

Candu Reactor Severe Accident Analysis For Accident Management

This publication gives the general roadmap on how to perform the design and evaluation of the protection of nuclear power plants against human induced external hazards, consistent with IAEA Safety Standards. The publication concentrates on an overall view of the methodology and on the important considerations for its application to existing and new nuclear power plants. Topics covered include elements of the design/evaluation approach, developed in five phases: event identification; load characterization; design and assessment approaches; plant performance assessment and acceptance criteria; and operator response. The publication provides an approach to the assessment of extreme human induced external events which is fully consistent with the methods used for evaluation of nuclear facilities subjected to extreme natural events, such as earthquakes and floods.

Severe Accidents in Nuclear Reactors: Corium Retention Technologies and Insights presents an authoritative and practical analysis of the latest severe accident management strategies based on previous events and experiments. Written for utilities and industries operating and researching nuclear cooled reactor power plants, this book presents the exponential growth in research since major nuclear accidents and acts as a guide to retaining molten corium, both inside and outside the reactor vessel. Sections cover the physics behind several complex phenomena occurring during corium coolability, providing the reader with an in-depth understanding by presenting the insights obtained from simulated severe accidents. In addition, the book validates several severe accident codes and provides evidence on the termination of severe accident progressions to help the reader evaluate the safety of existing reactors and design the next generation of nuclear reactors. Provides a step-by-step guide to various severe accident management experiments Includes evidence on the termination of severe accident progressions Validates several severe accident codes

This Safety Guide is intended primarily for use with land based stationary thermal nuclear power plants but it may, in parts, have a wider applicability to other nuclear facilities. It provides recommendations and guidance on the possible format and content of a SAR in support of a request to the State regulatory body for authorization to construct and or operate a nuclear power plant. As such, it contains recommendations on meeting the requirements of Safety guide GS-R-1 "Legal and governmental infrastructure for nuclear, radioactive waste and transport safety" (2000, ISBN 9201008007)

Heat and Mass Transfer in Severe Nuclear Reactor Accidents

Proceedings of an International Symposium on Severe Accidents in Nuclear Power Plants

Licensability of CANDU-type Reactors in the United States

Preliminary Assessment of the R and D Requirements

Severe Accident Phenomenology

Benchmarking Severe Accident Computer Codes for Heavy Water Reactor Applications

"After the Fukushima Daiichi accident in 2011, one of the many actions committed to by the Canadian Nuclear Safety Commission (CNSC) in its Integrated Action Plan was an assessment and video representation for the public of how a full station blackout could progress in a CANDU reactor in Canada. This video was posted online in January 2013. The CNSC has now followed up with this technical paper, which assesses the timing of a hypothetical blackout, using the Darlington Nuclear Generating Station for illustration.For the assessment, it was necessary to make the extremely unrealistic assumption that operators take absolutely no action after a full station blackout. The assessment is not used to determine the effects of releases, but rather to assess the potential time and magnitude of releases to determine what operator action can be taken to prevent releases. The assessment identifies the multiple points when operator action becomes critical to stop the progression of an accident. Also, the assessment shows there is adequate time for operator action."--Executive summary, p. 2.

This book provides in-depth knowledge to solve engineering, geometrical, mathematical, and scientific problems with the help of advanced computational methods with a focus on mechanical and materials engineering. Divided into three subsections covering design and fluids, thermal engineering and materials engineering, each chapter includes exhaustive literature review along with thorough analysis and future research scope. Major topics covered pertains to computational fluid dynamics, mechanical performance, design, and fabrication including wide range of applications in industries as automotive, aviation, electronics, nuclear and so forth. Covers computational methods in design and fluid dynamics with a focus on computational fluid dynamics Explains advanced material applications and manufacturing in labs using novel alloys and introduces properties in material Discusses fabrication of graphene reinforced magnesium metal matrix for orthopedic applications Illustrates simulation and optimization gear transmission, heat sink and heat exchangers application Provides unique problem-solution approach including solutions, methodology, experimental setup, and results validation This book is aimed at researchers, graduate students in mechanical engineering, computer fluid dynamics,fluid mechanics, computer modeling, machine parts, and mechatronics.

