Summary record of the topical session of 12th Meeting of the IGSC

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Optimisation

Chairperson: L. Bailey (NDA)

Rapporteur: N. Hunt (NWMO)

Annex B:

Summary of the Topical Session on Optimization

Introduction

Lucy Bailey (NDA) opened the session with a short presentation to provide context and outlined the following objectives for the topical session:

- Explore issues of optimisation – what does it mean in practice?
- Can we clarify the principles of optimisation?
  - To what extent is the process of optimisation more important than the end results?
- Learn from experience in national programmes
  - Case studies from programmes at different stages
  - How have optimisation principles been applied in real programme decisions?
  - How are optimisation arguments presented in safety cases?
- Are there any optimisation issues that could benefit from further IGSC work?

Key topics discussed in the opening remarks included:

- **Balance:** this includes long-term safety versus near-term operational safety and the issue of safety versus cost;
- **Integration:** this relates to how optimisation is implemented at different programme stages, the implications of site selection (i.e., volunteer site versus "best" site) and stakeholder acceptability;
- **Regulatory Perspective:** this considers how different factors (such as dose, risk, cost, robustness, etc.) should be weighted and the optimisation arguments that regulators are expecting;
- **Process:** the "who", "what" and "when" of optimisation.

Presentations on National Experience

Following the introductory remarks, Claudio Pescatore of the NEA Secretariat gave a general presentation on "Thoughts on Optimisation". This proposed a list of factors to consider during optimisation, consisting of radiation protection, environmental protection, operational safety, operating requirements, social expectations, cost-effectiveness, etc. It was suggested that optimisation is the outcome of a transparent and societal decision-making process that balances the various factors, within externally applied constraints (e.g., the site may not be the "best" location, the need for compliance with regulatory requirements, etc.). It was suggested that when a decision is considered valid at one point it must be considered optimal and it is the sum of all these optimal decisions that constitutes optimisation.

Presentations from selected national programmes provided case studies in optimisation for a range of situations:

NEA:	Optimisation of the System of Decommissioning Waste Production through Disposal
UK:	NDA Approach on Upstream and Disposal System Optioneering
Germany:	Methods to Support Comparison of Sites for Deep Geological Disposal of Radioactive Waste

France: Presentation on Optimisation in Siting Decisions

Finland: Comparison and Evaluation of KBS-3 Horizontal and Vertical Options

USA: Optimisation at WIPP Based on 11 Years of Operational Experience

The WPDD presenter (M. Dutzer, ANDRA) discussed optimisation in the context of the management of large disused components. For this work the "drivers" consisted of transportation, clearance and recycling strategies, availability of interim storage facilities, availability of treatment facilities, availability of disposal facilities and economics. The "actors" were the facility operators, transporters, regulators, concerned authorities and public and stakeholder groups. The presentation explained how a selection criteria matrix (without weighting factors) was adopted as a discussion tool. The use of such a matrix helped to ensure that the optimisation process was transparent between all interested parties. It was suggested that the overall optimisation should be developed after assessing all phases of the work.

The UK presenter (S. King, NDA) noted that "optimisation" refers to "dose optimisation" in the UK so "optioneering" is used as an alternative terminology. In the UK the optimisation process is focussed on optimising value in terms of hazard reduction, safety and security, environmental impact, cost and income. Consideration of the entire value chain from start to finish creates possibilities for cost savings and helps to facilitate moving the project forwards. Flexibility in the approach should be maintained to the extent practicable at each stage.

The German presenter (J. Wollrath, BfS) discussed optimisation in the context of methods for comparing potential sites with different host rocks. The aim was to develop an evaluation system and derive suitable evaluation standards, as the German Government requires the repository option that "guarantees the highest degree of safety". This requires analytical comparisons of specific repository sites, something which has not previously been attempted in Germany. The information required for comparison studies includes site data, design information, scenarios, safety functions, important processes and a preliminary safety assessment. Two distinct and complementary methods were used for the comparison, these being a Verbal Argumentative Method (in which weighting factors are used to determine the robustness in different time windows, by calculating a 'robustness deficit' for relevant safety functions) and probabilistic calculations.

The French presenter (F. Boissier, ANDRA) focussed on the work done to identify a specific location for a repository within a relatively small domain. Four initial options were derived based on technical and scientific criteria. These were then considered with local stakeholders and the National Review Board, factoring in societal issues to position the site with the already identified area of interest. Factors considered included making safety a priority, building for economic growth and ensuring an equitable distribution of benefits. In this work, optimisation first considered technical and safety issues, and then addressed stakeholder desires.

The Finnish presenter (M. Snellman, Posiva) discussed optimisation in the context of the evaluation of vertical and horizontal options for container emplacement in the KBS-3 concept. The horizontal concept is advantageous based on backfill requirements (no tunnel backfill would be required for horizontal emplacement), environmental impact, use of foreign materials, rock disturbance, ease of fabrication and overall cost. The final emplacement decision will depend on the safety case together with design, demonstration tests, retrievability tests, cost studies and rock spalling considerations.

