



NUCLEAR WASTES

Technologies for
Separations and
Transmutation

NATIONAL RESEARCH COUNCIL

Nuclear Wastes Technologies For Separations Transmutation

Michael J Apted, Joonhong Ahn



Nuclear Wastes Technologies For Separations Transmutation:

Nuclear Wastes National Research Council, Division on Earth and Life Studies, Commission on Geosciences, Environment and Resources, Committee on Separations Technology and Transmutation Systems, 1996-02-23 Disposal of radioactive waste from nuclear weapons production and power generation has caused public outcry and political consternation *Nuclear Wastes* presents a critical review of some waste management and disposal alternatives to the current national policy of direct disposal of light water reactor spent fuel The book offers clearcut conclusions for what the nation should do today and what solutions should be explored for tomorrow The committee examines the currently used once through fuel cycle versus different alternatives of separations and transmutation technology systems by which hazardous radionuclides are converted to nuclides that are either stable or radioactive with short half lives The volume provides detailed findings and conclusions about the status and feasibility of plutonium extraction and more advanced separations technologies as well as three principal transmutation concepts for commercial reactor spent fuel The book discusses nuclear proliferation the U S nuclear regulatory structure issues of health safety and transportation the proposed sale of electrical energy as a means of paying for the transmutation system and other key issues

Advanced Separation Techniques for Nuclear Fuel Reprocessing and Radioactive Waste Treatment Kenneth L Nash, Gregg J Lumetta, 2011-03-15 Advanced separations technology is key to closing the nuclear fuel cycle and relieving future generations from the burden of radioactive waste produced by the nuclear power industry Nuclear fuel reprocessing techniques not only allow for recycling of useful fuel components for further power generation but by also separating out the actinides lanthanides and other fission products produced by the nuclear reaction the residual radioactive waste can be minimised Indeed the future of the industry relies on the advancement of separation and transmutation technology to ensure environmental protection criticality safety and non proliferation i e security of radioactive materials by reducing their long term radiological hazard Advanced separation techniques for nuclear fuel reprocessing and radioactive waste treatment provides a comprehensive and timely reference on nuclear fuel reprocessing and radioactive waste treatment Part one covers the fundamental chemistry engineering and safety of radioactive materials separations processes in the nuclear fuel cycle including coverage of advanced aqueous separations engineering as well as on line monitoring for process control and safeguards technology Part two critically reviews the development and application of separation and extraction processes for nuclear fuel reprocessing and radioactive waste treatment The section includes discussions of advanced PUREX processes the UREX concept fission product separations and combined systems for simultaneous radionuclide extraction Part three details emerging and innovative treatment techniques initially reviewing pyrochemical processes and engineering highly selective compounds for solvent extraction and developments in partitioning and transmutation processes that aim to close the nuclear fuel cycle The book concludes with other advanced techniques such as solid phase extraction supercritical fluid and ionic liquid extraction and biological

treatment processes With its distinguished international team of contributors Advanced separation techniques for nuclear fuel reprocessing and radioactive waste treatment is a standard reference for all nuclear waste management and nuclear safety professionals radiochemists academics and researchers in this field A comprehensive and timely reference on nuclear fuel reprocessing and radioactive waste treatment Details emerging and innovative treatment techniques reviewing pyrochemical processes and engineering as well as highly selective compounds for solvent extraction Discusses the development and application of separation and extraction processes for nuclear fuel reprocessing and radioactive waste treatment

Handbook of Nuclear Chemistry Attila Vértes,Sándor Nagy,Zoltán Klencsár,Rezso György Lovas,Frank Rösch,2010-12-10 This revised and extended 6 volume handbook set is the most comprehensive and voluminous reference work of its kind in the field of nuclear chemistry The Handbook set covers all of the chemical aspects of nuclear science starting from the physical basics and including such diverse areas as the chemistry of transactinides and exotic atoms as well as radioactive waste management and radiopharmaceutical chemistry relevant to nuclear medicine The nuclear methods of the investigation of chemical structure also receive ample space and attention The international team of authors consists of scores of world renowned experts nuclear chemists radiopharmaceutical chemists and physicists from Europe USA and Asia The Handbook set is an invaluable reference for nuclear scientists biologists chemists physicists physicians practicing nuclear medicine graduate students and teachers virtually all who are involved in the chemical and radiopharmaceutical aspects of nuclear science The Handbook set also provides further reading via the rich selection of references

