

Critical review: Japanese modelling & PA

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Overview

- At a top level this involves the fundamental development of the safety case:
 - The models of future waste arisings
 - Repository concepts and supporting models and system understanding
 - Site Descriptive Model (SDM) and supporting site understanding (and site selection process)
 - Operational and post-closure safety assessment models
- **These areas are generally poorly covered by conventional QM approaches** and quality depends, to a large extent, on assuring “best practice”, audited by expert reviews

The Good News

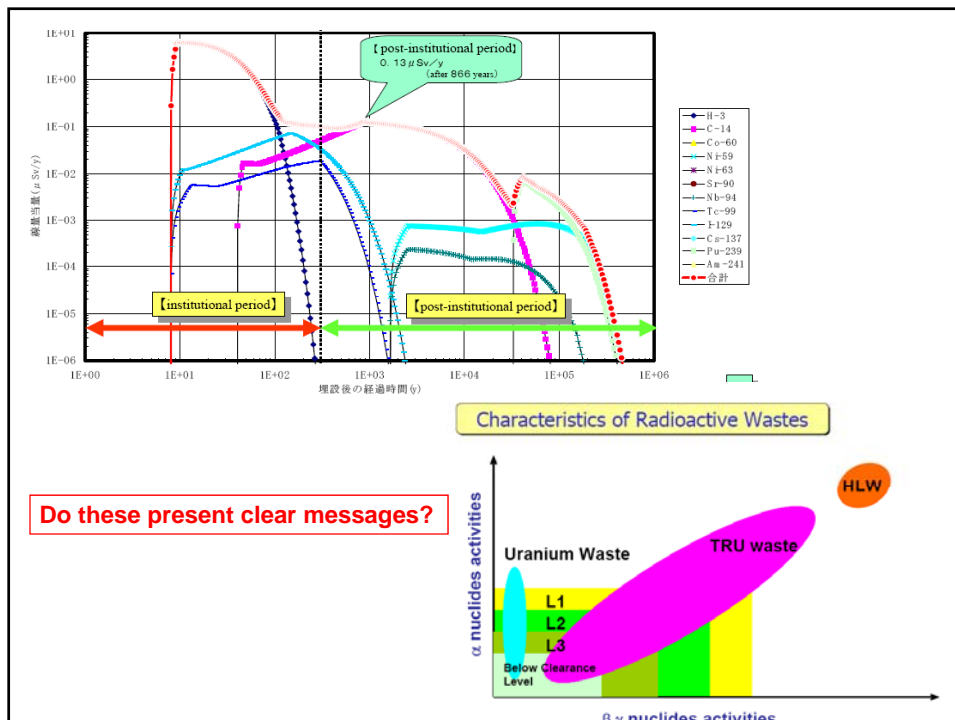
- Even in the absence of ISO certification, **QA processes** in important Japanese projects have been of a relatively high level, e.g.
 - Internal (Nagra) and external (NEA) review of JNC H12: the former, in particular, involved complete documentation of the review process, although it has never been openly published
 - Review of major NUMO documents by ITAC / DTAC; again good internal documentation of the review process
 - Good internal review of JNC/FEPC 1st TRU report and well-planned review process for 2nd TRU report

The Bad News

- Limitations are clear when current QA expectations considered; similar to other national programmes:
 - Older, existing disposal projects not subject to re-evaluation / re-licensing and hence no formal quality assurance to currently accepted levels (as in e.g. France)
 - Reviews of content constrained by incomplete documentation of source data; inconsistencies identified, but quality of older data uncertain (as in e.g. UK)
 - Well-planned review processes sometimes incompletely implemented and limitations undocumented (as in e.g. Switzerland)
 - International review of license application discussed, but not embedded in an openly documented QMS to ensure transparency (as in e.g. Sweden)

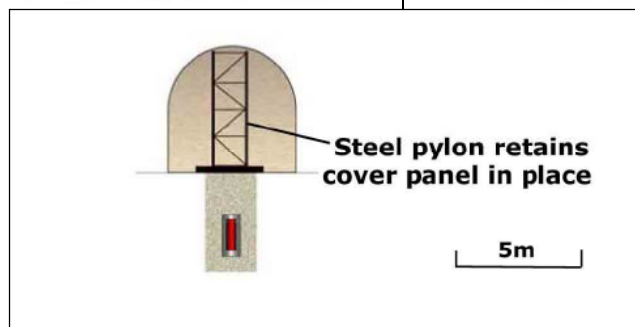
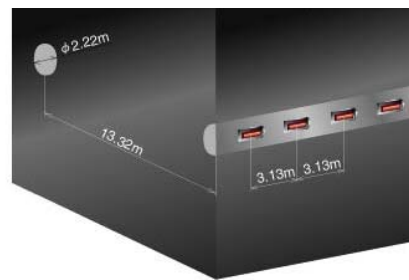
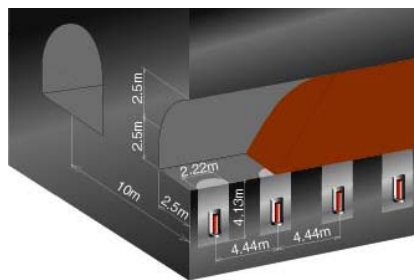
Indicators of QA problems – strategic level

