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Geological disposal: technically ripe for implementation

There is a world-wide scientific consensus that safe geological disposal of high-level nuclear waste is technically feasible, while public acceptance has still not been achieved in most Member States. The European Commission's Joint Research Centre (JRC) has analysed the state of the art of science, technology and procedures needed across the EU for implementation. It has identified no major conceptual or research gap for the host rocks and repository systems envisaged, namely those in clays, hard rocks and salt.

The new research from the JRC, conducted by its Institute for Energy (IE), concludes that the critical step in implementing this waste management solution is regulatory approval, coupled with public acceptance. The approval requires an adequate set of regulations and criteria for evaluation as well as enabling of regulators. The report, entitled "Geological disposal of radioactive waste: moving towards implementation", summarises these requirements.

There are numerous difficulties behind implementation of geological disposal. While final responsibility rests with the national regulators and although a harmonised European regulatory framework could be of some advantage, the report concedes that "broad consensus" might be the most realistic approach, with individual countries retaining their own regulatory mechanisms. In addition, enabling and resourcing national regulators is likely to become an important task in the near future in some countries, thus ensuring that they are capable of performing the required tasks.

Regarding geological disposal, the situation is different across Europe. Some countries, such as Sweden and Finland, have defined road-maps with specific dates for implementation. Others, such as Germany and the UK, are also technically advanced and have identified suitable host rock formations, but the development of disposal facilities at specific sites continues to be held back due to local opposition. In most of the countries that have more recently joined the EU, funding and knowledge acquisition are additional barriers to implementation.

In this line, the report calls for continuing scientific co-operation to ensure a harmonised level of understanding throughout the EU. It suggests as well that mechanisms to demonstrate equivalence between member states' regulations might be a more efficient approach as opposed to harmonised or unified regulations and adds that supporting more advanced countries in their implementation is likely to create synergies in other member states. Finally, it analyses the possible benefits of sharing radioactive waste management facilities between countries.

Research perspective

On a technical level, the JRC report examines the various elements of a deep geological repository system: waste forms, containers, buffers, backfills and host rocks. Research in these areas appears to be mature enough to proceed with step-wise implementation that provides options for review and reverting decisions after each step. Continuing R&D activities in these topics are not a sign of immaturity or

lack of confidence, but an effort to demonstrate that decisions are still valid or to further increase safety margins.

However, other areas have been identified where further research could be conducted. They relate to:

- certain processes affecting radionuclide behaviour in the repository and the surrounding rock, such as the microbiological activity during repository development and after closure, and physico-chemical surface processes affecting long-lived radionuclides as well as their colloid-mediated migration;
- gas generation and multi-phase flow processes, as there is a limited number of conceptual and numerical modelling tools available, and
- the interaction between the repository components, such as the interaction of host rocks with steel corrosion products and other feedback and coupling mechanisms into the geomechanical properties.

To download the "Geological disposal of radioactive waste: moving towards implementation" report, please visit: www.jrc.ec.europa.eu/rr

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