March 7, 2024

Lindy Bean – CINR Administrator
Kelly Cunningham – Nuclear Fuels & Materials Librarian
Anna Podgorney – RTE Administrator

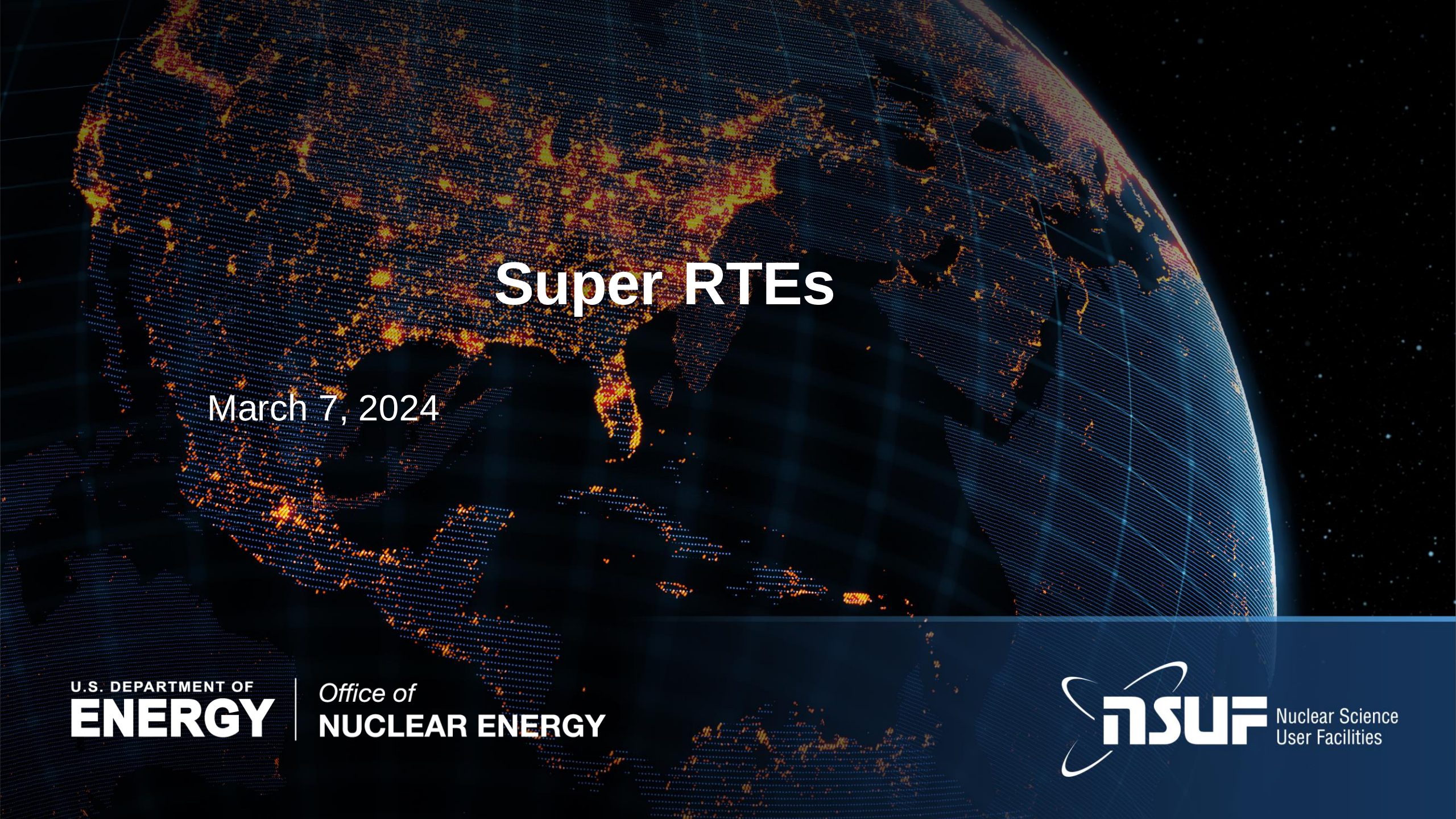
2024 NSUF Users Meeting
CINR, NFML, & Super RTE

CINR Upcoming Changes

- NSUF Readiness
  - Part I B.3.1 readiness is lightly discussed then refers to Part IX Appendix D Accessing Nuclear Science User Facilities for detailed description of readiness criteria.

