

## Understanding Radioactive Waste

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Geochemical Aspects of Radioactive Waste Disposal  
Hazardous and Radioactive Waste Treatment Technologies Handbook  
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Environmental Risk Assessment of Soil Contamination  
Radioactive Waste Management, Second Edition  
Mission Plan for the Civilian Radioactive Waste Management Program

## Radioactive Waste Management

A complete overview of sources of radioactive waste, this book highlights the issues involved in safe transportation and decontamination as well as in decommissioning of nuclear facilities. It covers radioactive decay and radiation shielding calculations, management and disposal of spent nuclear fuel and high level-waste, low-level waste, transuranic waste, Uranium mill tailings, and mixed waste. It discusses technical and regulatory aspects of waste management and provides a look at historical record and its influence on current policy.

## The Impact of Low-Level Radioactive Waste Management Policy on Biomedical Research in the United States

## **Geological Disposal of Radioactive Waste**

Deep Geological Disposal of Radioactive Waste presents a critical review of designing, siting, constructing and demonstrating the safety and environmental impact of deep repositories for radioactive wastes. It is structured to provide a broad perspective of this multi-faceted, multi-disciplinary topic: providing enough detail for a non-specialist to understand the fundamental principles involved and with extensive references to sources of more detailed information. Emphasis is very much on “deep geological disposal – at least some tens of metres below land surface and, in many cases, many hundred of metres deep. Additionally, only radioactive wastes are considered directly – even though such wastes often contain also significant chemotoxic or otherwise hazardous components. Many of the principles involved are generally applicable to other repository options (e.g. near-surface or on-surface disposal) and, indeed, to other types of hazardous waste. Presents a current critical review in designing, siting, constructing and demonstrating the safety and environmental impact of deep repositories for radwaste Addresses the fundamental principles of radioactive waste with up-to-date examples and real-world case studies Written for a multi-disciplinary audience, with an appropriate level of detail to allow a non-specialist to understand

## **Geochemical Aspects of Radioactive Waste Disposal**

Of all the books written about the problems of sustainable development and environmental protection, Sustainable Development: Science, Ethics, and Public Policy is one of the first to examine the role of science, economics and law, and ethics as generally applied to decision making on sustainable development, particularly in respect to the recommendations contained in Agenda 21. Specifically, the book examines the role, capabilities, and certain strengths and weaknesses of these disciplines and their ethical implications in the context of sustainable development problems. Such an analysis is necessary to determine whether sustainable development problems create important new challenges and problems for government so that, where appropriate, new tools or approaches may be designed to overcome limitations or take advantage of the strengths of current scientific, economic and legal capabilities. Audience: Environmental professionals, whether academic, governmental or industrial, or in the private consultancy sector. Also suitable as an upper level text or reference.

## **Hazardous and Radioactive Waste Treatment Technologies Handbook**

In the early 1990s, Russian President Boris Yeltsin revealed that for the previous thirty years the Soviet Union had dumped vast amounts of dangerous radioactive waste into rivers and seas in blatant violation of international agreements. The disclosure caused outrage throughout the Western world, particularly since officials from the Soviet Union had denounced

environmental pollution by the United States and Britain throughout the cold war. *Poison in the Well* provides a balanced look at the policy decisions, scientific conflicts, public relations strategies, and the myriad mishaps and subsequent cover-ups that were born out of the dilemma of where to house deadly nuclear materials. Why did scientists and politicians choose the sea for waste disposal? How did negotiations about the uses of the sea change the way scientists, government officials, and ultimately the lay public envisioned the oceans? Jacob Darwin Hamblin traces the development of the issue in Western countries from the end of World War II to the blossoming of the environmental movement in the early 1970s. This is an important book for students and scholars in the history of science who want to explore a striking case study of the conflicts that so often occur at the intersection of science, politics, and international diplomacy.

