

The Total System Performance Assessment/Site Recommendation International Peer Review

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The US Department of Energy (DOE) requested the International Atomic Energy Agency (IAEA), jointly with the OECD's Nuclear Energy Agency, to provide, on the basis of available international standards and guidance, an independent evaluation of the total system performance assessment methodology developed by the DOE Yucca Mountain Site Characterization Office (YMSCO).

In response, an International Review Team (IRT) was organized by a Joint Secretariat formed by Nuclear Energy Agency (NEA) and International Atomic Energy Agency (IAEA). IAEA participated in the context of that Agency's statutory functions to perform services useful in research on, and development or practical application of, atomic energy for peaceful purposes, and to establish international standards of safety and provide for their application. The NEA participated under its mandate for improving and harmonizing the technical basis for dealing with nuclear waste related issues among its member countries.

The primary subject of review was the document entitled the Total System Performance Assessment - Site Recommendation (TSPA-SR). Supporting documents were made available (e.g., Process Model Reports and Analysis Model Reports), as was documentation of work performed during the period of the review and its documentation. The primary focus of the review, however, was the TSPA-SR document, however.

Two meetings were held in Las Vegas (June, August 2001), and three exchanges of questions and responses by email took place between meetings. At the end of the August meeting preliminary results were orally presented. An Executive Summary was due to DOE end October (delivered on time), and a final report is due to DOE in January 2002 (expected to be delivered as scheduled).

The presentation at the IGSC meeting was based solely on the recollections of the presenter who was in the audience where the IRT gave an overview of very preliminary impressions that the DOE's:

- TSPA-SR methodology conforms to international practice;
- TSPA-SR is appropriate for addressing the regulatory compliance requirements that are the basis for the site recommendation decision;
- TSPA-SR and process models need more work, however, if it is to provide regulatory "reasonable assurance" of safety, or is to become part of a comprehensive safety case with considerations that go beyond regulatory compliance.

At the IGSC meeting some impressions were given of the technical detail to be expected in the final report. It was made clear that these were strictly unofficial accounts of what may become IRT observations:

- Good choices were made for waste package and drip shield materials, but more experimental work is needed to provide firmer basis for modeling;
- The cladding model needs a firmer basis;
- The assumed movement of radionuclides out of waste packages through continuous films of water is incredible, not just conservative;
- Unsaturated flow and transport modeling is good, but active fracture model needs validation;
- Saturated zone flow and transport modeling needs additional site specific work and a new regional model;
- Uncertainties need an overall strategy for evaluation and reduction;
- Some large uncertainty ranges conservative at process level, but may be non-conservative at system level (dose dilution, needs evaluation);
- More could be done to evaluate human intrusion;
- Several FEPs (features, events and processes) were suggested that need evaluation;
- Documentation is not yet sufficiently transparent.

The presenter's personal impressions of what was reported by the IRT at the end of August suggested this was a technically critical review, but balanced. The experience level of reviewers was apparent early in process, since meaningful areas of weakness quickly identified, and there were instances of critical observations based on known problems faced in other nations' evaluations of long-term safety.

An important issue for the IRT was the ability to compare safety evaluations of different nations' potential repositories. The U.S. regulatory performance measure does not allow such comparison (time constraint combined with locational specificity is unique), and investigating the possible use of alternative performance measures was suggested for greater comparability. Also, several times it was observed that this may have been a good example of a system-level safety evaluation, but it was not a good example of a safety case. A safety case requires showing understanding, and that may mean doing calculations simply because they provide insight. An example of such a calculation that was mentioned was calculating beyond the regulatory compliance period and boundary, and showing the potential fate of radionuclides in the Yucca Mountain setting, which is a hydrologically closed basin, beyond 10,000 years and 20 km.

After the final IRT report is received by the DOE, it will be responded to.