

Nuclear Science User Facilities: CINR Informational Webinar

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Nuclear Science User Facilities (NSUF)

DOE Office of Nuclear Energy's sole user facility

Focus: Irradiation effects in nuclear fuels and materials

- Awards provide access to capabilities and expertise at no cost to the user
- Access awards support experiment design, fabrication, transport, irradiation, PIE, final disposition of materials

Open and Competitive Proposals

- Consolidated Innovative Nuclear Research (CINR) FY 2024 FOA
 - Neutron irradiation and post irradiation examination (PIE), (\leq \$4M, up to 7 years)
 - PIE only, including synchrotron or neutron beamline access, up to 3 years)
 - Neutron irradiation only (up to 3 years)
 - Ion or gamma irradiation and PIE (up to 3 years)
 - Ion or gamma irradiation only (up to 3 years)
- Rapid Turnaround Experiments (RTE) – **Not part of the CINR FOA**

Center for Advanced Energy Studies – NSUF Partner Facility



Advanced Test Reactor at INL - NSUF Partner Facility



NSUF Capabilities – CINR Access Opportunities

Neutron Irradiations	Ion Irradiations	Gamma Irradiations	Hot Cells & Shielded Cells	Low Activity Laboratories	Beamlines
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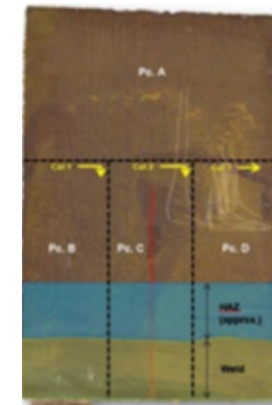
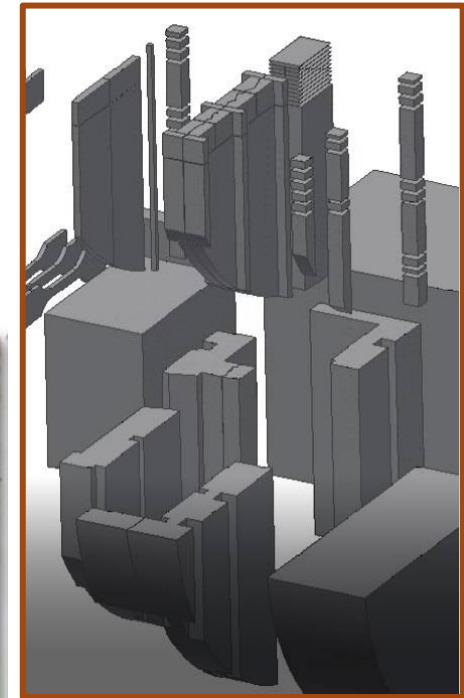
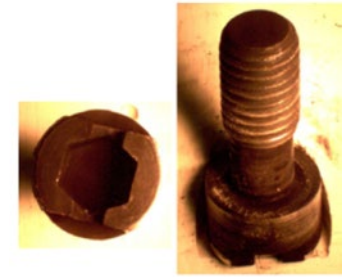
Pending Capability Additions:

ANL: APS AML HEXM beamline 2024

Visit nsuf.inl.gov for details of individual facilities and leads

Nuclear Fuel and Materials Library (NFML)

- Library includes >9000 specimens from NSUF projects, legacy research projects, commercial reactors, and research reactors
- Most specimens are neutron irradiated
- Web-based searchable database through <https://nsuf.inl.gov/> by material or fuel composition, specimen configuration, irradiation conditions, and publications
- Specimens include legacy samples from EBR-II and FFTF, commercial decommissioned and operating power reactors, donations from other sources, and the technical information and publications associated with all NFML project samples.
 - Steels – conventional and advanced
 - AM Materials
 - Ceramics
 - High purity elemental materials
 - Actinides
 - Various fuel forms and constituents (Please contact NSUF)
- Applicants may request NFML specimens for NSUF Access proposals. Please contact NSUF staff with questions.

