SAND2012-2214P

Exceptional service in the national interest

Sandia National Laboratories



Role of Sandia National Laboratories in the Waste Isolation Pilot Plant

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U.S. DEPARTMENT OF ENERGY | NNSA

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Location of Waste Isolation Pilot Plant (WIPP)

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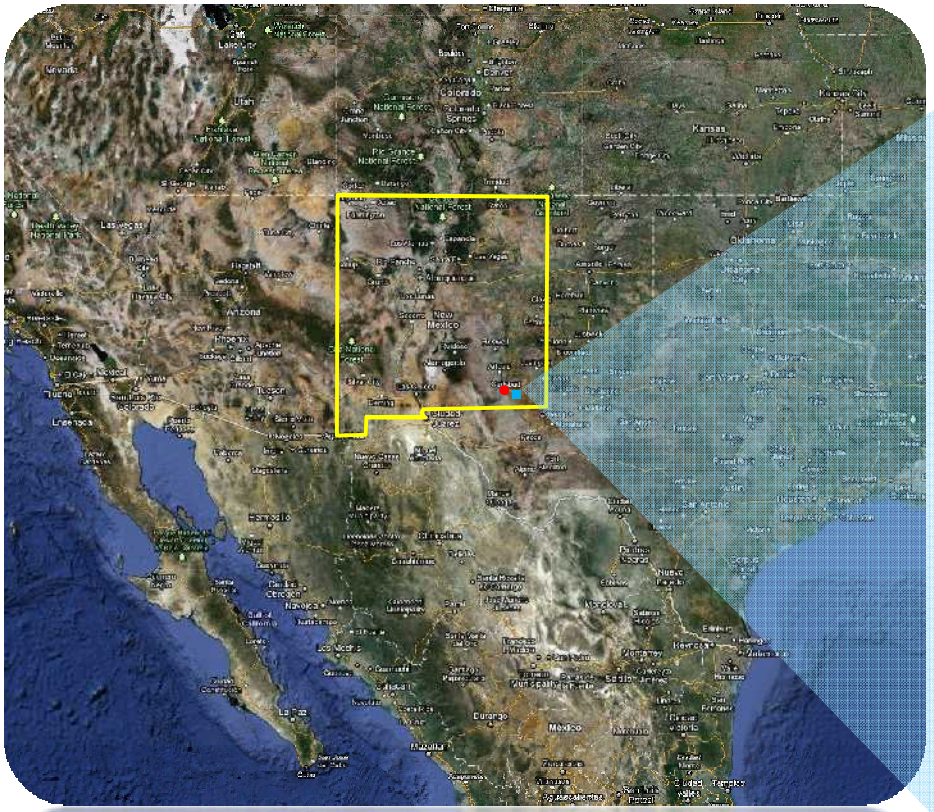
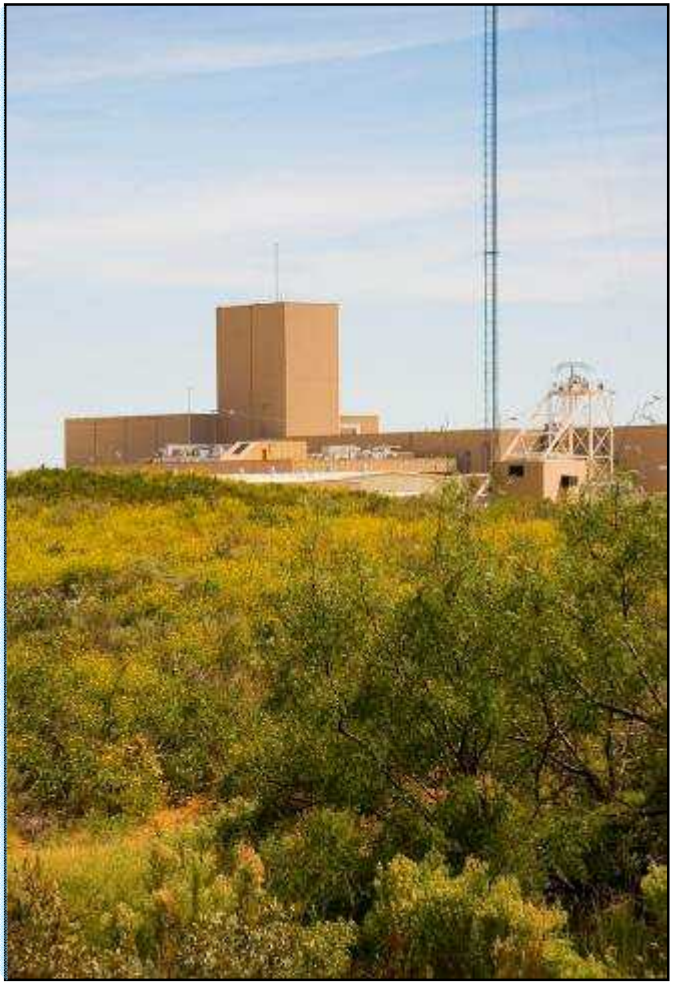
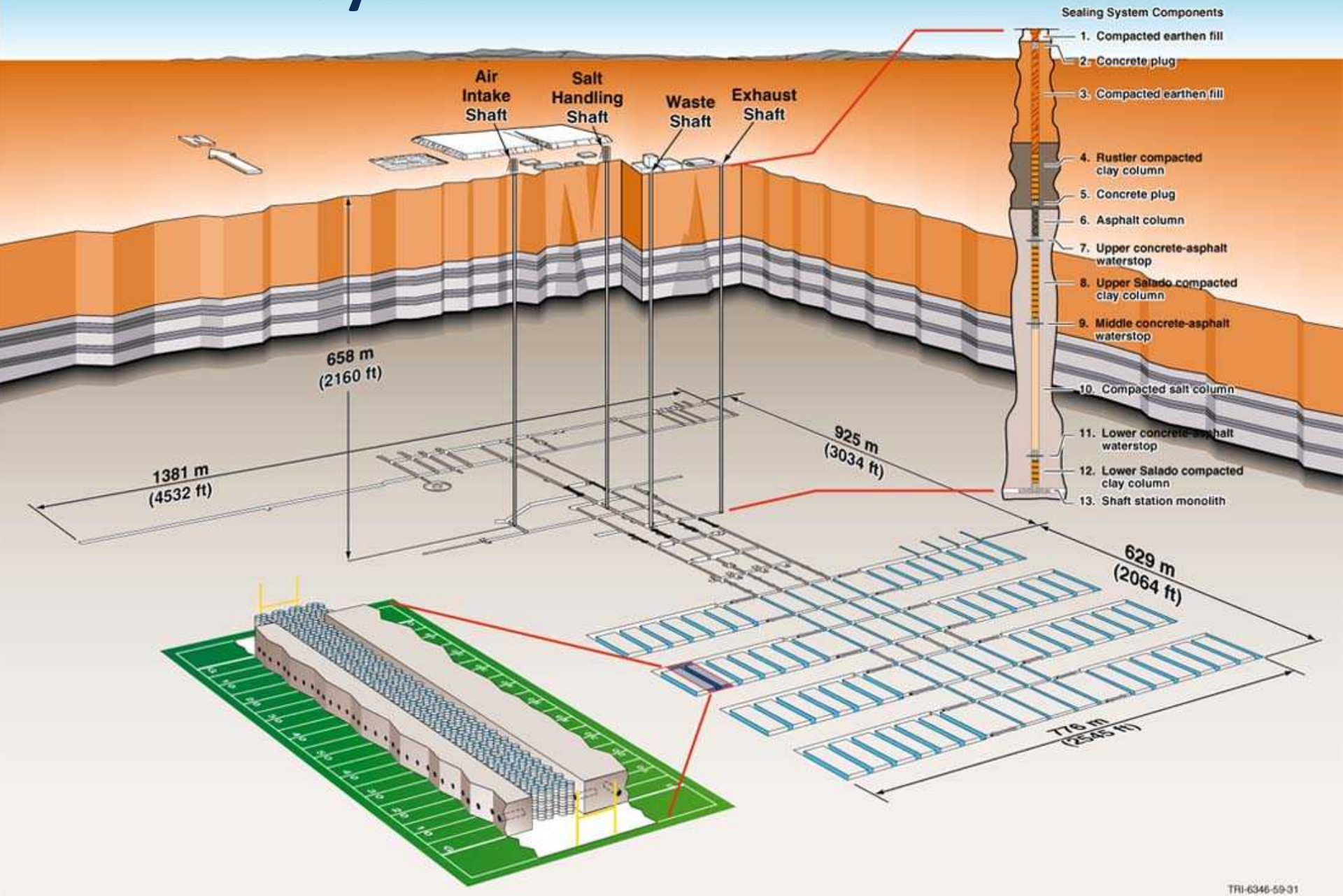
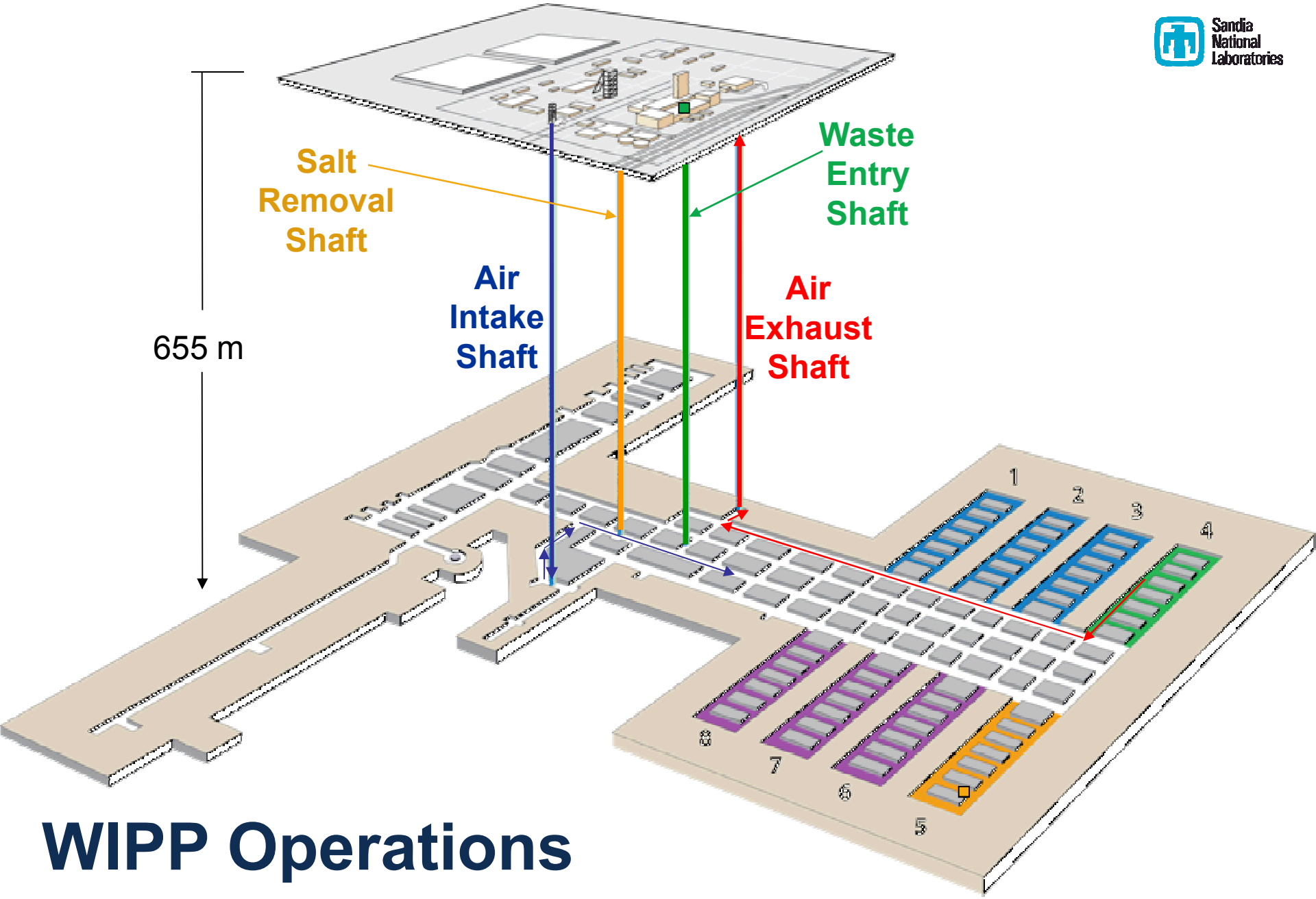




