CARD Project and Technology Platform in the Field of Geological Disposal of Radioactive Waste

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ABSTRACT

The feasibility of a Technology Platform that would provide a European framework for networking and co-operation in the field of research, development and demonstration (RD&D) for geological disposal of radioactive waste in the EU was investigated within the EU project CARD. The project was launched at the end of 2006 as a co-ordination action on research, development and demonstration priorities and strategies for geological disposal within the EU 6th Framework Programme and was concluded in May 2008. The project involved waste management organizations (WMO) from 10 EU countries with an interest in geological disposal, including ARAO – Agency for Radwaste Management in Slovenia.

During the implementation phase the project participants discussed and investigated the objectives, possible structure and working methods of a Technology Platform (TP). They also collected views and opinions from other stakeholders, such as national research providers, regulatory bodies, safety authorities and technical support organizations.

In the paper the views of the stakeholders and other findings and final conclusions of the CARD project are presented. The establishment of the Technology Platform from the perspective of the Slovenian waste disposal programme is also commented.

1 INTRODUCTION

Disposal of radioactive waste is considered as a safe and environmentally acceptable method of its isolation from the human environment. Different types of waste require different approaches and facilities for its emplacement to provide safe disposal. While short-lived low and intermediate level waste can be disposed of in engineered structures on the surface or close to the surface for high-level waste, spent fuel and other long-lived waste, the disposal at great depths - known also as geological disposal - is required.

Geological disposal means emplacement of the waste in repositories constructed several hundred metres underground in suitable geological media. It is based on a concept of multiple barriers that together provide safe containment of waste. The barriers prevent deep groundwaters, present in almost all rock formations, from rapidly leaching the wastes and transporting radioactivity away from the repository. The concept relies on both, man-made or engineered barriers and natural barriers, in the surrounding geological environment.
While the disposal of short-lived waste in near-surface repositories has been practised already for several decades and a number of such facilities, constructed above ground or in subsurface are in operation, the geological disposal of spent fuel and high-level waste has not yet been implemented. Only one geological repository – the Waste Isolation Plant or WIPP in Carlsbad in New Mexico - has been put in operation so far, but it is intended only for the nation's defense-related transuranic radioactive waste.

Primary principles of the engineered geological disposal concept are that waste will only be emplaced in a repository when there is high confidence in the ultimate long-term safety without relying on actions following the closure of the repository. Extensive investigations into geological settings and the properties of potential host formations, intensive research and development (R&D) on methodologies and disposal technologies as well as lengthy and expensive demonstration and test experiments are required before safety of the proposed geological disposal concept is proved and sufficient confidence in the proposed solution is achieved. In the last few decades significant efforts have been made by different waste management programmes in Europe and in the USA to identify the right types of host rock to locate the repository, to develop and design repository systems that will provide good containment of waste and to evaluate their behaviour and performance over long time periods.

Each country has developed its own active R&D programme, but since 1975 an important support to the R&D programme on geological disposal has been provided by the Euratom. By joining the efforts of individual EU countries, by pooling the resources and working together and by sharing the costs of research a tremendous added value has been provided. The early support was mainly oriented towards co-ordination activities between different research programmes and development concepts. Later, since the geological disposal concept has moved to maturity, the emphasis has been placed more on integration of efforts in order to rationalise and optimise solutions that can be achieved in Europe [1]. Most recent programmes are built around “Thematic Networks” which bring together expertise from many countries to work on common “Integrated Projects”.

With these different instruments for supporting and encouraging the R&D on geological disposal a number of important themes have been explored within the EU R&D programmes [1]:

- Development of repository technology,
- Long-term behaviour of wastes and containers,
- Groundwater and radionuclide movement around repositories,
- Safety assessment of geological disposal, as well as
- Public involvement in repository programmes.

Wide and efficient dissemination of results achieved in these research projects to all end-users has proved to be beneficial for all parties involved and has helped to bring the disposal programmes close to the implementation phase.

