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NRCMD 3.9

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Treatment of Uncertainty in the Geologic Disposal of High-Level Radioactive Waste

2. AUTHOR(s)
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3. NAME OF CONFERENCE, LOCATION, AND DATE(s)
The 11th International Conference on Environmental Remediation and Radioactive Waste Management

4. NAME OF PUBLICATION
ICEM'07 Conference Publication

5. NAME AND ADDRESS OF THE PUBLISHER	TELEPHONE NUMBER OF THE PUBLISHER
The American Society of Mechanical Engineers 22 Law Drive Fairfield, New Jersey 07007-2400	(800) 843-2763
6. CONTRACTOR NAME AND COMPLETE MAILING ADDRESS (*Include ZIP code*)	TELEPHONE NUMBER OF THE CONTRACTOR
Center for Nuclear Waste Regulatory Analyses Southwest Research Institute 6220 Culebra Road San Antonio, TX 78238	(210) 522-5160

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ICEM'07, September 2–6, 2007, Bruges, Belgium

TREATMENT OF UNCERTAINTY IN THE GEOLOGIC DISPOSAL OF HIGH-LEVEL RADIOACTIVE WASTE

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ABSTRACT

Safety or performance assessment of a geologic high-level radioactive waste disposal system is complex because such a system comprises many diverse components, involves many coupled processes, and, more importantly, must account for significant sources of uncertainty. The impact of these uncertainties is compounded by the need to project results thousands or hundreds of thousands of years into the future. An appropriate consideration of uncertainty in the repository safety or performance assessment is an important aspect of the U.S. Nuclear Regulatory Commission (NRC) regulations for the licensing of a potential high-level radioactive waste repository at Yucca Mountain, Nevada.

Treatment of uncertainty, as such, is a subject of great interest in many technical disciplines and a subject of significant discussion in the literature from both qualitative and quantitative standpoints. These discussions, however, are quite diverse, with various technical disciplines placing greater emphasis on different areas of uncertainty treatment to satisfy their subject-specific needs. For example, a preliminary literature review indicates that the "perceived" uncertainty is a point of significant discussion in ecological risk assessments, whereas the separation of epistemic from aleatory uncertainty is a more frequent topic in high-level waste disposal performance assessments.

The objective of this abstract is to present an overview of the treatment of uncertainty in safety and performance assessments for the disposal of high-level radioactive waste. The paper will discuss uncertainty in terms of its (i) sources, (ii) characterization, (iii) evaluation methods, (iv) presentation, and (v) propagation. Each of these aspects will be explained further by subdividing uncertainty into subcategories. As an example, the characterization of uncertainty in high-level waste disposal will be discussed in light of model completeness, model form, and parameter selection. The discussion of completeness uncertainty will encompass an appropriate treatment of features, events, and processes. The discussion of model uncertainty will highlight uncertainty about the hypothesis and appropriate model definition in evaluating dose and calculating probability of the occurrence of features, events, and processes. The discussion of parameter uncertainty will deal with the appropriateness of parameter values.

The paper will build on the current literature and provide a general uncertainty treatment framework. This framework could be used to aid process modeling experts in providing performance assessors with the uncertainty information that is consistent and coherent.

Acknowledgment: This abstract is an independent product of the Center for Nuclear Waste Regulatory Analyses and does not necessarily reflect the view or regulatory position of the U.S. NRC.