

# Overview of Nuclear Energy Capabilities

Visiting Civil Nuclear Energy Facilities in China  
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NUCLEAR ENERGY & GLOBAL SECURITY



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

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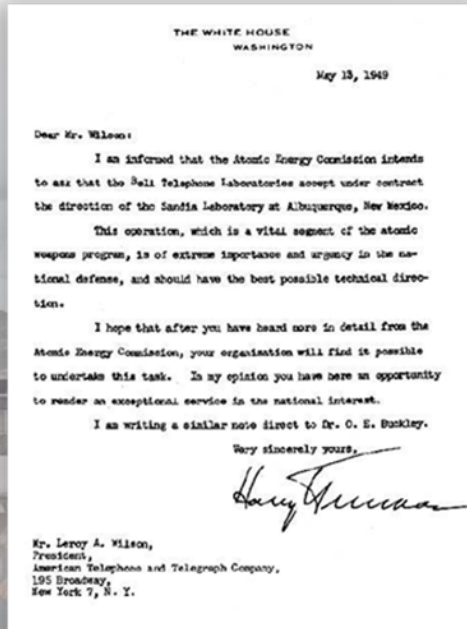
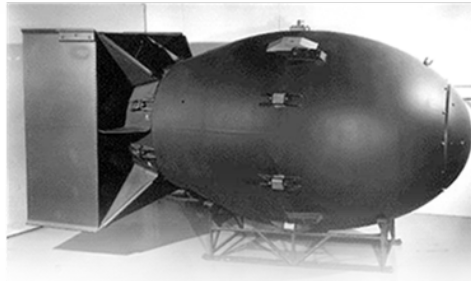
# Today's talk

