Kelly Cunningham
NSUF NFML Coordinator
NSUF User Development Workshop
May 20-24, 2024

NSUF Proposal Opportunities
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). The NFML includes:

- Samples resulting from NSUF-awarded projects,
- Legacy samples from the Experimental Breeder Reactor (EBR-II) shutdown in 1994,
- Samples from real-world components retrieved from decommissioned and operating power reactors,
- Donations from other sources, and
- Technical information and publications associated with all NFML project samples.



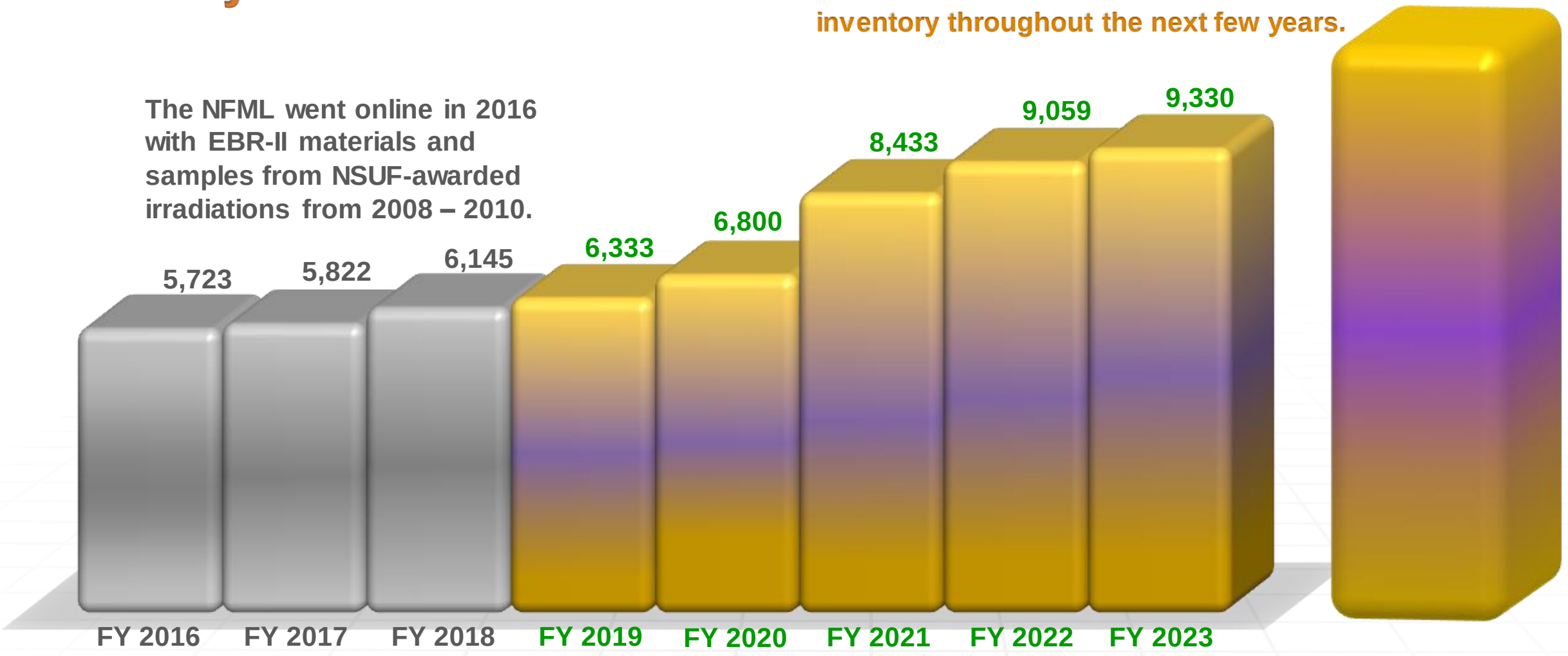
NFML samples are publicly available via NSUF competitive award processes or direct requests granted by the NSUF Director.

The Nuclear Fuels and Materials Library

Inventory Growth

Awarded irradiations from 2017-18 will add more inventory throughout the next few years.

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



Irradiation projects take ~7 years to complete (including PIE)

The Nuclear Fuels and Materials Library

Current Inventory Available to Applicants (subject to availability)

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		INL ATR
Nat'l Lab	**Library Submission - Neutron-Interactions of Advanced Materials**		ORNL HFIR
NSUF SAM	Neutron Transmutation Doping of High-Purity SiC		INL ATR
CINR	Nonstoichiometric Spinel as Inert Matrix		INL ATR
NSUF SAM	NSUF graphite and fiber optic	Sensors	*INL ATR*
CINR	Transducers for In-pile Ultrasonic Measurements of Fuels and Materials Evolution		*INL ATR*
CINR	Hydride LWR Fuel Rod	Fuel	INL ATR
DOE	**Library Submission - KJRR Fuel Plates**		INL ATR
DOE	**Library Submission - Peach Bottom Unit 2 Fuel Rod Sections and Remnants**		BWR NPP
DOE	**Library Submission - Unirradiated TRISO Fuel**		n/a
CINR	Low Fluence Behavior of Metallic Fuels		INL ATR
CINR	Measurement of Actinide Neutronic Transmutation Rates with Accelerator Mass Spectroscopy		INL ATR

The Nuclear Fuels and Materials Library

Current Inventory Available to Applicants (subject to availability)

