

NUMO International Technical Advisory Committee

Short Record of the ITAC-6 Meeting Tokyo, 16-18 December 2003

1 Introduction

President K. Tomon opened the meeting by reminding everyone that it is now a year since the open solicitation progress began, on 19 December 2002. NUMO has received lots of enquiries and many municipalities are interested. He believed that some municipalities will perhaps volunteer themselves as PIAs in the not too distant future. English versions of technical material will be important internationally and this will be the main focus of this meeting.

Charles McCombie noted that ITAC hoped also to be able to look at the overall programme and the R&D planning, as these issues will become increasingly important in the future. This would also be ITAC's 2nd meeting with DTAC and first open public meeting. He suggested that the ITAC/DTAC goal for this open meeting should be to demonstrate three things to the audience:

1. NUMO has developed a structured programme that will lead to the implementation of a state-of-the-art HLW repository.
2. NUMO is fulfilling its responsibility to present this programme openly and transparently and to answer any questions arising.
3. To help it in its work, NUMO has assembled competent groups of advisers, representing scientific and technical expertise and advanced programmes, both nationally and internationally.

2 NUMO contacts with AEC

S. Masuda updated the group on NUMO input to the AEC Long-term Programme for Research, Development and Utilisation of Nuclear Energy hearing on 7 November, which also involved input from JNFL and JNC. The minutes are available (in Japanese) on the AEC webpage. The history of the HLW disposal programme goes back to 1976, with a decision to start an R&D programme on geological disposal, leading eventually (via PNC/JNC core research projects) to the Final Disposal Act of 2000. NUMO's input highlighted several key issues:

- It is important to gain the understanding and support of local residents, through full transparency and information disclosure
- Every player, from government down, should be mutually supportive and co-operative
- The government should aim to explain the need for disposal to the public and especially to local residents, and should provide systems to allow their involvement

- The government and related organisations should push forward fundamental supporting R&D, as well as that needed for regulatory purposes
- Among these organisations, JNC should carry out R&D on the reliability of disposal technologies and safety assessment methodology using research facilities such as those at Tokai; these research facilities should be clearly distinguished from potential repository sites
- The implementers should take charge of developing technologies for safe and economically efficient implementation
- The key elements of confidence building are a sound scientific basis, demonstration of technologies, organisational trust and an independent, competent regulator.

Discussion focussed on NUMO's role in the four "activity" areas of integration, science, technology and R&D specification identified by S. Masuda, who saw the institutional roles as follows:

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| ➤ Science integration | Regulator responsibility |
| ➤ Technology integration | NUMO responsibility |
| ➤ Specific detailed science (R&D) | National labs such as JNC, JAERI; |
| ➤ Specific technology development | Industry, via contracts with NUMO. |

ITAC noted that this did not reflect the most common practices internationally and felt that this was not the optimum approach to R&D specification. The comments made were:

- It is good that NUMO is involved in developing the AEC programme.
- ITAC agrees that NUMO should be the technical integrator, but this is not sufficient. There is a need for NUMO to be able to influence and focus national R&D, as well as simply as technology integrator, since the implementer has the closest practical understanding of what R&D is necessary. Self-sustaining R&D programmes tend to lose focus and often tend to diverge from the key issues.
- The regulator cannot be the integrator of science. Both the regulator and implementer need their own, independent R&D programmes, but these do not need to duplicate each other.
- The current JNC R&D budget is 8 billion JPY (60 % for URLs), whereas NUMO's budget is only 2 billion JPY. This strongly influences what R&D can be done where.
- Although it may be appropriate that the government takes a large share of the R&D funding burden at present, NUMO may eventually "inherit" their science base (by analogy with other national programmes) and the costs. Therefore, NUMO should be confident that those involved are engaged in relevant R&D.

It could be useful for the ongoing NUMO discussions with AEC if ITAC were to develop a briefing and commentary paper on how the issues of responsibility for disposal R&D are organised in other national programmes (could be a topic for a future ITAC).

3 RC development

Charles McCombie introduced the joint ITAC views on the "Chapter 7" RC document that is currently being considered as the base for an English version of the Level 3 RC supporting document. There is also a recommendation for a similar English version of the SF document. The ITAC input was distilled into a set of "key messages" that the report should be conveying and these were presented in a set of overheads and not repeated here.

For similar future exercises, there is a clear need for more specific guidance on the level at which review is expected (e.g. on this document ITAC had overarching structural comments that made it debatable whether detailed text editing would be useful).