A Letter of Intent template
  - New in FY 2025; page limit changes from 2 pages to 3.

Retitle Preliminary SOW to Pre-Application SOW; Final SOW to Full-Application SOW and added Final SOW.
  - If awarded and once a project is complete, the Final SOW and project data will be put in HPC's Nuclear Research Data System (NRDS) data repository.



Super RTEs

March 7, 2024

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

NSUF Nuclear Science User Facilities

What are *Super* Rapid Turnaround Experiments (RTEs)?

- **Objective**
  - Offer an avenue for researchers to perform irradiation effects studies of ***broader*** scope on nuclear fuels and materials utilizing NSUF
    - Up to ***two*** partner institutions for PIE
    - One partner institution for irradiation
    - One partner institution for sample preparation/shipping
    - ***Double*** the access time at NSUF facilities
- **Limitation**
  - Super RTE call is expected **annually**
  - **12-month** project duration

Super RTE Facility Access Guidelines (https://nsuf.inl.gov/Page/super_rte)

Up to 6 Weeks

- Center for Advanced Energy Studies - Microscopy and Characterization Suite
- Oak Ridge National Laboratory - Low Activation Materials Development and Analysis Facility
- University of Florida - Materials Characterization Facility

Up to 4 Weeks

- Argonne National Laboratory - Intermediate Voltage Electron Microscopy - Tandem Facility
- Idaho National Laboratory - Analytical Laboratory, Electron Microscopy Laboratory, Irradiated Materials Characterization Laboratory
- Los Alamos National Laboratory - Lujan Center Beamlines, Plutonium Surface Science Laboratory
- Massachusetts Institute of Technology - MIT Nuclear Reactor Laboratory
- North Carolina State University - Nuclear Reactor Program
- Pacific Northwest National Laboratory - Radiochemistry Processing Laboratory, Materials Science and Technology Laboratory (PIE only)
- Purdue University - Interaction of Materials with Particles and Components Testing Facility
- Sandia National Laboratory - Ion Beam Laboratory, Gamma Irradiation Facility
- Texas A&M University – Accelerator Laboratory
- The Ohio State University - Nuclear Reactor Laboratory
- University of California, Berkeley - Nuclear Materials Laboratory
- University of Michigan - Michigan Ion Beam Laboratory
- University of Wisconsin - Characterization Laboratory for Irradiated Materials, Wisconsin Tandem Accelerator Ion Beam
- Westinghouse - Churchill Laboratory Services›

Up to 2 Week

- Idaho National Laboratory - Hot Fuel Examination Facility
- Lawrence Livermore National Laboratory – Center for Accelerator Mass Spectroscopy
- Oak Ridge National Laboratory - Irradiated Fuels Examination Laboratory, Irradiated Materials Examination and Testing Facility

Up to 6 Days

- Brookhaven National Laboratory - NSLS II X-ray Powder Diffraction (XPD) Beamline

Rules for Super RTE Proposal Submission

- **Content**
  - Must be original, no duplication of other funded work
  - **Scope must be unique, with no overlap with existing or proposed scope**
  - Produced data will lead to a scientific or engineering outcome that are suitable for publication and will be attributed to the NSUF
  - Must focus on irradiated or radioactive materials or nuclear fuels research, including in situ sensor performance characterization
    - Proposals can include limited non-irradiated structural or cladding reference samples, as appropriate
- **Facility**
  - Use NSUF capabilities at ***up to four partner institutions***
    - One partner institution for sample preparation/shipping; One for irradiation; ***Two*** for PIE
    - Requesting *only* sample preparation and/or sample shipment is not allowed
    - Proposals that request both irradiation and PIE should remain within the suggested RTE guidelines
- **Funding**
  - Only supports activities at, and shipping between, NSUF facilities
  - No funding to the PI to support salaries, tuition, travel, or other costs typically supported via NE Program R&D funds
  - Awarded Super RTEs must be completed no more than ***12*** months from the date of award

Rules for Super RTE Proposal Submission (continued)

