, editors
Foreword

This publication contains papers presented at the Symposium on Chemical and Biological Characterization of Municipal Sludges, Sediments, Dredge Spoils, and Drilling Muds, which was held in Cincinnati, OH, on 20-22 May 1986. The symposium was sponsored by the following U.S. Environmental Protection Agency (USEPA) Laboratories: the Environmental Monitoring and Support Laboratory (EMSL) and the Environmental Criteria and Assessment Office (ECAO) in cooperation with the Water Engineering Research Laboratory (WERL) all of Cincinnati, OH. The symposium was chaired by James J. Lichtenberg and cochaired by Cornelius I. Weber, John A. Winter of EMSL-Cincinnati, and Larry Fradkin of ECAO.

The publication is cosponsored by the EMSL-Cincinnati, ECAO, and ASTM Committees D19 on Water and D34 on Waste Disposal.
Acknowledgments

The Symposium Committee wishes to thank everyone who participated in the symposium, especially the USEPA scientists who chaired the sessions: William B. Horning, Gerald D. McKee, Robert H. Bordner, and Robert S. Safferman. The committee also wishes to express its appreciation to those USEPA staff members who assisted as volunteers at the symposium. Their participation contributed greatly to the overall success of the symposium. We would like to extend a special thanks to Jean Wilson, Pat Hurr, Cordelia Nowell, Mary Sullivan, Carol Haynes, and Kathie Fieler for their invaluable assistance with the registration and the many administrative details.

The committee also wishes to acknowledge David J. Reisman, the USEPA Project Officer, for his outstanding efforts in coordinating the symposium-related activities. In addition, we would like to thank Kate Schalk, Andrea Donoghue, Heidi Schultz, and Betsy Kostic of Eastern Research Group, Inc. for their fine effort in organizing and conducting the symposium and coordinating the peer reviews and subsequent publication of the symposium manuscripts. The promptness and congenial manner with which they handled questions and problems related to the conduct of the symposium contributed immeasurably to its overall success.

Finally, the committee wishes to express its thanks and appreciation to Robert L. Booth, Director of EMSL-Cincinnati and Jerry F. Stara, Director of ECAO-Cincinnati (since deceased) for their support and encouragement in presenting this symposium.
Contents

Overview

Keynote Address—Sludge and Risk Assessment—DONALD J. EHRETH AND PETER R. JUTRO

EPA REVIEW OF REGULATIONS RELATED TO SEWAGE SLUDGE DISPOSAL, SEDIMENT QUALITY, AND ANALYTICAL METHODOLOGY


Status of the U.S. EPA’s Sediment Quality Criteria Development Effort—CHRISTOPHER S. ZARBA

Regional and State Needs in Sampling and Analytical Methodology—JOHN A. LITTLE, JAMES H. FINGER, AND ROBERT W. KNIGHT

CHEMICAL CHARACTERIZATION

Sediment Reference Materials and the Canadian Marine Analytical Chemistry Standards Program—P. GREIG SIM, W. DAVID JAMIESON, SHIER S. Berman, AND VICTOR J. BOYKO

A Computerized Data Management System for U.S. EPA QA/QC Methods—ANDREW W. PANKO AND TONY O. DIFRUSCIO

The Variographic Experiment: An Essential Test for Optimizing Sampling Methodology in Monitoring Streams—FRANCIS F. PITARD

A Demonstration of a Universal Kriging Program for Monitoring Sediments in Lakes—PHILIP C. L. LIN AND JOSEPH F. ROESLER

Comparative Study of Methods for Estimating Bioavailable Particulate Phosphorus—THOMAS C. YOUNG, JOSEPH V. DE PINTO, AND BRYAN J. HUGHES

Characterization of Trace Metal Associations with Polluted Marine Sediments by Selective Extractions—WARREN S. BOOTHMAN

