NUMO
Nuclear Waste Management Organization of Japan

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Record of the 1st NUMO Technical Advisory Committee (TAC) meeting Tokyo, 24-26 November 2015

Background

NUMO has promoted a siting process for deep geological disposal of vitrified high-level waste (HLW) and long-lived intermediate-level waste (termed TRU waste in Japan) based on a volunteering approach. The Great Tohoku earthquake and Fukushima-Daiichi nuclear accident in 2011 increased nation-wide concerns about the feasibility and reliability of geological disposal in Japan. Since then, the Government has been rethinking this issue and concluded that there still exist many potentially suitable sites. Based on this conclusion, the Government approved the amended Basic Policy for the Final Disposal Act on May 22nd 2015, which includes a more active role of the Government in nominating scientifically favourable areas and encouraging municipalities in these areas to consider accepting an initial literature survey.

In parallel with the further discussion on identification of favourable areas, NUMO is preparing a "pre-selection, site-specific" safety case (the NUMO 2015 Safety Case), which we hope will lead into our first phase of siting work. As part of overall programme QA, we have restarted our Technical Advisory Committee (TAC), which includes both Japanese and foreign experts (list of members in Appendix 1). The programme of the meeting is included as Appendix 2 and a list of NUMO attendees in Appendix 3.

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 were captured in the Argumentation Model, which includes input by both TAC and NUMO participants. Other TAC comments that were not discussed during Blocks 1-5 were captured in the powerpoint summary of the closed session.

Day 1: 24th November

Block 1 Introduction & welcome

The welcome and introduction was given by Dr Shunsuke Kondo, the president of NUMO. He provided background to the policy on nuclear power and geological disposal in Japan, explaining the role of NUMO. He emphasised the importance of the TAC in providing both strategic guidance and technical QA to NUMO as they prepared for the challenges of moving forward with the site selection process following the Government´s decision to be more actively involved here.

An overview of the programme and logistics by Tetsuo Fujiyama (NUMO TAC coordinator) was also included in this block.

Prof Takayuki Sasaki, chairman of TAC, briefly introduced himself, followed by brief self-introduction of TAC and NUMO participants (see Appendices 1 & 3) and an overview of the background to the meeting for the domestic TAC members.

Block 2 Background to 2015R

The NUMO "pre-selection, site-specific" safety case (Dr Hiroyuki Umeki)

This presentation provided background to the current "pre-selection, site-specific" safety case, the rationale and role of the new TAC. It included an outline of the use of an Argumentation Model (AM) to structure the SC, which will form the basis of the block 5 brainstorming.

The AM approach was recognised by TAC to be very useful. It was suggested that maybe it could be expanded to include decision making as an explicit goal. This could be captured by adding a question at the top AM level "How will the safety case be used?" It could be very useful for establishing dialogue with regulator – maybe as an approach to be applied as soon as possible. In terms of application, it was noted that this approach is now a focus for safety case development in Belgium.

It was recommended to provide a hard copy of the full AM as a basis for the brainstorming: could be useful to provide an overview for those who are not so familiar with the approach.

In the comparison of options, the weightings of requirements may lead to preferences being developed at an early stage: but care should be taken that these do not exclude possibilities for the future.

Use of advanced tools: it should be ensured that their potential communication roles are emphasised and applied wherever possible.

2015R: approach and overview (Dr Tetsuo Fujiyama)
This presentation gave an introduction to the approach to documentation of the safety case and provided the context for the following presentations.

The key role of integration was emphasised and this was strongly accepted by TAC, who considered it well organised.

The relationship between nested SDMs and their role was not very clear: may need to be better explained.

The role of H12 needs to be better explained, which is not only technical but also socio-political. Emphasise how problems identified with H12 lead to progress – this should be stated explicitly. Related to the situation in the UK, where a safety case update is in progress.

Role in terms of feedbacks has to be explained to evolve as the programme develops.

In terms of communication with stakeholders – carefully consider who these are and what their information needs are and ensure that they are covered by documentation. In any case, all documentation should be freely available.

Emphasis on pre-closure safety is very important. This could be a topic for a future TAC.

Block 3 Safety case overview

Geological basis of safety case (Dr Kunio Ota for the siting team)
This presentation gave an introduction to NUMO´s site characterisation plans and provided an introduction to the test cases used to develop the demonstrations of site-specific concept development and associated safety assessment. Focus was on the Plutonic rock basement test case (case 1), but the more complex Neogene sedimentary case was also introduced.

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TAC thought capability to carry out synthesis well demonstrated. Use of URL data should emphasise illustration of generic application. Caution also needed in terms of use of any quantitative criteria, which may give problems in the future.

