

*NEA RWMC Workshop on Developing Safety Cases for Various Radioactive
Waste Disposal Facilities*

- Needs and Challenges of RWMC Organisations

8-10 December 2020

1. Background

At the back-end of the nuclear fuel cycle, radioactive waste management implementers have the full responsibility to ensure the safety of different waste management disposal options or processes. The implementers conduct thorough safety assessments which support decision making and form the core of a safety case in demonstrating safety.

A safety case is a collection of safety evidence and arguments that demonstrate the safety of a management process or facility throughout its lifetime. While the types of data, calculations, and analyses are different for demonstrating safety in various waste management processes, the approach and strategies used to structure safety cases for different back-end processes have aspects in common. For example, the safety objectives for both geological and near-surface disposal are to identify a suitable disposal site, in which to design, construct, operate and close a disposal facility so that protection before and after closure is optimised, with social and economic factors taken into account. Thus, the expertise, approach and strategies required for the development of assessment scenarios, the management of uncertainties and the associated risk evaluations in compiling and presenting safety cases for different disposal facilities share some commonalities.

SKB presented the “KBS-3” concept for a geologic disposal facility for spent nuclear fuel in crystalline rock in the early 1980s. Since then, other waste management organisations have proposed various concepts for different waste types and different geological environments. For example, Belgium and France have developed underground research laboratories (URLs) in clay rock formations. Japan has developed URLs in granite and sedimentary rock formations. Rock salt has been researched as a host rock in Germany and also the US, where the first geological disposal facility, WIPP, became operational in 1999 for the disposal of transuranic waste. Disposal operations temporarily ceased at WIPP in 2014, following a fire and leakages from some waste packages, but were resumed in 2017. WIPP remains the only operational geological facility at the current time, although a facility is being constructed in granite in Finland and good progress is being made for a facility in granite in Sweden and also in clay in France.

Additionally, there are a number of near-surface disposal facilities for low- and intermediate-level waste types operational around the world.

Each of these planned and operational facilities requires assessment of the safety of all aspects of facility construction, operation, closure and post-closure. The IAEA has suggested that safety assessments should be consistent with the graded approach set out in their Fundamental Safety Principles¹.

The concept of a safety case for a deep geological repository for radioactive waste was introduced by the NEA Expert Group on Integrated Performance Assessment (IPAG) and further developed

¹ IAEA 2006: “Fundamental Safety Principles, Safety Fundamentals”, No. SF-1, International Atomic Energy Agency Vienna, Austria, 2006.

in an NEA report on Confidence in the Long-term Safety of Deep Geological Repositories² (1999). The primary objective of the Integration Group for the Safety Case (IGSC), as defined by the Radioactive Waste Management Committee (RWMC) when established in 2000, is to develop the technical and scientific basis to support geological disposal development. The IGSC consists of senior safety experts with in-depth experience in developing deep geological disposal for long-lived radioactive waste. Over the years, the group has achieved significant milestones in developing the modern safety case concept, safety functions, strategies, and key elements in compiling robust safety cases for geological disposal facilities.

Having its effort focused mainly in deep geological disposal in the past decades and noting the importance of managing radioactive waste in a holistic and sustainable manner, the RWMC, in 2016, issued a Vision Statement (NEA/RWMC/2016)³ stating that its future work focus shall go beyond deep geological disposal. In particular, the RWMC is considering further utilising the existing IGSC expertise to gather the essential technical safety information for developing other disposal facilities. Surface and near-surface disposal facilities that are currently operating may be updating their safety case as part of the operating licence; for older facilities, there could be plans for updating the safety case in support of closure of a facility.

This workshop has been planned by the RWMC to better understand how the experience on deep geological disposal in the IGSC and that of other disposal options can be shared in the development, use and communication of a safety case. The RWMC considers the IGSC experience in integrating and presenting safety evidence in a safety case, identifying and assessing the risks associated with credible scenarios, managing uncertainties, identifying improvement and corrective actions to support key decisions to developing safety cases for other disposal facilities (e.g. near-surface or surface disposal) valuable and relevant. Additionally, the RWMC aims to improve its understanding of the use and updating of safety cases during operations by obtaining additional input and information on how safety cases are being used in decision making and communicating with stakeholders at operating near-surface or surface disposal facilities.

2. Objectives

The objectives of this workshop are, therefore:

- To better understand how to build robust safety cases (to enhance confidence) for various disposal options and their similarities and differences;
- To discuss the methodologies and the outcomes that can be shared between deep geological repositories and other types of disposal facilities;
- To review current challenges and identify the activities to be initiated at the NEA to support the development of safety case for various disposal facilities.