Distribution of Heavy Metals in Sewage Sludge: The Effect of Particle Size—JOHN A. CAMPBELL, JOHN V. TOWNER, AND RAJAH VALLURUPALLI
<table>
<thead>
<tr>
<th>Publication</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>An Examination of Methods for the Concentration of Suspended Sediment for Direct Metal Analysis—ARThUR J. HOROWITZ</td>
<td>102</td>
</tr>
<tr>
<td>Interpretation of Bed Sediment Trace Metal Data: Methods for Dealing with the Grain Size Effect—ARThUR J. HOROWITZ AND KENT A. ELRICK</td>
<td>114</td>
</tr>
<tr>
<td>Development, Evaluation, and Use of the Toxicity Characteristic Leaching Procedure (TCLP)—TODD A. KIMMELL</td>
<td>129</td>
</tr>
<tr>
<td>Development of New Jersey State Approved Methods for the Analysis of Sludge—SUSAN H. DENGLER</td>
<td>141</td>
</tr>
<tr>
<td>Use of Gas Chromatography/Mass Spectrometry to Monitor Selected Priority Pollutant Levels in Landfill Simulator Leachates—JAMES W. STAMM, JAMES J. WALSH, WILLIAM JESS, AND JANET I. RICKABAUGH</td>
<td>148</td>
</tr>
<tr>
<td>Method Development for the Determination of Formaldehyde in Samples of Environmental Origin—MERLIN K. L. BICKING, W. MARCUS COOKE, FRED K. KAWAHARA, AND JAMES E. LONGBOTTOM</td>
<td>159</td>
</tr>
<tr>
<td>Total, Extractable, and Leachable Organic Halides in Soil and Sediments—JOHN T. MARTIN AND YOSHIHIRO TAKAHASHI</td>
<td>176</td>
</tr>
<tr>
<td>Trace Organic Analysis of Suspended Sediments Collected with an In-Stream Composite Sampler: the Need for a Standard Method—IRWIN H. SUFFET, KATHRYN HUNCHAK, ARNIE WICKLUND, AND THOMAS BELTON</td>
<td>184</td>
</tr>
<tr>
<td>Determination of Polychlorinated Compounds (Dioxins, Furans, and Biphenyls) by Level of Chlorination with Automated Interpretation of Mass Spectrometric Data—ANN L. ALFORD-STEVENs AND WILLIAM L. BUDDE</td>
<td>204</td>
</tr>
<tr>
<td>Analysis for Diesel Oil Components in Drilling Fluids—DAVID F. TOMPKINS, EDWARD D. HANDEL, AND WILLIAM TELLIARD</td>
<td>223</td>
</tr>
<tr>
<td>Application of Analytical Pyrolysis and Cupric Oxide Oxidation to Characterization of Nonextractable Organic Constituents in Drilling Fluids and Sediments—THEADOR C. SAUER, JR., ALFONSO G. REQUEJO, JOHN S. BROWN, ROBERT C. AYERS, JR., AND PAUL D. BOEHM</td>
<td>228</td>
</tr>
<tr>
<td><strong>Biological Characterization</strong></td>
<td></td>
</tr>
<tr>
<td>Perspective on Risk of Waterborne Enteric Virus Infections—FLORA MAE WELLINGS</td>
<td>257</td>
</tr>
<tr>
<td>Round Robin Testing of Methods for the Recovery of Human Enteroviruses from Wastewater Sludges and Sewage Amended Soils—ASTM Consensus Standards Development—STEPHEN A. SCHAUB</td>
<td>265</td>
</tr>
</tbody>
</table>
Thermal Inactivation of Human Enteric Viruses in Sewage Sludge and Virus Detection by Nitrose Cellulose-Enzyme Immunoassay—PHILIP C. LOH, ROGER S. FUIIOKA, AND WESLEY M. HIRANO

Recovery of Naturally Occurring Rotaviruses during Sewage Treatment—V. CHALAPATI RAO, THEODORE G. METCALF, AND JOSEPH L. MILNICK

Mutagenic Potential of Municipal Sewage Sludge and Sludge Amended Soil—KIRBY C. DONNELLY, KIRK W. BROWN, AND CINDY P. CHISUM

Stream Impact Assessments Using Sediment Microbial Activity Tests—G. ALLEN BURTON, JR.

Biochemical Characterization of Estuarine Benthic Microbial Communities for Use in Assessing Pollution Impacts—STEPHEN J. SCHROPP, F. GRAHAM LEWIS, WILLIS EUBANKS, KEVIN R. CARMAN, AND DAVID C. WHITE

Variability of the Acute Toxicity of Drilling Fluids to Mysids (Mysidopsis bahia)—PATRICK R. PARRISH AND THOMAS W. DUKE

Toxicity Testing of Drilling Fluids: Assessing Laboratory Performance and Variability—R. CLIFTON BAILEY AND BARRETT P. EYNON

Acute Toxicity and Hydrocarbon Composition of a Water-Based Drilling Mud Containing Diesel Fuel or Mineral Oil Additives—RONALD J. BRETELER, ADOLFO G. REQUEJO, AND JERRY M. NEFF

Marine Sediment Toxicity Tests—PETER M. CHAPMAN


Toxicity Testing of Dredged Materials Using Multiple-Species Microcosms—RAYMOND W. ALDEN, III AND ARTHUR J. BUTT

Selecting an Appropriate Method for Estimating the Sediment Oxygen Demand Rate—KATHRYN J. HATCHER

Use of Benthic Oxygen Flux Measurements in Wasteload Allocation Studies—WAYNE S. DAVIS, THOMAS M. BROSNAN, AND ROBERT M. SYKES

Risk Assessment

Analytical Methods Necessary to Implement Risk-Based Criteria for Chemicals in Municipal Sludge—RANDALL J. F. BRUINS, LARRY FRADKIN, JERRY F. STARA, W. BRUCE PEIRANO, VLASTA MOLAK, AND ELLIOT LOMNITZ

The Regulation of Sludge Disposal Through Application of Risk Assessment Techniques—GAYNOR W. DAWSON, CHARLES J. ENGLISH, AND LARRY FRADKIN
Microbiological Risk Assessment for Land Application of Municipal Sludge—
PASQUALE V. SCARPINO, LARRY FRADKIN, C. SCOTT CLARK, NORMAN E. KOWAL,
ELLIOT LOMNITZ, MICHAEL BASEHEART, JOHN M. PETERSON, RICHARD L. WARD,
AND MARK HESFORD 480

Assessment of Risks Associated with Enteric Viruses in Contaminated Drinking
Water—CHARLES P. GERBA AND CHARLES N. HAAS 489

Index 495