Southeastern New Mexico, USA
50 km east of Carlsbad •

WIPP Layout

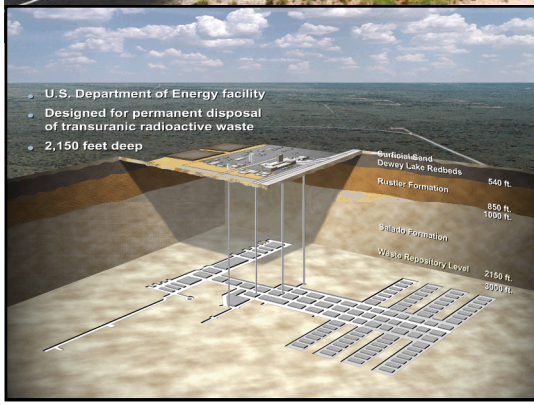

Air Intake Shaft
Salt Handling Shaft
Waste Shaft
Exhaust Shaft
658 m (2160 ft)
1381 m (4532 ft)
925 m (3034 ft)
629 m (2064 ft)
716 m (2545 ft)
Sealing System Components
1. Compacted earthen fill
2. Concrete plug
3. Compacted earthen fill
4. Rustler compacted clay column
5. Concrete plug
6. Asphalt column
7. Upper concrete-asphalt waterstop
8. Upper Salado compacted clay column
9. Middle concrete-asphalt waterstop
10. Compacted salt column
11. Lower concrete-asphalt waterstop
12. Lower Salado compacted clay column
13. Shaft station monolith
TRI-6346-59-31