Background report discussing the issue of safety in nuclear systems and providing brief accounts of some of the most serious reactor accidents in the world to date. Details are also provided of Ontario Hydro's problems with Unit 2 at Pickering. Chernobyl is not discussed here, but is the subject of a separate review (88-O0801). A review of parliamentary actions taken by both federal and provincial (Ontario) governments is included, as is a chronology from 1980 to present.

Establishing the Safety Infrastructure for a Nuclear Power Programme

75-INSAG-3 Rev. 1

Accident Analysis for Nuclear Power Plants with Pressurized Heavy Water Reactors

Exclusions Zones for Small Modular Reactors

CANDU

Nuclear Power Reactor Safety

Co-sponsored by the International Atomic Energy Agency and organised in collaboration with the European Communities.

This report contains practical guidance for performing accident analysis for nuclear power plants with pressurized heavy water reactors, based on current international good practice. It covers key aspects required including selection of initiating events and acceptance criteria, computer codes and modelling assumptions, the preparation of input data, presentation of results and quality assurance.

Dynamics and Control of Nuclear Reactors presents the latest knowledge and research in reactor dynamics, control and instrumentation; important factors in ensuring the safe and economic operation of nuclear power plants. This book provides current and future engineers with a single resource containing all relevant information, including detailed treatments on the modeling, simulation, operational features and dynamic characteristics of pressurized light-water reactors, boiling light-water reactors, pressurized heavy-water reactors and molten-salt reactors. It also provides pertinent, but less detailed information on small modular reactors, sodium fast reactors, and gas-cooled reactors. Provides case studies and examples to demonstrate learning through problem solving, including an analysis of accidents at Three Mile Island, Chernobyl and Fukushima Daiichi Includes MATLAB codes to enable the reader to apply the knowledge gained to their own projects and research Features examples and problems that illustrate the principles of dynamic analysis as well as the mathematical tools necessary to understand and apply the analysis Publishers Note: Table 3.1 has been revised and will be included in future printings of the book with the following data: Group Decay Constant, li (sec-1) Delayed Neutron Fraction (bi) 1 0.0124 0.000221 2 0.0305 0.001467 3 0.111 0.001313 4 0.301 0.002647 5 1.14 0.000771 6 3.01 0.000281 Total delayed neutron fraction: 0.0067

Format and Content of the Safety Analysis Report for Nuclear Power Plants

Proceedings

Severe Accident Progression Without Operator Action

Implementing Severe Accident Management in Nuclear Power Plants

Proceedings of the International Topical Meeting on Advanced Reactors Safety

Basic Safety Principles for Nuclear Power Plants

Papers and lectures from an international seminar on various heat and mass transfer aspects involved in severe accidents in nuclear power reactors.

The objective of this thesis is to estimate the size of the exclusion zone around a small modular reactor (SMR). The aim of such zone is to provide an atmospheric space sufficient to dilute any radioactive releases during an accident, to a level below the safe regulated radiation dose for the public. A hypothetical severe accident is considered for a generic SMR, and the whole-body radiation dose associated with the accident was estimated at various distances and reactor power levels. The results were verified against those of a more complex model for a typical CANDU reactor. The obtained results were then employed to estimate the radius of the exclusion zone, by determining the distance at which the dose is at or slightly below the permitted dose to a member of the public. The method first estimates the quantity and type of radioactive materials available for release to the environment following a nuclear accident, known as the Source Term. This thesis employed a simplified approach for estimating the Source Term, utilizing the magnitude of the fission product yields, radionuclide release fractions, and reactor thermal power. The estimated Source Term values were then used as input to an atmospheric plume dispersion model, to determine the radiation dose at various distances after dilution. The HotSpot Health Physics code was employed to estimate the radiation dose, because it is a convenient and efficient tool for the many calculations associated with the numerous radionuclides that would be released during a postulated reactor accident. In addition to the effect of atmospheric dilution of radionuclides, the thesis also examined how the size of the exclusion zone is influenced by technical regulations and standards, reactor design and safety features, and by the presence of engineered barriers. Further, this thesis presents a survey of SMR designs currently in development and a review of their unique safety features.

