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Setting the Terms of References for the SRA implementation

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SITEX-II OUTLINES

Sustainable network for Independent Technical Expertise of Radioactive Waste Disposal – Interactions and Implementation (SITEX-II)

The coordination and support action SITEX-II was initiated in 2015 within the EC programme Horizon 2020 with a view to further developing the independent Expertise Function network in the field of deep geological disposal safety. This network is expected to ensure a sustainable capability for developing and coordinating, at the international level, joint and harmonized activities, related to the Expertise Function. SITEX-II brings together representatives from 18 organisations involving regulatory authorities, technical support organisations, research organisations, specialists in risk governance and interaction with general public, including NGOs and an education institute. It is aimed at practical implementation of the activities defined by the former EURATOM FP7 SITEX project (2012–2013), using the interaction modes identified by that project. SITEX-II, coordinated by IRSN, is implemented through 6 Work Packages (WP).

WP1 - Programming R&D (lead by Bel V). The general objective of WP1 is to further define the Expertise Function's R&D programme necessary to ensure independent scientific and technical capabilities for reviewing a safety case for geological disposal. In this perspective WP1 will develop a Strategic Research Agenda (SRA) and define the Terms of Reference (ToR) for its implementation accounting for the preparatory work to be carried out in the framework of the JOPRAD project for construction of a Joint Programming of research for geological disposal.

WP2 - Developing a joint review framework (lead by FANC). The key objective of WP2 is to further develop and document in position papers and technical guides a common understanding of the interpretation and proper implementation of safety requirements in the safety case for the six phases of facility development (conceptualization, siting, reference design, construction, operational, post-closure).

WP3 - Training and tutoring for reviewing the safety case (lead by LEI). WP3 aims to provide a practical demonstration of training services that may be provided by the foreseen SITEX network. A pilot training will focus on the development of training modules at a generalist level, with emphasis on the technical review of the safety case, based on national experiences, practices and prospective views. The training modules will integrate the outcomes from WP1, WP2 and WP4 and support harmonisation of the technical review processes across Europe.

WP4 - Interactions with Civil Society (lead by Mutadis). WP4 is devoted to the elaboration of the conditions and means for developing interactions with Civil Society (CS) in the framework of the foreseen SITEX network, in view of transparency of the decision-making process. The future SITEX network is expected to support development of these interactions at different levels of governance and at different steps of the decision-making process. Three thematic tasks, namely R&D, safety culture/review and governance will be addressed by institutional experts and representatives of CS within SITEX-II as well as externally through workshops with other CS organisations.

WP5 - Integration and dissemination of project results (lead by CV REZ). The overall objective of WP5 is to produce a synthesis of the results achieved within all the WPs of SITEX-II together with an Action Plan that will set out the content and practical modalities of the future Expertise Function network. WP5 will also foster the interactions of SITEX-II with external entities and projects, as well as the dissemination of SITEX-II results so as to allow possible considerations from outside the project in the process of developing the future SITEX network.

WP6 - Management and coordination (lead by IRSN).

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Further details on the SITEX-II project and its outcomes are available at www.sitexproject.eu



ABSTRACT

The key objective of task 1.2 of SITEX-II WP1 is to identify plans for deploying actions fulfilling the needs identified in the SITEX-II SRA. Based on the JOPRAD Programme Document, the WPs currently considered in the EJP1 proposal development and the on-going European projects, SITEX-II has developed a first deployment plan for its SRA. This plan considers, for each SITEX-II SRA issue, the following possible options for the deployment of future activities:

- Consider the results of an on-going European project before starting new activities. This option is selected for the SRA issues associated to the on-going European projects listed in Table 4;
- Deploy activities through the EJP1. This option is selected for the SRA issues that currently enter in the scope of the envisaged EJP1 WPs (as presented during the first general meeting of the EJP1 proposal building phase on 18/10/2017);
- Deploy activities through the SITEX_Network. This option is considered for the SRA issues that currently do not enter, or partially enter, in the 2 previous options. The SRA issues that are currently candidates for a deployment through the future SITEX_network are summarized in Table 6, together with a short rationale.

The deployment plan is still preliminary and needs to be refined in the future, notably considering:

- the final EJP1 proposal that will be submitted in 2018 to the EC. For instance, the tasks of the envisaged RD&D and networking WPs are still being defined and the possible activities of the WP Knowledge Management still have to be defined;
- the future activities of existing projects and groups related to SITEX-II SRA issues (e.g. GEOSAF project, IGSC...) and led by organizations such as IAEA or NEA;
- the resources of the future SITEX_Network.



