APPENDIX B: Nuclear Data Priorities, Basis Statements, and Milestones

Nuclear Data Measurements							
Materials	**Pre-FY2022**	**FY2022**	**FY2023**	**FY2024**	**FY2025**	**FY2026**	**Post-FY2026**
Cesium (^{133}Cs)			LANL	LANL	LANL		
Basis	^{133}Cs is an important fission product for burnup credit. Cross sections have been identified as inadequate (ORNL/TM-2005/65). The DICER and DANCE instruments will be used at LANSCE to provide necessary data to support a new evaluation. (Contingent on Funding)						
Chlorine (^{35}Cl)			ORNL	ORNL			
			LANL	LANL			
Basis	Measurement of the ^{35}Cl (n,p) cross section from thermal to 100 keV using LENZ at LANL. Chlorine is present in fuel cycle facilities in Pu solutions, electrorefining processes, chloride salts, and as brine/drift in some repository environments. Improved ^{35}Cl (n,p) cross sections needed for poison credit in these in these environments. A need for improved ^{35}Cl cross sections has been specifically identified at LANL and Y-12. (Contingent on Funding)						
Chromium (^{53}Cr)	RPI						
Chromium (^{50,53}Cr)				ORNL			
Basis	Measurement of the ^{53}Cr neutron capture cross section in the 2-10 keV energy range is needed to resolve discrepancies observed in historical fast assembly benchmarks containing stainless steel. The RPI measurement will address data request by CSEWG and IAEA. ORNL will measure ^{50,53}Cr neutron capture below 10 keV at GELINA using diluted samples to reduce or minimize multiple scattering and neutron sensitivity effects impacting prior measurements. Cr50 data over the RR range are needed.						
Fluorine (^{19}F)				ORNL	ORNL		
				IRSN	IRSN		
Basis	Measurement of the ^{19}F inelastic scattering reaction channels at GELINA that appear to be underestimated in the current evaluation. Analysis and evaluation of the angular distributions in the RRR. Errors in fluorine may be contributing to bias in ^{233}U benchmarks. Fluorine is used in the uranium enrichment process and molten salt reactor coolants.						
Iodine						RPI	
Basis	Measurement of neutron capture cross section of Iodine at RPI needed to resolve large discrepancies in simulations of large NaI detectors used for neutron capture cross section measurements. Will also support improved modeling of NaI gamma detectors in neutron fields for other DOE and DOD applications.						
Iron (^{54}Fe)	RPI	RPI					
	IRSN	IRSN					
Basis	Measurement of the neutron capture cross section for ^{54}Fe in the keV energy range at RPI is needed to support development of consistent Fe cross section evaluations. Recent measurement and evaluation work on ^{56}Fe has highlighted the need for new measurements and evaluation for ^{54}Fe. Iron is a ubiquitous element used in reactor, fuel cycle facility, spent fuel storage, and radiation shielding applications. IRSN is interested in this measurement as well.						
Molybdenum (^{95}Mo)					RPI	RPI	RPI
					NNL	NNL	NNL
	LANL						
	IRSN						
Basis	Measurement of neutron capture in ^{95}Mo in resonance range, URR at RPI. Neutron transmission measurements previously completed at RPI. ^{95}Mo is a stable fission product and the primary absorbing nuclide in natural Molybdenum. Molybdenum isotopes are currently encountered in irradiated fuel as fission products or in molybdenum alloys in research reactors and space reactors. The current primary interest in NCS is for fission product credit for transport casks, irradiated fuel storage, and reprocessing plants (UPu-MoZr deposits in French reprocessing plant equipment for example). Needs identified by NR and IRSN for fission product credit and Y-12 for U-Mo applications (lower priority). Isotopically enriched sample required. LANL completed analysis of existing high-quality ORELA capture and transmission data in the resolved and unresolved resonance regions. RPI/NNL to reassess the						

Nuclear Data Measurements							
Materials	**Pre-FY2022**	**FY2022**	**FY2023**	**FY2024**	**FY2025**	**FY2026**	**Post-FY2026**
	needs for addition measurements once the RPI LINAC returns to operation following the upgrade.						
