Handbook Of Advanced Radioactive Waste Conditioning Technologies

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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 containers 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

this report provides information and discussion on planning methodologies and technologies for retrieval and reconditioning of radioactive wastes recovered from old inadequate disposal or storage facilities the objective of such projects is to improve waste safety and security in accordance with modern requirements selected international experiences in waste retrieval and recovery projects are included the report serves as a guide for storage and disposal facility personnel responsible for the organization and implementation of waste retrieval and reconditioning projects to optimize planning selection and use of available and applicable technologies and resources publisher s description

the main objective of radioactive waste management is to protect people and their environment from the potential harmful effects of radioactive waste and to minimize the burden for future generations safe disposal of conditioned radioactive waste is considered the final step of waste management waste acceptance requirements consistent with a disposal concept should be defined either by national authorities or repository operators with the aim of meeting the safety goal of radioactive waste disposal a waste package is designed as an engineered component for ensuring the safe management of radioactive waste it represents a principal unit used as a reference for controlling information and making decisions with due consideration to interdependencies of various steps in radioactive waste management converting waste acceptance requirements into waste package specifications is therefore an important but complicated procedure with great effects and consequences that may involve latent risks and problems

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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

this publication examines innovative technologies and strategies used in radioactive waste treatment and conditioning at nuclear power plants or which have important potential for use as part of the long range strategy focusing on low and intermediate level wastes lilw for water cooled reactors aspects discussed include applicable waste streams benefits and impacts of each technology current applications within the nuclear field and non technical approaches

the main immobilization technologies that are available commercially and have been demonstrated to be viable are cementation bituminization and vitrification vitrification is currently the most widely used technology for the treatment of high level radioactive wastes hlw throughout the world most of the nations that have generated hlw are immobilizing in either alkali borosilicate glass or alkali aluminophosphate glass the exact compositions of nuclear waste glasses are tailored for easy preparation and melting avoidance of glass in glass phase separation avoidance of uncontrolled crystallization and acceptable chemical durability e g leach resistance glass has also been used to stabilize a variety of low level wastes llw and mixed radioactive and hazardous low level wastes mllw from other sources such as fuel rod cladding decladding processes chemical separations radioactive sources radioactive mill tailings contaminated soils medical research applications and other commercial processes the sources of radioactive waste generation are captured in other chapters in this book regarding the individual practices in various countries legacy wastes currently generated wastes and future waste generation future waste generation is primarily driven by interest in sources of clean energy and this has led to an increased interest in advanced nuclear power production the development of advanced wasteforms is a necessary component of the new nuclear power plant npp flowsheets therefore advanced nuclear wasteforms are being designed for robust disposal strategies a brief summary is given of existing and advanced wasteforms glass glass ceramics glass composite materials gcm s and crystalline ceramic mineral wasteforms that chemically incorporate radionuclides and hazardous species atomically in their structure cementitious geopolymer bitumen and other encapsulant wasteforms and composites that atomically bond and encapsulate wastes are also discussed the various processing technologies are cross referenced to the various types of wasteforms since often a particular type of wasteform can be made by a variety of different processing technologies

an introduction to nuclear waste immobilisation third edition examines nuclear waste issues including natural levels of radionuclides in the environment the 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 the book has been updated to include a discussion of the disposal of nuclear waste from non energy sources also adding a chapter on the nuclear fuel cycle 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 book s final chapter concentrates on the performance assessment of immobilizing materials and safety of disposal providing a full range of resources needed to understand and correctly immobilize nuclear waste focuses on core technologies and an integrated approach to immobilization and hazards includes new scientific findings on wasteform performance and novel technological developments provides expanded coverage on decommissioning waste including clearance of bulk materials from regulatory control and novel processing approaches focuses on different matrices used in nuclear waste immobilization including cement bitumen glass and new materials

the focus of this report is on the low and intermediate level radioactive wastes generated and managed during the normal operating life of wwer nuclear power plants it identifies mechanisms for reducing the generation and disposal volumes of radioactive waste at wwer reactors and compares the waste management approaches of western pwr and wwer reactors to identify reasons why pwrs currently have lower waste generation storage and disposal volumes examining historical trends in plant design and waste management approaches it seeks to identify those changes which contribute most significantly to today s differences between pwrs and wwers in generation and disposal volumes the report determines the role of waste storage in promoting implementation of improved or advanced waste minimization technologies and approaches and proposes recommendations for improving wwer waste minimization

nuclear waste management facilities advances environmental impacts and future prospects examines best practices and recent trends in improving nuclear safety and reducing the negative environmental impacts of nuclear waste with strong emphasis on regulatory requirements this reference is essential for designing new integrated waste management practices using lessons learned from historical and current practices divided into three key sections part one introduces the reader to the safety and environmental impacts of the nuclear industry part two reviews recent technological and methodological approaches to enhancing safety as well as reducing the carbon footprint of both individual processes and integrated facilities topics covered include waste processing transmutation and decommissioning part three consider potential management schemes for special waste from innovative sources and wastes that contain emerging contaminants including waste recycling opportunities nuclear waste management facilities advances environmental impacts and future prospects is a crucial tool needed to implement the safest and most environmentally considerate best practices within nuclear waste management facilities presents recent approaches used to assess and improve the safety and reduce the environmental impacts of nuclear waste management facilities offers technical guidance to support the development and defense of the environmental impact assessment eia and safety cases to support the waste management facilities licensing throughout their lifecycles highlights the future perspectives for wastes produced from innovative reactors and wastes containing emerging contaminants and recycling opportunities

this report describes various national spent fuel conditioning concepts the current state of technology the waste package designs so far developed and the engineering operations required for their manufacture it supplements iaea technical reports series no 320 evaluation of spent fuel as a final waste form

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