

Overview of Nuclear Energy Capabilities

Visiting Civil Nuclear Energy Facilities in China
October 8-20, 2010

NUCLEAR ENERGY & GLOBAL SECURITY



T E C H N O L O G I E S

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Today's talk

- General overview
- Capabilities
- International nuclear energy projects (selected)

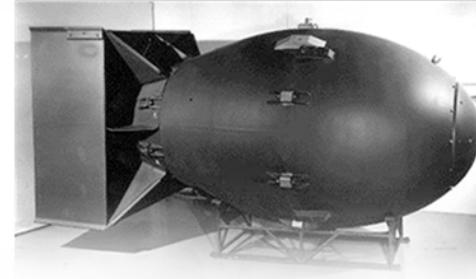
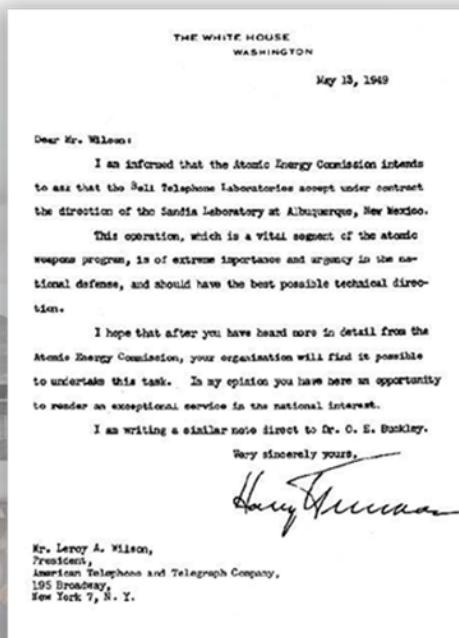


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Sandia's History

“Exceptional service in the national interest”

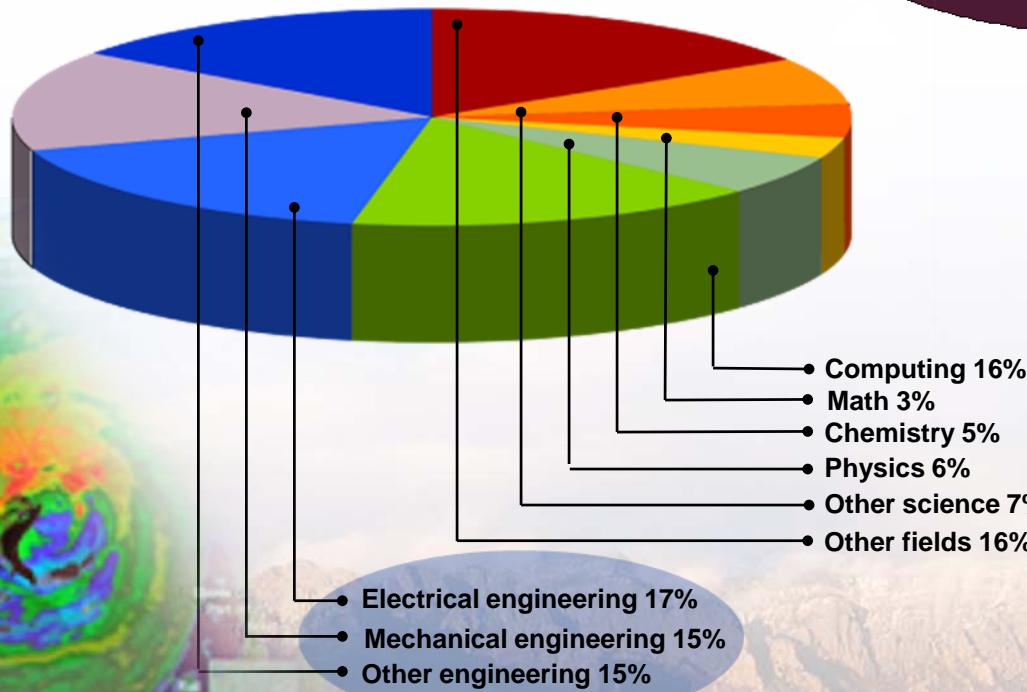


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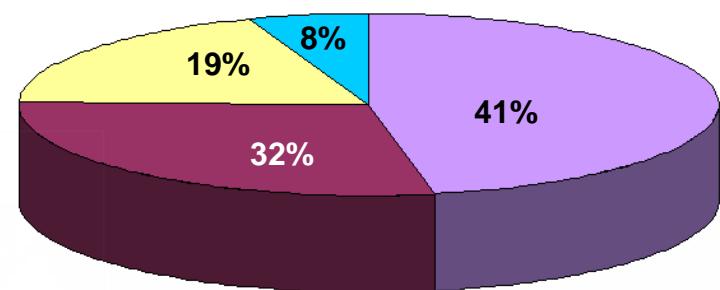
People and Budget