Nowadays, when the first national repository programmes have narrowed down to potential repository sites and research activities for final demonstration of the safety of disposal concepts need to be prioritized and targeted, new forms of co-operation and joint activities between the implementers and other stakeholders are required. A new instrument – a technology platform - which has already been successfully implemented in many other research areas, might be an efficient mechanism also in the field of geological disposal. Its applicability and suitability for further promoting and advancing the implementation of geological disposal has been investigated and analysed within the project CARD – the co-ordination action being launched as part of the Framework Programme FP6.
2 TECHNOLOGY PLATFORM OF GEOLOGICAL DISPOSAL

2.1 What are technology platforms?

The technology platform (TP) has been an innovation in EU research policy. It was introduced with the objective of fostering effective public-private partnerships. Through this cooperation, technology platforms can define the necessary research and technological priorities for that sector in the medium to long-term and serve to coordinate European and national, as well as public and private, R&D investments. In doing so, technology platforms can make a significant contribution to the development of a European Research Area [2,3].

This is a mechanism to bring together all relevant groups and interested stakeholders in a particular sector or area to develop a long-term vision to address a strategically important issue, and to create a coherent, dynamic strategy to achieve that vision. These vary from one sector to another, but usually include research institutions, national and regional public authorities, financial institutions, users groups, regulatory authorities, policy-makers, NGOs etc.

European Technology Platforms can provide a means to foster effective public-private partnerships between the research community, industry and policy makers in order to deliver the impetus to mobilise the research and innovation effort towards achieving a common goal with industry as the driving force.

The first technology platform was set up in the aeronautics sector in 2001. Since then, the concept has much progressed and nowadays more than 60 platforms are already in operation in sectors such as aeronautics, hydrogen, nano-electronics, innovative medicines, steel, energy, forest, textile, transport, biofuels, new materials, robotics, communications, food and others [3]. In 2007 a Technology Platform for Sustainable Nuclear Energy has also been launched [4].

Most of these TPs are successfully addressing technological challenges that can potentially contribute to a number of key policy objectives which are essential for Europe's future competitiveness, including the timely development and deployment of new technologies. Technology Platforms have proved that they can stimulate more effective R&D, particularly in the private sector, and optimise the benefits for all parties.

2.2 Technology platform in geological disposal?

The main objective of the EU project CARD was to assess the needs and feasibility of a Technology Platform that would provide a European framework for networking and co-operation in the field of RD&D for geological disposal of radioactive waste in the EU and provide foundations for the establishment of the TP for geological disposal, if the project will demonstrate sufficient interest in partners and stakeholders [5].

The project was launched at the end of 2006 as a co-ordination action on research, development and demonstration priorities and strategies for geological disposal within the EU 6th Framework Programme and was concluded in May 2008. The project involved waste management organizations (WMO) from 10 EU countries with an interest in geological disposal.

Possible co-operation and close interaction between European end-users for more efficient use of European resources in research and development of safe methods for final disposal of high-level radioactive waste and networking between different waste management implementers have already been investigated and tested. Strong support to the co-operation and networking among EU countries has been provided by the EU Research Programme. Already in 2002 the project called NET Excel [6] was financed within the 5-th EU Framework Programme. All major European end-users took part in the project (Sweden, UK,
Germany, Switzerland, Belgium, Spain, Finland, France). The main objective was to develop a common and systematic basis for priorities and co-ordination of future European research and technology development (RTD) work for Radioactive Waste Management, to suggest areas and priorities for joint RTD projects and to explore the possibility of forming a Network of Excellence with the main European organisations to jointly work on future co-ordinated RTD activities between European implementors. The project, which was accomplished in 2004, estimated that such an NoE is viable and recommendable.