Irradiation/ Submission	Title	Material	Reactor
CINR	Characterization of the Microstructures & Mechanical Properties of Advanced Structural Alloys for Radiation Service	Steels/Alloys	INL ATR
EBR-II Legacy	EBR II-Surveillance		EBR-II
EBR-II Legacy	EBR-II Legacy Hexblocks and Assemblies		EBR-II
EBR-II Legacy	EBR-II SS Creep		EBR-II
CINR	Enhancing tolerance of steels via nanostructuring by innovative manufacturing techniques		INL ATR
Industry	**Library Submission - Harvested Reactor Pressure Vessel Material from Zion Unit 1**		**LWR NPP**
CINR	High Fluence Embrittlement Database and ATR Facility for LWR Vessel Life Extension		INL ATR
CINR	Influence of Fast Neutron on the Mechanical Properties and Microstructure of Nanostructured Metals/Alloys		INL ATR
CINR	Irradiation Influence on Alloys Fabricated by Powder Metallurgy and Hot Isostatic Pressing for Nuclear Applications		INL ATR
CINR	Irradiation Performance of Fe-Cr Base Alloys		INL ATR
CINR	Irradiation Performance Testing of Specimens Produced by Commercially Available Additive Manufacturing Techniques		INL ATR
CINR	Irradiation Test Plan for the Advanced Test Reactor National Scientific User Facility/University of Wisconsin Pilot Project		INL ATR
CINR	Irradiation Testing of LWR Additively Manufactured Materials		INL ATR
CINR	Irradiation Testing of Materials Produced by Additive Friction Stir Manufacturing		INL ATR
Nat'l Lab	LANSCE APT 1996/1997/1999		LANL APT
Industry	**Library Submission - Baffle-former Bolt Donation to NSUF Nuclear Fuels and Materials Library**		**PWR NPP**
DOE	**Library Submission - High Fidelity Ion Beam Simulation of High Dose Neutron**		**BOR-60**
Industry	**Library Submission - LWR 304 SS Core Shroud Samples**		**LWR NPP**
DOE/AECL	**Library Submission - The Effects of Irradiation on Inconel X-750**		**CANDU**
CINR	Nanodispersion Strengthened Metallic Composites with Enhanced Neutron Tolerance		ORL HFIR

The Nuclear Fuels and Materials Library

Future Inventory to be Added to the Library

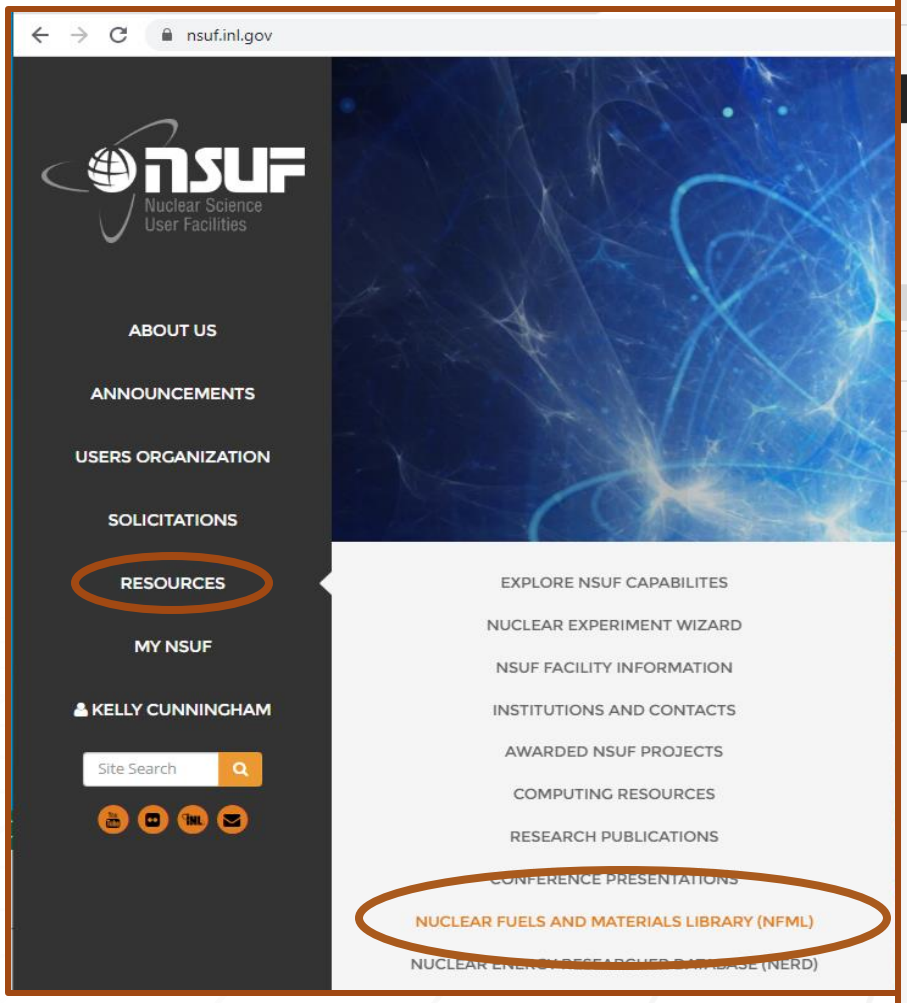
Irradiation/ Submission	Title	Material	Reactor
CINR	Radiation-Enhanced Diffusion of *Ag, Ag-Pd, Eu, and Sr in Neutron Irradiated PyC/SiC Diffusion Couples*	Ceramics	MIBL/HFIR
CINR	*Irradiation of Advanced Neutron Absorbing Material to Support Accident Tolerant Fuel (Samarium Hafnate, Hafnium Carbide)*	Ceramics	ORNL HFIR
CINR	*Additive Manufacturing Of Thermal Sensors For In-Pile Thermal Conductivity Measurement*	Sensor	NCSUR/MITR
CINR	*Radiation Effects On Optical Fiber Sensor Fused Smart Alloy Parts With Graded Alloy Composition Manufactured By Additive Manufacturing Processes*	Sensor	MITR
CINR	*High-Performance Nanostructured Thermoelectric Materials And Generators For In-Pile Harvesting*	Sensor	MITR/MIBL
CINR	*High Fluence Active Irradiation And Combined Effects Testing Of Sapphire Optical Fiber Distributed Temperature Sensors*	Sensor	MITR/OSUR
CINR	*Irradiation Of Optical Components Of In-Situ Laser Spectroscopic Sensors For Advanced Nuclear Reactor Systems*	Sensor	OSURR
CINR	*Integral Fuel Rod Real-Time Wireless Sensor & Transmitter Irradiation Test And Post Irradiation Examination*	Sensor	ORNL HFIR
CINR	*Irradiation Of Sensors And Adhesive Couplants For Application In Lwr Primary Loop Piping And Components*	Sensor	NCSUR
CINR	*Demonstration Of Self Powered Neutron Detectors Performance And Reliability*	Sensor	MITR
CINR	*Integral Fuel Rod Real-Time Wireless Sensor & Transmitter Irradiation Test And Post Irradiation Examination*	Sensor	HFIR
CINR	*Understanding Irradiation Behaviors of Ultrawide Bandgap Ga2O3 High Temperature Sensor Materials for Advanced Nuclear Reactor Systems*	Sensor	NCSUR
CINR	*Deployment And In-Pile Test Of An Instrument For Real-Time Monitoring Thermal Conductivity Evolution Of Nuclear Fuels*	Sensor	MITR
CINR	*Integrated Effects of Irradiation and Flibe Salt on Fuel Pebble and Structural Graphites for Molten Salt Reactors*	Salt	MITR