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List of abbreviations:

CS:	Civil Society
EC:	European Commission
EJP1:	European joint programme 1 (First implementation phase of the JP, 2019-2024)
JP:	Joint programme
PD:	Programme document
RD&D:	Research development and demonstration
RE:	Research entity
RWMD:	Radioactive waste management and disposal
SF:	Spent nuclear fuel
SRA:	Strategic research agenda
TSO:	Technical support organisation
WMO:	Waste management organisation
WP:	Work package



1 Context

One of the objectives of the SITEX-II WP 1 is to provide an input to the TSO working group of the European H2020 JOPRAD project [1]. The overall aims of the JOPRAD project are to assess the feasibility and, if appropriate, to generate a proposal for a future JP in the field of RWMD. The setting up of a JP in this field is promoted by the EC. The TSO working group of JOPRAD aims notably at identifying the key RD&D aspects that the expertise function could share with other actors (WMOs and REs) within the framework of a JP, as well as the conditions for preserving the independence of the organizations fulfilling an expertise function which would be involved in such a JP. In practice, these key RD&D aspects and conditions have been identified by the TSO working group of JOPRAD (deliverable 3.4 of JOPRAD [2]) notably based on the Strategic Research Agenda (SRA) of the expertise function developed within the SITEX-II WP1 (deliverable 1.1 of SITEX-II [3]). The WMO and RE working groups of JOPRAD have performed a similar work and have documented their conclusions in deliverables 3.3 [4] and 3.5 [5] of JOPRAD, respectively. These 3 deliverables of JOPRAD have contributed to setting the conditions for developing the JOPRAD PD (deliverable 4.2 [6]), setting out the RD&D priorities of common interest between all the JOPRAD participants and actor groups.

2 Objectives and strategy

The key objective of task 1.2 of SITEX-II WP1 is to identify plans for deploying actions fulfilling the needs identified in the SITEX-II SRA. A key conclusion of SITEX-II WP1 and the TSO working group of JOPRAD is that, if the conditions for preserving the independence of the organizations fulfilling an expertise function¹ are met², then all the activities and topics of the SITEX-II SRA could be implemented in the framework of a JP. Thus, there are a priori no SITEX-II SRA topics that should be addressed exclusively outside the framework of the JP. This is an advantage for TSOs as implementing R&D projects through the JP will allow notably to benefit from an EC co-funding and from the knowledge and expertise of other entities. To reach the objective of Task 1.2 of SITEX-II WP1, the following strategy was followed:

1. Verify that all SITEX-II SRA issues are in the scope of the JOPRAD PD;
2. Identify the common level of priority (High, Medium or Low) of the JOPRAD PD subdomains corresponding to the SITEX-II SRA issues;
3. Identify the on-going European projects entering in the scope of the SITEX-II SRA issues;
4. Considering the results of steps 1. to 3., establish the view of SITEX-II on the SITEX-II SRA issues (having a Medium or a High common priority in the JOPRAD PD and not entering in the scope of on-going European projects) that could be covered by the EJP1;

¹ Independence between the missions (i) of the organizations fulfilling an expertise function (e.g. TSOs providing a technical support to nuclear regulatory authorities) and (ii) the organizations fulfilling an implementing function (e.g. WMOs implementing geological disposal solutions).

² These conditions were established in the framework in task 1.2.1 of SITEX-II WP1 and task 3.2 (TSO working group) of the JOPRAD project. They are documented in §7 of the SITEX-II SRA and in §7 of the JOPRAD deliverable 3.4.



5. This view will be compared to those of the WMOs and the REs by the Core Group facilitating and coordinating the EJP1 proposal development. Based on that comparison, the Core Group will identify a list of possible EJP1 WPs;
6. Considering the results of the previous steps, associate each SITEX-II SRA issue to one or several of the following possible deployment options:
 - wait for the results of on-going European projects associated with the SRA issue before to start new activities ;
 - deploy activities through an EJP1 WP ;
 - deploy activities through the SITEX_Network.

The results of the 2 first steps of this strategy are presented in the section 3 of this deliverable. The results of steps 3 and 4 are presented in the section 4 and those of steps 5 and 6 are presented in section 5.

3 SITEX-II SRA issues associated to JOPRAD PD subdomains and their levels of common priority

SITEX-II WP1 has verified that all issues of the SITEX-II SRA are covered by the JOPRAD PD subdomains (step 1 of the strategy presented in section 2). This verification is presented in Appendix 1, where for each SITEX-II SRA issue, the corresponding JOPRAD PD subdomains are given, as well as their levels of common priority defined in JOPRAD (step 2 of the strategy presented in section 2). A synthesis is presented in Table 1, Table 2 and Table 3. The main results of this verification are the following:

- All SITEX-II SRA issues have corresponding subdomains in the JOPRAD PD.
- As shown in Table 1, the vast majority of the SITEX-II SRA issues for which a common interest in RD&D activities was identified have a High or a Medium level of common interest in the JOPRAD PD. For instance, among the 17 SITEX-II SRA RD&D issues:
 - 8 have corresponding JOPRAD subdomains with a High level of common interest;
 - 3 have corresponding JOPRAD subdomains with both High and Medium levels of common interest;
 - 4 have corresponding JOPRAD subdomains with a Medium level of common interest;
 - 2 have corresponding JOPRAD subdomains with a Low level of common interest.
- As shown in Table 2, several SITEX-II SRA issues for which a common interest only in horizontal activities was identified have a High or a Medium level of common interest in the JOPRAD PD. For instance, among the 19 SITEX-II SRA R&D issues:
 - 5 have corresponding JOPRAD subdomains with a High level of common interest;
 - 2 have corresponding JOPRAD subdomains with High, Medium and/or Low levels of common interest;
 - 6 have corresponding JOPRAD subdomains with a Medium level of common interest;
 - 6 have corresponding JOPRAD subdomains with a Low level of common interest.



