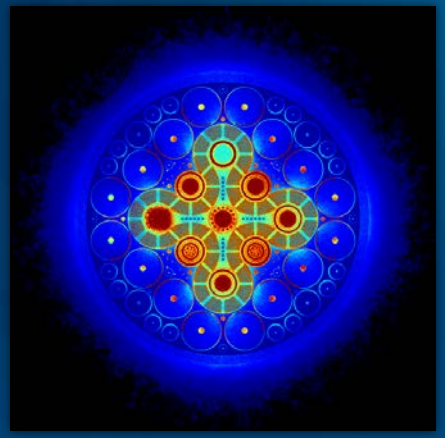
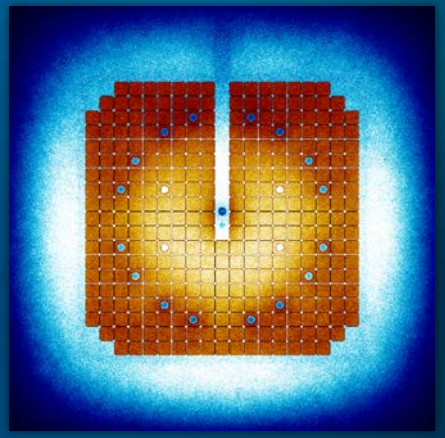
Nuclear Systems Design and Analysis (NSD&A) Division

Alexander Stanculescu, NSD&A Division Director

Tritium Focus Group Meeting

September 23, 2014



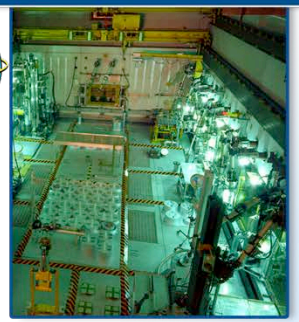


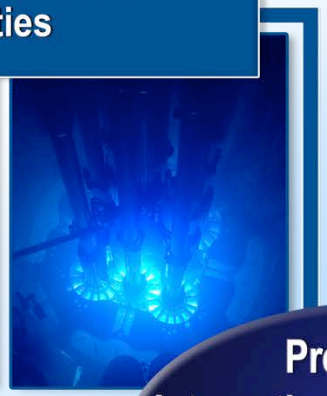
www.inl.gov

Idaho National Laboratory

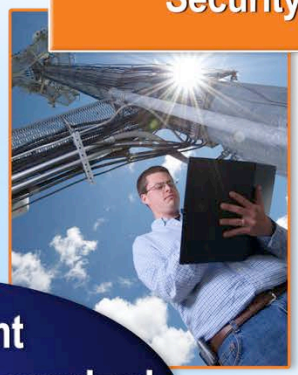
Our Identity – The National Nuclear Laboratory

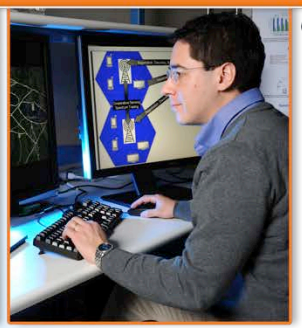
Develop world-class Nuclear Energy capabilities





Major center for National and Homeland Security technology RDD&D





Preeminent Internationally-Recognized Nuclear Energy RDD&D Laboratory

Foster education, research, industry, government and international collaborations

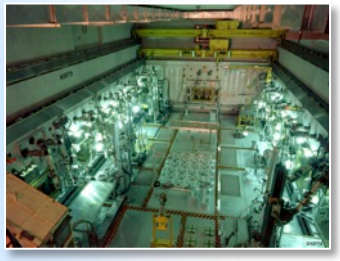
Lead clean energy systems RDD&D laboratory and a regional resource

Research – Development – Demonstration **– Deployment**

The Idaho National Laboratory Site

We Maintain –

- 890 square miles
- 111 miles of electrical transmission and distribution lines
- 579 buildings
- 177 miles of paved roads
- 14 miles of railroad lines
- 3 reactors
- 2 spent fuel pools
- Mass transit system
- Security
- Museum
- "Landfills"
- 300 metric tons of used fuel
- Educational and research partnerships – CAES



