NUMO International Technical Advisory Committee

Short Record of the ITAC-5 Meeting
Tokyo, 29-31 July 2003

Introduction

This short note summarises the main points discussed during ITAC-5. It is based on the presentation by Charles McCombie in the final wrap-up session of this meeting and subsequent discussion. This record contains many abbreviations and acronyms; some of the more important ones are explained in an appendix to this note.

General Remarks

During the opening session, the two new ITAC members – Keith Nuttall and Klaus Kühn briefly introduced themselves. This expansion not only extends the number of countries represented, but also widens the range of technical expertise included, the former bringing metallurgy, and the latter mining engineering expertise. The letter of appointment / reappointment from President K. Tomon was noted to present an interesting challenge for the future – identifying specific technical areas where input would be required.

The standard (style, presentation and content) of the NUMO presentations was extremely good and the level of preparation was greatly appreciated. Teams seem to be well established and to work together constructively. Responses to ITAC comments were well documented; this does not imply 100 % acceptance but rather well-balanced consideration of their applicability to NUMO's particular boundary conditions. ITAC appreciates continuation of its mandate and recognition of a need to be kept fully informed of progress in the Japanese national programme. This could be a focus for extended presentation in future ITAC meetings (especially as ITAC members are regularly questioned on NUMO progress).

The meeting itself had a similar format to the previous ITAC-4, containing a session with an international overview – in this case focused on QA experience. This session went well, but ITAC's internal co-ordination might be better organised in the future (especially with expanding membership). The topics for future special review presentations should also be identified as early as possible to help ensure such co-ordination. The interpreters / communicators were again very valuable for key sessions and should also be included in the future.

Status of NUMO programme

The international interest in NUMO's volunteering process has been considerable, which also increases the requirement for ITAC to provide support – explaining the expansion of its membership and strengthening of the secretariat. ITAC members would appreciate regular, detailed updates to allow response to the questions on progress which are often addressed to them.

Transparency was identified as essential for gaining and keeping public trust. The Japanese programme has exceptional legal requirements which will present a continuing challenge.

Priorities seem to be generally well set and SC / RC work seems well co-ordinated. Planning ahead to consider requirements of a site characterisation programme and linking this to RC development is sensible in a programme with a volunteering approach, since flexibility to respond to the wishes of different communities is essential. Long-term R&D programme planning will, with time, need more emphasis and could be a topic for a future ITAC session.

ITAC was impressed by the extent and content NUMO's PR work. The programme was comprehensive and the follow-up work to assess the impact of communication actions was well done. The extent to which feedback can be used to redirect / redefine messages might be a future focus for consideration, however. The DVD circulated to ITAC before the meeting was noted to be impressive. The dialogue with anti-nuclear groups is creative and potentially very useful. The upcoming local government reorganisation was recognised as causing particular challenges for the volunteering process.

Quality Management overview

A series of presentations overviewed the situations with regard to quality management (QM – regarded by ITAC as more comprehensive than QA) in the national waste management programmes of Sweden, Finland, France, Germany, Canada, USA (YMP and WIPP) and Switzerland. This was followed by an outline of NUMO's QA plans.

A synthesis of the experience in various national programmes derived from these presentations leads to identification of a number of areas of consensus in all programmes:

- QMS is necessary to avoid problems and perturbations; many examples are available to demonstrate this
- However, having formal QA alone is not sufficient to create a quality programme: there is also a need for good science and good management – as emphasised in ISO 9001
- QM / QA effort should focus on quality-critical activities: some activities require lower levels of QA (e.g. early generic R&D) and should not be overburdened by inappropriate (overly prescriptive or complex) procedures

- ISO standards (or an equivalent) form a good basis for a QMS and for the structure of key documentation although it may need to be adapted for the needs of a waste management organisation
- The QMS should permeate the whole organisation, from the top down, starting with a top-level policy declaration and commitment
- Responsibilities for QMS within the organisational structure must be defined, documented, accepted and implemented at all levels
- Considerable effort is required to develop and implement a QMS - and sustained effort to maintain it
- The backbone is a good documentation and information management system: documentation is a key part of QMS and should be initiated as early as possible
- Contracting organisations should have their own QMS (consistent with the waste management organisation's QMS) or work within the waste management organisation's QMS
- A good QMS is an asset, not a burden
- Waste management organisation and regulator should interact over the QMS.

