SAND2008-7369P

Sandia's Roles in the Global Nuclear Energy Partnership

October 2008

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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.

GNEP Vision

A lot of new nuclear power. Contribute to the global energy security, climate change and pollution reduction.

Reduce the risk of nuclear weapon proliferation. **NO SEPARATED PLUTONIUM**

Solve the problem of nuclear waste. **NO ACTINIDES TO THE REPOSITORY.**

Implementation

The key technical element is closing the fuel cycle - recycling- in a way that alleviates both the proliferation risk and permits a global solution to the waste problem.

The key policy element is the development of a global fuel leasing regime.

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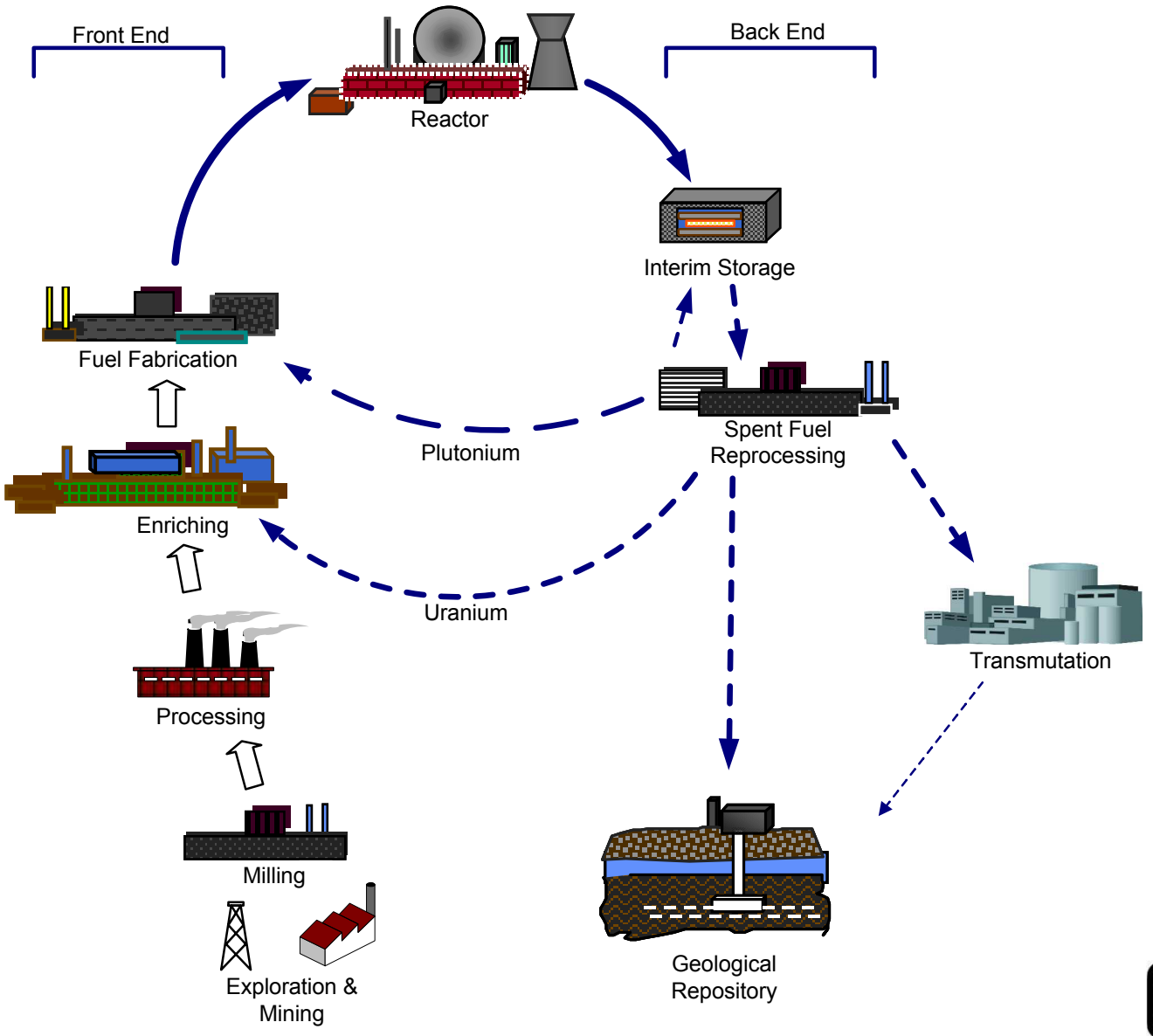
Advance Fuel Cycle Initiative
R&D to Close the Fuel Cycle



