
The IAEA activities and international projects on the safety of radioactive waste disposal

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Abstract:

The IAEA safety standards have been developed in order to serve as the global reference for protecting people and the environment from harmful effects of ionizing radiation. The IAEA safety standards provide a robust framework of fundamental principles, requirements and guidance to ensure safety.

In the field of disposal of radioactive waste, one specific Safety Requirement has been published, and several safety guides have been developed and published as a supporting document of the Safety Requirement. Those sets of Safety Standards have been maintained and updated periodically with the strong involvement of the Member States.

In addition, several international harmonization projects have been organized in order to promote the global acceptance and the harmonized use and application of those Safety Standards.

In this paper, the up-to-date information on IAEA's international projects is summarized on the safety of radioactive waste disposal as well as the overview of IAEA Safety Standards.

1 IAEA SAFETY STANDARDS IN RELATION TO THE SAFE DISPOSAL OF RADIOACTIVE WASTE

By Statute the IAEA is authorized to establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety for protection of health and minimization of danger to life and property and to provide for the application of these safety standards. While regulating safety is a national responsibility, international standards and harmonized approaches to safety promote consistency, help to provide assurance that nuclear and radiation related technologies are used safely, and facilitate international technical cooperation. The standards also provide support for States in meeting their international obligations.

The IAEA Safety Standards reflect an international consensus on what constitutes a high level of safety for protecting people and the environment from harmful effects of ionizing radiation. The process of developing, reviewing and establishing the IAEA standards involves the IAEA secretariat and all Member States, many of which are represented on the four IAEA safety standards committees and the IAEA Commission of Safety Standards.

Figure 1 show the long term set of Safety Standards that has been developed since 2008.

In the field of the safe disposal of radioactive waste, the overarching Specific Safety Requirements SSR-5 on Disposal of Radioactive Waste, published in 2011 (2) sets out the safety objective and criteria for protection of people and the environment against radiation risks arising from disposal facilities in operation and after closure. SSR-5 establishes 26 requirements related to the disposal of all types of radioactive waste in particular regarding the planning for the disposal of radioactive waste, the development operation and closure of a disposal facility, the assurance of safety and existing disposal facilities.

A series of general and specific Safety Guides provide comprehensive guidance on, and international best practices for, meeting the requirements. Figure 2 gives an overview of the safety standards published or in development in the field of disposal of radioactive waste. The collection of safety guides supporting the safety requirements are divided into facility specific guides (geological, near surface and borehole disposal) and safety guides applicable to all activities and facilities (classification, safety case, management systems, monitoring and surveillance).

In the following section, a brief description of some of the safety guides related to disposal of radioactive waste is given.

