

Sandia National Laboratories Program Overview

*Presentation for
Japan Atomic Energy Agency
March 26, 2008*

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¹Energy, Resources, & System Analysis / Geohydrology

²Nuclear Energy & Global Security Technologies / Performance Assessment Integration

³Institutional Relationships



Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company,
for the United States Department of Energy's National Nuclear Security Administration
under contract DE-AC04-94AL85000.





Topics for Discussion

Sandia National Laboratories Overview

Nuclear Energy

Global Nuclear Energy Partnership

Waste Isolation Pilot Plant

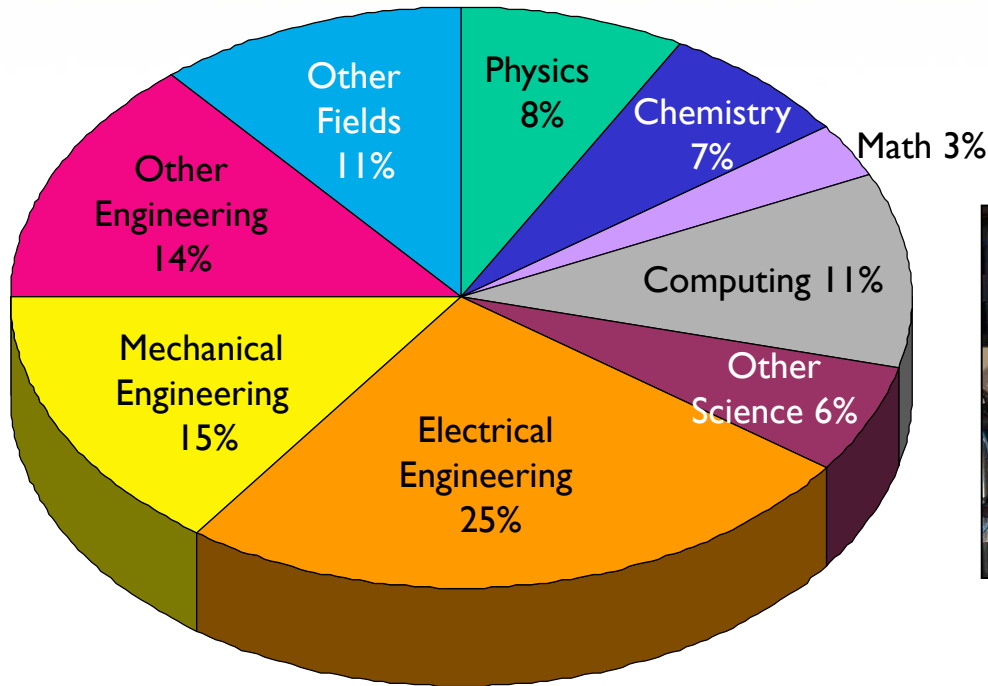
Yucca Mountain

Related Projects

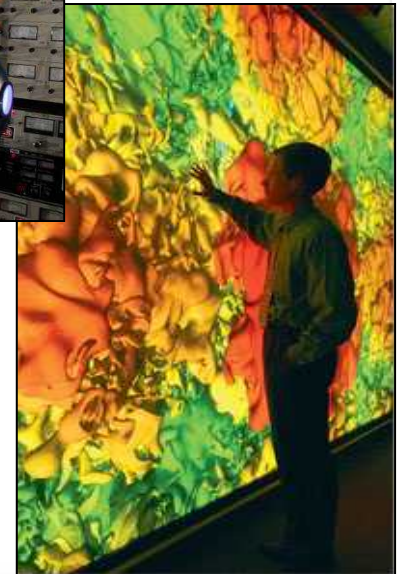
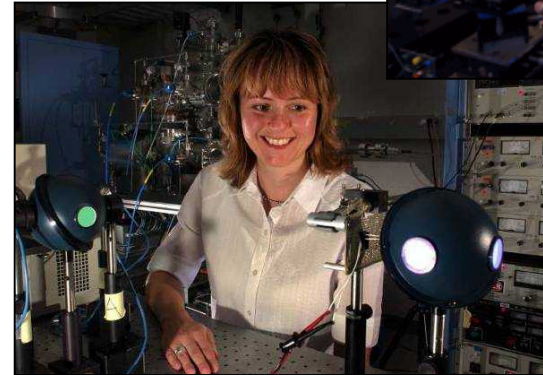
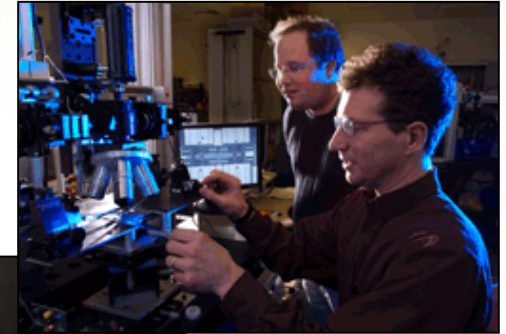


Sandia is a multidisciplinary science and engineering lab dedicated to national and global security

