

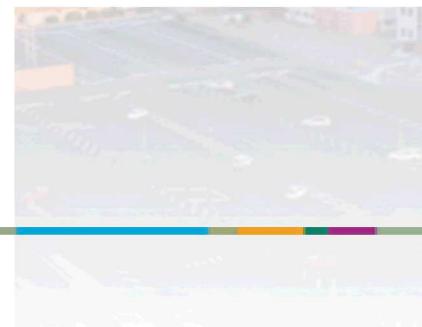


The Performance Assessment Methodology

PRESENTED BY

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NEFC Knowledge Management Deep Dive
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Agenda

- **1:00 – 1:15 Introduction**
 - Cliff Hansen
- **1:15 – 3:00 The YM PA**
 - Dave Sevougian
- **3:00 – 3:15 Break**
- **3:15 – 4:15 The WIPP PA**
 - Todd Zeitler
- **4:15 – 5:00 PA Lessons**
 - Jon Helton, Cliff Hansen, Eric Vugrin, Dan Clayton, Chris Camphouse, Todd Zeitler, Seth King

A Performance Assessment (PA) is an analysis that answers four questions

- ***Q1: What can happen?***
- ***Q2: How likely is it to happen?***
- ***Q3: What are the consequences if it does happen?***
- ***Kaplan and Garrick “risk triplet”***
 - Originated with safety assessments for nuclear power plants
 - Used in performance assessments for WIPP and YM
 - S. Kaplan and B. J. Garrick, 1981. “On the Quantitative Definition of Risk”, *Risk Analysis*. Vol 1, no 1, 11-27.
- ***Q4: What is the uncertainty in the answers to the first three questions?***

Yucca Mountain as an Example

- Defined for Yucca Mountain by the U.S. Environmental Protection Agency at 40 CFR 197.12 (as amended 15 October 2008)

Performance assessment means an analysis that

- (1) **Identifies the features, events, processes**, (except human intrusion), and sequences of events and processes (except human intrusion) that might affect the Yucca Mountain disposal system and their probabilities of occurring;
- (2) **Examines the effects of those features, events, processes**, and sequences of events and processes upon the performance of the Yucca Mountain disposal system; and
- (3) **Estimates the annual committed effective dose equivalent** incurred by the reasonably maximally exposed individual, including the associated uncertainties, as a result of releases caused by all significant features, events, processes, and sequences of events and processes, weighted by their probability of occurrence.

Representative Uses of PA

■ Evaluate regulatory requirements

- Provide quantitative measures for safety case
- Quantify performance margin and barrier capability
- Prioritize repository risks

■ Understand the repository system

- Prioritize information and testing needs
- Evaluate design options/alternatives
- Evaluate consequences of features, events and processes

■ Understand the repository system model

- Determine most influential processes, models and features
- Determine significance of data, parameter and model uncertainty

