Nuclear Waste Management Organization of Japan

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Record of the 2nd NUMO Technical Advisory Committee (TAC) meeting

Tokyo, 30 May – 1 June 2016

Background

Since the last meeting of the Technical Advisory Committee (TAC), which includes both Japanese and foreign experts, NUMO has used the input provided by TAC to refine the "pre-selection, site-specific" safety case (the NUMO 2015 Safety Case), which was the focus of this second meeting. The list of participants of the meeting is given in Appendix 1 (TAC members) while the programme of the meeting is included as Appendix 2.

This record provides brief documentation of discussions at the meeting, following the "Chatham House Rule" of not attributing comments to specific participants. The discussions during the brainstorming within block 3 were captured in the Argumentation Model, which includes input by both TAC and NUMO participants. Other TAC comments that were not discussed during Blocks 1-3 were captured in the summary of the closed session.

Day 1: Monday 30 May

Block 1 Introduction & welcome

The welcome was given by Dr Shunsuke Kondo, the president of NUMO, who again emphasised the importance of the TAC in providing both strategic guidance and technical QA to NUMO in the light of recent developments, which are hoped to advance the siting process in Japan. For this, the NUMO 2015 safety case will play a key role by providing a generic source of information to interested stakeholders.

Prof Takayuki Sasaki, chairman of TAC, provided his own welcome and allowed participants to introduce themselves. He emphasised that all comments were appreciated and constructive criticism was welcome.

Director, Head of Department Akira Deguchi then provided an update on recent developments in Japan as background to the NUMO safety case (SC). A special focus was the more active role of Government and development of "scientifically preferable areas" by METI working groups, which should lead to dialogue to encourage volunteers to initiate the literature surveys that lead on to site characterisation studies.

Need for dialogue was emphasised based on international experience, distinguishing between nationwide and community communication / dialogue. In terms of terminology, potentially less suitable should be distinguished from clearly excluded. Also, from UK experience, anything not preferable may be considered unsuitable by the general public.

An overview of the goals, programme and logistics by Manager Tetsuo Fujiyama (NUMO TAC coordinator) provided guidelines for the rest of the meeting.

Block 2 Progress since TAC*#1*

2.1 Site Descriptive Model (SDM) developments (Kunio Ota & Site Investigation Technology Group)

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This presentation is summarised responses to TAC#1 comments before providing an update on SDM development work, with special emphasis on the two sedimentary cases. A large file provided extensive background – but some of this was not presented due to time limitations. The huge progress indicated that NUMO has abilities and capacity to meet the challenges ahead. The need for a comprehensive technical review was emphasised by TAC. Possibly more explanation of the caveats associated with the SDM production process would be useful, especially in terms of the degree of detail included. Also consider explain how pros and cons of sites to meet requirements are captured.

Documentation of responses to TAC comments was clear and showed well-structured progress to improve and extend the geological database. The plans for future developments seemed reasonable. A special focus should be on developing understanding of safety functions and how required characterisation can be carried out on a site-specific basis.

The Pre-Neogene SDM is very different from disposal settings considered elsewhere – especially melange. For accretionary complexes, the heterogeneity needs to be captured and uncertainties discussed – especially when communicating with the geological community. Some sub-classification might be needed (e.g., Jurassic vs Cretaceous). The proposal to present work to both national and international technical meetings was supported by TAC.

There was extensive discussion of degree to which flow at repository depth would be horizontal. This is clearly very dependent of geological assumptions and will be very site-specific, including in particular the properties of faults, which can be either permeable or low-permeability flow barriers. The latter may be more common in Pre-Neogene rocks.

2.2 Repository design (Shigeru Kubota & Repository Engineering Group)

This presentation gave an introduction to the design work, including both responses to TAC#1 comments and an overview of recent progress, with emphasis on tailoring designs to Neogene sediments. It was noted that the pre-Neogene case has not yet been analysed. The responses to TAC comments were clear and comprehensive, although full technical review of key supporting material is needed. For example, there is a need to explain the requirements and safety functions of backfill and plugs.