Neptunium (^{237}Np)					ORNL	ORNL	ORNL
					LANL	LANL	LANL
Basis	Measurement of ^{237}Np nuclear data at LANL. ^{237}Np is an actinide of interest in nuclear criticality safety for applications at ORNL and other sites. Applications include ^{238}Pu production w/ HFIR at ORNL (low NCSP priority) and fast burst reactor for LANL. Nuclear data improvements will improve critical mass estimates. On the HPRL there is a request for fission cross section in the energy range from 200 keV to 20 MeV. The application list was fast systems, and the required accuracy is 1.5-4%. This requirement comes from the desire to improve the current low accuracy in the covariance matrix (6-8%). (Note that LANL Measurement is Contingent on Funding)						
Plutonium (^{239}Pu)			LANL	LANL	LANL		
			IRSN	IRSN	IRSN		
Basis	There has been a recent IRSN request for a new measurement of the ^{239}Pu neutron total cross section at low neutron energies to better enable a new resonance evaluation of the plutonium isotopes. This evaluation work is concentrated on the evaluation of ^{239}Pu to improve benchmark calculations for thermal plutonium solutions, which remain problematic despite much work over the years. While transmission (total cross section) data are available in the low-energy region, the majority of these data are not of the quality needed to inform the resonance evaluation. Capabilities afforded by the new DICER (Device for Indirect Capture Experiments on Radionuclides) instrument at LANSCE (Los Alamos) promise higher-quality data to support the evaluation work.						
Plutonium (^{240}Pu)	LANL	LANL					
	LLNL	LLNL					
Basis	Measure ^{240}Pu prompt fission neutron energy spectra (PFNS) with Chi-Nu detector at LANL (LANCSE/WNR). The need for more accurate PFNS has been recognized. Supports applications with WG Pu and reactor grade Pu. This is a joint LANL/LLNL measurement.						
Samarium (^{151}Sm)							LANL
Basis	^{151}Sm is an important fission product for burnup credit. Cross sections have been identified as inadequate (ORNL/TM-2005/65). The DICER and DANCE instruments will be used at LANSCE to provide necessary data. (Contingent on Funding)						
Strontium (^{86,87}Sr)						ORNL	ORNL
Basis	Enriched ^{86,87}Sr transmission and capture measurements at GELINA are needed to supplement existing ^{88}Sr ORNL measurements to support complete RR evaluation for natural strontium isotopes for ENDF/B. ^{86,87}Sr are minor isotopes representing about 18% of natural strontium.						
Uranium (^{233}U)	LANL	LANL		LANL	LANL	LANL	
Basis	^{233}U neutron capture measurements in resonance range and the unresolved fast energy range at the Lujan center at LANCE/LANL using the DANCE detector. ORNL report on ^{233}U data assessment concluded that a new evaluation with revised (renormalized) fission cross section is needed. After re-evaluation of the ^{233}U, new capture cross section measurements (resonance region) may be needed to support this evaluation. NCS applications at LANL (CMR), ORNL, DAF/NCERC, spare unirradiated LWBR modules at INL. LANL will measure capture cross section using the DANCE detector multiplicity features in FY20-FY22. Prompt fission neutron spectra will be measured at LANSCE / Chi-Nu in FY24-FY26 (subject to available funding).						
Uranium (^{236}U)						ORNL	ORNL
Basis	^{236}U high-resolution transmission measurements in the RRR at GELINA or LANL to complement recent LANL fast energy evaluation. ^{236}U is a minor activation product present in HEU. Improved ^{236}U cross section evaluation supports all DOE programs using HEU.						
Vanadium (^{51}V)				ORNL	ORNL		
Basis	Recent vanadium measurements showed large multiple scattering corrections needed to be accounted for neutron energies below 10 keV. Additional measurements are needed at GELINA possible using diluted samples on order to reduce or minimize the neutron sensitivity to experimental setup. Vanadium is used in some fissile material containers.						