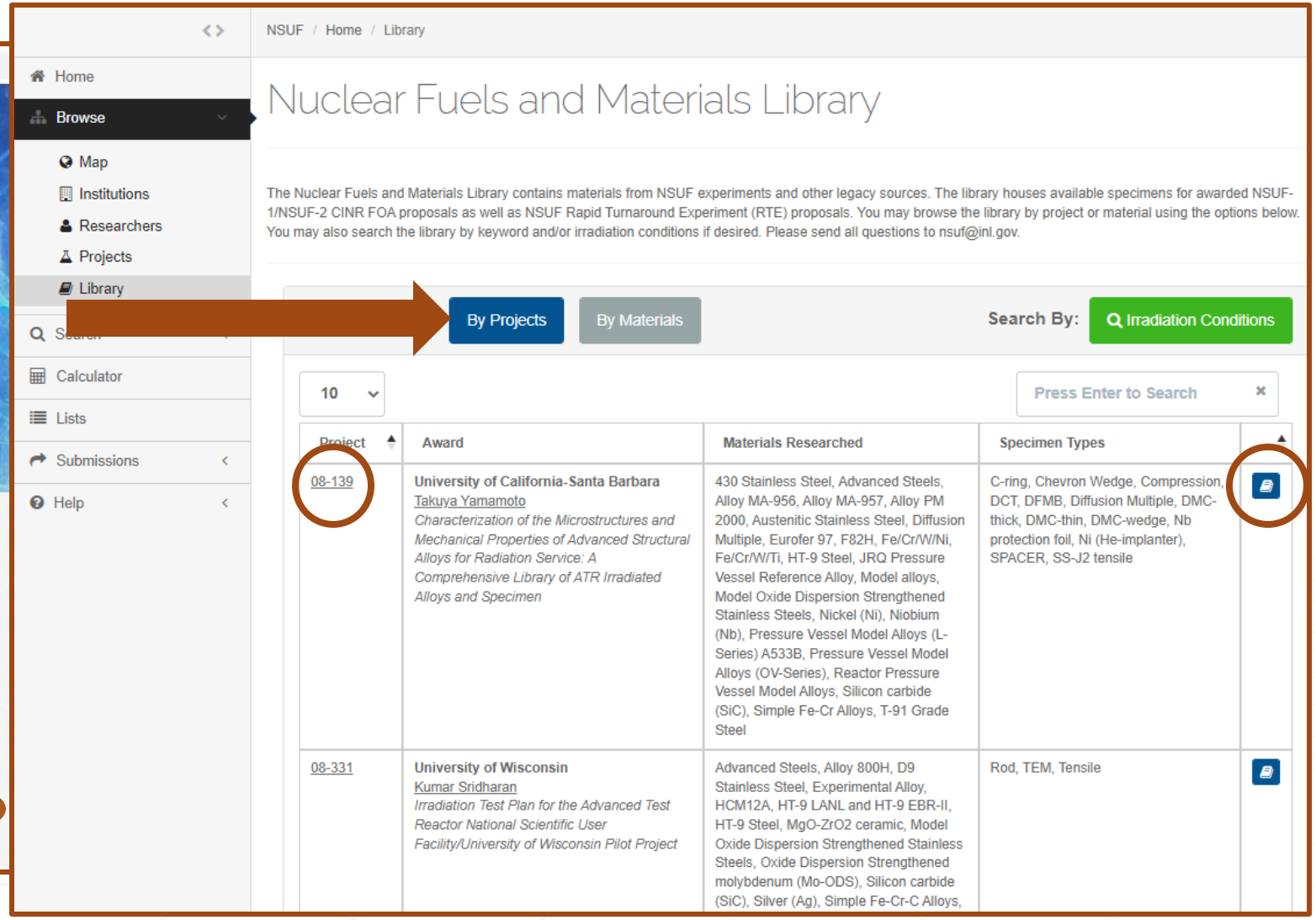
The Nuclear Fuels and Materials Library

Future Inventory to be Added to the Library

Irradiation/ Submission	Title	Material	Reactor
CINR	Demonstration of a Methodology for Direct Validation of MARMOT Irradiation-Induced Microstructural Evolution & Physical Property Models Using U-Zr (MVP)	Fuel	ATR
CINR	Thermal Conductivity Measurement of Irradiated Metallic Fuel Using TREAT (THOR-EPIC) (EBR-II fuel pins, fresh U-PU-Zr)	Fuel	TREAT
Nat'l Lab	Characterization-scale Instrumented Neutron Dose Irradiation (CINDI) (U-Zr, U-Mo)	Fuel	TREAT
CRADA	*Disc Irradiation for Separate Effect Testing with Control of Temperature (DISECT) (U-Zr, U-Mo)*	Fuel	BR2
CINR	*Fission Product Transport in TRISO*	Fuel	MIBL
CINR	*High Power Irradiation Testing of TRISO Fuel Particles with UCO and UO2 Kernels in Miniature Fuel Specimen Capsules in HFIR*	Fuel	ORNL HFIR
CINR	Nuclear Operations Effect on Mobility and Accelerated Diffusion (NOEMAD) Zr-(CR,NB, Ta, Mo), (Zry-Cr), Cr-(Nb, Ta, Mo)	Steels/Alloys	TREAT
CINR	Irradiation Influence on Alloys Fabricated by Powder Metallurgy and Hot Isostatic Pressing for Nuclear Applications [High Entropy Alloys (HEAs)]		ATR
CINR	Irradiation Testing of LWR Additively Manufactured Materials (Alloys 316L, Inconel 718)		ATR
CINR	Aeroprobe Test of Additively Manufacture Materials (ATAMM) (316L)		ATR
CINR	NuScale SMR Materials Irradiation and Testing (SA 508, F6NM)		ATR
CINR	Investigation of Degradation Mechanisms of Cr coated Zirconium Alloy Cladding in Reactive Initiate Accidents (RIA)		TREAT
CINR	Assessment of Irradiated Microstructure and Mechanical Properties of FeCrAl Alloy Fabrication Routes (GENIE)		ATR/MIBL
LDRD	Tensile Testing Utilizing the Standard Capsule Irradiation (TTUSC) *(HEAs)*		ATR
CINR	Enhancing Irradiation Tolerance of Steels via Nanostructuring by Innovative Manufacturing Techniques (N-SERT) (HEAs)		ATR
CINR	*Role of Minor Alloying Elements on Long Range Ordering in Ni-Cr Alloys*		WIBR
CINR	*Capacitive Discharge Resistance Welding of 14YWT and Ferritic ODS Alloys for Cladding Applications*		WIBL/MIBL
CINR	*High-dose Ion Irradiation Testing and Relevant Post-Irradiation Examination of Friction-Stir-Welded ODS MA956 Alloy*		TAMU
CINR	*Irradiation-Assisted Stress Corrosion Cracking of PWR-Irradiated Type 347 Stainless Steel*		MIBL
CINR	*Machine Learning on High-Throughput Databases of Irradiation Response & Corrosion Properties of Selected Compositionally Complex Alloys for Structural Nuclear Materials (FeCrMnNi, FeCrMoNi, MoNbTiV, MoNbTaW Quaternary Systems)*		WIBL

