JRC
EUROPEAN COMMISSION

19 February 2010

Strategic cooperation sets the scene for geological disposal of nuclear waste in Europe

A group of eight European radioactive waste management organisations have set up the "Implementing Geological Disposal Technology Platform" (IGD-TP) with support from the European Commission. Their vision is that "by 2025, the first geological disposal facilities for spent fuel, high-level waste and other long-lived radioactive waste will be operating safely in Europe". The world's first geological disposal facilities will start operation in Finland, Sweden and France in the period 2020-2025.

While in the US the Obama administration has said it will abandon the nuclear waste disposal project at Yucca Mountain and has set up a "blue-ribbon" commission on America's future management of nuclear waste, in Europe, two countries (Sweden and Finland) have already selected a disposal site for nuclear waste and France will specify a location by 2013. In a number of other European countries (e.g. Switzerland and UK), geological disposal is the reference management option and things are moving forward to the site selection stage.

In Europe, almost one third of the electricity consumed is produced by nuclear power. With a total of 145 reactors in operation in 15 countries (data from 2007) and 8 new reactors under construction, nuclear energy is set to remain as part of the energy-mix. On the policy side, the target is to reduce CO_2 emissions by 20% by 2020. Increased sustainability of nuclear energy in the long term, through deployment of Gen-IV systems, is also one of the key technology challenges in the EU's Strategic Energy Technology Plan (SET-Plan). In the shorter term, the SET-Plan also identifies developing long-term waste management solutions as a priority.

Even if all nuclear reactors were shut down today, the accumulated nuclear waste would still need to be taken care of, and as the European Commission already stated in 2008 "many scientific and technical areas important to geological disposal have reached maturity level, and moving towards implementation should be encouraged and facilitated"[1]. Nevertheless, such decisions belong to national authorities. Yet, there is a joint awareness that continued and strengthened cooperation on the scientific, technical and societal challenges of geological disposal is beneficial for its safe and timely implementation. This is the rationale behind IGD-TP (www.igdtp.eu).

Technology platforms are meant to provide a framework for stakeholders, led by industry, to define research and development (R&D) priorities, timeframes and action plans. In the case of IGD-TP, the eight founding organisations belong to countries where nuclear is a well-established part of the energy mix: Belgium (ONDRAF/NIRAS), Finland (Posiva Oy), France (ANDRA), Germany (BMWi), Spain (ENRESA), Sweden (SKB), Switzerland (Nagra) and United Kingdom (NDA). Since the formal launch of IGD-TP, some 30 other European industrial and R&D bodies have endorsed the platform's vision document and applied for membership. There is also interest from bodies outside Europe.

These organisations have committed themselves to build confidence in the safety of geological disposal, encourage the establishment of waste management programmes that integrate it as the accepted option, facilitate access to expertise and technology, and

[1] COM (2008) 542 final "Sixth situation report on radioactive waste and spent fuel management in the European Union", p. 4.

maintain competences in this field. The objective is to facilitate the stepwise implementation of geological disposal by resolving any remaining scientific, technological and social challenges.

Current situation

In the world, each year, nuclear power reactors create enough spent fuel to fill a football field to a depth of 1.5 metres, with a weight of about 10,500 tons.

In Europe, France and UK use the spent fuel reprocessing option and Belgium, Switzerland and Germany have used it until recently. Finland and Sweden are actively pursuing the option of direct disposal of spent fuel. In the majority of countries with nuclear power plants, a definitive spent fuel policy does not exist, other than arrangements to ensure a safe extended period of storage either at the nuclear reactor sites or in a centralised facility (50-100 years).

Is geological disposal the only option?

In 2008, the Radioactive Waste Management Committee of the Nuclear Energy Agency published a collective statement entitled "Moving Forward with Geological Disposal of Radioactive Waste"[2], urging progress towards implementing geological disposal as the option for final disposal of spent fuel or the high-level waste from reprocessing.

This recommendation points out that other alternatives have been carefully studied in the past and discarded by the international scientific and technical community, such as: launching the nuclear waste into the space, ocean dumping, disposal under continental glaciers, sub-seabed disposal and long-term supervised storage.

In addition, the committee pointed out that even if the high-level waste volumes (and long-term radiotoxicity) decrease with partitioning and transmutation, there will still be ultimate wastes remaining that will require geological disposal.

The principles behind this recommendation are:

- Geological disposal provides a unique level and duration of protection for high activity long-lived radioactive waste;
- The overwhelming scientific consensus world-wide is that it is technically feasible;
- It can be accommodated in a broad range of geological settings.

In addition, the International Atomic Energy Agency (IAEA) has published various reports with guidelines for sitting geological repositories and their safety requirements.

Challenges ahead

There are scientific, technological, social and political challenges ahead, as expressed within the IGD-TP vision document. Extensive research, development and demonstration (RD&D) work has been carried out as part of national programmes and with significant support from the Euratom Framework Programmes (some €300M over 25 years). As a European Commission Joint Research Centre report[3] has highlighted, the continuation of R&D activities in certain areas is not a sign of immaturity or lack of confidence, but an effort to reinforce the validity of decisions or to further increase safety margins.

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[2] http://www.nea.fr/html/rwm/reports/2008/nea6433-statement.pdf

[3] European Commission's Joint Research Centre report on "Geological disposal of radioactive waste: moving towards implementation"

Remaining scientific and technical challenges include:

- the further reduction in uncertainties regarding the predictions on the repository behaviour in the very long term,
- understanding when knowledge is sufficient for well founded decision-making,
- how to transfer the results of RD&D activities into proven and reliable technologies, and
- aspects related to operational safety of repositories.

It will be a major challenge by an implementer to produce a safety case and license application for a deep geological repository, and a major challenge by a regulator to review such an application. The work within IGD-TP will greatly facilitate these tasks, and over the next few months the platform will be developing its all-important Strategic Research Agenda and Deployment Strategy

Contact

Elena González Verdesoto: Elena.gonzalez-verdesoto@ec.europa.eu
Mob: + 32 498 98 64 82

More information

- Vision document of the IGD TP: http://www.igdtp.eu/Documents/VisionDoc_Final_Oct24.pdf
- Sixth situation report on radioactive waste and spent fuel management in the EU: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52008DC0542:EN:HTML
- IAEA's sitting of geological disposal facilities safety series No. 111-G4.1 (1994): http://www-pub.iaea.org/MTCD/publications/PDF/Pub952e_web.pdf
- IAEA's Geological Disposal of Radioactive Waste Safety Requirements IAEA Safety Standards Series No. WS-R-4 (2006): http://www-pub.iaea.org/MTCD/publications/PDF/Pub1231_web.pdf
- European Commission's Joint Research Centre report on "Geological disposal of radioactive waste: moving towards implementation": www.jrc.ec.europa.eu/rr
- Press pack: www.jrc.ec.europa.eu/aaas