The perturbing factors considered are OK at the LS (Literature Survey) stage – but other problems come into play at a more detailed level (salinity, chemistry,…). Maybe these should be explicitly mentioned, but certainly more complex in Japan as specific repository concepts are not defined.

No clear international analogue of the type of sedimentary environment considered (maybe closest might be Wellenberg, although this was not studied at such a regional scale).

Moving ahead to show how designs and safety cases are tailored to sites will be a key output of the work. It is also important to take into account the simplicity of the site setting as a key characteristic to consider when making decisions between sites.

Dissolved inorganic carbon (DIC) concentration cut-off seemed unusual, but was explained in terms of risks of stress-corrosion cracking.

Wider ranges of models could be considered and it might be useful to explain how specific models are chosen.

Engineering basis of the safety case (Dr Satoru Suzuki for the engineering team)
Suzuki-san´s presentation covered for HLW, including common aspects for TRU, with a focus on Chapter 4 but with some material from Chapter 5 where there were overlaps. Emphasis was also on fitting layout to the SDM, with case 1 used as an example.

The general approach was considered reasonable, with the importance of RM to guide design emphasised. When defining requirements / safety functions, maybe consider priorities – especially for the key roles of buffer in H12. May be worth considering if change management function of RM tool could be implemented, so that evolutions of concepts / designs with evolving knowledge can be traced. Also the iteration of examination of requirements to identify gaps that need to be filled by R&D should be explicit.

Resistance of OP against earthquakes needs to be explained – and should be also expanded to consider the impact on the buffer.

Grouping of plutonic and hard sediments together is not very transparent: seems to be based predominantly on mechanical properties and may need to be expanded on to make uncertainties /caveats more clear for both hard rock and soft rock.

Simple considerations of layout note hydro and mechanical constraints – what if these conflict or vary within a block? This should be discussed.

Assessment of accidents: more focus on designing to facilitate recovery from accidents may be useful (learning from WIPP).

Lots of work presented, but it was tricky to see the links involved and something that specifies how the decision involved are made is recommended (improved version of slide 23).

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Under QA (slide 11) or somewhere else, have more focus on robustness, in terms of simplicity that makes it easy to QA. QM is mentioned in many places (also in earlier presentations) – more explicit explanation of how it is implemented would be valuable.

For assured ease of retrieval, a better definition of the time period that is the goal may be useful (e.g. could be about 100y). This should realistically consider possible programme changes that could modify the present idealised implementation plan.

Arguments for practicality of implementation (Dr Satoru Suzuki for the engineering team)

Leading on from the previous presentation, the designs developed for TRU were discussed, using the same structure as before.

The safety functions are not very clear for TRU (e.g. slide 6), probably due to its complexity. Maybe these need to be explained a bit more for different groups and how potential adverse impacts of design components will be picked up. Certainly this is a focus for feedback from SA. For the specific case of corrosion gas, options presented may need more emphasis on how this is treated.

Specifications of tunnel dimensions seems very conservative (slide 17): maybe worth considering if there is potential for optimisation, e.g. allowing for higher temperatures or spreading high heat waste among lower heat material.

The move from fork lift to an overhead crane needs to be explicitly taken into account when examining drop heights for accident scenarios.

Thermal assessment may need to consider possible chemical heat, e.g. due to cement hydration or reactions in specific waste types.

Mechanical models need to consider impact of fractures carefully, on a location-specific basis.

Assessment of pre-closure safety (Dr Satoru Suzuki for the engineering team)

To complete the output from the engineering team, pre-closure safety aspects were overviewed.

TAC noted that this work is very advanced and more detailed than in many other advanced programmes. Assessing impacts of natural disasters and combinations of accidents seems very important and it is important to ensure all credible scenarios are included, as some may be forgotten with the post-1F emphasis on large earthquakes and tsunamis.

Considering conventional and radiological safety separately could give problems, as conflicts may arise in some cases (e.g. in case of fires). This should be reconsidered.

It would be good to explicitly mention when accident would need repackaging waste (especially for TRU) or whether it would still be acceptable for disposal, possibly as part of consideration between conflicts between operational and post-closure safety.

More consideration of large-scale design implications of accidents would be worthwhile (e.g. again learning from WIPP).

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TRU bituminised fire scenario is not the most extreme possible, so should be extended – including, for example, pressure change in the drums due to temperature rise. Maybe useful information available from Sandia. Also note longer durations of fires assumed in the UK – maybe check that assumptions are reasonable.

Consider Black Swans – could be the basis of an international project, leading to a focus on resilience.

Day 2: 25th November

Block 4 Post-closure safety

Post-closure safety case (Dr Susumu Kurosawa for the SA team)
This presentation outlined the approach to and results from post-closure safety assessment.