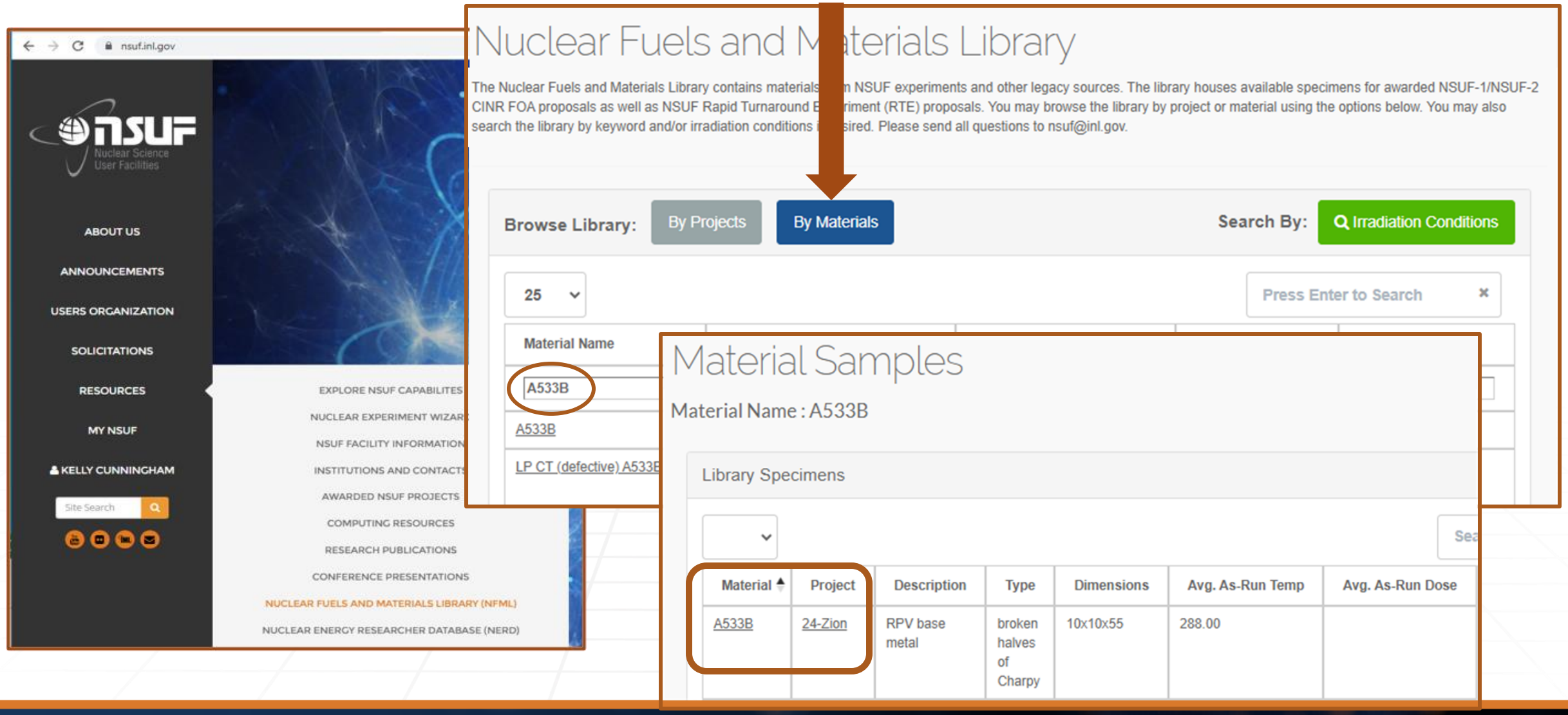
The Nuclear Fuels and Materials Library
Finding NFML Material/Samples – Search by Projects





The Nuclear Fuels and Materials Library

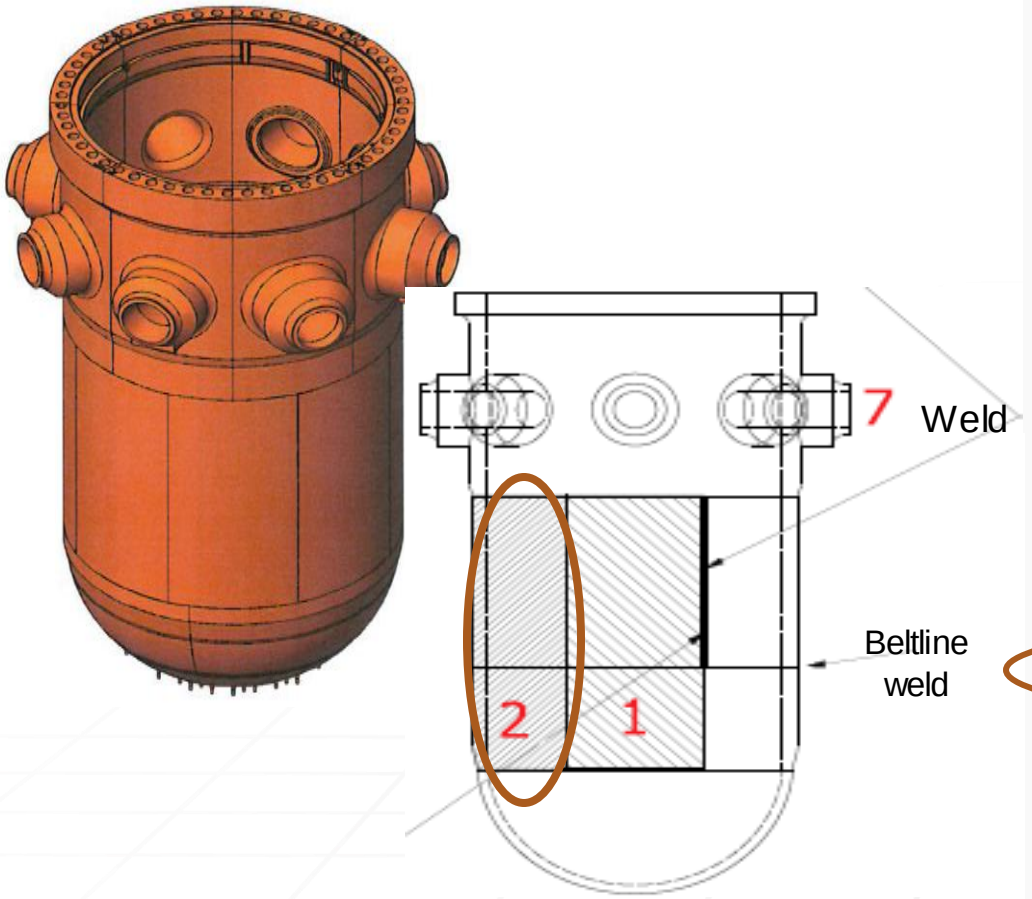
Finding NFML Material/Samples – Search by Materials