- As shown in Table 3, the examples of topics of the SITEX-II SRA for which technical aspects could be investigated in an integrated manner with social and citizen sciences aspects are of Medium or Low level of common interest or not covered by the JOPRAD PD.

Table 1: issues of the SITEX-II SRA for which a common interest in RD&D activities was identified and the level of common priority of their corresponding subdomains in the JOPRAD PD (H, M and L stand respectively for High, Medium and Low priorities).

SITEX-II SRA Issues for which a common interest in RD&D activities was identified			Priority of corresponding subdomains in JOPRAD PD
Main topic	Issue	Description	
1	3	Understanding of the release processes and speciation of the radionuclides for different types of wastes.	H/M
2	1	Oxidative transient	L
	2	Chemical conditions induced by metallic and/or cement materials and components	H
	3.1	Generation processes and rates of safety-relevant gases other than H ₂	H
	3.2	Influence of gas on geochemistry and microbial activity in HR and EBS	H
	3.3	Gas migration through EDZ and EBS.	H
3	1	Heterogeneous behaviour of bentonite components	H
	2	Behaviour of metallic components	H
	3	Behaviour of cementitious components	H/M
4	1	Competition between sorption of radionuclides and other elements from EBS/Waste	M
	2	Influence of organic matter on radionuclide migration	M
	3	Influence of the thermal transient on RN migration in EBS and HR	M
	4	Influence of microbial activity on RN migration	H
	5	Transport of volatile radionuclides in the disposal system	M
5	1	Efficiency of the monitoring system over the operational period	H/M
	2	Assessment of the risk of fire and explosion	L
8 ³	1	Integrity of dry casks for spent fuel storage	H

³ This Main Topic is not included in the SITEX-II SRA but was of common interest in the JOPRAD TSO Working Group.



Table 2: issues of the SITEX-II SRA for which a common interest only in horizontal activities was identified and the level of common priority of their corresponding subdomains in the JOPRAD PD (H, M and L stand respectively for High, Medium and Low priorities).

Main topic	SITEX-II SRA Issues for which a common interest only in horizontal activities was identified		Priority of corresponding subdomains in JOPRAD PD
	Issue	Description	
1	1	Uncertainty about databases and methodologies used for defining waste inventories (including historical waste)	H
	2	Evolution of the waste inventory due to possible neutron activation	L
	4	Waste acceptance criteria	M
2	4	Co-disposal of waste: interactions between different types of wastes	L
5	3	Assessment of the risk of flooding	L
	4	Influence on long term safety of pre-closure disturbances	M
6	1	Uncertainties associated with site characteristics	H
	2	Management of uncertainties associated with geodynamics and tectonic movements	M
	3	General methodologies for the safety assessment	M
	4	Safety assessment models	H/M/L
7	1	Methods to review the safety case	M
	2	Assessment of the technical feasibility of a geological disposal concept	H/L
	3	Evolution of the safety case content with the lifecycle of the disposal programme	M
	4	Organization of the pre-licensing phase	L
	5	Reversibility and Retrievalability	L
8 ³	1.1	Monitoring and assessing the state of the waste package and the state of the waste form in storage conditions	H
	1.2	Consequences on safety of the ageing of the waste and consequences of the uncertainty about the actual state of the waste after a long storage period	H
	1.3	Determination in which circumstances a re-processing of the waste should be performed and what type of re-processing is appropriate	L
	2	Safety of storage facilities awaiting the availability of geological disposal	H



Table 3: example of topics in the SITEX-II SRA for which a common interest in R&D activities integrating technical and social and citizen sciences aspects was identified and the level of common priority of their corresponding subdomains in the JOPRAD PD (M and L stand respectively for Medium and Low priorities).

SITEX-II SRA examples of topics for which a common interest in R&D activities integrating technical and social and citizen sciences was identified			Priority of corresponding subdomains in JOPRAD PD
Main topic	Topic Example	Description	
7	1	Application of the optimization of the radiation protection principle	L
	2	License of disposal operation	Not included
	3	Conditions for closure	Not included
	4	Site selection process	M
	5	Safety culture in the context of geological disposal	To be investigated via cross cutting theme 1 "Safety Culture"
	6	Intergenerational governance of the operational phase	Not included

From this analysis, SITEX-II WP1 concludes the following:

- the JOPRAD PD globally well consider the needs of the expertise function identified in the SITEX-II SRA and the deliverable 3.4 of JOPRAD.
- It is found that several SITEX-II SRA issues for which a need in RD&D or horizontal activities was identified correspond to JOPRAD PD subdomains with a High or a Medium level of common priority. These issues are thus in good position to be addressed in EJP1.
- The following issues correspond to JOPRAD PD subdomains with a Low common priority and are thus not expected to be covered in EJP1. If organisations with an expertise function want to undertake actions corresponding to these issues in the coming years, they would thus have to be deployed in another framework (e.g. within the SITEX_Network⁴):

Issues related to R&D activities

- Main Topic 2 – Issue 1: Oxidative transient
- Main Topic 5 – Issue 2: Assessment of the risk of fire and explosion

Issues related only to horizontal activities

- Main Topic 1 – Issue 2: Evolution of the waste inventory due to possible neutron activation
- Main Topic 2 – Issue 4: Co-disposal of waste: interactions between different types of wastes

⁴ One of the objectives of SITEX-II (in particular if SITEX-II WP5) is to prepare the setting up of a network that will fulfill the functions identified in the former SITEX project and tested within SITEX-II. This network would be named SITEX_Network.



