

Summary record of the topical session of 10th Meeting of the IGSC

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Balancing Operational and Long-Term Safety Considerations

Chairperson: P. Gierszewski (NWMO)

Rapporteur: P. DePreter (ONDRAF/NIRAS)

Item 15 TOPICAL SESSION: Balancing Operational and Long-Term Safety Considerations

15.1 Introduction by the Chairperson

P. Gierszewski (NWMO), Chair of the Session, introduced the topic. In terms of background, the updated IGSC PoW [NEA/RWM/IGSC(2007)16/REV1] noted that implementers have mostly focused on long-term safety, as it is the most challenging issue. Operational safety issues were considered a lower priority, given that there is already substantial experience in safely operating nuclear facilities and mines that might be transferable to deep repositories.

However, as programmes move closer to implementation, it becomes more difficult to maintain a separation between operational and long-term safety (and assessment of them). At a minimum, the conditions and duration of the operating phase define the “boundary” or starting conditions for assessing long-term safety. Furthermore, while the design and selection of repository layout, engineered components and excavation techniques are driven by long-term safety requirements, they also must take account of operational safety and feasibility of construction, avoiding excessive technical complexity. Issues such as ventilation and excavation impose design and operational requirements that might potentially affect long-term performance or disposal system evolution.

The aims of the topical session are to:

- Gather information on ongoing work in national programmes to address the key questions (below)
- To gain an overview of operational safety issues outside RWMC and assess the potential for knowledge transfer
- Starting from the key questions, to define the challenges and issues that could be of interest to, and benefit from discussion by, IGSC
- To assess the need for further IGSC work on this topic and, if so, to define the activities and timeframes.

Key questions were identified by IGSC in the PoW. They are shown below along with some examples (shown in sub-bullets) of specific aspects that could be of interest:

- What are the main operational safety issues that have implications for long-term performance?
 - Example: To what extent are the various practices and constraints legally required?
 - Example: What are the minimum mining requirements and practices that apply for safe operation of a deep repository?
 - Example: Are there separate safety cases for operational and long-term safety? If so, how are the links made?
- How do these constraints vary according to key aspects of the disposal system concept such as waste type, host rock, planned operational lifetime, etc.?
- How does the stepwise design and optimisation process balance operational and post-closure safety constraints related to conventional hazards, engineering feasibility, radiation protection?
 - Example: What practical measures can be (or have been) taken to address specific hazards or issues---i.e. selection of materials, design elements?
 - Example: How flexible must be the design to adapt to the constraints at different stages?
 - Example: What methodologies are used to identify, prioritise and track the various requirements?
 - Example: How are these considerations balanced? Are there ‘trade-off’s’ that must be made between short-term and long-term safety?)
- What lessons can be learned from other relevant industries (e.g., especially the mining industry), and what are the limits of transferability?

15.2

Presentations on National Experience

Eight presentations were provided on national experience related to the key questions; an additional presentation was provided by AREVA to describe the perspective and possible relevant experience on operational safety in the mining industry. The presentations were:

- a. Canada: Balancing operational and long-term safety in OPG’s L&ILW DGR design (H. Leung and P. Gierszewski, OPG) – presented by P. Gierszewski
 Canada: Operational safety issues in uranium mines: application to deep geological repository (B.R. Ravishankar, CNSC)
- b. France: Operational safety and conventional hazards in designing a HLW repository (B. Cahen, Andra)
- c. France: Balancing operational and post closure safety issues (P. Bodénez and G. Dandrieux, ASN; C. Serres, IRSN) – presented by P. Bodénez
- d. Germany: Implications of pre-closure activities on the backfilling and sealing measures for the ERAM LLW (R. Mauke and J. Wollrath, Federal Office for Radiation Protection, BfS) – presented by J. Wollrath
- e. Germany: Experience from developing an advanced safety concept for HLW disposal in rock salt (J. Krone, DBE Technology)
- f. US: Balancing operational risks and worker safety with long term repository benefits in the Yucca Mountain repository design (E. Smistad, DOE-YM) – presented by B. Forinash
- g. Finland: Experience from ONKALO (M. Snellman, Saanio & Riekkola Oy)

- h. Industry: Operational safety and radiation protection: practical experience in uranium mining
(*J-M. Marino, AREVA*)

The slides from all presentations are available on the dedicated web page for the IGSC-10 meeting.

