U.S. DEPARTMENT OF ENERGY | Office of NUCLEAR ENERGY

Clean. Reliable. Nuclear.

Nuclear Science User Facilities

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Nuclear Science User Facilities (NSUF) General

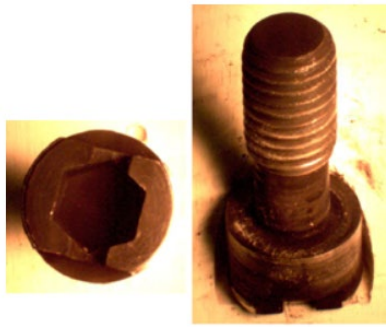
- **Established in 2007 as DOE Office of Nuclear Energy's first and only user facility**
  - Link intellectual capital with nuclear research infrastructure to fulfill mission of DOE Office of Nuclear Energy
  - Focus: Irradiation effects in nuclear fuels and materials
  - Provide access to capabilities and expertise at no cost to the user
  - Support experiment design, fabrication, transport, irradiation, PIE, disposition
- **Projects are selected through open, competitive proposal processes**
  - Consolidated Innovative Nuclear Research FOA (1 call/year)
    - Neutron Irradiation and Post Irradiation Examination (PIE) ($500K - $4.0M, up to 7 years)
    - Synchrotron or Neutron Beamline or PIE only ($50K to $750K, up to 3 years)
    - Neutron irradiation only ($500K - $3.5M, up to 3 years)
    - Ion or Gamma Irradiation only ($20K - $100K, up to 3 years)
    - Ion or Gamma Irradiation and PIE ($50K - $250K, up to 3 years)
  - Rapid Turnaround Experiments (3 calls/year)
    - Not part of the CINR FOA
  - Proposals welcome from university, national laboratory, and industry applicants

A Consortium Offering Research Opportunities

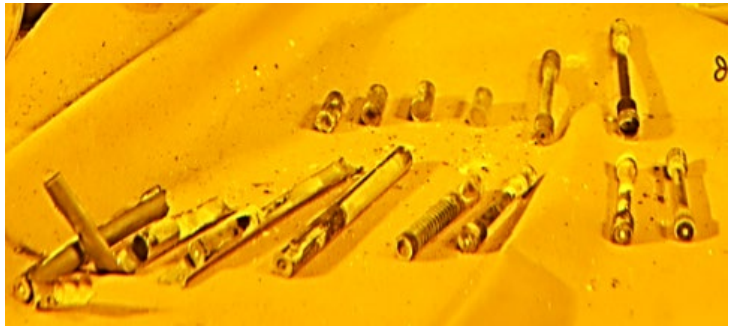
Neutron Irradiations	Ion Irradiations	Gamma Irradiations	Post Irradiation Examination	Characterization Beamlines	High Performance Computing
INL Idaho National Laboratory	Wisconsin University of Wisconsin-Madison	INL Idaho National Laboratory	INL Idaho National Laboratory	CAES Center for Advanced Energy Studies	Brookhaven National Laboratory	INL Idaho National Laboratory
Oak Ridge National Laboratory	University of Michigan	Oak Ridge National Laboratory	Oak Ridge National Laboratory	Cal	NC State University	
Massachusetts Institute of Technology	Argonne National Laboratory	Sandia National Laboratories	PNNL	NC State University	Los Alamos National Laboratory	
NC State University	Sandia National Laboratories		University of Michigan	Purdue University		
Ohio State	Texas A&M University		Westinghouse	University of Florida		
SCK•CEN Studiecentrum voor Kernenergie Centre d'Etude de l'Energie Nucleaire	Lawrence Livermore National Laboratory		Los Alamos National Laboratory	Wisconsin University of Wisconsin-Madison		
			SCK•CEN Studiecentrum voor Kernenergie Centre d'Etude de l'Energie Nucleaire			

Nuclear Fuels and Materials Library (NFML)

- The library includes over 6000 specimens from NSUF projects, legacy research projects, commercial reactors, and research reactors
- Most specimens are neutron irradiated with small number of ion irradiated materials
- Web-based searchable database through nsuf.inl.gov
  - Material or fuel composition
  - Specimen configuration
  - Irradiation conditions
  - Publications