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

# Sandia's History

***"Exceptional service in the national interest"***

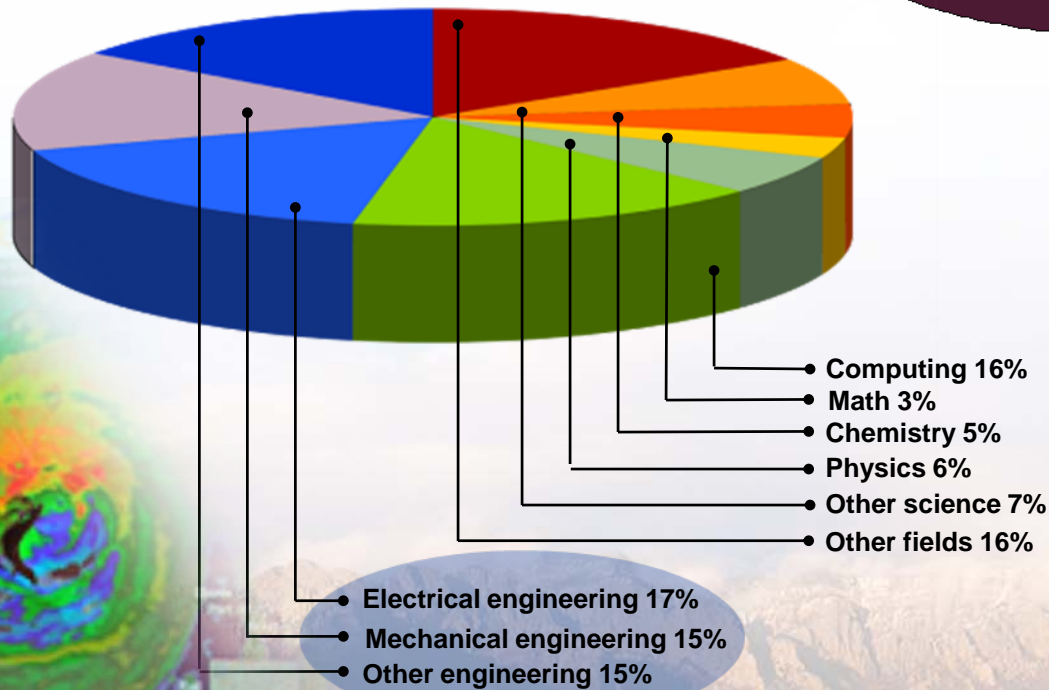




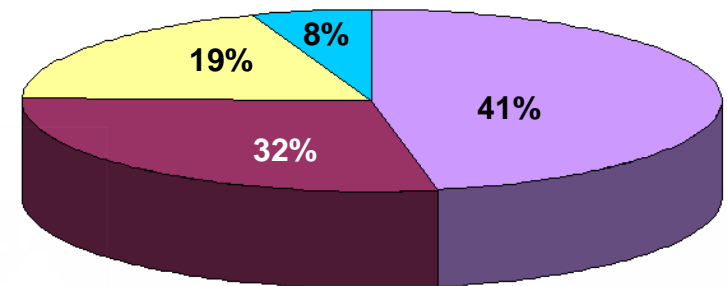
# People and Budget

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

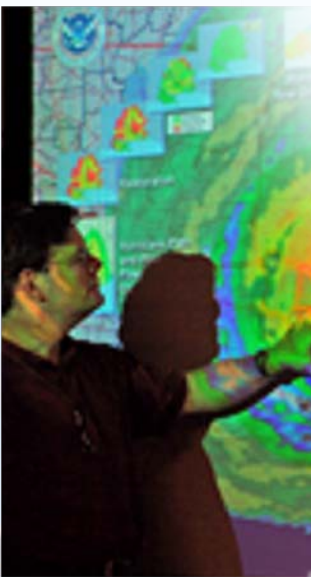
## Technical staff (3,850) by discipline:



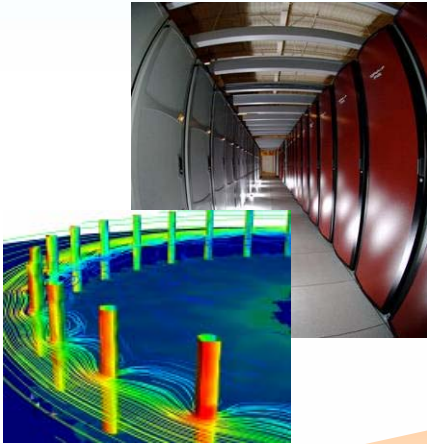
## FY09 operating revenue \$2.2 billion



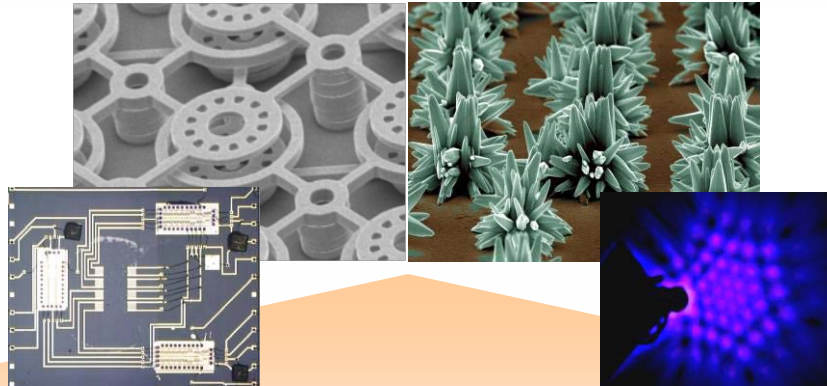
- Nuclear Weapons
- Defense Systems & Assessments
- Energy, Resources, & Non-proliferation
- Homeland Security & Defense



