

Waste Management Research Abstracts

**Information on Radioactive Waste Management
Research in Progress or Planned**

Volume 28

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FOREWORD

The research abstracts contained in the Waste Management Research Abstracts Volume 28 (WMRA 28) were collected between October 1, 2002 and September 30, 2003. The announced submission period was June 1 to September 30, 2003; however, because the WMRA submission process is Internet-based (discussed below), abstracts may be submitted at any time of the year.

The abstracts reflect research in progress, or planned, in the field of radioactive waste management. For abstracts of completed research and other published information, the reader is advised to consult one of the many available commercial or non-commercial bibliographic information services, such as the IAEA's International Nuclear Information System (INIS). Please refer to the following URL for INIS:

<http://www.iaea.org/programmes/inis/index.html>

Though the information contained in this publication covers a wide range of programmes in various countries, the WMRA should not be interpreted as providing a complete survey of ongoing research in IAEA Member States. Enquiries for further information concerning a particular research abstract should be addressed to the author(s) at his/her institute.

The total number of abstracts published in WMRA 28 is 184, which breaks an annual decline in the number of abstracts that has occurred over the last several volumes (an average of 339 per volume in WMRA 23/24, 297 in WMRA 25, 190 in WMRA 26 and 148 in WMRA 27). In addition, a lower percentage of abstracts derived from the batch submission received from the Office of Scientific and Technical Information in the United States of America (i.e., WMRA 28 has a higher percentage of individual abstract submissions).

With the implementation of the Internet-based submission for WMRA, and combined with an automated "in-house" administrative system, abstracts in WMRA 25 through WMRA 28 were accessible via the Internet at the URL listed below as soon as they were authorized for publication by the WMRA Programme Officer.

<http://www.iaea.org/cgi-bin/irais.showwmt.pl?wmwra.wmt>

Many abstracts for WMRA 28 were authorized and became accessible on the Internet within only a few days of the date that they were submitted to the IAEA.

Individual abstracts may be viewed via the cited URL. In addition, searches may be carried out to find and view abstracts according to various search criteria, such as by publication volume, by waste management topic code, by specific database fields (such as title, country, principal investigator), et cetera. As such, for WMRA 25 and onward, it is not necessary to wait until a collection of abstracts is published - abstracts may be viewed interactively via the Internet as soon as they are authorized.

Even though individual abstracts are directly accessible via the Internet, collections of abstracts in WMRA 28 and in future WMRA volumes are or will be published on CD ROM to assist persons that may have difficulty accessing abstracts via the Internet.

WMRA 28 is a collection of Adobe[™] Acrobat[™] PDF files. In addition to being published on CD ROM, WMRA 28 may be downloaded from the cited URL. After downloading during a

brief on-line session, users can work with WMRA 28 off line. WMRA 23/24 to WMRA 27, also collections of PDF files, may be ordered on CD ROM or downloaded from the cited URL.

The database that holds the abstracts for WMRA 23/24 and onward also contains the abstracts for WMRA 22. It should be noted that WMRA 22 data were converted and loaded from a different electronic format. Thus slight differences in content and print format may appear when compared to later WMRA volumes. Although already in printed form, WMRA 22 data were “back loaded” to enable full text search and query functions via the Internet at the cited URL. The collection of abstracts in WMRA 22 is available only in printed form, which may be ordered from the cited URL.

Volumes of Waste Management Research Abstracts are available free of charge, on request, to governmental and private organizations and to researchers. To order copies of WMRA volumes, please use the electronic request form on the cited URL or mail a request to:

WMRA Programme Officer
Waste Management Research Abstracts
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The collection of waste management research abstracts is made possible by the continued participation of researchers who are willing to invest the time and effort necessary to submit information about their research via the Internet. The work of the Resident Missions to the IAEA in Vienna and the other governmental organizations in Member States who coordinated the submission of these abstracts is greatly appreciated.

This report was prepared by G.W. Csullog and I. Pozdniakov, Division of Nuclear Fuel Cycle and Waste Technology.

INTRODUCTION TO WMRA 28

It is with pleasure that the International Atomic Energy Agency presents the twenty-eighth issue of the Waste Management Research Abstracts (WMRA). This issue contains 184 abstracts that describe research in progress in the field of radioactive waste management. The abstracts present ongoing work in various countries and international organizations. Although the abstracts are indexed by country, some programmes are actually the result of co-operation among several countries. Indeed, a primary reason for providing this compilation of programmes, institutions and scientists engaged in research into radioactive waste management is to increase international co-operation and facilitate communications.

