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SATOAY - GARDNER ODONNELL

Sustainability of Life Cycle Management for Nuclear Cementation-Based Technologies, edited by Dr. Rahman and Dr. Ojovan, presents the latest knowledge and research on the management of cementitious systems within nuclear power plants. The book covers aging, development and updates on regulatory frameworks on a global scale, the development of cementitious systems for the immobilization of problematic wastes, and the decommissioning and decontamination of complex cementitious systems. The book's editors and their team of experts combine their practical knowledge to provide the reader with a thorough understanding on the sustainability of lifecycle management of cementitious systems within the nuclear industry. Sections provide a comparative tool that presents national regulations concerning cementitious systems within nuclear power plants, check international and national

evaluation results of the sustainability of different systems, help in the development of performance test procedures, and provide a guide on aging nuclear power plants and the long-term behavior of these systems in active and passive safety environments. Presents the latest information on the behavior of different cementitious systems used in the nuclear industry in one comprehensive resource Includes scientific justifications of system behavior during the design, operation, maintenance and decommissioning phases Aids the reader in the development of evaluation tests for problematic wastes

This open access book traces the journey of nuclear law: its origins, how it has developed, where it is now, and where it is headed. As a discipline, this highly specialized body of law makes it possible for us to benefit from the life-saving applications of nuclear science and technology, including diagnosing cancer as well as avoiding and mitigating the effects of cli-

mate change. This book seeks to give readers a glimpse into the future of nuclear law, science and technology. It intends to provoke thought and discussion about how we can maximize the benefits and minimize the risks inherent in nuclear science and technology. This compilation of essays presents a global view in discipline as well as in geography. The book is aimed at representatives of governments—including regulators, policy-makers and lawmakers—as well representatives of international organizations and the legal and insurance sectors. It will be of interest to all those keen to better understand the role of law in enabling the safe, secure, and peaceful use of nuclear technology around the world. The contributions in this book are written by leading experts, including the IAEA's Director General, and discuss the four branches of nuclear law—safety, security, safeguards and nuclear liability—and the interaction of nuclear law with other fields of national and international law. Increasing global consumerism and population has led to an increase in the levels of waste produced. Waste to energy (WTE) conversion technologies can be employed to convert residual wastes into clean energy, rather than sending these wastes directly to landfill. Waste to energy conversion technology explores the systems, technology and impacts of waste to energy conversion. Part one provides an introduction to WTE conversion and reviews the waste hierarchy and WTE systems options along with the corresponding environmental, regulatory and techno-economic issues facing this technology. Part two goes on to explore further specific aspects of WTE systems, engineering and technology and includes chapters on municipal solid waste (MSW) combustion plants and WTE systems for district heating. Finally, part three high-

lights pollution control systems for waste to energy technologies. Waste to energy conversion technology is a standard reference book for plant managers, building engineers and consultants requiring an understanding of WTE technologies, and researchers, scientists and academics interested in the field. Reviews the waste hierarchy and waste to energy systems options along with the environmental and social impact of WTE conversion plants Explores the engineering and technology behind WTE systems including considerations of municipal solid waste (MSW) its treatment, combustion and gasification Considers pollution control systems for WTE technologies including the transformation of waste combustion facilities from major polluters to pollution sinks

Designing new nuclear facilities is an extraordinarily complex exercise, often requiring teams of specialists several hundred strong. *Nuclear Facilities: A Designer's Guide* provides an insight into each of the main contributors and shows how the whole design process is drawn together. Essential reading for all nuclear professionals: those already involved in the industry will gain knowledge that enables them to interact more effectively with colleagues in other disciplines. Its wealth of information will assist students and graduates in progressing more rapidly into fully rounded contributors to the nuclear facility design process. Whilst those joining nuclear from other industries will find a structured introduction to the nuclear world and discover what differentiates it from other spheres of engineering. A single, comprehensive text on nuclear facility design which covers all major aspects of the process Packed full of essential information, its complex subject matter is explained in a logical and comprehensible style Valuable to

those involved in both new build and decommissioning projects. Written by a highly respected expert in the nuclear industry.

This is a compilation of topics that are at the forefront of many technical advances and practices in air and water control. These include air pollution control, water pollution control, water treatment, wastewater treatment, industrial waste treatment and small scale wastewater treatment.

