



SUSTAINABLE NETWORK FOR INDEPENDENT TECHNICAL EXPERTISE OF RADIOACTIVE WASTE DISPOSAL

INTERACTIONS AND IMPLEMENTATION

PROJECT SUMMARY

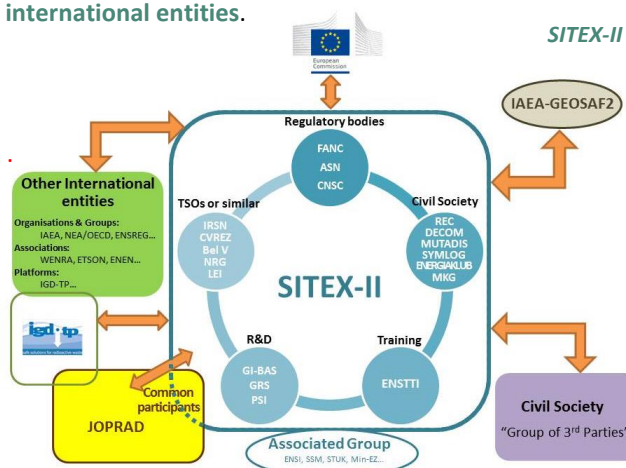
The coordination action SITEX-II was initiated in 2015 within the EC programme Horizon 2020, aiming at practical implementation of the activities defined by the EURATOM FP7 SITEX project (2012–2013), using the interaction modes identified by that project. The network is expected to ensure a sustainable capability for developing and coordinating, at the international level, joint and harmonized activities, necessary for the technical review of a safety case for deep geological disposal of radioactive waste (GD). SITEX-II ends this month; it involved various activities prefiguring those of the SITEX_Network, among which :

A COMMON VISION OF THE EXPERTISE FUNCTION

SITEX-II brings together representatives from 18 organisations involving regulatory authorities (FANC, ASN, CNSC), technical support organisations (Bel V, CVREZ, IRSN, NRG, GRS, DECOM), research organisations (GI-BAS, PSI, LEI), specialists in risk governance and interaction with general public, including NGOs (MUTADIS, ENERGIACLUB, MKG, REC, SYMLOG) and the education institute (ENSTTI)

- **defining the Strategic Research Agenda (SRA)** based on the common R&D orientations defined by SITEX, defining the ToR for the implementation of specific topics from the SRA, and **interacting with IGD-TP and other external entities mandated through the JOPRAD EU project** to implement research on radioactive waste disposal regarding the **potential setting up of an European Joint Programming on radioactive waste disposal**;
- **producing a guidance on the technical review** of the safety case at its different phases of development, fostering a common understanding on the interpretation and proper implementation of safety requirements for developing, operating and closing a GD and on the verification of compliance with these requirements; such activity is carried out **in link with other international entities (notably IAEA, NEA and WENRA) or projects (such as GEOSAF)**;
- **developing a training module for generalist experts** involved in the safety case review process, including the implementation a pilot training session; this activity accounts for the existing training programs performed by **international entities such as ENSTTI (SITEX-II partner), ENEN or IAEA**;
- **developing interactions between experts and Civil Society (CS) along the SITEX-II project**, in the definition of the aforementioned SRA, in the reflection regarding the review work, close interactions allowing enhancing a mutual understanding and sharing elements of safety culture and more globally, in the definition of governance patterns including CS in the framework of RWM and geological disposal; for that, the CS experts partners of SITEX-II interacted with **a larger group of CSO representatives**;
- disseminating and communicating SITEX-II outcomes, and more generally the concepts and approaches for the foreseen SITEX network, to **national and international entities**.

SITEX-II composition and interactions with external entities



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Within the SITEX-II project, one Task of Work Package 2 (WP2) aims at sharing national experience and prospective views on the interpretation and implementation of selected safety requirements and recommendations. Among the topics identified according to the priorities set up in the former SITEX project, four topics have been selected for the SITEX-II project:

- Optimisation of protection,
- Waste Acceptance Criteria,
- Operational issues in regards to post-closure safety,
- Programme for site characterization.