Hearing Before the Subcommittee on Energy Committee on Science House of Representatives , Economic Aspects of Nuclear Fuel Reprocessing United States. Congress. House. Committee on Science. Subcommittee on Energy,2006

Electrometallurgical Techniques for DOE Spent Fuel Treatment National Research Council,Commission on Physical Sciences, Mathematics, and Applications,Board on Chemical Sciences and Technology,Committee on Electrometallurgical Techniques for DOE Spent Fuel Treatment,2000-08-11 The Committee on Electrometallurgical Techniques for DOE Spent Fuel Treatment was formed in September 1994 in response to a request made to the National Research Council NRC by the U S Department of Energy DOE DOE requested an evaluation of electrometallurgical processing technology proposed by Argonne National Laboratory ANL for the treatment of DOE spent nuclear fuel Electrometallurgical treatment of spent reactor fuel involves a set of operations designed to remove the remaining uranium metal and to incorporate the radioactive nuclides into well defined and reproducible waste streams Over the course of the committee s operating life this charge has remained constant Within the framework of this overall charge the scope of the committee s work as defined by its statement of task has evolved in response to further requests from DOE as well as technical accomplishments and regulatory and legal considerations As part of its task the committee has provided periodic assessments of ANL s R D program on the electrometallurgical technology Electrometallurgical Techniques for DOE Spent

Fuel Treatment assesses the viability of electrometallurgical technology for treating DOE spent nuclear fuel and monitors the scientific and technical progress of the ANL program on electrometallurgical technology specifically within the context of ANL's demonstration project on electrometallurgical treatment of EBR II SNF. This report evaluates ANL's performance relative to the success criteria for the demonstration project which have served as the basis for judging the efficacy of using electrometallurgical technology for the treatment of EBR II spent nuclear fuel. It also addresses post demonstration activities related to ANL's electrometallurgical demonstration project and makes related recommendations in this area. Nuclear Waste Storage and Disposal Policy, and Hydroelectric License Extension and Energy Efficiency Legislation United States.

Congress. House. Committee on Energy and Commerce. Subcommittee on Energy and Air Quality, 2006 **The**

Department of Energy's FY 1997 Budget Request for Environment, Safety and Health, Environmental Restoration and Waste Management (non-defense) and Nuclear Energy United States. Congress. House. Committee on Science.

Subcommittee on Energy and Environment, 1997 **Geological Repository Systems for Safe Disposal of Spent Nuclear**

Fuels and Radioactive Waste Michael J Apted, Joonhong Ahn, 2010-07-27 Geological disposal has been internationally adopted as the most effective approach to assure the long term safe disposition of the used nuclear fuels and radioactive waste materials produced from nuclear power generation nuclear weapons programs medical treatments and industrial applications Geological repository systems take advantage of natural geological barriers augmented with engineered barrier systems to isolate these radioactive materials from the environment and from future populations Geological repository systems for safe disposal of spent nuclear fuels and radioactive waste critically reviews the state of the art technologies scientific methods regulatory developments and social engagement approaches directly related to the implementation of geological repository systems Part one introduces geological disposal including multiple barrier geological repositories as well as reviewing the impact of nuclear fuel recycling practices and underground research laboratory activities on the development of disposal concepts Part two reviews geological repository siting in different host rocks including long term stability analysis and radionuclide transport modelling Reviews of the range of engineered barrier systems including waste immobilisation technologies container materials low pH concretes clay based buffer and backfill materials and barrier performance are presented in Part three Part four examines total system performance assessment and safety analyses for deep geological and near surface disposal with coverage of uncertainty analysis use of expert judgement for decision making and development and use of knowledge management systems Finally Part five covers regulatory and social approaches for the establishment of geological disposal programs from the development of radiation standards and risk informed performance based regulations to environmental monitoring and social engagement in the siting and operation of repositories With its distinguished international team of contributors Geological repository systems for safe disposal of spent nuclear fuels and radioactive waste is a standard reference for all nuclear waste management and geological repository

professionals and researchers Critically reviews the state of the art technologies scientific methods regulatory developments and social engagement approaches related to the implementation of geological repository systems Chapters introduce geological disposal and review the development of disposal concepts Examines long term stability analysis the range of engineered barrier systems and barrier performance

