



U.S. Department of Energy
Office of Civilian Radioactive Waste Management

YMP Approach to Decision-Making in a Learning Environment

Presented to:
Nuclear Waste Technical Review Board

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YUCCA
MOUNTAIN
PROJECT

The Learning Environment

- **During Site Characterization, DOE must make decisions about the repository that could constrain future actions or decisions**
- **Ongoing scientific investigations, and time, provide the opportunity to obtain new information that can affect the impacts of various decisions**
- **DOE has the ability and the intent to respond and adapt to that new information and incorporate it into decision making**

Continuous Learning

- **The Test and Evaluation Program will increase our understanding of the behavior of the natural and engineered barriers in comparison to our predictions**
- **New information will be evaluated for its effect on system and subsystem (including design) performance**
- **Design and operating decisions will be modified based on feedback from these evaluations, as well as other technological and policy developments**
- **Program should be designed to challenge models and assumptions**
- **Decisions can be revisited**

1990 NAS Report

“Although the basic scientific principles are well known, quantitative estimates (no matter how they are obtained) must rely on assumptions. As a consequence, the resulting estimates are uncertain to some degree, and they will remain uncertain no matter how much additional information is gathered.”

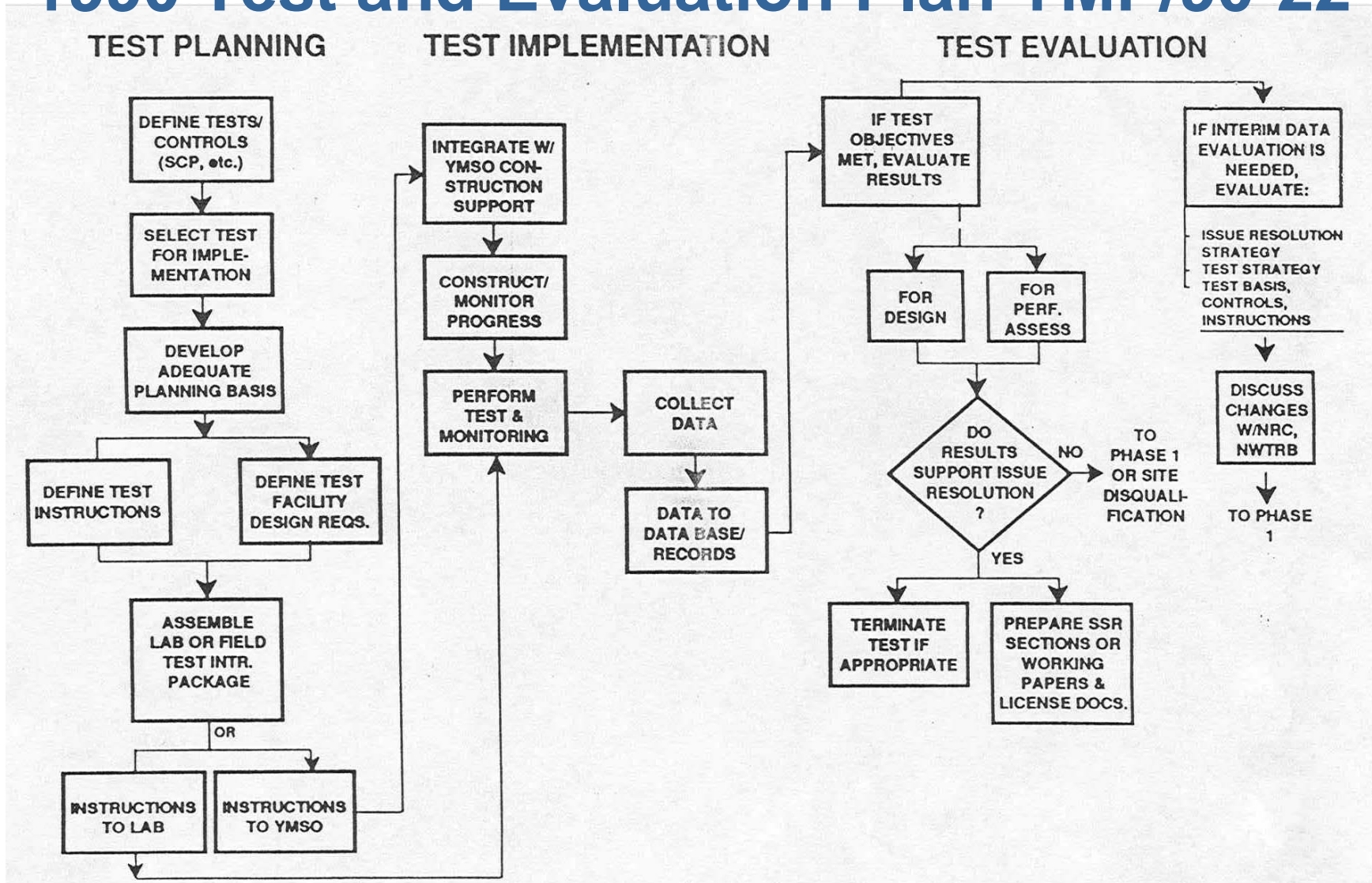
“... proof in the conventional sense cannot be available until we have experience with the behavior of an engineered repository system — precisely what we are trying to predict.”