In further discussion, ITAC raised the following additional points:

- Terminology: a more standardised and neutral terminology is needed that can equally incorporate H12 and other major concepts. The suggestion was to distinguish at the top level "repository concepts" (RC); below each RC all "variants" or "alternatives" of that concept should be called "design options". There is no need for the RCs to be equally developed at all stages of NUMO's programme and the terminology need not reflect the amount of supporting work that has been done at any time. For example, there is no need at present to have a "reference concept" and already identifying one may indeed be a burden at a time when site properties are not known.
- The current list of RCs is not intended to be comprehensive: NUMO is open to any new concepts that may be appropriate and is continuously thinking about ways to develop and optimise concepts, but does not have a specific objective to define entirely new concepts. ITAC agreed that this was a sensible approach, that developing a "comprehensive list" for its own sake would not be useful and that it could dilute effort unnecessarily. There should be a sufficient range of RCs to cover the range of SFs that might occur. NUMO needs to be clear in the introduction to its documentation about its objectives and boundary conditions for developing RCs.
- There is some uncertainty about whether specific hydraulic cage concepts would actually work in highly permeable formations (N.B.: experience with the Swedish WP Cave), so these should be treated with caution.
- The RCs called "novel" generally date back a long way, but are distinguished by being mainly paper concepts, with little practical development work to date. Although technologies will evolve a lot before implementation, there is still a lot of development to do on even the well-established "feasibility concepts" such as KBS-3 (which is 25 years old).
- At present NUMO will need to adapt RCs to match actual site properties. This is not the same as formal optimisation, which is a difficult and sensitive topic.
- It could be useful for ITAC, at a future meeting, to make presentations to NUMO about national approaches to the closely related issues of monitoring, inspectability, reversibility, retrievability and demonstration facilities.

H. Umeki then presented the current RC development work. The final results of the work will be presented at ITAC- 7 in April 2004. Each of the current six work packages was presented briefly and discussed as the presentation progressed.

ITAC comments were as follows:

- When this project is presented publicly, the framework in which quantitative values (e.g. respect distances) are being used should be clearly stated. For example, are these working guideline values or rigid criteria? NUMO responded that these values are not strict criteria and are just being used at the present stage of their programme to see how repository layout could be constrained.
- It is important to point out that all respect distances are site and formation specific. Although it is necessary to use a range of numbers in the RC project to scope potential layout constraints, it must be made clear to readers of documents that these are not being "frozen in" to the programme as target values at this stage of the programme.
- The organic content of sediments could be mentioned as potentially affecting their suitability (although significance may be very site- and concept-specific).
- The geological environments being considered should reflect the real geological environments in Japan, rather than being constrained by the two "classic" categories: e.g. separate rock type category, tuffs, might be useful (in addition to "hard rocks" and "sediments").
- Consideration of buffer temperatures above 100°C is appropriate, but this will mean new R&D needs to be carried out by NUMO. If bentonite can be assured to remain dry (e.g. encapsulated in sealed, pre-fabricated emplacement modules), temperatures up to ~300°C might be considered, but would need more supporting R&D.
- Very high temperature options (> 300°C in dry bentonite) raised many uncertainties and specific R&D by NUMO seems not to be justified. In any case, at these temperatures in bentonite, the thermal constraints would probably be set by behaviour of other parts of the system.
- Working environment constraints could consider humidity as well as temperature (e.g. as in German mining regulations).
- Mechanical constraints should include consideration of high *in situ* stresses and stress anisotropy.
- Design strategy might wish to consider countermeasures against adverse chemistry problems (by analogy with countermeasures considered for adverse flow conditions).
- In all RC work it is essential to iteratively integrate the SF and PA work – i.e. this is continuous and not just at major programme stages.
- There will need to be a traceable methodology for how a choice of RCs is made at a site with multiple possibilities – the next ITAC might look at the status of NUMO's selection methodology (MAA) in this area.
- It would be useful to summarise the ongoing work in open documents.

4 Current status of NUMO QMS activities

Y. Takahashi introduced the status of NUMO's quality management system (QMS) work. The QMS is aimed principally at the production of NUMO's mission documents, which need to be reliable, technically credible, transparent and traceable, to meet stakeholder requirements. It will be applied within the Science & Technology Department, with K. Kitayama in overall charge of QMS management, supported by a Quality Manager and a QMS Support Team.

In due course, NUMO would like to acquire ISO 9001:2000 accreditation, but currently has no planned path to this goal. The structure of QMS documents has been planned, along with the three categories of technical documents to which QA will be applied and the QA process itself. The review process involves both internal and external reviewers for almost all levels of report. QA Level 1 documents will require a quality plan. There is no QA planned for day-to-day communications, such as e-mails.