The Nuclear Fuels and Materials Library

New Donation - HARVESTED NUCLEAR POWER PLANT MATERIAL (A533B)

Zion Unit 1 Reactor Pressure Vessel



NSUF Nuclear Science User Facilities — Research

NSUF / Home / Library / Harvested Reactor Pressure Vessel Material from Zion Unit 1 ...

Project

Project Type	NFML
Project Title	Harvested Reactor Pressure Vessel Material from Zion Unit 1
Abstract	The decommissioning of the Zion Units 1 and 2 Nuclear Generating Station in Zion Illinois presented a special and timely opportunity for developing a better understanding of materials degradation and other issues associated with extending the lifetime of existing nuclear power plants (NPPs) beyond 60 years of service. In support of extended service and current operations of the US nuclear reactor fleet, ORNL, through the Department of Energy (DOE), Light Water Reactor Sustainability (LWRS) Program, coordinated and contracted with Zion Solutions, LLC, to acquire materials from Zion to evaluate potential materials degradation issues associated with extended lifetime of existing nuclear power plants. The LWRS Program and other organizations acquired materials from the Zion Unit 1 reactor pressure vessel (RPV) containing well-characterized base metal heat B7835-1 and a section of the well-characterized WF-70 beltline weld (between the lower and the intermediate shells). The harvested material was cut into blocks for machining into mechanical test specimens and microstructural characterization samples. A portion of the A533B test specimens have been donated from the DOE LWRS Program to the NSUF Program to be listed in NFML and made available for nuclear energy research.
Research Team	
Project Code	24-Zion
Research Area	Light Water Reactor Sustainability (LWRS)
Material Type	Reactor Pressure Vessel (RPV) Steels
Keywords	RPV, Harvested, PWR, NPP, Base Metal
Document Name	LWRS Report on Completion of Machining of Zion Unit 1 RPV Blocks.pdf

Samples (112) | Resources (4) | Publications (2) | Presentations (0)

Samples (112) | Resources (4) | Publications (2) | Presentations (0)

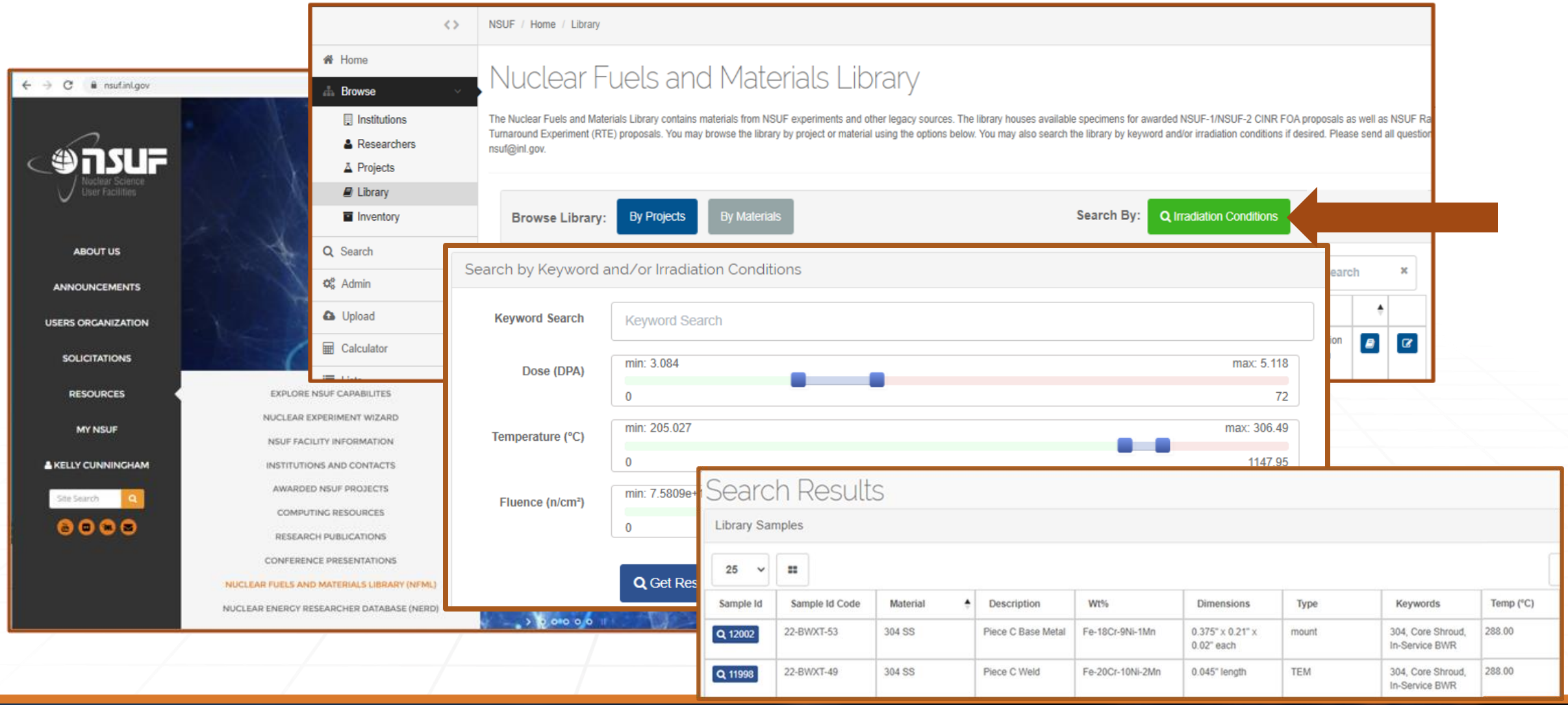
Samples (112) | Resources (4) | Publications (2) | Presentations (0)