3. IGSC work experience and the Safety Case

The IGSC developed the modern safety case concept and promoted the use of safety functions in demonstrating safety. Key elements of a safety case for radioactive waste disposal, as depicted in

² NEA (1999), Confidence in the Long-term Safety of Deep Geological Repositories, NEA No. 1809, NEA, Paris.

³ NEA (2016), NEA Radioactive Waste Management Committee Statement, NEA/RWM(2016)7/REV1.

Figure 1, are briefly described below. More details of safety case development for geological disposal are presented in IGSC publications (NEA 2004⁴, Safety Case Brochure, 2012⁵):

- a. **Context** – the purpose of the safety case and the decisions to be supported.
- b. **A safety strategy** - the adopted approach and management plan for achieving safe disposal. A strategy that guides key decision making in planning, developing, licensing and operating a safe disposal programme.
- c. **Assessment basis** – the collection of scientific, technical information and understanding required in safety assessment including the methods of analysis, computer codes, models and databases.
- d. **Safety assessment** – identification of relevant features, events and processes (FEPs) and scenario development in meeting the defined safety functions, safety calculations, modelling and data analysis, management of uncertainties.
- e. **Statement of confidence** – the adequacy of the presented safety evidence, arguments to justify a positive decision to proceed.

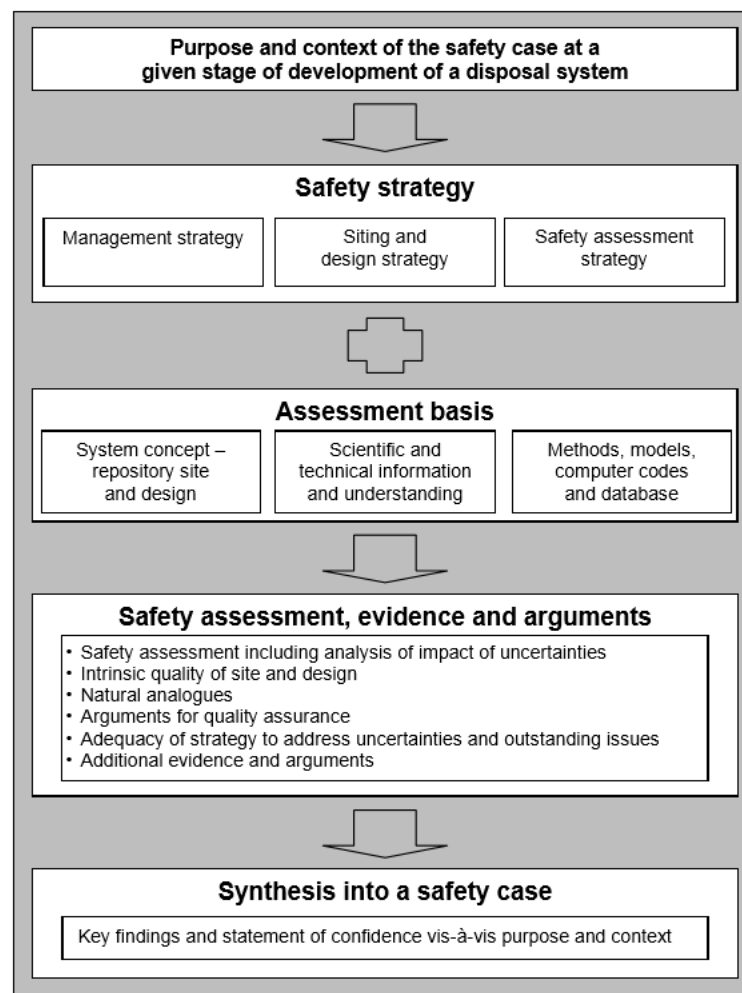


Figure 1. An overview of the relationship between the different elements of a safety case

⁴ NEA (2004), Post-Closure Safety Case for Geological Repositories: Nature and Purpose, NEA No. 3679, NEA, Paris.

⁵ NEA (2013), The Nature and Purpose of the Post-closure Safety Cases for Geological Repositories, NEA/RWM/R(2013)1, NEA, Paris.

The IGSC has conducted many projects and activities over the years and accumulated valuable experience for developing robust safety cases. Among which, their knowledge in the following areas might be useful and transferable to developing safety cases for near-surface or above-ground radioactive waste disposal, including:

- Facility siting
- Facility operational safety including identifying operational hazards
- Development of Waste acceptance criteria (WAC)
- FEP database management and scenario development
- Post-closure safety, disposal system evolution, treatment, and management of uncertainties
- Communications between regulators and implementers pre and during licensing.