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.

Advanced District Heating and Cooling (DHC) Systems presents the latest infor-

mation on the topic, providing valuable information on the distribution of centrally generated heat or cold energy to buildings, usually in the form of space heating, cooling, and hot water. As DHC systems are more efficient and less polluting than individual domestic or commercial heating and cooling systems, the book provides an introduction to DHC, including its potential contribution to reducing carbon dioxide emissions, then reviews thermal energy generation for DHC, including fossil fuel-based technologies, those based on renewables, and surplus heat valorization. Final sections address methods to improve the efficiency of DHC. Gives a comprehensive overview of DHC systems and the technologies and energy resources utilized within these systems. Analyzes the various methods used for harnessing energy to apply to DHC systems. Ideal resource for those interested in district cooling, teleheating, heat networks, distributed heating, thermal energy, cogeneration, combined heat and power, and CHP. Reviews the application of DHC systems in the field, including both the business model side and the planning needed to implement these systems.

This handbook is a practical aid to legislative drafting that brings together, for the first time, model texts of provisions covering all aspects of nuclear law in a consolidated form. Organised along the same lines as the *Handbook on Nuclear Law*, published by the IAEA in 2003, and containing updated material on new legal developments, this publication represents an important companion resource for the development of new or revised nuclear legislation, as well as for instruction in the fundamentals of nuclear law. It will be particularly useful for those Member States embarking on new or expanding existing nuclear programmes.

Radioactive waste management and contaminated site clean-up reviews radioactive waste management processes, technologies, and international experiences. Part one explores the fundamentals of radioactive waste including sources, characterisation, and processing strategies. International safety standards, risk assessment of radioactive wastes and remediation of contaminated sites and irradiated nuclear fuel management are also reviewed. Part two highlights the current international situation across Africa, Asia, Europe, and North America. The experience in Japan, with a specific chapter on Fukushima, is also covered. Finally, part three explores the clean-up of sites contaminated by weapons programmes including the USA and former USSR. Radioactive waste management and contaminated site clean-up is a comprehensive resource for professionals, researchers, scientists and academics in radioactive waste management, governmental and other regulatory bodies and the nuclear power industry. Explores the fundamentals of radioactive waste including sources, characterisation, and processing strategies Reviews international safety standards, risk assessment of radioactive wastes and remediation of contaminated sites and irradiated nuclear fuel management Highlights the current international situation across Africa, Asia, Europe, and North America specifically including a chapter on the experience in Fukushima, Japan

Over the past decade significant progress has been achieved in the development of waste characterization and control procedures and equipment as a direct response to ever-increasing requirements for quality and reliability of information on waste characteristics. Failure in control procedures at any step can have important, adverse consequences

and may result in producing waste packages which are not compliant with the waste acceptance criteria for disposal, thereby adversely impacting the repository. The information and guidance included in this publication corresponds to recent achievements and reflects the optimum approaches, thereby reducing the potential for error and enhancing the quality of the end product. -- Publisher's description.

This book serves as a reference for engineers, scientists, and students concerned with the use of materials in applications where reliability and resistance to corrosion are important. It updates the coverage of its predecessor, including coverage of: corrosion rates of steel in major river systems and atmospheric corrosion rates, the corrosion behavior of materials such as weathering steels and newer stainless alloys, and the corrosion behavior and engineering approaches to corrosion control for nonmetallic materials. New chapters include: high-temperature oxidation of metals and alloys, nanomaterials, and dental materials, anodic protection. Also featured are chapters dealing with standards for corrosion testing, microbiological corrosion, and electrochemical noise.