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Sandia GNEP/AFCI Program

- Regulatory
  - Safety, Licensing and Environmental Impacts
  - Safeguards & Security
  - Transportation and Integrated Waste Management
  - Systems Analysis
    - Socio-economic Impacts
    - Technology Decisions
- Fuel Cycle Technology Development
  - Engineered Nuclear Waste Storage Forms
  - Fuels Development – ACRR Testing & Modeling
  - Supercritical CO_2 Cycle for Advanced Reactors
  - Process Control and MC&A Instrumentation
  - Modeling & Simulation

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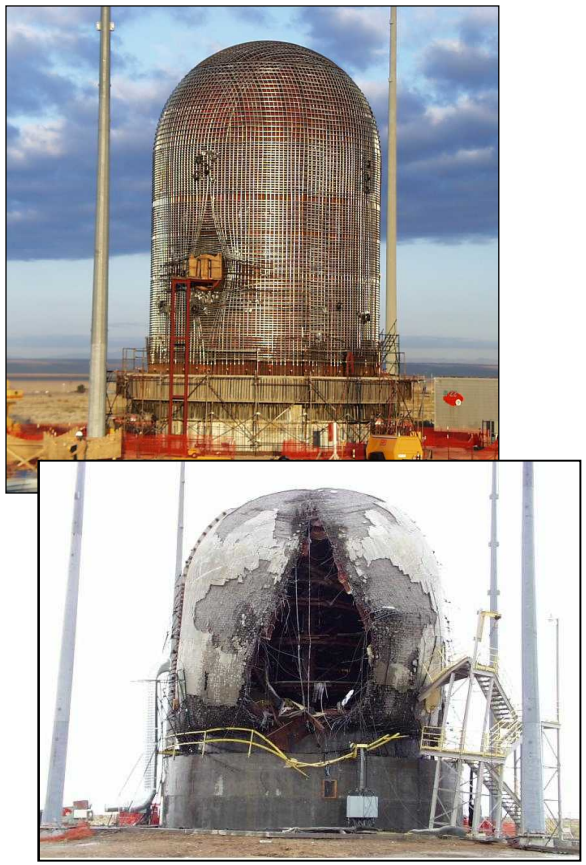
Safety & Licensing

- Sandia leads safety and regulatory area for GNEP
  - Extensive, broad-based experience with NRC & DOE
  - Full-range of capabilities
    - Experiments
    - Modeling and Simulation for Safety Analyses
    - Risk Assessment Development and Application
  - Strong Partnering with other Labs
- Key Safety Activities
  - Develop Safety & Licensing Framework for New Facilities
  - Safety Technology Development
    - Experiments & Computational Tools
  - Safety Integration and Analysis
    - Apply the tools for Safety Analysis and PRA



