Nuclear Waste Management Organization of Japan

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Record of the 6th NUMO Technical Advisory Committee (TAC) meeting

14 September 2021

Background

This virtual meeting of TAC is focused entirely on capturing input from the review of the English version of the NUMO Safety Case report to allow it to be finalised for submission to the OECD/NEA. The list of participants of the meeting is given in Appendix 1 (TAC members attendees), 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. To facilitate use, it does not follow the chronological order of TAC input, but regroups this to provide a logical development of the issues considered.

1. Welcome (Chairman Takayuki Sasaki)

Group Manager Fujiyama opened the meeting and Chairman Prof Sasaki welcomed the TAC members, thanking them for their careful reviews and the SKB team for supporting NUMO in implementing the review comments.

2. NUMO status (Tetsuo Fujiyama)

Dr. Fujiyama then provided a short update on the status of the SC report production, noting that the report should be available around next month online. He also outlined the timetable for the NEA review, which will commence with a kick off meeting in November, hopefully in Paris.

Dr. Fujiyama also gave an update on the status of the LS which began in November 2020. He noted that after the LS stage, sites will only go forward to the PI stage if public acceptance is gained. To this end, NUMO are currently engaged in communication activities at the 2 volunteer communities in Hokkaido and also across Japan at this time.

3. TAC review issue resolution (Ian McKinley (Vice-Chair), Johan Andersson and NUMO team)

Ian McKinley (Vice-Chair) and Johan Andersson outlined the process that TAC review comments were managed and the triage categories were defined by them and NUMO team. Even for complex technical issues, most could be resolved by the NUMO team. Nevertheless, six issues were highlighted for further discussion by TAC:

a. Geological assessment timescales not consistent with those for safety assessment

The question was asked of TAC, how can we add confidence for a timescale of ≈ 1 M years? It was noted that, from the standpoint of uplift and erosion, the slow evolution processes are well understood and that, for this driver, confidence can be assessed in stochastic models, as the regional tectonic setting is the driver for uplift. More specifically, it was explained that NUMO can evaluate evolution of geological environments up to 100 k years based on extrapolation of present tectonic movement, while longer-term can refer to the stochastic techniques used to

estimate over longer timescales (well described in Section 3.2 of the NUMO Safety Case report).

It was noted also that there is a need to bridge the period between 100 k and 1 M years. It was suggested that, as a practical measure, NUMO could define a *grey zone* after 100,000 years in the provision of input for dose calculations and state that this cannot be better assessed in the generic stage, but will be done in the future on a site-specific basis.

The question was asked that, if the uncertainties are very large over 1 M years, does this need consideration in the PA output? It was suggested that NUMO could apply cut-offs on such calculations, or indicate with shading (based on the 3 time frames of up to 100 ky, 100 ky to 1 My, over 1 My) the increasing uncertainty with time and add a statement that the results should be treated with appropriate caution.

It was highlighted that the Japanese version of the report is already published, so perhaps minimal changes to the results should be made and therefore adding some more explanation in the SC report might be the best way of handling this issue.

b. Uncertainties (including propagation) and data specification

Everyone agrees that uncertainty management is an issue for the future and that, in Chapter 7, an overview of how NUMO will treat each form of uncertainty as the siting process continues in the future should be provided. TAC members were asked for input on how best NUMO should handle this, and comments were provided by TAC as follows.

The current primary concern is the scale of uncertainty. Is there a way to identify the specific drivers of uncertainty and categorise or group them by size or threshold? Should they be prioritised? A key goal is identification of the largest uncertainties, which will be addressed through future site characterisation work. How does NUMO do this when many uncertainties are strongly coupled? For WIPP, it was done on a FEP-by-FEP basis in order to identify the most sensitive issues in terms of consequences/impacts. This can be done conceptually with a hypothetical site, but is best done when candidate sites have been identified using more detailed site specific information and sufficient numerical descriptions. Thus, we must acknowledge that the key uncertainties will be site specific.

Sensitivity analysis was suggested for identification of the uncertainties most influencing results. Although the ideal way involves detailed modelling to capture understanding, greatly simplified models can be used for initial scoping sensitivity analysis.

An alternative approach involves expert judgement. It was suggested that an exercise to capture what the sensitivities are and describe the methodology to refine the key uncertainties, would be useful. As siting progresses and the repository concept becomes better defined, such assessment can become more detailed. The initial goal would be to show how such a procedure could be established. This would be a potential future TAC topic, capturing the expert knowledge of both the Japanese and international members. Perhaps something could be added to Chapter 7 to indicate how this will be done in the future.

c. Need to consider chemical evolution in more detail (e.g., including microbes, colloids and gas) and assess impacts on key safety functions

It was firstly noted that caveats have been added to the SC report to highlight the importance of these areas and how they will be dealt with in the future. However, the question was asked: are there chemical issues that might call the SC into question and additionally what interactions should be studied/prioritised for future safety cases?

It was noted that the reviewers' concerns focussed mainly on HLW and not TRU waste and that the general issue was that geochemistry is given too little attention, not only in the assessment but also when planning site investigations. If there are good reasons for this, then NUMO should say clearly state why, giving clear justification.

In the safety case, chemical erosion of bentonites was considered only to be an issue for salinities below 4 mM, whereas even the most dilute deep waters in Japan are above this limit. It can be further noted that, in Japan, there is generally a reasonable thickness of surface sediment and there is no glaciation, so therefore there is no driving factor for low salinity water to depth. However, it was suggested that there is a need to expand justification for excluding this process, particularly as it seems the salinity limit of 8 – 12 mM has recently been considered in Scandinavia and the low densities of the Japanese bentonite buffer may make it more sensitive to erosion. Although this may be of little concern for repositories under the sea or a coastal location, NUMO should not forget about high permeability rock inland, which, when coupled to the topographic relief, could drive meteoric water to depth. TAC was assured that a more cautious description has been added to the report in this regard.