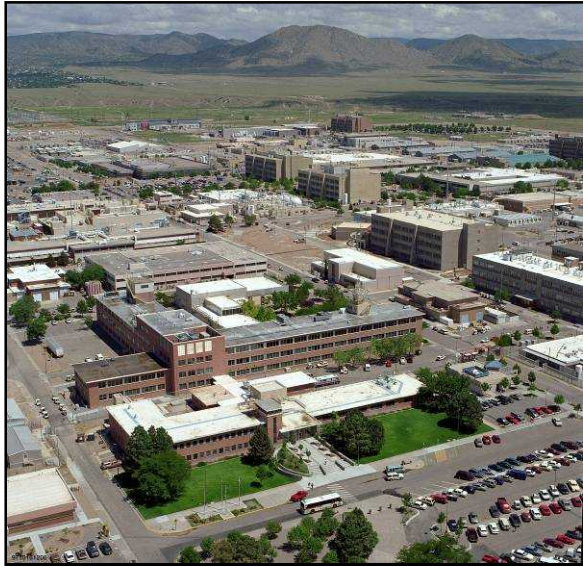
US Department of Energy



- ***Over 8,500 full-time employees***
- ***Over 1,500 PhDs***
- ***Over 2,500 MS/M***



Sandia National Laboratories is geographically distributed



*Albuquerque,
New Mexico*



*Tonopah Test Range,
Nevada*



*Kauai Test Facility
Hawaii*



Nevada



WIPP, New Mexico



Pantex, Texas

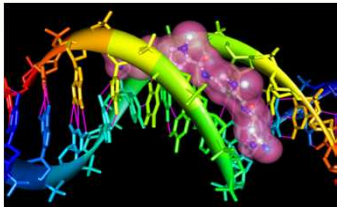


Livermore, California



Sandia
National
Laboratories

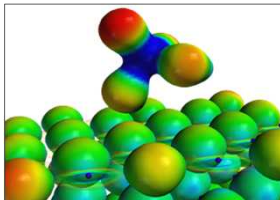
***Our work is supported by our science,
technology, and engineering capabilities
→ Sandia Science and Technology Councils***



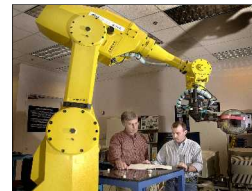
*Bio Science
& Technology*



Engineering Sciences



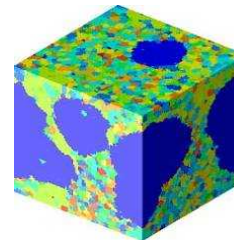
*Chemical &
Earth Sciences*



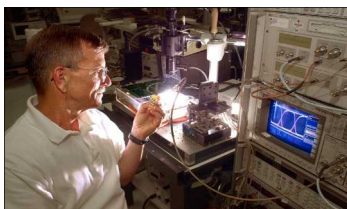
Manufacturing Sciences



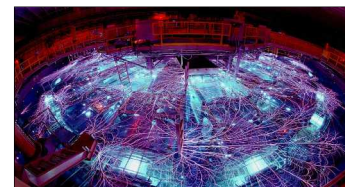
*Computer &
Information Science*



Materials Sciences



Electronics

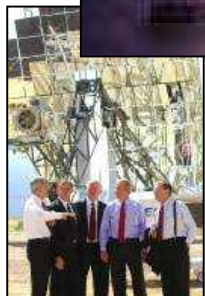
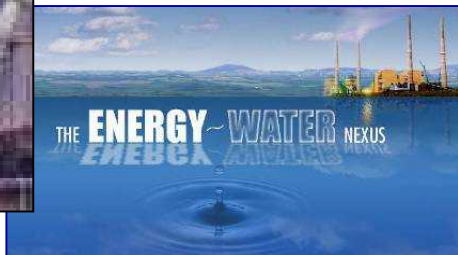


Pulsed Power Science



Energy, Resources, and Nonproliferation Strategic Management Unit

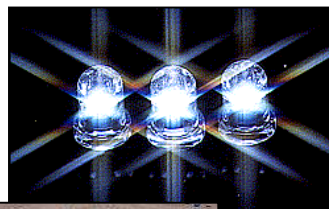
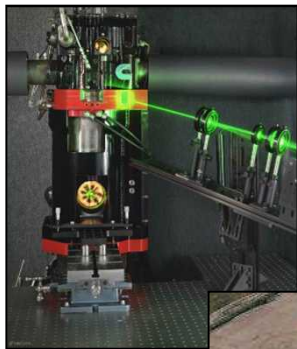
Fuel and Water Systems



