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Sandia National Laboratories

International Atomic Energy Agency (IAEA) Training in Radioactive Waste Disposal Technologies in URFs Repository Performance Confirmation

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U.S. DEPARTMENT OF ENERGY | NNSA

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Introduction

1. Performance confirmation monitoring versus other testing and monitoring objectives
2. Performance confirmation for the Waste Isolation Pilot Plant
3. Performance confirmation for Yucca Mountain
4. An approach for developing, evaluating and implementing the next generation of performance confirmation monitoring

Repository Monitoring Requirements

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OPERATIONS

1. Engineering Systems Testing & Evaluation
2. Design, Construction & Operations Testing
3. Health, Safety & Effluents
4. Security and Emergency Testing
5. Licensing Specifications

LONG-TERM SCIENCE

6. Regulatory Directed Testing
7. Elective Testing
8. Performance Confirmation

Performance Confirmation at WIPP

- 1960's & 1970's
  - –At first it was believed that site characterization data and a technical performance demonstration would provide the answers needed to ensure all stakeholders that a repository would be safe to dispose of radioactive waste. The project had no real plan for performance confirmation monitoring.
- 1980's
  - –After failed attempt to site a facility at Lyons Kansas – loss of trust
  - –Switch from DOE self-regulation to EPA disposal standards
  - –Federal, State and multiple stakeholders became involved
- Other "Assurances" needed beyond a technical performance demonstration
  - –EPA Regulations Included performance confirmation elements
  - –State of New Mexico agreement includes confirmation-related experiments and monitoring

WIPP Performance Confirmation

- Multi-phase program with different goals/objectives
  - Site characterization Testing and Monitoring
    - To Build a Performance Assessment (safety case)
  - Operational Phase Monitoring
    - To verify basis of Performance Assessment/Results
  - Post-Closure Monitoring
    - To enhance institutional controls and long-term stewardship

Site Characterization Testing and Monitoring

- Information was needed to build a defensible PA model
  - Site characterization investigated host rock, geologic structure, hydrology, seals/rock interactions, waste/brine chemistry, geochemistry, gas generation, Kds and many other aspects of the system
- Resources and timelines limit the depth that scientific research can investigate a particular aspect of the system
  - What information is important or needed
  - What information can be developed
  - What is known

WIPP Operational-Phase Monitoring

- EPA Regulations govern program
  - Monitoring is an Assurance Requirement
  - *"The Department shall conduct an analysis of the effects of disposal system parameters on the containment of waste in the disposal system …. The results of the analysis shall be used in developing plans for pre-closure and post-closure monitoring...."*

