



U.S. DEPARTMENT OF  
**ENERGY**

**Nuclear Energy**

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**Follow-up on 2004 Nuclear Energy Research  
Advisory Committee (NERAC)  
World Class Laboratory  
Report**

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# Overview

- **Background and Context**
- **Highlights of Idaho National Laboratory (INL) Major Accomplishments**
- **DOE's Request to NEAC on Suggestions and Recommendations**



## Background and Context

- In 2003 Department of Energy (DOE) decided to consolidate ANL-West/INEEL and split NE laboratory operations from EM cleanup activities
- DOE issued an RFP in May 2004, calling for establishment of the INL
- September 2004, NERAC issued recommendations identifying the characteristics, capabilities, and attributes a world-class nuclear laboratory would possess
- In November 2004, DOE awarded INL contract to BEA team
- February 2005 INL launched via new contract
- INL contract and progress by BEA was constructively informed by NERAC's 2004 report
- 5 Year contract option was exercised in March 2014 - current contract through September 2019



# Highlights of Major Accomplishments

World-class nuclear technology research laboratory:

- INL demonstrated the viability of using uranium oxycarbide (UCO) tristructural isotropic (TRISO)-coated particle fuel in advanced gas reactors
  - Demonstrated ability to isolate one TRISO damaged SiC fuel particle from an irradiated test train
  - Identified the location of silver fission products inside irradiated TRISO fuel particles
  - TRISO fuel was irradiated in the ATR for full power equivalent of 620 days and reached a peak burnup of 19.5%, more than 4 times the rate for commercial LWR fuel and prior TRISO fuel trials
- The Multiphysics Object-Oriented Simulation Environment (MOOSE) framework and its associated compute codes BISON, MARMOT and RattleSNake, along with RELAP-7 and MAMBA-BDM were used to produce a multiphysics calculation incorporating neutronics, fuel performance, thermal fluid dynamics and CRUD formation
  - MOOSE received kudos from High Performance Computing Magazine
- INL established three new user facilities
  - Biomass Feedstock National User Facility sponsored by DOE-EERE
  - Wireless National User Facility established for multiple sponsors in government and industry
  - The Advanced Test Reactor National Scientific User Facility (ATR-NSUF)



# Highlights of Major Accomplishments Continued

- The Research and Education Campus was revitalized with Energy Systems Laboratory (ESL) and the Energy Innovations Laboratory (EIL), completing a transformation that started with the Center for Advanced Energy Studies (CAES) building and university buildings
  - The EIL received multiple awards in design and construction, including LEED platinum status
- INL worked with TerraPower to design a nuclear - synfuels process and economic integration: current CRADA for analyzing use of nuclear - hybrid energy
- INL collaborated with NuScale Power on studies that demonstrated the technical feasibility of using light water reactors to recover heat for use in other industrial processes
- INL performs the Industrial Control Systems Cyber Emergency Response Team (ICS-CERT) for DHS, to share control systems-related security incidents and mitigation measures
- INL developed the critical infrastructure test range, a large scale facility for electrical grid research and geomagnetic disturbance effects
- The U.S. Army designated INL as the Abrams armor center of excellence
- INL staff selected to chair the OECD-NEA expert groups on accident tolerant fuels and on validation and data centers



# Highlights of Major Accomplishments Continued

- INL's leadership in cybersecurity was recognized by the International Atomic Energy Agency (IAEA) , which designated INL as a provider for physical security and nuclear-cybersecurity
- INL is a team member in the Critical Materials Institute (CMI), DOE energy innovation hub which is focused on assuring the supply of materials critical to clean energy technologies
  - CMI is composed of multiple national lab, university and industrial partners
  - INL leads the "Improving Reuse and Recycling" focus area and co-leads the "Diversifying Supply" and "Cross-cutting Research" Teams
- INL was designated by DOE-EERE as their center for competence in battery performance testing, electric vehicle data analysis/performance assessment, and wireless charging system performance testing
- INL lead the first Integrated Nuclear-Renewable Energy Systems Workshop focused on the development of a roadmap for Nuclear - Hybrid Energy
- INL has won 17 R&D 100 Awards since the Inception of the Contract