- Lack of integrated national waste inventory and scenarios / models of future arisings to put repository projects in context (...although discussed by JAEA)
- Poorly-defined / inconsistent terminology (e.g. “TRU”): unambiguous nomenclature is an essential component of a QMS
- Limited awareness of the limitations of past projects that were not subject to integrated QA (especially H3, H12, TRU progress reports, safety assessments for existing disposal facilities)



Indicators of QA problems – repository concepts

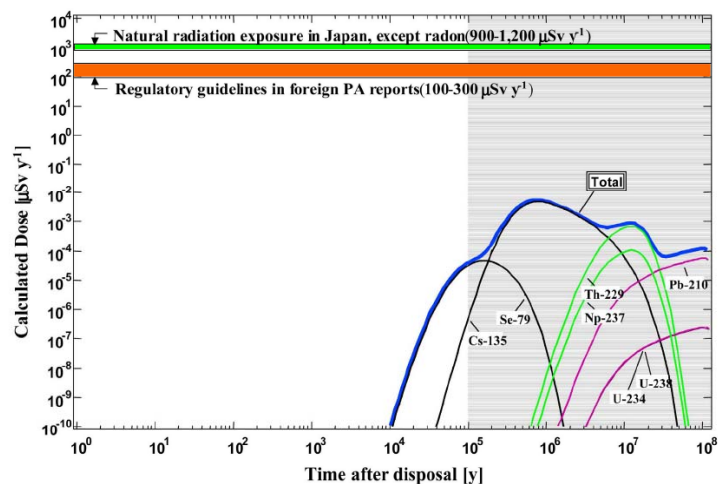
- Limitations of use of idealised repository concepts which focus entirely on post-closure safety not emphasised
- Limited emphasis on fundamental limitations of the assessment process (e.g. inability to distinguish between major design variants)
- Mixture of conservative and non-conservative assumptions that make assessment of safety margins difficult
- Highly idealised (unrealistic) models of the geosphere and its interaction with the EBS



Do these present clear messages?

Indicators of QA problems – site representation

- Limitations of use of idealised site conceptual models which focus entirely on post-closure safety not emphasised
- Limited emphasis on fundamental limitations of the characterisation process (especially during LS and PI phases)
- Mixture of conservative and non-conservative assumptions that make assessment of safety margins difficult
- Highly idealised (unrealistic) models of the RN transport pathways and, especially, GBI



Good indication of time limit of model – but what does this mean for any specific site in Japan?

Quality issues – PA Models - 1

QA system should focus on identifying and resolving technical limitations, e.g.

- Lack of integrated programme of verification and, in particular, validation (not only for codes, but also system-level assessments)
- Little discussion of limitations of generally assumed time-independent parameters / unreasonable extrapolation of results to very long times
- Potential major perturbations received little attention (e.g. effects on concrete liners, borehole caps)
- Biosphere models lack full consideration of special Japanese boundary conditions

Quality issues – Models - 2

- Over-exaggeration of applicability of chemical thermodynamic codes and simple concepts such as Eh (redox potential) and Kd (sorption distribution coefficient): lab data used to support models without considering counter-evidence suggesting inapplicability (e.g. lack of redox equilibrium in natural waters, sorption isotherm non-linearity / sorption-desorption hysteresis)
- Poor inter-disciplinary integration as required for consistency checks (e.g. hydrochemistry, hydrogeology, isotope hydrology, natural analogues, etc.)

Quality issues – Databases - 1

- Lack of rigour in treatment of errors
- Lack of integrated programme of review based on quality-assured source data (general problems of time-pressure, lack of experienced generalists, inconsistently-used / wrongly-interpreted background data)
- Problems with strict database freezing
- Incomplete consistency checks (internal, for related data such as solubilities, Kds, diffusivities and external, comparing to similar databases used in other projects)
- Biosphere dilution: key parameter that is little discussed

Quality issues – Databases - 2

- Lack of appreciation of the fundamental limitations of chemical thermodynamic databases
- Inconsistent and poorly-documented source data to support definition of transport properties of fractured rock (and very little support at all for porous medium database)

Overview

- Despite no ISO certification, QA processes associated with technical documentation of major projects in Japan reasonably represents the state of the art
- As in other countries, the challenge is to establish a process that will identify problems in terms of quality of technical content and guide resolution of these in an efficient and rigorous manner