### **New Understanding Physics for Advanced Level**

Many books have been written on hazardous waste and nuclear waste separately, but none have combined the two subjects into one single-volume resource. *Hazardous and Radioactive Waste Treatment Technologies Handbook* covers the technologies, characteristics, and regulation of both hazardous chemical wastes and radioactive wastes. It provides an overview of recent waste technologies. A reference for scientists and engineers, the handbook focuses on waste-related thermal and non-thermal technologies, separation techniques, and stabilization technologies. It includes information on the DOE and DOD waste matrix located at various sites. It reveals current R&D activities in each technology and what improvements can be made in the future. A detailed schematic diagram illustrates each technology so that the process can be explicitly understood. In addition, the handbook covers relative life-cycle cost estimates for treatment systems using various technologies. With contributions from an international panel and extensively peer-reviewed, *Hazardous and Radioactive Waste Treatment Technologies Handbook* provides the latest information on waste remediation technologies and related regulations. Often in the field you will encounter more than one type of hazardous waste. This handbook gives you the design information you need to decide which technology to use and how to design the equipment for your particular needs. You can then incorporate appropriate technologies into a mixed waste treatment system.

### **Radioactive Waste Management**

In order to validate predictive models of the very long-term processes which affect the performance of radioactive waste repositories, there has been an increased interest in the information and understanding which can be obtained from studying similar mechanisms in natural systems. These "natural analogues", as they are known in the jargon of waste management, have been studied sporadically for many years, but there has been a considerable rejuvenation of interest in the last four years, possibly owing to the fact that performance assessment methodology is gradually maturing to the point where it needs the kind of support which analogues can offer. Since 1982, the Commission of the European Communities

has been involved in specific work on natural analogues in the framework of its activities on radioactive waste management, principally within the MIRAGE project which concerns migration of radionuclides in the geosphere. As a consequence, the Commission took the initiative, in 1985, of establishing a Natural Analogue Working Group (NAWG) whose members can benefit from the overall expertise available for managing their own natural analogue research programmes. In this group, modeller's requirements and the results of field research are exchanged at regular intervals. A number of wide-ranging investigation programmes, both on national and international scales, are currently underway or being initiated, and several of these have been discussed recently at the NAWG.

### **Toward a Better Understanding Maine's Low-level Radioactive Waste**

### **Disposition of High-Level Waste and Spent Nuclear Fuel**

### **Understanding Radioactive Waste**

Understanding Risk addresses a central dilemma of risk decisionmaking in a democracy: detailed scientific and technical information is essential for making decisions, but the people who make and live with those decisions are not scientists. The key task of risk characterization is to provide needed and appropriate information to decisionmakers and the public. This important new volume illustrates that making risks understandable to the public involves much more than translating scientific knowledge. The volume also draws conclusions about what society should expect from risk characterization and offers clear guidelines and principles for informing the wide variety of risk decisions that face our increasingly technological society. Understanding Risk Frames fundamental questions about what risk characterization means. Reviews traditional definitions and explores new conceptual and practical approaches. Explores how risk characterization should inform decisionmakers and the public. Looks at risk characterization in the context of the entire decisionmaking process. Understanding Risk discusses how risk characterization has fallen short in many recent controversial decisions. Throughout the text, examples and case studies--such as planning for the long-term ecological health of the Everglades or deciding on the operation of a waste incinerator--bring key concepts to life. Understanding Risk will be important to anyone involved in risk issues: federal, state, and local policymakers and regulators; risk managers; scientists; industrialists; researchers; and concerned individuals.

### **Deep Geological Disposal of Radioactive Waste**

This title features clearly written text and extensive colour diagrams, experiments and examples. Summaries, short and long questions and multiple-choice questions ensure thorough exam preparation and revision. Frequent hints and questions provide invaluable support and facilitate study at home. It provides excellent support from GCSE; in particular Double Award Science, and extra support with mathematics. Fully worked solutions are further explained by an interactive CD-ROM.

### **Natural Analogues in Radioactive Waste Disposal**

'Decommissioning and Radioactive Waste Management' provides a detailed understanding of the issues associated with these processes.

### **Sustainable Development: Science, Ethics, and Public Policy**

Soil is an irreplaceable resource that sustains life on the planet, challenged by food and energy demands of an increasing population. Therefore, soil contamination constitutes a critical issue to be addressed if we are to secure the life quality of present and future generations. Integrated efforts from researchers and policy makers are required to develop sound risk assessment procedures, remediation strategies and sustainable soil management policies. Environmental Risk Assessment of Soil Contamination provides a wide depiction of current research in soil contamination and risk assessment, encompassing reviews and case studies on soil pollution by heavy metals and organic pollutants. The book introduces several innovative approaches for soil remediation and risk assessment, including advances in phytoremediation and implementation of metabolomics in soil sciences.