# **Idaho National Laboratory's (INL) Researcher Focus – the Future of Nuclear Energy R&D Lives in Idaho**

- INL has attracted and retained some of the best and brightest researchers and technical leaders
- INL collaborates with universities and industry to leverage capabilities and solve critical problems
- CAES collaboration with Idaho universities has grown the number of students in nuclear related disciplines from 23 in 2005 to over 300 today; and
- Idaho universities have won 26 NEUP awards since 2009



INL leads Idaho STEM (iSTEM) , an internationally regarded program for grades K-12 in Science, Technology, Engineering and Math



## Nuclear Energy



2009  
Technical  
Support  
Building



2009  
Radiation  
Measurements  
Laboratory



2009  
Test Train  
Assembly  
Facility



2010  
Radio  
Analytical  
Chemistry  
Laboratory

Planned in 2016  
Operations Support  
Building

**ATR** - Four new facilities/upgrades; 33,419 sq ft new lab and office space, \$15 M capital investment



2009  
Vehicle Test  
Station

**MFC** - Five new facilities/upgrades; 38,459 sq ft new lab and office space - \$29 M capital investment



2009  
Radiochemistry  
Laboratory

**REC** - Seven new leased facilities; 454,000 sq ft new lab and office space, \$163 M capital investment (commercial developers)



2011  
Modular  
Office  
Building

Materials and  
Fuels Complex

Advanced Test  
Reactor Complex

Research and  
Education Campus

**Total Capital  
Investments of \$207 M**



2012  
Irradiated  
Materials  
Characterization  
Laboratory



2012  
MFC Dial  
Room



2008 - Center for  
Advanced Energy  
Studies



2008 – National &  
Homeland Security  
Laboratory



2008 – Supply  
Chain Management  
Offices



2008 – National &  
Homeland Security  
Laboratory



2010 – National &  
Homeland Security  
Laboratory



2012 – Energy  
Systems  
Laboratory



2013 – Energy  
Innovation Laboratory



## **DOE's Request to NEAC on Suggestions and Recommendations**

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DOE requests the NEAC prepare a report, that reflects on the 2004 NERAC report, to recommend future opportunities enhancing the INL's stature as a world class laboratory