Samples (112) | Resources (4) | Publications (2) | Presentations (0)

Year	Title	Authors	Conference	Dates	Location
No data available in table					

The Nuclear Fuels and Materials Library

Finding NFML Material/Samples – Search by Irradiation Conditions



The Nuclear Fuels and Materials Library

Recent Donation - HARVESTED NUCLEAR POWER PLANT MATERIAL

LWR Core Shroud Material Irradiation Conditions

Project

Is Active	True
Project Type	NFML
Project Title	LWR 304 SS Core Shroud Samples
Abstract	
PI Name	Ms. Kelly Cunningham
Email:	
Phone:	
Research Team	
Tech Lead	Collin Knight
Project Code	22-BWXT
Research Area	Light Water Reactor Sustainability (LWRS)
Material Type	Austenitic Steels
Keywords	Core, LWR

BWXT Piece B1 Remnant 1"x 0.7" x 0.65"



Samples (82) | Resources (10) | Publications (0) | Presentations (0)

15 | Export Sample Data

	ID	KGT#	Description	Material	Specimen	Available
View	22-BWXT-01		Piece A Base Metal	304 SS	remnant	Yes

NSUF / Home / Browse Projects / LWR 304 SS Core Shroud Samples... / 22-BWXT-15

22-BWXT-15 LWR 304 SS Core Shroud Samples

Is Approved	True
Program	NSUF
Project	LWR 304 SS Core Shroud Samples
Reactor	LWR
Reactor Position	core shroud
Sample Id Code	22-BWXT-15
Material Code	Piece B2
Material Name	304 SS
Material Description	Piece B Weld, HAZ, BM
Specimen Type	remnant
Dimensions (mm)	1.8" x 0.7" x 0.65"
Number Of Samples	1
Samples Remaining	1
Available for Research	Yes
Anticipated Availability	August 8, 2023
Certification	No
Storage Facility	Hot Fuel Examination Facility
Notes	Irregular shaped piece contains mostly weld and HAZ, and base material adjacent to tensile specimens (on wetted surface). Weight 35 g. Es
As Run Temp (°C)	288.00
As Run Dose (DPA)	3.25
As Run Fluence (n/cm²)	2.3E+21
As Run Flux (n/cm²/s)	1E+10
As Run Environment	LWR
Composition by Wt. (%)	Fe -19.8Cr -9.83Ni -1.52Mn -0.42V -0.16Co -0.13Si -0.1B -0.1Cu -0.1Mo -0.1Nb -0.1P -0.1S -0.1Ta -0.1Ti -0.1Zr