This vital reference is the only one-stop resource on how to assess, prevent, and manage severe nuclear accidents in the light water reactors (LWRs) that pose the most risk to the public. LWRs are the predominant nuclear reactor in use around the world today, and they will continue to be the most frequently utilized in the near future.

Therefore, accurate determination of the safety issues associated with such reactors is central to a consideration of the risks and benefits of nuclear power. This book emphasizes the prevention and management of severe accidents to teach nuclear professionals how to mitigate potential risks to the public to the maximum extent possible.

Organizes and presents all the latest thought on LWR nuclear safety in one consolidated volume, provided by the top experts in the field, ensuring high-quality, credible and easily accessible information Explains how developments in the field of LWR severe accidents have provided more accurate determinations of risk, thereby shedding new light on the debates surrounding nuclear power safety, particularly in light of the recent tragedy in Japan Concentrates on prevention and management of accidents, developing methodologies to estimate the consequences and associated risks

Corium Retention Technologies and Insights

Ontario Hydro Submission to the Ontario Nuclear Safety Review

Severe Accidents in Nuclear Power Plants

Fuel Coolant Interactions Under Forced Mixing Conditions

General Considerations

Pressurized Heavy Water Reactors

Pressurized Heavy Water Reactors: CANDU, the seventh volume in the JSME Series on Thermal and Nuclear Power Generation series, provides a comprehensive and complete review of a single type of reactor in a very accessible and practical way. The book presents the full lifecycle, from design and manufacturing to operation and maintenance, also covering fitness-for-service and long-term operation. It does not relate to any specific vendor-based technology, but rather provides a broad overview of the latest technologies from a variety of active locations which will be of great value to countries invested in developing their own nuclear programs. Including contemporary capabilities and challenges of nuclear technology, the book offers practical solutions to common problems faced, along with the safe and approved processes to reach suitable solutions. Professionals involved in nuclear power plant lifecycle assessment and researchers interested in the development and improvement of nuclear energy technologies will gain a deep understanding of PHWR nuclear reactor physics, chemistry and thermal-hydraulic properties. Provides a complete reference dedicated to the latest research on Pressurized Heavy Water Reactors and their economic and environmental benefits Goes beyond CANDU reactors to analyze the popular German and Indian designs, as well as plant design in Korea, Romania, China and Argentina Spans all phases of the nuclear power plant lifecycle, from design, manufacturing, operation, maintenance and long-term operation

In a postulated severe accident scenario, a fuel channel in the core of a CANDU reactor becomes blocked and the fuel melts. The molten fuel may be ejected into the surrounding moderator. This report examines the existing literature relevant to the possibility of a fuel coolant interaction under these circumstances. Four experimental studies are identified and discussed in which the initial ejection of molten fuel into coolant approximates the postulated accident scenario. Currently available codes for predicting fuel coolant interaction are also reviewed. Finally, an experimental program is proposed to supplement the existing data base and resolve the probability of a fuel coolant interaction under forced mixing conditions.

Pressurized Heavy Water Reactors: Atucha-II, the eighth volume in the JSME Series on Thermal and Nuclear Power Generation, provides a comprehensive and complete review of a single type of reactor in a very accessible and practical way. The book presents a close analysis of the Atucha reactor, covering reactor physics, aging management of major components, and the role of codes in PHWR and Nuclear Regulation and Licensing. Including contemporary capabilities and challenges of nuclear technology, the book offers solutions and advice on common problems faced, guiding the reader through safe and approved processes that will help them reach suitable solutions. Professionals involved in lifecycle assessments and researchers interested in the development and improvement of nuclear energy technologies will gain a deep understanding of PHWR nuclear reactor physics, design and licensing. A comprehensive reference on the latest research on Atucha Pressurized Heavy Water Reactors and their impact on sustainability goals Analyzes The Atucha-2 BEPU and LBLOCA Considers the licensing of Atucha-2, its physics and aging management of major components

Environmental Impact Statement

Dynamics and Control of Nuclear Reactors

Thermal and Hydraulic Behavior of CANDU Cores Under Severe Accident Conditions

Energy Research Abstracts

Severe Accidents in Nuclear Reactors

Arrangement Between the United States of America and the Republic of Korea, Signed at Rockville June 5, 1995 with Addenda