WIPP Operations

Objective

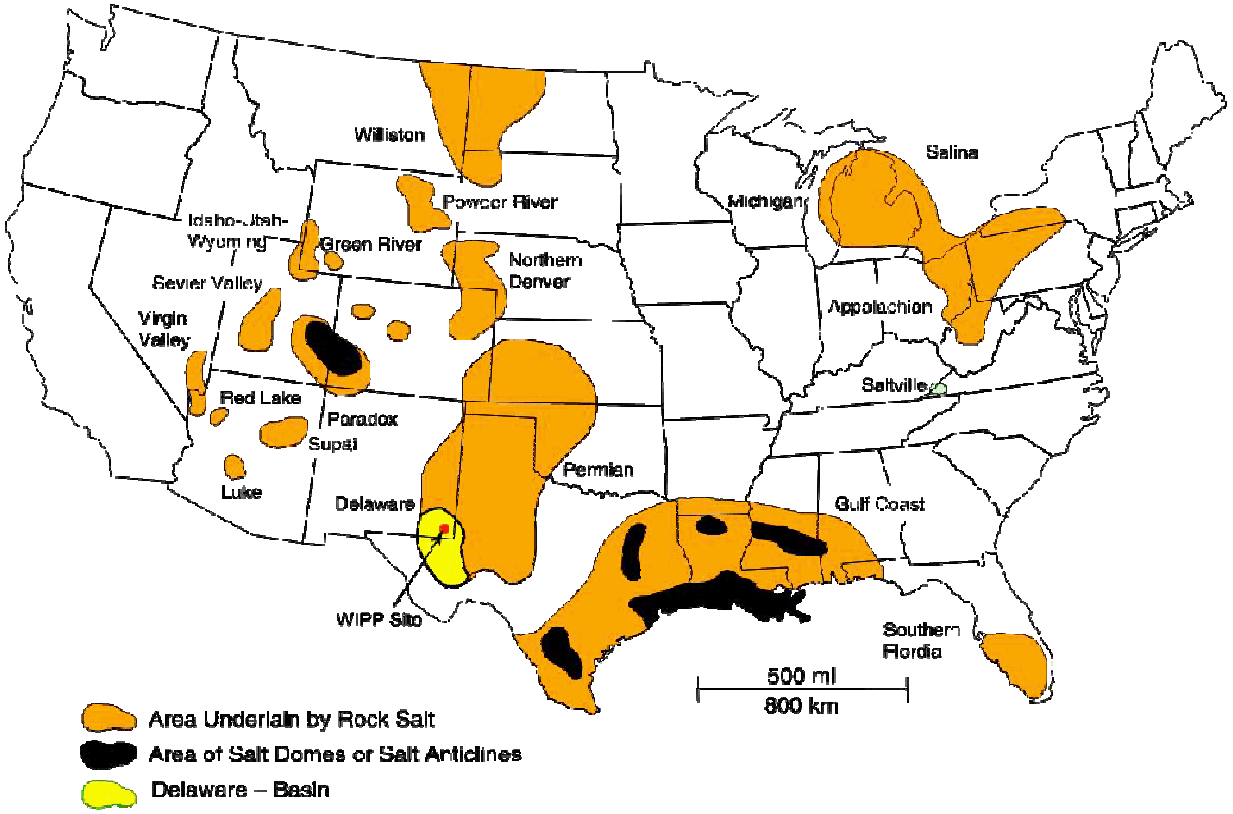
- Remove the nuclear waste from the accessible environment (approximately 170,000 m^3 for WIPP)
- Transport the packages from the generator sites to the repository
- Place the packages in an underground repository with the intention to permanently dispose of the waste in the repository



National Academy of Science

1957

- National Academy of Sciences concludes that the most promising disposal option for radioactive wastes is in salt deposits.



"Salt at great depth flows. It will encapsulate any waste placed at depth and isolate it from the surface environment for eons."

"The great advantage is that no water can pass through salt. Fractures are self healing…."

Initial Candidate Sites Focused on Bedded Salt

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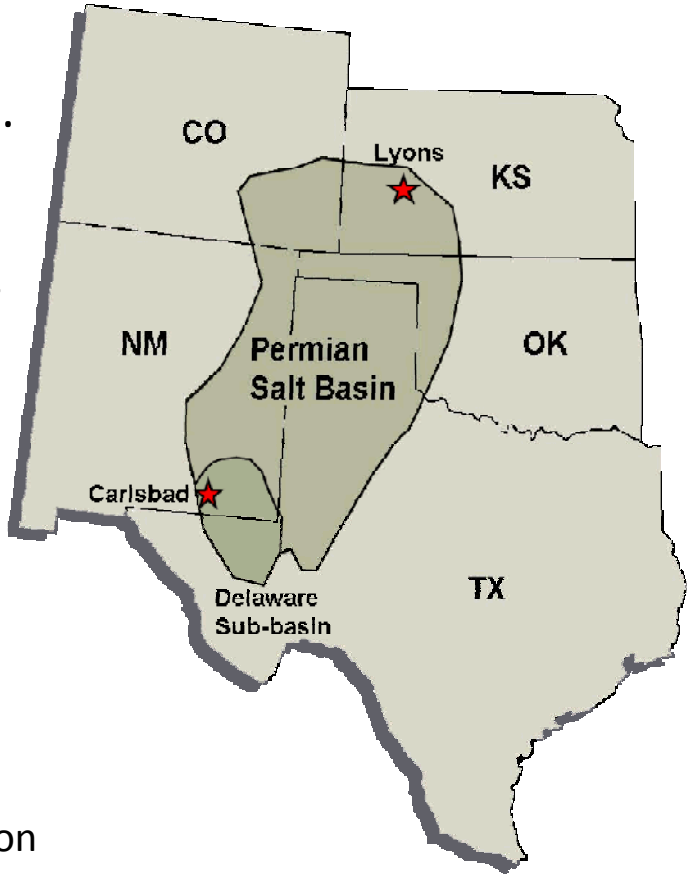
1968

- Project Salt Vault near Lyons Kansas.
  - Nearby oil production provided easy targets for critics and the Lyons site became politically troubled very quickly.