- Specimens Include:
  - Steels – Conventional and Advanced
  - Nickel and Uranium Alloys
  - Ceramics
  - High purity elemental materials
  - Actinides
  - Various fuel forms and constituents (Please contact NSUF)



NSUF Workscopes

University, National Laboratory, or Industry Applicants

- **NSUF 1.1: TESTING OF ADVANCED MATERIALS OR ADVANCED SENSORS FOR NUCLEAR APPLICATIONS**
- **NSUF 1.2: IRRADIATION TESTING OF MATERIALS PRODUCED BY INNOVATIVE MANUFACTURING TECHNIQUES**
- **NSUF-2.2: HIGH PERFORMANCE COMPUTING AT IDAHO NATIONAL LABORATORY**

Industry Applicants

- **NSUF-2.1: CORE AND STRUCTURAL MATERIALS**

NSUF Changes and Reminders

- **NSUF-2.1 workscope is open to industry applicants only (Change from FY 2020 FOA)**

- **NSUF process described in Appendix D**
- **Non-negotiable User Agreement in Appendix E**
- **LOI, Pre-Applications, Preliminary SOW, Final SOW, Full Applications submitted by Lead Applicant**
- **Cost Estimates (for NSUF Access) prepared and submitted by NSUF Technical Leads**
- **Preliminary development effort must be complete and applicant ready for NSUF**
  - Applicant must demonstrate readiness in Pre-Application and Full Application
  - NSUF Readiness Criteria described in FOA Part I B.2.2

NSUF-2: NSUF Access Only Workscopes

- **Objective**
  - Provide access to the capabilities of the NSUF for research projects supporting the DOE Office of Nuclear Energy mission
- **Types of Projects**
  - Neutron Irradiation and Post Irradiation Examination (PIE)
  - Synchrotron or Neutron Beamline or PIE only
  - Ion or Gamma Irradiation only
  - Ion or Gamma Irradiation and PIE
  - Computational projects requiring INL High Performance Computing
- **Restrictions**
  - NSUF-2.1 open to industry applicants only
  - R&D support funding for applicant not provided
  - Source, scope and duration of R&D funding must be identified
  - NSUF does not fund travel, salaries, or other user costs

NSUF-2 Focus Areas

- **NSUF-2.1: CORE AND STRUCTURAL MATERIALS**
  - Understanding irradiation effects such as aging and material degradation (e.g. fatigue, embrittlement, void swelling)
  - Development of radiation resistant materials for current and future reactor applications
  - Not requesting common place conventionally and additively manufactured materials (304SS, 316SS, 718 Inconel, uncoated Zirconium alloys, SiC and SiC-SiC composites that have been the target of previous NSUF awards
  - A complete list of NSUF awards made under the FY2017 to FY2020 CINR funding opportunities can be found under the R&D flag on the website NEUP.inl.gov

NSUF-2 Focus Areas

- **NSUF-2.2: HIGH PERFORMANCE COMPUTING AT IDAHO NATIONAL LABORATORY:**
  - Provide scientific computing capabilities to support efforts in advanced modeling and simulation (Sawtooth, Falcon and Lemhi)
  - Proposals in this area may address a wide range of research activities
    - Performance of materials in harsh environments (including the effects of irradiation and high temperatures),
    - Performance of existing light water and advanced nuclear reactors
    - Multiscale, multi-physics analysis of nuclear fuel performance

INL HPC Capabilities

- **Sawtooth**: INL's newest supercomputer operates with a LINPACK rating of 5.6 petaflops and is ranked #37 on the November 2019 TOP500 list. The HPE SGI 8600 system comprises 99,792 cores with 403 TB of memory. The system also includes dedicated GPU capability.

- **Lemhi**: A Dell 6420-based system operating on an OmniPath fat tree network. It contains 20,160 cores and 94 total terabytes of memory. Lemhi is rated at 1 petaflop and ranked #427 on the November 2018 TOP500 list.

- **Falcon**: A SGI ICE-X distributed memory system comprised of 34,992 cores, with each node containing dual Xeon E5-2695 v4 processors. It is rated at 1.1 petaflops and includes 121 TB of memory.

Contact Information

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NSUF
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