### **A Science-Based Approach to Understanding Waste Form Durability in Open and Closed Nuclear Fuel Cycles**

There are two compelling reasons for understanding source term and near-field processes in a radioactive waste geologic repository. First, almost all of the radioactivity is initially in the waste form, mainly in the spent nuclear fuel (SNF) or nuclear waste glass. Second, over long periods, after the engineered barriers are degraded, the waste form is a primary control on the release of radioactivity. Thus, it is essential to know the physical and chemical state of the waste form after hundreds of thousands of years. The United States Department of Energy's Yucca Mountain Repository Program has initiated a long-term program to develop a basic understanding of the fundamental mechanisms of radionuclide release and a quantification of the release as repository conditions evolve over time. Specifically, the research program addresses four critical areas: (a) SNF dissolution mechanisms and rates; (b) formation and properties of U<sup>6+</sup>-secondary phases; (c)

waste form-waste package interactions in the near-field; and (d) integration of in-package chemical and physical processes. The ultimate goal is to integrate the scientific results into a larger scale model of source term and near-field processes. This integrated model will be used to provide a basis for understanding the behavior of the source term over long time periods (greater than 10<sup>5</sup> years). Such a fundamental and integrated experimental and modeling approach to source term processes can also be readily applied to development of advanced waste forms as part of a closed nuclear fuel cycle. Specifically, a fundamental understanding of candidate waste form materials stability in high temperature/high radiation environments and near-field geochemical/hydrologic processes could enable development of advanced waste forms "tailored" to specific geologic settings.

### **The Politics of Radioactive Waste Disposal**

This document contains information on all aspects of radioactive wastes. Facts are presented about radioactive wastes simply, clearly and in an unbiased manner which makes the information readily accessible to the interested public. The contents are as follows: questions and concerns about wastes; atoms and chemistry; radioactivity; kinds of radiation; biological effects of radiation; radiation standards and protection; fission and fission products; the Manhattan Project; defense and development; uses of isotopes and radiation; classification of wastes; spent fuels from nuclear reactors; storage of spent fuel; reprocessing, recycling, and resources; uranium mill tailings; low-level wastes; transportation; methods of handling high-level nuclear wastes; project salt vault; multiple barrier approach; research on waste isolation; legal requirements; the national waste management program; societal aspects of radioactive wastes; perspectives; glossary; appendix A (scientific American articles); appendix B (reference material on wastes). (ATT).

### **Understanding Radioactive Waste**

The International Atomic Energy Agency estimates that nuclear power generation facilities produce about 200,000 cubic meters of low and intermediate-level waste each year. Vital medical procedures, industrial processes and basic science research also produce significant quantities of waste. All of this waste must be shielded from the population for extended periods of time. Finding suitable locations for disposal facilities is beset by two main problems: community responses to siting proposals are generally antagonistic and, as a result, governments have tended to be reactive in their policy-making. Decision-making and Radioactive Waste Disposal explores these issues utilizing a linear narrative case study approach that critically examines key stakeholder interactions in order to explain how siting decisions for low level waste disposal are made. Five countries are featured: the US, Australia, Spain, South Korea and Switzerland. This book seeks to establish an understanding of the political, economic, environmental, legal and social dimensions of siting across those countries. This valuable resource fills a gap in the literature and provides recommendations for future disposal facility siting efforts. The

book will be of interest to students and scholars of environmental law, justice, management, politics, energy and security policy as well as decision-makers in government and industry.

### **Geological Disposal of Radioactive Waste**

### **Radioactive Waste Management**

#### **Radioactive Waste**

The Department of Energy's Office of Environmental Management (DOE) is responsible for the safe cleanup of sites used for nuclear weapons development and government-sponsored nuclear energy research. Low-level radioactive waste (LLW) is the most volumetrically significant waste stream generated by the DOE cleanup program. LLW is also generated through commercial activities such as nuclear power plant operations and medical treatments. The laws and regulations related to the disposal of LLW in the United States have evolved over time and across agencies and states, resulting in a complex regulatory structure. DOE asked the National Academies of Sciences, Engineering, and Medicine to organize a workshop to discuss approaches for the management and disposition of LLW. Participants explored the key physical, chemical, and radiological characteristics of low-level waste that govern its safe and secure management and disposal in aggregate and in individual waste streams, and how key characteristics of low level waste are incorporated into standards, orders, and regulations that govern the management and disposal of LLW in the United States and in other major waste-producing countries. This publication summarizes the presentations and discussions from the workshop.