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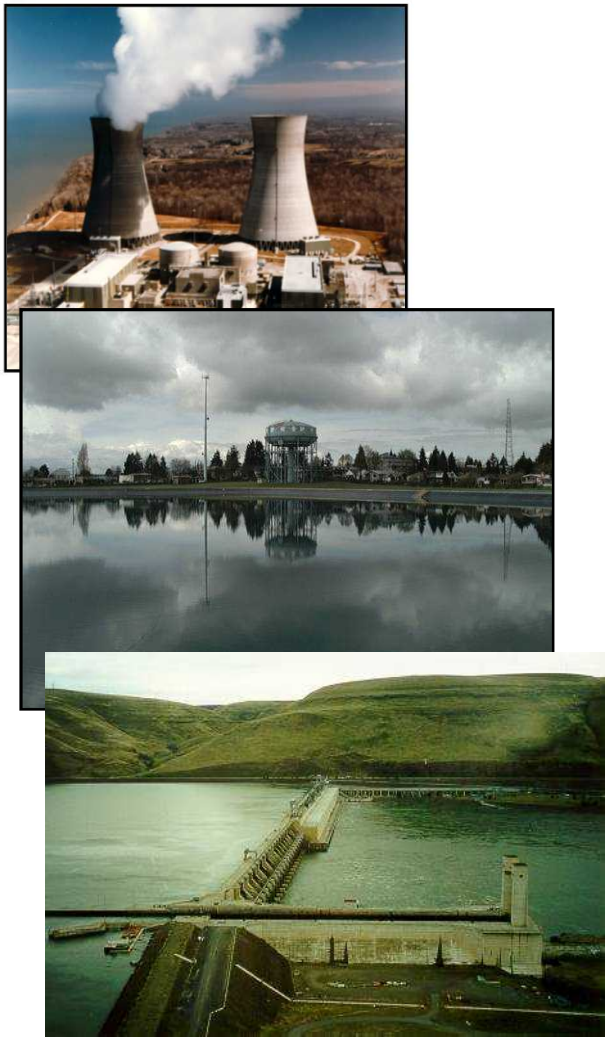
Safeguards and Security



- Licensing of recycling facilities with require emphasis on safeguards and security
- Sandia is DOE and NNSA's Lead Laboratory for Physical Security
- Major efforts in International Safeguards and Security
- These capabilities are being applied to define the regulatory framework

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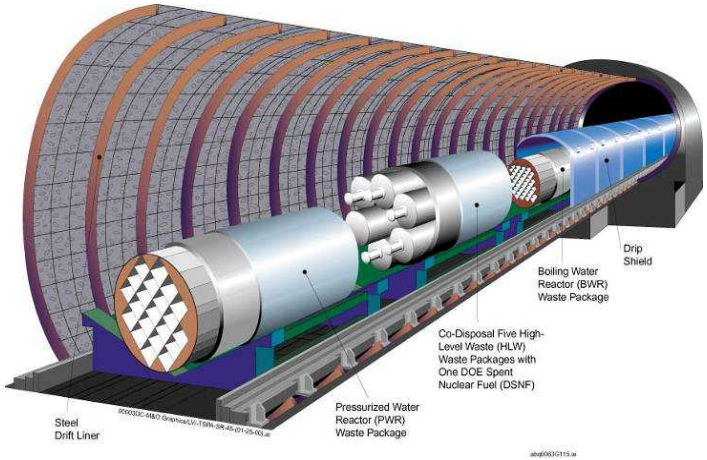
Systems Analysis

- Transportation & Integrated Waste Management
  - Leveraging YMP Lead Lab Role
- Environmental Impacts
- Socio-Economic Impacts
- Technology Decisions



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Waste Form Development

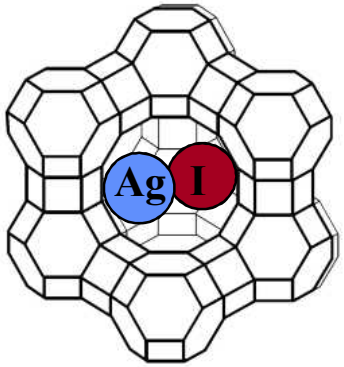
New waste streams will result from the advanced fuel cycle