- Main Topic 5 – Issue 3: Assessment of the risk of flooding
- Main Topic 7 – Issue 4: Organization of the pre-licensing phase
- Main Topic 7 – Issue 5: Reversibility and Retrievability
- Main Topic 8 – Issue 1.3: Determination in which circumstances a re-processing of the waste should be performed and what type of re-processing is appropriate
- Although SITEX-II has recognized in its SRA the importance of considering social and citizen science aspects in future research projects or activities, in the JOPRAD PD there is a low or no interest in the SITEX-II SRA specific examples of topics integrating these aspects. It seems thus unexpected that these specific examples will be covered in EJP1. If organizations with an expertise function want to undertake actions corresponding to these specific topic examples in the coming years, they will thus have to be deployed in another framework (e.g. within the SITEX_Network). This will have to be evaluated further when the EJP1 proposal, and more particularly its foreseen WP for interacting with the CS, will be further developed.

4 Views of SITEX-II on the SITEX-II SRA issues that could be covered by EJP1

As explained in the previous section, all SITEX-II SRA issues corresponding to subdomains of the JOPRAD PD with a High or Medium level of common priority could be covered by EJP1. Several of these SRA issues are in the scope of on-going European projects (as shown in Table 4).

Table 4: On-going EC projects entering in the scope of SITEX-II SRA.

EC Project (on going or future)	Dates	Related SITEX-II SRA Main Topic - Issue
CAST: Carbon-14 Source Term	Until 31/03/2018	2 - 3.1
CEBAMA: Cement-based materials, properties, evolution, barrier functions	Until 31/05/2019	3 - 3
MIND: Microbiology In Nuclear waste Disposal	Until 31/05/2019	2 -3.2 4 -4
MODERN2020: Development and Demonstration of monitoring strategies and technologies for geological disposal	Until 31/05/2019	5 - 1
CHANCE: Characterization of conditioned nuclear waste for its safe disposal in Europe	From June 2017 Until 2021	1 - 1
THERAMIN: Thermal treatment for radioactive waste minimisation and hazard reduction	From June 2017 Until 2020	1 - 4
DISCO: Modern Spent Fuel Dissolution and Chemistry in Failed Container Conditions	From June 2017 Until 2021	1 - 3
BEACON: Bentonite Mechanical Evolution	From June 2017 Until 2021	3 - 1



For these specific SRA issues, it does not seem relevant to start in EJP1 new large RD&D activities, as an evaluation of the outcomes of these on-going European projects will not be possible before the start of the proposal development for EJP1. However, if a common (WMOs, TSOs and REs) interest exists in specific aspects connected to these SITEX-II SRA issues which are not covered by the on-going European projects in Table 4, they could give rise to new (or be combined to new) activities in EJP1. Considering the SITEX-II SRA, the prioritization in the JOPRAD PD (see in section 3), the relevant on-going European projects (see Table 4), as well as the need for embedding all types of actors (including the Civil Society) in EJP1, SITEX-II supports the development of new activities in EJP1 on the themes listed in Table 5.

Table 5: themes supported by SITEX-II for new R&D projects within EJP1 (input sent in March 2017 to the Core Group facilitating and coordinating EJP1 proposal development).

	Themes for new RD&D activities in EJP1	Associated SITEX-II SRA Main Topic - Issues
1	Metallic component behaviour along the stages of storage and disposal programmes	2 - 2 3 - 2 8 - 1
2	Gas migration	2 - 3.2 2 - 3.3 4 - 5
3	Radionuclide migration within disturbed EBS and HR	4 - 1 4 - 2 4 - 3
4	Conditions for closure	6 - all
5	Management of uncertainties	7 - all

These 5 themes, described in more detail in the following sections (based notably on the SITEX-II SRA), were proposed in March 2017 to the Core Group facilitating and coordinating the development of a proposal for EJP1. The themes 1 to 3 correspond to SITEX-II SRA issues for which a common interest was mainly identified in RD&D activities. In EJP1 they could thus give rise to shared RD&D activities, including processes of “knowledge sharing and interpretation” (KSI) with the CS (based on the model described in section 6 “Socio-Political Cross-Cutting Themes” of the JOPRAD PD). The themes 4 and 5 correspond to SITEX-II SRA issues for which an interest was identified mainly in horizontal activities. These themes could be transversal and could give rise to multidisciplinary activities, involving technical and social/citizen sciences, and gathering all types of actors (i.e. including Civil Society).



4.1 METALLIC COMPONENT BEHAVIOUR ALONG THE STAGES OF STORAGE AND DISPOSAL PROGRAMMES

- Behaviour during storage: consequences on safety of the ageing of metallic waste packages and consequences of the uncertainty about the actual state of waste packages after a long storage period (impacts on the safety of the storage facility and on the transportation of the waste, impacts on the safety of the future disposal).
- Behaviour during disposal:
 - Study of metal corrosion (e.g. steel, copper) in repository conditions and its impact on canister lifetime;
 - chemical transients caused by the degradation of metallic materials and their impact on other coupled processes.