Trial operation of the system begins this month, with full operation (with continual improvements) from March 2004.

ITAC commented:

- The QMS starts at an appropriate level of detail for this stage of the NUMO programme.
- Starting within the Science & Technology Department is appropriate, but QMS should eventually extend throughout the whole organisation. NUMO responded that they have discussed this at Board level and the Administrative group are also interested in implementing some kind of parallel system.
- Formal internal decision-making processes should be within the scope of the QMS.
- NUMO will need to introduce QA into its contracted work. The whole national R&D programme providing supporting data for NUMO will eventually need to display appropriate QA. NUMO responded that, at present, the QMS framework at least gives an indication of how they should review documents that come in from other organisations.
- QA is also vital in data and project management (as well as documentation).
- The regulator will probably develop an interest in assessing NUMO's QMS at some point.
- It would be useful for ITAC to see some of the Quality Guidelines for one of the groups, to see whether they compare with their own national experience.
- As most of NUMO's S&T work will be contracted out, NUMO needs to look at contracts as being rather like a specification to a manufacturer.
- Audit is an important part of a QMS. NUMO responded that internal audit is not currently part of the QMS and it will be up to the overall QMS Manager to decide what is needed and when.

- Many of these above points will need to be addressed before NUMO moves to certification.

5 Science & Technology Department mid-term programme

K. Kitayama presented the mid-term programme, the objective of which is to select PIAs by FY 2007¹. It is hoped that the literature survey will begin next year when the first volunteers are expected to emerge². Two areas of activity are anticipated: technological work to support the PIA application and development of the technological basis for the subsequent DIA stage (methodology for repository design and PA for volunteer areas and eventual assessment of their acceptability).

Frameworks and work plans exist for the four main groups of work: collecting information, evaluation, reporting in public documents and work for the next stage. This is presented in the form of a matrix that covers, conceptually, the next ten years.

ITAC commented:

- In the absence of any national regulatory standards, it is appropriate that NUMO is developing a working "self standard", although ITAC suggest calling it just a "working standard". The idea could be extended to the whole organisation, with the definition of some kind of NUMO ethical mission standard. NUMO responded that, although ethical ideas were not to the fore, many of the concerns of the public and regulator could be incorporated.
- All work should have the concern of obtaining public trust in mind, and this should not just be left to the specific activities identified in this context in the presentation of K. Kitayama.
- Quality culture is a valuable way of gaining public confidence, but it is difficult to define. NUMO responded that it has parallels in NPP safety culture. Everyone involved must be conscious of wanting voluntarily to improve quality and the process begins best if the managers provide the tools and mechanisms to do this – it should start at the top.
- It would be useful to see how the R&D and PA work will be integrated into the parallel evaluation of information on volunteer sites. The present matrix is a little confusing as to what happens, when and could usefully be elaborated.
- Between meetings, it would be useful for ITAC members to receive a short (one page) update "newsletter" of NUMO activities and developments.

¹ A report on PIA selection covering each area will be prepared in mid-2006 and an application for PIAs submitted to the government in early 2007.

² The meeting heard that municipal and general elections, along with local government merger plans, had slowed down the process in 2003 – the last will not be completed until autumn 2004. Thus NUMO acknowledges that it may have to adjust its timeplans.

- ITAC feels that it could usefully review a specific list of the technical projects that fit into the framework presented at this meeting. NUMO responded that it already had this in mind.

6 DTAC – ITAC Open Discussions

The objectives of this joint meeting were to discuss the final drafts of the Level 3 documents, gather information for preparing the final Japanese and English³ versions and improve the transparency of the documentation process. The minutes of the open meeting will also be made available (separately from these ITAC minutes) on the NUMO web site.

In the short pre-meeting, there was discussion over the use of the term "inspectability" (of packages in an un-backfilled, unclosed repository). Some DTAC members found this to be an unnecessary sub-division of "monitoring", which may make the latter more difficult to explain. It was made clear that the requirement for NUMO to develop a position on issues such as inspectability, monitoring, retrievability etc, does not mean that either ITAC or DTAC is proposing that these activities should necessarily be incorporated into the RC or operational plan. However, NUMO needs to be prepared to respond to questions on all these aspects now. An issue of particular public interest in Japan is long-term safety and timescales and how these can be handled with confidence.