Nuclear Data Measurements							
Materials	**Pre-FY2022**	**FY2022**	**FY2023**	**FY2024**	**FY2025**	**FY2026**	**Post-FY2026**
Zirconium (^{90,91,92,94,96}Zr)	ORNL	ORNL	ORNL	ORNL			
Basis	Neutron capture and possibly transmission measurements in resonance range at GELINA. Old ORELA transmission data on enriched isotopes are available for analysis. Isotopically enriched samples are required. Zirconium is a key structural element that is primarily used in cladding for fuel rods and is currently in consideration for use with advanced nuclear fuel matrices in the form of zirconium hydride. The main application is reactor fuel cladding. ^{nat}Zr transmission and capture measurements were recently completed by ORNL. NR continues to be unsatisfied with Zr evaluations in ENDF.						
Polystyrene (C_8H_8)	ORNL RPI	ORNL					
Basis	Polystyrene is a moderator material found in several thermal systems (PCT001, PCT02, MCT012, MCT013, MCT014, MCT016). Currently, polyethylene is used as a surrogate to represent thermal scattering in polystyrene in neutron transport simulations. This SNS measurement and evaluation will determine the validity of this approximation, as well as inform future substitutions for other hydrocarbons found in benchmarks. RPI will perform subthermal transmission measurements to support this TSL evaluation.						
Polyethylene (C_2H_4)	RPI						
Basis	Polyethylene is a ubiquitous moderator material used in critical assemblies, shipping containers and fuel cycle facilities. RPI will perform subthermal transmission measurements to support TSL evaluation validation.						
Yttrium Hydride (YH_x)	RPI	RPI					
Basis	Yttrium hydride is an advanced high temperature moderator used in advanced reactor designs. RPI performed subthermal transmission measurements to support TSL evaluation validation as part of the subthermal transmission target development.						

List Legend	ORNL	RPI	LANL	LLNL/NCSU	IRSN	NNL	BNL

Nuclear Data Evaluations							
Materials	**Pre-FY2022**	**FY2022**	**FY2023**	**FY2024**	**FY2025**	**FY2026**	**Post-FY2026**
Beryllium (^{9}Be)		LANL	LANL	LANL	LANL	LANL	
Basis	Be-9 evaluations continue to be challenged by benchmark critical experiments. See pg. 167 of the ENDF/B-VIII.0 report. The accompanying text indicates "there is considerable spread in these Be assembly results." The ENDF/B-VIII.0 evaluation of Be-9 carried over cross sections from ENDF/B-VII.1 but adopted JENDL-4.0 evaluations of elastic scattering angular distribution and (n,2n) angular and energy distributions. This leaves a less-than-satisfactory inconsistency between the elastic angular distributions and integrated cross sections that should be resolved. The proposed approach is to employ a new representation of the four-body (2n,2 alpha) breakup channel in the R-matrix analysis.						
Cerium (Ce)	ORNL						
Basis	Neutron transmission and capture of ^{142}Ce in the resonance range. Cerium is an element that is predominately ^{140}Ce (88.450 a/o) and ^{142}Ce (11.114 a/o) and can be found in chemical processing streams because it is commercially used as a catalyst or additive for chemical applications (e.g., glass polishing powder). As a result, cerium appears as an admixed material in process streams. ^{142}Ce is also a stable fission product. Ce has been identified by DOE-EM as a parasitic absorber in Hanford waste processing. DOE-EM requested improved cerium cross sections to support poison credit in NCS analyses.						
Chlorine (^{35}Cl)			ORNL	ORNL	ORNL		
Basis	Revise ^{35}Cl resonance evaluation based on ^{35}Cl(n,p) measurements. Chlorine is present in fuel cycle facilities in Pu solutions, electrorefining processes, chloride salts, and as brine/drift in some repository environments. Improving ^{35}Cl(n,p) cross sections needed for poison credit in these environments. A need for improved ^{35}Cl cross sections has been specifically identified at LANL and Y-12. When measured (n,p) data from nTOF will be available, a new fit to include those can data can be performed together with any new available measurements from LANL						
Chromium (^{50,53}Cr)				ORNL	ORNL	ORNL	
Basis	Measurement and evaluation of ^{50,53}Cr neutron capture cross section below 10 keV energy range is needed to resolve discrepancies observed in historical fast assembly benchmarks containing stainless steel. ORNL will measure ^{50,53}Cr neutron capture below 10 keV at GELINA using diluted samples to reduce or minimize multiple scattering and neutron sensitivity effects impacting prior measurements. Cr50 data over the RR range is needed. The cluster of s-wave resonances (mainly for ^{53}Cr) in the neutron energy region between 1-10 keV is the major update to be performed in the ENDF/B-VIII.0 library. As in the current release the magnitude of the capture cross sections is inconsistent with benchmark calculations.						