The discussions allowed developing a common understanding by SITEX-II regulators and Technical Support Organisations (TSOs) on these topics and were summarised in position papers. Hereafter a focus is given on the main message of the position paper dealing with the issue on optimisation of radiological protection applied to a geological repository for radioactive waste.



FOCUS ON OPTIMISATION OF RADIOLOGICAL PROTECTION APPLIED TO THE DEVELOPMENT AND IMPLEMENTATION OF A GEOLOGICAL DISPOSAL

The role and responsibilities of both the regulator and the disposal facility operator within the step wise process of a disposal radiological optimisation has to be clearly dedicated/defined. The expertise function delivered by the Regulatory Body (formed by the regulator itself and/or its TSO) must assess the implementation of the optimisation principle and associated requirements throughout the disposal development process and beyond. In particular, it is important that the safety case shows that the principle of optimisation has been addressed in relevant choices and decisions on the disposal system. Whenever desirable, the regulatory body shall perform its own studies on key elements of the safety case, in order to assess the implementation of the optimisation principle.

The optimisation of radiological protection in the sense of ICRP definition is a process which consists of the identification and use of safety criteria/attributes necessary to select the best protective options under prevailing circumstances. The output of this process is seen as an important issue related to the whole lifecycle of waste management including the development of a geological disposal facility and its safety case. Though the optimisation principle applies both for operational and long term phases, the long term aspects of a disposal safety case are significantly different from those of other nuclear facilities. In fact, optimisation of long term radiological protection requires taking into account uncertainties regarding doses and risks for the very long term. This can be achieved in practice by incorporating in the stepwise evolution of the safety case an ongoing questioning on the performance and the robustness of the repository components, which in turn calls for the optimisation of the whole disposal system to deliver the safety functions in the long term. As a consequence, both operational and long term radiological protection have to be optimised from early phases and across the full lifecycle of the geological disposal, and balanced as a whole. Impacts on each other have to be duly considered and assessed at every step of the way.

Optimisation includes both qualitative and quantitative judgements. Therefore, an open dialogue between the implementer and the regulator at an early stage of the disposal development is necessary, about the expectations and methodology for optimisation.

The crucial issue with applying the optimisation process to a repository is to evaluate both the potential benefits and harm for the system as a whole. Options are compared on the basis of safety criteria/attributes by assessing the effect on the performance and the robustness of the disposal system as a whole. The criteria/attributes selected must allow the safety benefits of the considered technical options to be assessed. Their selection and their weighting should be clearly allocated to problems being solved. The “optimum” (best taking into account the existing circumstances) is considered to be reached once the benefit in protection has become small with regard to the resources needed.

Optimisation of protection is applied continually during the different phases of the disposal facility lifecycle. Optimisation is predominant in its development stage as nearly all aspects of optimisation for the post-operational phase must occur prior to waste emplacement.

The efforts set in optimisation should follow a graded approach considering the complexity of the facility and the type of waste considered.

The optimisation process through the whole disposal lifetime has to be systematic and carefully structured to ensure that all relevant aspects are taken into account. The process has to be carefully documented. The optimisation process requires commitment at all levels in all concerned organisations as well as adequate procedures and resources. Therefore, the optimisation process should be an integral part of the management system.

International safety standards for radioactive waste disposal require an understanding of the relevance and the implications for safety to be developed by operators throughout the process of developing and operating disposal facilities. They require such facilities to be developed in a step-by-step manner supported by safety demonstration and subject to regulatory approval. This means planning the process steps, setting the milestones, identifying the decision points and involves a number of licence applications and approvals. A safety case and supporting assessment must be prepared and updated by the operator as necessary at each step in the development of the facility that presents all the arguments and evidence supporting the safety of the facility. The regulatory authority must review and assess the safety case and the outcome of its review will form a basis for the decision on granting regulatory approval.