The role of sulphur chemistry on the corrosion of steel was also identified as an important issue, especially if there is any risk of loss of the protective roles of the buffer. This may be less critical for massive steel (compared to copper) but again, TAC was assured that this issue will be identified as an issue to be examined in the future.

Another potential issue was that the geochemical interaction between the host rock and the EBS. Such interaction is strongly coupled to hydrogeology and it may be worth noting where NUMO list in the EBS/geosphere permeability scale compared to other advanced programme.

These were agreed to be important issues for the future and it was noted that actually the key messages are there. The point was made by NUMO that in fact, within the geological environment model, the EBS system and the host rock are coupled. The main report skips over chemical interactions, but such considerations were included in the Supporting Reports. NUMO agrees that additional material on the chemical issues should be included in the Main Report. This will be discussed with the SKB team and something added by way of a cross reference in Chapter 4 to considerations in Chapter 7.

d. Early high doses for some scenarios

The point was made that this is an issue the NEA reviewers are likely to pick up on. The question was then asked: could the dose results be presented differently or better caveats added? TAC suggested that, whilst over conservatism should be avoided, it may not be productive to waste time making more realistic estimates at this stage, as NUMO is illustrating a safety assessment framework and not assessing radiological impacts on the environment. The suggestion was made that perhaps a box or a figure could be added to explain the number of highly conservate assumptions involved (making it more of a "what if?" scenario).

NUMO will produce a qualitative argument explaining why they developed this very conservative scenario and will explain this to NEA, mentioning that more realistic modelling is required. Important is how NUMO strengthen the qualitative arguments to show that, under even huge conservatism, safety is still assured.

It was agreed that a text box that qualitatively highlights the conservatisms should be added and that feedback from NEA will be important. When the report goes to NEA for review, and when presenting the results, NUMO should highlight the over conservatism of the assumptions. The

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question was asked where this should be added, should it go into Chapter 6? NUMO will discuss this and decide as soon as possible.

e. Scenario development and how this has – or has not – affected assessment of the EBS by the design team and the safety assessment team respectively

It was firstly noted that scenario development should be dealt with together with uncertainty management. The question was then asked: how can NUMO improve this difficult area, is there any recent experience that would provide recommendations to NUMO for improvement in the future? TAC said a number of new ideas/approaches have been tried.

It was suggested that, for the present report, to expand related discussion in Chapter 4. Chapter 4 presents an assessment of the barriers, but, it is difficult to do this without assumptions about long-term evolution. Perhaps give some ideas of the evolution scenarios that are considered there, noting that performance assessment cannot be decoupled from engineering and design. It was suggested that this could form the basis of a special brain storming session for TAC in the future.

Perhaps it might be worth explicitly admitting in the conclusion, that scenarios were developed for the stage NUMO is at and that in the future scenarios will be modified. This can link to uncertainties, as a lot of key uncertainties lie within the scenarios. This could also be considered for a future TAC session workshop, covering the areas of scenario development and uncertainty management together.

f. Structure and content of Chapters 7 and 8

The main TAC issue with Chapter 7 is that a large part of it is more of a summary and very repetitive, such that the key messages involved in safety case development are lost (or diluted). It was suggested to revise the title and explain better the purpose of both these chapters.

It was mentioned that, perhaps, major changes at a late stage are risky as they may introduce errors or inconsistencies. However, if it is possible to remove the repetition quickly, then this could be done. But it was also stated that this is lower priority than some of the more technical issues – so perhaps adding a clear caveat at the beginning of the chapter would be sufficient.

The question was asked: should there be an executive summary added before the NEA review? There is an executive summary in the Japanese report (5 – 10 pages). It was agreed that perhaps, at this stage, it is not a high priority. More important is that Chapter 8 should be expanded and developed into a real summary. After this, a short executive summary could be produced if desired.

If Chapter 7 is to remain the same and not have the summary sections cut out, then the title needs to be changed to reflect what the chapter is actually about. It was accepted that the titles need to be revised and Chapter 8 needs to be expanded so it matches all the reviewers' recommendations.

Open questions?

Finally, the question of whether any important issues had been missed was discussed.

The one issue raised involved operational safety (Chapter 5): in the report it says there will be no RNs released during the operational phase based on the assessment of a small number of simplified accident scenarios. Caveats on this need to be included, especially for the case of

bituminised waste (TRU Gr.3), which is a major concern in France and hence may be a focus for the NEA reviewers. NUMO could add a note to show awareness that this is an issue and consider international experience here to assess associated issues in the future.

4. Wrap up (Tetsuo Fujiyama)

Dr. Fujiyama thanked everyone for the valuable discussions and for being able to cover everything in one session. He informed TAC that NUMO will be in touch with them if there were any further issues for discussion.

5. Plans for next TAC and Close (Tetsuo Fujiyama/Hiroyuki Umeki)

With the aim of focusing on how the SC will develop in the future and guide NUMO's stepwise site selection process, a provisional date for the next TAC meeting was set as the week of 5th September 2022 (hopefully in person). Based on current plans for the NEA review, this would thus be after this has been completed and the results can be presented to TAC. TAC members will have this date confirmed as soon as possible, at least 6 months beforehand.

The closing address was given by Executive Director Dr. Umeki, who emphasised how valuable TAC input has been for the production of this first safety case and thanked members for their efforts in increasing confidence in the reliability of the SC documentation.

Appendices
1. TAC Participants list
2. TAC meeting programme