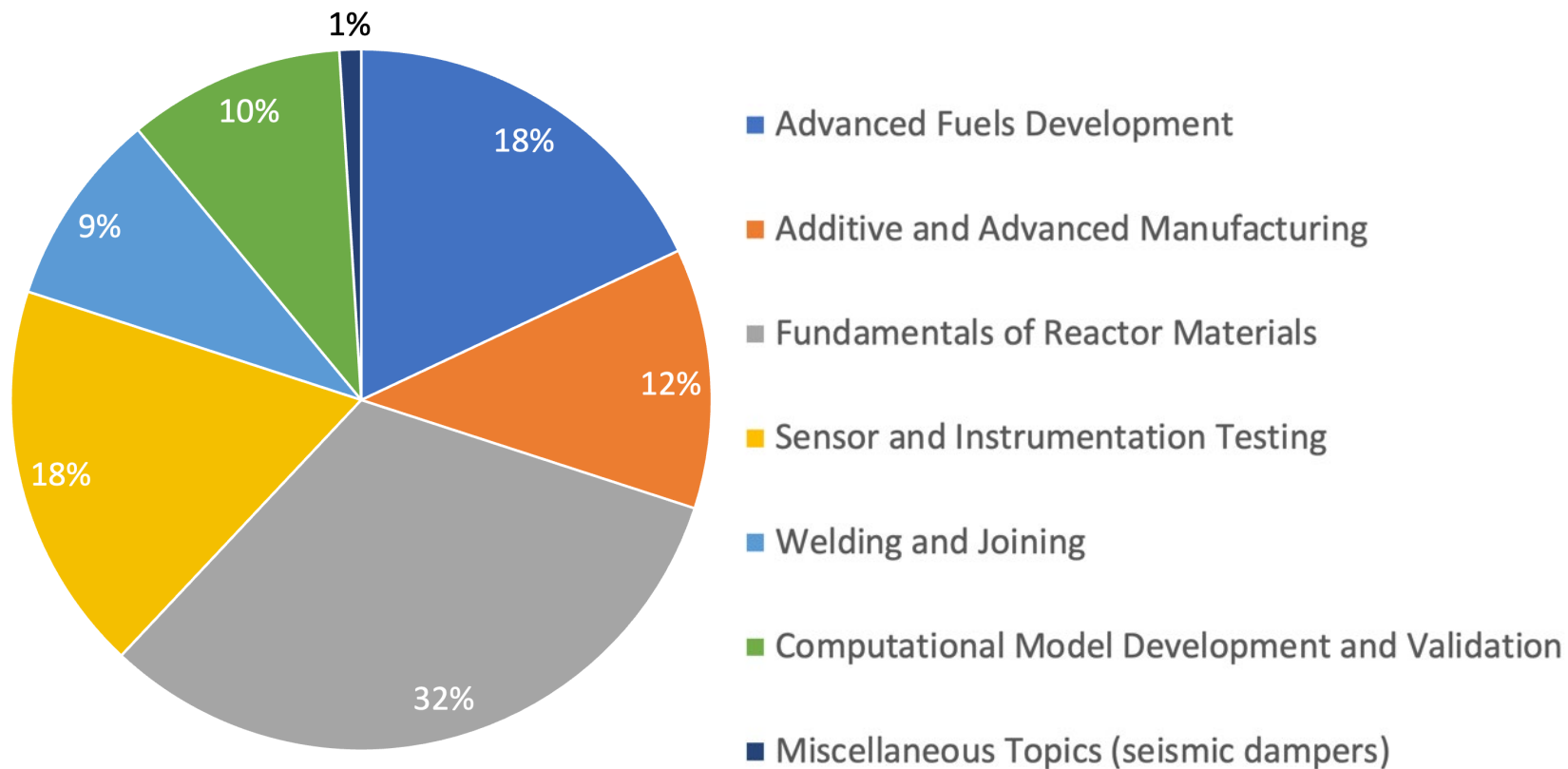


NSUF Research Covers all Technical Readiness Levels

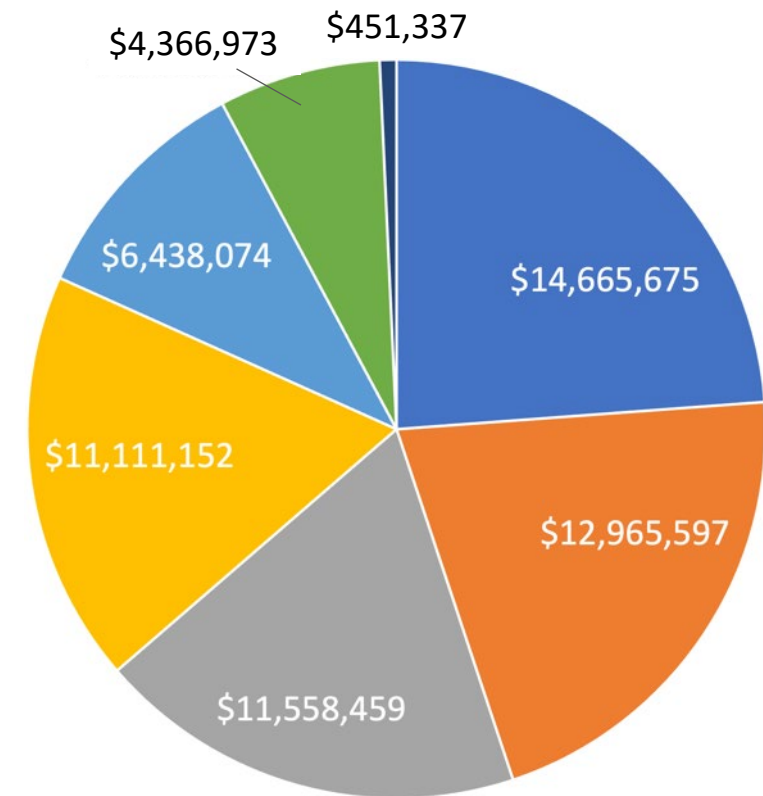


CINR Awarded Projects FY 2015 – FY 2022

Number of Awards by Field



Value of NSUF Access Awards by Field



NSUF Topic Areas

Nuclear Science User Facilities Joint R&D and Access (NSUF-1)

- Joint R&D and Access
- Eligible to lead: Universities ONLY
- Up to 7 years, and up to \$1,000,000 of R&D support
- NSUF Access funding up to \$4,000,000
- Federal POC: Christopher Barr

R&D Support Clarification for NSUF-1:

- R&D support is for work directly associated with the proposed irradiation and/or post irradiation examination. The includes compilation and interpretation of NSUF access results including interim and final reports.
- R&D support is not for the developmental of new materials, fuels, or sensors. Applicants are expected to demonstrate that their project is ready for NSUF access. **Proposed projects that include development of materials that are not ready for NSUF access irradiation or post-irradiation will not be considered.** Readiness requirements are detailed in FOA Section I.B.3.1
- Any question on R&D support and NSUF readiness should be directed the NSUF Program Office.

Nuclear Science User Facilities Joint R&D and Access (NSUF-1) Topic Area

Objective

- Provide access to the capabilities of the NSUF for research projects supporting the DOE Office of Nuclear Energy mission.
- Provide R&D support for work directly associated with the proposed irradiation and/or post irradiation examination

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
- INL High Performance Computing access can be added to any of the NSUF topic areas

Restrictions

- Access to NSUF capabilities will require agreement and final signature to the User Agreement
- Project meets NSUF readiness requirements

NSUF-1.1: CORE AND STRUCTURAL MATERIALS BEHAVIOR AND DEVELOPMENT

Focus:

- Fundamental understanding of irradiation effects in core and structural materials and the behavior of nuclear fuels (including cladding) in reactor, and research into advanced nuclear fuels and improving the performance of current fuels

Areas of interest may include:

- Core and Structural Materials: material aging and degradation mechanisms, testing alternate and/or radiation resistant materials for application in current and future fission reactors, and materials from alternate or advanced manufacturing techniques (including welding and joining)
- Fuels: physics and chemistry of nuclear fuels and other radioactive materials, irradiation and thermal effects on microstructure development and the effects on, for example, thermophysical and thermomechanical properties as well as chemical interactions.

