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# Confirmation Monitoring of Repositories in the United States

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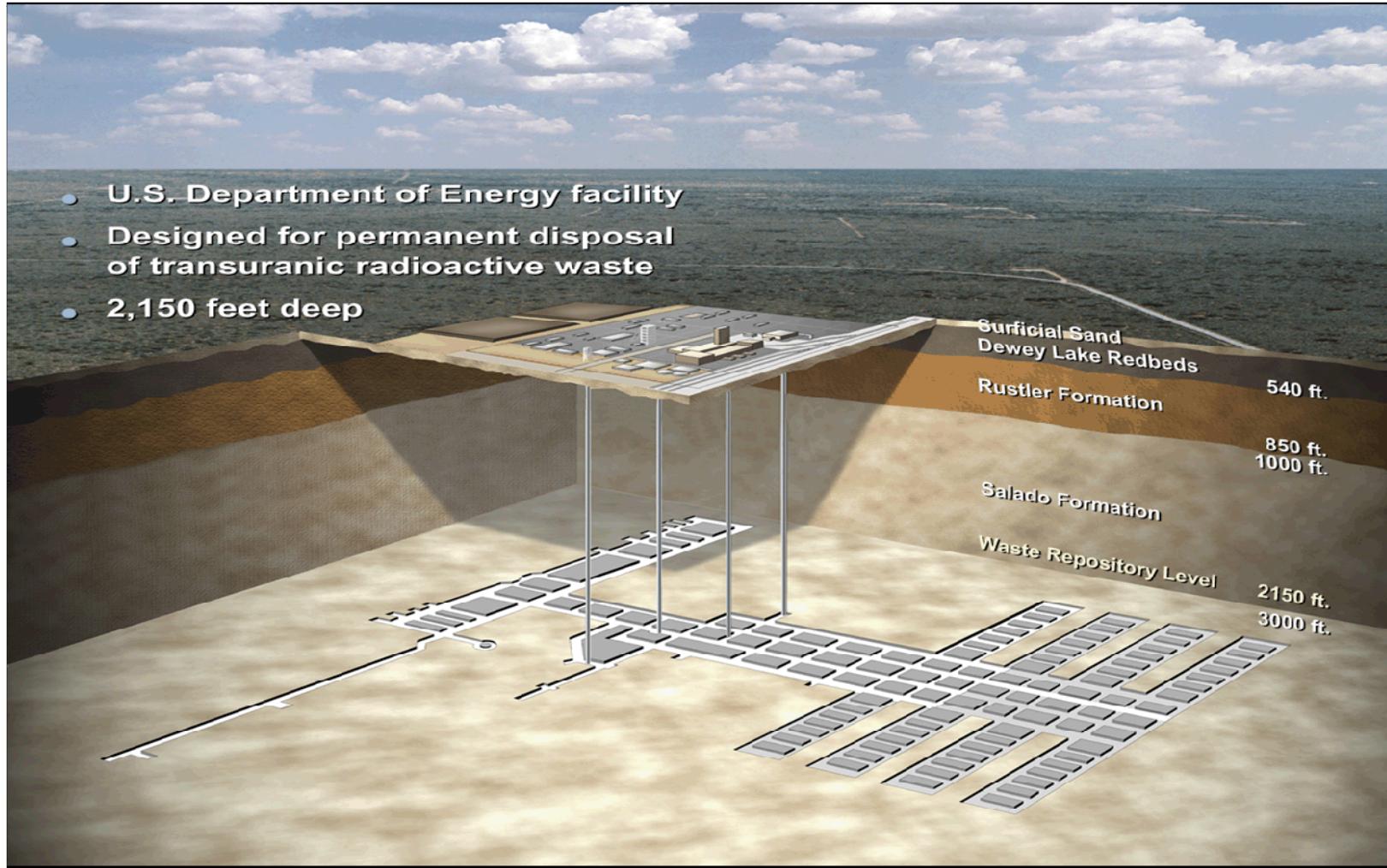