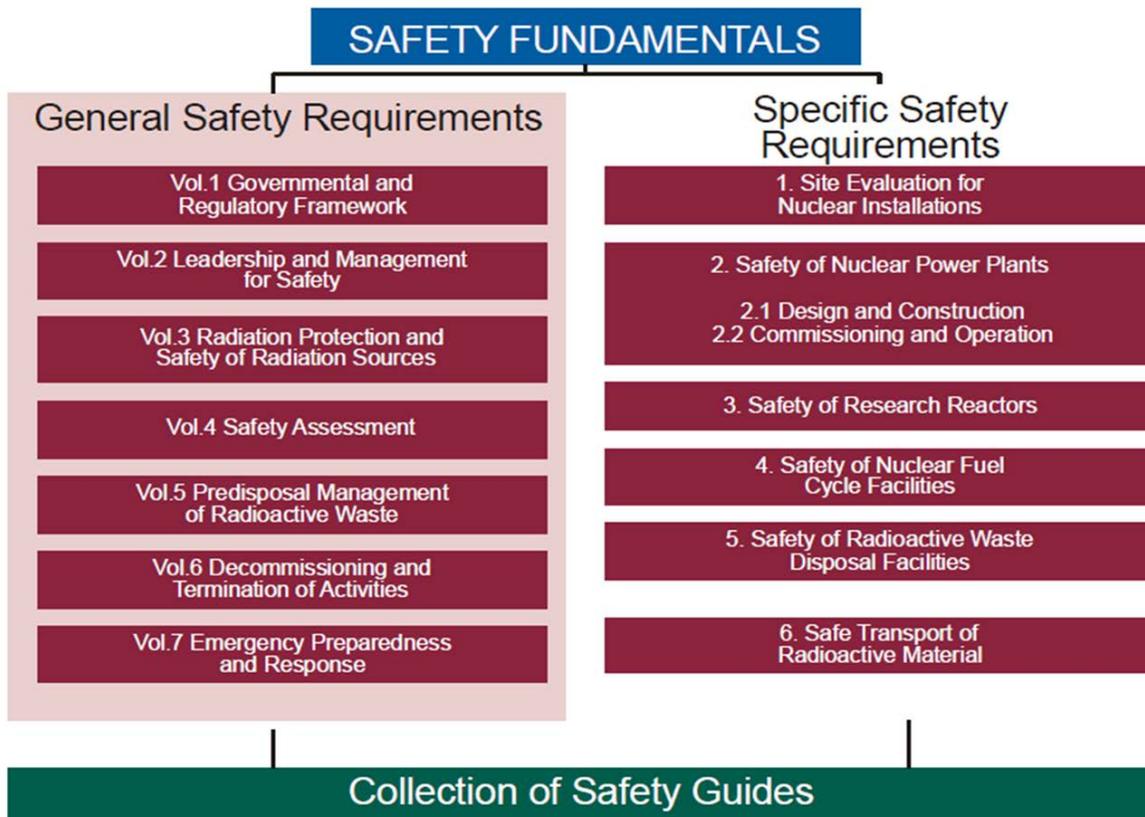


Figure 1: Long term Structure of the IAEA Safety Standards

1.1 GSG-1: the IAEA Classification of Radioactive Waste

This general safety guide published in 2009 was developed to set out a general scheme for classifying radioactive waste that is based primarily on considerations of long term safety and, by implications, disposal of radioactive waste. The safety guide contributes to assist in the development and implementation of appropriate radioactive waste management strategies and facilitates communication and information exchange within and among States. The safety guide, which provides on the classification of the whole range of radioactive waste, defines 6 main classes of waste and establishes a generic linkage between these classes of waste and disposal options. However, the document indicates that, notwithstanding the generic linkage between classes of waste and disposal options, the suitability of waste for disposal in a particular disposal facility is required to be demonstrated by the safety case and supporting safety assessment.

1.2 SSG-23: The Safety Case and Safety Assessment for the Disposal of Radioactive Waste

The objective of this Safety Guide, published in 2012, is to provide guidance on how to assess, demonstrate and document the safety of all types of radioactive waste disposal facility. The most important considerations when assessing the safety of radioactive waste disposal facilities after closure are identified, and guidance is provided on best practice in undertaking such assessment and presenting the safety case. This guidance is relevant for operating organizations, which bear the responsibility of preparing the safety case, as well as for the regulatory body, which is responsible for developing regulations and regulatory guidance that determine the basis and scope of the safety case. To further support regulatory processes, the Safety Guide also provides guidance on the review by the regulatory body of the safety case.

1.3 Safety guides for the disposal of radioactive waste

Three facility specific safety guides have been published or are in publication for the disposal of radioactive waste: Geological Disposal Facilities for Radioactive Waste (SSG-14), Borehole Disposal Facilities for Radioactive Waste (SSG-1) and Near Surface Disposal Facilities for Radioactive Waste (in publication). With these three facility specific safety guides, guidance is provided for meeting the requirements on disposal of radioactive waste for the potential disposal facilities for all types of radioactive, as indicated in the IAEA classification.



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Figure 2 : Main IAEA safety standards for the safe disposal of radioactive waste

2 APPLICATION OF IAEA SAFETY STANDARDS

In order to facilitate the application of Safety Standards, the IAEA organizes various technical meetings and hosts international projects. International intercomparison and harmonization projects are one of the mechanisms developed by the IAEA for examining the application and use of its safety standards, with a view to ensuring their effectiveness and working towards harmonization of approaches to the safety of radioactive waste management. Currently, 4 international projects are going on. These projects have broad representation from Member States, providing an opportunity to compare national approaches to safety demonstration and licensing with the safety standards — both existing and those under

development. This process provides valuable input to the standards development process while at the same time obtaining feedback on the efficacy of existing standards. These projects also provide an excellent forum for knowledge transfer.

