

Safety of Nuclear Installations

Objective

To support Member States in improving the safety of nuclear installations during site evaluation, design, construction and operation through the availability and application of up-to-date safety standards. To support Member States in establishing and enhancing their national safety infrastructure through the conduct of safety review services and facilitation of adherence to, and implementation of, the CNS and the Code of Conduct on the Safety of Research Reactors. To support Member States in capacity building through human resource development, education and training, and knowledge management and knowledge networks by means of international cooperation, including exchange of information and operating experience, and coordination of research and development activities.

Regulatory Infrastructure for Safety

The Agency held four workshops on Self-Assessment of Regulatory Infrastructure for Safety, in India in February, in Poland in March, in the Czech Republic in May and in Egypt in October 2022.

The Agency signed Practical Arrangements that formalize cooperation in the area of education and training in radiation protection and safety with the Malaysian Nuclear Agency and the National Nuclear Energy Commission of Brazil in September 2022.

Convention on Nuclear Safety

The Agency continued preparations for the Joint Eighth and Ninth Review Meeting of the Contracting Parties to the Convention on Nuclear Safety to be held in 2023. The Convention on Nuclear Safety Working Group met twice, in July and November 2022, to discuss proposals with a focus on contingency planning and business continuity, and other proposals aiming to improve the peer review process. An Officers' Meeting was held in July 2022 to discuss and agree, inter alia, on the updated templates for the Joint Eighth and Ninth Review Meeting.

Nuclear Harmonization and Standardization Initiative

The regulatory track of the Nuclear Harmonization and Standardization Initiative (NHSI) aims to set up a flexible framework for collaboration that will help to harmonize the outcome of regulatory design reviews, enabling reactors of similar design to be built in different countries despite differences in their regulatory frameworks. The NHSI regulatory track consists of three complementary working groups:

Working Group 1 aims to develop pragmatic solutions for regulators to share the information they need to work together or learn from each other during design reviews. These solutions need to ensure that any information that is subject to special controls can be shared to meet the necessary requirements in all involved countries. Working Group 2 is looking at developing a joint international

review process that could be performed before the national licensing process is initiated, so as to enable any obstacles that would be a barrier to future licensing to be identified at an early stage. The advantage of such a joint international review process is that it would allow countries to use the outcomes of such reviews even if they were not involved in the review themselves. Finally, Working Group 3 is developing a process for regulators in one country to leverage regulatory reviews conducted in another country, as well as a process for regulators to work together in parallel while they undertake their national design reviews. This working group is also gathering lessons from current bilateral and multilateral collaboration during design reviews.

The results of the work of the three working groups and the processes developed will be presented in a number of publications that are under development.

IAEA SMR safety working group

In order to coordinate the Agency's work in this area, the Agency has established a working group on safety of small and medium sized or modular reactors (SMRs). The purpose of the working group is to foster communication and ensure harmonization of the Agency's work on and developments in SMR safety, and to coordinate joint initiatives in support of Member States. The working group is focusing on communicating and coordinating Agency activities relating to SMR safety, with intra- and inter-Departmental interfaces taken into consideration; sharing insights from relevant developments at the Small Modular Reactor Regulators' Forum, the International Nuclear Safety Advisory Group and industry forums on safety considerations for SMRs; developing and implementing a work plan for 2021–2026 to enhance the safety of evolutionary and innovative reactors, including SMRs; and maintaining oversight of the application of the Agency safety standards to evolutionary and innovative reactors, including SMRs.

A key deliverable of the working group in 2022 was the publication of Safety Reports Series No. 123 on *Applicability of Safety Standards to Non-Water-Cooled Reactors and Small Modular Reactors* (available on the IAEA Preprint Repository). This Safety Report was developed with input from experts in technology and safety standards from 30 Member States and several international organizations, including representatives of regulatory bodies and the Small Modular Reactor Regulators' Forum. On the basis of the findings in the Safety Report, the working group has developed a programme of work with an oversight mechanism to ensure that safety issues relevant for non-water-cooled reactors and SMRs are properly considered during the review, update and development of safety standards. The programme also anticipates the development of other Agency publications (e.g. Safety Reports or IAEA Technical Documents) to capture lessons learned from the operation of non-water-cooled reactors and SMRs, and from other stages in their life cycle, with regard to how requirements and recommendations from safety standards are implemented.

In particular with regard to practices in areas where knowledge is continuing to evolve, the working group continues to coordinate Agency efforts to provide Member States with a suitable forum and a repository of technology-specific knowledge on SMR safety. In 2022, the working group coordinated the implementation of four webinars on SMR safety. In October 2022, a video was commissioned to better inform interested parties, including the general public, about the Agency's role in assisting Member States to address the challenges that innovative reactors and SMRs may present.

