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)
    - Irradiation and Post Irradiation Examination (PIE) ($500K - $4.0M, up to 7 years)
    - Beamline or PIE only ($50K to $750K, up to 3 years)
    - Irradiation only ($500K - $1.5M, 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	INL Idaho National Laboratory	INL Idaho National Laboratory	CAES Center for Advanced Energy Studies	INL Idaho National Laboratory
Oak Ridge National Laboratory	University of Michigan	Oak Ridge National Laboratory	Oak Ridge National Laboratory	Cal	125 Illinois Tech Since 1890
MIT Massachusetts Institute of Technology	Argonne National Laboratory	Sandia National Laboratories	PNNL	NC State University	Brookhaven National Laboratory
NC State University	Sandia National Laboratories		University of Michigan	Purdue University	NC State University
Ohio State	A&M Texas A&M University		Westinghouse	University of Florida	Los Alamos National Laboratory
SCK•CEN Studiecentrum voor Kernenergie Centre d'Etude de l'Energie Nucleaire	Lawrence Livermore National Laboratory		Los Alamos National Laboratory	Wisconsin	
			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 Applicants

- **FC-2.5: SEPARATE EFFECTS TESTING IN TREAT USING STANDARD TEST CAPSULES**

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 1.3: NUCLEAR MATERIALS DISCOVERY AND QUALIFICATION INITIATIVE**
- **NSUF-2.1: CORE AND STRUCTURAL MATERIALS**
- **NSUF-2.2: NUCLEAR FUEL BEHAVIOR AND ADVANCED NUCLEAR FUEL DEVELOPMENT**
- **NSUF-2.3: ADVANCED IN-REACTOR INSTRUMENTATION**
- **NSUF-2.4: HIGH PERFORMANCE COMPUTING AT IDAHO NATIONAL LABORATORY**

NSUF Changes and Reminders

- **NSUF-2 workscopes are open to university, national laboratory and industry applicants (Change from FY 2019 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**
  - Irradiation only (Typically sensors)
  - Irradiation and PIE
  - PIE only
  - Beamline (Ion or Characterization)
- **Restrictions**
  - Open to university, national laboratory and industry applicants
  - 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
- **NSUF-2.2: NUCLEAR FUEL BEHAVIOR AND ADVANCED NUCLEAR FUEL DEVELOPMENT**
  - Increase fundamental understanding of the behavior of nuclear fuel
  - Improve performance of current fuels or develop advanced fuels
  - Irradiation and thermal effects on microstructure, thermophysical and thermomechanical properties, and chemical interactions
  - Projects should aim at proposing simple irradiation experiments with post irradiation examination investigation of fundamental fuel performance aspects such as radiation damage, species diffusion or fission products
  - Coupling of experimental methods with modeling and simulation is encouraged

NSUF-2 Focus Areas

- **NSUF-2.3: ADVANCED IN-REACTOR INSTRUMENTATION**
  - Support qualification of advanced in-reactor instrumentation
    - For characterization of materials under irradiation in test reactors
    - For on-line condition monitoring of power reactors
  - Advanced instrumentation, sensors, and measurement techniques for use in advanced reactors is encouraged
- **NSUF-2.4: HIGH PERFORMANCE COMPUTING AT IDAHO NATIONAL LABORATORY**
  - Provide scientific computing capabilities to support efforts in advanced modeling and simulation (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, multiphysics analysis of nuclear fuel performance

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