NUMO question: how is gas handled in SFR? Here it is seen not to be an explosion risk, rather a concern for post-closure risk of damage to EBS. In France, a waste acceptance criterion limits this problem, but ventilation is scaled to reduce concerns – with backup in case of failure.

Response to highly permeable / low strength rocks: it may be that layout less important, although this is needed to check if acceptable volume of rock present. Examining potential for more robustness from other concepts would be valuable.

Requirements on barrier properties need to be critically assessed, in terms of ensuring flexibility. Possibly make hierarchical and distinguish between external requirements and those that are specific to concepts / NUMO chosen safety case components. Should be reviewed and checked to be relevant and state-of-the-art (for present boundary conditions rather than H12 / TRU-2). Possible future changes in waste characteristics should also be considered when specifying thermal limits.

The arguments for overpack (OP) lifetime were discussed: this was noted to be mainly to simplify analysis and communication rather than a strict requirement for post-closure performance.

Although there was a focus on retrievability (based on recent political boundary conditions), reversibility was also considered, but in less detail. The goals of “retrievability” studies

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(ambition level) need to be clearly defined. Lessons could also been learned from WIPP accident and the ANDRA position on retrieval & reversal. The issues need to be communicated to relevant groups / committees in Japan.

2.3 Pre-closure safety assessment (Kazuhisa Yamashina & Repository Engineering Group)

Yamashina´s short presentation mainly covered responses to TAC comments, with a brief update on recent work, which is focused on conventional safety, and proposed future R&D.

Procedures to ensure completeness of scenarios identified and interactions between initiating events (common mode events) were outlined – although combinations of events will be considered only in the future. Fire scenarios were discussed in detail, but it was clear that some assumptions (e.g., duration of fire) are not completely conservative (e.g., if oil leak into a container that limits the surface area – could easily increase fire duration by 1-2 orders of magnitude).

More background on managing operational hazards, probability assessment, countermeasures, etc. would be useful. These should be able to be explained to the general public. The assessment of hazards should take more credit for expected prevention measures and take over experience gained in relevant surface (or subsurface) nuclear facilities. For fire guidance, maybe take over from relevant research facilities that directly study underground fires.

Something that seems to be missing is a comprehensive waste acceptance programme for TRU related to pre-closure safety issues.

2.4 Long-term safety assessment (Kiyoshi Fujisaki, Susumu Kurosawa & Performance Assessment Group)

Leading on from the previous presentation, long-term, post-closure safety was discussed in two blocks, the first focusing on the performance assessment processes and models and the second on the associated databases. This seems to represent a lot of work. Unlike the other presentations, there was no specific block for discussion of last TAC comments; these were picked up within the presentation, but this made it a bit trickier to assess completeness of coverage.

The assessment scenarios, models and results first considered scales of associated SDM sub-models, but too little detail was available at the RN transport scale and all geochemistry was missing.

Scenario likelihoods are mentioned, but there was no numerical estimation of boundaries between different classes (likely, less likely, very unlikely) to allow risk assessment.

Parameters set for some of the analyses are difficult to understand – e.g., glass dissolution time seems conservative (not realistic) for likely case and incredibly pessimistic (more like “what if?”) for unlikely scenarios. For bentonite stability, the salinity seems high enough that erosion would not be a problem. Are NUMO aware of latest data on this?

The presented peak doses at times in the order of 10 years look completely incredible. The entire release model and its basis need to be explained / justified. Results give no good arguments for safety, but do indicate a priority has to be bringing TRU assessment to a similar level as HLW.

For Neogene sediment, the basis for the mass transport model needs to be explained, with reference to the SDM.

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The databases are developed in a structured manner, but lack any assessment of internal compatibility / general credibility. Derivation of parameters by averaging data that vary greatly on log-log plots must be discussed in a critical manner and, instead of single values, ranges of values used for sensitivity analysis.