Based on the NET Excel results a proposal with the acronym GEODISNET was submitted to the FP6 call for proposals in 2003. The proposal aimed at developing a concept for a GEOlogical DISposal NETwork for joint efforts within different areas of radioactive waste management in Europe. ARAO from Slovenia was invited to take part in the proposal to contribute its experience in addressing WM problems in a small nuclear programme. Unfortunately the proposal failed in the evaluation process and the process for joining the efforts of EU WMO was stopped. For several years no initiative for networking among WMO was launched. It seemed that national interests between different European programmes are stronger than the need for a co-ordinated and co-operative approach.

The CARD project is a new attempt to bring together all involved stakeholders in EU to carefully investigate and judge if there is sufficient level of support for the European TP in the field of RD&D for geological disposal of radioactive waste. The European Commission has been all the time very supportive to the networking and further co-operation among EU WMO. It has a strong interest in implementation of a TP in this area as a vehicle to develop safe and feasible geological disposal in member countries by building confidence in safety cases, supporting technical demonstrations of the maturity of the concept of geological disposal and supporting the implementation of repositories. Providing conditions for sustainable networking of partners and stakeholders working in the field of radioactive waste management can help to realise these objectives and to promote the sustainability of RD&D in the field of geological disposal by:

- synergy between RD&D projects of different waste management organisations,
- information exchange and technology transfer, shared knowledge basis
- continuity of expertise,
- coordination and avoidance of duplication of RD&D activities,
- effective utilisation of resources,
- increased confidence in RD&D programmes,
- advising EC on relevant topics.

3 CARD PROJECT - TECHNOLOGY PLATFORM OF GEOLOGICAL DISPOSAL

The CARD Project partners were nine waste management organisations and one technical support organisation (table 1). During the implementation phase the participants worked on objectives, development of structure and practical requirements of TP and discussed their findings at two meetings. They prepared a questionnaire on preliminary vision of the TP and gathered information from the key stakeholders:

- regulatory bodies,
- national research organisations,
- public authorities.

Analysis of answers from 82 respondents served as input data for evaluation of TP feasibility, and a draft proposal for TP organisation was prepared and discussed at the final workshop. High level of support for TP on geological disposal was expressed by all
participants at the workshop and it was decided that a vision document would be prepared and presented to EC [7].

Table 1: Participants in CARD Project

<table>
<thead>
<tr>
<th>Member state</th>
<th>Waste management organisation</th>
<th>Technical support organisation</th>
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</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>ONDRAF/NIRAS</td>
<td></td>
</tr>
<tr>
<td>Czech Republik</td>
<td>RAWRA</td>
<td></td>
</tr>
<tr>
<td>Finland</td>
<td>Posiva OY</td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>ANDRA</td>
<td>GRS</td>
</tr>
<tr>
<td>Germany</td>
<td></td>
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<tr>
<td>Slovenia</td>
<td>ARAO</td>
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<tr>
<td>Spain</td>
<td>Enresa</td>
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<tr>
<td>Sweden</td>
<td>SKB</td>
<td></td>
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<tr>
<td>Switzerland</td>
<td>Nagra</td>
<td></td>
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<tr>
<td>United Kingdom</td>
<td>NDA</td>
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</tbody>
</table>

The questionnaire provided information on the stakeholders’ views on the likelihood of participation in TP, expected benefits of TP and stakeholders’ constraints, opinion on the function of TP from the point of view of co-operation on research and technology transfer, organisation structure and roles of TP partners. The main benefits and constraints identified by the participants are listed in table 2.

Table 2: Identified benefits and constraints of TP.