There were, however, a number of areas where application of QMS varies between national programmes, for example:

- Specific organisational structure of the system
  - Centralised or distributed responsibilities
  - Full-time or part-time QMS staff
  - Hierarchical level of QMS management staff in organisation
  - Number of dedicated staff (although this may be less variable than it first appears, when expressed as % of total programme manpower)
- Certification
  - If formal certification is carried out
  - What type of certification process is chosen
  - When the decision is made to certify the QA programme
  - Regulatory involvement in the certification process
- Public access to documents highly variable, but it was noted that:
  - Management policy (based on national legislation) on what will be publicly available is needed
  - Trend is towards complete openness – it may be best to assume all information might become accessible to the public and implement a QMS that accommodates this
- Dealing with contractors; there were considerable differences in
  - Whether QMS procedures of the contractor or the WMO are used
  - Who audits the contractor (WMO, external or contractor audits)
  - Extent to which QMS requirements are stipulated in contracts

  However, it was noted that, in all cases, ultimate responsibility cannot be delegated and the WMO retains this.
- Involvement of regulators; significant differences existing in

  - Degree to which prescriptive QA requirements exist
  - When implementer-regulator interaction occurs
  - Intensity of interactions
- Grading of QA systems; there were differences in the use (and the perceived usefulness) of single or multi-level systems
- Data management; although all programmes accept its importance, there were differences in definition of how and when to accept/reject data, how and why to freeze databases and procedures to formally release data for a particular application
- Extent and timing of external review of important reports
- Nomenclature (although standardised in ISO 9001, different programmes tend to evolve their own terminology), e.g.
  - QA, QM, TQM, QMS, etc.
  - Guidelines, manuals, procedures.

NUMO's Quality Management plans

Congratulations were extended to NUMO for following ITAC's previous recommendations and starting to implement a QA system. NUMO's Science & Technology Department is a good place to start, but it was emphasised that the QMS must eventually encompass the whole NUMO organisation, top to bottom, with overall responsibility at directorate / board level. Similarly, document control is a good place to start a trial application, but the QMS must eventually encompass all activities. Some specific comments on document control procedures:

- External review is recommended for important documents (e.g. the Level 3 reports)
- Consider formally including a linguistic review for important documents which are produced in English (contributes greatly to international credibility)
- Version control is very important for documents which may be subject to later revision or alteration.

The first critical (and challenging!) application of QC will involve addressing the data arising from literature review of sites. The proposed methodology (grading, standards, committee) is very good and should be incorporated formally into the QMS as a specified procedure. Some suggested additions to the QA management documents (listed by T. Ashida in his presentation) are:

- Software
- Auditing procedures
- Corrective actions
- etc.

It was considered extremely valuable to establish contact with regulators ASAP during planning / implementation of the QMS. In all areas, staff training is a key issue which is particularly critical for NUMO due to the present system of staff rotation.

Siting / site characterisation

Level 3 SF report

The level 3 SF report looks good. The clear record of ITAC input and the way in which it has been incorporated into this draft was valuable (and showed clear balancing of level of response). If possible, an external review of the final draft is recommended. This report has extensive support references, which provide a valuable resource. As such, it may be worth considering wide distribution to universities (even if most relevant experts are on existing panels and thus already on the distribution list). ITAC encouraged publishing technical papers based on this report in the open literature, since this would help to build up the scientific credibility of the work. An English language summary of the report might also be useful.

Literature survey plan

The literature survey plan for volunteer sites was well described. Clearly the NUMO GIS is a very useful tool here, which seems to be now well established. The list of data items seems comprehensive: the aim should certainly be to gather all possible data in these categories (and all associated interpretations). There will be an additional need to keep up to date with incoming data arising during the survey period. It may be worth making it clear that all items will probably not be available at most sites, thus requiring data from analogous sites/environments – which need to be carefully chosen. Even then, this is a wish list, not a list of absolute requirements. Absence or poor quality of information does not prevent progressing further to the PI stage for potentially suitable sites.