4.2 GAS MIGRATION

Although considerable amount of work has been carried out on this theme (in particular in the past FORGE EC project), new projects could investigate the following issues that have not been addressed or only partially addressed up to now:

- Influence of gas on geochemistry, and associated impact on radionuclide transport;
- Processes driving gas migration through EDZ and EBS, associated in particular with possible saturation levels and scenarios of bentonite evolution or with other perturbations such as alkaline plume.

4.3 RADIONUCLIDE MIGRATION THROUGH DISTURBED EBS AND HR

- Impact of organic matter on radionuclide migration (the former CORI proposal in which TSOs were notably interested could be implemented within an EJP1);
- Impact of products from EBS/waste degradation on radionuclide migration (e.g. competition between radionuclides and other metal elements);
- Impact of temperature on EBS/HR migration properties.

4.4 CONDITIONS FOR CLOSURE

- Determining the influence of THMC processes on the effective closure (e.g. performance on the long term of plugs and seals made at a real scale) ;
- Examining the criteria on which a partial or full closure could be decided: technical (e.g. surveillance strategy and methods) and socio-political criteria used to assess the assets and drawbacks of the possible strategies for closure (partial, full, gradual approach), implications of requirements regarding reversibility and retrievability;



- Identifying the conditions required to implement the closure on the basis of the analysis of the above criteria, in terms of pluralist expertise and governance scheme involving the various stakeholders in the decision making process.

4.5 MANAGEMENT OF UNCERTAINTIES

Projects in this theme could be a follow-up of the former EC-FP6-PAMINA project and investigate:

- The scientific methodologies for treating uncertainties (e.g. data on site characterization, on waste inventories, ...)
- How to manage uncertainties in the safety case and along the decision-making process associated to the disposal programme.

5 Plans for the deployment of actions covering the SITEX-II SRA issues

Considering the 5 themes proposed by SITEX-II for new activities in EJP1 (see in Table 5), and considering the views of WMOs and REs, the following possible EJP1 Work Packages were identified by the Core Group facilitating and coordinating the EJP1 proposal development (possible WP of the EJP1 associated to Knowledge Management activities⁵ are still to be identified by the JP mandated actors). This list of WPs is the situation on December 2017 and could still change before the submission of the EJP1 proposal.

RD&D activities

1. Modelling of process couplings and numerical tools applied to Performance Assessment
2. Assessment of chemical evolution of ILW and HLW disposal cells
3. Mechanistic understanding of gas migration (mainly in clay-based materials)
4. Influence of temperature on clay-based material behaviour
5. Cement-Organics-Radionuclide-Interactions
6. Fundamental understanding of radionuclide mobility
7. Spent Fuel characterization and evolution until disposal

Networking activities

1. Waste management routes in Europe from cradle to grave
2. Understanding of uncertainty, risk and safety by different actors

⁵ Related to developing training, guidance's, states of knowledge.



Based on this information, SITEX-II has developed a first deployment plan for its SRA. This plan is presented in Appendix 2 and considers, for each SITEX-II SRA issue, the following possible options for the deployment of future activities:

- Consider the results of an on-going European project before starting new activities. This option is selected for the SRA issues associated to the on-going European projects listed in Table 4;
- Deploy activities through the EJP1. This option is selected for the SRA issues that currently enter in the scope of the envisaged EJP1 WPs (as presented during the first general meeting of the EJP1 proposal building phase on 18/10/2017);
- Deploy activities through the SITEX_Network. This option is considered for the SRA issues that currently do not enter, or partially enter, in the 2 previous options. The SRA issues that are currently candidates for a deployment through the future SITEX_network are summarized in Table 6, together with a short rationale.

The deployment plan is still preliminary and needs to be refined in the future, notably considering:

- the final EJP1 proposal that will be submitted in 2018 to the EC. For instance, the tasks of the envisaged RD&D and networking WPs are still being defined and the possible activities of the WP Knowledge Management still have to be defined;
- the future activities of existing projects and groups related to SITEX-II SRA issues (e.g. GEOSAF project, IGSC...) and led by organizations such as IAEA or NEA;
- the resources of the future SITEX_Network.