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Constraints</th>
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<tbody>
<tr>
<td>- Increased confidence in scientific and technical basis of geological disposal as a safe and feasible solution.</td>
<td>- Additional costs and staff requirements, additional administrative work.</td>
</tr>
<tr>
<td>- Economic benefits due to sharing costs of projects sharing similar goals and better co-ordination and organisation.</td>
<td>- Common goals of shared project should not influence immediate issues in national programmes.</td>
</tr>
</tbody>
</table>

Waste management organisations, technical support organisations and research providers expressed their willingness to participate in TP. Other stakeholders, mainly regulators, governmental bodies and local communities did not express their interest in participating although they supported the idea of TP on geological disposal. It was recognised that knowledge management, education and training in the nuclear field should be very important issues in TP and that social stakeholders should also be included. The important strategic role of TP, both at the European and at the national level was stressed. Main conclusions of the final workshop of partners and stakeholders were:

- Waste management organisations, technical support organisations and research providers are interested in TP in the field of RD&D for geological disposal, other stakeholders might support TP but their direct participation may be limited.
- The WMO with the responsibility for commissioning and applying RD&D to the development of repository safety cases and repository designs, or to the development of national policies and programmes must provide the driving input to establish and direct a TP.
- The main role of TP in geological disposal is to help identify RD&D needs and offer solutions by co-operation between partners. The WMOs see a potential for
considerable cost savings through cost-sharing and co-ordination in a well-managed TP.

The proposed TP structure includes a forum for exchange of information on needs and results, a working programme (working groups for specific tasks and projects or activities) and secretariat (Figure 1). The activities are controlled and monitored by an executive group appointed by waste management organisations that have the responsibility of implementing national programmes for geological disposal, or in formulating disposal policy. The executive group gets the input information on the interests of stakeholders from the exchange forum. The EC will take an interest as an observer, offer advice in relation to its experience of similar ventures and provide some support for coordination activities of the platform.

Organisations will decide for themselves whether or not to participate, and on what level of commitment, depending on the benefits they see in participation and on their own resources. The TP is holding open the possibility for increased participation in future.

Figure 1: Structure for the Technology Platform for RD&D for geological disposal.

The CARD Project has shown that TP for geological disposal is feasible. A decision was taken to produce a vision document to define the scope of TP, focusing mainly on practical implementation of policies of geological disposal in the member states. The waste management organisations SKB from Sweden and Posiva from Finland, with the assistance of German and French representatives, have volunteered to draft this document. Only management of high level and long lived radioactive waste will be included in TP activities. The vision document will define TP of geological disposal as:
- a forum for discussion of RD&D issues and priorities,
- a means for sharing information and experience,
- a mechanism for co-ordination of RD&D.

Once the Vision document has been drafted it will be distributed for consultation and comments from the CARD representatives and other stakeholders. It is also planned to organize a meeting during the Eurawaste’08 Conference in Luxembourg in mid October to present the on-going work and the draft vision of the TP to a broad range of stakeholders.
It is hoped that the Vision Document will be supported by the stakeholders and a critical mass of organisations will be obtained to commit themselves to it and to launch the Technology Platform for geological disposal of radioactive waste.

4 IS TP ON GEOLOGICAL DISPOSAL OF INTEREST FOR SLOVENIA? IS SLOVENIA AN INTERESTING PARTNER?

When considering the future establishment of TP for RD&D for geological disposal from the perspective of our country several questions emerge: What does the establishment of TP on geological disposal mean for Slovenia and our national waste disposal programme? Is TP on geological disposal beneficial and of interest for us? Can Slovenia be an interesting partner? What role can we play in the TP?

During the implementation phase of the CARD project, ARAO as a project partner collected views and opinions from the Slovenian stakeholders on the objectives, possible structure and working methods of a TP. The questionnaire was distributed among six organizations, four of them considered as technical organizations, a regulator and waste management organization as a potential partner: IJS - research Institute “Jožef Stefan”, GeoZS – Geological Survey of Slovenia, IBE Consulting Engineers, ZAG – Slovenian National Building and Civil Engineering Institute, SNSA – Slovenian Nuclear Safety Administration and ARAO – Agency for Radwaste Management.

All six organizations recognized the establishment of the TP as beneficial. The most important benefits perceived by them are: sharing of information, planning and results, utilisation of resources, identifying joint research priorities and centres of competence.