Copper (^{63,65}Cu)	ORNL	ORNL					
		LANL	LANL	LANL			
Basis	A revised evaluation of copper isotopes is needed to improve the benchmark performance above 100 keV up to 300 keV. This will include a statistical analysis of the resonance parameters above 100 keV to quantify the impact of the missing resonances in the measured data as well as a guidance in the level spin assignment. Due to the importance of the copper being used in critical assembly applications as reflector, additional work on the angular distributions is needed. Moreover, since benchmark sensitivity extends above 300 keV, a careful analysis of the high energy cross sections is needed. With the adopted corrections described above, further analyses will be devoted to quantifying the impact of the angular distributions in the RRR on benchmarks calculations and neutron scattering measurements.						
Fluorine (^{19}F)				ORNL	ORNL	ORNL	
				IRSN	IRSN	IRSN	
Basis	The evaluation of the ^{19}F inelastic scattering reaction channel is needed since it appears to be underestimated in the current ENDF/B-VIII.0 evaluation. Further analyses and related evaluation of the angular distributions in the RRR are needed. Since fluorine is used in the uranium enrichment process and molten salt reactor coolants, errors in the ^{19}F evaluated data may be contributing to bias in ^{233}U benchmarks.						

Nuclear Data Evaluations							
Materials	**Pre-FY2022**	**FY2022**	**FY2023**	**FY2024**	**FY2025**	**FY2026**	**Post-FY2026**
Hafnium (^{176,177,178,179,180}Hf)	ORNL	ORNL	ORNL	ORNL			
	IRSN	IRSN	IRSN	IRSN			
	NNL	NNL	NNL	NNL			
Basis	Hafnium is a neutron poison used in reactor and fuel cycle applications. IRSN, ORNL and NNL will review the existing Hf RRR and URR evaluations and develop new evaluations if needed to improve agreement with the TEX HEU/Hf experiment. New isotopic measurements needed to make desired improvement.						
Iron (^{54,56,57}Fe)	ORNL	ORNL	ORNL				
	IRSN	IRSN	IRSN				
	BNL	BNL	BNL				
Basis	Although the effort on the Fe isotopes was planned as joint effort between ORNL and IRSN, IRSN mainly led the evaluation effort and it is unclear the status of this set of evaluations. The ORNL contribution to ^{56}Fe was the generation of a preliminary ENDF file solving the problem with the benchmark performance. However, a rigorous evaluation work is still needed for the three major isotopes mainly for the assessment of the inelastic scattering reaction channel. ORNL will revise the ^{54}Fe, ^{56}Fe, and ^{57}Fe resonance evaluations. BNL also participating under DOE-SC funding.						
Iron (^{56}Fe)	ORNL	ORNL	ORNL				
	IRSN	IRSN	IRSN				
	BNL	BNL	BNL				
Basis	Revise high energy resonance region evaluation. Iron is a key element of structural materials in the DOE Complex (e.g., steel) and is used in many configurations (e.g., tanks, piping, admixed material that can serve as neutron absorber, etc.). ^{56}Fe has numerous resonances above the evaluated resonance range, extending far above the threshold for the first inelastic state. Currently, the latest ^{56}Fe evaluation in the ENDF/B data files does not have detailed resonance parameters here; rather, the evaluation provides a pointwise representation. The ^{56}Fe resonance evaluation will significantly improve radiation transport calculations for systems involving iron (i.e., critical benchmark analyses and criticality safety analyses of processes in the DOE Complex). Evaluation work was performed at IRSN in the past but was not apparently included in ENDF (this will be reviewed and considered for inclusion in ENDF). BNL also participating under DOE-SC funding.						