Safe and Secure Transport and Storage of Radioactive Materials reviews best practice and emerging techniques in this area. The transport of radioactive materials is an essential operation in the nuclear industry, without which the generation of nuclear power would not be possible. Radioactive materials also often need to be stored pending use, treatment, or disposal. Given the nature of radioactive materials, it is paramount that transport and storage methods are both safe and secure. A vital guide for managers and general managers in the nuclear power and transport industries, this

book covers topics including package design, safety, security, mechanical performance, radiation protection and shielding, thermal performance, uranium ore, fresh fuel, uranium hexafluoride, MOX, plutonium, and more. Uniquely comprehensive and systematic coverage of the packaging, transport, and storage of radioactive materials Section devoted to spent nuclear fuels Expert team of authors and editors

A complete guide to environmental remediation technologies, techniques, and regulations This practical resource offers comprehensive coverage of the latest environmental codes alongside step-by-step remediation procedures. The book features information on all segments of the market, including water, air quality, and hazardous wastes, and enables you to ensure compliance with federal regulations. Handbook of Environmental Engineering fully explains engineering methods and technologies and directly connects them to applicable standards. You will get details on environmental tools such as sensors and monitoring, toxicity controls and treatments, and waste disposal. Measurement data, environmental impact assessments, and real-world examples demonstrate how to apply each technique in the field.

Once a nuclear installation has reached the end of its safe and economical operational lifetime, the need for its decommissioning arises. Different strategies can be employed for nuclear decommissioning, based on the evaluation of particular hazards and their attendant risks, as well as on the analysis of costs of clean-up and waste management. This allows for decommissioning either soon after permanent shutdown, or perhaps a long time later, the latter course allowing for radioactivity levels to drop in any activat-

ed or contaminated components. It is crucial for clear processes and best practices to be applied in decommissioning such installations and sites, particular where any significant health and environmental risks exist. This book critically reviews the nuclear decommissioning processes and technologies applicable to nuclear power plants and other civilian nuclear facilities. Part one focuses on the fundamental planning issues in starting a nuclear decommissioning process, from principles and safety regulations, to financing and project management. Part two covers the execution phase of nuclear decommissioning projects, detailing processes and technologies such as dismantling, decontamination, and radioactive waste management, as well as environmental remediation, site clearance and reuse. Finally, part three details international experience in the decommissioning of nuclear applications, including the main nuclear reactor types and nuclear fuel cycle facilities, as well as small nuclear facilities and legacy nuclear waste sites. Critically reviews nuclear decommissioning processes and technologies applicable to nuclear power plants and other civilian nuclear facilities Discusses the fundamental planning issues in starting a nuclear decommissioning process Considers the execution phase of nuclear decommissioning projects, including dismantling, decontamination, and radioactive waste management, as well as environmental remediation, site clearance and reuse

As the re-emergence of nuclear power as an acceptable energy source on an international basis continues, the need for safe and reliable ways to dispose of radioactive waste becomes ever more critical. The ultimate goal for designing a pre-disposal waste-management system depends on producing waste containers

suitable for storage, transportation and permanent disposal. Cement-Based Materials for Nuclear-Waste Storage provides a roadmap for the use of cementation as an applied technique for the treatment of low- and intermediate-level radioactive wastes. Coverage includes, but is not limited to, a comparison of cementation with other solidification techniques, advantages of calcium-silicate cements over other materials and a discussion of the long-term suitability and safety of waste packages as well as cement barriers.

This volume provides in-depth coverage of such topics as multi-reservoir system operation theory and practice, management of aquifer systems connected to streams using semi-analytical models, one-dimensional model of water quality and aquatic ecosystem-ecotoxicology in river systems, environmental and health impacts of hydraulic fracturing and shale gas, bioaugmentation for water resources protection, wastewater renovation by flotation for water pollution control, determination of receiving water's reaeration coefficient in the presence of salinity for water quality management, sensitivity analysis for stream water quality management, river ice process, and computer-aided mathematical modeling of water properties. This critical volume will serve as a valuable reference work for advanced undergraduate and graduate students, designers of water resources systems, and scientists and researchers. The goals of the Handbook of Environmental Engineering series are: (1) to cover entire environmental fields, including air and noise pollution control, solid waste processing and resource recovery, physicochemical treatment processes, biological treatment processes, biotechnology, biosolids management, flotation technology, membrane technol-

ogy, desalination technology, water resources, natural control processes, radioactive waste disposal, hazardous waste management, and thermal pollution control; and (2) to employ a multimedia approach to environmental conservation and protection since air, water, soil and energy are all interrelated.