NSUF-1.2: TESTING OF ADVANCED MATERIALS FOR SENSORS

Focus:

- Fundamental understanding of irradiation effects in candidate materials for sensors and instrumentation systems. Applicants may propose irradiation testing and/or post-irradiation examination.

Areas of interest may include:

- Advanced Sensor Materials: Irradiation testing and post irradiation examination of candidate sensor materials
- Advanced Instrumentation or Measurement Systems: Irradiation and post irradiation examination of candidate instrumentation or measurement systems (including electronics and associated peripheral components necessary for operation and data acquisition); the purpose and application of the instrument or measurement system in the operation of nuclear energy systems or as part of the development of nuclear components

NSUF Topic Areas

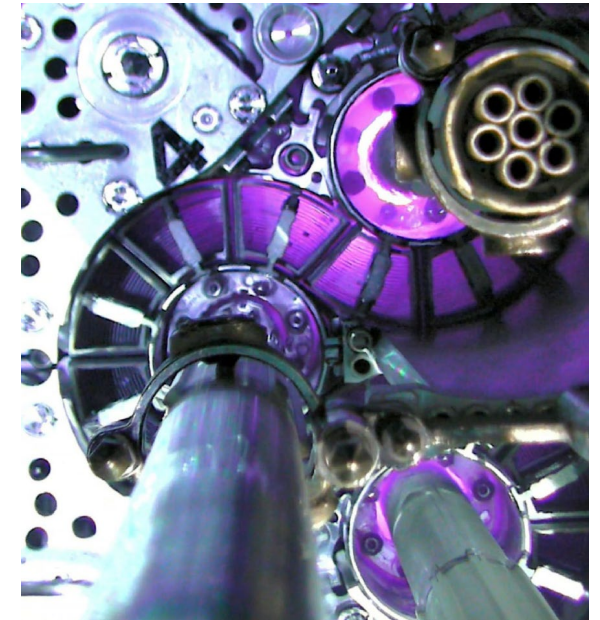
Nuclear Science User Facilities Access Only (NSUF-2)

- NSUF Access ONLY
- Eligible to lead: Universities, National Laboratories, and Industry
- No R&D support provided to applicant
- NSUF Access funding up to \$4,000,000
- Federal POC: Christopher Barr

NSUF Readiness:

- **Proposed projects that include development of materials that are not ready for NSUF access irradiation or post-irradiation will not be considered.**
- Questions on R&D support and NSUF readiness should be directed the NSUF Program Office.

ATR In-vessel image



Nuclear Science User Facilities Access ONLY (NSUF-2) Topic Area

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
- INL High Performance Computing access can be added to any of the NSUF topic areas.

Restrictions

- NSUF Access only does not fund travel, salaries, or other user costs
- Access to NSUF capabilities will require agreement and final signature to the User Agreement
- Project meets NSUF readiness requirements

NSUF-2.1: CORE AND STRUCTURAL MATERIALS BEHAVIOR AND DEVELOPMENT

Focus:

- Fundamental understanding of irradiation effects in core and structural materials and the behavior of nuclear fuels (including cladding) in reactor, and research into advanced nuclear fuels and improving the performance of current fuels

Areas of interest may include:

- Core and Structural Materials: material aging and degradation mechanisms, testing alternate and/or radiation resistant materials for application in current and future fission reactors, and materials from alternate or advanced manufacturing techniques (including welding and joining)
- Fuels: physics and chemistry of nuclear fuels and other radioactive materials, irradiation and thermal effects on microstructure development and the effects on, for example, thermophysical and thermomechanical properties as well as chemical interactions.

NSUF-2.2: TESTING OF ADVANCED MATERIALS FOR SENSORS

Focus:

- Fundamental understanding of irradiation effects in candidate materials for sensors and instrumentation systems. Applicants may propose irradiation testing and/or post-irradiation examination.