- **Project Completion**
  - Must be completed within ***12*** months of award
  - Only *two* traditional RTEs ***and one Super RTE project*** can be active at any given time
  - A completion report for one of the active projects must be submitted at least 2 weeks before the call closes to be eligible to submit a traditional RTE or Super RTE proposal
  - The PI must make all project data available to the research community
    - NSUF recommends using a Data Management and Sharing Plan (DMSP) by utilizing the Nuclear Research Data System (NRDS)
    - NRDS is a newly developed NSUF HPC data repository
    - NRDS will provide lifecycle storage of NSUF and NEUP project data
- **Completion Report Criteria**
  - Report should provide a summary of both the work completed and the data obtained
  - Describe the potential impact to the state-of-knowledge
  - **Completion reports must be submitted within 4 months of any completed RTE project**
  - A project is considered active until a completion report is submitted and approved

Rules for Super RTE Proposal Submission (continued)

- **PI Expectations:**
  - Only one PI per proposal
  - A PI may submit no more than one proposal per Super RTE call
  - **To be eligible for a Super RTE proposal submission:**
    - ***A PI may have up to two awarded traditional RTE projects, with none under review, or***
    - ***A PI may have up to one awarded traditional RTE project, with one under review***
  - Proposals from PIs not from a U.S. institution must include a collaborator who is from the U.S. and this collaborator must have a significant role in the experiment or project that supports the RTE
    - The roles and responsibilities for each U.S. collaborator must be clearly identified in the technical narrative
  - All proposals must include a **2-page** technical narrative, curriculum vitae (or equivalent) for the PI and all team members
  - Proposals must include all publications the PI and co-PIs have produced as a result of any and all previous NSUF funded experiments or projects (RTE and CINR)
  - Data generated from the work must be made available to the research community in a timely manner. The PI is responsible for the collection, management, and sharing of the research data through a data management plan (e.g., NRDS)
  - Acknowledgment of NSUF-funded research

Failure to meet any of the above rules will result in disqualification of the proposal

Super RTE Call Schedule

Call announcement seminar	3/25/2024 11 a.m. - 12 p.m. MDT
Solicitation period opens	4/1/2024
Individual Q&A sessions *(must be scheduled in advance by contacting the RTE Administrator: anna.podgorney@inl.gov)*	TBD
Proposal due date	4/30/2024 at 4 p.m. MDT
Selection review	Estimated 6/1/2024
Proposals awarded	Estimated 8/1/2024

RTE Program Administration

- Brenden Heidrich, *Director*
- Collin Knight, *Deputy Director*
- Keith Jewell, *Chief Scientist*
- Rongjie Song, *Chief Scientist*
- Anna Podgorney, *RTE Administrator (anna.podgorney@inl.gov, (208) 526-2123)*

Please contact Anna to schedule Individual Q&A session in March!