Table 6: SITEX-II SRA issue candidates for a deployment through the SITEX_Network

SITEX-II SRA Issues candidate for a deployment through the SITEX_Network			Explanation
Main topic	Issue	Description	
1	2	Evolution of the waste inventory due to possible neutron activation	Not covered by on-going EC projects and Low common priority in the JOPRAD PD.
2	1	Oxidative transient	This issue has a Low common priority in the JOPRAD PD but could be (at least partly) covered by the RD&D WP #2.
	4	Co-disposal of waste: interactions between different types of wastes	Not covered by on-going EC projects and Low common priority in the JOPRAD PD.
3	2	Behaviour of metallic components	This issue could be partly covered by the R&D WP #2 of EJP1. However, the following specific points mentioned in the SITEX-II SRA would not be covered: <ul style="list-style-type: none"> • Study of metal (e.g. steel, copper) corrosion in repository conditions or of canister design lifetime. • Exchanging on container design and manufacturing issues (e.g. modelling codes and standards and QA/QC programs and procedures for container design and manufacturing)
4	1	Competition between sorption of radionuclides and other elements from EBS/waste	Not covered by on-going EC projects and do not seem to be covered by RD&D WP #6 of EJP1.
5	2	Assessment of the risk of fire and explosion	Not covered by on-going EC projects and Low common priority in JOPRAD PD.
	3	Assessment of the risk of flooding	
5	4	Influence on long term safety of pre-closure disturbances	Not covered by on-going EC projects and by current Networking WP of EJP1.
6	3	General methodologies for the safety assessment	Not covered by on-going EC projects and not fully covered by the Networking WP #2 of EJP1 (only the aspects related to uncertainty management will enter the scope of this WP).
7	all	Lifecycle of a disposal programme and its safety case	Not covered by on-going EC projects and not fully covered by the Networking WP #2 of EJP1 (only the aspects related to uncertainty management will enter the scope of this WP).
8	all	Pre-disposal radioactive waste and spent fuel management	Not covered by on-going EC projects and not fully covered by the Networking WP #1 and #2 of EJP1 (in WP#2 only the aspects related to uncertainty management will be covered).



6 References

- [1] EC H2020 Coordination and Support Action JOPRAD “Towards a Joint Programming on Radioactive Waste Disposal”, <http://www.joprad.eu>
- [2] “Aspects of the SITEX SRA to be included in a JP”, JOPRAD Deliverable 3.4, January 2017
- [3] “Strategic Research Agenda of the expertise function in the field of geological disposal of radioactive waste”, SITEX-II Deliverable 1.1, January 2017
- [4] “Aspects of the IGD-TP to be included in Joint Programming on Radioactive Waste Disposal”, JOPRAD Deliverable 3.3, January 2017
- [5] “Aspects of the SRA of research entities to be included in a JP”, JOPRAD Deliverable 3.5, January 2017
- [6] “Programme Document – The Scientific and Technical Basis of a Future Joint Programme on Radioactive Waste Management and Disposal”, JOPRAD Deliverable 4.2, Version 2, November 2017



7 Appendices

APPENDIX 1: SITEX-II SRA ISSUES IN THE JOPRAD PROGRAMME DOCUMENT AND THEIR LEVELS OF PRIORITY.

For each SITEX-II SRA issue, the Table on the following pages identifies the corresponding subdomains of the JOPRAD Programme Document (version 2, 29/11/2017).

The legend used in the table is the following.

- Horizontal Activities :
 - EP: Exchanges on Practices
 - SA: Establish States of the Art
 - TK: Perform Transfer of Knowledge
- Levels of Priority
 - H : High
 - M : Medium
 - L : Low



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SITEX SRA Main topics and issues						Corresponding JOPRAD Programme Document subdomains				
#	Description	R&D activity	Horizontal activity			#	Description	Priority	R&D activity	TK
			EP	SA	TK					
Main Topic 1: Waste inventory and source term										
#1.	Uncertainty about databases and methodologies used for defining waste inventories (including historical waste)					1.1.1	Inventory Uncertainty	H		
#2.	Evolution of the waste inventory due to possible neutron activation					3.6	Evolution of Waste Inventory	L		
#3.	Understanding of the release processes and speciation of the radionuclides for different types of wastes					1.1.4	Radionuclide Release from Wasteforms other than Spent Fuel	H		
						1.1.9	Spent-Fuel Evolution	M		
#4.	Waste acceptance criteria					2.1.6	Waste Acceptance Criteria	M		
Main Topic 2: Transient THMBC conditions in the near-field										
#1.	Oxidative transient					2.2.3	Oxidative Transients	L		
#2.	Chemical conditions induced by metallic and/or cement materials and components					1.3.5	Metallic & Cementitious Chemical Perturbations	H		
#3.	Transients associated with gas production and migration									
#3.1	Generation processes and rates of safety-relevant gases other than H ₂					1.4.2	Gas Generation Processes	H		
#3.2	Influence of gas on geochemistry and microbial activity in HR and EBS					1.5.5	Effects of Microbial Perturbations on Radionuclide Migration	H		
						1.3.2	Microbial Influence on Gas Generation	H		
						1.4.4	Gas Reactivity	H		
#3.3	Gas migration through EDZ and EBS					1.4.1	Gas Migration through the Excavated Disturbed Zone/EBS and Far-Field	H		
#4.	Co-disposal of waste: interactions between different types of wastes					1.3.8	Co-disposal Interactions	L		
						3.12	Co-disposal Interactions	L		
Main Topic 3: Evolution of EBS material properties										
#1.	Heterogeneous behaviour of bentonite components					1.3.1	Bentonite and other Clay Based Components	H		
#2.	Behaviour of metallic components					1.3.5	Metallic & Cementitious Chemical Perturbations;	H		
#3.	Behaviour of cementitious components					1.3.3	Cementitious Component Behaviour	H		
						1.3.4	Low pH Cements	M		



