INDEPENDENT SCIENTIFIC PANEL REVIEW OF EROSION WORKING GROUP RECOMMENDATIONS
January 2, 2013

INTRODUCTION

The Independent Scientific Panel (ISP) has reviewed the document titled "Recommendations for Phase 1 Erosion Studies" dated July 20, 2012 (hereafter "erosion recommendations"). The document was prepared by the Erosion Working Group (EWG). The ISP has also considered comments submitted by stakeholders including public groups and the Nuclear Regulatory Commission (NRC).

This document provides the comments of the ISP regarding the erosion recommendations with consideration of stakeholder comments. The ISP consists of the following members:

- Dr. James Clarke
- Dr. B. John Garrick
- Dr. Kristin Shrader-Frechette
- Dr. Chris Whipple

The ISP appreciates the opportunity to comment on the erosion recommendations and to consider stakeholder input in the process.

COMMENTS :

1. The Main Objective of the Studies Should be Clearly Articulated

Unmitigated erosion could breach waste locations and contribute to the release and spread of radionuclides in the environment where receptors could be exposed. The principal threat to the waste locations from erosion is thought to be from gully advance[1]. Erosion studies, if properly done, could provide valuable additional scientific information that could be used in a risk assessment of the principal erosion threat. The main objective of the studies should be framed with this in mind. Accordingly, the recommendations document should include a discussion of the ability of the CHILD model to address the principal erosion threat and to provide predictions of erosion behavior for future time periods of concern, including annual, decadal, century-long, millennial, and multi-millenial. In addition to characterizing the likelihood of gullies intersecting the waste locations over these different future time periods, it would be informative to have estimates of potential consequences from such events. The likely doses that various receptors would receive at future times also would be useful for understanding the significance of such events. However, because an analysis of these consequences would involve the fate and transport of radionuclides and assumptions about food sources for the receptors, this may be outside of the expertise of the EWG.

Because the recommendations document emphasizes facilitating agency consensus as an important objective, the document should include a discussion of the specific agency dissensus issues, and which of these issues the document hopes to illuminate; however, agency consensus may be a desired consequence of achieving the true main objective, rather than being the objective itself. Carefully articulating the main objective, viz. evaluating the threat to waste locations from gully advance, should also serve to focus the studies in a direction that solves a defined problem and avoids wasting time and resources in unproductive areas. Problem formulation in a hierarchical structure

[1] It should be noted that rapid catastrophic failure from slope instability or seismic ground motion may pose greater risks to waste locations than gully advance; however, these risks will be addressed by other SME groups and are not directly addressed by the erosion studies. Hence, gully advance is considered to be the principal *erosion* threat.

should help this. The study plans should be as clear as possible about which problem is being addressed by each activity, and how activities build upon one another to address the principal erosion threat.

2. Emphasis Should be Placed on Basing the Studies on Sound Science

The erosion recommendations mention "filling data gaps" and "building on" previous studies. Given the criticism of some previous studies, the recommendations should make it clear that previous studies, models, and data will be weighed carefully (and published criticism of the studies will also be weighed carefully) and evaluated as to whether they are scientifically defensible. Previous studies and data that are scientifically defensible should be used as applicable; studies, models, and data that are questionable should only be considered with full consideration of their limitations. Study plans should address how data and model quality will be assessed, both for existing data and models and for new data and models.

3. The Erosion Recommendations Should Address Uncertainty in More Detail

The document states that differences in perceptions of uncertainty lie at the root of agency differences on erosion prediction. Given the importance of uncertainty, and consistent with No.1 above, the document should explicitly address expected uncertainty issues with regard to the principal erosion threat (gully advance) more fully, and include consideration of the following:

- Irreducible residual uncertainty may be too great to be the sole basis for decision-making, but together with other lines of evidence, analysis of uncertainties can certainly aid the decision-making process.
- A preliminary assessment of the potential of these studies to reduce uncertainty as it relates to the principal erosion threat is recommended.
- Expected contributions from epistemic uncertainty that results from a lack of knowledge and that sometimes can be reduced, and aleatory uncertainty that results from variability and that cannot be reduced.
- Uncertainties regarding erosion predictions for future decades, centuries, and millennia.
- Uncertainties regarding various climate, institutional, and governmental assumptions.
- Sources of uncertainty.
- Deterministic versus probabilistic methods for evaluating uncertainty - advantages and disadvantages of each with respect to evaluating the principal erosion threat.

4. The Erosion Studies Should Include Consideration of Natural Analogs

Natural analogs are a powerful tool that can assist in estimating future events, and were not explicitly mentioned in the erosion recommendations. The EWG should incorporate an effort to identify and use natural analogs in the studies.

5. Collaboration With Other Working Groups is Important

There should be collaboration with the scoping of the studies of the other working groups, particularly with the engineered barriers group, to assure a systems perspective on developing information that will aid the decision-making to achieve an integrated and economical clean-up and decommissioning program.

6. Stakeholder Comments Provide Useful Technical Suggestions and Valuable insight

The stakeholder comments reviewed by the ISP cover a broad spectrum of topics, including topics outside the ISP scope. Many of the stakeholder technical comments touch on the themes discussed above. The ISP has reflected on, and has given due consideration to the input, and believes that the stakeholder comments include good suggestions and provide valuable insight into issues of concern to the commenters.

The following additional comment was provided by one ISP member:

The Agencies Should Provide Guidance to the EWG on Needed Data Quality Objectives so that the EWG Can Opine on Whether Additional Studies Can Meet the Objectives

Before committing any additional time and resources to further erosion studies, the agencies should engage the EWG on the question of whether the state of the practice of erosion prediction over timeframes that span annual, decadal, century-long, millenial, and multi-millenial periods is sufficiently developed to provide quantitative predictions with a level of precision and/or accuracy that will facilitate agency consensus. Much of earth science is descriptive rather than quantitative in nature, and the irreducible uncertainty associated with quantitative erosion prediction over the time periods cited above may be unacceptable regardless of contributions from additional studies. A data quality objectives (DQO) type of framework could be a way to approach this issue. Under this process, before any studies begin or continue, the agencies first would attempt to frame the questions that would need to be answered (including the annual, decadal, millennial, or multi-millenial time periods to which these questions apply) to facilitate consensus, along with the level of precision and accuracy desired. Next, the EWG would provide its best estimate of whether the desired goals could be met. Without a clear answer to this question, the agencies risk expending time and resources without having confidence that, at the conclusion of the process, there will be any greater prospect of consensus than existed at the Final Environmental Impact Statement (FEIS) stage.