- On-site workforce: 11,415
- Regular employees: 8,225
- Gross payroll: ~\$900 million

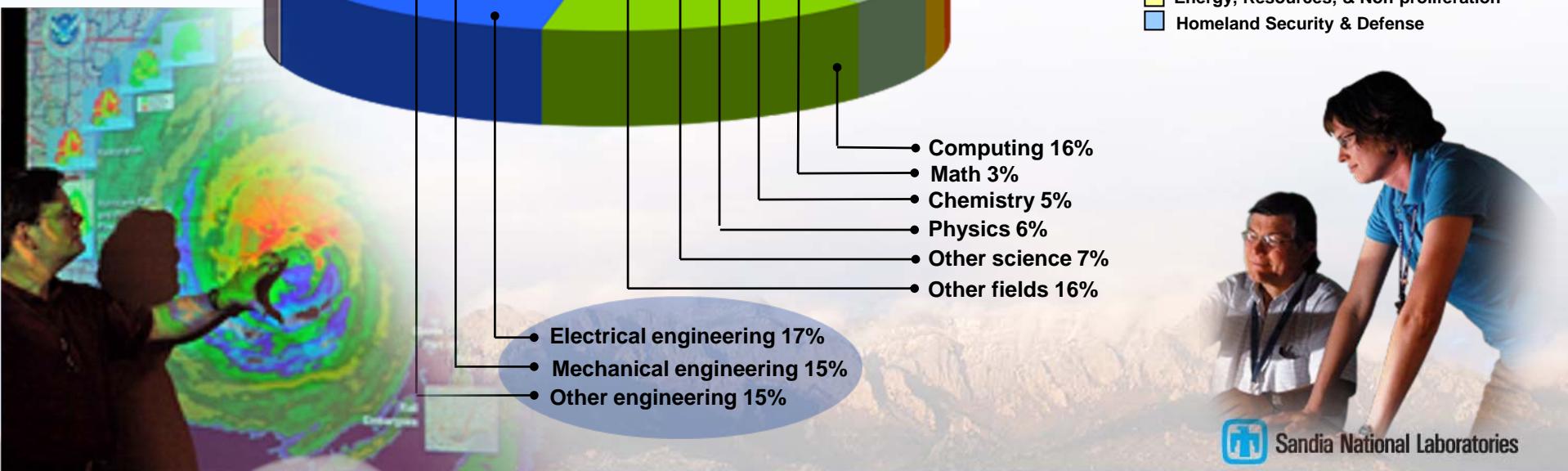
Technical staff (3,850) by discipline:



FY09 operating revenue
\$2.2 billion

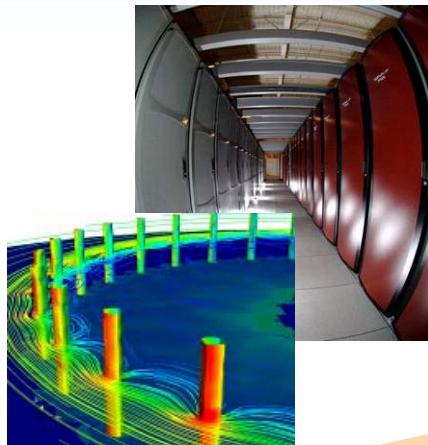


- Nuclear Weapons
- Defense Systems & Assessments
- Energy, Resources, & Non-proliferation
- Homeland Security & Defense

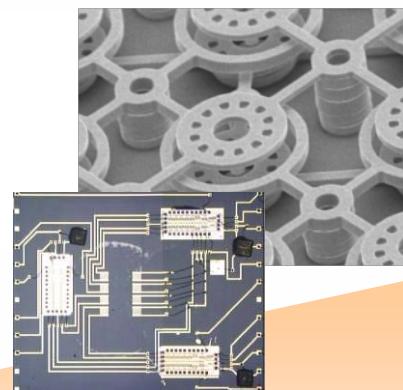


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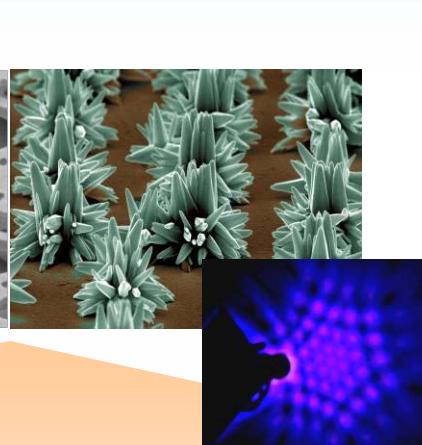
Research Disciplines Drive Capabilities



