
Development by AVN of review guidance for safety assessment of radioactive waste disposal

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Abstract:

This paper describes the evolution of the waste disposal context in Belgium since 1998 and the implications this had on AVN and its international relationships. The way in which AVN responded to these changes through the development of a review methodology is explained in detail.

1 CONTEXT OF RADIOACTIVE WASTE MANAGEMENT IN BELGIUM

1998 was for AVN a key date in its technical involvement in the field of radioactive waste disposal. During this year, the Belgian government decided to entrust the Belgian waste agency ONDRAF/NIRAS with the development of an integrated disposal concept for low-level waste defined as “category A waste”. From a technical point of view, a near surface or a deep geological solution could be envisaged. In case of a near surface concept, more detailed investigations on the feasibility should be undertaken. From a societal point of view, the Belgian government wanted the project to be developed in cooperation with the local communities. The term “concept phase” refers to this development of an integrated disposal concept phase. According to the governmental decision, entities who already hosted class 1 nuclear facilities were potential candidates for hosting a low-level radioactive waste disposal [1 and 2]. The government also mentioned in its decision that this conceptual phase should be developed in strong cooperation with the Safety Authorities, namely the Federal Agency for Nuclear Control (FANC) and AVN.

At the same time, in Belgium, ONDRAF/NIRAS continued its R&D program on deep geological disposal for Category B&C waste (long-lived & high radioactive waste). A clay layer named “Boom Clay” is investigated as potential host rock. An alternative clay layer named “Ypresian clay” is also the subject of an investigation program. After the publication of the SAFIR 2 report, which was subjected to a NEA peer review, discussions between ONDRAF/NIRAS and the Safety Authorities (FANC & AVN), similar to the one established for category “A” waste, has been initiated for category “B&C” waste.

2006 will become for AVN the second key date in its technical involvement in the field of radioactive waste disposal. In June 2006, the Belgian government decided that a Near-Surface Disposal Facility will be located in the area of Dessel in the Northeast of Belgium. A pre-project and a project phase are scheduled. The project phase will start in 2009. The pre-project phase, which started in September 2006, gives Safety Authorities the opportunity to work on the Belgian regulatory framework for radioactive waste disposal through guidance development. Together with AVN, FANC has conceived a working plan until the end of 2008 that aims at achieving this goal.

2 IMPACT ON AVN ACTIVITIES

AVN has been fully aware of the changes in the Belgium context and the evolution in the international radioactive waste management programs. AVN anticipated this through its growing involvement in radioactive waste disposal activities in combination with the Decommissioning and Dismantling activities. A short overview of the impact of this context on the AVN activities will be described in the following sub-chapters. Three main activity types can be distinguished: The Belgian activities, the International activities and the internal R&D activities.

2.1 Belgian activities

In close cooperation with the Belgian Safety Authority FANC, AVN acted as an independent expert in the concept phase of the Belgian agency ONDRAF/NIRAS, reviewing the different documents provided. During the concept phase, FANC and AVN were more and more aware

of the necessity to improve the regulatory framework in order to address radioactive waste disposal specificities. Progress was made namely through bilateral relations with other safety authorities, especially from France. Following the Paris meeting of November 4^h, 2004, where the French-Belgian document “*Geological Disposal of Radioactive Waste: Elements of a Safety Approach*” [3 and 5] was presented to a large audience of regulators and operators, FANC and AVN decided to participate in the “European Pilot Project” [4], which was the enlargement of the French-Belgian working group to a wider group of regulators.

2.2 International activities

In parallel, AVN, that already participated in the PHARE and TACIS projects for Nuclear Power Plants, was more and more involved in EU projects dealing with radioactive waste disposal (Ukraine, Bulgaria, Lithuania, Byelorussia, Russian Federation). The different projects concerning low-level waste disposal, in which AVN takes part, deal among other things with:

- Establishing proposals for the table of contents of the safety assessment report for a radioactive waste disposal facility;
- Establishing proposals for the table of contents of the safety assessment report for a radioactive waste or spent fuel storage facility;
- Reviewing preliminary and intermediate safety assessment reports of radioactive waste disposal facilities;
- Reviewing site selection reports;
- Waste Acceptance Criteria for radioactive waste disposal facilities.

2.3 AVN R&D activities

Since 1998, the year in which the involvement of AVN in the field of radioactive waste moves from R&D activities to project activities, AVN has devoted a lot of time and effort to this field by following training courses at universities, by participating in many international workshops [6], meetings and IAEA activities like ASAM or ICEM, by being involved in the development of IAEA standards and guidance and also by increasing its staff in charge of radioactive waste disposal.

2.4 Need for Review Guidance

All those developments have lead AVN to develop guidance for reviewing Safety Assessment Reports (SARs) of radioactive waste disposal facilities. Such an AVN review guidance document can ensure a common review methodology for the concerned people. On the one hand, the review methodology will, for each component σ data, track the potential link with a safety-related system, structure or component, and on the other hand, will establish a list of reference documents. Developing such review methodology should reinforce the quality of the AVN advices on safety assessment reports for near surface disposal and for deep geological disposal.

For near surface disposal, since one year now, an internal research and development project is put in place for which regular internal meetings are organised. In a first stage of the project, a compilation of the Belgian and international (IAEA and NEA) regulatory requirements and guidance was carried out. The addition of references to French, UK and US regulatory documents allowed broadening the perspective of this compilation. In another

stage, performed in parallel with the first one, a standard canvas for the review guidance was developed. The next paragraph provides more information on this canvas.

