

Safety cases for the deep disposal of radioactive waste: where do we stand?

B. Forinash, C. Pescatore, H. Umeki *

The last few years have witnessed a resurgence in the prospects for nuclear power as part of the worldwide energy mix, with decisions on nuclear phase-out being reconsidered and new build being contemplated in several countries. In this rejuvenated environment, however, one of the challenges remains to manage and permanently dispose of the resulting radioactive wastes, especially the most long-lived ones.

The NEA hosted an international symposium on “Safety Cases for the Deep Disposal of Radioactive Waste: Where Do We Stand?” on 23-25 January 2007 in Paris, France. The symposium, organised in cooperation with the European Commission and the International Atomic Energy Agency, provided the opportunity to take stock of recent progress and remaining challenges in evaluating and supporting the safety of long-term disposal of radioactive waste.

The NEA Radioactive Waste Management Committee (RWMC) has for many years provided leadership to assist member countries by focusing on the development of strategies for the safe, sustainable and broadly accepted management of radioactive waste. The Committee has provided important contributions to the now widely accepted position that geological disposal represents an ethical, appropriate and technically feasible solution to the long-term management and disposal of spent fuel and long-lived radioactive waste (NEA, 1995). Central to successfully implementing geological disposal is the ability to evaluate and to illustrate the safety of a disposal system after closure and far into the future in a manner that is clear, scientifically sound and persuasive to decision makers and the public: namely, the safety case. The RWMC Integration Group for the Safety Case (IGSC) is dedicated to supporting the

elaboration and implementation of the safety case for disposal of radioactive waste.

A safety case is the synthesis of evidence, analyses and arguments that is presented by the implementers at specific points in repository development to quantify and substantiate a claim that the repository will be able to meet its intended function, namely to provide for safety after closure and beyond the time of control of the facility (NEA, 2004). A safety case is typically used to support a decision to move to the next stage of repository development, but it could also be prepared to help review the current status of the project, or in view of testing the methodology for performing a safety case. The key function of the safety case is thus to provide a platform for informed discussions whereby interested parties can express and test their own level of confidence in the project at a given stage, as well as identify the issues on which further work is warranted. The safety case – and its supporting arguments and data – evolves during repository development and is debated, updated and reviewed at various stages in the process. This continuing process of review and development is expected to result in increasingly comprehensive and cogent safety cases and in high, shared confidence in the quality of the decision it was meant to support.

Progress in the past decade

Over 15 years ago, the NEA sponsored an international symposium on the topic of “Safety Assessment of Radioactive Waste Disposal Repositories”. The symposium’s conclusions showed that there was wide consensus on the general approach to safety assessment for geological disposal. A variety of well-developed tools and methodologies were also available for undertaking the task of safety assessment including, for example, for scenario development, data collection, model development and probabilistic analysis (NEA, 1989). The outcomes of the symposium provided the basis for the 1991 Collective Opinion that the technical basis and methods existed to evaluate adequately the potential impacts of geological disposal systems, and to provide a basis for decision making on such disposal sites (NEA, 1991).

* Ms. Betsy Forinash (elizabeth.forinash@oecd.org) and Dr. Claudio Pescatore (claudio.pescatore@oecd.org) work in the NEA Radiation Protection and Radioactive Waste Management Division. Dr. Hiroyuki Umeki (umeki.hiroyuki@jaea.go.jp) is the Chair of the IGSC.

Since that time, the concept of the safety case has continued to evolve beyond simple safety assessment and numerical calculations to encompass other arguments and evidence that can support an evaluation of safety. In addition, important advances have been made in terms of a much-expanded pool of scientific and experimental data; improved understanding of processes at various spatial and temporal scales; advancement of modelling techniques; and better appreciation of the importance of openness, communication and stakeholder involvement in developing and presenting safety cases.

The 2007 symposium gave participants the opportunity to review progress and to identify emerging trends and challenges. It brought together experts in the field of radioactive waste disposal from 16 NEA member countries, international organisations and the Russian Federation. Among the participants were representatives from implementing agencies, regulatory agencies, scientific support organisations, international agencies and private sector consultants. Over three days, the symposium programme offered nearly 40 presentations and posters covering topics such as the status of the national programme in France, the host country; the safety case concept and its evolution; practical experience in implementing and communicating safety cases in national programmes; and the role of safety cases in societal dialogue and decision making. Several panel discussions allowed in-depth discussions of key topics.

There is a good, shared understanding of what a safety case is and what comprises its main elements. The symposium supported the observation that safety cases have evolved into tools to both assess safety and aid in decision making. Key aspects of this evolution in the past decade include:

- improved and structured documentation to favour clarity and traceability of the argumentation;
- evidence and arguments that showcase the knowledge basis (and scientific understanding) built up by the project;
- the development of more sophisticated analytical tools and databases;
- the introduction of new conceptual tools such as the concept of the safety function;
- the utilisation of a breadth of performance and safety indicators besides the traditional dose and risk indicators;
- the open discussion, in the safety case itself, of extant issues of concern and the identification of a path forward to their resolution.

Examples of recent, successful uses of safety cases for national decision making include Switzerland and France.

The symposium underscored the contributions and value of international organisations and dialogue in formulating the concept of a safety case and in developing methodologies and scientific information

that support it. The leading role of the NEA in this area was recognised. Additional lessons learnt are:

- Bringing together dedicated experts from multiple disciplines and their integration into stable teams is of paramount importance.
- Technical aspects of the safety case can be discussed and refined with the help of local stakeholders. Notably, if the repository host locality is large enough, there are likely to be citizens who have knowledge to competently review and comment on the technical aspects of the safety case.
- Given that successive safety cases may span several decades (at least), the preservation of data – and the information supporting the quality of data – is a key challenge.
- While there is a good, shared understanding of what a safety case is, the term “safety case” is difficult to translate from English into other languages. Similar difficulties are encountered with other terms such as “confidence” versus “trust”, “safety” versus “security”, “safeguards” or “uncertainty”. There may be benefit in clarifying and defining certain key terms.
- Important initiatives are under way to further improve the conceptual and technical bases of the long-term disposal safety case.

The proceedings of the symposium are expected to be available to the public in summer 2007.

Conclusion

The 2007 symposium was the first one in many years to focus on the specific subject of the safety case for disposal. It served the community of specialists to verify the state of the art in the area, and afforded additional verification that the current, shared understanding of the purpose and contents of a safety case allows for better discussions and exchange of experience. A final lesson learnt, to this effect, is that a higher frequency of symposia is required to reach out to both specialists and non-specialists.

Given the foreseeable, undiminished importance of the disposal safety case for future decision making in national programmes, the NEA and its Integration Group for the Safety Case are well-poised to continue to provide a key service to the international radioactive waste management community for many years to come. ■

References

1. NEA (1989), *Safety Assessment of Radioactive Waste Repositories: Proceedings of the Paris Symposium*, OECD/NEA, Paris.
2. NEA (1991), *Can Long-Term Safety Be Evaluated? An International Collective Opinion*, OECD/NEA, Paris.
3. NEA (1995), *The Environmental and Ethical Basis of Geological Disposal: A Collective Opinion of the NEA Radioactive Waste Management Committee*, OECD/NEA, Paris.
4. NEA (2004), *Post-closure Safety Case for Geological Repositories: Nature and Purpose*, OECD/NEA, Paris.