Establishing guidelines and approaches for interpreting the data and evaluating interpreted data in a structured, prioritised manner is very important and the approach outlined seemed suitable. It may be worth being more explicit about:

- Who will do the interpretation & conceptual modelling?
- Who will review it?
- How the link between data quality evaluation and "fitness for purpose" for conceptual modelling will be established?
- The exact role and timing of the review by the "evaluation committee" – are they only a QA body or do they play a more active role in data synthesis?

There is a clear need for a policy on obtaining and making available third-party, confidential data. The plan at present to attempt to make such data open (or buy it),

otherwise simply noting its existence and investigating it further in the next stage of site investigation seems sensible (but such data quality must be checked carefully).

Iterative solicitation of literature from the public is a very good idea, as this will enhance transparency and completeness. However, review of this information needs to be carefully handled.

If the presentation is to be made again, some improvements to the wording might be noted:

- The literature survey objective should be better explained – selection of PIAs needs a detailed assessment of the literature involved and, possibly, consideration of other factors (i.e. is not an automatic output from this searching process)
- The GIS does not show "areas of site suitability" (only **potential** suitability)
- NUMO should avoid use of the term "target area" (which implies that a favoured area is considered).

PIA selection methodology

Overall methodology for PIA selection has not been presented as yet (although an MAA methodology was briefly reviewed in ITAC-4), but ITAC would be interested to see more ideas as they develop. Planning the first steps of assessment of volunteer sites is a good area to start, however, as understanding uncertainties in "SSEF data" and associated interpretations will be very important. Concerning the Evidential Support Logic (ESL) example presented, key ITAC comments were:

- ESL is one way of looking at tracing the procedures for assessing uncertainty – there are others and it may be worth considering a comparison of the advantages and disadvantages of the different ways of examining the treatment of uncertainties when utilising expert opinion (emphasise that this is an evidence model, not a process model)
- It could be a useful way of organising and presenting expert thinking and illustrating uncertainties involved; maybe useful, for example, to distinguish between confidence in source data and confidence in interpretations
- It could document the thought processes of experts and quantify their extent of use of data (importance, sensitivity), but this needs associated documentation and clearer terminology (e.g. to clarify the difference between "literature information" and "judgement based on literature information")
- It can give qualitative insights to help decision process, but one should not rely on the numbers (especially in cases with lots of missing data, there is a poor conceptual understanding of key processes; danger of over-interpretation of numerical output and mistaking ignorance for uncertainty)
- It would need special effort to make it transparent to public - the ratio plot presented was particularly confusing and might be better dropped (or greatly simplified and, even then, reserved for technical audiences).

Finally, it was suggested that methods and examples of handling uncertainty and expert opinion could be a topic for a future ITAC.

Development of a site-specific characterisation plan

ITAC considered it useful (for both NUMO and volunteers) to prepare a "toolbox" by development of preliminary generic plan for model environments. Classification of work into "standard", "specific" and "additional" investigations and defining potential geological environment patterns allows a flexible "menu" of characterisation methods to be derived. However, the time sequence of investigations needs to be considered for different environments. In addition, the ambition level (objective) of SC during the PIA stage needs clear definition: for example, when to stop a particular measurement programme, what quality of data is "sufficient".

For more detailed programme development, resource planning will be particularly important as there may be limited availability in Japan of skilled teams / specialist equipment (especially if several sites are characterised in parallel – in addition to possible competing work at the Rokkasho low-level radioactive waste disposal site, Mizunami and Horonobe URL programmes, etc.). While it might be useful to have the same teams involved at more than one site, this could further complicate logistics if work at several sites needs to be co-ordinated. In any case, it is important that uniform evaluation approaches are used at all sites. Finally, a decision needs to be made about when (and how) costs will be taken into account.