Experts with a wide range of competencies are required to review a safety case for geological disposal. During the former SITEX project, five types of experts were identified to be necessary for such technical review -**generalist experts, environmental experts, numerical modellers, risk experts, experts in long-term safety**- and the knowledge and skills required were compiled into “experts’ profiles” [1, 2]. SITEX-II was initiated with a view to further developing an independent “Expertise Function” network in the field of deep geological disposal safety. One of the missions of the network will be training and tutoring [1], thus the Work Package 3 (WP3) of SITEX-II was devoted to the **development of training module for generalist experts** and demonstration its implementation in practice to test the viability of the network to fulfil this mission.



SITEX-II EXPERIENCE IN TRAINING AND TUTORING FOR REVIEWING A SAFETY CASE FOR GEOLOGICAL DISPOSAL

Nine organisations participated in SITEX-II WP3: LEI (Lithuania), Bel V, FANC (Belgium), CNSC (Canada), CV Rez (Czech Republic), Decom AS (Slovakia), IRSN, Mutadis (France), ENSTTI. The activities within WP3 were led by LEI and were organized into three tasks: Identification of the practices, experiences and prospective views on training and tutoring (Task 3.1); Development of a training module for generalist experts in geological disposal (Task 3.2); Implementation of a pilot training session for “common core module” (Task 3.3).

A questionnaire was developed to collect information from SITEX-II partners on their strategies and practices on competence building of technical experts. A thorough analysis of the answers led to the following **key conclusions and recommendations** to be considered while developing the training module for the pilot training session (Task 3.2) [3]:

- The importance and necessity of knowledge management and learning processes such as training, learning from experience and continual improvement is acknowledged. The strategy for knowledge management is more formalized and documented in the organisations having dedicated human resource or knowledge management departments or is incorporated into overall organisation’s management systems.
- Different means of knowledge management and expert training are used: while some have dedicated departments, internal procedures or schools for expert training, others rely more on co-working of younger and senior experts, participation in research programmes on the national and international level. Usually, organizations have several parallel ways for knowledge management and training of experts in parallel.
- On-the-job training, participation in research projects and taking external courses were reported as the common ways for competence development. Considering this observation, the form of SITEX training could be recommended to be defined as a package of activities on a cycle of several years (lectures accompanied with practical exercises, visits, partial review of existing safety cases, etc.).
- To ensure effective competence building in the specialized areas for technical review of a safety case, a means to “equalize” the background of the participants needs to be considered.

It was also observed that the events organized and coordinated by the IAEA are highly acknowledged and attended most frequently. **In view of the absence of training schemes dedicated to the review of the safety case for geological disposal at an international level, the development of a sustainable scheme could expect international acknowledgment.** Existing IAEA eLearning material was acknowledged and recommendations were given for trainees (newcomers) to access IAEA eLearning material prior coming to SITEX pilot training session.

REFERENCES:

1. SITEX, 2014a. Terms of Reference (TOR) of the SITEX network. EC 7FP Euratom SITEX project deliverable N°: 6.2
2. SITEX, 2014b. A plan for competence development in expertise of radwaste disposal safety. EC 7FP Euratom SITEX project deliverable N°: 4.2.
3. SITEX-II, 2016a. Synthesis of existing practices for training and tutoring of experts in geological disposal safety. EC H2020 Euratom SITEX-II project deliverable N°: 3.1.
4. SITEX-II, 2016b. Strategic Research Agenda of the Expertise function in the field of geological disposal of radioactive waste. EC H2020 Euratom SITEX-II project deliverable N°: 1.1.
5. SITEX-II, 2017a. Development of a training module for generalist experts in geological disposal. EC H2020 Euratom SITEX-II project deliverable N°: 3.2
6. SITEX-II, 2017b. Material for training module for generalist experts in geological disposal. EC H2020 Euratom SITEX-II project deliverable N°: 3.3
7. SITEX-II, 2017c. Lessons learnt from the pilot training session. EC H2020 Euratom SITEX-II project deliverable N°: 3.4