In the following sections, activities on these projects are described.

2.1 International Project on Demonstrating the Safety of Geological Disposal

GEOSAF, the International Project on Demonstrating the Safety of Geological Disposal, was commenced in 2008. GEOSAF has been established to work towards harmonization in approaches to demonstrate the safety of geological disposal with a special emphasis on the expectations from the regulatory authorities engaged in the licensing process with respect to the development of the safety case. GEOSAF provided a forum to exchange ideas and experience in developing and reviewing the safety case. It also aimed at providing a platform for knowledge transfer.

Whilst the project addressed the elements of the safety case necessary for safety demonstration and the work necessary to support the various safety arguments, it also considered the process of reviewing and evaluating the safety case by regulatory authorities or technical safety organizations and the needed resources for conducting this technical review.

During the three-year project, GEOSAF worked towards the development of a questionnaire devoted to review the safety case that would structure a foreseen IAEA review procedure in order to foster harmonization and common understanding of key issues for demonstrating and reviewing the safety of the facility.

In addition, GEOSAF launched a specific programme of work on the safety of the operational phase taking into account that little work was undertaken internationally to develop a common view on the safety approach related to the operational phase of a geological disposal. The outcomes of this pilot study are documented in a companion report (3) attached to the main project report (4). It is expected from the pilot study that it will serve as a basis of a potential further work.

The first phase of the GEOSAF project ended in 2011. On the request of the participants, a follow-up project has recently been initiated. The inaugural meeting of the project took place in IAEA headquarters in March 2012, which defined the scope and work plan for the new 2-year project. The first technical meeting for the follow-up activity (GEOSAF Part II) was held in May 2013.

One of the key issues that the GEOSAF Part II addresses is how to define the interface between the operational and post-closure safety in the process to implement geological disposal facilities. The GEOSAF Part II project will elaborate on a structure and methodology to define an overarching safety case supporting the demonstration of safety of geological disposal, integrating both the operational and post-closure phases.

2.2 Practical Illustration and Use of the Safety Case Concept in the Management of Near-Surface Disposal

PRISM, the International Project on Practical Illustration and Use of the Safety Case Concept in the Management of Near-Surface Disposal, was launched in 2009 as a 3-year project. PRISM is the fourth in the series of near surface disposal projects that the IAEA has organized since the late 1980s. Over this period there has been steady progress with implementation of safe solutions for near surface disposal of radioactive waste. Countries that were engaged in the early years of nuclear power development have made progress in dealing with legacy wastes from that period. Disposal of the increasing volumes of radioactive waste from the decommissioning of the early generation of nuclear power plants is taking place and some facility closures have taken place. The experience base for near surface disposal covers the entire lifecycle of facility development - from planning through to post closure monitoring and surveillance.

The PRISM project is concerned with the nature and use of the safety case over the lifecycle of a near-surface disposal facility. Previous near surface disposal projects such as the NSARS, ISAM and ASAM projects focused mainly on safety assessment methodologies and their application. Compared to these projects, the emphasis has shifted from safety assessment and calculations, to questions of practical implementation. The objective of this project was to share experience and communicate good practice from this perspective, in particular concerning the components and expectations of the safety case and their evolution over the lifecycle of a near-surface radioactive waste disposal facility, and the decision making at different stages in the facility lifecycle, using the safety case. An examination of the safety case and safety assessments for licensing related activities was also the part of the project, as well as of specific implementation steps, such as site characterization and design.

The PRISM project ended in 2012 and the project report is under preparation. The follow-up project is going to be launched this year with the objective of working on the design and preparation of a model safety case using the approach developed during the PRISM project.

2.3 Human Intrusion in the context of Disposal of Radioactive Waste

HIDRA, the International Project on Human Intrusion in the context of Disposal of Radioactive Waste, is one of the most recently launched project on disposal of radioactive waste. This project was launched in 2012 as a 2-year project specially focusing on future human action and human intrusion into disposal facilities. Since this project covers both geological and near-surface disposal systems, due consideration is given to the coordination with the above-mentioned activities related to the safety case (PRISM and GEOSAF).

