

## **GEOLOGIC DISPOSAL: KEY OBSERVATIONS AND LESSONS LEARNT. THE NEA PERSPECTIVE**

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### **Introduction**

- The Nuclear Energy Agency (NEA) is a specialised agency of the Organisation for Economic Co-operation and Development (OECD). As part of our mission to our 28 member countries, we help maintain and further develop, through international co-operation, the scientific, technological and legal bases required for a safe, environmentally friendly and economical use of nuclear energy for peaceful purposes. We also provide authoritative assessments, and help forge common understandings, on key issues, in order to inform both our member governments' deliberations on nuclear energy policy and the broader OECD policy analyses in such areas as energy and sustainable development.
- We have been and still are a leading organization in the field of radioactive waste management and, in particular, geologic disposal. Our activities cover both policy, regulatory, technical, and public-involvement aspects of geologic disposal. We have helped the field move forward through joint and pioneering projects such as the Stripa project in the 80s as well through regulatory and policy reflection. We have developed what is today the reference approach to produce a disposal safety case.
- Our first major report dates from 30 years ago, when we issued the so-called "Polvani report" of September 1977 on "Objectives, concepts and strategies for the management of radioactive waste arising from nuclear power programmes". Since then a lot has been learnt. A list of recent NEA documents dealing with radioactive waste management is provided with the documentation for this conference. In the rest of the paper, we offer an overview on the key observations and lessons learnt since our pioneering "Polvani report".

### **Key observations and lessons learnt**

*Why geologic disposal?*

- Whatever the future of nuclear power, it is generally recognized that safe and acceptable disposal solutions for existing and committed-to long-lived and high-activity waste must be pursued. There are no miracle solutions: physical transmutation of some of the waste or advanced fuel cycles will not eliminate the need for disposal. Besides, long-lived and high-activity radioactive wastes are also generated from non-power applications of nuclear materials and isotopes, such as in medicine, industry, and research.
- Mature and safe methods for the management of radioactive waste are currently available and are being implemented. Society, as an extra precaution, has determined that some long-lived wastes, including high-level radioactive waste and spent fuel, should be disposed of such that they are contained and isolated from humans and the accessible environment without the need for continued human intervention.
- International conventions prohibit disposal in the sea bed which, for all practical purposes, restricts disposal to land-accessible locations. Underground disposal is thus being investigated world wide as the ultimate waste management end-point. The concept anticipates that any releases are small both relative to the overall inventory of waste and in absolute terms, and that these proportionately small releases migrate very slowly, resulting, at most, in a negligible incremental impact on public health.
- The level and time frame of protection that is demanded – and can be provided – by a geological disposal system is unprecedented when compared to other practicable options, including those in common use for many non-radioactive but hazardous wastes. The placement of these wastes deep underground, in a robust engineered system matched to a suitable geologic setting, is thus felt to afford appropriate protection for the present and future generations.
- The geologic disposal concept, including its safety and ethical implications, has been debated in national legislatures; in state, provincial and local discussions; by individuals; in peer reviewed literature; in international organizations; and by national scientific bodies. This demonstrates a general consensus on the geologic disposal option, achieved through a broad societal process.
- Delaying work on geologic disposal – i.e. by adopting a wait and see strategy – requires continuing and more and more demanding care, which cannot be guaranteed. A long-term management option

without a definite end-point is thus is not only unacceptable ethically, but it is also potentially unsafe. Against this background, most countries have inscribed geologic disposal in their policy objectives.