<table>
<thead>
<tr>
<th>IJS</th>
<th>Utilisation of resources, sharing of results, networking, identifying centres of competence, identifying joint research priorities</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBE</td>
<td>Sharing of information and results</td>
</tr>
<tr>
<td>ZAG</td>
<td>Utilisation of resources, sharing of planning and results, influence on programmes</td>
</tr>
<tr>
<td>GeoZS</td>
<td>Sharing of information and results, identifying centres of competence, influence on programmes</td>
</tr>
<tr>
<td>SNSA</td>
<td>Exchange of information on planning and management, utilisation of resources, sharing of planning and results</td>
</tr>
<tr>
<td>ARAO</td>
<td>Exchange of information on planning and management</td>
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</tbody>
</table>

TP for geological disposal was recognized as an appropriate mechanism for achieving these objectives. High agreement and support was also achieved on the proposed structure of the TP with a remark that attention needs to be paid to the selection of most qualified personnel and representatives in the executive body.

Concerning the expectations and the resource commitment related to the TP, the majority of respondents expect improvement of their knowledge, access and sharing of RD&D information and results, but only limited resources or even no resources are available for this purpose.
Table 4: Expectations and resource commitment related to the TP.

<table>
<thead>
<tr>
<th>Acquire knowledge, opportunity for research, resources limited</th>
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<tbody>
<tr>
<td>IJS</td>
</tr>
<tr>
<td>Sharng of RD&amp;D information and results, no resources planned</td>
</tr>
<tr>
<td>IBE</td>
</tr>
<tr>
<td>Improving the knowledge, new information, no resources planned</td>
</tr>
<tr>
<td>ZAG</td>
</tr>
<tr>
<td>Expanding the knowledge, research, resources limited</td>
</tr>
<tr>
<td>GeoZS</td>
</tr>
<tr>
<td>Exchange of views, licensing of geological disposal, resources</td>
</tr>
<tr>
<td>N/A</td>
</tr>
<tr>
<td>SNSA</td>
</tr>
<tr>
<td>Direct discussion and access to technological development,</td>
</tr>
<tr>
<td>training, resources limited</td>
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<tr>
<td>ARAO</td>
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</table>

Having in mind that the need for geological disposal is relatively distant in Slovenia and the repository for spent nuclear fuel is scheduled only in 2065, the responses are not surprising. In this early stage of our national disposal programme large engagement of resources is premature. Nevertheless, common support for the establishment of TP for geological disposal has been proved and recognized as beneficial even for our waste management programme by giving advance insight on future requirements through the same processes and providing an opportunity to allocate resources to follow developments and encourage solutions. It is therefore wished that Slovenian stakeholders will join the TP for geological disposal once it has been established.

5 CONCLUSIONS

Within the Euratom FP6 project CARD the feasibility of a Technology Platform that would provide a European framework for networking and co-operation in the field of RD&D for geological disposal of radioactive waste in the EU was investigated and assessed. The project involved waste management organizations (WMO) from 10 EU countries with an interest in geological disposal including ARAO – the Waste Management organisation from Slovenia.

During the implementation phase the project participants discussed and investigated the objectives, possible structure and working methods of a TP. They also collected views and opinions from other stakeholders, such as national research providers, regulatory bodies, safety authorities and technical support organizations.

The responses of the stakeholders indeed demonstrate a sufficient level of support for a European TP in the field of RD&D for geological disposal of radioactive waste. The project has also shown that the proposed structure and methods of working can meet the identified requirements for networking and co-operation of those organisations that are central to implementations of geological disposal in Member States.

The CARD project has established and tested the prioritised needs and objectives of potential participants in the Technology Platform. The resulting database of information provides the basis for production of a Vision Document for the TP.

The Vision Document is now being drafted. After its completion it is hoped that a critical mass of organisations will be obtained to commit themselves to it and to launch the Technology Platform for geological disposal of radioactive waste.

REFERENCES