# Research Disciplines Drive Capabilities



**High Performance  
Computing**



**Nanotechnologies  
& Microsystems**



**Extreme  
Environments**

**Computer  
Science**

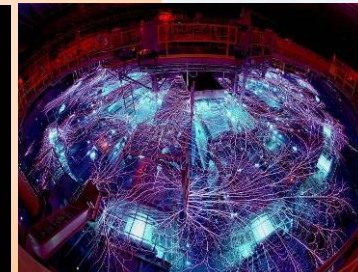
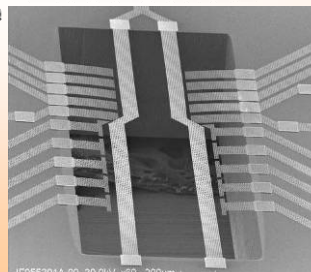
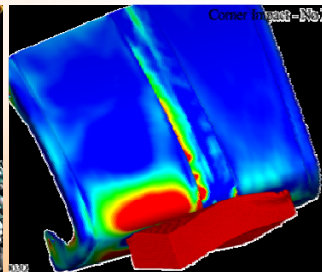
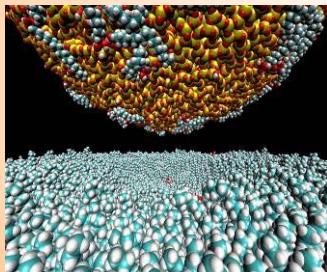
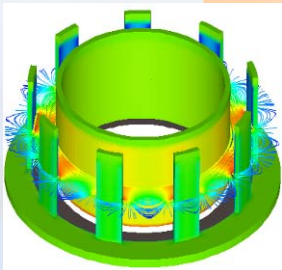
**Materials**

**Engineering  
Sciences**

**Micro  
Electronics**

**Bioscience**

**Pulsed Power**



**Research Disciplines**

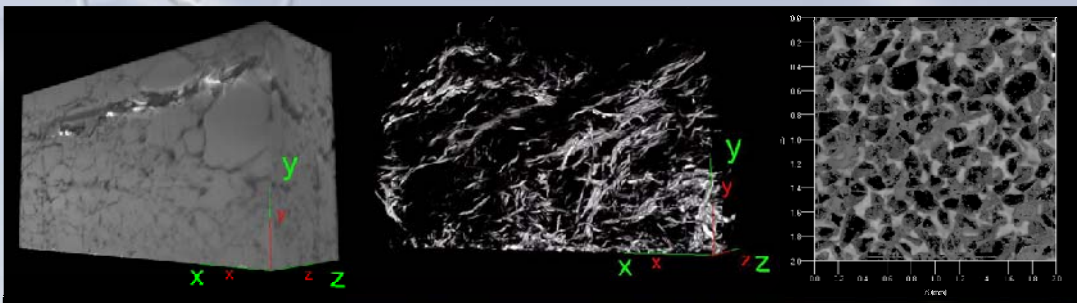


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# Geoscience Research & Applications

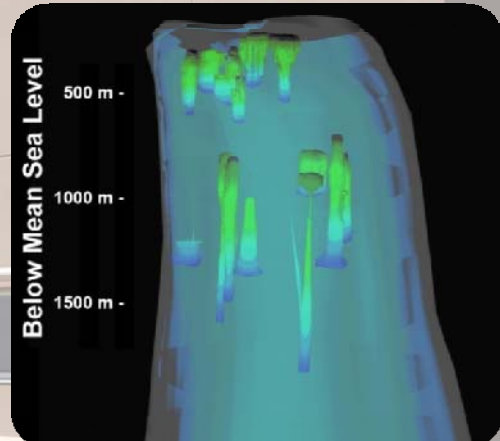


Selma Chalk, MS  
(x dim=25 microns)

Kirtland Shale, NM  
(x dim=25 microns)

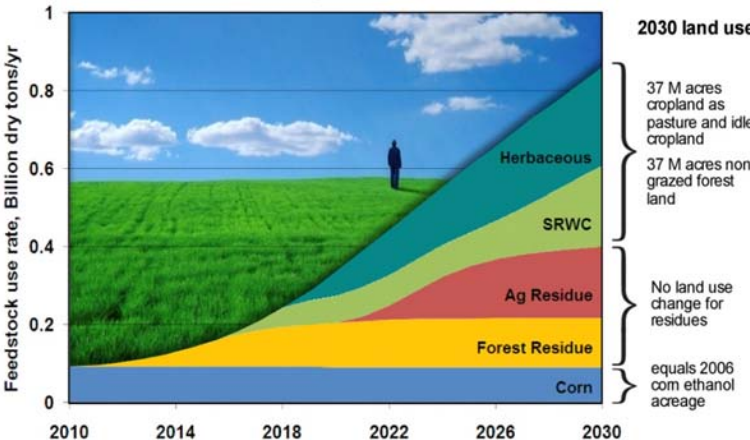
Castlegate Sandstone, CO  
(x dim = 2mm)