Nuclear Energy



***Science Underpins and Enables
Technology for the Energy, Resource
and Global Security Missions***



Science and Technology



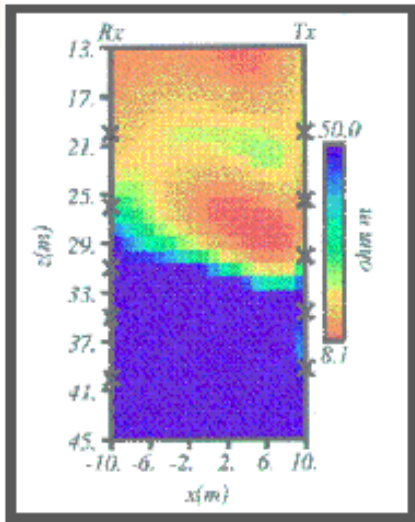
Global Security



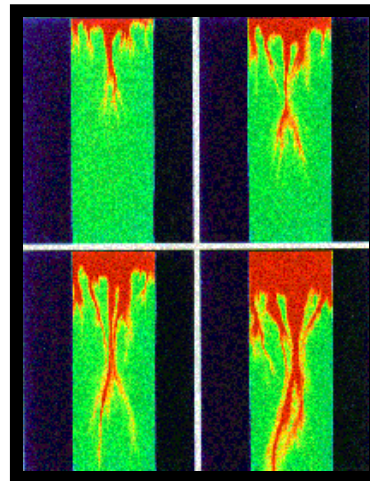
Sandia
National
Laboratories

Mission-Driven Geoscience

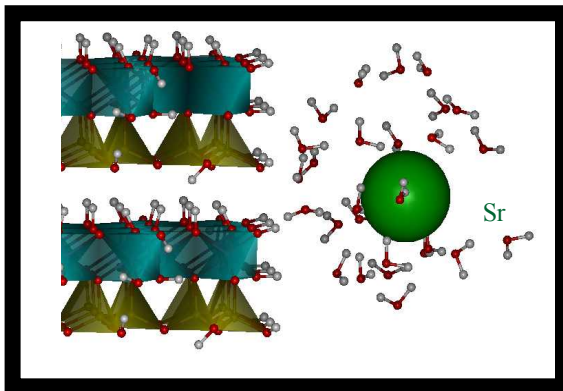
Geoscientists in our Center are advancing the fundamental state of knowledge in their fields, are leaders in the broad technical community, and are enabling a breadth of Sandia programmatic goals.



Geophysics



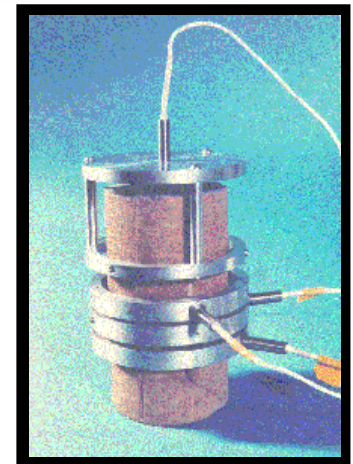
Geohydrology



Geochemistry



Geotechnology



Geomechanics

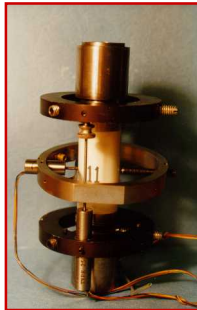


Nuclear Applications

We bring a broad suite of Geoscience capabilities to nuclear weapons and non-nuclear military applications.

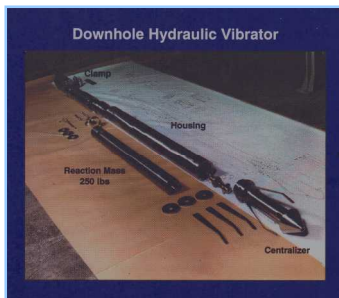
Earth Materials Characterization

- Geomechanical testing
- Geological characterization
- Geochemical remote sensing
- Water purification
- Geophysical methods



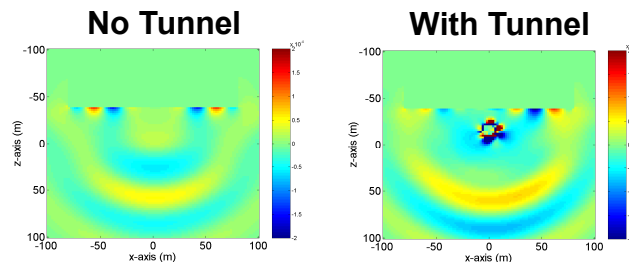
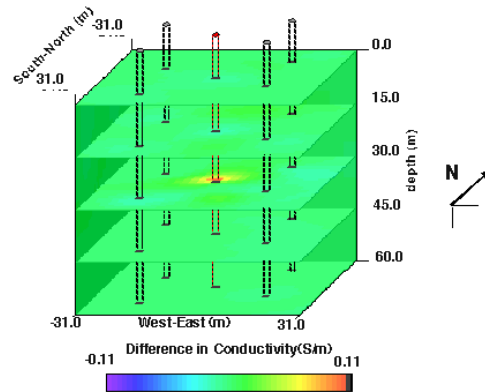
Instrumentation

