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Strategic Research Agenda Main Achievements and Way forward

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D 1.7 Strategic Research Agenda Main Achievements and Way Forward

IMPLEMENTING GEOLOGICAL DISPOSAL OF RADIOACTIVE WASTE TECHNOLOGY PLATFORM (IGD-TP)

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1 Background

In July 2011, the Implementing Geological Disposal of Radioactive Waste Technology Platform (IGD-TP) published a Strategic Research Agenda (SRA). This document identified the main RD&D issues that need a coordinated effort over the next years in order to reach the Vision 2025.

The vision 2025 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 commitment is to:

- Build confidence in the safety of geological disposal solutions among European citizens and decision-makers.
- Encourage the establishment of waste management programs that integrate geological disposal as the accepted option for the safe long-term management of long-lived and/or high-level waste.
- Facilitate access to expertise and technology and maintain competences in the field of geological disposal for the benefit of Member States.

Of particular interest are the issues for which enhanced co-operation within the IGD-TP is considered desirable and practically achievable. Because the SRA identifies the Key Topics of RD&D that have the greatest potential to support repository implementation through enhanced cooperation in Europe, it also provide valuable input to identifying topics for future calls for proposals issued by the EC framework program.

The Key Topics were identified in relation to their priorities, which have been established collectively through discussions among many European waste management organizations and also because benefits are expected to flow to a broad range of participants. In developing the SRA, attention has been focused on increasing cooperation in areas of repository safety and technological development through combined use of resources, which represent the major objectives of the EC framework program. The SRA is aiming to also be the instrument for creating synergies, co-operation and co-ordination, both internally between the IGD-TP participants and with external activities that take place in other technological platforms such as the SNE-TP and within other international forums.

The SRA is complemented by the Deployment Plan introducing various adapted cooperation tools to implement its actions. They will rely in particular on the Euratom Framework Programs, which should echo the SRA's priorities.

The principal guidelines to define the Key topics were the following:

- To fill in the areas where implementation-oriented research is still needed;
- To define co-operation with added value and not to overlap with work carried out in existing forums and provides possibilities for extended international co-operation;
- to take into account the staged process of repository development;
- To concentrate especially on common issues such as methodology and strategy that can be done together in the IGD-TP in a value added way;
- To concentrate on topics of high urgency in relation to the Vision 2025;
- Not to differentiate the issues according to host rock type;
- To put the emphasis on safety-related research;
- To emphasis construction and operational safety issue;
- To acknowledge the need to involve socio-economic issues.

The key topics are:

- Safety case.
- Waste forms and their behavior.
- Technical feasibility and long-term performance of repository components.
- Development strategy of the repository.
- Safety of construction and operations.
- Monitoring.
- Governance and Stakeholder involvement.

2 Updated SRA

2.1 Methodology

In the framework of the SecIGD2 project it was proposed that by the end of 2015, the SRA could be updated. Thus, the possible update of the SRA and the setting up of a Working Group were discussed during EG 12 and EG 13.

During EG 12, EG members decided that the first step should be a review of the SRA according to the findings of the past four years and the on-going strategy. It was stressed that the SRA should be updated only if needed.

In EG 13, the Secretariat presented for discussion a ToR draft for a potential SRA WG. This ToR draft expressed what could be the objectives of the update, taking into account the experience gained during the setting up of the SRA.

EG members considered that major achievements were made in the setting up of research projects covering the SRA Key Topics and topics identified. In addition EG members considered that cooperation has improved since the inception of the platform and not only between the more advanced programs.

However, research activities on some topics have not been initiated yet, especially considering that some of them should be addressed at a later stage of implementation.

In conclusion, the EG decided that each EG member, whatever the stage of development of their project, should provide a short analysis, from their point of view, on the major achievements of the platform. In addition, they should express their interest in participating in the activities and suggest improvements that could be carried out in the future (organizational and technical point of view).