Materials in a nuclear environment are exposed to extreme conditions of radiation, temperature and/or corrosion, and in many cases the combination of these makes the material behavior very different from conventional materials. This is evident for the four major technological challenges the nuclear technology domain is facing currently: (i) long-term operation of existing Generation II nuclear power plants, (ii) the design of the next generation reactors (Generation IV), (iii) the construction of the ITER fusion reactor in Cadarache (France), (iv) and the intermediate and final disposal of nuclear waste. In order to address these challenges, engineers and designers need to know the properties of a wide variety of materials under these conditions and to understand the underlying processes affecting changes in their behavior, in order to assess their performance and to determine the limits of operation. Comprehensive Nuclear Materials 2e provides broad ranging, validated summaries of all the major topics in the field of nuclear material research for fission as well as fusion reactor systems. Attention is given to the fundamental scientific aspects of nuclear materials: fuel and structural materials for fission reactors, waste materials, and materials for fusion reactors. The articles are written at a level that allows undergraduate students to understand the material, while providing active researchers with a ready reference resource of information.

Most of the chapters from the first Edition have been revised and updated and a significant number of new topics are covered in completely new material. During the ten years between the two editions, the challenge for applications of nuclear materials has been significantly impacted by world events, public awareness, and technological innovation. Materials play a key role as enablers of new technologies, and we trust that this new edition of Comprehensive Nuclear Materials has captured the key recent developments. Critically reviews the major classes and functions of materials, supporting the selection, assessment, validation and engineering of materials in extreme nuclear environments Comprehensive resource for up-to-date and authoritative information which is not always available elsewhere, even in journals Provides an in-depth treatment of materials modeling and simulation, with a specific focus on nuclear issues Serves as an excellent entry point for students and researchers new to the field

Alternative Fuels and Advanced Vehicle Technologies for Improved Environmental Performance: Towards Zero Carbon Transportation, Second Edition provides a comprehensive view of key developments in advanced fuels and vehicle technologies to improve the energy efficiency and environmental impact of the automotive sector. Sections consider the role of alternative fuels such as electricity, alcohol and hydrogen fuel cells, as well as advanced additives and oils in environmentally sustainable transport. Other topics explored include methods of revising engine and vehicle design to improve environmental performance and fuel economy and developments in electric and hybrid vehicle technologies. This reference will provide professionals, engineers and researchers of alternative fu-

els with an understanding of the latest clean technologies which will help them to advance the field. Those working in environmental and mechanical engineering will benefit from the detailed analysis of the technologies covered, as will fuel suppliers and energy producers seeking to improve the efficiency, sustainability and accessibility of their work. Provides a fully updated reference with significant technological advances and developments in the sector Presents analyses on the latest advances in electronic systems for emissions control, autonomous systems, artificial intelligence and legislative requirements Includes a strong focus on updated climate change predictions and consequences, helping the reader work towards ambitious 2050 climate change goals for the automotive industry

Handbook of Advanced Approaches towards Pollution Prevention and Control, Volume One: Conventional and Innovative Technology, and Assessment Techniques for Pollution Prevention and Control condenses all relevant information on pollution prevention and control in a single source. This handbook (Volume One of Two) covers the principles of pollution prevention and control technologies, recent advances in pollution prevention, control technologies and their sustainability, modernization in pollution prevention, and control technologies for future and next generation pollution prevention. This book is an indispensable resource for researchers and academic staff in chemical and process engineering, safety engineering, environmental engineering, biotechnology and materials engineering. Provides in-depth information on the principles and advances in pollution prevention and control practices Discusses emerging technologies and processes for advanced pollution pre-

vention and control Presents developments on the use of the assessment models as tools to support the research and applications of different technologies and processes Provides history, fundamentals, state-of-the-art, and future trends Edited by expert team of world-class editors