Development of a training module for generalist experts in geological disposal

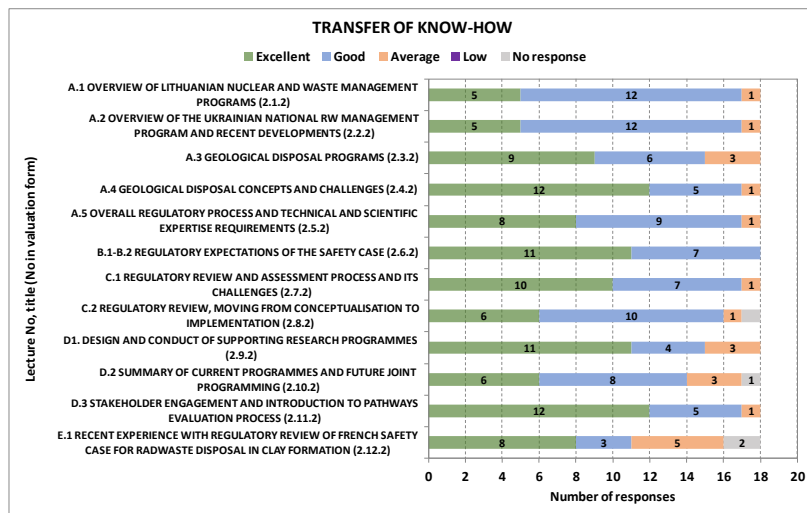
Development of training module has led to the development of training material and organisation of five-days training course aimed at generalist experts. The pilot training session was organized 12-16 June 2017 in Kaunas (Lithuania). Eighteen trainees participated in the pilot training session.

Lessons learned from the pilot session

Participants and lecturers were requested to undertake a formal evaluation of the pilot training session and training participants took an examination at the end of the training session.

The **key lessons** from the evaluation were:

- There is a great interest in training on regulatory review of the safety case for geological disposal and on a variety of related processes/activities necessary to support the regulatory review. The review process requires an adequate understanding of the geological disposal concept, overall requirements for implementation, safety case development and safety case review, managing of an independent R&D programme, interaction with various stakeholders, etc.
- The potential of the lecturers for future SITEX_Network training is high as the content and transfer of know-how received a positive evaluation by the majority of trainees.
- Based on the overall evaluation by trainees, the training session was highly rated (18.4 out of 20).
- Summarizing the feedback provided by the lecturers it was concluded that the pilot training session was successful, attracted appropriate and active participants, confident and experienced lecturers and provided good feedback for further improvement.
- 70% of trainees received a rather high mark and exceeded the average mark.
- Despite high rating of the lectures and exercises there is still room for further improvements. Suggestions provided by the trainees were grouped as related to organisational aspects, related to the content of developed module and related to the content of future training.
- The feedback received indicated a number of topics where participants felt more detailed training would be of benefit specifically related to regulatory review and assessment.



Future SITEX training

The pilot training course was successfully implemented both technically and administratively and demonstrated that the necessary expertise is available within the SITEX member organisations to present such training events. Two options can be contemplated for future training activities. One option is the training programme proposed involving participants committing to a series of training courses, scientific visits and a review project. The programme suggested would be integrated within the activities of the future SITEX_Network. The second option is a series of training courses over a defined period involving general courses similar to the pilot course and several specialist courses focussed on the topics previously identified by SITEX. The viability of either option depends on the numbers of participants anticipated to be interested and the funding model determined.

Decisions will have to be made on the nature of future training activities the SITEX_Network wishes to pursue and the funding model to be adopted. It is envisaged these issues will be address early in 2018 and details of the training to be pursued will be developed.

Conclusions

- The effective collaboration within the SITEX-II project WP3 led the training module material being developed for testing at a pilot training session;
- The material developed was based on extensive experience gained by different organisations such as research organisations, technical support organisations, regulatory authorities, civil society organisations;
- The experience of development and implementation of the pilot training session, as well as the evaluation of the feedback from all participants form an extensive basis for further development of the training and tutoring services to be provided by the future SITEX network.