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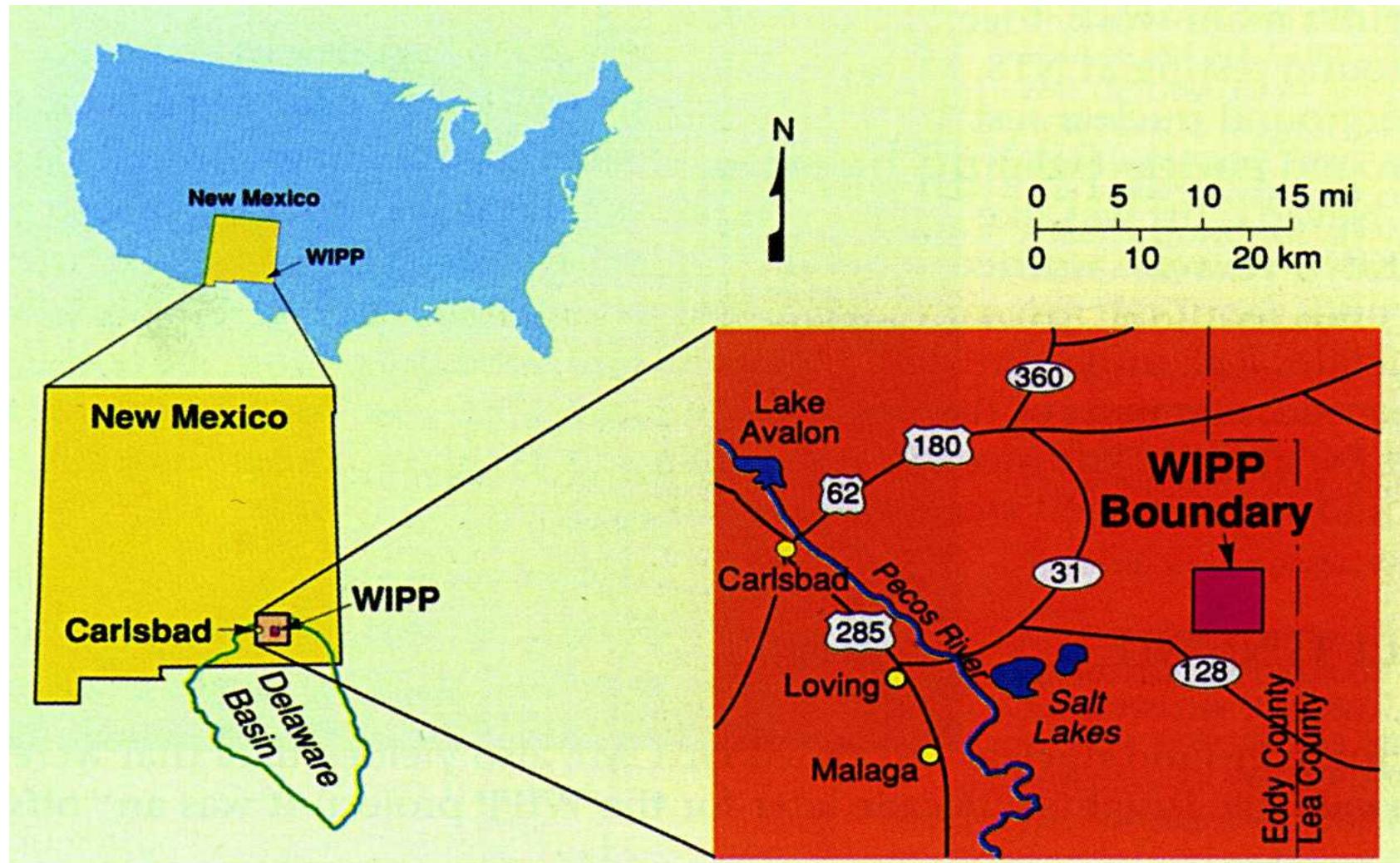
# Outline

