

Use of Risk Information in Regulatory Review

Presented by

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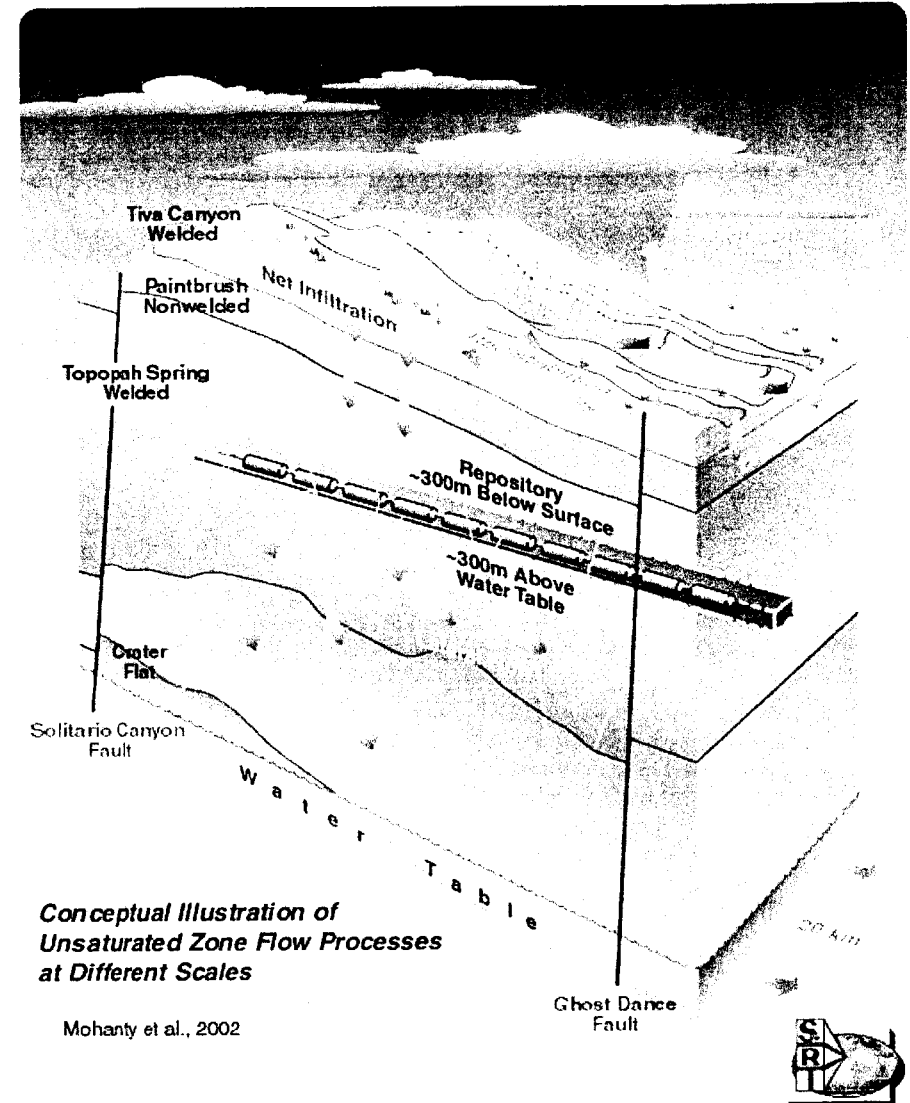
Management of Uncertainty in Safety Case: The Role of Risk

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Presentation Outline

- Background
- Yucca Mountain Review Plan
- Working Definition of Risk Insights
- Example Risk Insights
- Use of Risk Insights
- Summary



Background

- U.S. Department of Energy (DOE) plans to submit a license application (LA) to construct a repository in early 2005
- NRC/CNWRA staff preparing to review LA for final environmental impact decisions
- Yucca Mountain Review Plan (NUREG- 1804, Rev. 2) provides guidance for LA reviewers
- Staff must use risk insights to focus on the issues most significant to repository performance during the licensing review

Yucca Mountain Review Plan

- Provides non-prescriptive review methods and acceptance criteria
 - DOE selects and justifies compliance demonstration methods
 - NRC review based on risk significance
- Instructs reviewers to base depth of review on significance to performance (e.g., a FEP)
- Overall risk-informed review philosophy — audit every aspect of license application, determine depth and scope of detailed reviews commensurate with the risk significance

Working Definition of Risk Insights

- Risk insights are conclusions drawn about the significance of a specific physical component to waste isolation
- Rates (High, Medium, Low) based on one of three criteria
 - potential to affect waste packages
 - potential to affect radionuclide release from waste form
 - potential to affect radionuclide transport through the geosphere and biosphere

Types of Risk Insights

- Identification of major components or scenarios based on potential effects
- Determination of principal barriers
- Importance of uncertainty in detailed and abstracted conceptual models
- Importance of major assumptions
- Importance of coupled processes
- Identification of important models
- Identification of important parameters and evaluation of the significance of parameter correlation

Example Risk Insights

- Nominal case
 - Peak dose from most likely scenario is 2×10^{-4} mSv/yr
 - For most realizations, dose is essentially zero
 - Expected dose is dominated by only a few realizations
 - Peak expected dose does not occur until after the end of regulatory period
 - Most dose is from low-retardation, long-lived radionuclides (Tc-99, I-129, and some from Np-237)
- Effect of Igneous Activity
 - Greatest effect is from extrusive volcanism
 - Decreases the time of peak release
 - Increases the radiological risk
 - Uncertainties remain relatively high

Example Risk Insights (cont'd)

- Pinch Point Analysis
 - Radionuclide releases in 10,000 years attributed to a small fraction of waste packages assumed to have defects
- Influential parameters
 - Retardation coefficient for Np-237 in the alluvium
 - Airborne mass load above a fresh ash deposit
- Influential alternative conceptual models
 - Nominal case: (i) no retardation alternative; (ii) loss of passivity of the oxide film on waste package
 - Igneous activity: model for magma flowing along drifts as an alternative to volcanic conduit
- Influential components
 - Waste package, unsaturated zone, and saturated zone provide substantial individual contributions

Current Use of Risk Insights

- Programmatic
 - Incorporate insights gained through post-closure performance assessment activities into the pre-licensing issue resolution and agreement closure activities
 - Provide consistency and continuity in staff's focus on more risk significant concerns and agreements especially during transition from issue resolution to license application review
 - Identify, evaluate, and discuss differences between NRC and DOE on scenarios, models, and assumptions
- Technical
 - Use system model to identify scenarios, models, and assumptions important to performance

Current Use of Risk Insights (cont'd)

- Technical
 - Communicate performance assessment methodologies; modeling approaches, assumptions, and limitations; and interim results to other staff to ensure common understanding
 - Conduct further process-level studies
 - Localized corrosion of C-22; Effect of rockfall on WP failures; Aqueous chemistry on WP surfaces
 - Moisture redistribution in heated drifts; Sorption in alluvium; 3D geologic framework model development
 - Igneous activity consequences
 - Refine performance models as necessary to reflect evolution of staff understanding
 - Enhance realism of total-system performance assessment input parameters and models

Summary

- NRC/CNWRA conducting analyses to gain risk insights for issue resolution and a risk-informed review
- Primary guidance document: Yucca Mountain Review Plan
- Risk insights linked to FEPs that affect waste packages, radionuclide release from waste form, and radionuclide transport in geosphere/ biosphere
- Uncertainty/sensitivity analyses (parametric, distribution, component), pinch-point analysis, and barrier importance analysis provide risk insights
- Risk insights activities build a common understanding of risk significance