New products (wastes) require robust, long-term storage options

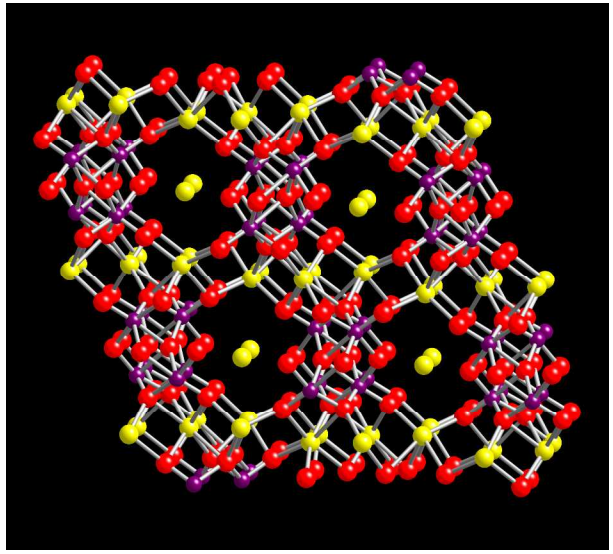
Waste form characteristics must be developed for every waste stream.

- Develop getters
- Develop stable waste forms
- Teamed with ORNL on testing

Sandia is leading the effort on Iodine sequestration



Silver-Iodine Zeolite Waste Form



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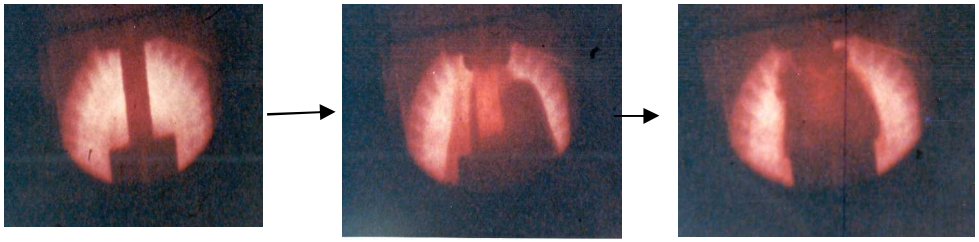
Fuels Development
Transient Testing and Modeling

Sandia conducted numerous transient tests using ACRR in support of CRBR licensing

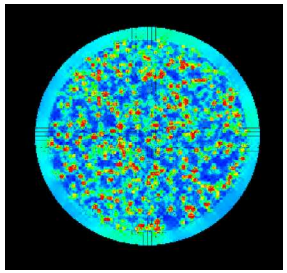
Sandia is teamed with INL to use ACRR to perform transient testing of transmutation fuels and perhaps driver fuels for ABR

Provides early data to demonstrate safety performance

ACRR has been used to simulate a wide range of transient fuel test conditions



Pin heatup, clad melt and FP release, and fuel disruption sequence in LMFBR high burnup fuel pin (FD Program - PNC, UKAEA, KFK, NRC)



Advanced Modeling of Fuel Behavior

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Supercritical CO_2 Technology for ABR

- Advanced Brayton cycle for more efficient thermal to electricity conversion on Advanced Burner Reactor
- Lower capital costs are also possible
- Sandia is leading DOE Advanced Energy Conversion effort
- Teamed with ANL on design and development for ABR system