“Engineers and scientists, no matter how experienced or well trained, are unable to anticipate all of the potential problems that might arise in trying to site, build, and operate a repository.”

“the necessary conditions of the system are flexibility and resiliency-flexibility to respond rapidly to ongoing findings in the geology, geohydrology, and geochemistry (within broad constraints); and resiliency to continuously adjust the performance assessment to reflect new information”

*from: Re-Thinking High-Level
Radioactive Waste Disposal*

Summary Flow Diagram from the 1990 Test and Evaluation Plan YMP/90-22



Technical Basis for Program Decisions

Oversight

NRC Technical Exchanges, Appendix 7 Meetings
NWTRB Panel Meetings, Reports to Congress
State of Nevada; Affected Units of Local Government
Public

Prior TSPAs

DOE TSPA-91, 93, 95, VA
NRC IPA-1, -2, -3
EPRI TSPA Phases 1, 2, and 3

Process Model Abstraction

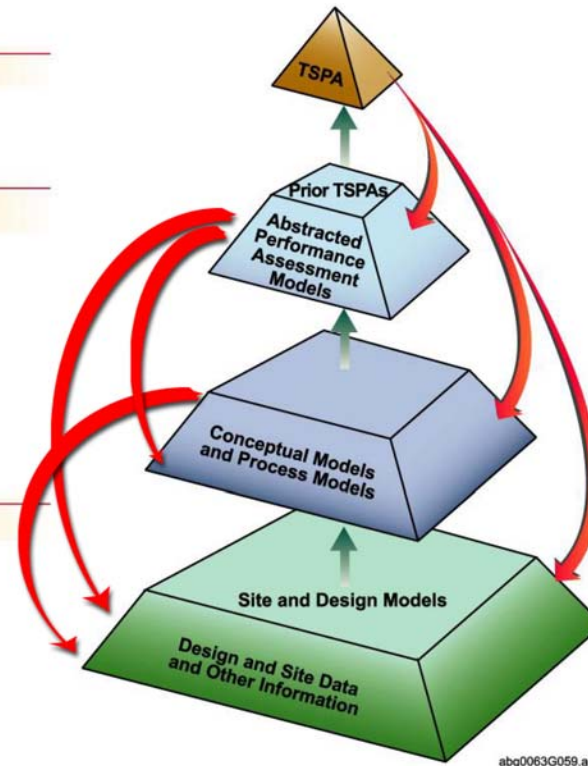
Unsaturated Zone Flow
Engineered Barrier System Environments
Waste Package & Drip Shield Degradation
Waste Form Degradation
Engineered Barrier System Transport
Unsaturated Zone Transport
Saturated Zone Flow and Transport
Disruptive Events
Biosphere

Process Models

Unsaturated Zone Flow Model
Seepage Model
Near Field Geochemistry Model
In-Drift Environment Model
Multi-Scale Thermal Hydrological Model
Waste Package and Drip Shield Corrosion Model
Unsaturated Zone Transport Model
Saturated Zone Flow and Transport Model
Volcanic Eruption Model