High Performance Computing

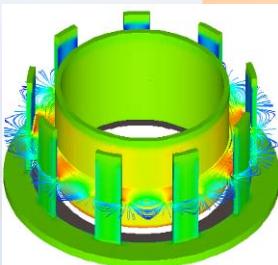


Nanotechnologies & Microsystems

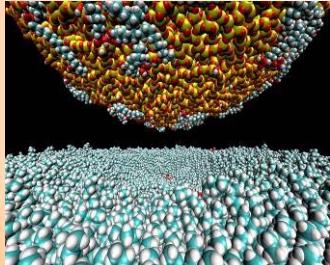


Extreme Environments

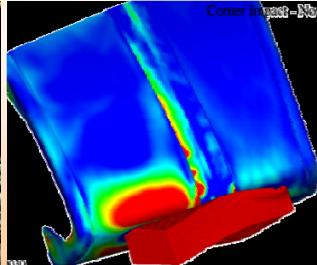
Computer Science



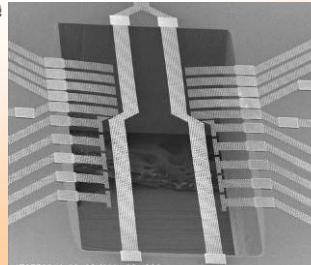
Materials



Engineering Sciences



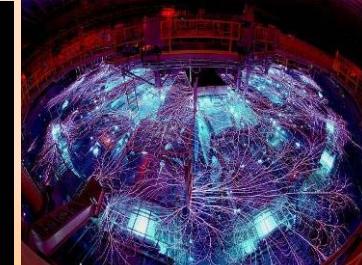
Micro Electronics



Bioscience



Pulsed Power

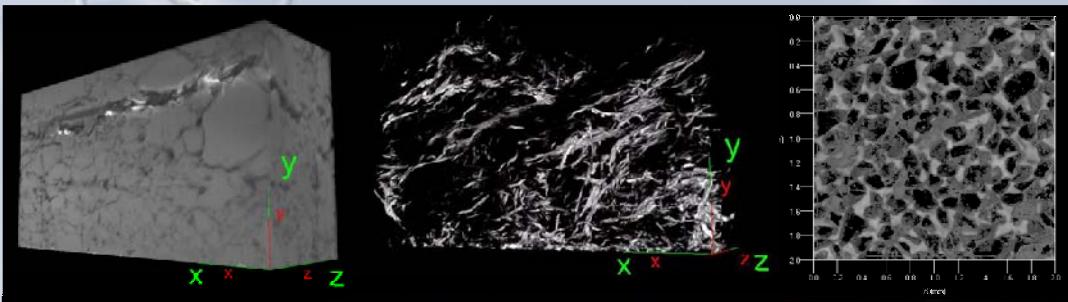


Research Disciplines



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Geoscience Research & Applications