NSUF
Nuclear Science
User Facilities

March 7, 2024

NSUF 2024 Users Organization Meeting

Kelly Cunningham

Nuclear Science User Facilities
Nuclear Fuels and Materials Library

Nuclear Science User Facilities

https://nsuf-research.inl.gov/Browse/Library

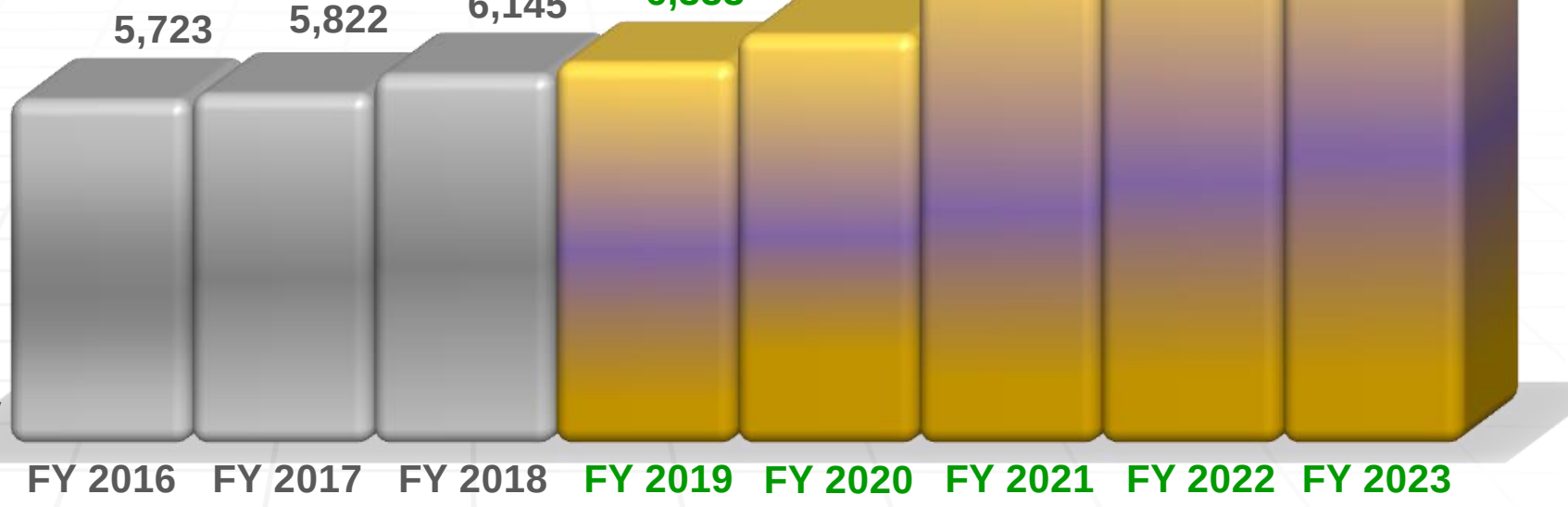
The Nuclear Fuels and Materials Library

Overview

The Nuclear Fuels and Materials Library (NFML) is owned by the U.S. Department of Energy's Office of Nuclear Energy (DOE-NE) and curated by the Nuclear Science User Facilities (NSUF). Samples in the NFML are publicly available via NSUF competitive award processes or direct requests granted by the **NSUF Director**. The NFML is comprised of:

- Legacy samples from the Experimental Breeder Reactor (EBR-II) shutdown in 1994,
- Samples retrieved from decommissioned and operating power reactors,
- Samples resulting from NSUF-awarded irradiations,
- Pedigree information for NFML project samples,
- and Donations from other sources.

Awarded irradiations since 2017-18 will add more samples throughout the next few years.



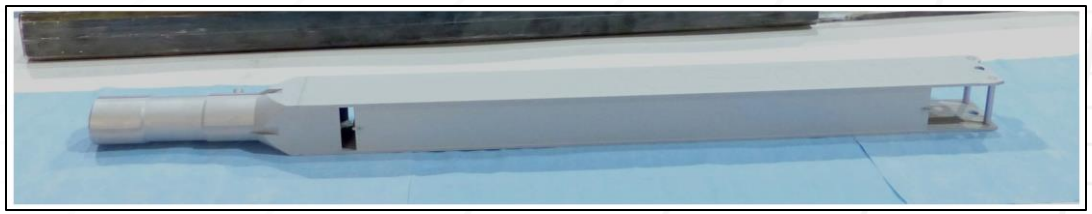
The NFML went online in 2016 with EBR-II legacy materials and samples from NSUF-awarded irradiations from 2008 – 2010.

FY 2023 New Acquisitions

Program-to-Program Transfer

CRADA - Ki-Jang Research Reactor (KJRR) Fuel Assembly Irradiation

- U-7Mo dispersed in Al-Si matrix, Al-clad fuel plates (Title transfer to DOE-ID was included in the Cooperative Research and Development Agreement (CRADA)
- Primary purpose of the campaign was to provide data about the irradiation performance of the KJRR fuel assembly.
- Korea Atomic Energy Research Institute (KAERI) fabricated the KJRR fuel experiment and shipped to the INL to be irradiated in the ATR, PIE in the HFEF, and as-Run irradiation conditions analyses performed.



Lead Test Assembly

Fuel Plates

Cooperative Research and Development Agreement (CRADA)

FY 2023 In-Process Acquisitions (HARVESTING)

Program-to-Program Transfer

Zion Nuclear Power Plant Reactor Pressure Vessel Material

- NFML staff and LWRS staff discussing acquisition for years
- PIE completed in 2023
- List of samples and supporting documents have been assembled
- Need official statement of transfer from LWRS Program to NSUF Program

Legal Transfer of Title and Ownership

Zircaloy Channel and Water Rod Samples (nozzle feedthroughs) from BWR NPPs

- Zircaloy channel and water rod samples (nozzle feedthroughs) from BWR NPPs
- NFML staff working with PNNL staff to collect pedigree information
- Determination of ownership for title transfer