For geological disposal a slightly different approach has been adopted. For its deep geological disposal program, the operator aims the publication, by 2010, of a Safety and Feasibility Case “SFC1” in an argillaceous host rock. For this reason and acting as TSO, AVN develops guidance on its expectations on the argillaceous formation layer (host rock) in order to have an in-house reference guidance on host rock requirements and to provide the safety authority with a first draft of a future guidance on waste disposal host rock. The structure and the contents of this guidance will be described in section 4 of this document.

3 ACTIVITIES AND REVIEW GUIDANCE FOR NEAR SURFACE DISPOSAL

3.1 Review guidance

After looking at similar international developments in the first stage of the project, it has been decided to use the NUREG-1200 “Standard Review Plan for the review of a licence application for a Low-Level Radioactive Waste Disposal Facility” as a starting point for the work. However, due to some specific features, NUREG-1200 could not entirely be used for the AVN purposes, mainly because the NUREG has been written in strong connection with the 10 CFR 61 code which is not applicable in Belgium. Moreover, the purpose or the content of some sub-chapters of the SRP structure does not correspond to the considered safety approach for radioactive waste disposal as seen by the Belgian Safety Authorities. As example, chapter 4 of the NUREG SRP’s called “Acceptance Criteria” could not be applied in a straightforward manner.

After all, the adopted structure of the developed AVN review guidance is similar to the one of NUREG-1200 but the content has been adapted to our understanding of the near surface disposal safety. In accordance with a proposal for the table of contents of the Belgian SAR [7], the intent is to develop a review guidance document for each main sub-chapter of the SAR report.

Concerning the review guidance content, AVN pays attention to the description of the review area, the safety evaluation and the acceptance criteria. In each review guidance, the possible safety-related systems, structures or components have to be identified and detailed. At the end, a summary table is developed in which the evolution of the safety concerns is set forth, taking into account the different periods of the life of the disposal facility. In addition to these periods, the table also contains a row dedicated to “safety case” concerns, addressing safety considerations on methodology and/or on safety approach. These considerations deal with the principles of safety like passivity, robustness, demonstrability, multi-functions and with the radiological principles [3]. Focusing the review guidance on the implementation of the safety principles should ensure a broadened application of the review guidance.

For each review guidance or for each sub-chapter of the “SAR” table of contents, the scope of the review guidance is detailed. Based on this, the necessary competence for the review team is identified and consequently an easy identification of the different technical responsibility centres or TRC’s of AVN that will be in charge of the review, could be performed. In AVN, a TRC is an internal group of experts in a specific domain, e.g. TRC 500: Mechanics. Other interesting feedback of developing the review guidance is to provide colleagues less familiar with disposal concepts with the key safety concerns in case of

review, for example, fire or radiation protection experts. By using such review guidance, a higher level of coherence should be reached.

In order to avoid similar issues as the one AVN encountered trying to use NUREG-1200, methods or approaches specific to a country or site should be identified in the review guidance. And as already mentioned, the review guidance is not only a tool, which allows a verification of the compliance with the regulatory criteria, but also a tool, which will ensure that the implementation of the safety principles has been performed through the disposal concept.

3.2 Acceptance criteria and the Belgian Regulatory Framework

As explained in chapter 2, a preliminary work has been carried out to compile both the in-force Belgian regulatory requirements and guidance, and the international IAEA standards. It is observed that the review guidance development generates an important feedback on the Belgian regulatory framework. The development of the section "Acceptance Criteria" allows the identification of the level of adequacy of the current Belgian regulation on radioactive waste disposal.

The outcome of this work is the identification of matters of improvement in the Belgian regulatory framework. Complementary information is extracted from stage 1 of our project, being the review of the international standards and regulatory statements from France, the UK and the USA.

Through the progressive development of the review guidance, some regulatory statements from international standards or reference countries will be adopted. They will become basic reference statements for future guidance.

4. ACTIVITIES AND REVIEW GUIDANCE FOR GEOLOGICAL DISPOSAL

In Belgium, since many years, the SCK•CEN research centre and the operator NIRAS/ONDRAF perform important work for characterisation of the Boom clay. Two reports describing the state-of-the-art of this work have been published: SAFIR (end of the 80's) and SAFIR 2 (2000). In 2002, the SAFIR 2 report was subjected to an international peer review organised by NEA. After these important milestones, the operator is currently focussing on the next decade. The development of a first Safety and Feasibility Case is foreseen. As the program becomes more and more oriented towards a development of a deep geological disposal concept, AVN, which consequently is getting more and more involved, has written its expectations on the "a minima" properties of an argillaceous host rock layer [8].

These expectations deal with the long-term geological stability, the geometry of the host rock, the hydrogeological properties, the geochemical properties and biotic features, the thermal properties, the robustness of the host rock with respect to disturbance caused by the repository, the natural resources and the ability of host rock characterisation. The disposal environment has not been addressed as a safety function, but through the role it could be allocated in a safety strategy. More specifically, considerations on the depth of the disposal, on the natural resources in the disposal environment and on the hydrogeology of the environment have been developed.

This document has currently a draft status. It has been sent for comments to the FANC and to the operator (NIRAS/ONDRAF). Quite recently, AVN also wants to develop contact with other TSO's in order to collect their comments on its document.

5 CONCLUSIONS

The more definite involvement of AVN, in national disposal projects as well as in international projects, initiates the internal development of tools for reviewing Safety Assessment Reports for Near-Surface Disposal Facilities. Through the development of a review guidance, AVN aims at strengthening its competence in the review of a Safety Assessment Report. Developing such review guidance provides the tool for a uniform review, independent from the reviewer and accepted throughout AVN, and a guidance for experts not familiar with radioactive waste disposal.

Such work is also the opportunity to develop some technical safety guidance like that on the argillaceous sedimentary formations.

6 REFERENCES

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