- What is WIPP
- How Performance Confirmation became an important element of WIPP
- The Evolution of Performance Confirmation
- WIPP Pre- and Post-Operational Performance Confirmation Programs
- Performance Confirmation Example

# What is WIPP



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# How Performance Confirmation Became an Important Element of 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
  - 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

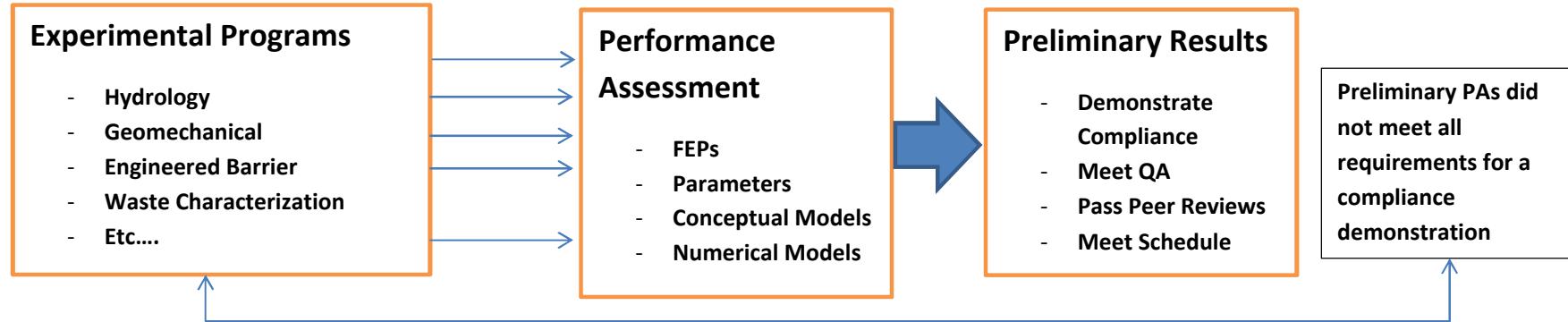


- Multi-phase program with different goals/objectives
  - Site characterization Testing and Monitoring
    - To Build a Performance Assessment (safety case)
  - Operational Phase Monitoring
    - To verify basis of Performance Assessment/Results
  - Post-Closure Monitoring
    - To enhance institutional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