Legal Transfer of Title and Ownership

Material in High Temperatures and Extreme Environments Lab (MiHTEE) 304L SS

- 304L SS irradiated control rod from Swedish BWR …
- Determination of ownership for title transfer

FY 2023 In-Process Acquisitions (REPOSITORY)

Program-to-Program Transfer
Microreactor Program Yttrium-Hydride Samples

- ATR-irradiated Yttrium Hydride samples
- Were tested as a moderator material for microreactors
- NSUF working with MFC staff to move samples to long-term storage
- Need official statement of transfer from the Microreactor Program to NSUF Program

Material Preservation Contract
University of California – Santa Barbara to University of California - Berkeley

- Residual NSUF experiment samples and small inventory of neutron irradiated samples stored at UCSB for years
- Current curator wants to ensure samples are preserved
- NSUF Samples to be inventoried and moved to UC-B for secure guardianship
- NSUF and UC-B agree that DOE-NE may secure ownership for NSUF curation and inclusion in the NFML

Material Information and Access
Westinghouse Electric Company Information Sharing

- WEC owns material from past experiments that can fill gaps in the NFML inventory …
- Method to access the information through the NFML is yet to be determined
- Collaboration would provide opportunities for researchers to find relevant material that pairs with their experiments.

NSUF Data Management and Sharing Plan (DMSP)

*DOE Policy for Digital Research Data Management

Sharing and preserving data are central to protecting the integrity of science by facilitating validation of results …. To the greatest extent, with the fewest constraints possible, … data sharing should make digital research data available to and useful for the scientific community, industry, and the public.

DMSPs to be required with all NSUF proposals (guidance and a DMSP template are in process)

- **DMSPs must detail how project data will be:**
  - Captured
  - Analyzed
  - Shared
  - Preserved
- **DMSPs will also describe:**
  - The data that will be created
  - The instruments used to create the data
  - Who owns the data
  - Who can access the data and when (3-year embargo before public release)
  - What facilities and equipment will be necessary to disseminate, share, and preserve the data

*Requirements for public data access resulting from awarded NSUF research **must be released in an open, machine-readable, and digitally accessible archive,** including charts, graphs, tables, figures, or images.*

Researchers can meet this requirement by accessing INL **HPC's Nuclear Research Data System (NRDS) Portal through the NSUF website using their NSUF credentials.**

*https://www.energy.gov/datamanagement/doe-policy-digital-research-data-management

The Nuclear Fuels and Materials Library

FY 2023 NFML Current and Future Inventory (FY 24-28)

Irradiation/ Submission	Title	Material	Reactor
CINR	Advanced Damage Tolerant Ceramics: Candidates for Nuclear Structural Applications	Ceramics	INL ATR
CINR	Effect on Thermophysical Properties of Hf3Al-Al Composite: A Concept for Fast Neutron Testing at ATR	Ceramics	INL ATR
Nat'l Lab	Library Submission - Neutron-Interactions of Advanced Materials	Ceramics	ORNL HFIR
NSUF SAM	Neutron Transmutation Doping of High-Purity SiC	Ceramics	INL ATR
CINR	Nonstoichiometric Spinel as Inert Matrix	Ceramics	INL ATR
NSUF SAM	NSUF graphite and fiber optic	Ceramics	INL ATR
CINR	Transducers for In-pile Ultrasonic Measurements of Fuels and Materials Evolution	Ceramics	INL ATR

NSUF SAM	Neutron Transmutation Doping of High-Purity SiC *(avail ~2025)*	INL ATR

Irradiation/ Submission	Title	Material	Reactor
CINR	Hydride LWR Fuel Rod	Fuel	INL ATR
DOE	Library Submission - KJRR Fuel Plates	Fuel	INL ATR
DOE	Library Submission - Peach Bottom Unit 2 Fuel Rod Sections and Remnants	Fuel	BWR NPP
DOE	Library Submission - Unirradiated TRISO Fuel	Fuel	n/a
CINR	Low Fluence Behavior of Metallic Fuels	Fuel	INL ATR
CINR	Measurement of Actinide Neutronic Transmutation Rates with Accelerator Mass Spectroscopy	Fuel	INL ATR