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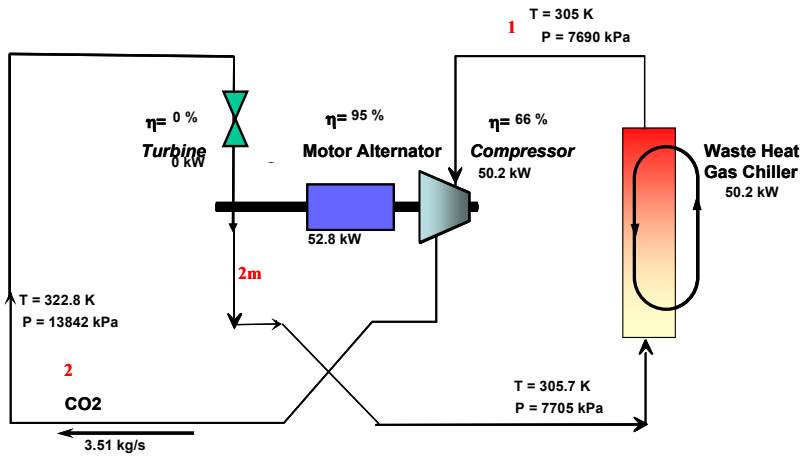
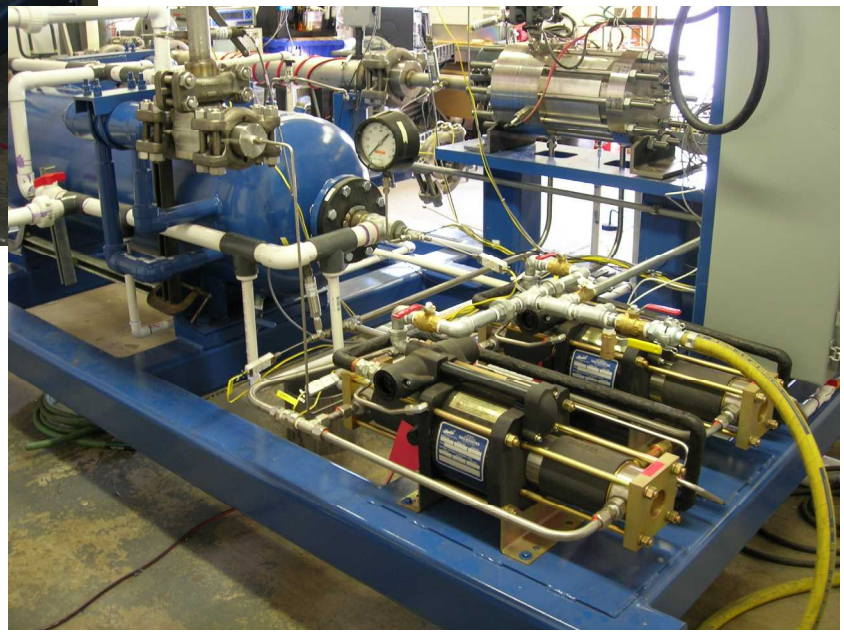
Single Compression S-CO2 Test Loop





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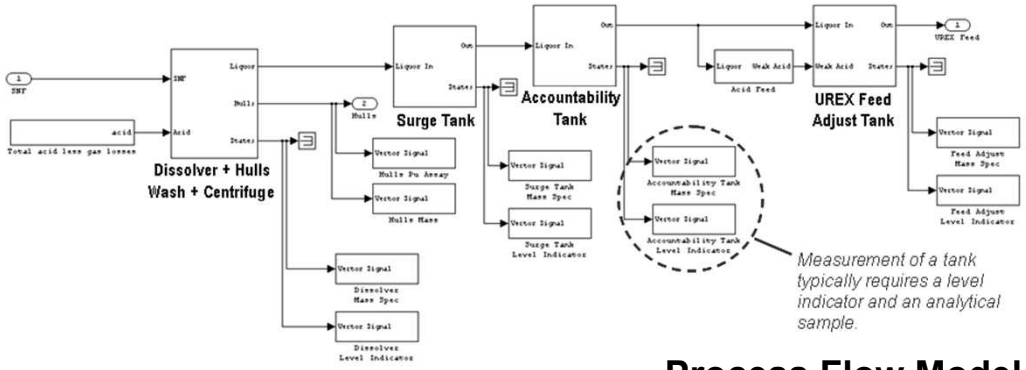
Nuclear Material Safeguards and Security
Safeguards Performance Modeling