The general process illustrated conforms with general practice, but details of FEPs and their relationships (slides 11-14) seems strange in places: maybe needs careful review as part of QA. Some of this runs already using domestic members, but may usefully be checked by key international experts who understand the NUMO boundary conditions (at some stage, maybe next FY).

Including chemotoxic elements in safety cases is something to be considered – e.g. as in the UK. There are, however, limited databases or relevant international regulations (check previous review carried out by MCM). JAEA is responsible for RI waste, where this has been considered and resulted in a push for appropriate regulations. In any case, probably something to be considered here only after 2015R.

The way the presentation emphasised safety functions was considered to be very useful. These may be related more clearly to specific barrier roles and pick up timescales involved for the operation of the barrier function. Some of this may be captured by the storyboard approach. The treatment of FEPs using arguments may be complemented by scoping calculations to support the qualitative material presented. Effectively this is same as Posiva approach – where the completeness was questioned and, therefore, maybe bottom-up checks need more emphasis.

The very detailed study of FEPs is useful but a lot of work: maybe for 2015R there should be more emphasis on top-level functions.

Focus on realism is good, but uncertainties in conceptual models should be picked up to identify differences between sites and disposal concepts. It may be focused on key FEPs rather than analytical modelling. This may be especially the case for sediments, where repository-introduced impacts may be a lot more important. It is important, however, that international experience on sediments is not taken over directly.

Communication is very important – especially if SA gives different results for sites, which can be over-interpreted by the general public. Maybe present results in a manner other than doses (e.g. using storyboards).

Terminology: “containment” not directly equivalent to that in Scandinavia – although similar to uses in some other countries (may be worth explicitly noted).

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In terms of failure times, possible consideration of early failure (of a few OPs) may be worthwhile to examine sensitivity in terms of impact on doses (probably very little)

"Near field" model focuses only on fracture networks: it will be important to decide how the sediment case will be handled. Generally, more description of how the other cases will be handled is needed and could be a focus for a future TAC.

Long-term erosion – should be based on site- and design-specific characteristics (uplift rate, disposal depth).

In terms of overall arguments for safety (slide 34), QA is noted – but how is this done and documented needs to be described in more detail (maybe a general requirement for the safety case).

Integration of the pre-selection site-specific SC (Dr. Tetsuo Fujiyama)
The final NUMO presentation overviewed how the work of the different groups is integrated and incorporated into the 2015R.

The presentation was considered to be useful and might be usefully captured in the report (e.g. Chapters 2 or 8).

The complex tools to visualise the hydrogeological conditions in and around the EBS are very useful – not only for RN release assessment, but also related to EBS practicality (e.g. bentonite stability). It is also important to capture uncertainties when discussing output.

Moisture control – this is clearly a very important issue for pit emplacement and there is currently no practical solution that would be applicable to expected Japanese inflow rates.

PEMs have many attractions, but modelling the system in detail is required to support the safety case. A particular issue is the backfilling – which needs further consideration. For both buffer and backfill that are using natural materials, inherent heterogeneity needs to be taken into account.

The fault distribution looks a bit strange (slide 6), but related to stochastic approach: in real sites, a more rational set of faults / distribution of their properties would result.

At the present stage, the use of Spider´s web diagrams was recognised to be very useful, especially if based on top-level attributes, rather than more quantitative methods like MAA. Consideration of cost (or a related attribute) might also be included.

Block 5 Brainstorming: safety case completeness

Moderated brainstorming: this was focused by use on an initial argumentation model (AM) that was modified in real time to reflect input by TAC and NUMO participants. The output is available in the form of a functional pdf, which allows convenient reading of the AM.

Although not strictly part of the safety case completeness, TAC noted the great challenges associated with producing safety cases covering a range of HLW / TRU waste repository designs fitted to 3 very different geological settings. Although this is a reasonable aim given NUMO´s boundary conditions, it is a challenge which is beyond anything previously attempted

by a waste management organisation. It may be worth considering focusing on a single test case to allow more depth to be obtained from the limited human resources available – but it was recognised that this may not be acceptable from a socio-political viewpoint. In any case, the decision on the degree of width / depth of studies may be worth mentioning in the introduction to the 2015R.

Day 3: 26th November

Block 6 TAC closed session & wrap up

TAC key observations were captured in ppt format and presented to NUMO by the chairman. Comments from NUMO were captured in the expansion of this presentation. All TAC members will provide their input on draft materials (this record, the closed session powerpoint and the AM) within 1 week. Such input is incorporated directly into Appendix 5.

Next meeting: provisionally set as 30th May – 1st June 2016, to be reconfirmed by NUMO.

Closing address by Umeki-san emphasised how useful and efficient this meeting has been and encouraged further participation in the future.

Appendices
1. TAC Participants list
2. TAC meeting programme