

Development of an R&D Programme in Bel V in the field of radioactive waste disposal.

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Outline of the presentation

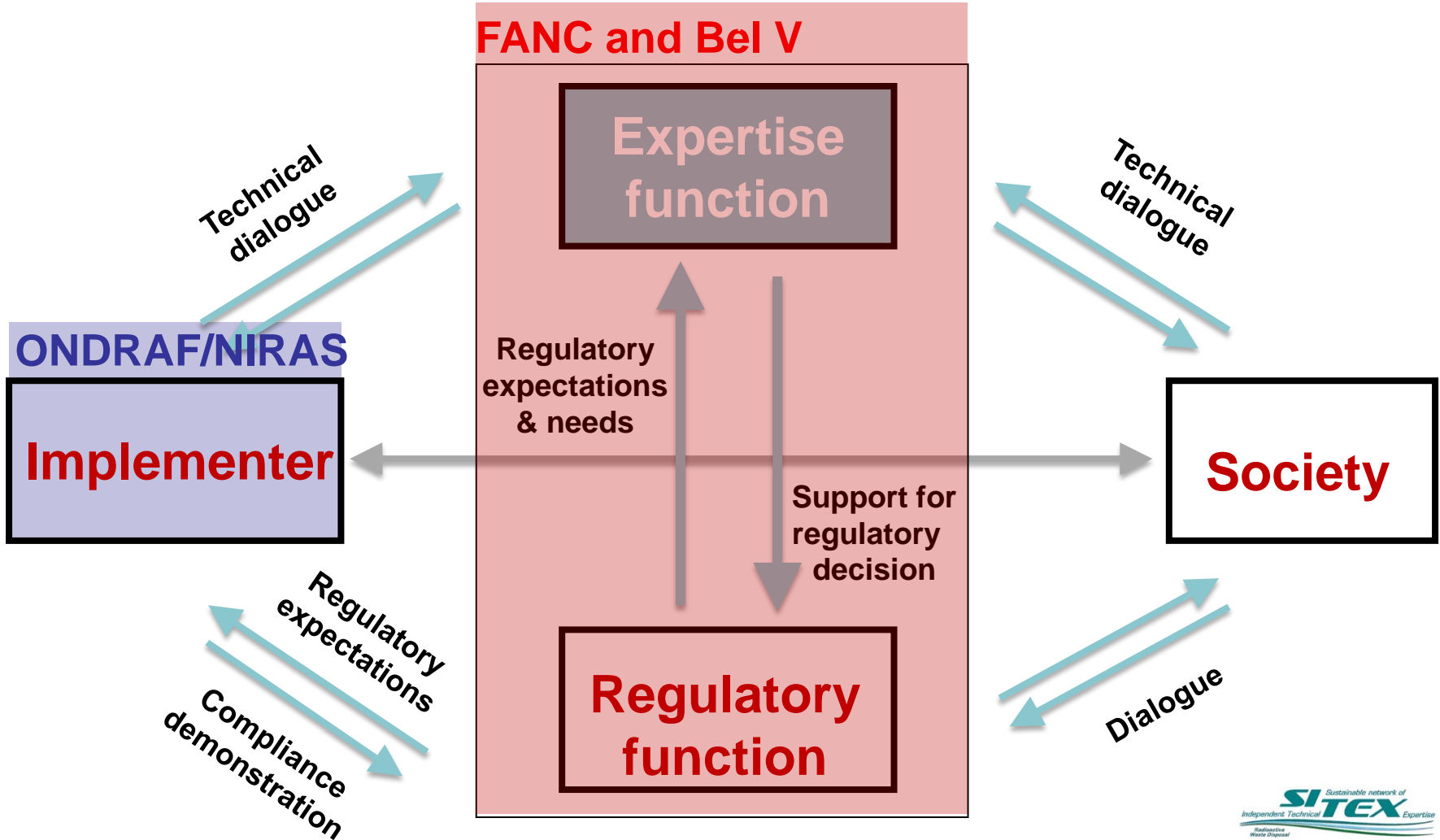
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1. Presentation of Bel V

- Bel V is a subsidiary of the Federal Agency for Nuclear Control (FANC, the nuclear safety authority), acting as a TSO.
- Bel V performs certain regulatory missions delegated by the FANC. Mainly, Bel V:
 - supervises the commissioning and the operation of nuclear installations;
 - advises the authorities on the development of nuclear emergency planning and intervenes in the management of nuclear and/or radiological crisis situations;
 - performs and evaluates safety reviews in the nuclear and radiation protection fields (e.g. waste management).
- It is through the association of the FANC on one side, and Bel V on the other that the function of Regulatory Body (RB) is ensured in Belgium.

1. Presentation of Bel V

In the case of the implementation of a waste disposal



2. Status of the Belgian GD programme

In septembre 2011

- ONDRAF/NIRAS has finalized a Waste Plan recommending the geological disposal of high-level and/or long-lived radioactive waste (Boom and Ypresian Clays are considered).
- This Waste Plan has been submitted to the federal government for a decision-in-principle, in order to set a clear policy for the long-term management of high-level and/or long-lived waste in Belgium.
- In October 2013, the decision of the government is still pending.

Federal Agency for Nuclear Control (FANC) official point of view:

FANC supports a decision-in-principle “go-ahead for geological disposal” but considers that the decision to already select a specific type of host geological formation (i.e. poorly indurated clay) is premature.

