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A Selection of Records From the
International Nuclear Information System
Applicable to the:

International Conference on Small Modular Reactors and their Applications

21 – 25 October 2024, Vienna, Austria

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Resources

1 Lessons Learned in Regulating Small Modular Reactors Challenges, Resolutions and Insights

International Atomic Energy Agency (2022)

Abstract

There is considerable interest in Member States in the design and deployment of Small Modular Reactors (SMRs). However, there is limited information available about international regulatory experience in this field. This publication identifies key regulatory challenges and lessons learned that have emerged in regulatory reviews and decision making related to SMRs in Member States and provides considerations on future actions. It is expected that this publication will help enhance the effectiveness of regulating SMRs deployed in the short and medium term.

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2 Small Modular Reactors: Challenges and Opportunities

Vaya Soler, Antonio, Berthelemy, Michel, Verma, Aditi, Bilbao y Leon, Sama, Kwong, Gloria, Sozoniuk, Vladislav, White, Andrew, Rouyer, Veronique, Sexton Nick, Kimberly, & Vasquez-Maignan, Ximena (2021). Small Modular Reactors: Challenges and Opportunities (NEA--7560).
Nuclear Energy Agency of the OECD (NEA)

Abstract

Small Modular Reactors (SMRs) are gaining recognition among policymakers and industry players as a promising nuclear technology. SMRs can be defined as nuclear reactors with a power output between 10 MWe and 300 MWe that incorporate by design higher modularization, standardisation and factory-based construction levels enabling more predictable delivery models based on the economies of series. Today, more than 50 concepts are under development covering a wide range of technology approaches and maturity levels. The value proposition of the SMR technology also includes potential financing and system integration benefits. These attractive features, however, rely on a business case that requires the development of a global SMR market to become economically viable. Large-scale deployment of SMRs faces several technical, economic, regulatory and supply chain challenges and will need considerable governmental efforts and efficient international collaborative frameworks to be realised in the next decade.

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3 Codes and Standards, Design Engineering, Testing and Manufacturing of Components of Small Modular Reactors

Subki, Hadid, & Batra, Chirayu (2021). 15th GIF-IAEA Interface Meeting Presentations, (p. v).
International Atomic Energy Agency (IAEA)

Abstract

Codes & Standards - Applicability to SMRs: Key Advantage #Number Sign#1: Enabling Design Simplification: • Minimized number of systems and components without compromising safety; • Simplification to improve economics, maintainability and availability of components without compromising safety. Key Advantage #Number Sign#2: Confirm a robust supply chain: • Assure 'diverse' supply for replacement by manufacturers other than the original manufacturers; • Improve the assurance of sustainable operation of the nuclear power plant. Findings on Standardization: • Standardization alone will not solve all issues in advanced reactor product development; • Excellence in applying advanced manufacturing and NDE techniques are often proprietary; not readily shareable or standardized because it would benefit competitors; • The biggest challenge to quality product is to having the capability of designing, manufacturing and delivering, within time and budget, products that meet the requirements.

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4 Benefits and Challenges of Small Modular Fast Reactors. Proceedings of a Technical Meeting

International Atomic Energy Agency (2021)

Abstract

The IAEA usually defines small and medium sized or modular reactors (SMRs) as reactors producing up to 300 MW(e) (small sized or small modular) and reactors producing 300–700 MW(e) (medium sized). There has been increasing interest in SMRs globally owing to their various benefits, such as flexible power generation options, the wide range of applications, enhanced safety resulting from inherent passive safety features, reduced upfront capital investment, and possibilities for cogeneration and non-electrical applications. At the same time, SMRs face various technical and economic challenges to their development and wide-scale deployment. To understand the current status of the research and development in this area and to provide a forum to exchange information on related topics, the IAEA organized the Technical Meeting on Benefits and Challenges of Fast Reactors of the SMR Type in September 2019. The meeting brought together designers and researchers to discuss possible benefits of these reactors and the associated innovative systems that will help in their safe, secure, economical and early deployment, and to identify challenges that might impede the development of fast SMRs and find possible solutions to address the related issues. A total of 23 peer reviewed papers were presented during the technical meeting, which was divided into four main technical sessions: (i) sodium cooled fast SMRs, (ii) heavy liquid metal cooled fast SMRs, (iii) safety aspects of fast SMRs and (iv) technology and research in support of SMR development. Three group discussions — on (i) in-factory construction, (ii) technological challenges to be resolved and (iii) benefits of fast SMRs including market needs — provided a comprehensive understanding of the most relevant topics in this area. All papers were peer reviewed by an international advisory group prior to the event. This publication presents the proceedings of the technical meeting and summaries of the technical and group discussion sessions, conclusions and recommendations discussed at the meeting, as well as the papers presented at the event.