Accident Analysis for Nuclear Power Plants with Pressurized Heavy Water ReactorsIAEA

Fundamental of Nuclear Engineering is derived from over 25 years of teaching undergraduate and graduate courses on nuclear engineering. The material has been extensively class tested and provides the most comprehensive textbook and reference on the fundamentals of nuclear engineering. It includes a broad range of important areas in the nuclear engineering field; nuclear and atomic theory; nuclear reactor physics, design, control/dynamics, safety and thermal-hydraulics; nuclear fuel engineering; and health physics/radiation protection. It also includes the latest information that is missing in traditional texts, such as space radiation. The aim of the book is to provide a source for upper level undergraduate and graduate students studying nuclear engineering.

The construction of nuclear power plants in the United States is stopping, as regulators, reactor manufacturers, and operators sort out a host of technical and institutional problems. This volume summarizes the status of nuclear power, analyzes the obstacles to resumption of construction of nuclear plants, and describes and evaluates the technological alternatives for safer, more economical reactors. Topics covered include Institutional issues--including regulatory practices at the federal and state levels, the growing trends toward greater competition in the generation of electricity, and nuclear and nonnuclear generation options. Critical evaluation of advanced reactors--covering attributes such as cost, construction time, safety, development status, and fuel cycles. Finally, three alternative federal research and development programs are presented.

Atucha II

Safety Aspects of Nuclear Power Plants in Human Induced External Events

Final Report, Volume 1 : Analytical Methods and Results

Nuclear Safety in Light Water Reactors

Advanced Computational Methods in Mechanical and Materials Engineering

Nuclear Safety

This vital reference is the only one-stop resource on how to assess, prevent, and manage severe nuclear accidents in the light water reactors (LWRs) that pose the most risk to the public. LWRs are the predominant nuclear reactor in use around the world today, and they will continue to be the most frequently utilized in the near future. Therefore, accurate determination of

the safety issues associated with such reactors is central to a consideration of the risks and benefits of nuclear power. This book emphasizes the prevention and management of severe accidents, in order to teach nuclear professionals how to mitigate potential risks to the public to the maximum extent possible. Engineers, researchers, students and the personnel of vendors, safety authorities and nuclear power generation organizations require the knowledge offered by this volume's globally renowned experts to ensure they obtain a core competency in nuclear safety. Organizes and presents all the latest thought on LWR nuclear safety in one consolidated volume, provided by the top experts in the field, ensuring high-quality, credible and easily accessible information Explains how developments in the field of LWR severe accidents have provided more accurate determinations of risk, thereby shedding new light on the debates surrounding nuclear power safety, particularly in light of the recent tragedy in Japan Concentrates on prevention and management of accidents, developing methodologies to estimate the consequences and associated risks

This report gives the results of a study of the thermo-hydraulic aspects of severe accident sequences in CANDU reactors. The accident sequences considered are the loss of the moderator cooling system and the loss of the moderator heat sink, each following a large loss-of-coolant accident accompanied by loss of emergency coolant injection. Factors considered include expulsion and boil-off of the moderator, uncover, overheating and disintegration of the fuel channels, quenching of channel debris, re-heating of channel debris following complete moderator expulsion, formation and possible boiling of a molten pool of core debris and the effectiveness of the cooling of the calandria wall by the shield tank water during the accident sequences. The effects of these accident sequences on the reactor containment are also considered.

In the Fukushima Daiichi accident, the instrumentation provided for accident monitoring proved to be ineffective for a combination of reasons. The accident has highlighted the need to re-examine criteria for accident monitoring instrumentation. This publication covers all relevant aspects of accident monitoring in NPPs. The critical issues discussed reflect the lessons learned from the Fukushima Daiichi accident, involve accident management and accident monitoring strategies for nuclear power plants, selection of plant parameters for monitoring plant status, establishment of performance, design, qualification, display, and quality assurance criteria for designated accident monitoring instrumentation, and design and implementation considerations. Technology needs and techniques for accident monitoring instrumentation are also addressed.