BWXT Piece B2

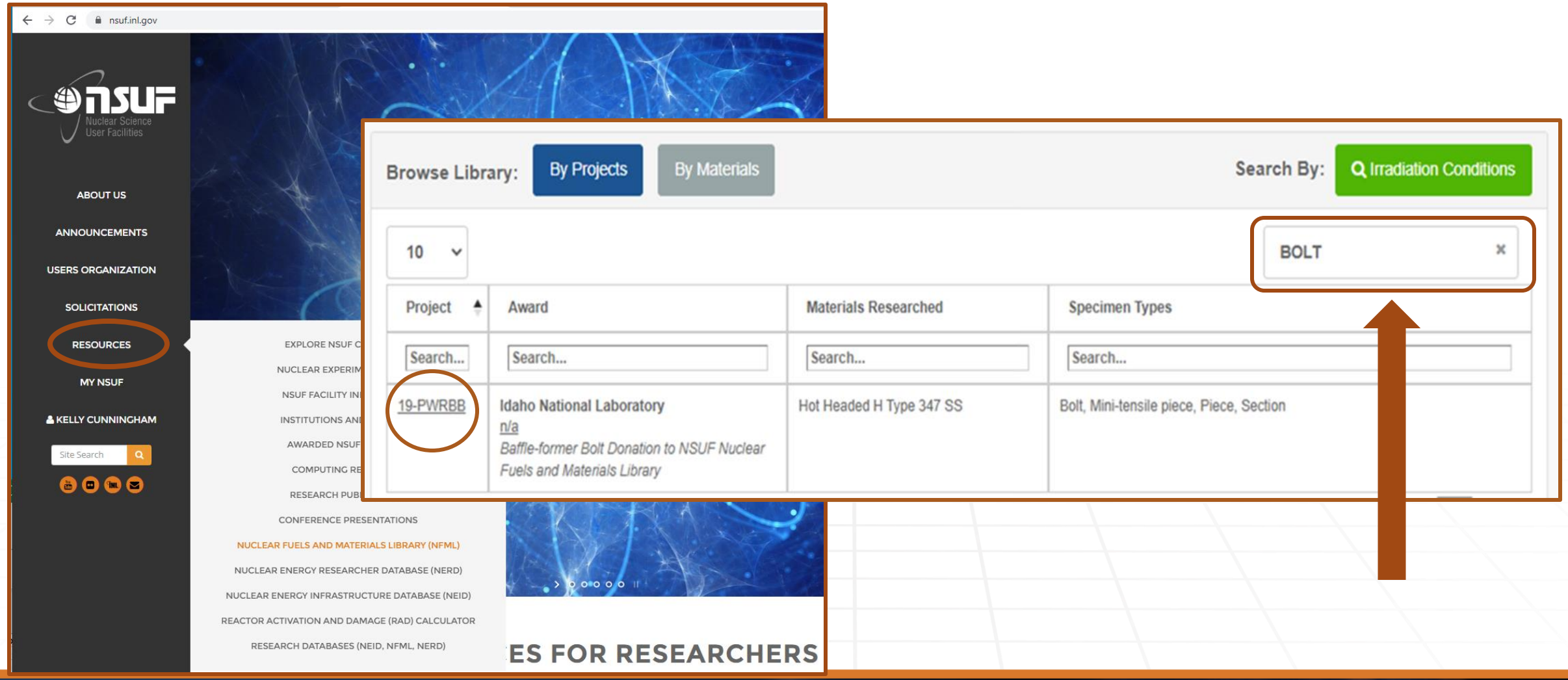


As Run Temp (°C) 288.00

As Run Dose (DPA) 3.25

The Nuclear Fuels and Materials Library

Finding NFML Material/Samples – Search by Text



The Nuclear Fuels and Materials Library

Past Donation - HARVESTED NUCLEAR POWER PLANT MATERIAL

Text Search - Baffle-former BOLTS from Pressurized Water Reactors

Project

Project Type	NFML
Project Title	Baffle-former Bolt Donation to NSUF Nuclear Fuels and Materials Library
Abstract	Baffle-former bolts have become a significant aging management issue for pressurized water reactors (PW cell facility currently holds baffle-former bolts extracted from several different PWRs, removed at different t locations within the reactor assemblies. Because of this, the collection of baffle-former bolts represents a v conditions and an especially large spread in radiation damage dose. Therefore, these materials are seen a research that seeks to support the life extension of PWRs. The NSUF program allows researchers access science facilities, and the library of irradiated materials maintained by INL further supports allowing researc irradiated materials. For this reason, the donation of the baffle-former bolts to INL's library would substanti volume of PWR relevant materials available to researchers and support advancing the understanding of ag issues and irradiation damage in commercial reactor components. Ultimately, this supports long-term oper
Research Team	Kevin G. Field, Kumar Sridharan, Philip D. Edmondson
Project Code	19-PWRBB
Research Area	Cladding and Other Structural Materials
Material Type	Austenitic Steels/Alloys, RPV Steels
Document Name	RT-LTR-18-7 Baffle Bolts.pdf
Partner Facilities:	Idaho National Laboratory



NSUF / Home / Browse Projects / Baffle-former Bolt Donation to NSUF Nuclear Fuels and Materials L... / 19-PWRBB-002

19-PWRBB-002 Baffle-former Bolt Donation to NSUF Nuclear Fuels and Materials Library

Program	NSUF
Project	Baffle-former Bolt Donation to NSUF Nuclear Fuels and Materials Library
Reactor	PWR
Sample Id Code	19-PWRBB-002
Material Code	3212
Material Name	Hot Headed H Type 347 SS
Material Description	Intact
Specimen Type	Bolt
Number Of Samples	1
Samples Remaining	1
Available for Research	Yes
Anticipated Availability	September 1, 2019
Certification	Yes
Storage Facility	Churchill Laboratory Services
Notes	See project attachment RT-LTR-18-7
As Run Temp (°C)	347.00
As Run Total Dose (DPA)	15
Keyword Tags	347 SS; Baffle Bolt

The Nuclear Fuels and Materials Library

NSUF Proposal Form – NOT NFML Samples

☐ **Samples are listed in the Nuclear Fuels and Materials Library**

If not listed in the NFML, please answer the following questions.

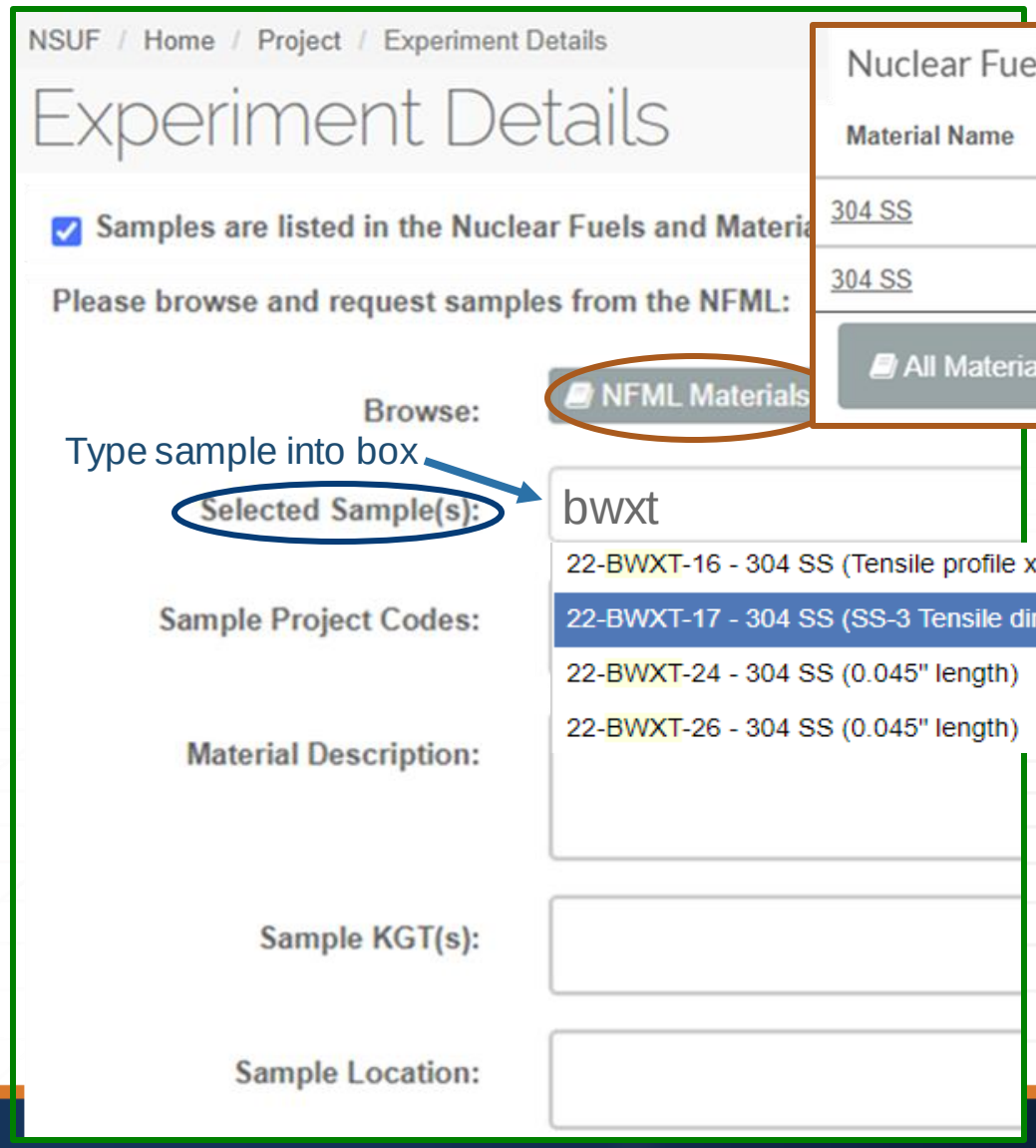
All fields are required.