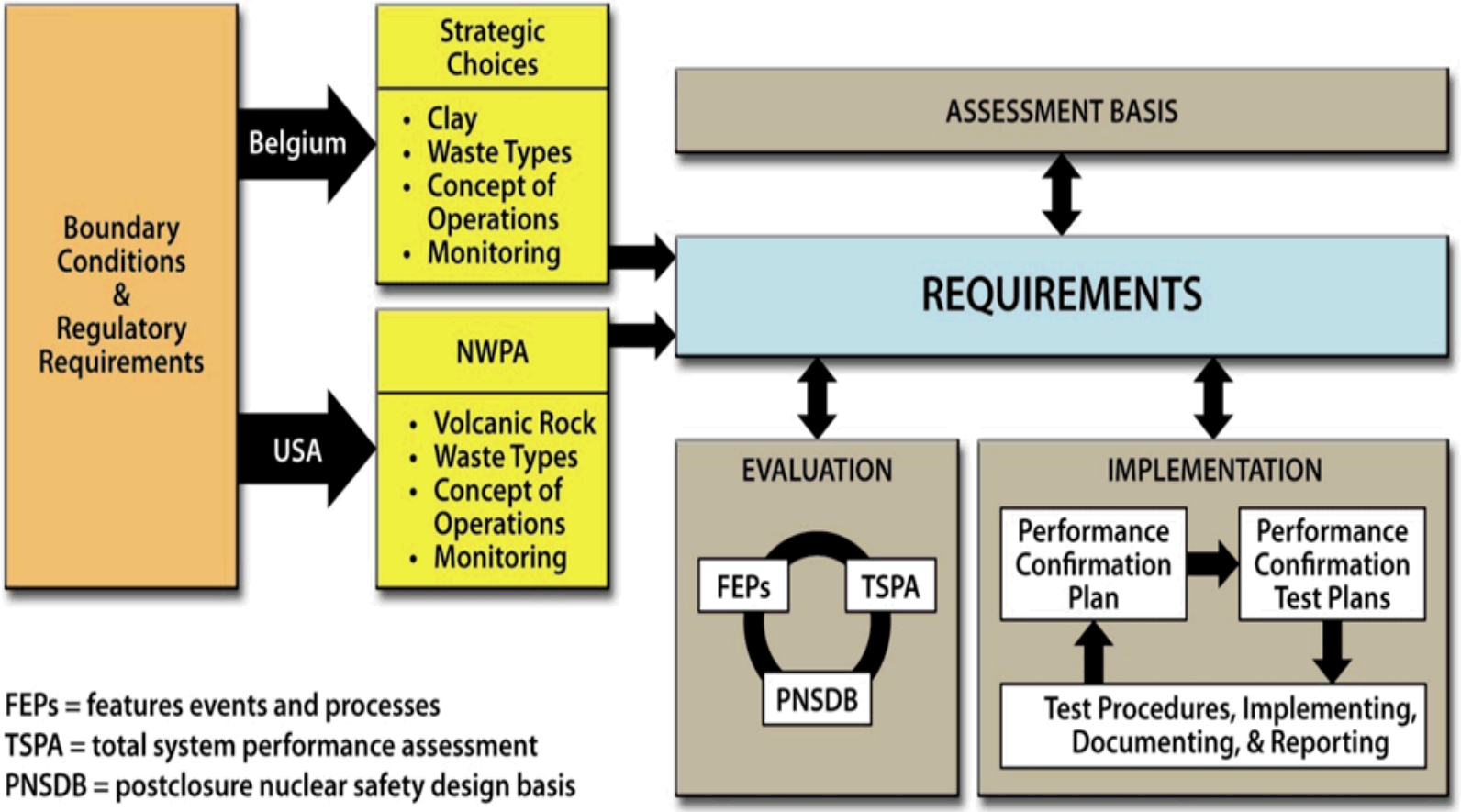
WIPP Operational-Phase Monitoring

- Analysis addressed significant disposal system parameters defined by their
  - effect on the system's ability to contain waste
  - effect on the ability to verify predictions about the performance of the disposal system
- Addressed an important disposal system concern
- Obtained meaningful data in a short time period
- Will not violate disposal system integrity
- Complemented existing monitoring programs