Areas of interest may include:

- Advanced Sensor Materials: Irradiation testing and post irradiation examination of candidate sensor materials
- Advanced Instrumentation or Measurement Systems: Irradiation and post irradiation examination of candidate instrumentation or measurement systems (including electronics and associated peripheral components necessary for operation and data acquisition); the purpose and application of the instrument or measurement system in the operation of nuclear energy systems or as part of the development of nuclear components

INL HPC Capabilities

All NSUF awarded projects may request access to NSUF's High Performance Computing Capabilities

These capabilities include:

- Sawtooth: 6 Petaflops performance - HPE SGI 8600-based system with 99,792 cores, 395 TB of total memory high-speed InfiniBand EDR interconnect network, high-speed storage, and 0.56 petaflops of GPU capabilities. The current LINPACK rating for Sawtooth is more than six (6) petaflops from both CPUs and GPUs.
- Lemhi: 1 Petaflop performance - Dell PowerEdge distributed memory system with 20,160 cores, 94 TB of total memory, Omni-Path interconnect network, and high-speed storage. The LINPACK rating for Lemhi is 1.002 petaflops.
- Hoodoo: a Lambda Hyperplane deep learning distributed memory system with 44 NVIDIA A100 Tensor Core GPUs and 7.2 TB of total memory dedicated to machine learning applications. Hoodoo provides a maximum GPU performance of 429 teraflops double precision or 858 teraflops single precision.
- Storage: 5 Petabytes of disk storage including a WORM (Write-once read-many) filesystem for use in multi-year archiving of data.

Sawtooth



Lemhi



Contact HPC at the Nuclear Computational Resource Center (NCRC) at <https://inl.gov/ncrc/>

Cautions and Requirements

Duplication of NSUF work

- Proposals that advocate duplicating previous or on-going NSUF supported irradiation studies will not be considered. A complete list of NSUF awards made under the FY2017 to FY2022 CINR funding opportunities can be found under the R&D flag on the website NEUP.inl.gov

Duplication of other DOE-NE R&D Program work

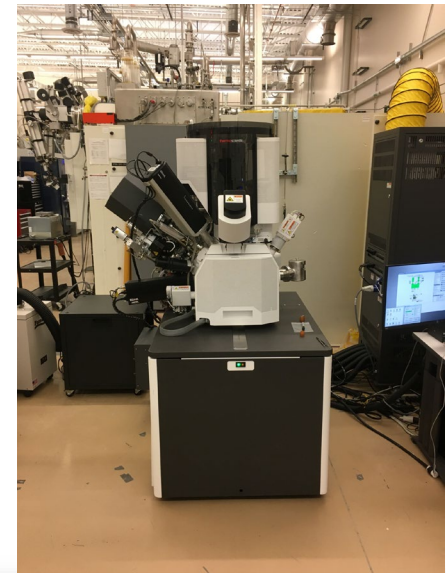
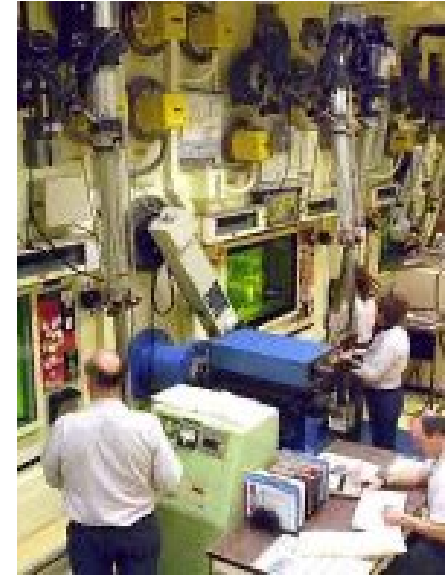
- Please review the recent competitive awards, R&D program websites and documents to ensure that no proposed work duplicates efforts previously or currently funded by any DOE-NE funded R&D program.

NSUF User Agreement

- Upon award of an NSUF supported project, the NSUF User Agreement must be signed before activities will begin on the project.
- Failure to sign the non-negotiable User Agreement within 30 days of receipt of the User Agreement may result in cancellation of an awarded project.