The public meeting was held at Kenchiku Kaikan Hall and was divided into two sections, dealing with the RC and SF Level 3 documents respectively. NUMO presented the objectives and outline structure of each (RC, H. Umeki and SF, H. Tsuchi), after which DTAC and ITAC gave short presentations on their review comments (RC, Professors Y. Ichikawa and N. Chapman and SF, Professor T. Ohe and Dr. M. Apted). The floor was then opened to discussions and to questions from the audience. The following sections cover the main issues discussed.

6.1 Safety Case

What is the safety case and how should it be used? There is considerable discussion of this, especially in the USA. Although broad agreement exists on the general intention – there is no real unanimity between countries and organisations on precise requirement, definition or application. Despite having an origin and use in normal industrial practices, the term does not exist in formal radioactive waste regulations in most countries and is difficult to translate into many languages, including Japanese. At its simplest level, it is a collection of arguments used to show how a repository system performs and provides safety. This collection includes rigorous modelling aimed at producing quantitative dose or risk estimates to demonstrate regulatory compliance and much "softer" information to illustrate

³ This will not be a direct translation of the Japanese version, but will be directed at an overseas audience, which has different information needs.

how the system or its components work. Examples of the latter are natural analogues, comparison with natural geochemical fluxes, simplified description of key processes, etc.

A key issue is showing how much uncertainty exists in each argument and what its impact is on confidence in overall safety. Perhaps the key definition is that a safety case comprises multiple lines of arguments to show safety (including confidence in the models and data used for its evaluation), with an emphasis on frequent iterations of safety assessment as knowledge grows. This is the approach being adopted by NUMO, which sees it as part of a staged process that will need dialogue throughout, with the public and the regulator.

The current trend seems to be that formal compliance testing using PA is becoming a less prominent (but still essential) part of overall safety cases, as more readily understandable arguments and evidence are increasingly being presented. This seems also to be what the Japanese public are looking for. Experience from the media side indicates that the Japanese public would look for a simple safety message, based on an objective standard.

6.2 Transparency & Trust

Part of demonstrating safety involves ensuring that there is confidence in the institutions and processes concerned with granting permissions: the implementer, the regulator, the government, the prefecture and the municipality. In this respect, it is important for all parties to have competent and respected experts providing advice. Also critical is open access to information for all and a clearly defined process (and rules) that is adhered to. NUMO made the point that it does have systems for ensuring that all information is, in principle, made available (some information is, however, commercially, legally or personally confidential in nature) and an appeals procedure for any organisation that feels it cannot obtain what it needs. The DTAC/ITAC noted that, in principle, all technical material is made accessible by this NUMO system: this simple approach is better than being over-cautious, which can backfire later in the programme when unpublished documents come to light and may appear to have been hidden.

It was suggested that NUMO needs to be very clear about how it will develop its safety case and how it will decide when it is sufficient. Objective criteria may be needed for doing this and third-party, external judgements (independent reviewers) should be included in the decision-making process. NUMO said that the core of the whole matter was transparency, linked to a "safety culture", which it is developing. In France, an independent review board proved very powerful and actually resulted in a site being dropped, even though its selection had been supported by both implementer and regulator.

Not only must the process of decision-making related to site properties be transparent, but also that associated with other key aspects of the programme - such as the benefit or compensation packages and the outreach scheme. This is why the transparent process has to encompass the government and the prefecture / municipality as well. There is a danger that transparency can be lost as the project moves upwards, from implementer to internal government decision-making. The implementer has then to accept the consequences of decisions that are out of its control. For example, in Germany, a site accepted by one

government was cancelled by another; a highly non-transparent procedure where the process was changed, which destroyed confidence.

Adequate funding for the communities (municipalities) and their experts is important. In Sweden this is provided by the central "waste fund" and is out of the control of the implementer. Decision-making within the community should be seen to be clearly independent of the implementer.

It should be noted that the safety regulation for HLW disposal in Japan is still under discussion. This makes it less easy for NUMO, as well as making the whole process less transparent. Public trust will be enhanced when the safety regulation is established and the regulatory review is assured to be conducted competently and accurately.

6.3 Repository Concepts

A view was expressed that the near-field will probably be the centrepiece of the disposal system that governs performance, based on the H12 experience. Evidence from the various countries represented by ITAC suggests that this will not necessarily be the case; national concepts place different emphasis on the engineered barrier system (EBS) and the natural barrier system (NBS), that is inevitably site or formation specific. It was also noted that the weighting on the EBS and NBS can change, even for a well-known host rock and disposal concept, as the programme evolves and the specific system become better understood. Examples cited included: Sweden and Finland, where, over twenty years, increasing emphasis was placed on the EBS as it became clear that the possibility and impacts of high flow features in the rock could not be eliminated and the USA, where the role of the NBS at Yucca Mountain diminished as the site became better understood. NUMO noted that attaining the right NBS-EBS balance will be important, as it may wish, for example, to eliminate over-designed aspects of the EBS if site conditions can be shown to compensate. Some programmes (e.g. Germany in salt, Switzerland and France in tight clays) may be able to place less emphasis on the EBS, owing to the very low permeability host rocks.