Radioactive wastes are generated from a wide range of sources, including the power industry, and medical and scientific research institutions, presenting a range of challenges in dealing with a diverse set of radionuclides of varying concentrations. Conditioning technologies are essential for the encapsulation and immobilisation of these radioactive wastes, forming the initial engineered barrier required for their transportation, storage and disposal. The need to ensure the long term performance of radioactive waste forms is a key driver of the development of advanced conditioning technologies. The Handbook of advanced radioactive waste conditioning technologies provides a comprehensive and systematic reference on the various options available and under development for the treatment and immobilisation of radioactive wastes. The book opens with an introductory chapter on radioactive waste characterisation and selection of conditioning technologies. Part one reviews the main radioactive waste treatment processes and conditioning technologies, including volume reduction techniques such as compaction, incineration and plasma treatment, as well as encapsulation methods such as cementation, calcination and vitrification. This coverage is extended in part two, with in-depth reviews of the development of advanced materials for radioactive waste conditioning, including geopolymers, glass and ceramic matrices for nuclear waste immobilisation, and waste packages and con-

tainers for disposal. Finally, part three reviews the long-term performance assessment and knowledge management techniques applicable to both spent nuclear fuels and solid radioactive waste forms. With its distinguished international team of contributors, the Handbook of advanced radioactive waste conditioning technologies is a standard reference for all radioactive waste management professionals, radiochemists, academics and researchers involved in the development of the nuclear fuel cycle. Provides a comprehensive and systematic reference on the various options available and under development for the treatment and immobilisation of radioactive wastes Explores radioactive waste characterisation and selection of conditioning technologies including the development of advanced materials for radioactive waste conditioning Assesses the main radioactive waste treatment processes and conditioning technologies, including volume reduction techniques such as compaction

Environmental remediation technologies to control or prevent pollution from hazardous waste material is a growing research area in academia and industry, and is a matter of utmost concern to public health, to improve ecology and to facilitate the redevelopment of a contaminated site. Recently, in situ and ex situ remediation technologies have been developed to rectify the contaminated sites, utilizing various tools and devices through physical, chemical, biological, electrical, and thermal processes to restrain, remove, extract, and immobilize mechanisms to minimize the contamination effects. This handbook brings altogether classical and emerging techniques for hazardous wastes, municipal solid wastes and contaminated water

sites, combining chemical, biological and engineering control methods to provide a one-stop reference. This handbook presents a comprehensive and thorough description of several remediation techniques for contaminated sites resulting from both natural processes and anthropogenic activities. Providing critical insights into a range of treatments from chemical oxidation, thermal treatment, air sparging, electrokinetic remediation, stabilization/solidification, permeable reactive barriers, thermal desorption and incineration, phytoremediation, biostimulation and bioaugmentation, bioventing and biosparging through ultrasound-assisted remediation methods, electrochemical remediation methods, and nanoremediation, this handbook provides the reader an inclusive and detailed overview and then discusses future research directions. Closing chapters on green sustainable remediation, economics, health and safety issues, and environmental regulations around site remediation will make this a must-have handbook for those working in the field.

Describes laws and regulations dealing with radioactive waste, lists pertinent organizations, and provides an annotated bibliography

Handbook of Advanced Approaches towards Pollution Prevention and Control, Volume Two: Legislative Measures and Sustainability for Pollution Prevention and Control condenses all relevant information on pollution prevention and control in a single source. This handbook (Volume Two of Two) covers the principals of pollution prevention and control technologies, recent advances in pollution prevention, control technologies and their sustainability, modernization in pollution prevention and control technologies for future and next generation of pol-

lution prevention and control technologies. The book is an indispensable resource for researchers and academic staff in chemical and process engineering, safety engineering, environmental engineering, biotechnology, and materials engineering. Provides in-depth information on the principles and advances in pollution prevention and control practices Discusses emerging technologies and processes for advanced pollution prevention and control Presents developments on the use of the assessment models as tools to support the research and applications of different technologies and processes Provides history, fundamentals, state-of-the-art, and future trends Edited by expert team of world-class editors

The potential development of any nuclear power programme should include a rigorous justification process reviewing the substantial regulatory, economic and technical information necessary for implementation, given the long term commitments involved in any new nuclear power project. Infrastructure and methodologies for the justification of nuclear power programmes reviews the fundamental issues and approaches to nuclear power justification in countries considering nuclear new build or redevelopment. Part one covers the infrastructure requirements for any new nuclear power programme, with chapters detailing the role and responsibilities of government, regulatory bodies and nuclear operator and the need for human resources and technical capability at the national level. Part two focuses on issues relevant to the justification process, including nuclear safety, radiation protection and emergency planning. Current designs and advanced reactors and radioactive waste management are also considered, along with the economic, social and envi-