2.2 Questionnaire

Thus, the Secretariat prepared a questionnaire, in which the EG member should state their point of view:

1. Key Topics and Priorities, with regards to your objectives and the stage of development of your research program

1. Are Key topics and topics described in the SRA still relevant?
2. Are the level of importance /urgency of each topic still appropriate?
3. Did you identify new issues/inputs not listed as topics?
4. Are some objectives, common at the level of the Technology Platform, in opposition or contradiction with your national objectives?
5. Are the needs adequately covered for WMOs close to realizing the vision and approaching licensing?
6. Are the needs adequately covered for WMOs at early stage of their program?

2. Achievements

1. In how many EC projects related to IGD-TP's SRA are you involved in?
2. In how many Joint Activities are you involved in?

3. What are from your perspective the main technical achievements of the IGD-TP since its inception?
4. About the need to involve socio-economic issues in the programme, what initiative could be taken by the platform to better interact with socio economic actors?
5. Do you think that the way we interact with TSO/NRA through Sitex is appropriate (cross participation to events)? What do you expect from this interaction?
6. Do you think that the way we interact with SNETP is appropriate (Working Group)? What do you expect from this interaction?
7. Have you identify some other groups with which we could interact? On what domain?

3. Performance criteria and Improvements

1. What could be the performance criteria for the platform?
2. What should be done to develop projects or TSWG to respond to SRA priorities?
3. Is the SRA too broad?
4. Should some areas, purely national issues be included?

4. Conclusion

1. What is your main motivation for involvement in the EG?
2. Is there any fundamental change that may imply an update of the SRA?
3. Do you think that yearly update of the Master Deployment Plan is sufficient?
4. In the near future, do you expect to increase your involvement in TSWG, IEP or cross-cutting activities? In what specific domain?
5. Any other comment?

3 Elements of analysis

The synthesis of EG member's answers is given in following tables.

Key Topics and Priorities	Synthesis of EG member's answers
Are Key topics and topics described in the SRA still relevant?	Yes
Are the level of importance /urgency of each topic still appropriate?	No. Opportunities of changes of priority are proposed (see below)
Did you identify new issues/inputs not listed as topics?	Yes. New topics are suggested
Are some objectives, common at the level of the Technology Platform, in opposition or contradiction with your national objectives?	No (excepting monitoring for NDA)
Are the needs adequately covered for WMOs close to realizing the vision and approaching licensing?	Yes (not applicable for some WMO's as PURAM)
Are the needs adequately covered for WMOs at early stage of their program?	Yes and no, depending of developments of WMO's programs: <ul style="list-style-type: none"> • Key topics addressed and formulated should remain driven by advanced programs. Early stages of the repository development (preliminary generic studies and site characterization methodologies) could be more detailed. • ILW disposal could be developed, considering that ILW will be firstly emplaced in repository for some WMO (NDA, Andra...).

Performance criteria and Improvements	Synthesis of EG member’s answers
What could be the performance criteria for the platform?	<ul style="list-style-type: none"> • ‘balanced scorecard’ representing technical, financial, safety and participation metrics • number of JA’s • regular questionnaire addressed to IGD-TP members and other organisations to become and maintain member
What should be done to develop projects or TSWG to respond to SRA priorities?	To increase the role of EG: <ul style="list-style-type: none"> • to set a stronger direction for needs-driven programs of work • to strongly follow the development of projects, and to assess results according to SRA objectives/priorities • to increase technical discussion • to make synthesis each year to draw lesson learn and progress for each SRA key topics
Is the SRA too broad?	No (taking into account the fact that SRA is mainly driven by advanced programs)
Should some areas, purely national issues be included?	No (Technical issues of interest to one country must be exclude)

Achievements	Synthesis of EG member's answers
In how many EC projects related to IGD-TP's SRA are you involved in?	At least 2 (except for PURAM)
In how many Joint Activities are you involved in?	Depending of WMO, but in general more than 10
What are from your perspective the main technical achievements of the IGD-TP since its inception?	<ul style="list-style-type: none"> • To increase influence on EC research programs (and planning); • To better organize response to EC project calls, joint projects and other activities; • To introduce new forum for joint discussion of common issues.
About the need to involve socio-economic issues in the programme, what initiative could be taken by the platform to better interact with socio economic actors?	<p>To further integrate socio-economic issues in the platform activities, as evidence shows that these issues impact the technology required for disposal, for example:</p> <ul style="list-style-type: none"> • To integrate socio-economic aspects in the design of the individual projects; • To interact with stakeholders at a European-level (e.g. EESC, AMAC, PRIMO, European trade organization, European Consumer organization, ENSREG/WENRA etc.).