- Borehole energy sources and receivers
- Downhole communications



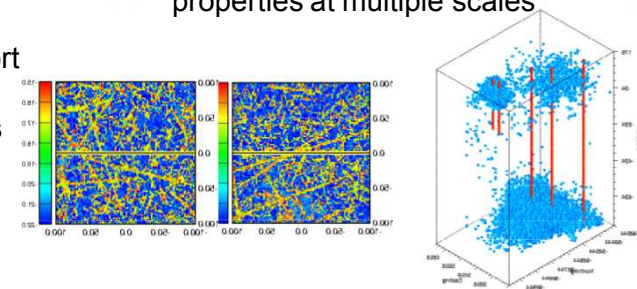
Numerical Modeling

- 3D geophysical wave propagation (seismic, electromagnetic)
- Discrete element modeling of blasting
- Subsurface flow and contaminant transport
- Dynamic structural interactions
- Molecular scale modeling of geomaterials



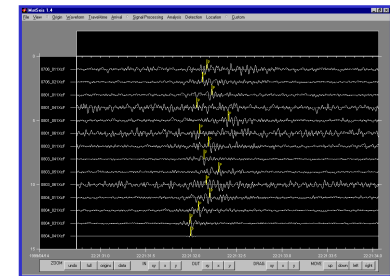
Geostatistics

- Uncertainty propagation
- Estimating spatially varying properties at multiple scales



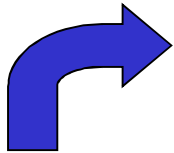
Data Analysis and Visualization

- 3D geologic visualization
- Computational systems for geophysical data analysis (MatSeis)



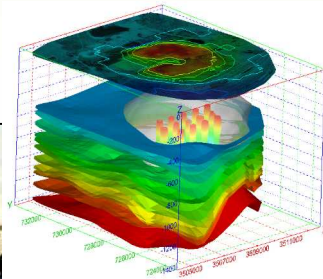
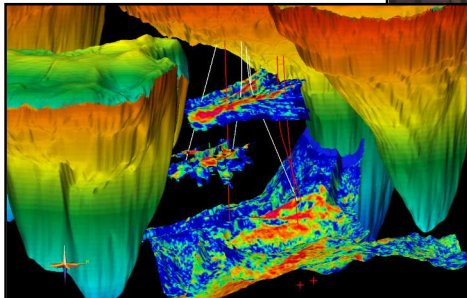
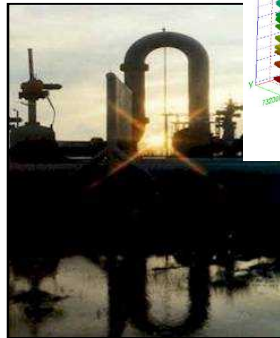
Energy

We solve subsurface technical challenges to ensure secure, sustainable and environmentally sound energy supplies, efficient and safe energy storage, and effective carbon management.



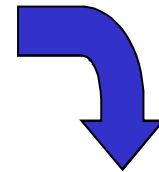
Energy Exploration & Generation

- Nuclear
- Fossil
- Renewable



Storage & Transmission

- Strategic Petroleum Reserve
- Compressed Air Energy Storage
- Electric Grid Reliability
- Diesel Engine Performance



Waste Management

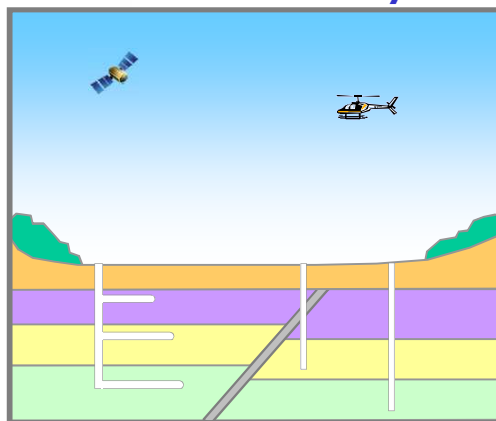
- Geologic Repositories
- Spent Fuel Transportation
- Environmental Restoration
- Carbon Sequestration



Repositories & Transportation

We solve key technical issues to enable safe and secure management of hazardous, radioactive, and mixed waste materials

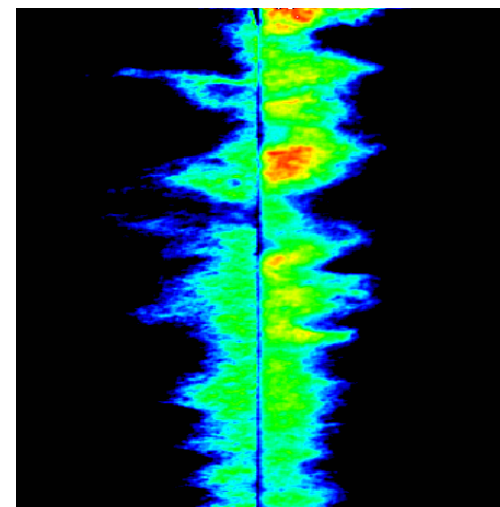
Site Characterization and Decision Analysis