Caprock sealing analysis for CO<sub>2</sub> sequestration

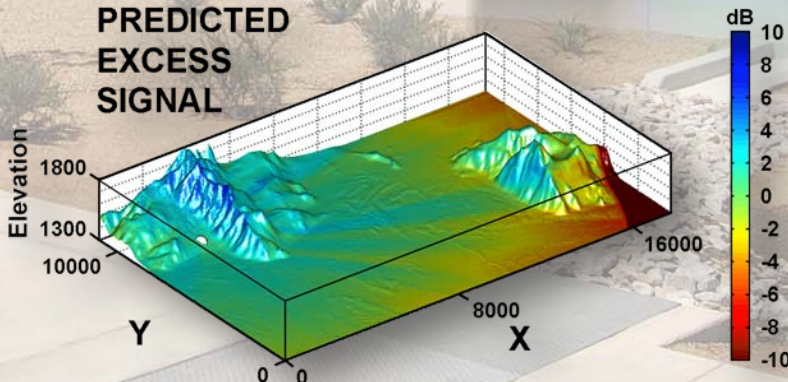


SPR 3D  
Representation of  
caverns in Bayou  
Choctaw Salt  
Dome

**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



OTF COMPOUND  
looking SE



Technology Integration and Development



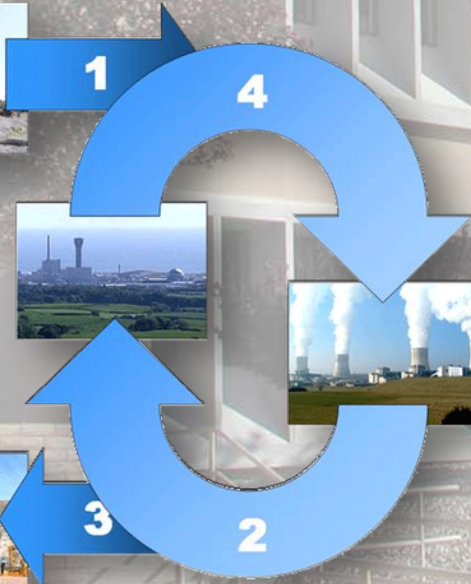
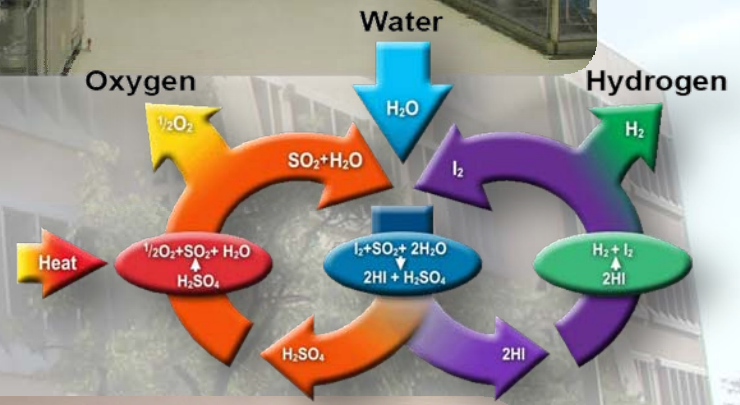


# Advanced Nuclear Energy Program

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



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



Advanced Fuel  
Cycle Initiative  
Research to  
Close the  
Nuclear Fuel  
Cycle