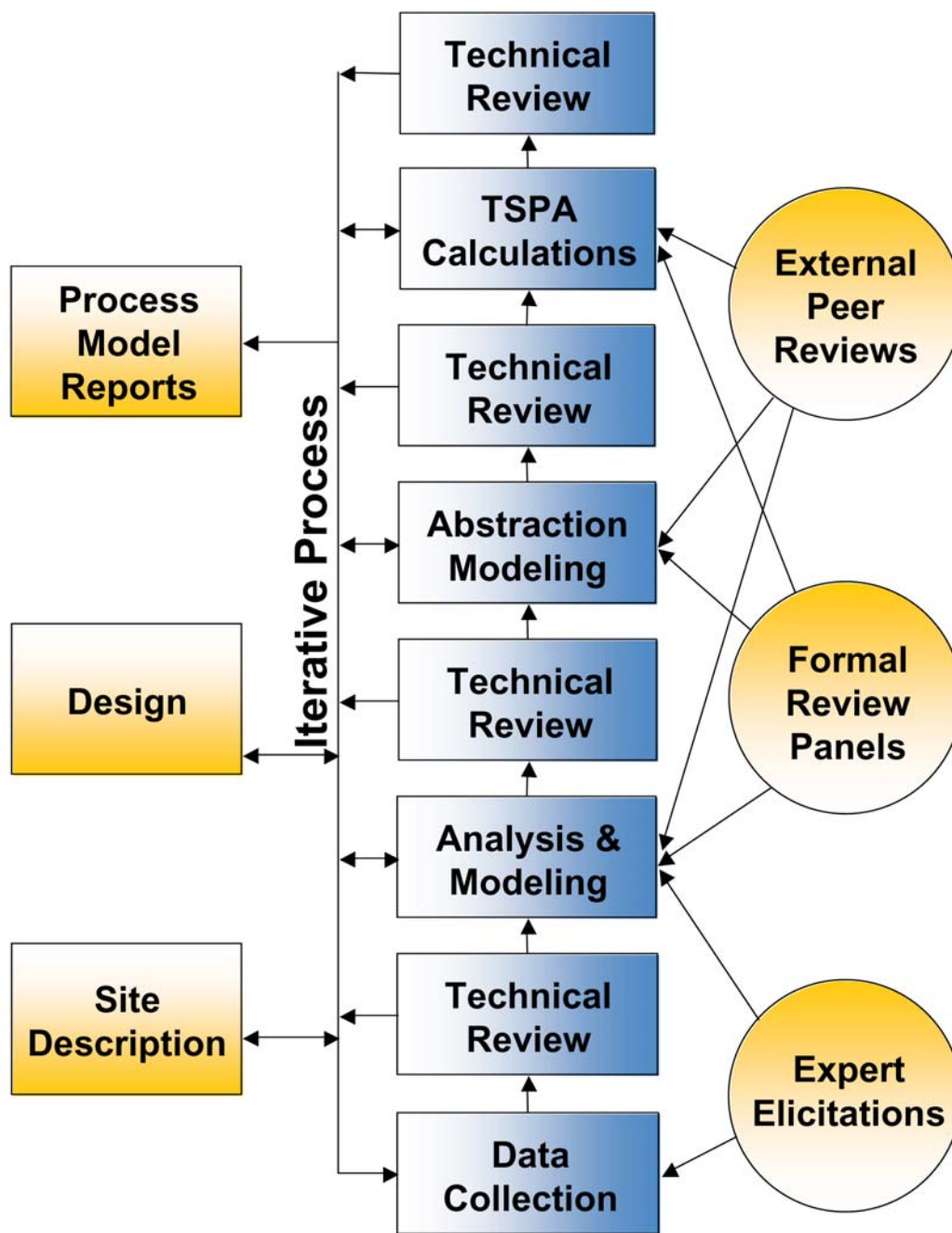
Site and Design Information

Site Description Document
Repository Design
Waste Package Design
Laboratory Data
In-Situ Data
Analog Data
Expert Elicitations
Peer Reviews



The Pyramid is Only Part of the Story

- **TSPA pyramid has been used by the Project in many documents**
- **Is it an accurate representation of how we execute our technical program?**
- **Does it represent the way that we should execute our technical program?**
- **We are currently considering alternate representations**



Example Review Criteria

- **TSPA**
 - Technical adequacy for evaluating regulatory compliance
 - Evaluation of relative contributions to performance
- **Abstracted Models**
 - Abstracted results bound process level results
 - Simplification is defensible
- **Process Level Models**
 - Adequate data to characterize parameters
 - Adequate conceptual model
 - Adequate match to predictions
- **Data Collection**
 - Adequate implementation of technical procedures

Decisions in a Learning Environment

- **The Program will evolve because of:**
 - **Continual influx of new data and new understanding from within and outside of the program**
 - **Feedback and re-evaluation of design and operating decisions based on new data and process-level analysis**
 - **Re-analysis of TSPA as process-level models change, during the pre-closure operational period**

Conclusions

- **We continually seek new information from our own scientific work of testing and evaluation**
- **We continually seek new insights from external sources of expertise**
- **We evaluate potential changes as information comes to light**