CINR	High Temperature In-Pile Irradiation Test of Single Phase U_3Si_2, *(avail ~early 2025 & ~2029)*	ATR
CINR	Demonstration of a Methodology for Direct Validation of MARMOT Irradiation-Induced Microstructural Evolution & Physical Property Models Using U-Zr (MVP) *(avail ~2026 & ~2027)*	ATR
CINR	Thermal Conductivity Measurement of Irradiated Metallic Fuel Using TREAT (THOR-EPIC) (EBR-II fuel pins, *fresh U-Pu-Zr* avail ~2028)	TREAT
CRADA	Disc Irradiation for Separate Effect Testing with Control of Temperature (DISECT) & Characterization-scale Instrumented Neutron Dose Irradiation (CINDI) *(U-Zr, U-Mo avail ~May 2024)*	BR2/TREAT

The Nuclear Fuels and Materials Library

FY 2023 NFML Current and Future Inventory (FY 24-28)

Irradiation/ Submission	Title	Material	Reactor	Add Mfg
CINR	Characterization of the Microstructures & Mechanical Properties of Advanced Structural Alloys for Radiation Service: A Library of ATR Irradiated Specimens	Steels/Alloys	ATR	
EBR-II	EBR II-Surveillance	Steels/Alloys	EBR-II	
EBR-II	EBR-II Legacy Hexblocks and Assemblies	Steels/Alloys	EBR-II	
EBR-II	EBR-II SS Creep	Steels/Alloys	EBR-II	
CINR	Enhancing Irradiation Tolerance of Steels via Nanostructuring by Innovative Manufacturing Techniques (N-SERT)	Steels/Alloys	ATR	AM
CINR	High Fluence Embrittlement Database and ATR Facility for LWR Vessel Life Extension	Steels/Alloys	ATR	
CINR	Influence of Fast Neutron on the Mechanical Properties and Microstructure of Nanostructured Metals/Alloys	Steels/Alloys	ATR	
CINR	Irradiation Influence on Alloys Fabricated by Powder Metallurgy and Hot Isostatic Pressing for Nuclear Applications	Steels/Alloys	ATR	AM
CINR	Irradiation Performance of Fe-Cr Base Alloys	Steels/Alloys	ATR	
CINR	Irradiation Performance Testing of Specimens Produced by Commercially Available Additive Manufacturing Techniques	Steels/Alloys	ATR	AM
CINR	Irradiation Test Plan for the Advanced Test Reactor National Scientific User Facility/University of Wisconsin Pilot Project	Steels/Alloys	ATR	
CINR	Irradiation Testing of LWR Additively Manufactured Materials	Steels/Alloys	ATR	AM
CINR	Irradiation Testing of Materials Produced by Additive Friction Stir Manufacturing a.k.a. Aeroprobe Test of Additively Manufacture Materials (ATAMM)	Steels/Alloys	ATR	AM
Nat'l Lab	LANSCE APT 1996/1997/1999	Steels/Alloys	LANL APT	
Industry	Library Submission - Baffle-former Bolt Donation to NSUF Nuclear Fuels and Materials Library	Steels/Alloys	PWR NPP	
DOE	Library Submission - High Fidelity Ion Beam Simulation of High Dose Neutron	Steels/Alloys	BOR-60	
Industry	Library Submission - LWR 304 SS Core Shroud Samples	Steels/Alloys	LWR NPP	
DOE/AECL	Library Submission - The Effects of Irradiation on Inconel X-750	Steels/Alloys	CANDU	
CINR	Nanodispersion Strengthened Metallic Composites with Enhanced Neutron Tolerance	Steels/Alloys	HFIR	
CINR	**Nuclear Operations Effect on Mobility and Accelerated Diffusion Zr (NOEMAD)** *(avail mid 2024)*	TREAT		
CINR	**Irradiation Influence on Alloys Fabricated by Powder Metallurgy and Hot Isostatic Pressing for Nuclear Applications** *(High Entropy Alloys (HEAs) avail ~mid 2024)*	ATR	AM	
CINR	**Irradiation Testing of LWR Additively Manufactured Materials** *(Alloys 316L, Inconel 718 avail ~mid 2024)*	ATR	AM	
CINR	**Aeroprobe Test of Additively Manufacture Materials (ATAMM)** *(316L avail ~mid 2025)*	ATR	AM	
CINR	**NuScale SMR Materials Irradiation and Testing** *(SA 508, FBNM avail ~late 2027)*	ATR		