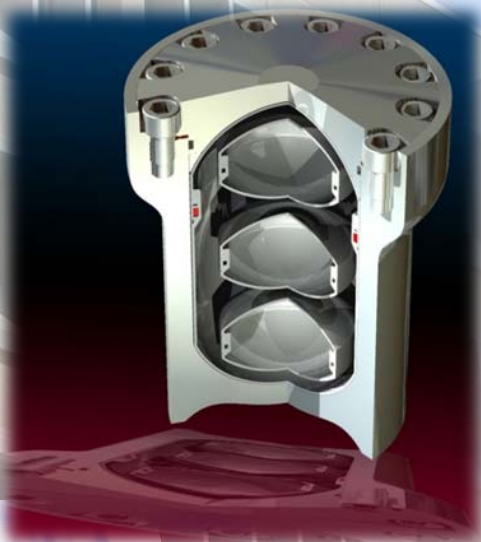


Space Nuclear  
Power RTG  
Launch Safety  
Mars Science Lab  
Rover

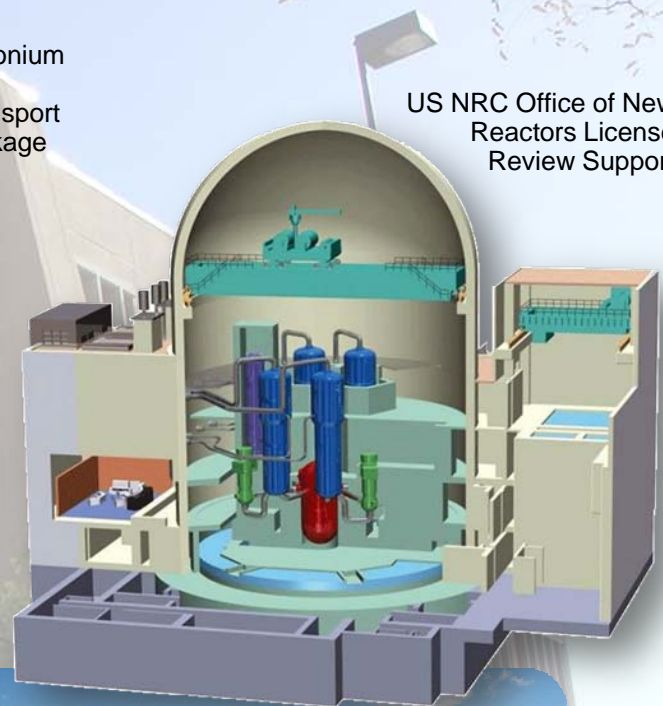




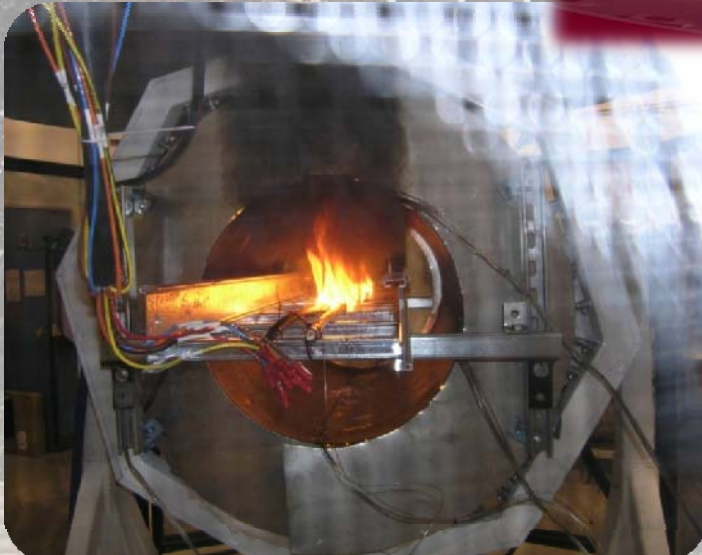
# Nuclear Energy Safety Technologies



Plutonium  
Air  
Transport  
package



US NRC Office of New  
Reactors License  
Review Support



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



Environmental Restoration, Mixed Landfill Cover



# 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

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## ■ 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

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- **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