1972

- Local politicians from Carlsbad, NM learn of problems at Lyons (1972), and actively pursue AEC to explore nearby potash district for candidate sites.
  - Delaware Basin turns out to be deepest and thickest, but nearby oil production and potash mining still make site selection controversial.



DOE National Security and Military Applications of Nuclear Energy Authorization Act of 1980

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1979

- Act authorized DOE to construct WIPP and to seek New Mexico endorsement to operate a geologic repository for waste generated for defense purposes (weapons development waste).
  - Act does not allow disposal of waste from civilian power production.

Substantial influence by both local and state politicians to proceed. Economic impact (jobs) drove influence but ‘good science’ demanded at every step.

Construction of WIPP

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1981 ▪ Surface construction of WIPP begins.

1983 ▪ First underground rooms are completed.

1988 ▪ Engineered facility is ready for waste disposal.

Major WIPP Events After the Facility Readiness

1989	▪ Nuclear Regulatory Commission certifies the TRUPACT-II shipping container
1992	▪ WIPP Land Withdrawal Act designates EPA as WIPP's primary regulator
1993	▪ EPA issues radiation standards for waste containment.
1996	▪ EPA issues criteria for compliance
1998	▪ EPA certifies that WIPP complies with 40CFR191
1999	▪ First shipment of TRU waste from Los Alamos National Laboratory ▪ New Mexico Environment Department issues a Hazardous Waste Facility Permit
2004	▪ Recertification CRA-2004
2007	▪ Begin Remote Handled Waste Disposal
2009	▪ Recertification CRA-2009
2011	▪ SDI PCN

CARLSBAD CURRENT-ARGUS

stand (36 cents home-delivered) 26 Pages SUNDAY April 18, 1999 Serving Eddy County, New Mexico

It's official: WIPP's open for business

Richardson, N.M. congressmen on hand for grand opening ceremony

By Victoria Parker-Stevens

CARLSBAD — As a thank you to those who worked more than 25 years to see a nuclear waste repository open, the Waste Isolation Pilot Plant held special ceremonies Saturday morning.

While the first shipment arrived at the plant March 26

"Today I'm especially proud to be an American and associated with those who made this possible."

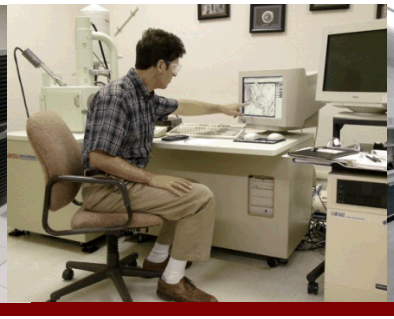
LOUIS WHITLOCK RD

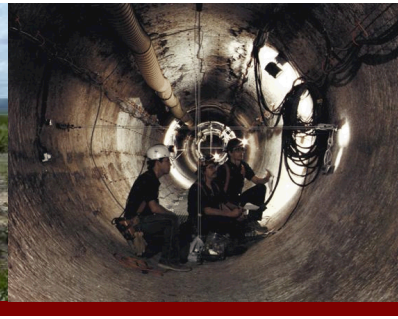
First Tru Waste Receipt (3/26/1999)

Waste Isolation Pilot Plant

Sandia's WIPP Mission

- Sandia is the scientific advisor for the DOE Carlsbad Field Office
  - Provides scientific support in performance assessment, geochemistry, hydrology and geomechanics for continued WIPP compliance with EPA regulations.
  - Sandia's 36-year involvement in WIPP represents the longest-running project in Sandia.
- The Carlsbad Defense Waste Management Programs Group advances the state of repository science and solves problems in domestic and international nuclear waste management.
  - Advances the Nation's capabilities in repository science.
  - Supports new nuclear waste disposal strategies for the Nation.
  - Supports domestic and global nuclear waste projects.