A safety case for a radioactive waste disposal facility needs to explain how the facility will provide longterm containment and isolation of the waste from the human environment. Safety cases consider a range of different scenarios. In order to demonstrate the safety and robustness of a disposal facility for radioactive waste, it is important to develop a safety case that also considers the possibility that in the future knowledge of the disposal facility location and the hazard it presents is lost and that future human actions may unintentionally impact the facility. However, there is no agreed international position on how to incorporate future human actions into safety assessment, siting and design.

The objectives of the HIDRA project are to:

- Share experience and practical considerations for development and regulatory oversight of assessments of impacts of future human actions, primarily human intrusion, in the context of the safety case during the lifecycle for a disposal facility
- Provide specific information regarding technical, societal and design considerations to support development of a structured process or methodology for developing scenarios for site-specific application
- Describe the role of assessments of future human actions for siting, design and development of waste acceptance criteria in the context of the safety case
- Provide suggestions for communication strategies to describe the rationale for assessments of future human actions and for interpretation of the results of those assessment for the public

It is expected that the project will provide guidance on how to address human actions in the safety case and safety assessment of radioactive waste disposal in the future, and how to use those assessments to optimize siting, design and waste acceptance criteria within the context of a safety case. An important product is expected to be a catalogue of “measures” that can be used to reduce the likelihood and/or consequences associated with human intrusion.

2.4 Activities related to Intermediate Level Waste Disposal

This year, the IAEA launched a new activity on Intermediate Level Waste (ILW) disposal. A first technical meeting was held at the IAEA headquarters in September to exchange information on national projects related to the ILW disposal and to discuss specific safety issues that need to be taken into account in the development of an ILW disposal facility.

The IAEA Safety Glossary (5) and the Safety Guide on the Classification of Radioactive Waste (GSG-1) (6) describe definitions on ILW. However, no specific safety guides has been published on this waste class so far. Indeed it is considered that the existing safety guide on Geological Disposal facilities for Radioactive Waste (SSG-14) (7) is generic enough to also cover the safety issues related to the disposal of intermediate level waste.

However, it is also recognized that a facility designed for the disposal of ILW may differ substantially from a geological disposal facility for HLW/spent fuel in terms of adapting the safety provisions needed to the inherent risks caused by the waste, e.g., the expected performance over time of the engineered barriers, variety of waste characteristics that to be disposed of, and the design provisions aimed at ensuring the facility's safe operation.

In order to fill the gap between the existing safety standards on disposal facilities and specific considerations on the development of ILW disposal facility, the IAEA initiated the activity to develop a new technical document that can be used as supplemental reference for the existing IAEA Safety Standards.

It is expected that this document will be drafted in 1 to 2 years and will be published as an IAEA Safety Report.

2.5 Peer review service to Member States

The IAEA has been providing peer reviews to its Member States for radioactive waste and spent fuel management, decommissioning and remediation of sites contaminated by radioactive materials. The reviews undertaken by the IAEA may be orientated towards national frameworks, regulatory systems and/or aspects of national programmes for the management of radioactive waste, spent fuel, decommissioning and remediation. They may also involve detailed assessment and technical advice on the implementation of specific programmes and project activities, with an emphasis on technology or on safety, or both.

The IAEA is developing a dedicated Peer Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation, whose objective is to provide independent expert opinion and advice on radioactive waste and spent fuel management, decommissioning and remediation issues, based upon the IAEA safety standards and technical guidance, as well as international good practice.

This IAEA Peer Review Service is intended for facility operators and organisations responsible for radioactive waste management, as well as for regulators and national policy and decision makers. Both government and private sector entities can call upon this service, which is also available to international organizations.

3 CONCLUSIONS

The IAEA has an essential role to play in supporting and assisting Member States to meet challenges related to the development and implementation of various activities toward the safe disposal of radioactive waste. The complementary approach of developing Safety Standards and providing for their application, in particular through the organization of international projects and also through the development of specific tools such as peer review services, contributes to facilitate the discussion on gaining international consensus and ultimately on enhancing the safety of radioactive waste management in Member States.

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