# Site Characterization Testing and Monitoring

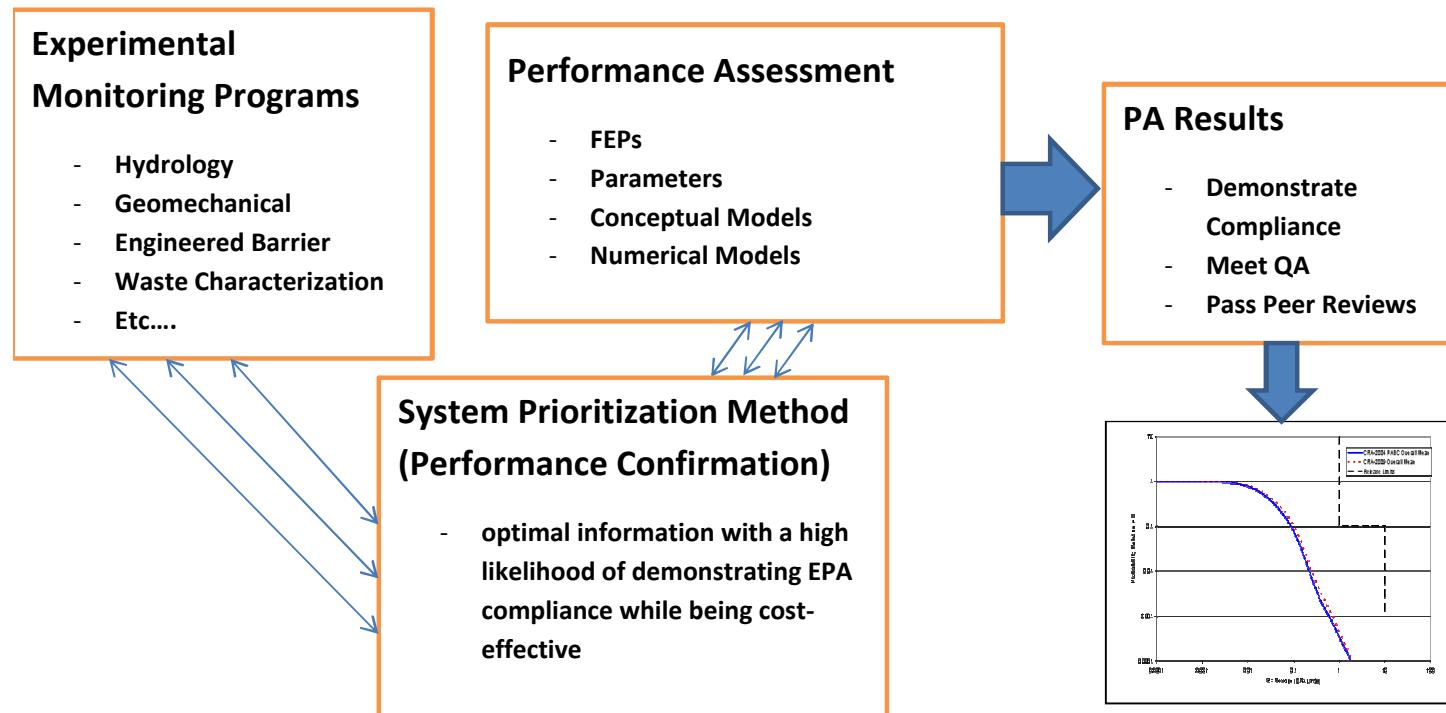
- Information was needed to build a defensible PA model.
  - Site characterization investigated host rock, geologic structure, hydrology, seals/rock interactions, waste/brine chemistry, geochemistry, gas generation, Kds and many other aspects of the system
- Resources and timelines limit the depth that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

## Without Performance Confirmation Considerations



Limited \$\$\$ and Time

## With Performance Confirmation Considerations



# WIPP Pre-Operational Monitoring

- The important elements identified for further monitoring related to:
  - Concentrations and Transport of Colloid Carriers
  - Culebra Fracture/Matrix Flow Laboratory Studies
  - Multi-Well Tracer Test
  - Rock Mechanics
  - Studies of Short- and Long-Term Shaft Seal Components
  - Blowout Releases
  - Dissolved Actinide Solubilities for Oxidation States +III to +VI
  - Chemical Retardation for Th, Np, Pu, U and Am

