

Development of the Strategic Research Agenda of the Implementing Geological Disposal of Radioactive Waste Technology Platform - 11020

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ABSTRACT

Several European waste management organizations have established a technology platform to accelerate the implementation of deep geological disposal of radioactive waste in Europe. European waste management programmes in Sweden, Finland, and France are prepared to start the licensing process of deep geological disposal facilities within this decade.

A technology platform called Implementing Geological Disposal of Radioactive Waste (IGD-TP) was launched in November 2009. A vision report of the platform was prepared during 2008-2009 and it was presented at the Launch event in Brussels stating that "Our 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." By the end of 2010 about sixty different organisations had joined the IGD-TP and committed to share its vision. The IGD-TP intends to constitute a tool for reducing overlapping work, to produce savings in total costs of research and implementation, and to make better use of existing competence and research infrastructures.

A working group to develop a Strategic Research Agenda (SRA) for the IGD-TP was set up in January 2010. Intensive effort has been carried out to define and prioritize the key Research, Development and Demonstration (RD&D) topics that address the remaining scientific, technological and social challenges needed to support the realization of the vision. In the work process, a methodology for coming up with the Key Topics in RD&D was developed and a seminar for all committed participants of the IGD-TP was organised to ensure that relevant input from the deep geological disposal community was taken into account in the work. The SRA document is published after an open consultation in early 2011. This paper presents the development of this SRA.

Despite the differences between the timing and the challenges of the different waste management programmes, there is a joint awareness that cooperation on the scientific, technical, and social challenges related to geological disposal is needed, and the cooperation will be beneficial for the timely and safe implementation of the first geological disposal facilities.

INTRODUCTION

The Technological Platform concept was introduced by the European Commission in 2002 [1]. It is aimed to be a tool to develop a common vision and a strategic research agenda with short- and medium term objectives for implementation. The ambition is to bring together research and development-relevant stakeholders with various backgrounds (e.g. regulatory bodies at various geo-political levels, industry, public authorities, research institutes and the academic community, the financial world, and civil society) who would develop a long-term research and development strategy in areas of research needed in Europe. In the technology platform, the stakeholders jointly develop and commit to a common Vision and a Strategic Research Agenda (SRA). After these are developed, the stakeholders start to implement the SRA with the aim to improve European competitiveness in the areas of Research and Technological Development (RTD) stated on the agenda and needed to achieve the shared vision. The action plan for the SRA's implementation is described in a Deployment Plan (DP).

The Implementing Geological Disposal of Radioactive Waste (IGD-TP) Technology Platform was launched in November 2009 and a vision report of the platform was presented at the Launch event in Brussels stating that "Our

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." [2]

The organization structure [3] of Implementing Geological Disposal of Radioactive Waste Technology Platform (IGD-TP) includes an Executive Group (EG) that is supported by a Secretariat and a forum for exchange (Exchange Forum, EF) of information, advice and discussion on Research, Development and Demonstration (RD&D) needs and their deployment. By autumn 2010, fifty eight different organisations had joined the IGD-TP.

The IGD-TP Executive Group (EG) is the decision making and management forum of the IGD-TP. By definition, technology platforms are industry or implementer-driven. Thus the members of the EG are organisations, which are either responsible for implementing a waste management programme or are formally responsible for the RD&D programme needed for implementation of geological disposal. The EG members' responsibilities are to take decisions and steer the different tasks of the platform; to prioritize activities and projects to be funded jointly for deployment; to initiate, monitor, and evaluate activities; to fund the Secretariat; to approve the SRA and the consequent Deployment Plan (DP); to establish working groups; to encourage information exchange with "Mirror groups" including regulators; and to develop reports and information to the IGD-TP Exchange Forum.

After the IGD-TP had agreed on its vision that provides the common direction for the future work, work was started on the identification and prioritization of research topics that need to be addressed to make the agreed vision to become reality. In January 2010, the IGD-TP's Executive Group (EG) provided the guidelines for a Strategic Research Agenda working group (SRA WG). The working group started the development work immediately. The Strategic Research Agenda includes both short-term and long-term RD&D objectives for the technology platform in alignment with the vision 2025. Like the IGD-TP's Vision Report, also this document is consulted and published. The work related to the development of the IGD-TP's SRA is described in detail in the following. The SRA is intended to be published in early 2011.