15.3 Discussion

15.4 Conclusions

P. Gierszewski (NWMO, Chair of the topical session), with input from P. DePreter (ONDRAF/NIRAS, session rapporteur), made some preliminary observations based on the presentations.

In terms of the operational safety issues, there are notable commonalities among the various national programmes who presented. These include, for example: ventilation, backfilling, shaft vs. ramp, fires, gas generation, and reversibility/retrievability. Duration of the operational and open phase (including the durability of various engineered components over decades to centuries) is also important in most programmes, especially the possible implications if repositories need to exceed the original design life because of a nuclear renaissance. Other potential issues are canister design, tunnel lining and materials management. Quality assurance (QA) and engineering/as-built confirmation are important aspects of operational safety; there is also important feedback from site characterisation to construction and design. The national legal context has significant implications for how the issues are addressed in each programme.

It was also observed, however, that the issues of concern differ somewhat according to the host rock and waste type. For example, the possibility of earthquake during operations is an issue of particular concern for the Japanese repository programme. Some important differences were also noted with respect to salt and gas generating wastes, as well as in terms of whether water inflow is an issue – in clay, this is really not considered. It would be interesting to see if decisions on ramp vs. shaft access to disposal areas – an issue noted in several national presentations -- correlates with host rock, waste type, or other factors (siting process, etc.).

No generic principles were identified to balance constraints imposed by operational safety considerations and post-closure safety considerations. Rather, the analysis and decisions are made on a case-by-case basis. Decision making may also consider economic factors, especially if the safety differences are not large and if the overall facility can be shown to be acceptably safe both during operations and the over the long term. It is important, in any case, that a plan be developed to identify and address main safety issues for both operations and post-closure. It was also noted that ongoing optimization of procedures, safety assessment and even repository design may continue during operations.

Partly because of the case-specific nature of decision making, it was observed that there probably limited applicability of experience from uranium mining to geological repositories, given differences in the criteria, motivations, priorities, etc. Some practical experience from mining is relevant concerning several known key safety topics: fire hazard, ventilation, rock fall, explosive gases. On the other hand, many issues are unique to geological disposal. It was observed that uranium mining

practices and philosophies have changed considerably in recent years, and that it is important to continue to track such practices to learn what might be transferable.

There was discussion on whether operational safety is an appropriate topic for IGSC to monitor and, if so, whether specific activities should be pursued. There was agreement that the topic is of interest and falls within the IGSC mandate. Furthermore, from a practical point of view, those with responsibility for long-term safety often have overlapping responsibilities concerning operational safety issues. There are different approaches in national programmes for how operational safety will be addressed and, in particular, whether it will be included in a single comprehensive safety report or will be addressed in separate licensing decisions – which depends significantly on the national regulatory structure. Nevertheless, regardless of how they are addressed in licensing, there is a need (and an intention) in implementation to comprehensively document both aspects of safety and to identify the links.

Several options for further IGSC action are possible, ranging from periodic “monitoring” of the topic to dedicated activities on specific topics. For the moment, there is limited practical experience in balancing operational and long-term safety, and it is not yet evident how they are linked. However, several programmes are approaching implementation and facing the resolution of operational safety issues, especially as they relate to design. In this regard, there is notably commonality across programmes and some key issues can be identified, such as ventilation and fire hazards. Ultimately, the goal would be establish the links with long-term safety and other aspects of repository development, but an important first step is to better understand the operational safety issues and operational safety assessment under development in national programmes. It was agreed, therefore, that NWMO would host an informal workshop or meeting on the topic, for programmes with an immediate interest in operational safety; indications of interest were expressed by Andra, BfS, EA, HSK and IRSN. The meeting would likely take place in late 2009 or early 2010. It would be organized outside the auspices of the IGSC, but feedback from the meeting would be expected to serve as input to decision making for future IGSC activities on the topic. Thus, the topic will be revisited at the next and following meetings in discussions of future activities.