Achievements	Synthesis of EG member's answers
Do you think that the way we interact with TSO/NRA through Sitex is appropriate (cross participation to events)? What do you expect from this interaction?	Yes
Do you think that the way we interact with SNETP is appropriate (Working Group)? What do you expect from this interaction?	Yes
Have you identify some other groups with which we could interact? On what domain?	No, except renewable energy or energy storage communities

Conclusion	Synthesis of EG member's answers
What is your main motivation for involvement in the EG?	<ul style="list-style-type: none"> • To share knowledge, experience and good practice • To closely follow and to learn from the development of the most advanced programs • To optimize resources at national and European levels
Is there any fundamental change that may imply an update of the SRA?	No, only minor changes may be needed, for example prioritization (importance, urgency) of the Key Topics that should be updated (see below)
Do you think that yearly update of the Master Deployment Plan is sufficient?	Yes
In the near future, do you expect to increase your involvement in TSWG, IEP or cross-cutting activities? In what specific domain?	No
Any other comment?	<p>Overall feeling is that good work is doing. But more attention should be addressed to “less advanced programs”.</p> <p>NB : Specific comment on administration of European projects that is considered as heavy/onerous and may limit participation of organizations</p>

4 Opportunities of changes of priority

Following opportunities of changes of priority and proposal from IGD-TP members are given in following tables.

Key Topic 1: Safety case (Priority)	Proposal
Topic 1.1: Increase confidence in, and testing and further refinement of the tools (concepts, definition of scenarios and computer codes) used in safety assessments (H)	To move from high to medium priority because the IGD-TP added value is limited compared to what is already done within NEA
Topic 1.2: Improve safety case communication (H)	

Key Topic 2: Waste forms and their behavior (Priority)	Proposal
Topic 2.2 : release from ILW and their detailed characteristics (H)	To maintain high priority even if progress were made. Actually, ILW will be disposed of at first for many WMO
Topics 2.3: MOX fuel: relation between structure and dissolution (M)	In the SRA, it was suggested “development of burn-up credit methodology and its application for fuels with higher enrichment that allow higher burn-up – Numerous studies related to post-emplacement criticality evaluation have been performed. The studies showed that, with the application of burn-up credit, canisters of spent fuel in a repository will remain sub-critical when a moderate burn-up is reached. However, questions related to this issue are raised by regulators. There is a need to increase literature on validation experiments for criticality assessments. We suggest to move priority from medium to high.
Topics 2.4: High burn-up fuels and criticality (H)	

Key Topic 3: Technical feasibility and long-term performance of repository components (Priority)		Proposal
Topic 3.1: Full-scale demonstration of HLW container (from manufacturing to emplacement) (H)	To maintain high priority although progress were made. These topics remains relevant for some WMOs to support licensing authorization	
Topic 3.2. The industrial scale operations for buffer and backfill need to be demonstrated including the entire production and emplacement chain in the repository (H)		
Topic 3.3. Construction of main underground facilities: Confirmation of rock properties for final detailed design is required (H)		
Topic 3.4. Repository layout design including operational safety studies (H)	See topics 5	
Topic 3.9. Improved understanding of the impact of hydro-geochemical evolution on the long-term performance of bentonite buffer in specific disposal concepts developed for crystalline host rocks (H)	To maintain high priority	

Key Topic 4: Development strategy of the repository (Priority)	Proposal
Topic 4.1: Improved methodologies for developing strategies and approaches for adaptation and optimization (M)	To maintain medium importance priority. This topic is still relevant to support licensing process for many WMOs
Key Topic 5: Safety of construction and operations (Priority)	Proposal
Topic 5.1: Improved methodology, approaches and documentation on safety of construction and operations (H)	<p>To maintain high priority to support licensing process. Layout design should be separated from operational safety study. Layout design would be host rock and concept specific. It should be moved to medium or low priority since the prospects of European cooperation on this are questionable. Operational safety should maintain high importance priority because :</p> <ul style="list-style-type: none"> • approaches to assess operational safety for underground repositories still deserve developments; • It is of great importance to support licensing authorization. Beside preventing accidents during operation, operational safety should support post closure safety. Methodologies derived from reactor safety studies are not fully relevant in our domain.