Lanthanum (La)	ORNL	ORNL					
Basis	^{139}La resonance range evaluation based on ^{nat}La measurements. Lanthanum is an element that is predominantly ^{139}La (99.910 a/o) and a stable fission product. The primary NCS interest is for fission product credit. In the latest version of ENDF nuclear data library, the resonance analysis is based on parameters obtained with an experimental set up which is known to have certain problems. Currently, ENDF/B-VIII evaluations for La do not have adequate covariance data based on experimental data. Improved covariance data are needed to support sensitivity/uncertainty analyses for fission product credit applications.						
Lead (^{204,206,207,208}Pb)	ORNL	ORNL	ORNL				
	RPI	RPI	RPI				
	BNL	BNL	BNL				
	NNL	NNL	NNL				
	IRSN	IRSN	IRSN				
Basis	Lead is a ubiquitous material in the nuclear industry. Lead possesses not only high photon attenuation properties, which make it almost a universal choice as a gamma-ray shielding material, but also desirable neutronic qualities. Our ability to match experimental data with Pb (reflectors and as a scattering target) is less that we desire. Pb-208 is the majority isotope of natural lead. The current ENDF evaluation is known to suffer from deficiencies in neutron angular distributions. The emphasis of the re-evaluation work is on these angular distributions. We will judge success of this work based on recent semi-integral measurements performed at RPI. ORNL proposed to revisit RRR to address angular distribution concerns. RPI/BNL/NNL/IRSN also have a NE funded collaboration to evaluate Pb at energies relevant to fast reactors.						

Nuclear Data Evaluations							
Materials	**Pre-FY2022**	**FY2022**	**FY2023**	**FY2024**	**FY2025**	**FY2026**	**Post-FY2026**
Lithium (^{6}Li)	LANL	LANL	LANL	LANL			
Basis	The Li-6 evaluation in ENDF/B-VIII.0 was based on a combination of EDA R-Matrix fits to all reactions open in the Li-7 system up to ~ 4 MeV, influenced by the standards GMA 2017 result for the (n,t) reaction, and ENDF/B-VII.1 values above ~4 MeV. Li-6 is important for a number of reasons, including as a detector (and reference) in experiments, for example, for Chi-Nu measurement of prompt fission neutron spectra. It is important to extend the R-Matrix analysis to the full 20 MeV range for better precision and more complete (covariance information) at the important lower energy scale of a few MeV. Supports need at Y-12 for the new electrorefining process.						
Molybdenum (^{95}Mo)			IRSN	IRSN	IRSN		
Basis	Resonance region evaluation. ^{95}Mo is a stable fission product and the primary absorbing nuclide in natural molybdenum. Molybdenum isotopes are currently encountered in irradiated fuel as fission products or in molybdenum alloys in research reactors and space reactors. Current primary interest for NCS is for fission product credit for transport casks, irradiated fuel storage, and reprocessing plants (UPu-MoZr deposits in reprocessing plant equipment for example). Needs identified by NR and IRSN for fission product credit and Y-12 for U-Mo applications (lower priority).						
Neptunium (^{237}Np)				ORNL	ORNL		
				LANL	LANL		
Basis	Fast and RRR/URR evaluation. ^{237}Np is an actinide of interest in nuclear criticality safety for applications at ORNL and other sites. Applications include ^{238}Pu production w/ HFIR (low NCSP priority) and fast burst reactor for LANL. Nuclear data improvements will improve critical mass estimates. On the HPRL there is a request for fission cross section in the energy range from 200 keV to 20 MeV. The application list was fast systems, and the required accuracy is 1.5-4%. This requirement comes from the desire to improve the current low accuracy in the covariance matrix (6-8%). ORNL to provide RRR/URR evaluation and LANL the fast energy range evaluation.						
Nitrogen (^{14}N)		ORNL	ORNL	ORNL			
	Nitrogen cross section are important in the reprocessing process and related analyses. Nitrogen was recently included as action item in the series of INDEN meetings for light nuclei evaluations. In the ENDF/B-VIII.0 library there are no resonance parameters for nitrogen.						
Oxygen (^{16}O)		LANL	LANL	LANL	LANL	LANL	
Basis	^{16}O is a pervasive isotope in criticality safety applications, including as a component of water or a component of fissile material. Challenges related to fidelity of ^{16}O evaluations have persisted for decades in validation studies. Extending high-fidelity R-Matrix analysis to higher incident neutron energies should help address these issues.						