THE STRATEGIC RESEARCH AGENDA AND ITS PURPOSE

The Strategic Research Agenda of the IGD-TP aims to identify, prioritize and assign importance to RD&D issues that could be worked together in Europe to achieve the IGD-TP's vision. Further by implementing or deploying the SRA, the IGD-TP aims to achieve the following benefits:

- Co-operation in focused RD&D with openness about the results is an important stepping stone for the implementation of deep geological disposal in the countries aiming for implementation of facilities in 2025, as well as for countries that will follow later.
- Stakeholder confidence in Europe can be enhanced by a demonstration of a viable solution or solutions for managing spent fuel, high-level and/or long-lived radioactive wastes.
- To produce savings in total costs of research and implementation by constituting a tool for reducing overlapping work, and to make better use of existing competence and research infrastructures. Thus participation in the technology platform will support and be of benefit to waste management programmes, independent of the time plans of such programmes.

As a starting point for the SRA each Executive Group member organization identified three top issues for their organization that could prevent them from reaching the vision i.e. that would need to be addressed prior the submission of the license applications or that the waste management programmes would need to address before proceeding to the next stage of their repository development programme. The Executive Group then after discussion produced guidelines the SRA work and the working group. The guidelines included for example the requirement to set up a logical framework to fill in the areas where implementation oriented research is still needed and to defined topics for cooperation adding value and not overlapping with work carried out in other forums. In the SRA document, the staged process of repository development should be taken into account with the first priority on the needs of waste management organisations close to reaching the vision. In addition, it should also define the needs of waste management programmes in the midst of their development and of those programmes starting up. Further, the

SRA is required to be focused and not a compilation of wish lists and it should take into account the deployment of the SRA. Neither should the SRA be divided on issues depending on different host rocks.

THE SRA WORKING GROUP

The members of the SRA working group were selected from the Executive Group member organization, which had joined the IGD-TP in early 2010.

The members in the SRA working group represented the following implementing organisations: ANDRA (France), BMWi¹ (Germany), ENRESA (Spain), NAGRA (Switzerland), NDA (United Kingdom), ONDRAF/NIRAS (Belgium), POSIVA Oy (Finland), PURAM (Hungary), and SKB (Sweden).

In addition, the SRA working group is supported by the SecIGD² project (coordinated by Posiva Oy and partnered by SKB, ANDRA, and BMWi) and the EC's project officer as an observer and the IGD-TP's Secretary General as a catalyst and facilitator for the development work.

THE WORKING STEPS IN THE DEVELOPMENT OF THE SRA

The previous attempts to develop an RD&D agenda for joint work among the implementing organisations has not been able to achieve a full scale cooperation between the actors even though e.g. in the Net.Excel project [2] several areas of joint interest were identified.

During the vision production, the importance of the vision as the major steering instrument and criteria for RD&D issue selection was acknowledged. Already in the vision, a classification basis for the issues for further work was developed. This classification basis was further developed in the SRA development work.

During the SRA development process also the methodology of the SRA development was documented and revised during the process. The methodology is described in detail in the SRA document [4] to be published in early 2011. This documentation was considered important because generic principles of developing a Strategic Research Agenda for a technology platform do not exist. The process is described in its main principles in this chapter.

Classification Basis and Definitions

By definition and based on the agreed IGD-TP classification basis, **Key Topics** are of high importance to the waste management programmes and are selected by their importance and urgency i.e. the time schedules that are to be met in getting the RD&D results needed for implementation by 2025 according to the IGD-TP Vision. The Key Topics identified are aimed mainly to address scientific and technical issues still considered open and the communication of these results to various stakeholders of deep geological disposal.

Each of the Key Topics is identified on the basis of the actual state-of-the-art and it covers a spectrum of more detailed **Topics** that need to be addressed by joint activities. These Topics are to some extent interrelated and require further RD&D in order to complement the scientific and technical basis needed for licensing. The work on the Topics does not necessarily directly contribute to the waste management programmes at the midst of their development. However, the benefit to the programmes that follow is recognized in particular by the scientific and technical community because addressing the Topics contributes to a broader understanding of geological disposal in general and will eventually further enhance the state-of-the-art of the scientific and technological basis.