Key Topic 6: Monitoring (Priority)	Proposal
Topic 6.1: Monitoring strategies and programs for performance confirmation of the repository (H)	To maintain high priority. Major importance in supporting licensing authorization, then in following up operational period (including reversibility). It is a starting point for long term behavior of disposal
Topic 6.2: Availability of monitoring technologies and techniques (H)	
Topic 6.4: Monitoring of engineered barrier systems (EBS) during operations (M)	To move from medium priority to high priority. This is linked to the requirements from safety authorities in many countries. It is also of importance for licensing authorization and stakeholders confidence
Key Topic 7: Governance and Stakeholder involvement (Priority)	Proposal
Topic 7.1: Governance of decision-making processes (H)	To maintain high priority, even if sentence of “acceptance” could be changed with “cost/benefit” concept (taking into account all aspects as social, public, economic, politic.

5 Opportunity to introduce new topics

Following opportunities of changes of priority and proposal from IGD-TP members are given in following tables

Key Topic and new topics	Proposal
Key Topic 1: Safety case <ul style="list-style-type: none"> Gas issues in performance assessment 	All new topics are relevant. However, they are implicitly included in topics of current SRA . They are also described at a level of details adapted for the Deployment of activities but not to the objective of SRA. In order to keep the consistency of the approach, we suggest not to include them.
1. Key Topic 2: Waste forms and their behavior <ul style="list-style-type: none"> Direct characterization of spent fuel ILW disposal e.g. waste forms 	
1. Key Topic 3: Technical feasibility and long-term performance of repository components <ul style="list-style-type: none"> Effect of long term saturation time on bentonite buffer Microbiological assisted processes Shear Strength of metal canister 	
1. Key Topic 4: Development strategy of the repository <ul style="list-style-type: none"> ILW disposal concepts, co-disposal 	
1. Key Topic 7: Governance and Stakeholder involvement <ul style="list-style-type: none"> Social science 	

Besides three new Waste management specificities were identified, Preservation of host rock materials, Use of non-destructive technics for siting and Disposal facilities acceptance criteria (DFAC).

6 Conclusions

6.1 General comments

Following general comments are to be considered:

- There is a very good common and shared position on the majority of the proposed questions of questionnaire;
- Sharing experience, knowledge, first-hand information and good practices within WMOs and working together are considered as key drivers for the involvement in the IGD-TP activities;
- Participating in the IGD-TP and in the EG gives a unique opportunity to closely follow (and to learn from) the development of the most advanced programs;
- IGD-TP offers financial leverage on common research interests, especially where large expenditure or unique facilities are required;
- IGD-TP helps to shape a RD&D program on geological disposal with the limited resources available; The lack of available resources in many of national research programs also limits the possibility of expansion of joint activities;

6.2 Update of SRA

Topics and key topics of current SRA are still relevant. Minor adjustments could be made. The SRA adequately covers the needs from the more advanced countries but not the lesser advanced countries. However, national issues should be left aside. The yearly update of MDP is currently enough to reflect the changes of the proposed work program of the IGD-TP.

Thus, considering that the IGD-TP's Vision document is still valid, the EG members recommend it should not be changed, but it should be amended when decisions regarding licensing are taken. The experience is that the minor changes that come up can be handled through the yearly update of the Master Deployment Plan. However, it is recommended to review the urgency/priorities relatively frequently (to be defined: once every year?), since priorities tend to change over the years and depending on how the different programs develop. The regular establishment of a state of progress of the knowledge and a board of correspondence with the topics of the SRA, in particular the achievement of the objectives, could help to that.