ITM

This work is considered a good consensus-building tool in an area that is critical for NUMO. It is good that some information is now available on NUMO's web-site, but it would perhaps raise the credibility of this effort if some papers could be published in the open scientific literature. NUMO may also want to consider if similar international, consensus-promoting groups could be useful for other key topics.

Finally, it was noted that some useful general input on site characterisation has recently become available from AkEnd (English translation copies of report provided by K. Kühn).

Repository concept development

The special challenges to NUMO RC development caused by the volunteering process were acknowledged; there is a need to look at a wide range of RCs due to the uncertainty over environments which might be offered. Nevertheless, there is also a need to be careful about how much detailed study is required at each step of the siting process (avoid diluting effort by analysing concepts which will never be implemented).

The structured approach to RC / ARC development outlined, which emphasises efficiency, flexibility and documentation of decision-making, was considered to be convincing. The exercise tailoring RC to a particular site seemed to be good for team building in NUMO. Nevertheless, such exercises could make use of more realistic data and also real mining and nuclear facility experience rather than just repository designers' concepts.

Level 3 RC report

The contents list looks good and ITAC were pleased to note that most of their comments had been taken on board. However, the objectives and audience for the PA component of this document still seems a little unclear.

Alternative Repository Concepts

The outline of ARC work carried out over the last 2 years was of great interest and caused much discussion. As noted above, the special boundary conditions set by the volunteering process justify a wider and more flexible approach than in programmes with a specific siting option. However, there is a clear need to be comprehensive and balanced in evaluating all reasonable alternatives and explaining why particular examples are dropped or developed before progressing too far with a few favoured concepts. It is reassuring to see that such a review is a topic for a planned workshop and this could, indeed, take place at a future ITAC (e.g. as a special session or a brainstorming meeting).

It is important that ARC work should be fully integrated with the RC (H12 variants) studies as soon as possible. Although it is very important to have RC flexibility, NUMO needs to carefully consider potential impacts (policy, PR, credibility, cost, public demand) associated with pursuing different options. It would also be sensible to plan to concentrate on specific options as soon as possible, i.e. once sites have been sufficiently characterised. In this regard, NUMO need to be clear about key drivers affecting RC choice, and their relative importance and policy origins (including likelihood of future policy or priority changes). For example, footprint size is currently considered to be very important, but particular stakeholder preferences may emerge in the future at specific sites.

NUMO should beware of apparent priority ranking at this early stage (e.g. on the assessment of required engineering developments), as this is certainly premature. For all concepts in which it is considered (including the H12-RC), careful consideration of the potential negative impacts of a long open period (for institutional control or easy retrieval) is recommended.

In subsequent discussion, possible confusion due to the RC / ARC terminology was noted. In principle, all design variants considered so far are effectively based on the fundamental H12 concept – i.e. vitrified HLW in a steel-based overpack within a bentonite / sand buffer disposed of below the water table. True alternative concepts (e.g. deep rock melting, SYNROC) are not considered. To improve clarity, the RC project might be termed "Repository Tailoring to site conditions " while the ARC might be called "Design

Optimisation ". In the latter case, it should be emphasised that the optimisation considers not only factors like cost, but also operational and long-term safety, operational practicality (including QA) and public acceptability.

Tailoring RCs to a specific site

From a summary of the procedure, database and results from this project, ITAC concluded that the principle was good: providing a valuable training exercise and a start to thinking about the complexities of sites and the uncertainties resulting from sparse data. As suggested above, however, it could be developed further by incorporating more realistic site information and a wider range of environments. In any case, the teams involved should be aware that actual sites may be conceptually very different from those modelled here. In particular, it will be important to consider how to cope with more complex sites with sparser / missing data.

To ensure realism, it is important that data selection is checked for sensible correlations by geological experts: note that random parameter sampling can lead to impossible or highly improbable datasets. In order to be used to provide input to define site-specific characterisation programmes, the exercise also requires a defensible PA (ideally considering both operational and post-closure safety).