¹ Bundesministerium für Wirtschaft und Technologie

² Euratom 7th framework coordination and support action project "Secretariat of the Implementing Geological Disposal Technology Platform" (SecIGD) 2010-2012 www.igdtp.eu/secigd/

Cross-cutting Activities, in comparison with Key Topics and Topics, are seen from a different view point. They deal primarily not so much with scientific and technical issues of geological disposal but with administrative, management and societal issues. Accordingly, such activities are considered as matters of more generic nature to geological disposal and radioactive waste management.

Stages of Repository Development

In the vision report [2], the stepwise implementation process of a repository was outlined to consist of the following steps:

- Establishing a waste inventory,
- Developing concepts and technology for safe disposal,
- Selecting and characterizing a disposal site,
- Designing a geological repository to the site,
- Demonstrating technology used in the geological repository,
- Demonstrating the safety of the whole disposal system based on scientific knowledge,
- Constructing the repository and manufacturing the needed system components,
- Operating the repository according to nuclear safety requirements, and
- Closing the repository.

The steps in the repository development were used to describe in more detail the activities that are needed in the staged development of the repository. Each specific stage of the repository development needs to address the following fundamentals and the requirements and constraints set by these fundamentals: the selected safety strategy and methodology used; the scientific and technical basis for long-term safety; the site related characteristics; and the repository and component design basis.

The stages of the repository development after the concept and site selection steps can be further broken down into more detailed stages that relate to the design and technology used in the repository:

- Technology development for the chosen disposal concept and generic and site specific repository design,
- Generic and site specific technology demonstration of technical feasibility and performance,
- Repository construction methodologies development and construction at the selected site,
- Industrial-scale manufacturing and emplacement of the repository components, and
- Repository operations: Both pilot operations and operating a nuclear facility.

The SRA Development Framework

The starting point of the SRA issues' compilation was the top issues identified by the members of the Executive Group. A framework for categorizing the issues was developed in the SRA working group [4]. The framework consists of three main issue areas for the classification of the Key Topics. These areas were:

- Demonstration of long term safety including the safety case and scientific specifics,
- Demonstration of disposal techniques and components including technology development, waste acceptance and disposal, operational safety, monitoring, industrial schemes, sealing and closure, and
- Confirmation of site related matters including site properties and site analysis.

The framework's main areas were complemented with Cross-cutting Activities and with a category of issues that were considered waste management programme specific and would therefore not meet the criteria that the issues could be worked on jointly as part of the deployment of the SRA.

The identified issues were compiled under the chosen framework and the listing was complemented with updated information drawn from the latest RD&D programmes of the waste management organisations engaged in the SRA development. In the lengthy compilation list each listed item was evaluated in terms of:

- What is the specific product needed related to the identified issue for the licensing or for proceeding to the next stage of the waste management programme?
- What is the current approach used to deal with the identified issue? What type of improvements would be needed or would be favorable approaches to deal with the issue?
- What are the alternative approaches, if the desired product is not achieved?
- What is the importance and priority of the issue solution for the individual waste management programme and by when the issue needs to be solved?
- What is the potential for collaboration within the IGD-TP around the issue?

The compilation list consisting of about 60 partly overlapping items was then circulated and complemented with the individual member's information related to each item. The resulting compilation list was then discussed and filtered down initially to ten Key Topics. These Key Topics were subjected to consultation by the participants of the IGD-TP. The consultation process of the SRA is described in a separate chapter later on this paper.

THE CONTENT OF THE STRATEGIC RESEARCH AGENDA

The essence of the SRA document is the Key Topics and the Topics related to them. For each of the Key Topics, the SRA includes their specific definitions, the Key Topic's objectives and the rationale and benefits from addressing the Key Topic. In the description also on-going work on the Key Topic is described and considerations for its deployment given.

After the IGD-TP's internal consultation processes in autumn 2010, the Key Topic list was reduced to a list of seven Key Topics [4]:

Key Topic 1: Safety case.

Key Topic 2: Waste forms and their behaviour.

Key Topic 3: Technical feasibility and long-term performance of repository components.

Key Topic 4: Development strategy of the repository.

Key Topic 5: Operational safety.

Key Topic 6: Monitoring.

Key Topic 7: Governance and stakeholder involvement.

The Key Topics consist of 37 individual Topics, with the majority of the Topics concentrating on the technical feasibility and long-term performance of repository components reflecting the maturity of the repository development in the waste management programmes closest to licensing. Sixteen Topics were identified as being of high priority and urgency for future deployment of the SRA. Further four areas for Cross-cutting Activities were identified including dialogue with the regulators, competence maintenance and education and training, knowledge management, and communication.