Data provided by researchers for publication in WMRA 28 were entered into a research in progress database named IRAIS (International Research Abstracts Information System). The IRAIS database is available via the Internet at the following URL:

<http://www.iaea.org/programmes/irais/>

This database will continue to be updated as new abstracts are submitted by researchers world-wide. The abstracts are listed by country (full name) in alphabetical order. All abstracts are in English. The volume includes six indexes: principal investigator, title, performing organization, descriptors (key words), topic codes and country. Figure 1 provides a description of the elements of an abstract. Internet access to WMRA supports a variety of search functions and allows searching by words or phrases included in the texts of the abstracts. When performing searches, users should take note of the following conventions that are typically used in full texts:

isotope numbers: ^{60}Co , ^{235}U etc. are represented by Co-60, U-235 etc.

chemical formulas: UO_2 , H_2O , Fe_2O_3 etc. are represented by UO2, H2O, Fe2O3, etc.

m^2 is represented by m2

m^3 is represented by m3

ms^{-1} is represented by 'm per s' or 'm/s' and Bqm^{-3} by 'Bq per m3' or 'Bq/m3'

exponentials do not use superscripts; for example 10^3 is written 1E3

A list of waste management topic codes can be found starting on page viii.

FIGURE 1 Elements of an Abstract (continued on next page)

1.	GFR20030001	
2.	Title: Development and in-Situ Testing of Redundant Fiber Optic Monitoring Systems	
4.	Title in Original Language: Entwicklung und in-situ Erprobung redundanter faseroptischer Überwachungssysteme	3. Topic Code(s): 181 -Methodologies, Analytical Methods, Measurements Instrumentation
5.	Abstract: One of the issues to be solved in a geological repository is operational in-situ monitoring. Availability of appropriate monitoring tools is a major development objective, in order to ensure operational safety and in order to respond to a variety of other safety related demands. In-situ monitoring would provide the opportunity to increase confidence in the safety of the disposal system by verifying that the repository evolves in the manner predicted. Long-term effectiveness, low maintenance, reliable functioning with high accuracy, and resistance to various mechanical and geochemical impacts are major attributes of monitoring systems devised to be operated at least during the operational phase of a repository. In addition, low maintenance and automatic data acquisition without disturbing normal operation will help reducing significantly the operational costs. Due to these reasons DBE TECHNOLOGY is developing thermo-hydro-mechanical sensing systems based on fiber optic technology as the basis for monitoring systems at final disposal sites. Among the different sensing and multiplexing techniques available, the sensor development focuses on Fiber Bragg Grating and Intensity Modulation Sensing technology along with their corresponding multiplexing technique. This project is aimed at in-situ testing of fiber optic sensing systems in different geological formations and engineered barrier systems.	
6.	WM Descriptor(s): data acquisition systems; fiber optics; fibre optics; measuring instruments; optical fibers; optical fibres; optical systems; quality assurance; safety; technology development; temperature measurement	
7.	Principal Investigator: Jobmann, Michael W. DBE Technology GmbH Eschenstrasse 55 D-31224 Peine , GERMANY Tel: 05171431530 Fax: 05171431506 E-mail: jobmann@dbe.de	8. Organization Performing the work: DBE TECHNOLOGY GmbH Eschenstrasse 55 D-31224 Peine GERMANY
9.	Other Investigators: Voet, Marc I.D.FOS Research e.e.i.g.	10. Organization Type: Private industry
11.	Program Duration: From: 2000/02/01 To: 2004/09/30	
12.	State of Advancement: Research in progress	13. Preliminary reports available: No
14.	Sponsoring Organization(s): Bundesministerium für Wassertechnologie und Entsorgung	15. Associated Organization(s): none
16.	Recent publication info: Jobmann, M. & Biurrun, E. 2003: Research on Fiber Optic Sensing Systems and their Application as Final Disposal Monitoring Tools, Proceedings of the WM'03 Conference, February 23-27, 2003, Tucson, AZ.	

FIGURE 1 (continued from previous page)