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Main Topic 4: Radionuclide behaviour in disturbed EBS and HR									
#1.	Competition between sorption of radionuclides and other elements from EBS/waste				1.5.2	Sorption, Site Competition, Speciation and Transport	M		
#2.	Influence of organic matter on radionuclide migration				1.5.6	Organic-Radionuclide Migration	M		
#3.	Influence of the thermal transient on RN migration in EBS and HR				1.5.7	Temperature Influence on Radionuclide Migration	M		
#4.	Influence of microbial activity on RN migration				1.5.5	Effects of Microbial Perturbations on Radionuclide Migration	H		
#5.	Transport of volatile radionuclides in the disposal system				1.5.11	Transport of volatile radionuclides	M		
Main Topic 5: Safety relevant operational aspects									
#1.	Efficiency of the monitoring system over the operational period				2.5.1	Operational Monitoring Strategies; and Post-closure	H		
					2.5.2	Monitoring Strategies for closure and Post-closure	M		
					2.5.3	Monitoring Technologies;	H		
#2.	Assessment of the risk of fire and explosion				2.4.1	Fire and Explosion Assessment	L		
#3.	Assessment of the risk of flooding				2.4.2	Flooding Risk Assessment	L		
#4.	Influence on long term safety of pre-closure disturbances				2.1.1	Pre-closure disturbances	M		
Main Topic 6: Managing uncertainties and the safety assessment									
#1.	Uncertainties associated with site characteristics				3.1	Site Uncertainty Treatment	H		
#2.	Management of uncertainties associated with geodynamics and tectonic movements				1.6.2	Geological Uncertainties	M		
#3.	General methodologies for the safety assessment				2.1.2	Assessment Methodologies	M		
#4.	Safety assessment models				2.3.1	Performance Assessment Tools	M		
					2.3.2	Open-source Performance Assessment Code;	L		
					2.3.3	Long-range Transport Models;	M		
					2.3.4	Multi-scale Reactive Transport Models;	H		
					2.3.5	Upscaling in Support of Performance Assessment	M		
					2.3.6	Heterogeneity	M		
					2.2.6	Biosphere Models.	M		



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Main Topic 7: Lifecycle of a disposal programme and its safety case									
#1.	Methods to review the safety case				3.9	Safety Case Guidelines, Management & Review	M		
#2.	Assessment of the technical feasibility of a geological disposal concept				2.5.3	Monitoring Technologies;	H		
					2.5.4	Retrievability;	L		
					2.5.5	Concept & Design Adaptation;	L		
					2.5.7	Industrialization.	L		
					3.8	Concept Adaptation and Optimisation	L		
					3.17	Reversibility	L		
#3.	Evolution of the safety case content with the lifecycle of the disposal programme				3.9	Safety Case Guidelines, Management & Review	M		
#4.	Organization of the pre-licensing phase				3.11	Pre-licensing Management	L		
#5.	Reversibility and Retrievability				2.5.4	Retrievability	L		
					3.17	Reversibility	L		
<i>Examples of topics for which technical and societal aspects could be investigated:</i>									
	Application of the optimization of the radiation protection principle				3.13	Radiation Protection Optimisation Principle	L		
	License of disposal operation				Not included in the Programme Document.				
	Conditions for closure				Not included in the Programme Document.				
	Site selection process				3.3	Site Selection Process	M		
	Safety culture in the context of geological disposal				Socio-Political Cross-Cutting Theme 1: Safety Culture				
	Intergenerational governance of the operational phase				Not included in the Programme Document.				
Main Topic 8: Pre-disposal radioactive waste and spent fuel management *									
#1.	Ageing of waste in storage conditions								
#1.1	Monitoring and assessing the state of the waste package and the state of the waste form in storage conditions				1.2.2	Impact of Extended Storage on Waste Packages	H		
#1.2	Consequences on safety of the ageing of the waste and consequences of the uncertainty about the actual state of the waste after a long storage period				1.2.2	Impact of Extended Storage on Waste Packages	H		
#1.3	Determination in which circumstances a re-processing of the waste should be performed and what type of re-processing is appropriate				1.2.4	Re-working of Damaged and Aged Waste Packages	L		
#1.4	Integrity of dry casks for spent fuel storage: stability in terms of ageing effects of the cask and the spent fuel over prolonged interim storage time				1.2.2	Impact of Extended Storage on Waste Packages	H		
#2.	Safety of storage facilities awaiting the availability of geological disposal				2.4.5	Interim Storage Facility Safety	H		
* This Main Topic is not included in the SITEX-II SRA but was of common interest in the JOPRAD TSO Working Group.									



APPENDIX 2: PLAN FOR THE DEPLOYMENT OF SITEX-II SRA

The table on the following pages identifies the current possible plans for the deployment of actions associated to each SITEX-II SRA issue. These plans will have to be refined in the future, especially when the scope of the EJP1 activities will be finalized.

The legend used in the table is the following.

