BIBLIOGRAPHY ON SAMPLING GROUND WATER FOR ORGANIC COMPOUNDS

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CONTENTS

Abstract............................................................. 1
Introduction..................................................................... 1
  Purpose and scope................................................ 1
  Acknowledgments.................................................... 2
Bibliography on sampling ground water for organic compounds........ 3
  Sampling devices.................................................... 3
  Ground-water-sampling techniques.............................. 4
  Analysis of organic vapor(s) in soil......................... 6
  Effects of materials on sorption and desorption........... 7
  Well drilling and installation................................ 8
  Degradation of organic compounds............................ 8
  Well purging........................................................ 9
  Safety.............................................................. 10
  Well-network design............................................. 11
  Analytical methods for organic compounds................ 12
  Transport of organic compounds.............................. 14
  Miscellaneous references...................................... 15
Appendixes: Agenda for workshop "Sampling ground water for organic compounds," held in:
  A. Trenton, New Jersey, May 11-15, 1987......................... 17
  B. Miami, Florida, November 16-20, 1987......................... 19
  C. San Antonio, Texas, February 29-March 4, 1988.............. 20
  D. Sacramento, California, December 12-16, 1988............ 21
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ABSTRACT

Selected references applicable to the collection and analysis of representative samples of ground water for trace levels of organic compounds are presented in this report. The references were obtained from lists used during four workshops on "Sampling Ground Water for Organic Compounds" conducted by the U.S. Geological Survey in 1987 and 1988. The 128 references are organized into 12 topics: sampling devices, ground-water-sampling techniques, analysis of organic vapor(s) in soil, effects of materials on sorption and desorption, well drilling and installation, degradation of organic compounds, well purging, safety, well-network design, analytical methods for organic compounds, transport of organic compounds, and miscellaneous references.

INTRODUCTION

Interest in sampling techniques has increased because of possible contamination of the nation's ground-water resources by organic compounds. The wide range of physical and chemical properties exhibited by organic compounds cause their fate and transport in ground water to be different from the fate and transport of common inorganic cations and anions. The reliable collection of representative samples of ground water containing organic compounds requires the use of specialized sampling equipment, sampling techniques, and sample-handling procedures.

In order to disseminate information on these subjects to investigators currently involved in studies of contamination of ground water by organic compounds, four workshops entitled "Sampling Ground Water for Organic Compounds" were conducted by the U.S. Geological Survey. The workshops were held in Trenton, New Jersey, May 11-15, 1987; in Miami, Florida, November 16-20, 1987; in San Antonio, Texas, February 29-March 4, 1988; and in Sacramento, California, December 12-16, 1988. The topics discussed at these workshops cover a wide range of subjects relating to the sampling of ground water for organic compounds and could be used to plan future training courses. The references cited during the workshop presentations comprise a valuable resource for the planning of future ground-water-contamination studies.

Purpose and Scope

This report presents selected references relating to the equipment, techniques, and procedures used to sample ground water for organic compounds. The report includes 128 references that pertain to the collection and analysis of representative samples of ground water for trace amounts of organic compounds.

The 128 references are organized into 12 categories that correspond to the major topics discussed at the workshops--
1. Sampling devices
2. Ground-water-sampling techniques
3. Analysis of organic vapors in soil
4. Effects of materials on sorption and desorption
5. Well drilling and installation
6. Degradation of organic compounds
7. Well purging
8. Safety
9. Well-network design
10. Analytical methods for organic compounds
11. Transport of organic contaminants
12. Miscellaneous references.

The report also includes the topics covered in the workshops and their organization. The workshop agendas are listed in appendixes A through D.

Acknowledgments

BIBLIOGRAPHY ON SAMPLING GROUND WATER FOR ORGANIC COMPOUNDS

Sampling Devices


Ground-Water-Sampling Techniques


Pennino, J.D., 1988, There's no such thing as a representative ground-water sample: Ground Water Monitoring Review, v. 8, no. 3, p. 4-9.


Analysis of Organic Vapor(s) in Soil


Effects of Materials on Sorption and Desorption


Well Drilling and Installation


Degradation of Organic Compounds


Well Purging


Safety


U.S. Coast Guard, 1984, Chemical hazard response system manual (CHRIS), volume II, 7 chapters, various pagination.


Well-Network Design


**Analytical Methods for Organic Compounds**

Bagnati, R., Benfenati, E., Davoli, R., 1988, Screening of 21 pesticides in water by a single extraction with C-18 silica bonded phase columns and HRGC-MS, Chemosphere, v. 17, p. 59-65.