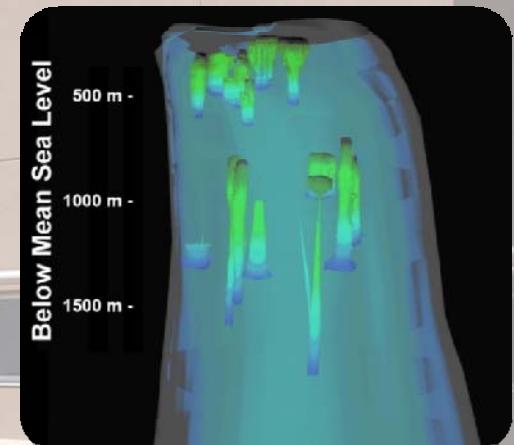


*Selma Chalk, MS
(x dim=25 microns)*

*Kirtland Shale, NM
(x dim=25 microns)*

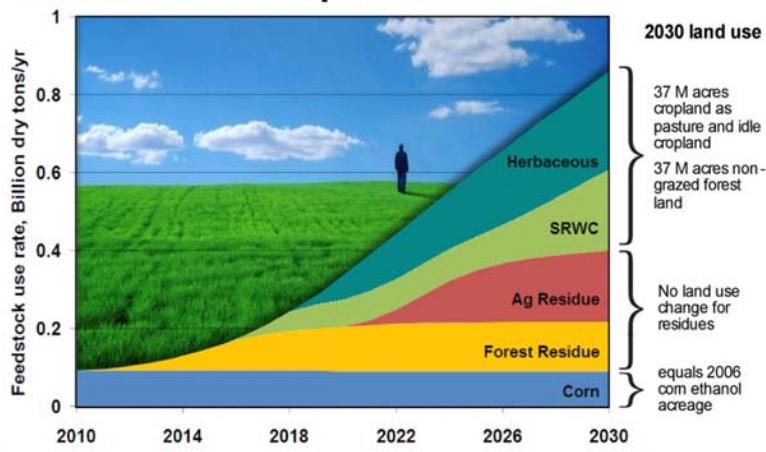
*Castlegate Sandstone, CO
(x dim = 2mm)*

Caprock sealing analysis for CO₂ sequestration

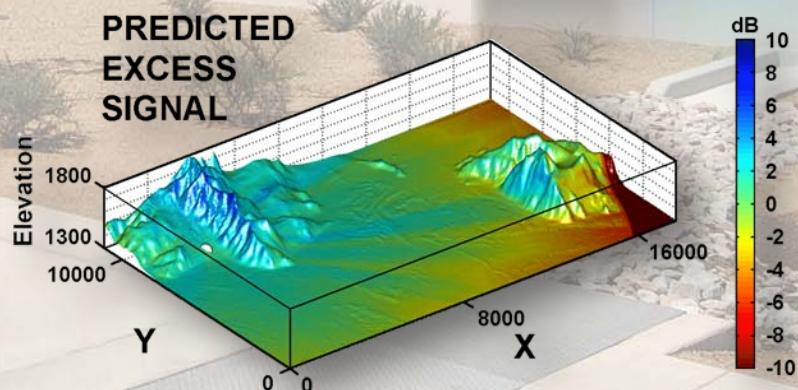


SPR 3D
Representation of
caverns in Bayou
Choctaw Salt
Dome

**Biomass for 90 billion gallons of ethanol
can be produced largely without reducing
current active cropland**



GM 90-Billion Gallon Biofuel Deployment Study, results of
systems dynamics modeling of biofuel feedstocks.

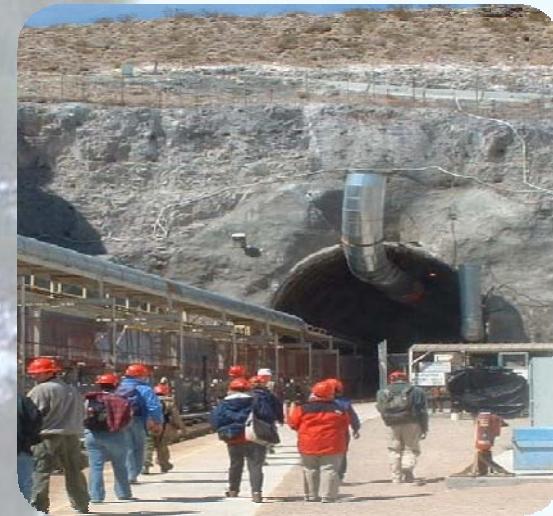


High-Fidelity Seismic and Acoustic Monitoring for
Underground Facility Emissions.



Repository Programs: WIPP and YMP

Yucca Mountain
Tunnel



■ North Portal of Yucca Mountain



Sandia mobile hydrologic well testing equipment



Training
Korean
engineers in
repository
science and
operations.



Cooperative International Programs

Chemical industry security
in Asia



IAEA Safeguards
Data Security



Warhead & Fissile Material Transparency Joint Exercise with the UK



Risk assessment of the Al-Kindi Company for the Production of
Veterinary Vaccines (Bagdad, Iraq).