Performance Confirmation for WIPP

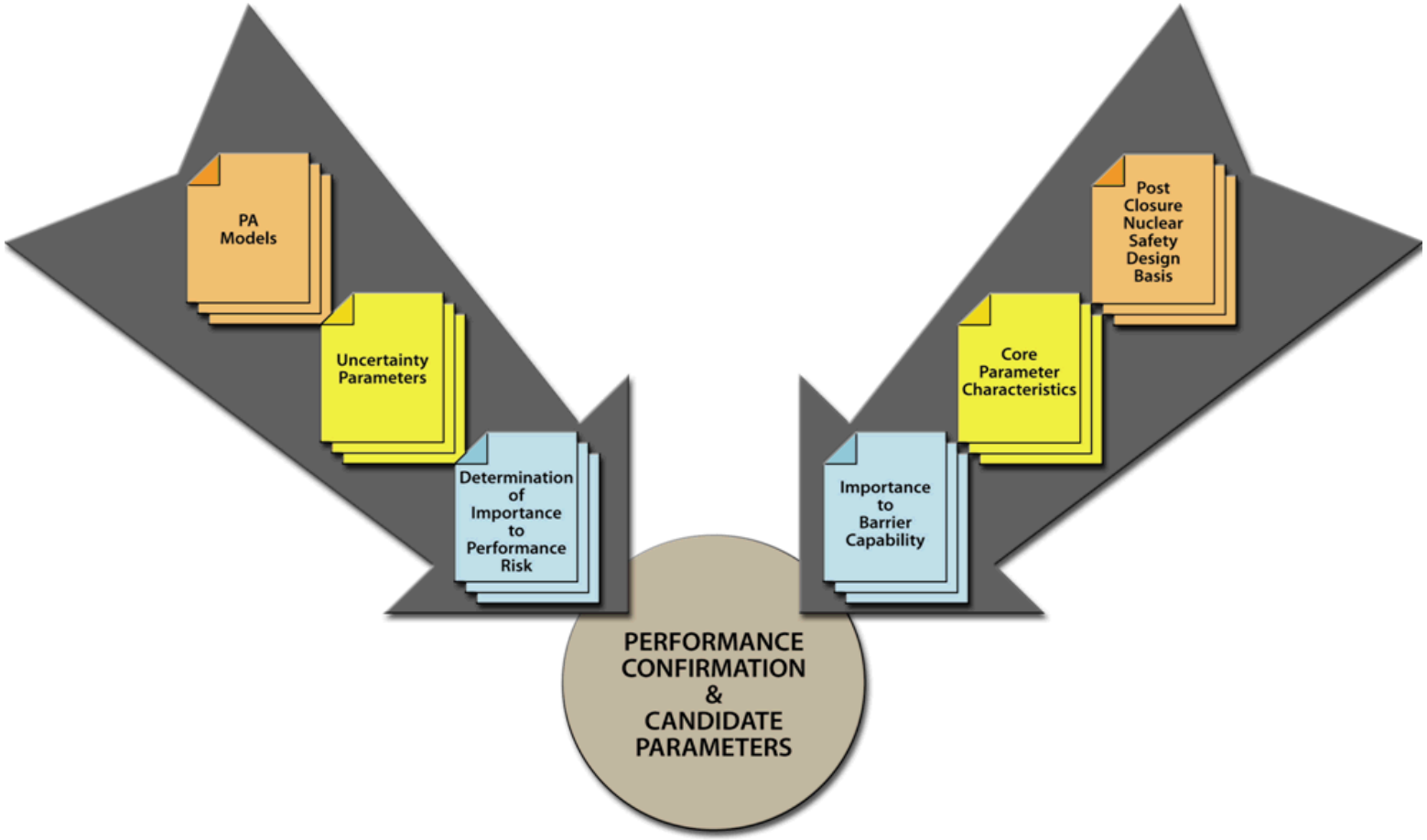
1. Creep Closure and Stresses
2. Extent of Deformation
3. Initiation of Brittle Deformation
4. Displacement of Deformation Features
5. Culebra Ground Water Compositions
6. Change in Culebra Ground Water Flow
7. Drilling Rate
8. Probability of Encountering a Castile Brine Reservoir
9. Subsidence Measurements
10. Waste Activity