WIPP Regulatory Framework

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U.S. Department of Energy (DOE)

National Environmental Policy Act (environmental impact statements), nuclear safety

U.S. Environmental Protection Agency (EPA)

10,000 year Repository certification, radionuclide regulation, PCBs

New Mexico Environment Department (NMED)

RCRA hazardous constituents, water discharge, groundwater, air

U.S. Nuclear Regulatory Commission (NRC)

Transportation Type B packages for nuclear materials

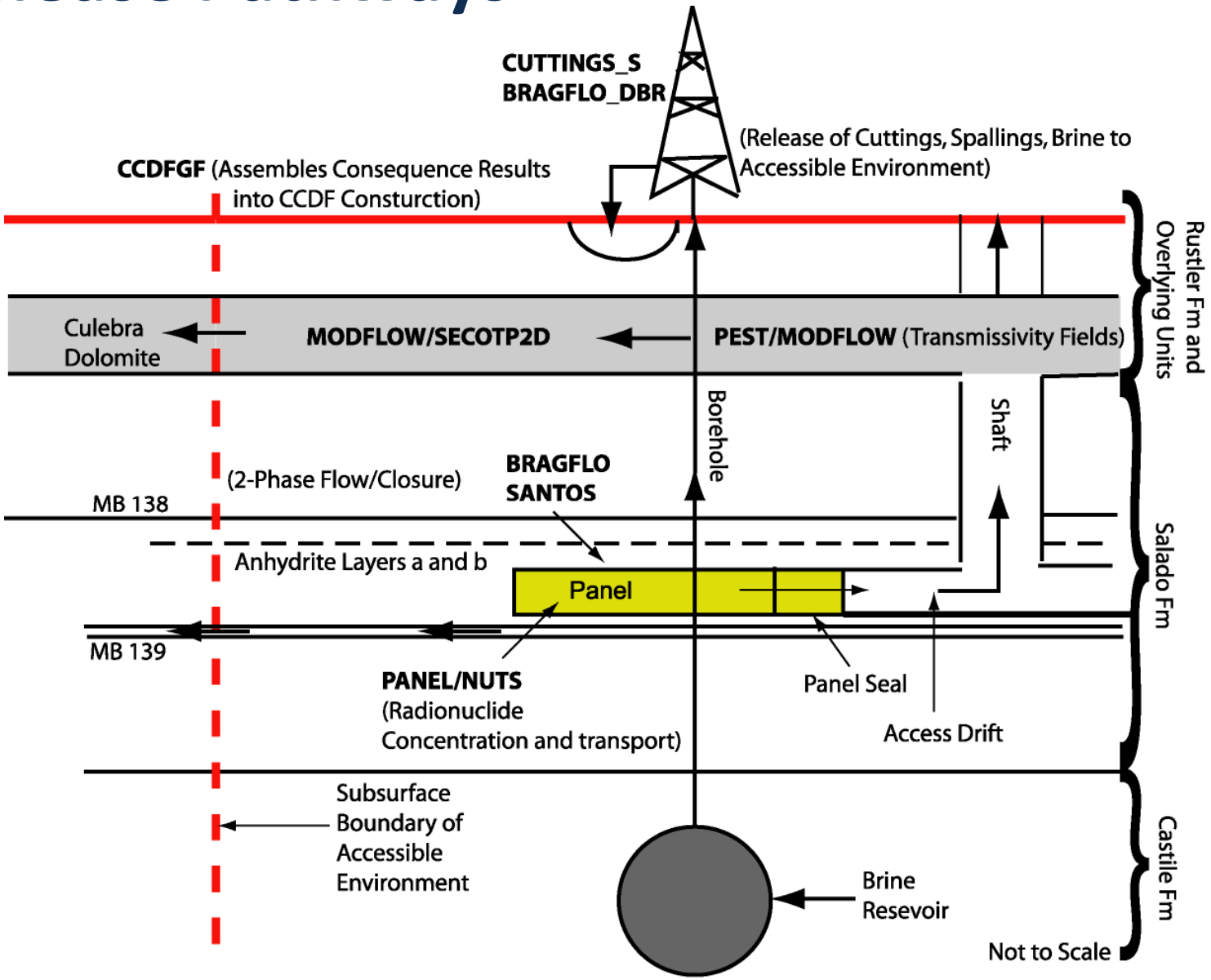
U.S. Department of Transportation (DOT)

Highway transportation, Type 7A containers

What is Performance Assessment?

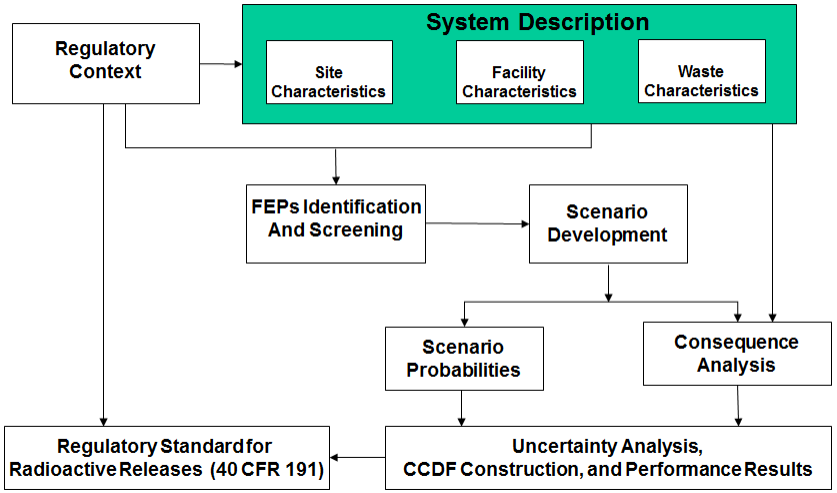
- Regulatory requirements were primary determinant for the development of the PA structure
  - The WIPP must be designed to provide *reasonable expectation* that *cumulative releases* of radionuclides to the accessible environment for *10,000 years* after disposal from all *significant processes and events* shall be less than specified *releases limits*
- Performance Assessment provides a quantitative estimate of the future performance of the repository system
- Probabilistic Risk Assessment used to predict repository performance
  - What can occur?
  - How likely are these to occur?
  - What are the release consequences?