Nuclear Waste Disposal Mark Holt, 2010-02 Contents 1 Proposals for a New Direction 2 Baseline Current Waste Program Projections 3 Options for Halting or Delaying Yucca Mountain Withdraw License Application Reduce Appropriations Key Policy Appointments Waste Program Review 4 Consequences of a Yucca Mountain Policy Shift Federal Liabilities for Disposal Delays Licensing Complications for New Power Reactors Environmental Cleanup Penalties Long Term Risk 5 Nuclear Waste Policy Options Institutional Changes Extended On Site Storage Federal Central Interim Storage Private Central Storage Spent Fuel Reprocessing and Recycling Non Repository Options New Repository Site 6 Concluding Discussion

Regaining Security William J. Weida, 2019-07-09 First published in 1997 this volume observes that of all the materials systems and facilities that designed and operated nuclear weapons the most readily available assets for reuse are often identified as the highly enriched uranium HEU and plutonium from warheads However proliferation concerns the reuse of much of this material unlikely This book explores the economic issues surrounding the major expenditures facing the US as it attempts to dispose of weapon grade nuclear materials in a proliferation resistant manner The book discusses the economic values of plutonium and HEU the economic nature of the nuclear industry reprocessing and operations costs the economics of burning plutonium to generate electrical power the economics of down blending and burning HEU military conversion as a rationale for selecting plutonium disposition options the economics of transmutation and the economics of other proposals ranging from monitored surface storage to vitrification The book concludes by identifying the major cost drivers affecting all disposition options

Fuel Cycle to Nowhere Richard Burleson Stewart, Jane Bloom Stewart, 2011-08-15 The origins of the current nuclear waste disposal crisis and directions for future policy

Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-level Radioactive Waste at Yucca Mountain, Nye County, Nevada: Impact analyses United States. Department of Energy. Office of Civilian Radioactive Waste Management, 1999

Radioactive Waste Management, 1981

Transactions of the American Nuclear Society American Nuclear Society, 2001

An Overview of the Global Nuclear Energy Partnership (GNEP), Including Proposed Advanced Reactor Technologies for Recycling Nuclear Waste United States. Congress. Senate. Committee on Appropriations. Subcommittee on Energy and Water, and Related Agencies, 2006

Assessing the Goals, Schedule, and Costs of the Global Nuclear Energy Partnership United States. Congress. House. Committee on Science. Subcommittee on Energy, 2006 Hearing to examine the goals schedules and costs of the advanced fuel cycle technologies research and development R D program in the Administration s Global Nuclear Energy Partnership GNEP proposal

Disposition of High-Level Waste and Spent Nuclear Fuel National Research

Council, Division on Earth and Life Studies, Board on Radioactive Waste Management, Committee on Disposition of High-Level Radioactive Waste Through Geological Isolation, 2001-07-05 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

Chemical Separation Technologies and Related Methods of Nuclear Waste Management Gregory R. Choppin, Mikhail Kh. Khankhasayev, 1999-02-28 Separation technologies are of crucial importance to the goal of significantly reducing the volume of high level nuclear waste thereby reducing the long term health risks to mankind International co operation including the sharing of concepts and methods as well as technology transfer is essential in accelerating research and development in the field The writers of this book are all internationally recognised experts in the field of separation technology well qualified to assess and criticize the current state of separation research as well as to identify future opportunities for the application of separation technologies to the solution of nuclear waste management problems The major emphases in the book are research opportunities in the utilization of innovative and potentially more efficient and cost effective processes for waste processing treatment actinide speciation separation methods technological processing and environmental restoration Handbook of Risk Theory Sabine Roeser, 2012 Risk has become one of the main topics in fields as diverse as engineering medicine and economics and it is also studied by social scientists psychologists and legal scholars But the topic of risk also leads to more fundamental questions such as What is risk What can decision theory contribute to the analysis of risk What does the human perception of risk mean for society How should we judge whether a risk is morally acceptable or not Over the last couple of decades questions like these have attracted interest from philosophers and other scholars into risk theory This handbook provides for an overview into key topics in a major new field of research It addresses a wide range of topics ranging from decision theory risk perception to ethics and social implications of risk and it also addresses specific case studies It aims to promote communication and information among all those who are interested in theoetical issues concerning risk and uncertainty This handbook brings together internationally leading philosophers and scholars from other disciplines who work on risk theory The contributions are accessibly written and highly relevant to issues that are studied by risk scholars We hope that the Handbook of Risk Theory will be a helpful starting point for all risk scholars who are interested in broadening and deepening their current perspectives

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