Developing and Assessing Performance Confirmation

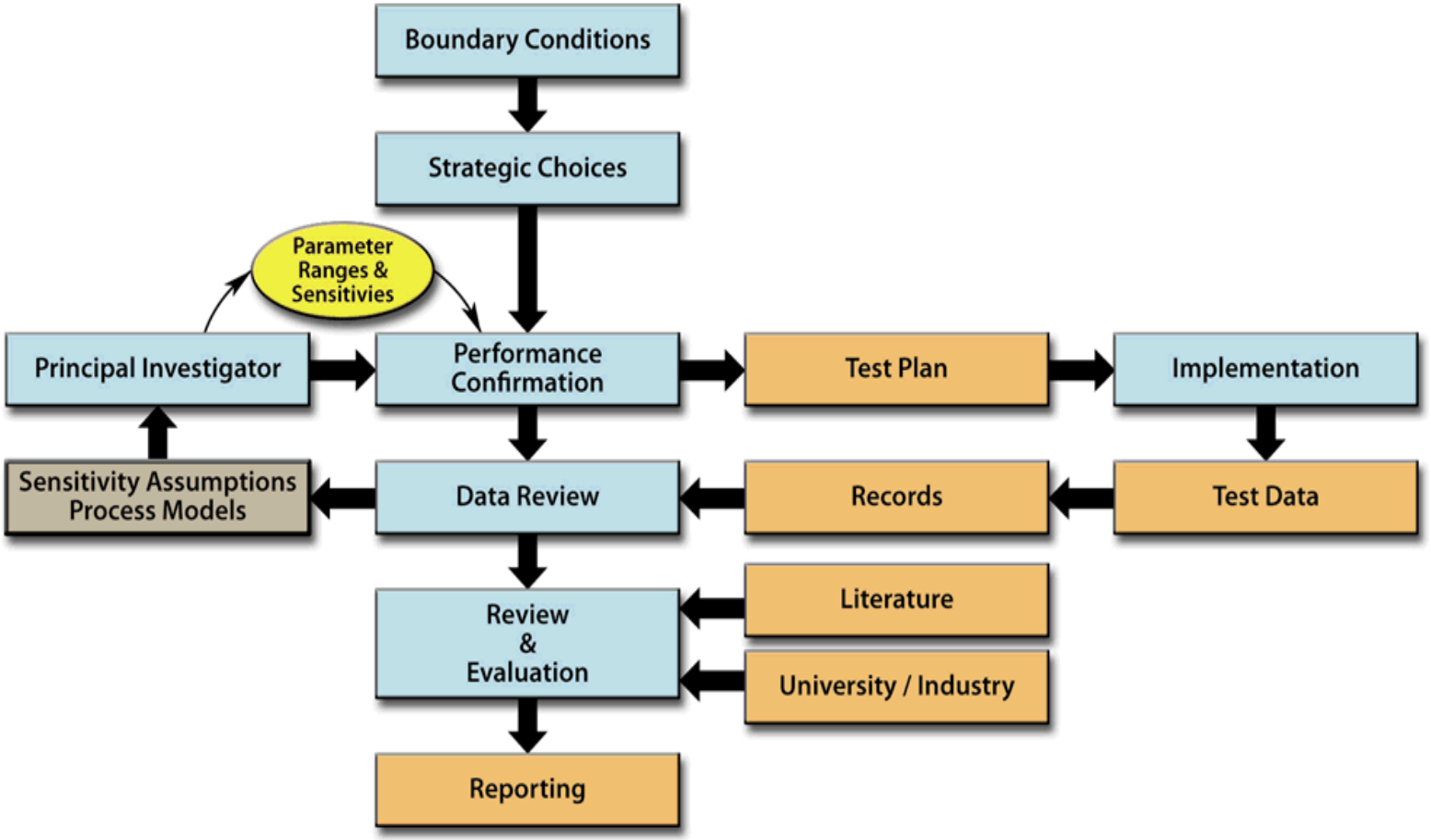


FEPs = features events and processes
TSPA = total system performance assessment
PNSDB = postclosure nuclear safety design basis

Confirmation Parameter Sources



Implementation



Performance Confirmation for Yucca Mountain

In September 2011NRC released its findings on the performance confirmation section of the SAR.

"*The NRC finds that the performance confirmation program is consistent with the NRC's Yucca Mountain Review Plan (YMRP). The SAR includes a description of the Performance Confirmation Program, which evaluates the adequacy of the supporting assumptions, data, and analyses in the SAR…On the basis of the NRC staff's review of the SAR and other information submitted in support of the SAR, the NRC staff notes that DOE has provided a reasonable description of its Performance Confirmation Program that is consistent with the guidance in the YMRP*."

Concluding Remarks

- Performance confirmation parameters should be demonstrably linked to the safety assessment
- In some manner, performance confirmation begins during site characterization but formally becomes a commitment when it is included in a license submittal
- Because PC test plans require detail including acceptable ranges and relevance to performance assessment, care should be exercised in development of and commitment to each PC test plan