Plutonium (^{238}Pu, ^{240}Pu, ^{241}Pu, ^{242}Pu)		LANL	LANL		LANL	LANL	
Basis	Minor isotopes of plutonium are always a part of the overall material. It is therefore important that appropriate attention be given to their nuclear data, especially fission data. Los Alamos has committed to consistent evaluations across isotopes. Develop consistent nu-bar evaluation supported by a model code to provide better evaluated nu-bar for minor Pu-isotopes in FY22-FY23. Develop consistent PFNS evaluation supported by a model code to provide better evaluated PFNS for minor Pu-isotopes in FY25-FY26.						

Nuclear Data Evaluations							
Materials	**Pre-FY2022**	**FY2022**	**FY2023**	**FY2024**	**FY2025**	**FY2026**	**Post-FY2026**
Plutonium (^{239}Pu)	LANL	LANL					
	ORNL	ORNL	ORNL	ORNL			
		IRSN	IRSN	IRSN			
Basis	^{239}Pu is one of the three major fissile isotopes of interest in Nuclear Criticality Safety. ^{239}Pu is used at LANL, LLNL, Hanford, SRS, and other locations in sufficient quantities to be an NCS concern. ^{239}Pu is a major factor in countless ICSBEP benchmarks. NCSP driver includes inadequate agreement of computations with PU-SOL-THERM benchmarks (biased high). Major experimental campaigns at LANSCE for ^{239}Pu fission cross section and PFNS are nearing conclusion and the resulting data need to be incorporated into an updated evaluation. ORNL to assist with evaluation work. ORNL and IRSN will collaborate on a review of existing RRR and URR evaluation data and prepare new RRR/URR evaluations that will improve agreement with TEX Pu experimental results.						
Plutonium (^{240}Pu)				ORNL	ORNL		
		LANL	LANL	LANL			
Basis	^{240}Pu is a meaningful component of almost all Pu benchmark experiments, and a significant component in some. This isotope is the next major constituent of plutonium and can reach 20% or more enrichment in reactor fuel. Some changes were made in ENDF/B-VIII.0, but there have been no accurate prompt fission spectra measurements previously. Such experiments, and subsequent re-evaluation will benefit criticality safety analysis for MOX fuel reprocessing, fabrication and disposal. LANL will evaluate the ^{240}Pu PFNS based on recent Chi-Nu measurements. ORNL will evaluate RR.						
Rhodium (^{103}Rh)	ORNL	ORNL	ORNL				
	NNL	NNL	NNL				
	IRSN	IRSN	IRSN				
Basis	Update resonance evaluation based on RPI transmission and capture measurements in the RRR/URR. ^{103}Rh is a stable fission product, NCS interest is for fission product credit. Integral experiments are in process that will determine need for new evaluations. Evaluation priority - elevated per IRSN request.						
Strontium (^{88}Sr)	ORNL	ORNL	ORNL				
Basis	Existing R-matrix analysis of ^{88}Sr in the RRR was performed from the fit of ORELA transmission and capture measurements but the evaluation work was never included in the ENDF/B-VIII.0 library. Strontium is a fission product typically found in spent fuel and in high level waste tanks at Hanford and Savanah River.						
Strontium (^{86,87}Sr)						ORNL	ORNL
Basis	^{86,87}Sr RR evaluation based on transmission and capture measurements performed at GELINA to supplement existing ^{88}Sr ORNL measurements to support complete RR evaluation for natural strontium isotopes for ENDF/B. ^{86,87}Sr are minor isotopes representing about 18% of natural strontium.						
Tantalum (Ta)	ORNL	ORNL					
	NNL	NNL					
	LANL	LANL					
Basis	Resonance evaluation based on GELINA and RPI measurements. Tantalum is used at Y-12 for recovering uranium from machine turnings and at LANL for Pu casting operations in PF-4 where it may provide modest moderation and reflection of fissile material. Tantalum is chosen due to its material properties, as it is one of the few materials that can contain molten plutonium metal. Due to this characteristic, tantalum is often used as crucible, distributer, launder, or molds for plutonium casting operations. The wall thickness of these materials varies from a few mm all the way up to a few cm. ^{181}Ta is one of the oldest evaluations in ENDF and long overdue for update. Integral experiments in progress to validate Ta cross sections. Fast region evaluation at LANL in support of PF-4 operations.						