ronmental impacts of nuclear power development. Part three reviews the development of nuclear power programme, from nuclear power plant site selection and licensing, through construction and operation, and on to decommissioning. Finally, a series of valuable appendices detail the UK experience of justification, nuclear safety culture and training, and the multinational design evaluation programme (MDEP). With its distinguished editor and expert team of contributors, Infrastructure and methodologies for the justification of nuclear power programmes is an essential reference for international and national stakeholders in this field, particularly governmental, non-governmental and regulatory bodies, nuclear power operators and consultants. Offers a comprehensive analysis of the infrastructure and methodologies required to justify the creation of nuclear power programmes in any country Provides coverage of the main issues and potential benefit linked to nuclear power Reviews the implementation of a nuclear power programme with particular reference to the requirements and methods involved in construction

This publication addresses inspection basics, concepts and methods on how to plan inspection activities, perform inspections of safety related structures, systems and components, evaluate the safety significance of inspection findings, and document the results. It presents high level considerations for the inspection of selected programmatic areas including plant operations, radiation protection, fire protection and maintenance activities at nuclear power plants (NPPs). The publication focuses on the regulatory inspection of operating NPPs and, when applicable, describes how the same inspection techniques can be ap-

plied to facilities undergoing construction, preoperational testing, and decommissioning. The general techniques described may be also used in the inspection of other types of nuclear facilities.

The book outlines recent advances in nuclear wasteform materials including glasses, ceramics and cements and spent nuclear fuel. It focuses on durability aspects and contains data on performance of nuclear wasteforms as well as expected behavior in a disposal environment.

Table of contents

Cementitious materials are an essential part in any radioactive waste disposal facility. Conditioning processes such as cementation are used to convert waste into a stable solid form that is insoluble and will prevent dispersion to the surrounding environment. It is incredibly important to understand the long-term behavior of these materials. This book summarises approaches and current practices in use of cementitious materials for nuclear waste immobilisation. It gives a unique description of the most important aspects of cements as nuclear waste forms: starting with a description of wastes, analyzing the cementitious systems used for immobilization and describing the technologies used, and ending with analysis of cementitious waste forms and their long term behavior in an envisaged disposal environment. Extensive research has been devoted to study the feasibility of using cement or cement based materials in immobilizing and solidifying different radioactive wastes. However, these research results are scattered. This work provides the reader with both the science and technology of the immobilization process, and the cementitious materials used to immobilize nuclear waste. It summarizes current knowledge in the field, and highlights impor-

tant areas that need more investigation. The chapters include: Introduction, Portland cement, Alternative cements, Cement characterization and testing, Radioactive waste cementation, Waste cementation technology, Cementitious wasteform durability and performance assessment.

The Department of Energy's Office of Environmental Management (DOE-EM) is responsible for cleaning up radioactive waste and environmental contamination resulting from five decades of nuclear weapons production and testing. A major focus of this program involves the retrieval, processing, and immobilization of waste into stable, solid waste forms for disposal. Waste Forms Technology and Performance, a report requested by DOE-EM, examines requirements for waste form technology and performance in the cleanup program. The report provides information to DOE-EM to support improvements in methods for processing waste and selecting and fabricating waste forms. Waste Forms Technology and Performance places particular emphasis on processing technologies for high-level radioactive waste, DOE's most expensive and arguably most difficult cleanup challenge. The report's key messages are presented in ten findings and one recommendation.

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 re-

searchers in this field. A comprehensive and timely reference on nuclear fuel re-processing 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 re-processing and radioactive waste treatment

The hazards of and alternatives to nuclear power are described in a graphic presentation following the history and politics of atomic power

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

This proceedings contains a collection of 26 papers from the following six 2013 Materials Science and Technology (M-S&T'13) symposia: Green Technologies for Materials Manufacturing and Processing V Materials Development and Degradation Management in Nuclear Applica-

tions Materials Issues in Nuclear Waste Management in the 21st Century Energy Storage III: Materials, Systems and Applications Nanotechnology for Energy, Healthcare and Industry Hybrid Organic - Inorganic Materials for Alternative Energy

A guide for constructing and using composite indicators for policy makers, academics, the media and other interested parties. In particular, this handbook is concerned with indicators which compare and rank country performance.