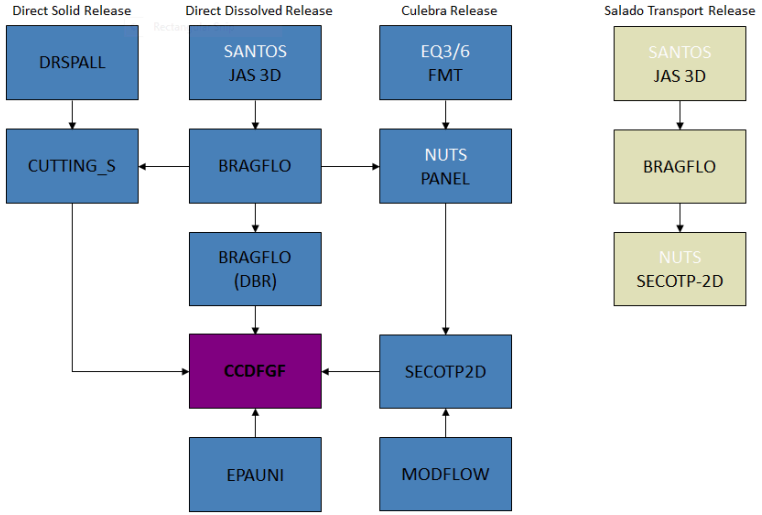
Release Pathways



PA Methodology

- Identify all potential release pathways and calculate the probability and consequences of releases over a 10,000-year regulatory period.
- PA Requires:
  - Site characterization (conceptual models and parameters)
  - ***Process models*** (e.g., flow and transport, geomechanical, geochemical, drilling)
  - Incorporation of uncertainty
  - System-level tool to link everything together





Science Programs to Support WIPP PA (Process Models)

- Geochemistry
  - Fe/Pb solubility and corrosion experiments
  - MgO hydration/carbonation experiments
  - Actinide solubility analysis
  - Geochemical modeling in high ionic strength, aqueous systems
- Hydrology
  - Groundwater flow and transport
  - Regional groundwater modeling
  - Ground water level monitoring and analysis in WIPP vicinity
  - Geochemical study of all water samples collected in WIPP vicinity
- Geomechanics
  - Salt creep modeling and void space analysis
  - Analysis of hydrodynamic strength of nuclear waste

Regulatory Compliance Cycle

- Submitted Compliance Certification Application (CCA) October, 1996
  - EPA Certified WIPP EPA May 1998
  - Began Waste Disposal March 26, 1999
- Submitted Compliance Recertification Application (CRA) March, 2004
  - EPA Recertified WIPP March, 2006
- Submitted the second CRA March, 2009
  - EPA Recertified WIPP Nov 29, 2010
- CRA recurs every 5 years
  - Will submit subsequent CRA's in years ending in "4" and "9"

Key Components of WIPP Success

- Clear and direct leadership, decision-making and simple organization
- Well documented technical program
- Unbiased and open site selection process
- Effective interactions with the regulators
- Obtain public acceptance
- Overarching themes: Safety and Transparency

Gaining Public Acceptance

- Involve public at every juncture
- DOE had a well-organized public outreach/educational program that started locally, and expanded outward
- Involving public helps to demonstrate transparency and openness; builds confidence
- WIPP regulatory compliance determinations employed an iterative public involvement process (also aids in transparency)