Performance Assessment



Flow and Transport in Fractured Rock



Global Nuclear Energy Partnership



GNEP
Ministerial
Meetings

**“aims to safely and securely expand
nuclear power worldwide while
responsibly managing nuclear waste
and reducing proliferation risks”**

Established September 16, 2007

- **16 Original members**
 - **USA, Japan, France, China, Russia, Australia, Bulgaria, Ghana, Hungary, Jordan, Kazakhstan, Lithuania, Poland, Romania, Slovenia, Ukraine**
- **5 Additional members (as of February 26, 2008)**
 - **Italy, Canada, Korea, Senegal, United Kingdom**



Sandia's GNEP Involvement

Planning and Assessment ~\$3.73 mil FY08

- **Fuels**
 - Transient fuel simulation
- **Separations**
 - Monitoring equipment design
 - Regulatory and safety
- **Waste Forms**
 - Geologic repository concept analysis
 - Readiness level assessment
 - Evaluation of testing protocols
 - Salt repository scoping study
 - Long-term waste form S&T
 - Waste form modeling and technology
 - Iodine waste form development
- **Safeguards**
 - Data validation and security
 - Safeguards performance model
- **Reactor**
 - Component testing requirements
 - Severe accident approach
 - Fast reactor
 - Regulatory framework
 - Technology assessment
 - Material, storage, transportation & disposal
- **Systems Analysis**
 - Analysis and integration
 - Economic analysis

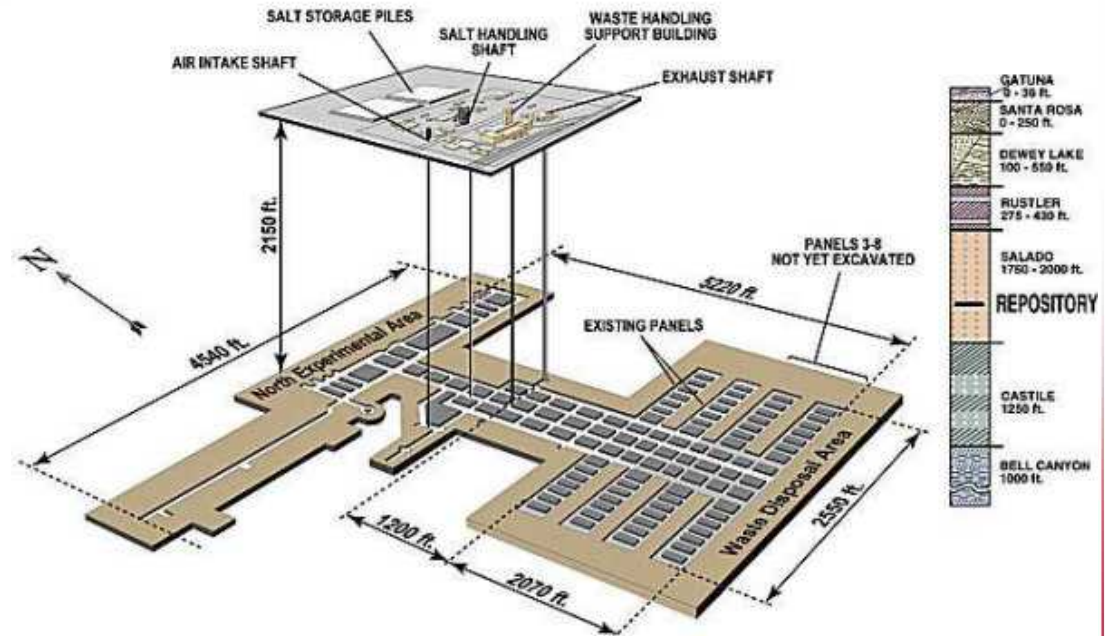


Waste Isolation Pilot Plant



- Received first shipment of CH-TRU waste on March 26, 1999
- RH-TRU waste was approved October 2006
- As of March 17, 2008, WIPP had received its 100th RH shipment, and over 6500 CH shipments (most from Rocky Flats and INL)
- Relicensing in 2009

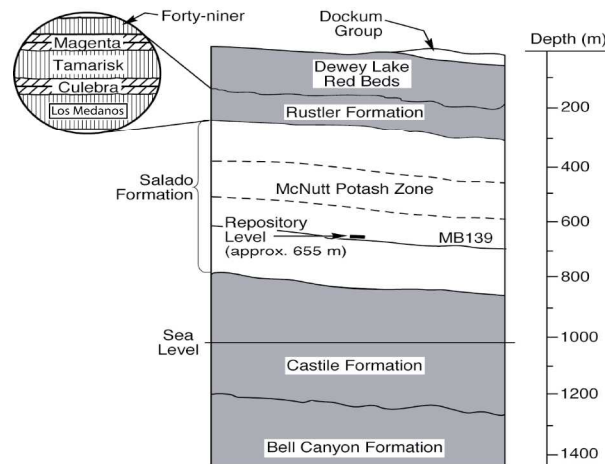
WIPP Facility and Stratigraphic Sequence