*Where do we stand with geologic disposal?*

- Since the Stockholm Conference of December 2003, important milestones in geologic disposal have been reached in a number of OECD countries. Namely, having taken into account important public and stakeholder involvement, geologic disposal is now the recognized reference solution also in Canada, France, and the United Kingdom. In France, a siting region has been identified for all high-activity and long-lived waste; in Canada a deep repository is being constructed for operational waste while a process will be defined for siting a repository for used nuclear fuel. The United Kingdom are now reflecting on how to set up a decision making process that would associate local communities in the identification of a geologic disposal site for radioactive waste.
- In the meanwhile other OECD countries, who had already committed themselves geologic disposal, have reached important milestones as well. In Finland and United States a site and a design have been identified and work is ongoing towards the development of a repository. In Sweden two localities have been short-listed and are now being investigated for the siting of a deep repository. In Switzerland, after the promulgation of the new Atomic Law, a plan has been drafted and is being implemented to search for repository sites. In Germany, a license has been granted to operate the deep repository at Konrad for “non-heat emitting wastes”, which include waste with long lived components. Finally, it is worth remembering that the WIPP deep repository for transuranic waste continues successful operation in the USA.

*Geologic disposal is technically feasible*

- Central to successfully implementing geologic disposal is the ability to demonstrate and communicate the safety and security of the repository system far into the future in a manner that is clear, scientifically sound and persuasive to decision-makers and the public.

- There is now a wide consensus on the general approach for the technical, safety assessment for geologic disposal, and many examples exist of recent successful uses of safety cases for national decision-making. Switzerland (2005) and France (2006) constitute the most recent examples. Exchanging information and working cooperatively under the aegis of international organizations such as the International Atomic Energy Agency of the United Nations and the Nuclear Energy Agency of the Organization for Economic Co-operation and Development have been important factors in this progress.
- OCED/NEA peer reviews have proven to be significant contributors to improving safety cases and to final decisions in moving national programmes to the next stage. The latter has been, for instance, the case in Japan, USA, Switzerland and France. We note with satisfaction that the two peer reviews we ran in the USA were co-organised with the IAEA.
- The deep disposal concept relies on the capabilities of both engineered barriers and the local geology to fulfil specific safety functions either in a complementary or in a redundant fashion. A large and experimental data base regarding sites and materials has been accumulating; there is an improved understanding of processes at various spatial and temporal scales; and significant advances in modelling techniques have been achieved. There also exist several underground research, demonstration and/or development facilities. Overall, it is felt by the experts, as well as by the non-specialist public that has been most exposed to the work, that sufficient evidence exists to suggest that geological disposal is a technically achievable solution.

*Some broader challenges in practical implementation*

- We are now facing the challenge of practical implementation of geologic disposal through further development and licensing. From a regulatory point of view, the ICRP recommendations (especially those on disposal), the IAEA Safety Fundamentals, and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management provide a framework of common objectives to guide this implementation. This international framework provides goals and objectives for achieving an appropriate level of protection including such elements as requiring a suitable regulatory framework, applying a stepwise approach in decision-

making, and protecting future generations without imposing undue burdens.

- Although countries are implementing the international framework and pursuing common safety objectives, every country is at a different juncture in the process and has different needs. Some countries have found it essential to reflect unique repository attributes in the selection of repository performance criteria.
- Regulators, implementers and policy makers have become more aware that confidence by the technical community in the safety of geologic disposal is by itself not enough to gain public confidence and acceptance. There is now agreement that a broadly accepted national strategy is required to provide not only the means to build the facility but also a framework and roadmap to provide both decision makers and the affected publics with the time and means to develop sufficient confidence in the various decisions at hand and, ultimately, in the achieved level of long-term protection. A first step in the strategy is the definition of a national energy policy which addresses the role of nuclear power and in which the waste arisings are recognised. The issuance of a national plan with indications for the final management of all types of radioactive wastes is an important addition and basis for discussion and public acceptance.
- Very importantly, the international framework – as embodied, for instance, in the Aarhus and Espoo conventions – also requires public information and stakeholder involvement, both nationally and across borders. Similar requirements are reflected in national laws, e.g., those concerning transparency in decision making and those requiring environmental impact studies.
- The legitimacy of the process is paramount: national policy and legislating bodies must put it in place and provide means to follow it on. The quality of the process is also paramount: (a) roles must be clear; (b) there should be adherence to both one's own roles and to the rules of the process; (c) all participants in the process must behave and be viewed as trustworthy and accountable.
- There has been important evolution in the expected roles of the various actors over time [see Table 1]. Regulators, for instance, are increasingly viewed – and requested to be – by the public as the “people's expert”. A capital role in the new decision making environment is being played by the host communities. These are increasingly becoming partners in negotiating for locally acceptable solutions problem that minimise negative impacts and provide for

local development, local control, partnership and, ultimately, a durable relationship between the facility and the community.