Design Safety and Safety Assessment

A Technical Meeting on Experiences in Using Probabilistic Safety Assessment in the Design of Nuclear Power Plants was held in Vienna in April 2022, to share experiences of the development of probabilistic safety assessment (PSA) models. The PSA models could be instrumental in supporting the use of PSA for justification and optimization of design safety for innovative technologies, including those used for SMRs.

The Agency held a Technical Meeting on the Software Reliability of Digital Instrumentation and Control Systems for Nuclear Power Plant Safety in Vienna in December 2022, to share Member States' experiences, approaches and challenges.

The Agency conducted Technical Safety Reviews of new-build projects and operating plants, helping Member States to enhance the nuclear safety justification in areas potentially in need of improvements in accordance with Agency safety standards: for Koeberg NPP in South Africa in October 2021–May 2022 and for Laguna Verde NPP in Mexico in March–November 2022.

Safety and Protection against External Hazards

The Agency published *Seismic Hazards in Site Evaluation for Nuclear Installations* (IAEA Safety Standards Series No. SSG-9 (Rev. 1)) in January 2022.

A Technical Meeting on the Effects of Climate Change on Meteorological and Hydrological Hazards for Nuclear Installations was held in November 2022. The meeting addressed the main concerns of the nuclear safety community in relation to hazards resulting from climate change and focused on identifying the best available methods for assessing site-specific hazards and on providing input and guidance to the Agency for developing technical documents.

A Technical Meeting on the Optimization of Protection of Advanced Reactors Against External Hazards was held in November–December 2022. The meeting reviewed the application of a risk informed and performance based approach to the optimization of protection for advanced reactors with advanced safety features.

The Agency continued to provide Site and External Events Design reviews, reviewing the site selection process and design safety in relation to external events: at Dukovany and Temelín NPPs (Czech Republic) in May 2022 and at Doicești (Romania), focusing on SMR siting, in August 2022. A large number of capacity-building events on regulatory review of the site-related chapters of the safety analysis report were organized for embarking countries.



OSART mission to Saeul NPP, Republic of Korea, October–November 2022.

Operational Safety of Nuclear Power Plants

Nine meetings were held in 2022 to supplement and improve the database of ageing management practices publicly available on the Agency's International Generic Ageing Lessons Learned website.

Five Operational Safety Review Team (OSART) missions, including follow-up missions, were successfully completed in 2022 in France, the Islamic Republic of Iran, the Republic of Korea and the United Arab Emirates. The revised OSART guidelines for NPPs and nuclear corporate organizations were published in 2022.

The Agency conducted a support mission based on the new Peer Review of Operational Safety Performance Experience methodology in Argentina in December 2022 to enhance Argentina's operational safety performance improvement programme.

The Agency conducted the first Independent Safety Culture Assessment mission, to Brazil in October 2022, and a Safety Culture Continuous Improvement Process service in Poland in November 2022.

Safety of Research Reactors and Fuel Cycle Facilities

In cooperation with the OECD/NEA, the Agency organized a Technical Meeting for the National Coordinators of the Joint IAEA–OECD/NEA Fuel Incident Notification and Analysis System (FINAS) in Paris in September 2022 to exchange information on incidents submitted to the FINAS database.

The Agency held a Technical Meeting on the Safety of Fuel Manufacturing for Advanced Reactors in Vienna in November 2022, where participants discussed safety aspects of manufacturing fuels for advanced reactors, including for small modular reactors.

The Agency published *Safety Assessment for Research Reactors and Preparation of the Safety Analysis Report* (IAEA Safety Standards Series No. SSG-20 (Rev. 1)) in August 2022.

The Agency held a Technical Meeting on the Periodic Safety Review of Nuclear Fuel Cycle Facilities in Vienna in June 2022 to discuss and exchange national experience regarding the periodic safety review of nuclear fuel cycle facilities.



Launch of Notification System to Protect Nuclear Installations from Natural Disasters

From earthquakes to floods and volcanic eruptions, natural disasters can occur very suddenly and can pose a serious challenge to the safety of nuclear installations and facilities. To be sufficiently prepared for such events, in 2022 the Agency launched the External Events Notification System (EENS) – a digital tool to help predict the severity of natural hazards and assess their effects on the safe operation and maintenance of nuclear facilities.

The EENS provides real-time information on disasters – including earthquakes, volcanic eruptions, wildfires, tsunamis, hurricanes and floods – that have taken place or are predicted to happen. Designed to provide initial assessments of the severity of external events on nuclear facilities, which the Agency’s Incident and Emergency Centre (IEC) uses to take action as needed, the system collects data on the location and scale of the hazardous event, effectively assessing the potential impact on nuclear installations and major population centres. It then sends the data to the IEC and the Agency’s External Events Safety Section (EESS) within 30 minutes, enabling an appropriate and timely response.