Waste Isolation Pilot Plant



- **Sandia is the chief scientific advisor for WIPP to the DOE**
 - Performance, compliance, and impact assessment, sensitivity analysis, scientific investigations and monitoring data analyses, computer modeling, technical review and expert elicitations
- **Key issues for relicense application**
 - Updating all geologic, geophysical, geochemical, hydrologic, and meteorological information
 - Culebra and Magenta aquifers
 - Regional groundwater flow
 - Adding additional monitoring data, analyses and results
 - Identification and justification for activities or assumptions that deviate from the last application
 - Update inventory of waste



TRI-6801-97-0



Yucca Mountain



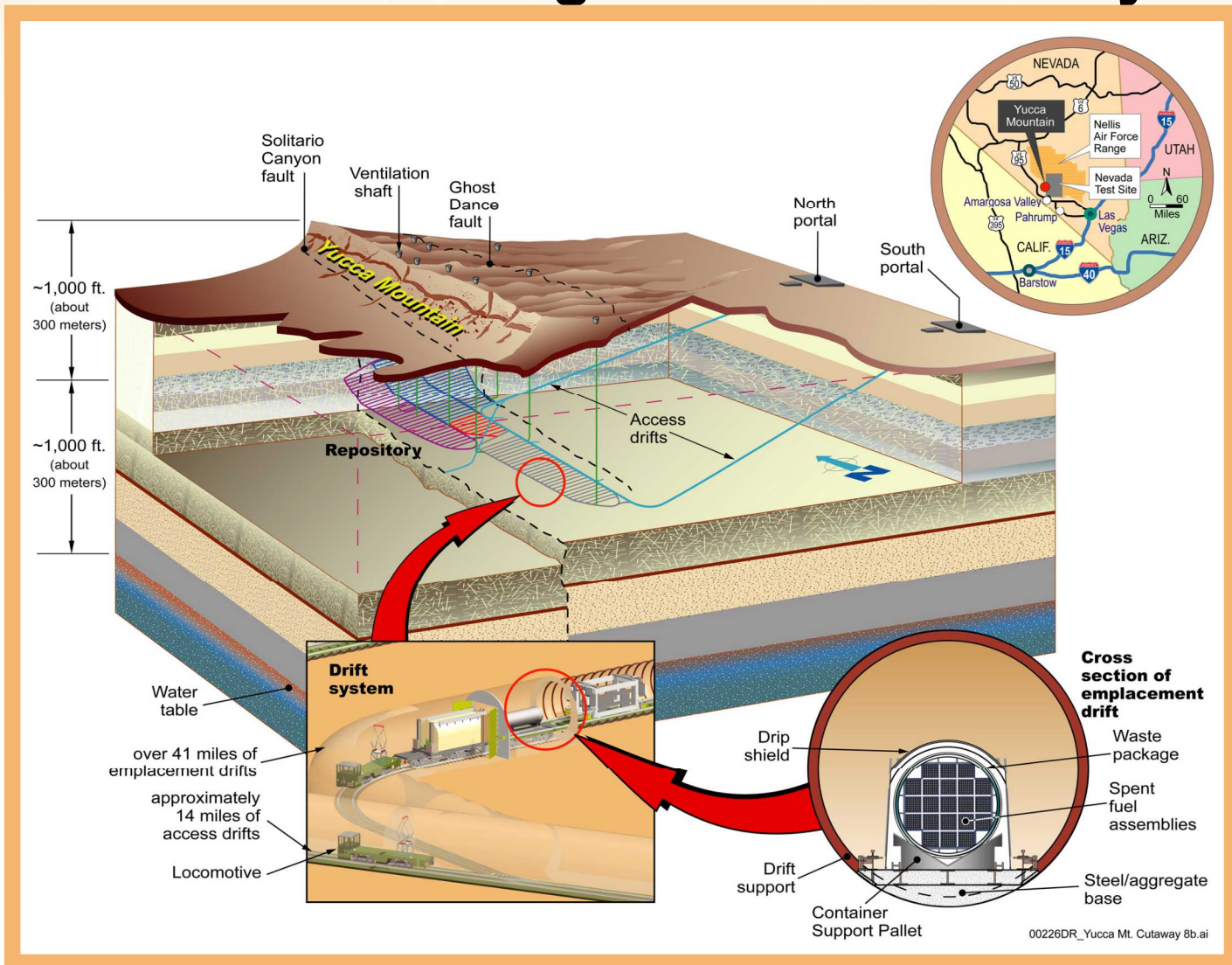


Sandia National Laboratories is the OCRWM Lead Laboratory for Repository Systems

- **Provide Office of Civilian Radioactive Waste Management with strong centralized leadership for its science program**
- **Provide management and integration for all Yucca Mountain scientific programs – includes budget allocation**
- **Increase technical credibility with the scientific community, as well as the project's regulators and stakeholders**
- **Support Office of Civilian Radioactive Waste Management's license application and its defense in the Nuclear Regulatory Commission's review process**
 - **Ensure that the technical and scientific basis for the Yucca Mountain repository is “without question”**
 - **Define scientific program to support License Application**
 - **Develop and defend Total System Performance Assessment and underlying technical bases**



