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Honorable Dale Klein, Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

RE: *Inscrutability of DOE's TSPA for Yucca Mountain*

Dear Chairman Klein:

We understand that DOE may now be running or is about to run its Total System Performance Assessment ("TSPA") simulation program, the results of which will form the basis for DOE's license application for its proposed Yucca Mountain nuclear waste repository, which DOE plans to file with NRC by June 2008. Accordingly, Nevada has been paying special attention to the new TSPA. We have purchased the GoldSim computer model (for \$10,000) and have run various scenarios that arose in DOE's earlier Site Recommendation TSPA ("TSPA-SR").

After our detailed review, we thought it imperative to call your attention to a glaring and critical problem with DOE's TSPAs, including its newest one. In short, the TSPA *does not meet* the basic requirements of a calculation intended to form the basis for a government license. The model is so complicated and so large, and takes so many computers to run it, and it must be run so many times for the answer to converge, that it is fundamentally not capable of being checked by any third party, including the NRC Staff. We doubt there is even anyone in DOE who has a comprehensive command of the entire model.

We understand that NRC Staff has developed its own model (the "TPA"), less complicated than DOE's, in order to help Staff to understand the issues. But the Staff is not the applicant, and its model cannot be the primary ground for license approval. The application has to stand or fall on the validity of DOE's model and results. That model must be transparent and capable of being checked. NRC cannot license Yucca Mountain on results from a black box, and it should so inform DOE.

Nevada has been reviewing the record illustrating the development of the new TSPA. There are a variety of documents that attempt to decipher DOE's TSPA process. Perhaps the best is from a DOE/NRC Technical Exchange meeting on TSPA for Yucca Mountain held on October 24-25, 2006, where Mr. S. David Sevougian gave a presentation on DOE's "TSPA Model Development and Implementation." We and our experts have studied the slides from that presentation in detail, and they raise grave concerns that the hardware configuration adopted by DOE – involving hundreds of computers – is wholly inappropriate for a major safety-related license application that should be accessible for scrutiny by interested third parties reviewing the application, including NRC Staff, Nevada, other interested parties, the Nuclear Waste Technical Review Board, and NRC's Advisory Committee on Nuclear Waste.

Specifically, Slide 13 of the presentation (attached) shows the so-called "TSPA-wulf" configuration that is proposed by DOE for use in licensing. A footnote states that "TSPA-wulf" is a reference to the "Beowulf Project" developed at NASA's Goddard Space Center, after which this type of computer cluster configuration is named (*i.e.*, a "Beowulf Computer Cluster").

Nevada was most surprised to learn that the specific Beowulf Computer Cluster proposed by DOE for Yucca's licensing requires use of an immense cluster of computers and processors that no participant can reasonably expect to duplicate:

- A Windows 2000 File Server (Dell PowerEdge 6600);
- 30 Windows 2000 or 2003 Master Servers (Dell PowerEdge 4600s/2650s/2850s/2950s), described as job distribution servers and connected via a Terminal Services Client to unspecified PCs for off-site development;
- 752 Processors, comprising:
 - 240 Windows Server 2003 Processors (60 Dell PowerEdge 2950s);
 - 440 Windows 2000 Processors (220 Dell PowerEdge 2650s/2850s);
 - 36 Windows 2000 Processors (9 Dell PowerEdge 6450s);
 - 36 Windows NT 4.0 Processors (9 Dell PowerEdge 6350s).

In other words, simply running, or likely even inspecting, the structure of DOE's TSPA for Yucca requires the coordinated use of literally *hundreds of computers and processors and software*, some of which is already obsolete.

Worse, within this Byzantine hardware and software context, the GoldSim simulation software is then required to implement the enormously complicated TSPA, with the computations for individual portions of the simulation being distributed to the various processors noted above. GoldSim is an expensive proprietary software package that requires extensive training to operate. While Nevada has purchased this model and paid the annual fees, and has engaged experts devoted to understanding and running GoldSim, it is hard to imagine that we will be able to check DOE's work adequately, not

to speak of less well-funded participants. Although a GoldSim reader can be downloaded at no cost, this can only be used to inspect files created using the full GoldSim suite. Whereas GoldSim input files are of limited size, full input/output files for the TSPA-LA are likely to be extremely large, and it is doubtful that the capabilities of the GoldSim reader will be adequate to inspect such files, let alone perform alternative runs.

But Nevada has an even more serious concern. In view of the alarmingly large numbers of processors involved and the sheer variety of operating systems used in combination, it is probable that both those operating systems and the GoldSim software will have been subjected to context-specific modifications by DOE to achieve efficient TSPA computations. This raises the issue as to whether the TSPA calculations undertaken in support of the Yucca Mountain License Application (“TSPA-LA”) will be *reproducible* by any participant (including NRC Staff), or indeed, by anyone anywhere. It is clear that the various parties to the Licensing Hearing, including NRC’s technical reviewers, will have no opportunity to conduct an adequate appraisal of the modeling unless they are provided with extensive access to the Beowulf Computer Cluster on which the model was originally run by the DOE.