KRMC-SANDIA Collaboration

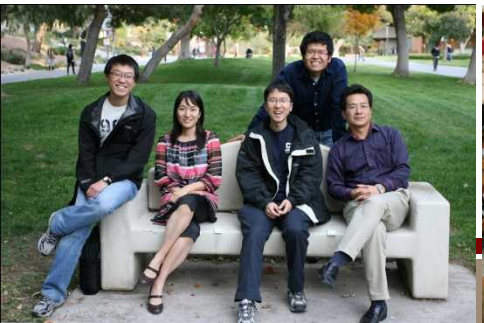
KRMC

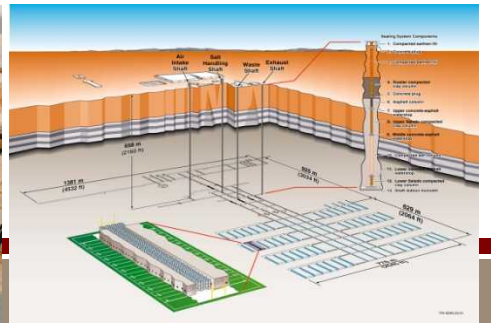
Sandia National Laboratories

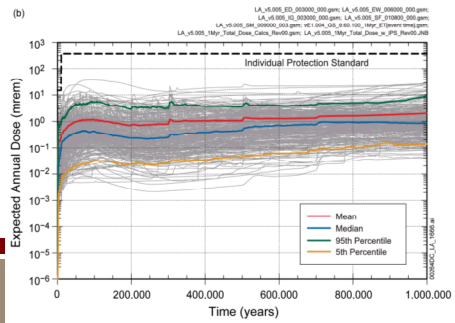
Repository Science Consortium

Annual Training	Repository Science	
Staff Exchange	On site collaboration	
Information Share	WIPP & YMP Publications Repository Data & Models Experience	
Collaborative R&D	SNL Laboratories SNL Computing Facilities Universities	Publications SAND Reports KRMC Reports
Annual Workshop	Evaluation and Planning	

The central goal of the RSC is to develop solutions and provide innovative technology advancements in the repository sciences in order to meet nuclear waste management challenges throughout the world. By fostering an international collaborative environment, the Repository Science Consortium will be able to undertake activities beyond the capabilities of its individual members.

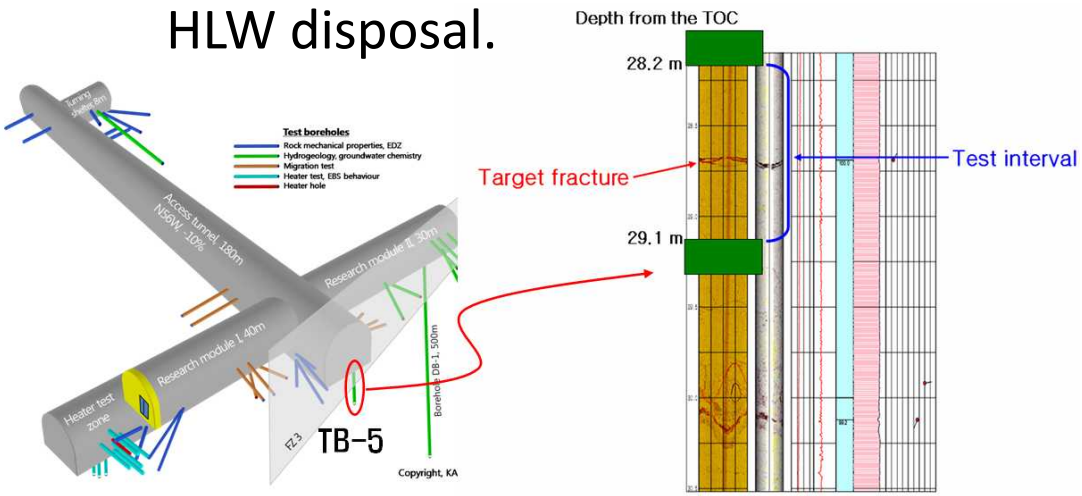




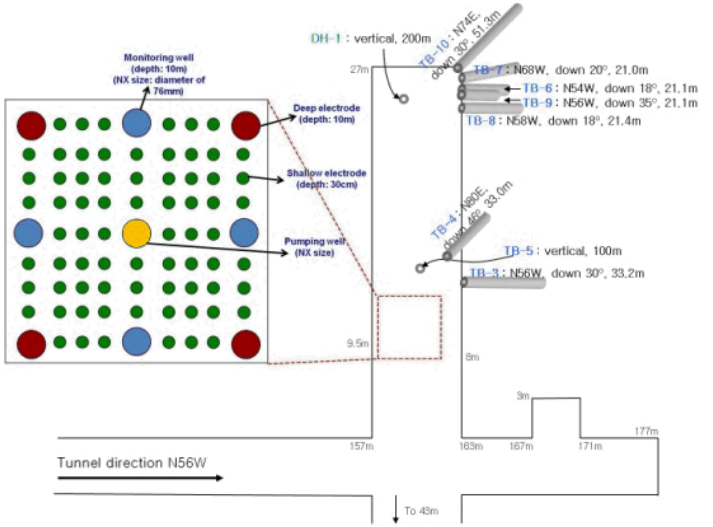


KAERI – SANDIA Collaboration

- Implementation of Hydrology Process Models in PA
- Influence of the pressure on a fracture aperture controlling a fracture transmissivity
- Evaluation of the correlation between the SP (Stream Potential) signal and fracture flow
- Deep borehole investigations for HLW disposal.



Acoustic televiewing results



Future

- Leading in international efforts to address safety, waste management, non-proliferation, and security concerns.
- Advancing the state of repository science and solves problems in domestic and international nuclear waste management.
- Securing a peaceful and free world through technology