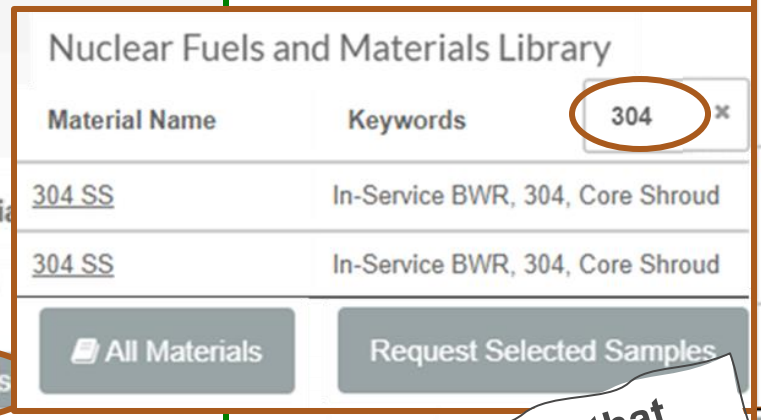
- What is the material?
- What is the current configuration, dimensions and description of the sample?
- What are the activity levels of the sample?
- In what specific facility and building is the sample located?
- Is the sample ready and available for the experiment?
- Who is the owner of the material?
- How are the samples identified? Please provide specific sample references utilized by the storage facility for positive identification.

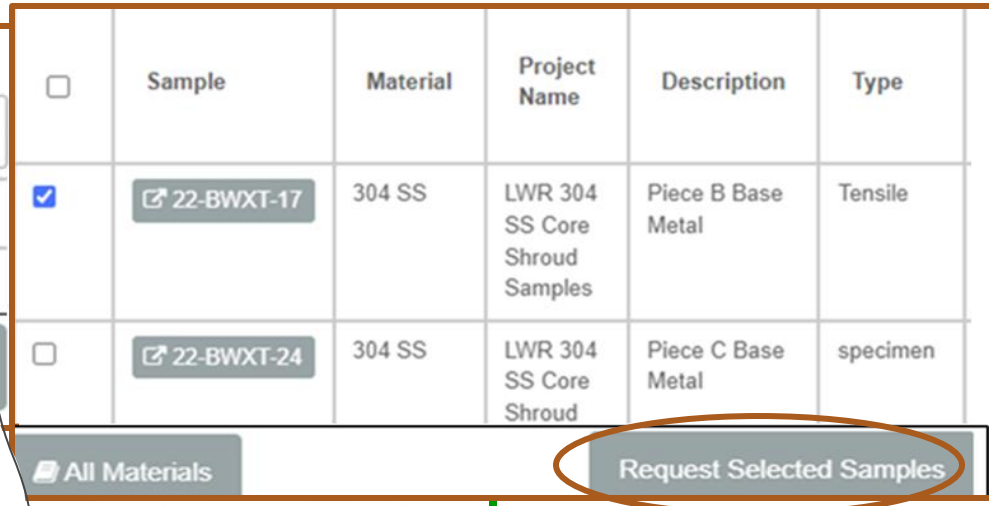
Material:	What is the material being researched?
Configuration:	What is the current configuration, dimensions and description of the sample?
Activity:	What are the activity levels of the sample?
Location:	In what specific facility and building is the sample located?
Availability:	Is the sample ready and available for the ex

The Nuclear Fuels and Materials Library

NSUF Proposal Form – Selecting NFML Samples

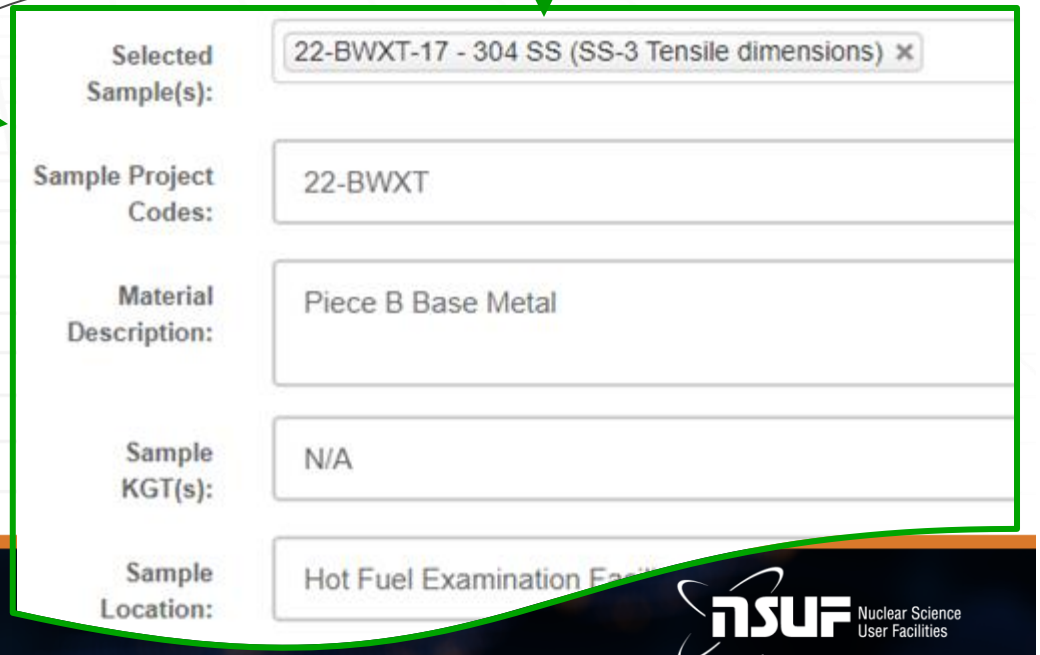






Samples that aren't listed are NOT available.

Form will auto-populate with selected NFML samples



The Nuclear Fuels and Materials Library

NFML Project Resources Available to Applicants

Kelly Cunningham

Administrator | NSUF Nuclear Fuels and Materials Library

Kelly.cunningham@inl.gov

Idaho National Laboratory

(w) 208-526-2369

(c)208-881-7763