Elements of no safety relevance should be taken out of the databases or, at least, the fact that their quality is lower because of unimportance noted.

The near-field scale model should explicitly consider the performance of the EBS, allowing assessment of how the overall 3D impact of different EBS components / geometries influence weighting of channels.

Day 2: Tuesday 31st May

2.5 Preliminary analysis of deep geological disposal offshore (Manabu Inagaki)

This preliminary assessment responds to the recent development of the emphasis of the advantage of coastal sites by the METI working groups. In particular, a special characteristic of coastal areas (especially offshore) is the role of sea-level change on the performance of the repository. Other aspects associated with exploration and operational safety will be considered later.

The PA model output seems unreasonably pessimistic in terms of gradient, release flow path and GBI: a simpler model that is more representative of the system would be much better. A concern is that the extremely powerful role of the subsea geological barrier for timescales of many ka are ignored completely.

The assessment of density flow could be usefully checked (e.g., maybe unstable initial BCs may cause problems) by consideration of analogues and data produced in Finland (new Posiva project involving an offshore borehole).

Block 3 Brainstorming: assuring confidence in the safety case

The moderated brainstorming was focused by use of an initial argumentation model (AM) that was modified in real time to reflect input by TAC and NUMO participants (Blocks 3.2 and 3.3). This record captures only input that is not included in the AM – from blocks 3.1, 3.4, 3.5 and 3.6. Additionally, further TAC input to all blocks was produced during the closed session.

3.1 Introduction and goals

The key feedback from this section was on the costs and efforts required in the production and review of high-quality SC documentation. The external costs are clearly lower for those programmes that produce documentation in English. For the much larger US programme, costs are at least an order of magnitude higher – and much more if the costs of QA programme are included.

3.4 Practicality of safe disposal

For the plutonic rock case: the key TAC comments were:

- For geosynthesis, only hydro is considered – all geochemistry and critical RN transport properties are missing, which should be a goal for the future.
- The proposed issues for post-closure performance assessment (PA) are very important.
- For engineering, managing high flow features is a key issue. It is important to consider the impact of required engineering measures on post-closure safety. Maybe consider also alternative canisters and buffers.

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- The definitions of Layout and Emplacement Determining Features (LDF and EDF, respectively) need careful consideration in terms of requirements on a concept-specific basis (maybe also for specific scenarios) – this may be an iterative process. It also requires wider consideration of alternative disposal concepts (especially for TRU).
- It is emphasised that no new concerns that call H12 /TRU-2 conclusions into question have emerged, while progress in capacity to assess safety has been demonstrated.

For Neogene sediments:

- It is important to assess if self-sealing of fractures, as seen to be a key factor in European sediment URLs, be assumed for Japanese sediments.
- Active faulting / folding is an issue for site characterisation and also for regional evolution.
- For post-closure assessment, methane is not a specific concern but there is a general issue for all gas, which can be a key concern for tighter sediment. If methane inflow is significant, however, this is an indication that formation is not tight and hence gas pressurisation may not be a concern.
- There needs to be understanding of any very low permeability formations and advantages of focusing emplacement in them. Thickness of suitable formations may be an issue, along with any associated heterogeneity. Chemistry can be important – e.g., high corrosion during both open and closed phase as considered in France.
- Site characterisation is a special challenge due to the complexity of such formations, including fault properties (certainly compared to European clays) – although maybe not more complex than the crystalline basement rocks.
- Organic content / microbiology may need particular consideration.

For Pre-Neogene sediments:

- Ophiolites may be present as potential sources of gas / high pH fluids; even if size tends to be rather small in Japan, these may need to be a focus of site characterisation in some locations.
- Uncertainty in frequency of / extent of water flow in faults needs to be considered.
- Contrasts may occur between and within formations – high level of heterogeneity in mineralogy, chemistry,… Potentially very large effort needed for characterisation and demonstrating safety.