3. R&D programme of Bel V in the field of RAW disposal

Why should Bel V (TSO) develop R&D activities in this field?

- to improve our understanding of the safety assessment approach followed by the operator (e.g. the conceptual models, the main hypotheses...);
- to develop capacities to independently assess the appropriateness and completeness of the scenarios considered in the safety assessment;
- to develop capacities to independently assess the appropriateness of input parameters (e.g. by independent experiments, by performing sensitivity analyses);
- To develop capacities to assess the model/code capabilities (e.g. by performing calculations with multiple models or codes).

These objectives are consistent with the 3 axes of SITEX R&D programme.

- Quality of input data
- Understanding of complex processes
- Verification of extent, intensity and impact of processes

3. R&D programme of Bel V in the field of RAW disposal

What are our capacities ?

- We have modelling capacities: e.g. (non) reactive transport of radionuclides, radiation protection (see in following slides).
- We do not have an URL and we do not carry experimental investigations.
- The overall R&D effort foreseen by Bel V has been recently significantly increased to about 10% of the total available time for the technical staff.

What are the possible R&D actions ?

- Literature survey, participation in conferences or international working groups (IAEA, OECD).
Such R&D actions are undertaken to cover fundamental issues that are already addressed by the international community.
- Sub-contract to other organisations (universities and research centres).
These R&D actions are undertaken to cover specific key issues for which the regulatory body (FANC and Bel V) does not have the necessary resources.
- R&D within regulatory body (FANC and Bel V) or in collaboration with other organisations (Framework Programmes of EC,...).

3. R&D programme of Bel V in the field of RAW disposal

How to develop our R&D programme?

- We have taken the opportunity of participating in the 7FP EU SITEX project to better define our R&D needs and actions for Geological Disposal of RAW.
- In the SITEX project, a basic and common R&D programme has been developed by participants.
- We will notably use this R&D programme to foster the development of our future R&D actions.

Pro and Cons of using a common R&D programme?

- It facilitates the development of collaborations with the other organizations.
- Needs for R&D actions are not similar for all participants (they depend on host rock, design ...). We will define our needs according to:
 - The safety issues associated to the safety concept of the implementer.
 - the safety requirements established in royal decrees and guidance applying to waste disposal.
 - the milestone of the Belgian waste management programme.

4. Example of R&D activities

Bel V modelling activities: non reactive transport 1/2

We have developed expertise in the following software packages:

- HYDRUS 1D and HYDRUS 2D STANDARD (PC-Progress)
- FEFLOW (DHI-WAZY GmbH)

We develop our own computational routines for:

- Performing batch calculations
- Allowing parameter variation as a function of time
- Performing sensitivity analyses (e.g. Monte Carlo)

Bel V supports FANC in the review of the PSAR for the Belgian Near Surface Disposal Facility

- Independent verification of hypotheses in the NF models of the LT safety assessment
- Influence of input parameters on various indicators (sensitivity analyses ...)

4. Example of R&D activities

Bel V modelling activities: non reactive transport 2/2

Collaboration with IRSN to have access to the MELODIE code

- MELODIE is a code developed by IRSN for the regulatory review of safety assessment for waste disposal facilities
- Allow to benchmark our modeling results

Bel V has participated in the following 6 FP EU Projects:

- PAMINA
Performance Assessment Methodologies in Application to Guide the Development of the Safety Case
- MICADO
Model Uncertainty for the Mechanism of Dissolution of Spent Fuel in Nuclear Waste Repository

4. Example of R&D activities

Bel V modelling activities: reactive transport

Bel V is equally interested in the coupling between the modelling of the radionuclide transport and the concurrent geochemical evolution of the confinement barriers.

Recent actions of Bel V in this new field of R&D:

- We joined recently a consortium of users of the reactive transport code HYTEC (PGT IV - developed by ARMINES).
- We have launched (in collaboration with ULB and IRSN) a PhD devoted to improving the current understanding of the retroaction of chemistry on transport parameters.
- We financially support (in collaboration with CEA and IRSN) a PhD aiming at modelling the influence of the clogging of argillaceous media on the diffusion of radionuclides.

4. Example of R&D activities

Collaboration on experimental investigations

- In the field of RAW disposal, Bel V has started to financially support some experimental investigations in 2012.
- We financially support (in collaboration with IRSN and ARMINES) a PhD aiming at investigating and modelling the evolution of material properties at concrete/clay interfaces. Some experiments are performed in the Tournemire URL of the IRSN.
- In the coming years, Bel V plans to further develop its R&D programme and extend its collaborations.
- It is notably the objective of the Bel V participation in the FP7 EU SITEX project.

5. Conclusion and perspectives

- SITEX has allowed Bel V to better define its R&D needs and actions in the field of RAW disposal. Bel V currently develops its R&D programme, notably based on the input of SITEX.
- Bel V progressively develops its internal expertise in modelling of transport of radionuclides.
- Bel V progressively initiates collaborations with other organizations (TSO, universities...) to launch an R&D programme.

Perspectives

To focus on needs related to the next (site selection) milestone.

- Host-rock performances (diffusion properties...)
- Influence of construction/operation on host-rock properties (permeability, microbial activity...)
- Influence of waste on host-rock (temperature increase, radiolysis...)
- Influence of external perturbations