RC development plan

The outline RC development flow plan was presented and key areas for future work identified. The flow chart that had been developed was considered to provide a good structure for the project. Some improvements which would make this plan clearer were suggested by ITAC (e.g. emphasise that focus is on RC development; separate R&D requirements also for geological & PA areas) and its revision encouraged.

Definition of legal / political constraints is a particularly critical area; impact of land ownership could be considerable and should be clarified as soon as possible. In terms of the questions brought up by NUMO in the RC presentation, the ITAC responses could be summarised as:

- **Respect distances?** These have been defined in specific programmes (e.g. SKB, Nagra). The consensus is that, although clearly site-specific, values are generally in the 10s to 100s m range (50 – 100m may be reasonable) and derived from mechanical-tectonic rather than groundwater flow considerations
- **Exclude specific rocks?** Excluding specific rocks may be necessary to improve credibility, but be qualitative (e.g. "within karstic rocks") and try to avoid quantitative exclusion criteria, which could unnecessarily reduce flexibility (but note that such exclusions are documented in many programmes)
- **Maximum bentonite temperature?** Maximum bentonite (near-field) temperature; should be revisited as present limits are not well justified. Staying below 100 °C makes life easier, but reduces flexibility – particularly for high emplacement density (small

footprint) designs. Note that bentonite may not be a critical component in some alternative designs / concepts and thus an extremely long lifetime might not be required

- **Water inflows?** There are few defined limitations at moment (one example was for Wellenberg in Switzerland), but it is expected that hard exclusion criteria may be defined soon (SKB & Posiva)
- **Bentonite / cement interaction?** ITAC considers this a very important but unresolved issue; a number of joint international studies are ongoing. For concepts with lots of cement / concrete, it is important that NUMO also considers cement-HLW glass and cement-rock interactions and enhanced radionuclide solubilities at high pH as potential problem areas
- **Host rock alteration?** Although not usually of concern, this issue needs to be carefully considered for RCs involving long open periods.

If a future RC brainstorming workshop involving ITAC and NUMO is considered, it should be carefully planned to ensure that NUMO and other key groups in Japan (NUMO's expert advisors, contractors) get maximum value from it. In such preparations, safety aspects should be considered. It is noted that the safety assessment tools needed to support repository design are different from those used for conventional PA.

Wrap up

Points arising from Charles McCombie's presentation of the ITAC summary:

- Regarding QMS, the national presentations were very useful, but it would be valuable for a country-specific statement on the pragmatic value of QA (an action was placed on ITAC members to add to their national summary abstract)
- Request for regular NUMO programme updates by email to ITAC. These could cover results from new technical areas, progress with volunteers, emerging issues, etc. (Action secretariat).
- NUMO homepage and "NUMO NOTE" from the Site Planning and Public Relations Department will also be efficient tools for transferring updated information to ITAC members
- ITAC 6: dates 16-18 December 2003 confirmed
- ITAC 7: provisionally 19 April week 2004
- DTAC status: no regular meetings at present.

In concluding both ITAC and NUMO considered that the meeting had been valuable and thanked all the participants for their active input and, in particular, the presenters for their considerable efforts.

List of abbreviations used in this record

ITAC = International Technical Advisory Committee
DTAC = Domestic Technical Advisory Committee
H12 = JNC integrated HLW disposal assessment = 2nd Progress Report
WMO = Waste Management Organisation (= implementer)

PI = Preliminary Investigation
PIA = Preliminary Investigation Area

SF = Siting Factors
SSEF = Site-Specific Evaluation Factors
SC = Site Characterisation
ESL = Evidential Support Logic
ITM = International Tectonics Meeting
GIS = Geographic Information System
QC = Quality Control
QA = Quality Assurance
QM = Quality Management
QMS = Quality Management System
TQM = Total Quality Management

RC = Repository Concept (based on H12)
ARC = Alternative Repository Concept
MAA = Multi-Attribute Analysis
PA = Performance Assessment
URL = Underground Research Laboratory
YMP = Yucca Mountain Project (USA)
WIPP = Waste Isolation Pilot Plant (USA)