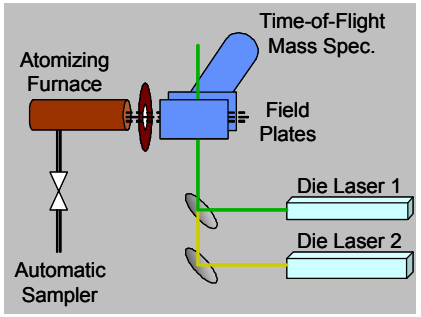
The fuel cycle must be proliferation resistant

- **Systems model tracks material flows**
- **Instrumentation for safeguards verification**



Process Flow Model

- identify potential diversion pathways



Verification Measurement Equipment

- reduce sampling turnaround time from hours to minutes

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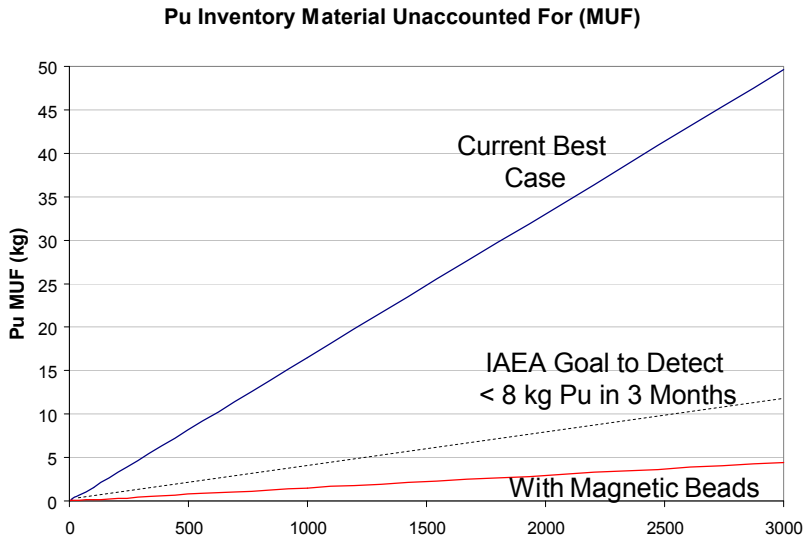
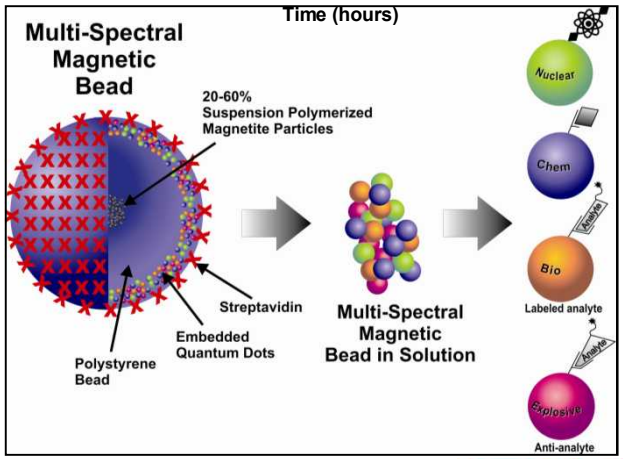
Advanced Safeguards Instrumentation

- Test and evaluate advanced instrumentation for process monitoring and MC&A for CFTC
  - Goal is to meet MUF target
- Supports Safeguards and Security Assessments
- Uses Sandia's core capabilities in microelectronics and radiation hardened components





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Modeling and Simulation

Enabling Future Nuclear Fuel Cycle Safety and Risk Assessments

Fast Reactors

We will need to demonstrate passive safety and margin to melt (unprotected LOF)
With limited testing, M&S will play a vital role
This implies high-fidelity, coupled neutronic, thermal, fluid, and structural analysis

Recycling Facilities

We need high-fidelity M&S to address licensing questions and support risk assessments
Advanced M&S to assess waste form performance