Idaho National Laboratory

3,496 Employees

FY-2013 Business Volume
$840M

CH2M•WG IDAHO, LLC

Idaho Cleanup Project

1,046 Employees
FY-2012 Business Volume
$255M

Idaho Treatment Group
AMWTP

620 Employees
FY-2012 Business Volume
$112M

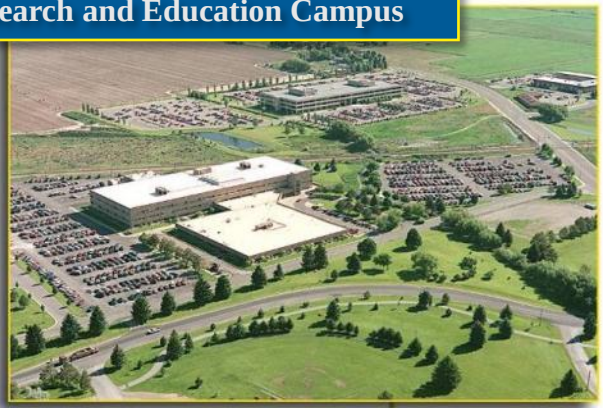
Naval Reactors Facility

1400 Employees
FY-2012 Business Volume
$230M

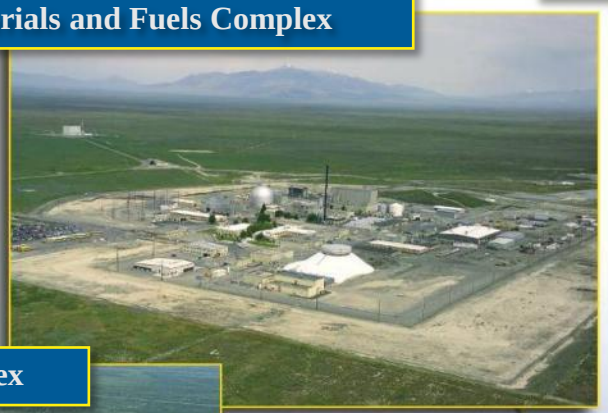
…the National Nuclear Laboratory

Most of the R&D Capabilities are Focused on Three Primary Site Areas

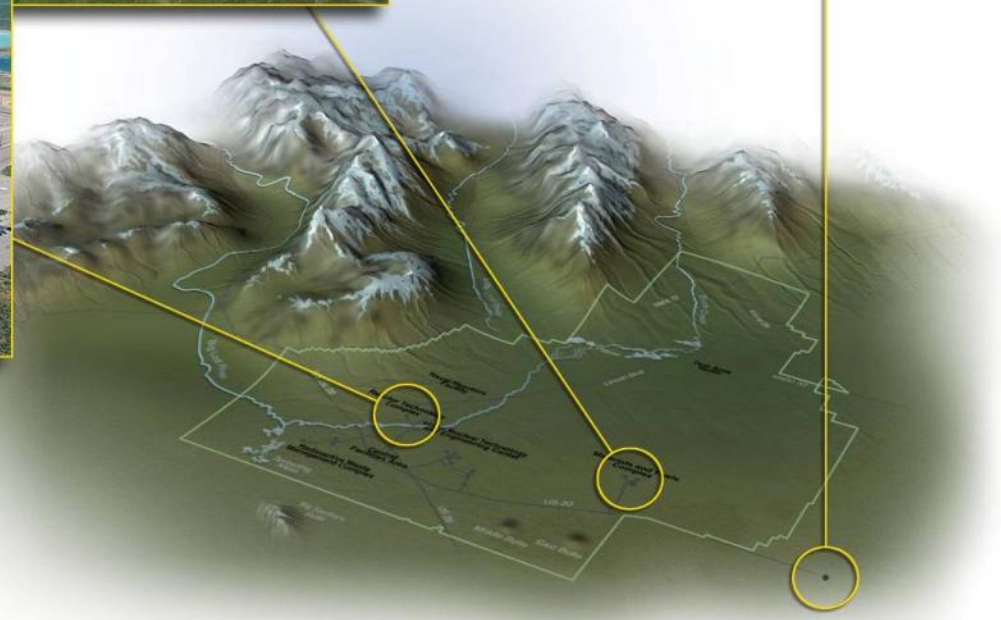
Research and Education Campus



Materials and Fuels Complex



Advanced Test Reactor Complex



INL Nuclear RDD&D Capabilities

ALWR Deployment

LWR Sustainability

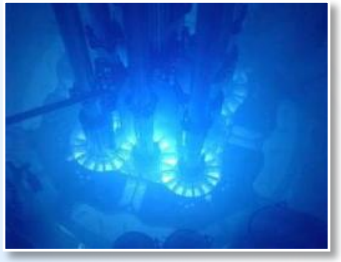
Next Generation Nuclear Plant & Small Modular Reactors

Aqueous & Pyro Fuel Recycling

Instrumentation & Control

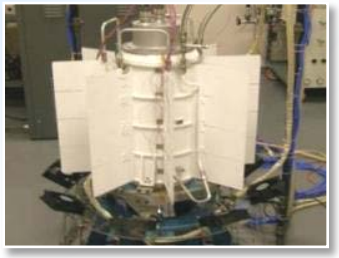
Hydrogen Production

Modeling and Simulation & Validation!