Finally, it is proposed to keep the specific working group dedicated to the less advanced programs needs in the framework of the SecIGD2 project.

Appendix : Table 1: List of the Key Topics and related Topics¹ with their foreseen start and outcome - dates, and an indication of their priority (H: high, M: medium, L: low) reviewed as March 2015

N°	List and Contents of the Topics for a given Key Topic ²	Start - date	End-date	Priority within the Key Topic
1	Key Topic 1: Safety case			
1.1	Increase confidence in, and testing and further refinement of the tools (concepts, definition of scenarios and computer codes) used in safety assessments	2012	2020	M
1.2	Improve safety case communication. This includes safety case communication on: Short-term safety of construction and operations, the transient phase, long-term safety.	2012	2025	M
1.3	Increase confidence in and further refinement of methods to make sensitivity and uncertainty analyses.	2015	2020	M
2	Key Topic 2: Waste forms and their behaviour			
2.1	High burn-up fuels: rapid release fraction and matrix dissolution	2015	2020	H
2.2	Release from ILW and their detailed characterization	2012	2016	H
2.3	MOX fuel: relation between structure and dissolution	2022	2028	M
2.4	High burn-up fuels and criticality	2015	2020	M
2.5	Improved data on vitrified HL waste	2012	2015	L
3	Key Topic 3: Technical feasibility and long-term performance of repository components			
3.1	Full-scale demonstration of a HLW container (from manufacturing to emplacement)	2015	2020	H
3.2	Buffer and backfill emplacement	2016	2020	H
3.3	Construction of underground facilities: Confirmation of rock properties for detailed repository design	2012	2018	H
3.4	Repository layout design including operational safety, reversibility and retrievability concerns	2015	2020	H
3.5	Pilot demonstration of repository operation	2011	2017	H
3.6	Full-scale plugging and sealing experiments and demonstrations	2012	2018	H
3.7	Non-destructive testing information exchange	2013	2019	L
3.8	Knowledge preservation	2016	2023	L
3.9	Long-term stability of bentonite in crystalline environments	2011	2017	H
3.10	Long-term behaviour of seals and plugs	2011	2017	H
3.11	Evolution of cement-based seals	2015	2023	M
3.12	Interaction of cement with clays	2016	2024	M
3.13	Optimisation of low pH cements	2016	2022	M
3.14	Salt backfill	2012	2018	M
3.15	Iron-bentonite interaction	2015	2023	M
3.16	Sharing of knowledge on HLW container materials behaviour	2012	2023	L
3.17	Thermal effects of bentonite-waste container contact performance at above 100°C	2015	2023	L

¹ Based on the contents of the SRA

² The SRA text describing a Topic can be a little different from the one given here

N°	List and Contents of the Topics for a given Key Topic ²	Start - date	End-date	Priority within the Key Topic
4	Key Topic 4: Development strategy of the repository			
4.1	Methodologies for adaptation and optimisation during the operational phase	2012	2018	M
5	Key Topic 5: Safety of construction and operations			
5.1	Improved methodology, approaches and documentation on risk assessment, risk management, further documentation for reporting operational safety issues – Operational Safety remain High see 3.4 -	2012	2018	M
5.2	Strategies to evaluate the impact of operational safety issues on the disposal system (long-term safety, design, costs...)	2019	2025	M
6	Key Topic 6: Monitoring			
6.1	Monitoring strategies and programmes for performance confirmation	2011	2015	H
6.2	Monitoring technologies and techniques	2011	2015	H
6.3	Monitoring of the environmental reference state	2011	2016	H
6.4	Monitoring of engineered barrier systems	2016	2020	H
6.5	Post-closure monitoring parameters and techniques	2023	2030	M
7	Key Topic 7: Governance and stakeholder involvement			
7.1	Governance of decision making processes: methods for the integration of technical, social and economic information	2011	2014	H
7.2	Use of research results for open and transparent dialogue with stakeholders (methods, tools, guidance)	2016	2025	M
7.3	Involvement of stakeholders, influence on the work of the researchers and the decision makers	2016	2025	M