**Transport of Organic Compounds**


Miscellaneous References


Workshop Agenda
Monday

Introduction
- Objectives of workshop
Physical and chemical characteristics of synthetic organic compounds
  - Characteristics and properties
  - Relationship of compound characteristics to analytical methodologies
Behavior and fate in ground water
Break
  - Physical processes of plume formation in the unsaturated and saturated zones
  - Advection and dispersion of plumes
Lunch
Factors affecting sampling design
  - Overview
  - Hydrogeologic effects
Break
  - Network design
  - Panel discussion
Adjourn

Tuesday

Drilling and installation options
  - Drilling techniques
  - Well construction
  - Clean well procedures
  - Development
Break
  - Effects of materials of construction of existing and new wells on water quality
  - Discussion
Lunch
Sampling equipment
  - Commercial devices
  - State-of-the-art devices
  - Principles of operation
  - Cost
Comparison of sampling devices
  - Purgeable compounds
  - Other constituents
Break
Safety
  - U.S. Geological Survey, Water Resources Division Protocols
  - U.S. Environmental Agency Protocols
  - Drilling
  - Sampling
Adjourn
Equipment exhibit/social hour
Manufacturers' representatives

Wednesday

Field demonstrations (concurrent sessions)
  Determination of stability
  Demonstration of sampling devices
  Sampling techniques
  Unsaturated-zone vapor sampling
  Unsaturated-zone vapor analysis
  Field-safety equipment

Thursday

Comparison of analytical techniques
  Isolation and concentration
  Compound detection
Break/Discussion
  Gas Chromatography/Flame Ionization Detector scan
Evaluation of analytical data
  Accuracy
  Discussion
Lunch
  Precision
    Significant differences
  Discussion
Project management
  Work plan
  Quality assurance/quality control requirements
  Sampling and waste disposal
Break
Group discussion of sampling problems
  BYOSP (Bring your own sampling problem)
  Successes and failures
Adjourn

Friday

Field demonstration data
Discussion
Workshop critique
  Oral
  Written
Adjourn
Workshop Agenda

Monday

Workshop objectives
Physical and chemical characteristics of synthetic organic compounds
Behavior and fate in ground water
Plumes (formation, advection, dispersion)
Ground-water-flow-system factors that affect sampling
Network-design factors that affect sampling
Safety

Tuesday

Sampling equipment
Site reconnaissance
Site introduction
Field demonstration

Wednesday

Sampler comparison
Effects of materials on sampling
Analytical methods
Quality assurance/quality control and evaluation of analytical data

Thursday

Pesticides in ground water
Discussion of sampling problems
Field-data results
Critiques and wrap-up
Appendix C: Agenda for workshop "Sampling ground water for organic compounds," held in San Antonio, Texas, February 29-March 4, 1988

Workshop Agenda

Monday

Welcome
Workshop objectives
Physical and chemical characteristics of synthetic organic compounds
Break
Behavior and fate of organic compounds in ground water
Basic principles of solute transport

Tuesday

Plume mechanics, well hydraulics, and the effects of wells on water samples
Break
Drilling, casing, and decontamination of monitoring wells
Safety
Sampling equipment
Break
Field screening for volatile organic compounds, soil gas and head-space analysis
Design and execution of an Installation Restoration Program Study
Introduction to the site

Wednesday

Field demonstration: sampling and samplers, field gas chromatograph, soil-gas analysis
Sampler comparison
Effects of materials on water quality
Quality assurance/quality control
Open house for manufacturers' representatives

Thursday

Analytical methods for organic compounds
Pesticide sampling and field screening
Discussion of field-sampling results
Sampling problems discussion
Critiques and wrap-up
Appendix D: Agenda for workshop "Sampling ground water for organic compounds," held in Sacramento, California, December 12-16, 1988

Workshop Agenda

Monday

Welcome, introductions, preview of the week, and workshop objectives
Physical and chemical characteristics of synthetic organic compounds
Break
Behavior and fate of organic compounds in ground water
Lunch
Basic principles of solute transport
Break
Plume mechanics, well hydraulics, and the effects of wells on water samples
Sampling the aquifer

Tuesday

Isotopes in ground water
Safety precautions and health
Break
Types of sampling equipment
Lunch
Field screening for volatile organic compounds, soil gas, and head-space analysis
Enzyme-based field screening for pesticides
Break
Introduction to the field site; travel plans and agenda for tomorrow morning

Wednesday

At field site: sampling procedures and demonstrations of field gas chromatograph, enzyme-based methods, field equipment
Clean-up, lunch and return to motel conference room
Comparison of sampling devices; comparison of purging criteria
Break
Effects of materials used on contamination potential in the field

Thursday

Analytical methods for organic compounds
Break
Pesticides--general chemistry, transport and fate, sampling and preservation
Quality analysis/quality control--from the field and data perspectives
Lunch
Oxidation-reduction measurements and sampling for metals in ground water
Break
Importance of microbial ecology to the study of ground water
Kodiak Island, Alaska--A case study

Friday

Discussion of class sampling results from field site
Break
Open discussion with instructors and class participants
Critique and wrap-up