NSUF Readiness

- NSUF Access (both NSUF-1 and NSUF-2) undergo a readiness review to evaluate if the proposed work is ready for NSUF access funded irradiation and/or post-irradiation examination.



Application Timeline and Information

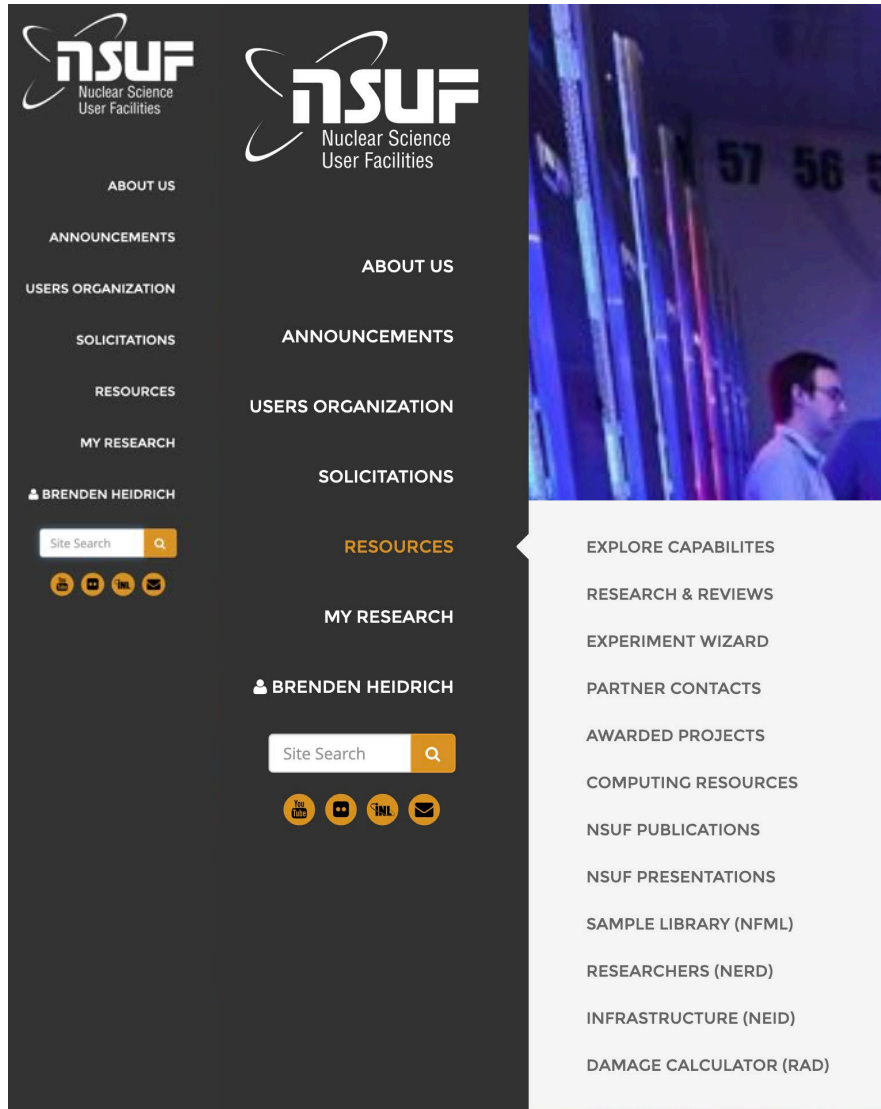
DOE Topic Area Office Hours: June 19-23, 2023
(Video links and presentations are available at www.NEUP.gov)

Contact NSUF Office staff for support anytime at <https://NSUF.inl.gov/> or email at NSUF@inl.gov

Timeframe:

Letter of Intent (Mandatory)	June 21, 2023 @ 5:00 pm ET
NSUF Pre-application (Mandatory)	July 12, 2023 @ 5:00 pm ET
NSUF Preliminary SOW (Mandatory)	August 31, 2023 @ 5:00 pm ET
NSUF Final SOW (Mandatory)	December 6, 2023 @ 5:00 pm ET
Full NSUF Application (Invited)	December 20, 2023 @ 5:00 pm ET



