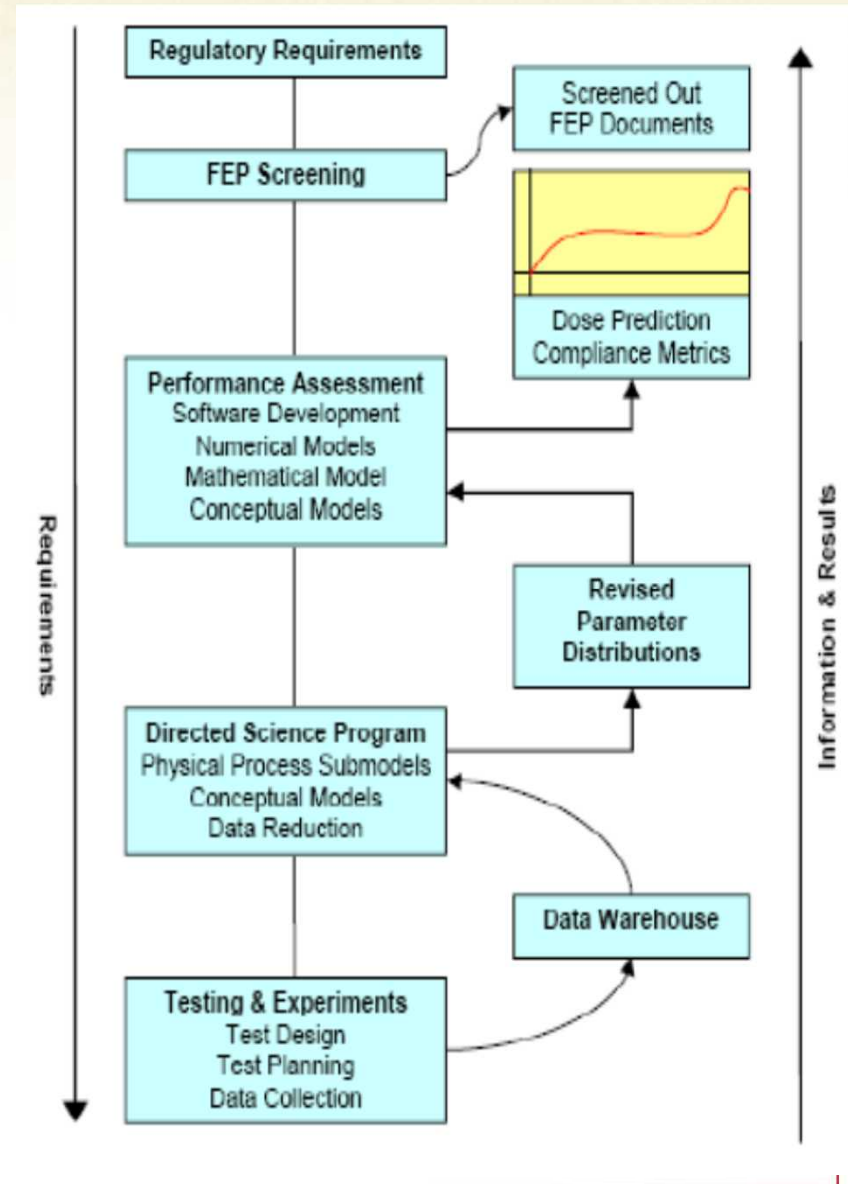
The Natural and Engineered Barrier System