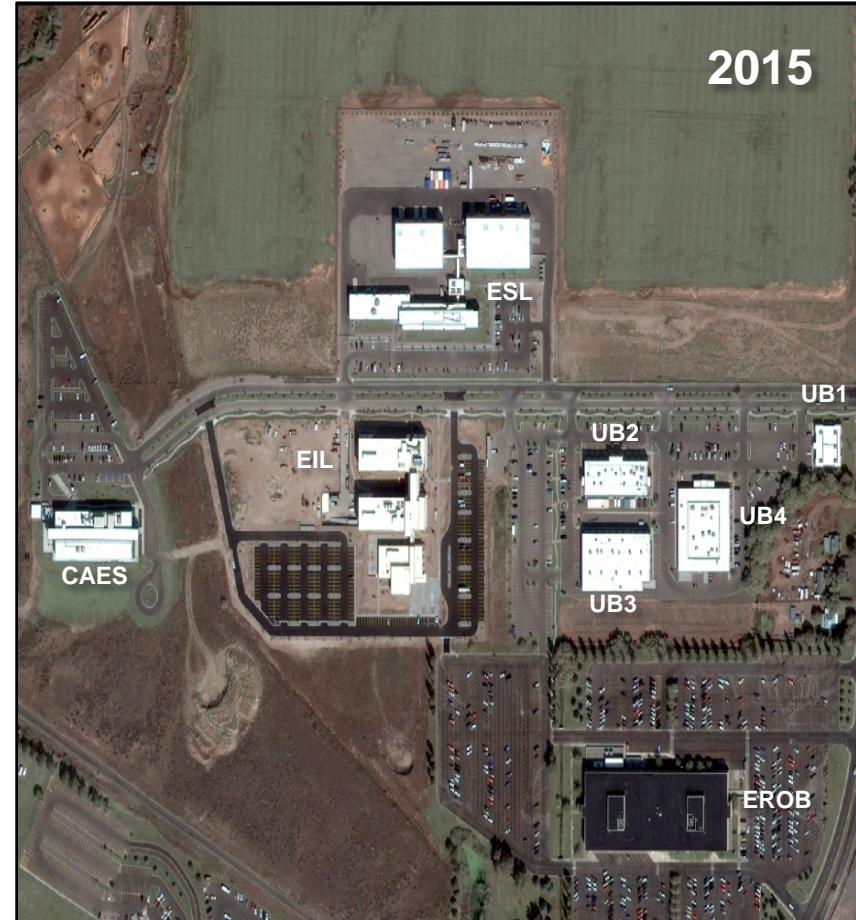
## Backup slides



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# *INL Research and Education Campus – Before & After*





# DOE Request in RFP

## DOE request in RFP

"The DOE's vision is for the INL to enhance the Nation's energy security by becoming the preeminent, internationally-recognized nuclear energy research, development, and demonstration laboratory within ten years. The INL will also establish itself as a major center for national security technology development and demonstration. This requires that the INL be a multi-program national laboratory with world-class nuclear capabilities. The INL will foster new government, industry, academic and international collaborations to produce the investment, programs and expertise that assure this vision is realized"

1. Establish the INL as the preeminent, internationally-recognized laboratory in nuclear energy technologies (including advanced fuel cycles)	9. Significantly improve the cost effectiveness of the INL and accept financial and programmatic responsibility for Contractor and Subcontractor conduct
2. Establish the INL as a major national security technology development and demonstration center	10. Establish and implement an effective contractor assurance system
3. Develop and retain capabilities that support the principal missions and the supporting missions described in this Statement of Work (SOW)	11. Identify national or commercial standards and best business practices that can be used in place of DOE requirements and implement those approved by DOE
4. Enhance the INL's role as a multi-disciplinary research center contributing to other national goals and obtain international recognition in the science and engineering fields	12. Conduct activities and the work in a manner that instills public confidence in the INL
5. Use innovative approaches to achieve the DOE vision	13. Conduct public outreach in a manner that sufficiently informs the public about and actively generates support for, INL programs
6. Ensure INL capabilities and resources are made available to other Federal agencies, state and local governments, academia, and the private sector	14. Work in a manner that is safe to workers, the public, and the environment
7. Market INL capabilities to strengthen programmatic results and impacts	15. Comply with legal requirements and the terms and conditions of this contract.
8. Solve technical, financial, and regulatory issues associated with program objectives	16. Provide for the long-term sustainability of the INL



# Priority Recommendations from NERAC in 2004 Report

## Commitment, Vision and Funding

1. Highest priority is to fund INL and allocate resources to build-up of facility and staff capabilities. Recognize and allow for contributions of other national laboratories

2. Understand and agree on vision and mission

## People

3. Develop policies and practices that attract/retain best and brightest scientists, engineers and technical managers

4. Identify and recruit the best and brightest scientists and engineering to be involved as collaborators. Ensure workforce and users/collaborators comprise a diverse population

5. Create a culture where research and scholarship are encouraged and rewarded

## Facilities

6. Fund INL to develop and maintain high quality, state of the art research facilities. Operate many if not most of the facilities as user facilities

## Governance and Metrics

7. Select M&O contractor with superb qualifications and a credible plan to achieve the vision

8. DOE focus on managing the contract, not the contractor. Hold the contractor accountable

9. INL should Visit and benchmark world-class labs