1	Reference Number	A unique identifier for each entry, in bold face, starting with the ISO code for the country followed by the year of update (four digits) and a four-digit number assigned in ascending numerical order.
2	Title	English title of the abstract.
3	Topic Code(s)	Radioactive waste management subject category codes. A list of these codes can be found starting on page vii-ix.
4	Title in Original Language	(optional) For work originally prepared in a language other than English, the title in the original language may be included here. Please note that non-ASCII characters are not supported.
5	Abstract	All abstracts are printed in English. For the representation of special characters such as chemical formulas, isotope numbers etc. see the information given in the Introduction.
6	WM Descriptor(s)	Descriptors or key words taken from the Radioactive waste management Thesaurus. The assigned descriptors are indexed in this volume and represent an additional search possibility.
7	Principal Investigator	The name of the primary researcher or author contributing to the document. Corporate/organization authors are also cited where applicable.
8	Organization Performing the work	Name and location of the primary author/investigator.
9	Other Investigator(s)	Name(s) of other researcher(s) or collaborator(s).
10	Organization Type	The type of organization where the research is being performed: an institution of higher education; a foundation or laboratory for research and/or development; private industry; or other.
11	Program Duration	The start and finish dates are given in the format YYYY-MM-DD.
12	State of Advancement	State of the research: research planned or in progress.
13	Preliminary report(s) available	Yes or no.
14	Sponsoring Organization(s)	The organization providing the funding for the research.
15	Associated Organization(s)	Any other organization(s) also performing the research.
16	Recent Publications Info	A list of recent, relevant publications.

WASTE MANAGEMENT TOPIC CODES

10 - RADIOACTIVE WASTE

100 - RADIOACTIVE WASTE - GENERAL

- 101 - General policies
- 102 - Programme Strategy, Planning and Management
- 103 - Effluents and Discharges
- 104 - Database & Information Systems, including Technology Transfer Systems. Technical Assistance and Costs
- 105 - Waste Minimisation
- 106 - Quality Assurance Aspects
- 108 - Waste Management System Analysis
- 109 - Waste Characterisation (Radionuclide Inventory Determination), including Computer Codes and Measuring Methods and Techniques

110 - LOW AND INTERMEDIATE LEVEL WASTE FROM NFC FACILITIES

- 111 - Gaseous Waste Treatment
- 112 - Liquid Waste Treatment
- 113 - Solid Waste Treatment
- 114 - Waste Immobilization (Bituminization, Cementation, Including Tests of Properties, Leaching Studies)
- 115 - Waste Packaging
- 116 - Waste Storage
- 117 - Waste Disposal
- 118 - Waste Transportation (Methods, Containers, Transportation Means)

120 - RADIOACTIVE WASTE FROM NON-NFC SOURCES

- 121 - Gaseous Waste Treatment
- 122 - Liquid Waste Treatment
- 123 - Solid Waste Treatment
- 124 - Waste Immobilization
- 125 - Waste Packaging
- 126 - Waste Storage
- 127 - Waste Disposal

130 - HIGH LEVEL WASTE

- 131 - Gaseous Waste Treatment
- 132 - Liquid Waste Treatment
- 133 - Solid Waste Treatment
- 134 - Waste Immobilization/Vitrification (including Heat Transfer, Leaching and Other Studies)
- 135 - Waste Packaging (Canister Types, Materials, Corrosion Studies)
- 136 - Waste Storage
- 137 - Waste Disposal (including Spent Fuel)
- 138 - Waste Transportation (Methods, Containers, etc.)

140 - SPENT FUEL

- 141 - Spent Fuel Immobilization/Conditioning
- 142 - Spent Fuel Packaging (Canisters, Materials. etc.)

- 143 - Spent Fuel Storage
- 144 - Spent Fuel Immobilization/Conditioning
- 145 - Spent Fuel Packaging (Canisters, Materials. etc.)
- 146 - Spent Fuel Storage
- 148 - Spent Fuel Transportation (Methods, Casks, etc.)

150 - ALPHA BEARING/TRU WASTE

- 151 - Gaseous Waste Treatment
- 152 - Liquid Waste Treatment
- 153 - Solid Waste Treatment
- 154 - Waste Immobilization
- 155 - Waste Packaging
- 156 - Waste Storage
- 157 - Waste Disposal
- 158 - Waste Transportation (Methods, Containers, etc.)
- 159 - Recovery of Radionuclides from the Waste

160 - HAZARDOUS/MIXED WASTE

- 161 - Biodegradation/Biotreatment
- 162 - Liquid Waste Treatment
- 163 - Solid Waste Treatment
- 164 - Waste Immobilization
- 165 - Waste Packaging
- 166 - Waste Storage
- 167 - Waste Disposal
- 168 - Waste Transportation (Methods, Containers, etc.)
- 169 - Removal/Recycling of Organics
- 171 - Technologies and Methodologies
- 174 - Rehabilitation of Mill Tailings

180 - WASTE CHARACTERIZATION

- 181 - Methodologies, Analytical Methods, Measurements Instrumentation
- 182 - Waste from form characterization
- 183 - Waste packages characterization
- 184 - Mixed waste characterization
- 185 - Radionuclide characterization in storage tanks
- 186 - Radionuclide characterization in drums
- 187 - Radionuclide characterization in-situ
- 188 - Radionuclide scanning
- 191 - ROHE in waste management facilities
- 192 - ROHE in laboratories
- 193 - ROHE in site characterization
- 194 - ROHE in D&D
- 195 - ROHE in drums characterization and retrieval
- 196 - ROHE in characterization and retrieval of buried waste
- 197 - ROHE in characterization and retrieval of liquid waste served in underground