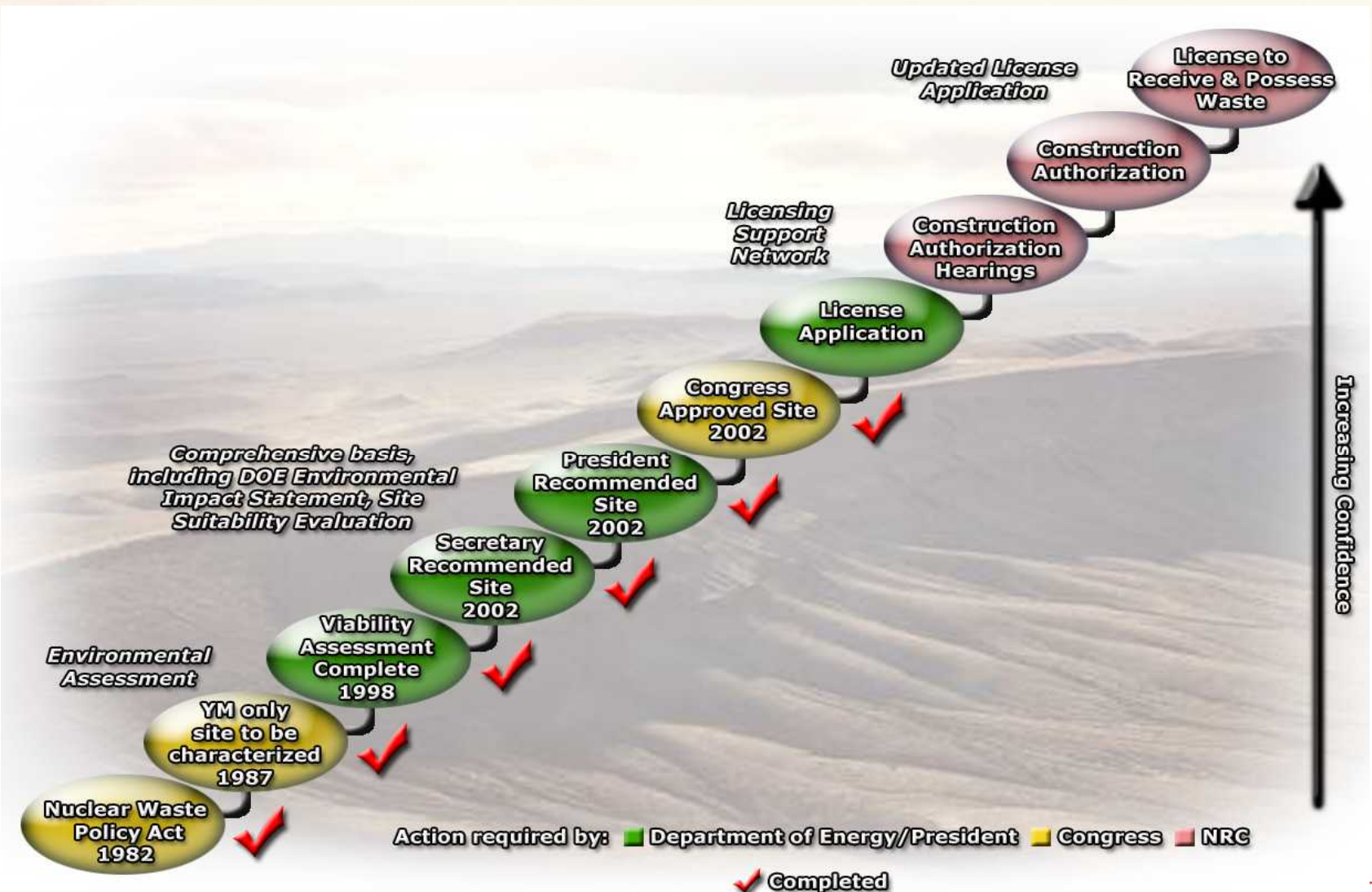
Lead Lab Mission Scope (PA Methodology)

SNL is responsible for the preparation and defense of all postclosure-related science

- Field and lab testing, data generation and data management
- Model and software development and configuration management
- Analyses and model reports (~120 reports, 10K+ pages)
- Performance Assessment (TSPA) compliance calculations
- LA Safety Analysis Report sections
- License defense
- Performance Confirmation
- Management and integration of all participants
 - Training, planning, resource and workforce management, business operations, QA



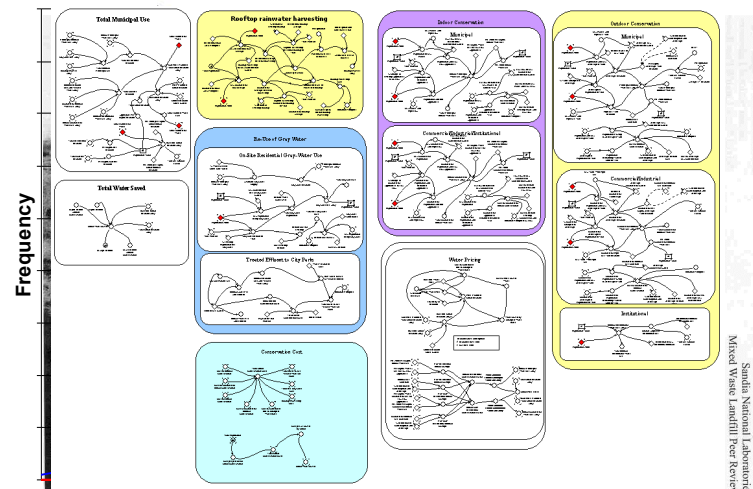
Repository Program Steps



Yucca Mountain Milestones

- **Draft Supplemental EIS (October 2007)**
 - **(October 12, 2007)**
- **License Application Design complete (November 2007)**
 - **(November 30, 2007)**
- **Licensing Support Network Certification (December 2007)**
 - **(October 19, 2007)**
- **Complete draft License Application (LA) (February 2008)**
 - **(expected April 16, 2008)**
- **Final Supplemental EIS (May 2008)**
- **Submit LA to NRC (June 2008)**
- **Begin Nevada rail construction (October 2009)**
- **NRC authorizes construction (September 2011)**
- **Repository construction continues in stages (September 2011 to early 2022)**
- **Submit updated LA to receive and possess waste (March 2013)**
- **Begin operations (Spring 2017)**





reducing model predictive error, *Vvater Resour. Res.* 41, W05020, doi:10.1029/2004WR003501