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5 Decarbonizing Industries with the Help of Small and Micro Nuclear Reactors

Midgley, Emma (2023). IAEA Bulletin (Online), 64(3), 12-13

Abstract

From cement and shipping to oil and gas and steel production, industries are examining and shifting practices to reduce emissions and transition their operations to net zero. New nuclear energy solutions are emerging as a key option. Upstream operations, such as extracting gas and oil through drilling, pumping and fracking, require massive amounts of energy, currently generated from fossil fuels. Downstream operations, such as refining and processing these materials for use as fuel, or for use in products such as pharmaceuticals or fertilizers, also require heat and electricity that are largely generated from fossil fuels. Many oil and gas, drilling, and extraction operations take place in remote locations, and in many cases, it is not possible for these processes to be fuelled by electricity from the grid. It is here that microreactors (MRs) or small modular reactors (SMRs) could provide a low carbon alternative.

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6 Preliminary Spent Fuel Waste Evaluation and Management for Small Modular Reactors

Xu, S.G., Merlo-Sosa, L., Bromley, B.P., & Piler, K. (2022). Fourth international conference on generation IV and small reactors (G4SR-4), (p. v). Canada: Canadian Nuclear Society

Abstract

Three Small Modular Reactor (SMR) concepts, micro-scale High Temperature Gas Cooled Reactor (mHTGR), small modular Chloride Salt-based Molten Salt Reactor (CMSR), and the small modular Fluoride Salt-based Molten Salt Reactor (FMSR), are designed to employ different moderators, coolants and fuels than CANDU® reactors. The use of graphite moderator, novel reactor coolant, and different uranium ceramic or salt fuel will make SMR fuel-waste management requirements different from CANDU® reactor spent fuel. This paper provides estimates of potential SMR spent fuel waste and a review of technologies for conditioning the waste to facilitate disposal with CANDU® fuel waste. Estimated SMR spent fuel waste is similar in the quantities of uranium, plutonium, minor actinides, and fission products for equivalent energy generation and similar enrichment, but differs in volume and chemical composition. Large volumes of graphite, fluorides, and chlorides will be found in the HTGR and MSR fuel waste, respectively. Separation of uranium compounds from graphite and salt matrix is necessary to reduce the waste volume and facilitate waste disposal.

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7 Coal-Fired Power Plants Repowering with Small Modular Reactors: Small Modular Reactors

Tsibrova, E., & Naydenov, I. (2023). Energy Forum'2023, Bulgaria

Abstract

The current paper examines the main features of small modular reactors in the context of coal-fired power plants repowering. NuScale and Xe-100 systems are thoroughly presented. The licensing procedure in Bulgaria is also shown.

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Technical Meeting on Codes and Standards, Design Engineering and Manufacturing of Components for Small Modular Reactors. Presentations

International Atomic Energy Agency (2022)

Abstract

The Technical Working Group (TWG) on SMR, established in 2018, focuses on technology development, design, deployment, and economics of SMRs that can be deployed in both expanding and embarking countries. The members of TWG-SMR provide advice and recommendations for the IAEA's activities on SMRs, among others in the areas of: • Codes and design standardization of structures, systems, and components; • Industrialization of SMRs, covering design, engineering, manufacturing, and supply chain; and • Capacity building for embarking and expanding nuclear countries. With relevance to these topics, the TWG-SMR discussed and highlighted key issues in this area. It was recognized that the Codes and Standards (C&S) could be country specific and dependent on the SMR design under consideration. Several Member States are working on and show interest in advanced SMR technology that involves high temperature materials; these issues should also be covered in C&S. Periodic surveillance such as weld examinations, steam generator tube inspections, structure integrity, etc, as was well as in-service inspections are essential to ensure nuclear facilities safety, resource optimization, as well as operation and maintenance. The requirements for commissioning, testing, inservice inspection and surveillance for SMRs may be different.