20 - ENVIRONMENTAL IMPACT/ASSESSMENT STUDIES

200 - ENVIRONMENTAL IMPACT/ASSESSMENT

- 201 - Dispersion and Migration of Radionuclides**
- 202 - Dispersion and Migration Models**
- 203 - Gas Diffusion Studies**
- 204 - Impacts from Landfill Sites**

210 - BIOLOGICAL UPTAKE AND TRANSFER

- 211 - Biological Uptake Mechanisms and Models**

220 - ENVIRONMENTAL TRANSFER

- 221 - Environmental Transfer Models**
- 222 - Microbial Effects**
- 223 - Effects of Gaseous Releases**

230 - RADIOLOGICAL ASSESSMENT

- 231 - Radiological Assessment Models**
- 232 - Environmental Risk Assessment**
- 233 - Long Term Environmental Impact**

240 - ENVIRONMENTAL MONITORING

- 241 - Monitoring Programmes**
- 242 - Monitoring Techniques**

30 - FACILITY AND/OR SITE SPECIFIC STUDIES

300 - FACILITY/SITE - GENERAL

- 301 - General Planning and Management**
- 302 - Site Survey and Characterization**
- 303 - Earth Science Models and Studies**
- 304 - Safety Assessment and Performance Studies**
- 305 - Design, Construction, Commissioning**
- 306 - Barrier Studies and Tests**

310 - STUDIES FOR NEAR SURFACE DISPOSAL FACILITIES

- 312 - Site Survey and Characterization**
- 313 - Earth Science Studies and Models**
- 314 - Safety Assessment and Performance Studies**
- 315 - Design, Construction, Commissioning**
- 316 - Barrier Studies/Tests/Impacts**

320 - STUDIES FOR GEOLOGICAL REPOSITORIES

- 321 - General Planning and Management**
- 322 - Site Survey and Characterization**
- 323 - Earth Science Studies and Models**
- 324 - Safety Assessment and Performance Studies**
- 325 - Design, Construction, Commissioning**
- 326 - Barrier Studies/Tests/Impacts including Near Field Effects**
- 327 - Waste Emplacement**

- 328 - Natural Analogue Studies
- 330 - STUDIES FOR LANDFILL SITES**
 - 331 - General Planning, Regulatory Concern, Limits
 - 332 - Site Characterization, Disposal Technologies
 - 333 - Landfill site remedial actions

- 40 - DECONAMINATION AND DECOMMISSIONING (D & D)**
 - 400 - D&D - GENERAL**
 - 401 - D&D Programme Strategy, Planning and Management
 - 402 - Nuclear Power Reactor Decommissioning
 - 403 - Research Reactor Decommissioning
 - 404 - Non-Reactor Facility Decommissioning

 - 410 - DECONTAMINATION TECHNOLOGIES**
 - 411 - Mechanical Decontamination Methods
 - 412 - Chemical Decontamination Methods
 - 413 - Electrochemical Decontamination Methods
 - 414 - Ultrasonic/Microwave Decontamination Methods
 - 415 - Decontamination by Melting
 - 416 - Other Methods and Techniques

 - 420 - DECOMMISSIONING TECHNOLOGIES**
 - 421 - Dismantling Techniques
 - 422 - Use of Explosives
 - 423 - Robotics, Remote Operations

 - 430 - MANAGEMENT OF DECOMMISSIONING WASTE**

- 50 - ENVIRONMENTAL RESTORATION**
 - 501 - Project Planning and Management
 - 502 - Feasibility Studies
 - 503 - Environmental Risk Evaluation including models
 - 504 - Economic Studies
 - 505 - Criteria
 - 511 - Site Characterization
 - 512 - Unknown
 - 521 - Decontamination of Soils
 - 522 - Decontamination of Groundwaters
 - 523 - Waste Retrieval, Emplacement of Barriers
 - 524 - Management of Restoration Waste

- 60 - LEGAL, REGULATORY AND GOVERNMENTAL ISSUES**
 - 601 - Criteria for Exempt Levels
 - 602 - Facility/Site Licensing Process
 - 611 - Waste Policy Acts

70 - PUBLIC INFORMATION/INTERACTION

701 - Public Information Programmes, Public Participation

702 - Information Centres

703 - Education and Training

704 - Socioeconomic Aspects

80 - ACTINIDE & TRANSMUTATION

800 - Actinide & Transmutation Studies