In addition to the identification of the major areas of strategic RD&D needed to achieve the IGD-TP's vision, the SRA document describes the background of the SRA work, the framework and methodology for developing the SRA and the way forward to the deployment of the SRA.

CONSULTATION OF THE SRA DOCUMENT

In the development process of the IGD-TPs' vision it became obvious that the priorities and joint collaborative actions are difficult to agree upon without having a good mutual understanding of the shared vision. The SRA work has been steered keeping the IGD-TP's vision in mind. Further a good agreement on the process how to come up

with the Key Topics is important. For the IGD-TP's participants not being members of the SRA working group the process and its outcome is not necessarily equally obvious from the outset and interactive consultation was seen as a necessary part of the process.

The member organisations of the SRA working group provided their first consultative comments to the compilation list from which a first set of ten Key Topics were derived from. These Key Topics were then submitted for a consultation to the IGD-TP's committed participants by organizing a SRA seminar at the EC premises in Brussels in June 2010. Fifty five IGD-TP participants joined this consultative event. After the presentations about the methodology, framework and individual Key Topics, the participants provided their input in a "Key Topic Walkabout", an interactive element developed for the event using wall chart techniques and small group dialogue on the consultation of the Key Topics at individual Key Topic "stations". An open topic station was also included into the process for input around topics that the participants considered missing.

The IGD-TP participants' input from the seminar was discussed and referenced against the vision and the compilation list in the SRA working group. The SRA's chapter on the Key Topics was then worked further to include the Key Topics according to the framework developed, their definition and rationale, including a listing of Topics under each Key Topic classified according to importance and urgency and describing on-going work related to each Topic and the implications for the deployment of the Topics.

The Key Topic chapter draft was then submitted for the Executive Group's review and after their approval, for short consultation to the IGD-TP participants prior finalizing the SRA document. Simultaneously, the Draft IGD-TP SRA document was finalized and published for an open consultation on the IGD-TP's website with an intention to discuss the SRA and its means of deployment in the first IGD-TP's Exchange Forum meeting taking place in Paris, France in February 2011.

The SRA draft and the Key Topics chapter have thus undergone several consultation rounds within the IGD-TP prior finalization for the public consultation on the IGD-TP's website.

WAY FORWARD TOWARDS THE DEPLOYMENT PLAN

The SRA document is intended to be a living document. Thus the first version is published on the public website of the IGD-TP as a web publication [4].

The task of the IGD-TP Executive Group is to review the SRA on a regular basis and set up a new working group to update the IGD-TP's Strategic Research Agenda when needed. The need arises for example when the review points out to significant changes in the basis on which the previous SRA was founded, or RD&D related to the Key Topics have been addressed at a sufficient level through joint or individual activities, or new topics have emerged as the repository programmes have advanced to the next stages of the repository development.

After the first Strategic Research Agenda is finalized, a Deployment Plan (DP) is produced outlining how the research and other support activities needed to implement the SRA will be organised, funded and carried out by the technology platform and its members. The IGD-TP's Deployment Plan is aimed to be published in 2011.

The IGD-TP's first Exchange Forum (EF) is planned for early February 2011. One aim of the EF is to solicit advice for the deployment of the SRA and to engage the members of the Exchange forum in the deployment process of the IGD-TP. The participants of the EF are able to find Key Topics and Topics that are of interest to their organisations and can through their engagement in the specific joint activities of the IGD-TP contribute to achieving the IGD-TPs vision.

CONCLUSIONS

The process of developing the Strategic Research Agenda for the Implementing Geological Disposal of Radioactive Waste Technology Platform has been a pioneering work in the geological disposal community in Europe. This work of producing the SRA has not only used the background information³ provided by previous European efforts [2] to initiate joint activities among the waste management programmes and other stakeholders, but also a methodology and framework for the vision-derived Strategic Research Agenda has been developed. The result of the work is a first research agenda that can be deployed jointly for the benefit of the geological disposal community and for the European member states independent of the timing of their disposal activities.

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³ European Commission Euratom 5th and 6th framework projects Net.Excel and CARD [2]

⁴ "Secretariat of the Implementing Geological Disposal Technology Platform" project (SecIGD)