DOE’s string-it-together approach raises other questions as well:

- Will the TSPA-LA calculations undertaken by DOE be delivered to other parties involved in the License Application (including, *inter alia*, NRC Staff and Nevada) in such a form that they can be scrutinized to an appropriate level of detail?
- In view of the opaqueness of DOE’s TSPA, and the unacceptability of issuing a license on the basis of NRC Staff’s own “TPA” model, how does the Staff intend to carry out its mandatory review?
- Will the TSPA-LA calculations be archived in such a form that they can be retrieved, modified, and recomputed by NRC Staff or Nevada, or by other outside reviewers, during and after the License Hearings? This question may be of special relevance both during the required Performance Confirmation program and at the end of the so-called retrievability period, when reviewers will gauge whether it is safe to close the repository permanently.
- Will the opacity of the TSPA-LA preclude an adequate review by NRC Staff and participants *of its QA status*?

With respect to the first of these questions, scrutiny at an appropriate level of detail could include either or both of the following:

- Loading of the TSPA-LA GoldSim model files such that model structure, equations, input parameterization and output data (including intermediate outputs, *e.g.*, from individual barriers) can be inspected;

- Modification of the GoldSim model files and the undertaking of variant calculations to inform opinions as to the safety significance of various DOE assumptions relating to model conceptualization, representation and parameterization.

As to the first of these, it is critically important to establish now whether the information from a TSPA-LA run, which will comprise hundreds to thousands of realizations, can be scrutinized on a single PC, or whether a Beowulf Computer Cluster, similar to that on which it was created, will be required for its scrutiny. If the latter, it is clear that the various parties to the Licensing Hearing will have no opportunity whatsoever to conduct an adequate appraisal of the modeling unless they are provided with extensive access to the elaborate Beowulf Computer Cluster on which the model was originally run by DOE. This would also require extensive access procedures, and would raise important issues of participant cost.

As to the undertaking of alternative calculations, it is clear that runs including hundreds or thousands of realizations would need to be undertaken in a parallel processing environment such as that described. Nevada has recently confirmed this with GoldSim representatives. However, it is important to know whether such runs could be undertaken using various types of clusters or whether they could be undertaken only in the specific cluster configuration adopted by DOE. In the latter case, effective scrutiny of the underlying assumptions made by DOE will be severely compromised unless the relevant parties are provided with extensive access to the Beowulf Computer Cluster on which the DOE originally ran the model. Again, cost and procedural implications abound.

In some cases, it may be adequate to investigate issues arising from the TSPA-LA calculations undertaken by DOE by performing a limited number of deterministic calculations (individual realizations). It would be reasonable that such calculations could be undertaken on a single PC. However, it seems far more likely that the TSPA-LA will be configured only to work on a hardware *cluster*. If this is the case, even this simpler level of scrutiny of assumptions could be closed off to relevant parties, particularly if the cluster has to be identical or very similar to the Beowulf Computer Cluster on which the TSPA-LA calculations were originally run.

Likewise, with respect to archiving of TSPA-LA calculations, it cannot reasonably be assumed that the original Beowulf Computer Cluster architecture will be preserved indefinitely by DOE. Hardware elements will need to be replaced and modifications will need to be made to the operating systems used. Thus, there will be a need to ensure that TSPA-LA calculations can be retrieved, scrutinized, modified and repeated, as required, both during the Yucca Licensing Hearings and after. This is especially important for consideration of license amendments that follow Construction Authorization, and in the implementation of a credible Performance Confirmation program.

In summary, Nevada's inspection of the TSPA Hardware Configuration recently described by DOE raises serious concerns (including due process concerns) as to whether

the TSPA-LA will be presented in such a way that it can be scrutinized at all and its adequacy fairly evaluated by other parties to the licensing hearing. Furthermore, it seems possible that the TSPA-LA will be so dependent upon a specific hardware configuration that future inspection of the results obtained, or the running of alternative calculations to address emerging issues, will be seriously compromised.

Ironically, DOE's 2002 site recommendation to the President was made on the basis of a rule, 10 C.F.R. Part 963, allegedly designed by DOE "to make the TSPA process and method more transparent and verifiable," with DOE promising that it had "undertaken significant efforts to make the results of [TSPA] calculations more transparent to non-technical audiences." *See* 66 Fed. Reg. 57298, 57319-20 (2001). (As required by the Nuclear Waste Policy Act, the Commission on September 24, 2001, concurred in DOE's Part 963 Site Recommendation Guidelines.) Those "transparency" assurances now ring hollow.

For all these reasons, Nevada respectfully requests NRC to investigate this issue, since it now appears to pose *the* most critical issue *vis-à-vis* the transparency of DOE's work and the genuineness of public participation in NRC's Yucca Mountain licensing proceeding. We bring this issue to you now so that there is sufficient time to resolve these critical public participation issues before DOE certifies its LSN document collection or files its license application.

Sincerely,



Robert R. Loux
Executive Director

Enclosure

cc: DOE
ACNW
TRB
Nevada Congressional Delegation