Performance Assessment (PA) Methodology

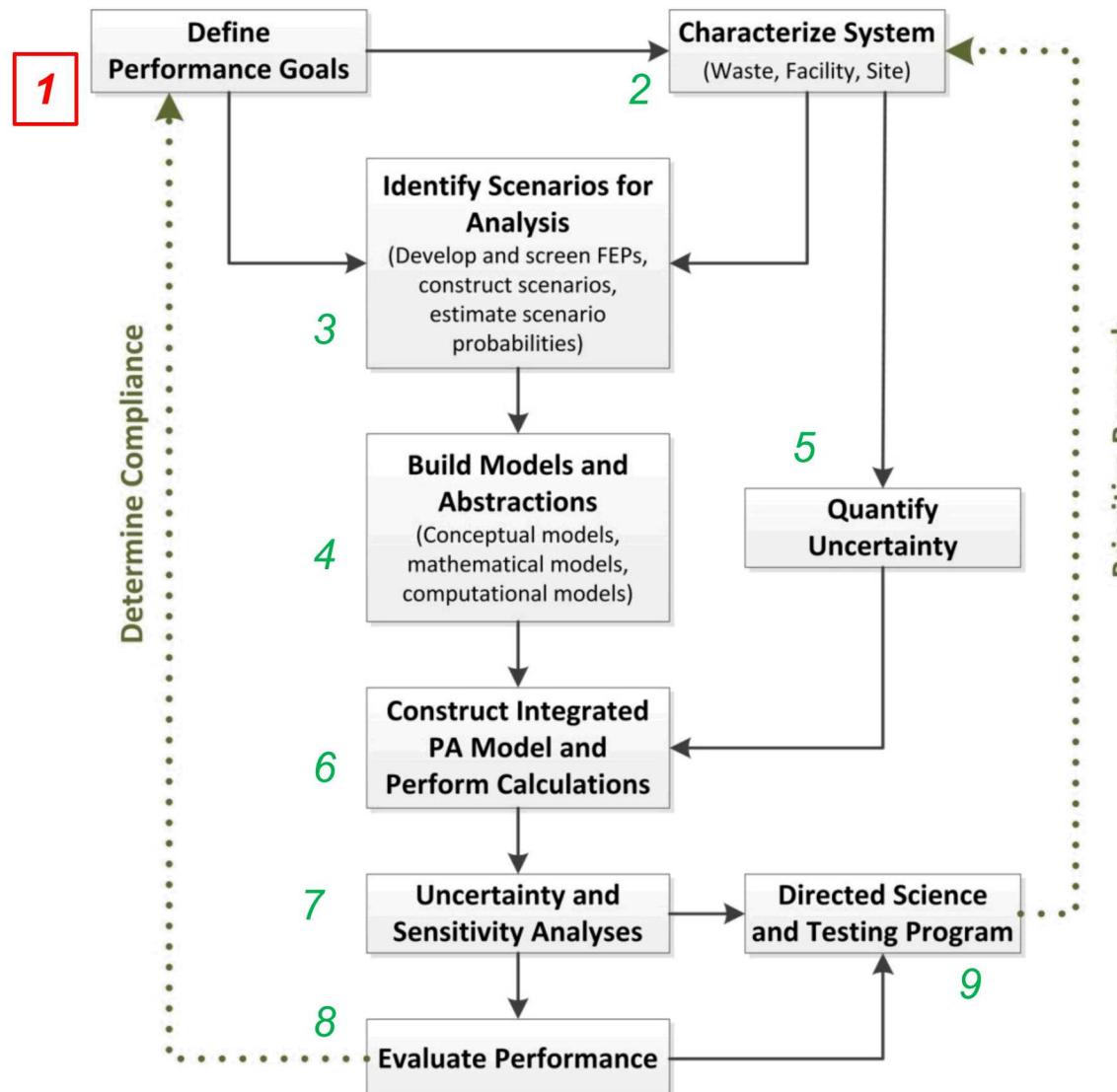


Figure from "Sandia National Laboratories Performance Assessment Methodology for Long-Term Environmental Programs: The History of Nuclear Waste Management", P. G. Meacham et al., SAND2011-8270, Sandia National Laboratories 2011.

Performance Goals

- YM Example: Individual Protection Standard
 - Estimate the annual committed effective dose equivalent
- Ideally, performance goals are taken directly from regulations governing the repository
 - Early iterations of the PA may have to assume performance goals
- Performance Goals
 - Provide the structure and required output for the PA
 - Complemented by subsystem performance indicators (e.g., transport time in the saturated zone)
 - Performance goals and indicators provide insight into repository processes that guide PA development, repository design, and site characterization

How do you know when a PA is done?

- Perhaps never “done” but it can be “enough”
- Advice from William Boyle:
 - “Enough” is a decision primarily of the applicant
 - The regulator is not the applicant’s consultant
 - “Convince yourself first”
- An indicator of maturity: when dominant uncertainties can’t be further reduced
- A PA is an ongoing process that delivers quantitative analyses
 - Recertification of WIPP every 5 years
 - “Recertification is a process that evaluates changes at WIPP to determine whether the facility continues to meet all the requirements of EPA’s disposal regulations. The recertification process helps ensure WIPP’s continued compliance based on the most accurate, up-to-date information available.”¹
 - WIPP PA continues to evolve with the repository

1. <https://www.epa.gov/radiation/certification-and-recertification-wipp>, Retrieved 27 Jan 2020

Performance Assessment (PA) Methodology

■ Example PAs:

- 2008 License Application for YM
- 2019 Recertification for WIPP