# 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

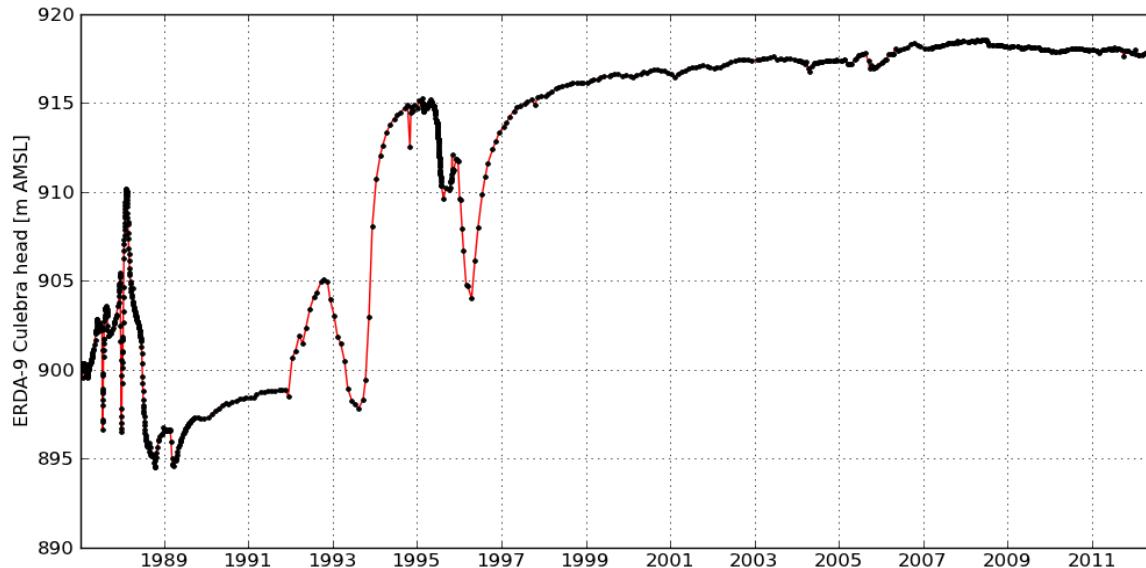
# WIPP Operational-Phase Monitoring



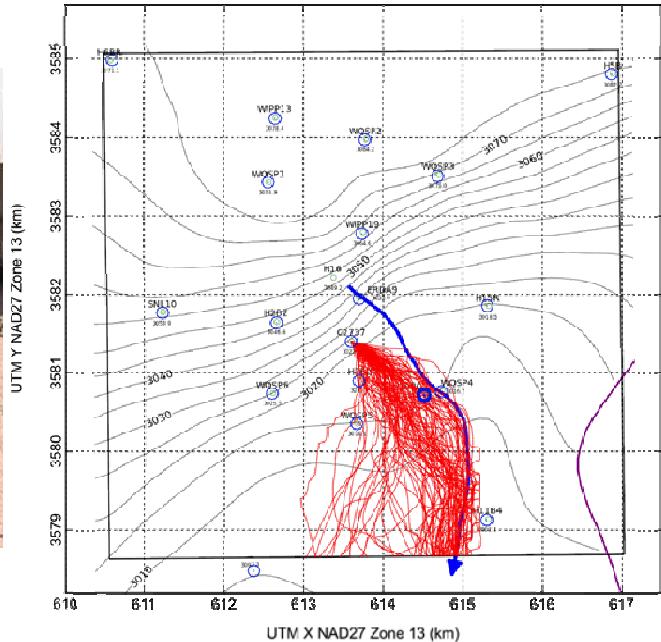
- Repository Monitoring
  - Creep Closure and Stresses
  - Extent of Deformation
  - Initiation of Brittle Deformation Displacement of Deformation Features
  - Subsidence Measurements
  - Waste Activity Monitoring
- Hydrology Monitoring
  - Culebra Ground Water Compositions
  - Change in Culebra Ground Water Flow
- Human Activity Monitoring
  - Drilling Rate
  - Probability of Encountering a Castile Brine Reservoir

# Performance Confirmation Example

- PA assumes steady-state conditions in the WIPP groundwater model used for flow and transport calculations
- Water levels in 17 of 32 monitoring wells exceeded the range used in PA for these wells



# Performance Confirmation Example



- 4 year investigation into the potential cause and possible modeling corrections
- Results – a refined WIPP ground water conceptual model; passed Peer Review; approved by EPA

# Performance Confirmation Example

- This example shows how the WIPP Monitoring program
  - Identified a condition outside PA expectations
  - Researched the cause and effects
  - Modified the modeling of the system to account for the new information.
- This Performance Confirmation action resulted in a more defensible and robust understanding of the disposal system – the goal of any Performance Confirmation program

# Summary

- Performance Confirmation Monitoring is an important element of the WIPP's program
- Performance Confirmation is useful during the site characterization phase and operational phase of a repository
- Actions of a Performance Confirmation program can increase understanding of repository conditions and defensibility of the repository's performance predictions