National Scientific User Facility

Advanced Fuel Development



Space Batteries

National Laboratories are **Capability Machines**

NSD&A Role

- **Nuclear Systems Design and Analysis (NSD&A) provides nuclear reactor/engineering analysis and design capability:**
  - **Basic capability for INL in it's role as "DOE's Nuclear Energy Lab"**
  - **Supporting both in-house and external needs aiming at the advancement of nuclear energy**
  - **Fostering innovation**
  - **Attracting and retaining skilled, high quality scientific and technical workforce**

NSD&A Skill Sets

- **Reactor physics**
- **Thermal hydraulics and safety analyses**
- **Experimental verification of thermal systems**
- **Fusion energy technologies and tritium safety**
- **Hydrogen production**

Output

- Analyses/designs of facilities and reactor concepts that are essential to the INL mission
  - Advanced Test Reactor (ATR)
  - Transient Reactor Test (TREAT)
  - Small Modular Reactors (SMR)/Next-Generation Nuclear Plant (NGNP)
  - Innovative reactors (GEN-IV concepts)
- Advanced Reactor System Safety Analysis
- Methodologies for reactor/engineering and safety analysis and design, including Verification and Validation (V&V) and Uncertainty Quantification (UQ)
- RELAP5-3D (70+ licenses, user group, maintenance, improvement)
- Fusion safety research

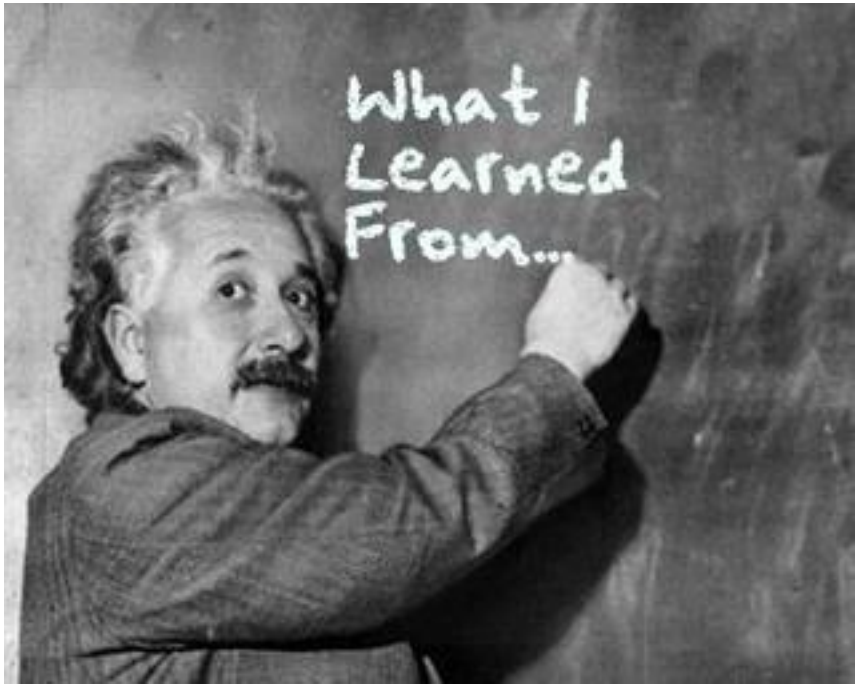
Fusion Safety Program (FSP)

- INL is the lead laboratory for Magnetic Fusion Energy Safety
- STAR (Safety and Tritium Applied Research facility) is Office of Science National User Facility

- FSP's Mission: assist the fusion community in developing the inherent safety and environmental potential of fusion power
  - Developing fusion licensing data and analysis tools
  - Participating in national and international collaborations and design studies
  - Assist US and international fusion community in licensing activities and guidance in operational safety
- FSP core competencies
  - Tritium retention and permeation in fusion plasma facing component and blanket materials
  - Dust and radiological source characterization, dust collection, and material oxidation
  - Fusion safety code development
  - Risk Assessment, codes and standards, and failure rate data collection
  - Waste management strategies

NSD&A's Take-home Message

- **Maintain and expand design, system analysis, and experimental capabilities to**
  - **Advance innovative nuclear energy technologies**
  - **Facilitate deployment and commercialization of nuclear reactors**
  - **Contribute to licensing, safety, and environmental assessment of the US magnetically confined fusion energy research program**
- **Nurture talent**
- **Deliver excellent science**



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