The Nuclear Fuels and Materials Library

FY 2023 NFML Current and Future Inventory (FY 24-28)

Irradiation/ Submission	Title	Material	Reactor	Add Mfg
CINR	Characterization of the Microstructures & Mechanical Properties of Advanced Structural Alloys for Radiation Service: A Library of ATR Irradiated Specimens	Steels/Alloys	ATR	
EBR-II	EBR II-Surveillance	Steels/Alloys	EBR-II	
EBR-II	EBR-II Legacy Hexblocks and Assemblies	Steels/Alloys	EBR-II	
EBR-II	EBR-II SS Creep	Steels/Alloys	EBR-II	
CINR	Enhancing Irradiation Tolerance of Steels via Nanostructuring by Innovative Manufacturing Techniques (N-SERT)	Steels/Alloys	ATR	AM
CINR	High Fluence Embrittlement Database and ATR Facility for LWR Vessel Life Extension	Steels/Alloys	ATR	
CINR	Influence of Fast Neutron on the Mechanical Properties and Microstructure of Nanostructured Metals/Alloys	Steels/Alloys	ATR	
CINR	Irradiation Influence on Alloys Fabricated by Powder Metallurgy and Hot Isostatic Pressing for Nuclear Applications	Steels/Alloys	ATR	AM
CINR	Irradiation Performance of Fe-Cr Base Alloys	Steels/Alloys	ATR	
CINR	Irradiation Performance Testing of Specimens Produced by Commercially Available Additive Manufacturing Techniques	Steels/Alloys	ATR	AM
CINR	Irradiation Test Plan for the Advanced Test Reactor National Scientific User Facility/University of Wisconsin Pilot Project	Steels/Alloys	ATR	
CINR	Irradiation Testing of LWR Additively Manufactured Materials	Steels/Alloys	ATR	AM
CINR	Irradiation Testing of Materials Produced by Additive Friction Stir Manufacturing a.k.a. Aeroprobe Test of Additively Manufacture Materials (ATAMM)	Steels/Alloys	ATR	AM
Nat'l Lab	LANSCE APT 1996/1997/1999	Steels/Alloys	LANL APT	
Industry	Library Submission - Baffle-former Bolt Donation to NSUF Nuclear Fuels and Materials Library	Steels/Alloys	PWR NPP	
DOE	Library Submission - High Fidelity Ion Beam Simulation of High Dose Neutron	Steels/Alloys	BOR-60	
Industry	Library Submission - LWR 304 SS Core Shroud Samples	Steels/Alloys	LWR NPP	
DOE/AECL	Library Submission - The Effects of Irradiation on Inconel X-750	Steels/Alloys	CANDU	
CINR	Nanodispersion Strengthened Metallic Composites with Enhanced Neutron Tolerance	Steels/Alloys	HFIR	
CINR	Investigation of Degradation Mechanisms of Cr coated Zirconium alloy cladding in Reactive Initiate Accidents (RIA) (avail ~late 2026)	TREAT		
CINR	Assessment of Irradiated Microstructure and Mechanical Properties of FeCrAl Alloy Fabrication Routes (GENIE) (avail ~late 2027)	ATR/MIBL	AM	
CINR	Nanodispersion Strengthened Metallic Composites with Enhanced Neutron Irradiation Tolerance (Al, Zr, Cu, steel composites avail ~late 2026)	HFIR	AM	
LDRD	Tensile Testing Utilizing the Standard Capsule irradiation (TTUSC) (HEAs avail ~late 2024)	ATR	AM	
CINR	Enhancing Irradiation Tolerance of Steels via Nanostructuring by Innovative Manufacturing Techniques (N-SERT) (HEAs avail ~late 2024 & ~early 2026)	ATR	AM	

User Input Request

NSUF Process for Accepting Material into the NFML

- Run to Brenden and Collin and shout “WE GOT ANOTHER ONE!”
- Discussion between NSUF Management, Chief Scientists
- Discussion between NSUF Management, Chief Scientists, and Donator

Trash or Treasure???

- A value assessment process (VAP) and/or wish-list will help expedite the decision.

User Input is Needed

- **What material gaps exist in the NFML?**
  - Reach out to past NFML users and viewers
  - **QR Code for user input**

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Idaho National Laboratory