*A common objective, a variety of paths*

- Culture, politics, and history vary from country to country and provide different contexts for establishing and maintaining public confidence. What works in one country may not be as effective in another. As a result of openness to different perspectives, there must be openness to nations reflecting individual cultural and societal values in their processes and regulatory criteria, which may result in similarities as well as differences among nations. For instance, what was expected to be a common regulatory approach and common safety criteria and time frame is now a more complex reflection of national and pan-national interests, local and regional cultural views and societal values. Differences in regulation and implementation may not only be appropriate but may even be critical for public confidence and acceptance.
- Cultural, societal, and geographical similarities and differences have resulted in a variety of paths, but common safety and security objectives underlie these paths in national disposal solutions. We need a continued, shared understanding of how this progress is being achieved and how we might achieve the same objectives in our own country but perhaps on a different path. International fora are important to identify similarities and differences and to identify overarching themes and lessons to be learnt.

**Conclusions**

- At one time disposal was viewed as if it were a relatively short-lived activity to be completed in the time span of perhaps a single generation – the goal being to provide a facility that could safely contain radioactive waste without any further action or intervention by future generations. Increasingly, the implementation of a disposal project has come to be viewed as an incremental process, perhaps taking several decades to complete. This changing vision involves not only the concept of protection of future generations, but incorporates as well an assumption of their involvement in the process and a need to preserve their ability to exercise choice. The last decade or so has seen an evolution in the roles and number of the relevant actors and,

with that, a gradual shift in the complexity of the approach to implementation of a disposal facility.

- Success for this conference should be viewed as reaffirming the *common objective of safe geologic disposal* and reinforcing the message that *continued attention by decision makers* is one important ingredient to keep on its course a process that still will take decades to be completed.
- Success should be viewed as reaching a common understanding that the *variety of paths represent complementary avenues*, which arise from modern, democratic, but nation-specific approaches to governance. Communication of this shared understanding by decision makers can have a significant impact on the confidence of all stakeholders.

Table 1. **Traditional and evolving roles and responsibilities**

<b>Stakeholders</b>	<b>Traditional roles and responsibilities</b>	<b>Evolving roles and responsibilities</b>
Policy makers	Defining policy options, investigating their consequences under different assumptions, making policy choices.	Informing and consulting stakeholders about policy options, assumptions, anticipated consequences, values and preference.  Setting the “ground rules” for the decision making processes.  Communicating the bases of policy decisions.
Regulators (policy makers in safety authorities)	Defining regulatory options, investigating their consequences under different assumptions, making choices regarding regulatory options.	Informing and consulting stakeholders about regulatory options, assumptions, anticipated consequences, values and preferences.  Communicating the bases of regulatory decisions.  Providing independent expertise for local communities.
Scientific experts, consultants	Providing qualified input for the decision makers.	Providing balanced and qualified input for stakeholders and encouraging informed and comparative judgement.  Acting as technical intermediaries between the general public and the decision makers.
Implementers	Finding a solution for the radioactive waste management problem, implementing the solution.	Co-operating with local communities to find an acceptable solution for the radioactive waste management problem.  Co-operating with local communities in implementing the solution.

Table 1. **Traditional and evolving roles and responsibilities** (cont'd)

Potential host communities	Accepting or rejecting the proposed facility.	Negotiating with implementers to find locally acceptable solutions for the radioactive waste management problem that minimise negative impacts and provide for local development, local control, and partnership.
Elected local or regional representatives	Representing their constituencies in debates on radioactive waste management facilities.	Mediating between several levels of governments, institutions and local communities in seeking mutually acceptable solutions.
Waste generators	Providing (partial or full) finance for solving the radioactive waste management problem.	Providing finance for solving the radioactive waste management problem under transparent arrangements and demonstrating this transparency.