For all settings:

- Need to assess impact of uplift on different design, using required improved models.
- Within the design studies, the issues associated with sealing may be worth mentioning – especially for gas from TRU wastes.
- Retrievability is a general issue that might vary between different host rocks. Nevertheless, it is probably better to consider general discussion rather than any detailed analysis at the present time.
- In all cases, sorption databases are certainly insufficient and need targeted R&D: maybe focus on key RN (integrated with solubility and speciation, considering also high pH). In-situ (URL) work is required to support desk and laboratory studies; this general requirement applies to all cases, but availability of suitable locations differs considerably.
- Need to check if any scenarios missing – e.g., up-coning of deeper, potentially more saline water due to drainage during operations.

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- Possible problem arise from classification of sediments by age alone. Although it is noted to be a sensitive topic, preferable sub-groups may be identified based on technical arguments (e.g., consider focus on coherent pre-Neogene and looking at distribution of rocks on the east coast of Japan – including off-shore). However, even here, basis for preference is tricky as factors such natural resource potential may be a complication.
- Extensive discussion of pros and cons of options indicated, as expected, that all have strengths and weaknesses.

3.5 Safety case QA and future implementation

When managing requirements, the actual definition of requirements is a challenge which needs input from experienced generalists and to be developed in a top down manner. These should be only going into the required level of detail for any specific stage of your program (material from UK may provide useful background). It was recommended to consider building an integration team and /or doing confidence assessments.

There is a need of a structured process for review management. This should be based on the iterative SC development – which is related to evolving QA system detail / completeness and associated confidence. A special concern is management of quality of safety-relevant material provided by external organisations.

For production and review, the role of experts was noted: but with little mention of generalists. The latter play is an important role in checking coverage of the interfaces between specialists. It is important to ensure that highly experienced senior staff can transfer to the younger teams the knowledge they have gained working in safety cases since H3 and experience from international SCs.

Some verification of codes and databases has been carried out, but little validation: more use of large scale / long-term experiments and analogues is needed in the future.

Attaching younger NUMO staff to other organisations was noted as important to expand their understanding of the international state of the art. Benefits could be extended by bringing key foreign staff in-house to NUMO for mentoring / knowledge transfer.

3.6 Demonstration of the communication tool

It is intended that an English version of the CT will be used for TAC / NEA review of 2015R; the key question was can it be assured that it will be ready in time? Other issues brought up included:

- For hyperlinks to supporting material, it would be valuable to build these to specific sections rather than entire reports.
- It seems that the CT can, in the future, be connected to GIS data – which could be valuable.
- An important attribute would be the ability to carry out review work off-line: can this option be included?
- Comments should be linked directly to specific points in the documentation (may be possible in newest pdf files, if set up properly).
- How is feedback managed, within some kind of issues resolution process? It would be useful to define this explicitly.
- It was considered very good that search functions are globally applicable to all documents – with the building of ranking of hits a valuable add-on.

Overall, TAC welcomed this development, which appeared to represent the state of the art, and encouraged its rapid implementation.

Day 3: Wednesday 1st June

Block 4 TAC closed session & wrap up

TAC key observations were presented to NUMO by the chairman Comments from NUMO were captured in the expansion of this presentation.

In terms of review of supporting documents, it was noted that international TAC members have very limited capacity and should best focus on the Main report, with emphasis on their particular technical specialities. The domestic TAC members may, however, be able to review more extensive Japanese documentation and assure that key issues identified in this meeting are addressed.

Next TAC meeting: this is provisionally set as 12-14 December 2016, to be reconfirmed by NUMO closer to the time. 12-14 June provisionally selected for 4th TAC.

The closing address by NUMO Executive Director Umeki emphasised how useful and efficient this meeting had been and thanked all participants for their valuable input.

Appendices
1. TAC Participants list
2. TAC meeting programme