PROGRESS WITHIN WORK PACKAGES: JUNE 2017 – NOVEMBER 2017

WP1 PROGRAMMING R&D (LEAD BY BEL V)

- In the framework of Task 1.2, WP1 has identified possible plans for deploying actions fulfilling the needs identified in the SITEX-II SRA (Deliverable D1.1). These plans are described in Deliverable D1.2 “Setting the Terms of References for the SRA implementation”, considering a.o. the JOPRAD Programme Document, the WPs currently considered in the EJP1 proposal development and the on-going European projects. In this deliverable, for each SITEX-II SRA issue, the following possible options for the deployment of future activities are considered:
 - Consider the results of an on-going European project before starting new activities;
 - Deploy activities through the EJP1 (this option is selected for the SRA issues that currently enter in the scope of the envisaged EJP1 WPs);
 - 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).

WP2 DEVELOPING A JOINT REVIEW FRAMEWORK (LEAD BY FANC)

- SITEX-II partners shared national experience and prospective views on the interpretation and implementation of safety requirements on site characterization program for geological disposal and on operational issues with regard to post closure safety, which will be documented in position papers. Position papers on optimization of protection and on waste acceptance criteria were drafted and sent to the partners for comments. The development of the guidance on reviewing a safety case has continued: relevant information was summarized and an operative articulation was set out. An excel tool to support the review of safety at successive phases of a geological repository lifecycle cases has been developed.
- 1 WP meeting was organized during this period (30/01 to 01/02/2017, Brussels)
- Two deliverables D2.1 “Interpretation and implementation of safety requirements” and D2.2 “Technical guide on the review of a safety case” were issued.

WP3 TRAINING AND TUTORING FOR REVIEWING THE SAFETY CASE (LEAD BY LEI)

- SITEX-II training course for generalist experts on „**Regulatory review of the safety case for geological disposal**“ was organized on 12th–16th June 2017 in Kaunas. The training event attracted participants: from Bulgaria, Belgium, Czech Republic, United Kingdom, France, Lithuania, Ukraine, and Germany. The lectures and practical exercises were given by the lecturers from SITEX-II Project partners: Bel V (Belgium), CV Rez (Czech Republic), Decom (Slovakia), FANC (Belgium), Mutadis (France), IRSN (France) and SSTC NRS (Ukraine). The training was organized jointly by LEI and ENSTTI.
- Three deliverables were compiled and finalised:
 - D3.2 “Development of a training module for generalist experts in geological disposal”;
 - D3.3 “Material for training module for generalist experts in geological disposal”;
 - D3.4 “Lessons learnt from the pilot training module”.

WP4 INTERACTIONS WITH CIVIL SOCIETY (LEAD BY MUTADIS)

- The deliverable D4.1 “Conditions and means for developing interactions with Civil Society” has been drafted, reviewed and issued. This deliverable presents the activities and results of WP4 all along the SITEX-II project, that encompass the outcomes of the three tasks following to present an integrated vision of the results:
 - the results of the review of the SITEX SRA as well as the description of appropriate processes for civil society to interact with experts along future research & development processes in European radioactive waste management. It also formulates research & development expectations of civil society regarding radioactive waste management (Task 4.1);
 - the conditions and means to share a common safety culture and rules of procedures to allow interactions of experts with CS along the safety case review process (Task 4.2); and
 - recommendations on “Intergenerational patterns of inclusive governance along the operational phase of geological disposal” (Task 4.3). It includes the results of the development of a pluralistic tool of dialogue entitled the “Pathway Evaluation Process” (PEP).