Fifth International Conference on Simulation Methods in Nuclear Engineering, September 8-11, 1996, Montreal, Canada

Monthly Catalogue, United States Public Documents

Safety Guide

Monthly Catalog of United States Government Publications

Fundamentals of Nuclear Engineering

The Atomic Energy Control Board is the agency of the Government of Canada which controls the development, application, and use of atomic energy, and participates on behalf of Canada in international measures of control. Immediately after the serious accident at the Chernobyl nuclear reactor complex in the Ukrainian Soviet Socialist Republic, the AECB attempted to obtain as much information as was available and to review the implications of the accident. A post-accident review meeting of nuclear power and radiation protection specialists was convened by the International Atomic Energy Agency in Vienna in August 1986. On the basis of the information presented at that meeting, the AECB carried out a study of the design of the Chernobyl reactor, the events which led to the accident, and its consequences. The causes of the accident were examined to ascertain whether they revealed any shortcomings in the safety of CANDU reactor sequence. A list of errors and violations of procedures at Chernobyl is included.

Proceedings of a symposium jointly organized with OECD/NEA, Sorrento, Italy, 21-25 March 1988. The contents of the proceedings represent a wide spectrum of topics and should provide an understanding of the issue of beyond the design basis accidents, quite frequently called 'severe accidents'. The papers give an overview of different national approaches, with the overall emphasis on preventive, mitigative and accident management measures. The most important outcome of the symposium was a clear awareness of accident management questions which were among the most controversial issues discussed.

The present report is a revision of Safety Series No. 75-INSAG-3 (1988), updating the statements made on the objectives and principles of safe design and operation for electricity generating nuclear power plants. It includes the improvements made in the safety of operating nuclear power plants and identifies the principles underlying the best current safety policies to be applied in future plants. It presents INSAG's understanding of the principles underlying the best current safety policies and practices of the nuclear power industry.

The Accident at Chernobyl and Its Implications for the Safety of CANDU Reactors

Nuclear Power

Advances of Computational Fluid Dynamics in Nuclear Reactor Design and Safety Assessment

Safety in Nuclear Power Systems

Atomic Energy, Safety

Treaties and Other International Acts Series

This publication reports on the results of an IAEA cooperated research project (CRP) on benchmarking severe accident computer codes for heavy water reactor applications. The CRP scope included the identification and selection of a severe accident sequence, selection of appropriate geometrical and boundary conditions, conduct of benchmark analyses, comparison of the results of all code outputs, evaluation of the capabilities of computer codes to predict important severe accident phenomena, and the proposal of necessary code improvements and/or new experiments to reduce uncertainties. The summary report provides a comparison of key results obtained from five participating countries and concludes with lessons learned and recommendations for the future.

Advances of Computational Fluid Dynamics in Nuclear Reactor Design and Safety Assessment presents the latest computational fluid dynamic technologies. It includes an evaluation of safety systems for reactors using CFD and their design, the modeling of Severe Accident Phenomena Using CFD, Model Development for Two-phase Flows, and Applications for Sodium and Molten Salt Reactor Designs. Editors Joshi and Nayak have an invaluable wealth of experience that enables them to comment on the development of CFD models, the technologies currently in practice, and the future of CFD in nuclear reactors. Readers will find a thematic discussion on each aspect of CFD applications for the design and safety assessment of Gen II to Gen IV reactor concepts that will help them develop cost reduction strategies for nuclear power plants. Presents a thematic and comprehensive discussion on each aspect of CFD applications for the design and safety assessment of nuclear reactors Provides an historical review of the development of CFD models, discusses state-of-the-art concepts, and takes an applied and analytic look toward the future Includes CFD tools and simulations to advise and guide the reader through enhancing cost effectiveness, safety and performance optimization

Surplus Plutonium Disposition (DOE/EIS-0283) for Siting, Construction and Operation of Three Facilities for Plutonium Disposition

A Report

Accident Monitoring Systems for Nuclear Power Plants

Paris, France, 18-20 February 2002

Workshop on Advanced Nuclear Reactor Safety Issues and Research Needs

Technical and Institutional Options for the Future