- Horizontal Activities :
 - EP: Exchanges on Practices
 - SA: Establish States of the Art
 - TK: Perform Transfer of Knowledge
- R&D WP of EJP 1 (WP #)
 1. Modelling of process couplings and numerical tools applied to Performance Assessment
 2. Assessment of chemical evolution of ILW and HLW disposal cells
 3. Mechanistic understanding of gas migration (mainly in clay-based materials)
 4. Influence of temperature on clay-based material behaviour
 5. Cement-Organics-Radionuclide-Interactions
 6. Fundamental understanding of radionuclide mobility
 7. Spent Fuel characterization and evolution until disposal
- Networking WP of EJP1 (WP #)
 1. Waste management routes in Europe from cradle to grave
 2. Understanding of uncertainty, risk and safety by different actors

Concerning the EJP1 Knowledge Management WP, at this stage of the EJP1 proposal development, the identification by the mandated actors of the activities of this WP is still pending. In the following table, the column related to this EJP1 WP represents thus a first view of SITEX-II and was completed in a grey colour (i.e. a different colour than the one used for the RD&D and the Networking WPs) , considering:

- The SRA issues that are associated to JOPRAD PD subdomains with a M or a H common priority;
- The SRA issues that are not or not fully covered by the current other WPs of the EJP1 and by other European projects.



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SITEX SRA Main topics and issues					Possible Deployment Plan					
#	Description	R&D activity	Horizontal activity			Wait results of on-going EC Project	Candidate for deployment in EP1 Phase 1			Candidate for deployment in SITEX_Network
			EP	SA	TK		R&D WP #	Networking WP #	Knowledge Management WP **	
Main Topic 1: Waste inventory and source term										
#1.	Uncertainty about databases and methodologies used for defining waste inventories (including historical waste)					CHANCE Project		WP # 1 & 2		
#2.	Evolution of the waste inventory due to possible neutron activation									
#3.	Understanding of the release processes and speciation of the radionuclides for different types of wastes					DISCO Project	WP # 5 WP # 7	WP # 2		
#4.	Waste acceptance criteria					THERAMIN Project		WP # 1		
Main Topic 2: Transient THMBC conditions in the near-field										
#1.	Oxidative transient									
#2.	Chemical conditions induced by metallic and/or cement materials and components						WP # 2	WP # 2		
#3.	Transients associated with gas production and migration									
#3.1	Generation processes and rates of safety-relevant gases other than H ₂					CAST Project				
#3.2	Influence of gas on geochemistry and microbial activity in HR and EBS					MIND Project	WP # 3			
#3.3	Gas migration through EDZ and EBS						WP # 3	WP # 2		
#4.	Co-disposal of waste: interactions between different types of wastes									
Main Topic 3: Evolution of EBS material properties										
#1.	Heterogeneous behaviour of bentonite components					BEACON Project				
#2.	Behaviour of metallic components						WP # 2			
#3.	Behaviour of cementitious components					CEBAMA Project	WP # 2			
Main Topic 4: Radionuclide behaviour in disturbed EBS and HR										
#1.	Competition between sorption of radionuclides and other elements from EBS/waste						WP # 6			
#2.	Influence of organic matter on radionuclide migration						WP # 5	WP # 2		
#3.	Influence of the thermal transient on RN migration in EBS and HR						WP # 6	WP # 2		
#4.	Influence of microbial activity on RN migration					MIND Project				
#5.	Transport of volatile radionuclides in the disposal system						WP # 3	WP # 2		



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Main Topic 5: Safety relevant operational aspects								
#1.	Efficiency of the monitoring system over the operational period			MODERN2020 Project				
#2.	Assessment of the risk of fire and explosion							
#3.	Assessment of the risk of flooding							
#4.	Influence on long term safety of pre-closure disturbances							
Main Topic 6: Managing uncertainties and the safety assessment								
#1.	Uncertainties associated with site characteristics					WP # 2		
#2.	Management of uncertainties associated with geodynamics and tectonic movements					WP # 2		
#3.	General methodologies for the safety assessment					WP # 2		
#4.	Safety assessment models				WP # 1	WP # 2		
Main Topic 7: Lifecycle of a disposal programme and its safety case								
#1.	Methods to review the safety case							
#2.	Assessment of the technical feasibility of a geological disposal concept							
#3.	Evolution of the safety case content with the lifecycle of the disposal programme					WP # 2		
#4.	Organization of the pre-licensing phase							
#5.	Reversibility and Retrievability							
Main Topic 8: Pre-disposal radioactive waste and spent fuel management *								
#1.	Ageing of waste in storage conditions							
#1.1	Monitoring and assessing the state of the waste package and the state of the waste form in storage conditions					WP # 2		
#1.2	Consequences on safety of the ageing of the waste and consequences of the uncertainty about the actual state of the waste after a long storage period					WP # 2		
#1.3	Determination in which circumstances a re-processing of the waste should be performed and what type of re-processing is appropriate							
#1.4	Integrity of dry casks for spent fuel storage: stability in terms of ageing effects of the cask and the spent fuel over prolonged interim storage time					WP # 2		
#2.	Safety of storage facilities awaiting the availability of geological disposal					WP # 2		
<p>* This Main Topic is not included in the SITEX-II SRA but was of common interest in the JOPRAD TSO Working Group. ** These activities are not identified yet in the current EJP1 proposal development phase. This column represent thus a first view of SITEX and not a common position between EJP1 mandated actors.</p>								