Nuclear Data Evaluations							
Materials	**Pre-FY2022**	**FY2022**	**FY2023**	**FY2024**	**FY2025**	**FY2026**	**Post-FY2026**
Uranium-233	ORNL	ORNL	ORNL	ORNL			
	IRSN	IRSN	IRSN	IRSN			
		LANL	LANL	LANL		LANL	LANL
Basis	^{233}U is a fissile nuclide of interest to criticality safety. The availability of ^{233}U is important to NCS applications mainly at Y-12, ORNL, and at NCERC. 1. The evaluation will include the newly evaluated thermal values from the standard evaluation including the updated fission prompt neutron spectrum. Reevaluate differential data to check the renormalization of ORNL fission data. A new fit for the fission cross sections to account for the Guber and n_TOF fission data, that agree within 2% from 10 eV to 100 keV and higher than the current ENDF/B-VIII.0 evaluated data. Above 100 eV, there are serious discrepancies between ENDF and the new experimental fission data (from Guber and n_TOF) of up to 10% in the 1–10 keV range (Guber). Update with the new standards. RPI has ^{233}U capture data, which is likely the Weston data (Danon). 2. New evaluation fast. Fission spectrum is important for intermediate benchmarks. Renormalize to new standards. Evaluation in the RRR is planned at ORNL/IRSN and in the fast region at LANL. In the RRR the main goal of the new evaluation is to improve the negative bias in the benchmark calculations.						
Uranium-234	LANL						
			ORNL	ORNL			
Basis	While ^{234}U makes up a small fraction of natural uranium, previous studies have shown that ignoring ^{234}U for HEU metal benchmarks can lead to a non-conservative result by as much as 0.4%. Recent advances in the capabilities of the DANCE detector at LANSCE, combined with improved theoretical modeling of the capture reaction (for example, including the M1 scissors-mode contribution to the gamma strength function) have enabled more accurate evaluations of (n,g) cross sections. This work to update the ^{234}U capture cross section will utilize both the experimental and theoretical advances. ORNL work will focus on checking the RRR to determine if it needs to be revised.						
Uranium-235	LANL	LANL	LANL				
			ORNL				
			IRSN				
Basis	^{235}U is one of the three major fissile isotopes of interest in Nuclear Criticality Safety. ^{235}U is used at LANL, LLNL, Hanford, SRS, and GDPs, Y-12, and other locations in sufficient quantities to be an NCS concern. ^{235}U is a major factor in countless ICSBEP benchmarks. Major LANSCE experiments of ^{235}U fission cross section and PFNS are concluding in the next few years, and the resulting data needs to be incorporated into an updated evaluation. Inelastic scattering cross section measurements are also planned, which will allow evaluators to better address these high-uncertainty interactions. Improvement of ^{235}U URR because based on old average resonance parameters. Includes ORNL revisiting ^{235}U URR evaluation.						
Uranium-236	LANL						
							ORNL
							NNL
Basis	^{236}U needs to be considered in modeling of spent fuel. Recent advances in the capabilities of the DANCE detector at LANSCE, combined with improved theoretical modeling of the capture reaction (for example, including the M1 scissors-mode contribution to the gamma strength function) have enabled more accurate evaluations of (n,g) cross sections. This work to update the ^{236}U capture cross section will utilize both the experimental and theoretical advances. ORNL/NNL will evaluate ^{236}U high-resolution transmission measurements in the RRR to complement recent LANL fast energy evaluation. ^{236}U is a minor activation product present in HEU. Improved ^{236}U cross section evaluation supports all DOE programs using HEU.						