Explosive
Portal, King
Hussien Border
between Isreal
and Jordan





International Security Systems



Training and Workshops

Physical
Security
Solutions for
High Value
Assets



Second Line of Defense Rail
Monitoring for Radiation



Technology
Integration
and
Development

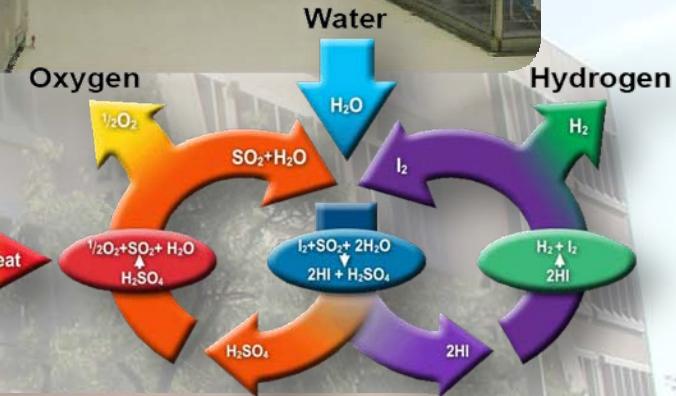


Advanced Nuclear Energy Program

GEN IV
Advanced
Energy
Conversion
Supercritical
CO₂ Brayton
Cycle
Technology for
Advanced
Reactors



Advanced Fuel
Cycle Initiative
Research to
Close the
Nuclear Fuel
Cycle



Space Nuclear
Power RTG
Launch Safety
Mars Science Lab
Rover

Nuclear
Hydrogen
Initiative
Sulfur Iodine
Thermo-
chemical
Water-Splitting
Cycle

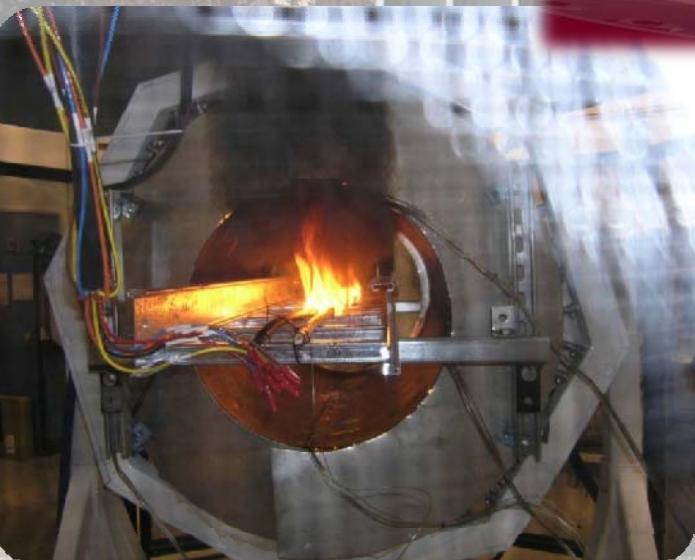


Nuclear Energy Safety Technologies

Plutonium
Air
Transport
package

US NRC Office of New
Reactors License
Review Support

Environmental Restoration, Mixed Landfill Cover



Fire Program, experiment on direct current (DC) control circuits respond to fire-induced cable failure



Nuclear Energy Safety Technologies

■ Computational simulation and technical analyses

- Nuclear reactor accident progression
- Public health consequences
- Containment performance
- Reactor fuel pin modeling
- Sodium combustion
- Airplane crash into nuclear power plant
- Emergency preparedness and response
- WIPP Performance Assessment
- YMP Total System Performance Assessment
- Physical Security
- Cyber Security





Nuclear Energy Safety Technologies

■ Experiments, data, and code validation

- Equipment qualification
- Spent fuel pool testing
- Severe transportation environments
- Reactor containment
- In-situ fuel pin clad strain
- Cable fire tests
- WIPP
- Yucca Mountain Project
- Physical Security
- Cyber Security





Nuclear Energy Safety Technologies

■ Methodology and technology development

- Dynamic PRA
- HRA
- Reactor consequence modeling/SOARCA
- Uncertainty quantification and risk margins
- Sodium combustion models
- Fast reactor models
- Energy conversion
- Nuclear hydrogen
- Waste form research
- Physical security
- Cyber security





Nuclear Energy Safety Technologies

■ Regulatory infrastructure

- License reviews for new nuclear power plants
- Regulatory gap analyses
- Standards & regulations development
- Environmental management
- Training
- Quality assurance





Nuclear Safety Projects Funded by foreign entities

- **Korea Power Engineering Co**
 - Nuclear waste training
- **Korean Atomic Energy Research Institute**
 - Hydrology training
- **Atomic Weapons Establishment, UK**
 - Spent fuel air transport package
- **Equipos Nucleares SA (ENSA), Spain**
 - Dual purpose spent fuel metal cask
- **Health & Safety Executive, UK**
 - Generic design assessment
- **Autoridad Regulatoria Nuclear, Argentina**
 - Review of probabilistic safety assessment for Atucha II
- **Federal Authority for Nuclear Regulation (in proposal phase)**
 - Technical support related to upcoming licensing effort for new reactors, APR-1400