A related issue is that the EBS and the host rock need to work together, e.g. even if most of the barrier function is related to the EBS, the natural environment still needs to be favourable for its longevity. As experienced in the Swedish and Finnish programmes, site-specific host rock characteristics (e.g. high salinity) and engineering demands (e.g. need for cement-based grouting) impact the EBS performance, which also opens discussion on whether the EBS system needs further development.

National experience showed that it was not good to be tied to a single concept at too early a stage. For example, the original case study presented to illustrate the Canadian disposal concept was based entirely on a specific, very "tight" rock, which AECL could not conclusively demonstrate was likely to occur in potential siting areas outside the pilot study site. This necessitated a late redesign effort, which placed more weight on the EBS to meet safety criteria. The need to adapt design to emerging site conditions is paramount, especially in a programme such as NUMO's, where there is almost no information about what the potential siting environment could be. NUMO will need to be able to adapt not

only to formation properties and environment, but other "geometrical" drivers, such as formation depth and available land area, all of which could affect repository concept significantly.

The H12 concept itself should thus be expected to evolve, but this should not be taken as a criticism of the original, generic work.

6.4 Siting Factors

The audience was interested to know how the Favourable Factors (FF) would be used in assessing on PIAs. NUMO explained that a variety of approaches to evaluating FFs was planned. Multi-attribute analysis is one method. There was some criticism that all such techniques lacked transparency; however, it was pointed out that MAA is actually a way of transparently showing how factors interact and how different weights and views can be taken into account in decision making. Indeed, the public can be involved in such activities. In all approaches where factors are compared and balanced, safety should be taken as an absolute condition and pre-requisite, prior to comparisons of other FFs.

It was noted that FFs and exclusion factors have been used in different ways and in different logical orders in each country. It was also acknowledged that the tectonic situation in Japan required a specific use of primary exclusion factors.

It is most important to avoid defining isolated, "secondary" exclusion factors at a late stage in the programme (e.g. setting maximum acceptable values for hydraulic conductivity), as site suitability (once past primary exclusion criteria) will depend on a balance of how factors interact to control site behaviour. It is necessary to explain this flexibility, as the public often wants to know what discoveries during a site investigation would cause an implementer to "walk away" from a site. At WIPP (USA), site investigations caused the siting area to be moved. This kind of response enhanced credibility when dealing with the public.

The NUMO approach to Supplementary Investigation Areas was discussed and both ITAC and DTAC agreed that it is essential to be able to do this additional work outside the PIAs. How it is implemented will need to be decided on a case-by-case basis. NUMO needs to have the support of the broader technical community in explaining its importance, as it may be a difficult issue to introduce to communities neighbouring a PIA.

7 English Level 3 documents

H. Umeki presented the scope of the two documents, with technical and international stakeholders being seen as the main audience. The reports will be short and stand-alone, in clear and easily readable text, with illustrative figures and clear messages. RC will be about 50 pages and SF about 150 pages (about 100 pages of this is a long appendix explaining, for the foreign audience, the Japanese geological situation and its future predictability).

The writing and review processes were discussed and agreed as follows:

- **Drafting group (Dec – mid March):** sets English style and produces 90 % complete, polished documents
 - ◆ I. McKinley with RC group (H. Umeki, M. Naito)
 - ◆ N. Chapman with SF group (H. Tsuchi)
- **Internal Review group (mid to end March):** checks structure OK, national strategic correctness and general "sanity check"
 - ◆ RC: S. Masuda, C. McCombie, possibly plus external expert
 - ◆ SF: K. Kitayama, J. Andersson, Prof. S. Yoshida + others
- **ITAC review group (early April):** clarity from an international reader's perspective; correctness and technical completeness
 - ◆ RC: M. Apted, K. Nuttall, B. Faucher, J. Vira
 - ◆ SF: K. Kühn, E. Webb, M. Apted
- **ITAC-7 overview (late April) & publication in May/June**

Publication will be in form of hard copies as well as electronic (on the NUMO webpage).

8 Closing Session

Charles McCombie presented the comments and suggestions of ITAC summarised above at the end of the meeting. The dates of the next meetings are:

- ITAC – 7: 20 – 22 April 2004
- ITAC – 8: 12 – 14 October 2004