NSUF Website Resources



The navigation menu is located on the left side of the website. It features the NSUF logo at the top, followed by a vertical list of menu items: ABOUT US, ANNOUNCEMENTS, USERS ORGANIZATION, SOLICITATIONS, RESOURCES, MY RESEARCH, and BRENDEN HEIDRICH. Below this list is a search bar and social media icons for YouTube, Twitter, LinkedIn, and Email. A secondary menu is visible on the right side of the navigation area, including ABOUT US, ANNOUNCEMENTS, USERS ORGANIZATION, SOLICITATIONS, RESOURCES, MY RESEARCH, and BRENDEN HEIDRICH. A large dropdown menu is open, listing various resources such as EXPLORE CAPABILITIES, RESEARCH & REVIEWS, EXPERIMENT WIZARD, PARTNER CONTACTS, AWARDED PROJECTS, COMPUTING RESOURCES, NSUF PUBLICATIONS, NSUF PRESENTATIONS, SAMPLE LIBRARY (NFML), RESEARCHERS (NERD), INFRASTRUCTURE (NEID), and DAMAGE CALCULATOR (RAD).

NSUF Partner Institutions

The behavior of fuels and materials in a nuclear reactor environment is extremely complex and provides a rich field for scientific investigation. These 19 NSUF Partner Institutions offer world-class capabilities to researchers for investigating this complex behavior and include the Advanced Test Reactor and post-irradiation examination capabilities at Idaho National Laboratory in addition to 620 capabilities available from 49 partner facilities.

Institution	Contact	Type	State	Country	Website
 Argonne National Laboratory	 Wei-Ying Chen Technical Lead (630) 252-5222	Dept of Energy	Illinois	United States	Website
 Brookhaven National Laboratory	 Simerjeet Gill Technical Lead (631) 344-5633	Dept of Energy	New York	United States	Website
 Idaho National Laboratory	 Simon Pimbiott NSUF Contact (208) 526-7499	Dept of Energy	Idaho	United States	Website
 Lawrence Livermore National Laboratory	 Scott Turney Technical Lead (925) 423-9012	Dept of Energy	California	United States	Website
 Los Alamos National Laboratory	 Tarik Saleh Technical Lead (505) 695-8871	Dept of Energy	New Mexico	United States	Website
 Massachusetts Institute of Technology	 Gordon Kohse Technical Lead (617) 253-4298	University	Massachusetts	United States	Website
 North Carolina State University	 Ayman Hawari Technical Lead (919) 515-4598	University	North Carolina	United States	Website
 The Ohio State University	 Raymond Cao Technical Lead (614) 247-8701	University	Ohio	United States	Website
 Pacific Northwest National Laboratory	 Stuart Maloy Technical Lead (509) 371-6775	Dept of Energy	Washington	United States	Website
 Purdue University	 Ahmed Hassanein Technical Lead (765) 494-5742	University	Indiana	United States	Website
 Sandia National Laboratories	 Michael Starr Technical Lead (505) 284-9614	Dept of Energy	New Mexico	United States	Website
 Texas A&M University	 Lin Shao Technical Lead (979) 845-4107	University	Texas	United States	Website
 Westinghouse	 Catherine Omar Technical Lead (724) 420-2077	Industry	Pennsylvania	United States	Website

Questions and Point of Contacts

Federal Program Manager:

Christopher Barr, Christopher.Barr@Nuclear.Energy.gov

Technical Point of Contacts:

Brenden Heidrich (NSUF Director), Brenden.Heidrich@INL.gov

Eric Whiting (HPC), Eric.Whiting@INL.gov

Additional information:

NSUF website includes description of partner institutions, capabilities, partner technical leads, NSUF Office staff, and additional information: <https://nsuf.inl.gov/>

INL HPC Website, <https://hpc.inl.gov/>



NSUF

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