The EENS was developed in cooperation with the Pacific Disaster Center (University of Hawai i) and internet application developer Tenefit. It involved adapting the Center’s DisasterAWARE platform specifically to the Agency’s goals of ensuring the safety of all nuclear installations where radioactive material may be affected by the hazard. Its creation aims to help countries prevent, mitigate and manage the risks of extreme weather events, which are increasing in many regions of the globe as climate change accelerates.

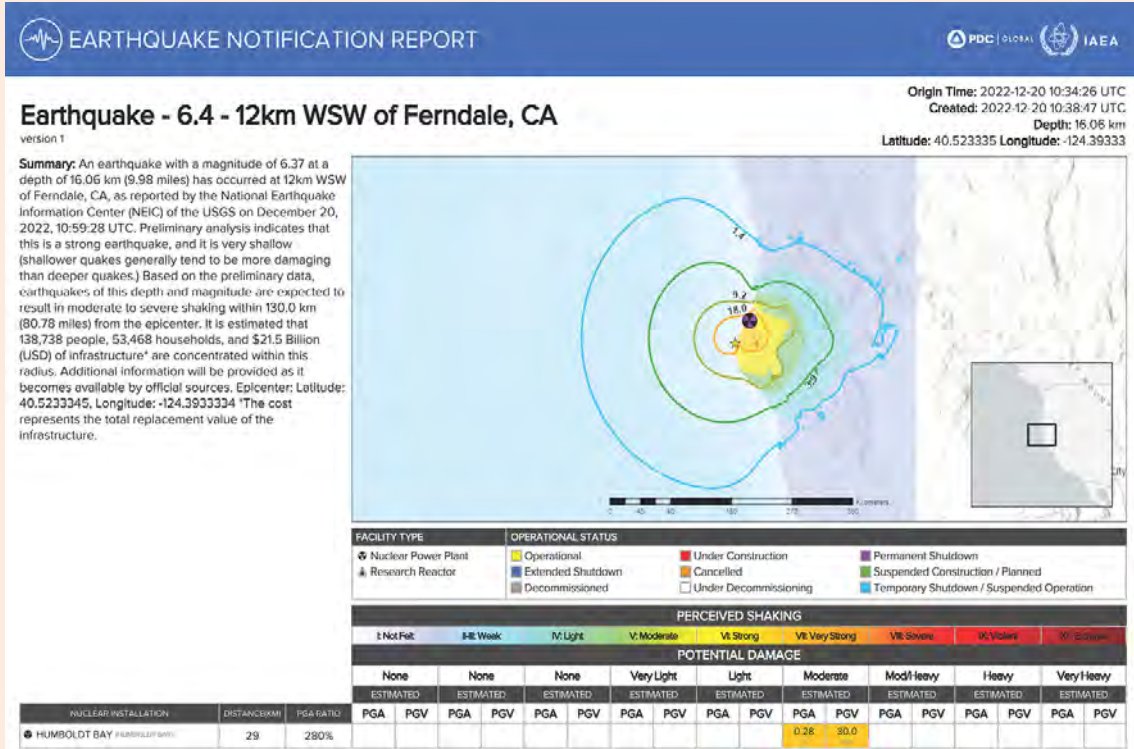
“This tool helps us to promptly identify natural hazards that can affect nuclear or radiation safety in order to exchange information and to coordinate international assistance between Member States,” said IEC Response System Officer Günther Winkler.

The EENS consists of two components: the Alert System and the External Event Damage Forecast. The Alert System monitors the situation around a nuclear facility in real time and warns the Agency of any hazard that could affect it. The External Event Damage Forecast receives information from the Alert System and creates an initial estimate of potential damage to the nuclear facility and its impact on populated areas. This estimate contains basic information about the event, including its magnitude, time, location and anticipated impacts.

In the event of a hurricane, for example, it would include basic information on the hurricane with maps, expected storm surge at coastal sites, possible arrival time and estimated wind speed at nuclear installation sites. “This information is vital for the IEC to be able to swiftly offer its assistance to support an affected country,” said Paolo Contri, Head of the Agency’s EESS.

The system has been in operation since August 2022, providing real-time monitoring of all external events affecting nuclear installations worldwide and helping to alert the IEC with a view to the potential provision of its services in the event of major damage. An analysis of lessons learned, on the basis of all available information, is already in progress.

The system was appreciated by many stakeholders at a dedicated side event during the 66th regular session of the General Conference in Vienna and at the EESS annual donors’ meeting held in October 2022, where the main funding organizations – Électricité de France (France), the Nuclear Regulation Authority (Japan) and the Department of State (United States of America) – welcomed the new tool and funded additional extensions to cover other types of events. In particular, Member States welcomed the systematic approach to analysing lessons learned with regard to near misses made possible by the EENS. The analysis of near misses, as opposed to analysing only accidents, represents a much more proactive mindset towards developing a generic approach to the assessment of plants’ ability to withstand rare and unanticipated events of all types.



EENS earthquake notification report for an earthquake that occurred off the west coast of the United States of America.