The USA presenter (A. Van Luik, USDOE) addressed optimisation in the context of operational issues for an operating facility. After 11 years of operation, optimisation is still ongoing. Adaption to new waste streams resulted in reconsideration of the safety basis and improved knowledge and experience resulted in improvements to simplify operations and reduce worker dose. It was noted that regulatory oversight may make changes difficult to implement.

Topical Session Discussion

Following the presentations, the floor was opened to discussion around the following topics:

- What are the key issues?
- Which would benefit from IGSC attention?
- What further work is warranted by the IGSC and on what timeframe?

The discussion was widely ranging and touched on many points. These points generally fell into two main categories, thoughts related to defining optimisation and thoughts related to defining the associated limitations.

Remarks related to defining optimisation:

- Learning is the central element of optimisation.
- Optimisation processes should be transparent.
- Optimisation is a decision on the optimal way forward at a particular point, supported by quantitative and/or qualitative measures.
- Optimisation proceeds as a series of steps with the objective of meeting the requirements at each stage.
- The optimisation goal is to keep moving forward as fast as possible.
- Optimisation is the sum of the decisions already made.
- Operating repositories are always considering changes – this indicates optimisation is an ongoing process.
- Once safety requirements have been met, other things can be varied and optimised. Therefore, optimisation only has a role when there are multiple choices that all meet the safety requirements. In that situation the objective is to identify which one enables faster/cheaper progress. Therefore, cost benefit arguments play an important role in optimisation decision making.
- The optimisation process may be quantitative or qualitative, or just an explanation of why the decision making process went a certain way (i.e. the rationale behind a decision).
- A matrix with weighting criteria may be helpful but care should be taken to ensure all possible influencing factors are incorporated.

Remarks related to defining limitations:

- Safety assessment is an established method for testing different options based on scientific method, but it is not an exact science. Therefore, optimisation cannot be an exact science.
- A single entire life-cycle/system optimisation exercise cannot be achieved because of the long time duration and number of process steps, but optimisation can be done in stages. Generally it will not possible to go back and revisit an already made decision (such as siting). Optimisation is therefore an ongoing process that evolves over decades as the system is being designed, operated and closed.
- Revisiting past decisions in the name of optimisation may be detrimental in some aspects, so this should only be done after careful consideration of the implications.
- It is important to know the constraints within which there is the flexibility to optimise (particularly for discussions with stakeholders). Such constraints are likely to include:
    - Regulatory dose/risk targets or similar constraints;
    - Societal considerations (e.g. volunteered sites, restrictions on environmental impacts, etc.).
- A clear understanding of the constraints is helpful in supporting the decisions to move forward, as the constraints provide the boundary conditions for decision making.
- There is a risk that if too many options are carried forward, issues may become clouded and undue complexity introduced. When there are multiple options, one must be chosen to permit progress (perhaps whilst maintaining a watching brief on other options). If other options appear later, one should again be selected to keep the process moving. In other words, optimisation should not be used as an excuse to allow the programme to stagnate – it may be better to make a decision on the information available to allow the programme to move forward and learn from the process, and then adapt the decision later if necessary.

Summary of Agreed Points

The variety of the remarks and views expressed during the topical session reflects the diversity of optimisation goals that may be pursued in the framework of a geological disposal programme. While optimisation of protection, as defined by ICRP, is regarded as a process to keep the magnitude of individual doses, the number of people exposed, and the likelihood of potential exposure as low as reasonably achievable with economic and social factors being taken into account, optimisation can also be seen as a way of increasing the technical quality and robustness of the whole waste management process. An optimal solution means addressing safety requirements whilst balancing other factors such as the need to use resources efficiently, political and acceptance issues and any other boundary conditions imposed by society.

Nonetheless, in summarising, the Chair noted that the discussion had shown a lot of agreement and consensus of views. In particular, it was valuable to note general agreement on the following points:

- Optimisation is a process that can be checked and reviewed and needs to be transparent. Optimisation is therefore a learning process, and as such can contribute to building confidence in the safety case by the demonstration of ongoing learning across the organisation.
- Optimisation occurs at each stage of the disposal facility development programme, and is therefore forward looking rather than focussed on re-examining past decisions. Optimisation should be about the right way forward at each stage, making the best decisions to move forward from the present situation based on current knowledge and understanding.
- Regulators need to be clear about their requirements and these requirements become constraints on the optimisation process, together with any societal constraints that may be applied in certain programmes. Optimisation therefore requires a permanent dialogue between regulator and implementer.
- Once the safety objectives (dose/risk targets and other constraints) have been met, further optimisation should be aimed at moving the project forward as efficiently as possible, and this could largely be reflected as cost optimisation.

It was noted that optimisation variables are not well defined and a more explicit discussion of this may be helpful, although the variables could be quite programme-specific. Part of these discussions may be taken up in the ad-hoc group on organisational issues that Mr. Ume