#### **Low-Level Radioactive Waste Management and Disposition**

This reviews sources of radioactive waste and introduces radioactive decay and radiation shielding calculations. It covers technical and regulatory aspects of waste management with discussion questions at the end of each chapter to provide an opportunity to explore the many facets of waste management issues. An extensive reference list at the end of each chapter retains the references from the first edition of the book and incorporates references used in preparing this revised text, giving readers an opportunity to look at historical records as well as current information.

#### **A Guide to the U.S. Department of Energy's Low-level Radioactive Waste**

Drawing on the authors' extensive experience in the processing and disposal of waste, *An Introduction to Nuclear Waste Immobilisation, Second Edition* examines the gamut of nuclear waste issues from the natural level of radionuclides in the environment to geological disposal of waste-forms and their long-term behavior. It covers all-important aspects of processing and immobilization, including nuclear decay, regulations, new technologies and methods. Significant focus is given to the analysis of the various matrices used, especially cement and glass, with further discussion of other matrices such as bitumen. The final chapter concentrates on the performance assessment of immobilizing materials and safety of disposal, providing a full range of the resources needed to understand and correctly immobilize nuclear waste. The fully revised second edition focuses on core technologies and has an integrated approach to immobilization and hazards. Each chapter focuses on a different matrix used in nuclear waste immobilization: cement, bitumen, glass and new materials. Keeps the most important issues surrounding nuclear waste - such as treatment schemes and technologies and disposal - at the forefront.

### **An Introduction to Nuclear Waste Immobilisation**

### **Decommissioning and Radioactive Waste Management**

Environmental concerns have pushed the decarbonisation of the European economy high on the EU political agenda. This has renewed old debates about the role of nuclear energy in the European economy and society that gravitate around the issues of nuclear safety and radioactive waste management (RWM). RWM carries many elements of technical complexity, scientific uncertainty and social value, which makes policy decisions highly controversial. Public participation is usually believed to improve these decisions, ease their implementation by solving substantial conflicts, and enhance trust and social acceptance. Drawing upon sources including Euratom and the OECD Nuclear Energy Agency, the author offers a detailed overview of public involvement in RWM in the EU, analysing the implementation of national policies through official programmes and the views of stakeholders from all Member States. This book highlights the key successes and challenges in the quest for greater participation in RWM, and extrapolates insights for other contested energy infrastructures and controversies in land use. This book will be of great relevance to students, scholars and practitioners with an interest in radioactive waste management, energy policy, and EU environmental politics and policy.

### **The Politics of Radioactive Waste Management**

Focused attention by world leaders is needed to address the substantial challenges posed by disposal of spent nuclear fuel from reactors and high-level radioactive waste from processing such fuel. The biggest challenges in achieving safe and

secure storage and permanent waste disposal are societal, although technical challenges remain. Disposition of radioactive wastes in a deep geological repository is a sound approach as long as it progresses through a stepwise decision-making process that takes advantage of technical advances, public participation, and international cooperation. Written for concerned citizens as well as policymakers, this book was sponsored by the U.S. Department of Energy, U.S. Nuclear Regulatory Commission, and waste management organizations in eight other countries.

### **Geological Disposal of Radioactive Waste**

Describes the negative effects of radioactive substances, the various ways that the environment is now protected, and the different types of nuclear waste.

### **Road Map to Understanding Innovative Technology Options for Brownfields Investigation and Cleanup**

This "objective" report, originally prepared for the U.S. Department of Energy, tells the glowing, happy story of nuclear waste disposal in America. The fourth edition has been updated to include the latest legislative and technical changes. It begins by explaining what radioactivity is and goes on to explore the merits of various methods of disposal and the use of licensing and regulation as forms of protection. Filled with graphs, tables, diagrams, and black and white photos. Annotation copyright by Book News, Inc., Portland, OR

### **Geological Disposal of Radioactive Waste**

This reviews sources of radioactive waste and introduces radioactive decay and radiation shielding calculations. It covers technical and regulatory aspects of waste management with discussion questions at the end of each chapter to provide an opportunity to explore the many facets of waste management issues. An extensive reference list at the end of each chapter retains the references from the first edition of the book and incorporates references used in preparing this revised text, giving readers an opportunity to look at historical records as well as current information.