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Backup Slides

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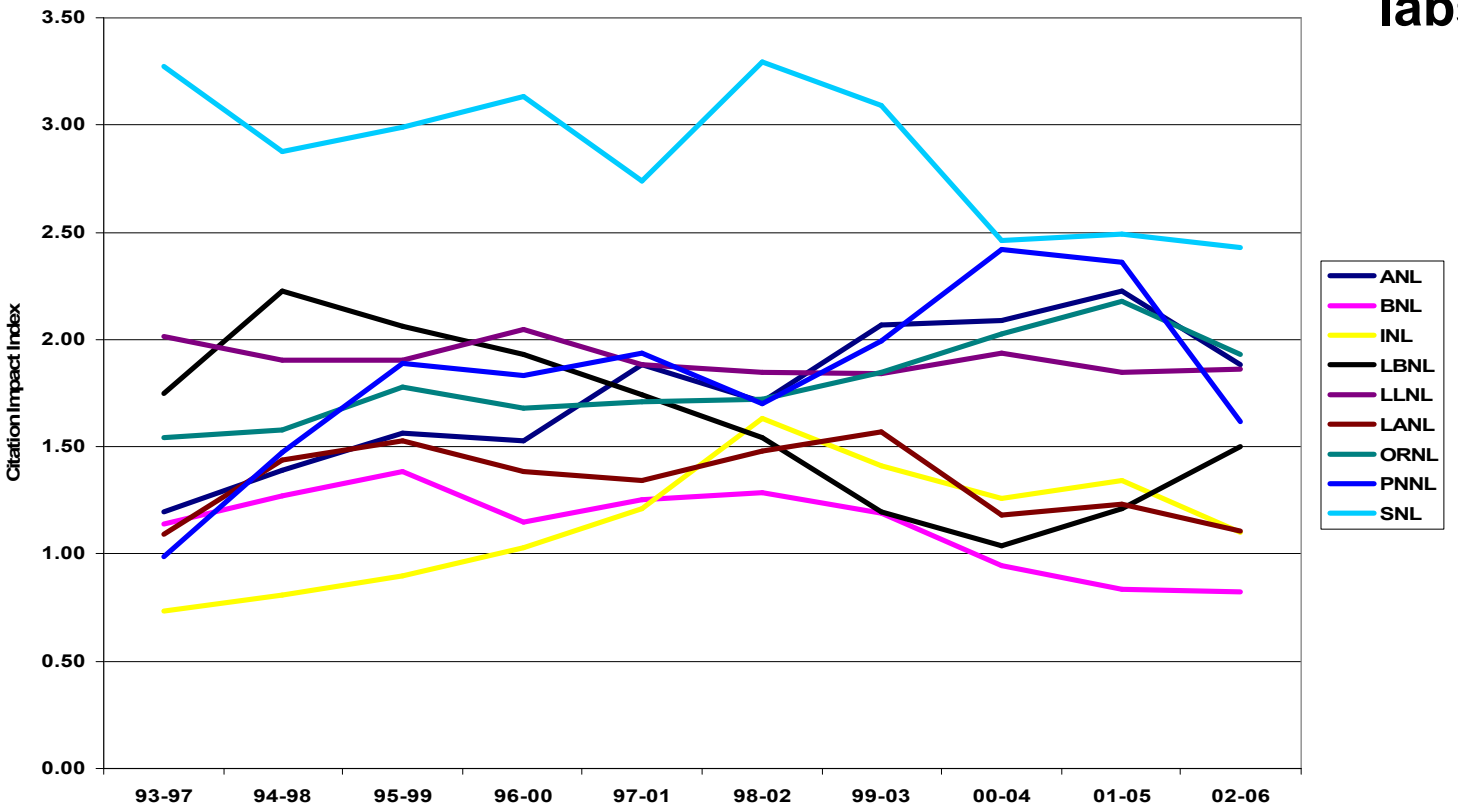
Sandia's Impact in Nuclear Engineering

Sandia has consistently led the DOE labs



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