PROGRESS WITHIN WORK PACKAGES: JUNE 2017 – NOVEMBER 2017

WP5 INTEGRATION AND DISSEMINATION OF PROJECT RESULTS (LEAD BY CV REZ)

- The work has consisted in achieving the main WP5 deliverables and in carrying out dissemination activities. Three deliverables were issued:
 - D5.3 “Plan for dissemination and exploitation – update”;
 - D5.4 “SITEX-II final project report”;
 - D5.5 “Action plan for establishing SITEX network”.
- Concerning dissemination activities, presentations on SITEX initiative were given at 19th IGSC Annual meeting, at ETSON General Assembly and in the 20th Regional Seminar in Brno. A workshop was organized with IGSC on regulatory review of safety cases. Also, three oral presentations were done at EUROSAFE 2017 :
 - Impulse Speech on on-going European Joint Programming in RWMD and related potential changes for TSOs;
 - SITEX-II experience in training and tutoring for reviewing a safety case for geological disposal;
 - Optimisation of radiological protection applied to the development and implementation of a geological disposal system.
- International meeting on SITEX-II outcomes was organised in October, 2017 in Fontenay-aux-Roses (France). It provided an appropriate platform to participants for a exchanging about SITEX-II project results. The goals and functions of a foreseen SITEX network were introduced and discussed. To support a common understanding about this network at international level, the representative of international institutions, associations and platforms were invited. This event was attended by 35 participants from 13 EU Member States.
- W5 meeting No.4 was organized at IRSN premises in Fontenay –aux-Roses in France in September 2017.



Participants at international workshop on SITEX-II outcomes Fontenay-aux-Roses, France (31 October 2017)

WP6 MANAGEMENT AND COORDINATION (LEAD BY IRSN)

- The main activity by WP6 was the coordination of the internal review process of the draft deliverables and their finalization for the end of the project
- Regarding financing and administrative aspects, the WP6 also coordinates the finalisation of the second periodic report and the final report for the end of January 2018



Participants at SITEX-II plenary meeting No. 4, Fontenay-aux-Roses, France (30 October 2017)

NEWS AND EVENTS

EVENT ANNOUNCEMENT

9th January, 2018
Fontenay-aux-Roses, France

Formal **launching of SITEX_Network** will take place at IRSN premises in Fontenay-aux-Roses, France

27th February, 2018
Berlin, Germany

Second RWMD EJP1* General Meeting (see below)

JOINT PROGRAMMING

SITEX-II SRA was a key input for the TSO working group of the JOPRAD project, as it was the basis for defining the R&D priorities of the JOPRAD “TSO working group”. Based on these priorities and those of the Research Entities and Waste Management Organisations, a draft JOPRAD programme document was developed (see <http://www.joprad.eu>). Accounting for this document, a “Core Group” with representatives from TSOs (IRSN, Bel V and CV REZ), WMOs, REs and Civil Society organisations (Mutadis) is now facilitating the preparation of a proposal for the future call of the EC on Joint Programming. At this stage, a common interest between TSOs, REs and WMOs in projects or networking activities on the following themes has been identified:

- **Cement-Organics-Radionuclides-Interactions**
- **Fundamental understanding of radionuclide mobility**
- **Spent Fuel characterization and evolution until disposal**
- **Assessment of chemical evolution of ILW and HLW disposal cell including different components in interface at the cell scale**
- **Influence of temperature on clay-based material behavior**
- **Mechanistic understanding of gas migration (mainly in clay-based materials)**
- **Modelling of process couplings and numerical tools applied to performance assessment**
- **Understanding of uncertainty, risk and safety by different actors**
- **Waste management routes in Europe**

15th December 2017

The common interest in these themes was confirmed by the answers received to a call for interest sent by the Core Group to all potential EJP participants (TSOs, REs and WMOs) identified by the JOPRAD project. The Working Groups will provide proposals on these topics to Core Group til 15 December 2017.

27th February 2018

A second general meeting for the proposal development of RWMD EJP1* will be held on 27th February in Berlin (Germany). Organised by the Core Group, this second meeting will gather the Mandated organisations, the WPs Coordination Teams, CSOs’ representatives. Contact RWMD-EJP1@andra.fr for more details.

* *RWMD: Radioactive Waste Management and Disposal; EJP: European General Programming*