### **Understanding Radioactive Waste**

### **Geological Disposal of Radioactive Waste**

Deals with the nature of radioactivity, biological effects, standards & protection, uses of isotopes, classification, disposal treatment, recycling of wastes, transportation, health protection, laws & regulations, societal aspects.

### **Radioactive Waste Management**

### **Radioactive Waste Disposal**

### **Poison in the Well**

### **Understanding Risk**

"Understanding Radioactive Waste is a needed source of objective information for the concerned public and an informative textbook. Reporting reliably on recent data, new technical developments, and the changing political scene, this book gives citizens the knowledge to form responsible opinions and help make decisions."--BOOK JACKET.Title Summary field provided by Blackwell North America, Inc. All Rights Reserved

### **Understanding Radioactive Waste**

The National Research Council's Committee on the Impact of Low-Level Radioactive Waste Management Policy on Biomedical Research in the United States was called on to assess the effects of the low-level radioactive waste management policy on the current and future activities of biomedical research. This report provides an assessment of the effects of the current management policy for low-level radioactive waste (LLRW), and resulting consequences, such as higher LLRW disposal costs and onsite storage of LLRW, on the current and future activities of biomedical research. That assessment will include evaluating the effects that the lack of facilities and disposal capacity, and rules of disposal facilities, have on institutions conducting medical and biological research and on hospitals where radioisotopes are used for the diagnosis and treatment of disease.

### **Advances in Understanding Engineered Clay Barriers**

## **Decision-making and Radioactive Waste Disposal**

Considers the politics of low-level and intermediate-level radioactive waste disposal (high-level waste is another kettle of [toxic] fish altogether, just now beginning to enter the political arena) from a comparative international perspective in order to discover what factors impinge upon the overriding need for legitimate and publicly acceptable solutions. Distributed by St. Martin's Press. Annotation copyright by Book News, Inc., Portland, OR

## **Geological Disposal of Radioactive Waste**

The use of clay barriers for waste-isolating purposes has gained increasing attention in the geotechnical engineering community. Practical interest is linked to fundamental research, which includes examination of the behaviour of compacted materials and expansive clays. The interaction between the barrier, waste and the surrounding ground may involve several thermo-hydro-mechanical and chemical-coupled processes that have been analyzed by means of 'in situ' tests, laboratory experiments and numerical modelling. Large-scale field tests have been developed in recent years by European Agencies dealing with the management of radioactive waste. These experiments have provided an opportunity to calibrate and to validate research models and offer benefits in terms of experience of instrumentation and installation techniques. The book includes about sixty papers presented in a symposium held in Spain in 2003. The four main topics of the book are: field emplacement and instrumentation techniques; fundamental research, material behaviour (i.e. bentonite), and laboratory testing; barrier behaviour and THM modelling; and chemical effects, HC and THMC modelling.

## **Environmental Risk Assessment of Soil Contamination**

## **Radioactive Waste Management, Second Edition**

## **Mission Plan for the Civilian Radioactive Waste Management Program**

There is an extremely voluminous literature on radioactive waste and its disposal, much in the form of government-sponsored research reports. To wade through this mountain of literature is indeed a tedious task, and it is safe to speculate that very few, if any, individuals have the time to examine each report that has been issued during the preceding ten years. This book attempts to summarize much of this literature. Further, many workers in the geosciences have not received training in the nuclear sciences, and many nuclear scientists could be better versed in geology. In this book an attempt is

made to cover some background material on radioactive wastes and geotoxicity that may not be an integral part of a geologist's training, and background material on geology and geochemistry for the nuclear scientist. The geochemical material is designed for both the geoscientist and the nuclear scientist. There is no specific level for this book. Certainly, it should be useful to advanced undergraduates and graduates studying geology and nuclear science. It does not pretend to cover a tremendous amount of detail in all subjects, yet the references cited provide the necessary source materials for follow-up study. It is my intention that the reader of this book will have a better, broader understanding of the geochemical aspects of radioactive waste disposal than is otherwise available in anyone source.

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