Nuclear Data Evaluations							
Materials	**Pre-FY2022**	**FY2022**	**FY2023**	**FY2024**	**FY2025**	**FY2026**	**Post-FY2026**
Uranium-238	LANL	LANL	LANL				
	BNL	BNL	BNL				
Basis	^{238}U is a ubiquitous isotope in HEU, LEU, natural uranium, and depleted uranium. It's presence in HEU and LEU fuels makes it a significant contributor to their reactivity and performance. NU and DU are often used as reflectors or shielding materials, and ^{238}U is obviously the dominant isotope in these materials. ^{238}U is a major factor in countless ICSBEP benchmarks. Major LANSCE experiments on the ^{238}U fission cross section and PFNS are concluding in the next few years, and the resulting data needs to be incorporated into an updated evaluation. LANL will evaluate PFNS and multiplicity data for ^{238}U. As part of a joint DOE-SC NDIAWG funded project, LANL and LBNL are remeasuring ^{238}U(n,n') cross section data. This will be evaluated into the existing ENDF evaluation by BNL also as part of this project. This evaluation is expected to also have an impact on neutron leakage in fast systems.						
Vanadium (^{51}V)	ORNL	ORNL	ORNL	ORNL			
Basis	Vanadium is a key structural element and is predominately ^{51}V (99.75 atom %). Primary NCS application is fire resistant cans. Recent data testing by LANL for ICSBEP critical benchmarks involving vanadium (i.e., HMF25, HMF40, and HMM16) results in an over-predication of the experiment eigenvalue. In addition, the HMF25 series of experiments exhibit an increasing calculated eigenvalue trend with increasing reflector thickness. The integral data testing indicates that there may be deficiencies in either the elastic scattering angular distributions or secondary energy distributions. In addition, the latest ENDF/B-VII.1 resonance evaluation is based on the JENDL-4.0 evaluation and does not have covariance data. Also, the ENDF/B-VII.1 and JENDL 4.0 resonance evaluations are based on the parameters provided in the Atlas of Neutron Resonances up to 42.5 keV, and the entire resolved resonance evaluation (up to 100 keV) is represented by the multi-level Breit Wigner (MLBW) formalism. As a result, the MLBW resonance evaluation does not account for the resonance-resonance interference effects. Therefore, the evaluated resonance parameters are not based on a detailed R-matrix analysis. Differential measurements are needed in the resonance region to accurately predict the neutron resonances, and a corresponding resonance evaluation is needed to provide detailed resonance parameters and covariance data. In addition, the SAMMY evaluation software has the capability to generate angular scattering distributions from the resonance parameters thereby providing detailed resonance scattering structure that will improve the elastic scattering modeling in the evaluation. The request is for ORNL to complete new ^{51}V cross-section measurements and a resonance evaluation to address computational biases with the existing ^{51}V evaluation. New measurement/evaluation of fast scattering angular distribution recommended.						
Zirconium (^{90,91,92,94,96}Zr)				ORNL	ORNL	ORNL	
				NNL	NNL	NNL	
		BNL	BNL				
Basis	Resonance evaluations. Zirconium is a key structural element that is primarily used in cladding for fuel rods and is currently in consideration for use with advanced nuclear fuel matrices in the form of zirconium hydride. The latest ENDF/B-VII.1 resonance evaluation relies on JENDL-4 data and resonance parameters from the Atlas of Neutron Resonances. As a result, the evaluated resonance parameters are not based on detailed R-matrix analyses. In addition, newer RPI total cross-section measurements on natural zirconium indicate that the older ENDF/B-VI.8 data match the recent RPI measurements better than the newer isotopic evaluations. Furthermore, improved differential measurements of the zirconium isotopes have been identified on the OECD/NEA nuclear data High Priority Request List (HPRL). Differential measurements are needed in the resonance region to accurately predict the neutron resonances for the zirconium isotopes, and corresponding resonance evaluations are needed to provide detailed resonance parameters and covariance data. In addition, the SAMMY evaluation software has the capability to generate angular scattering distributions from the resonance parameters thereby providing detailed resonance scattering structure that will improve the elastic scattering modeling for the zirconium isotope evaluations. NR continues to be unsatisfied with Zr evaluations in ENDF. BNL will re-evaluate the fast and URR regions of all stable Zr isotopes to ensure that the elastic scattering angular distribution is consistent with the rest of the fast region, to						

Nuclear Data Evaluations							
Materials	**Pre-FY2022**	**FY2022**	**FY2023**	**FY2024**	**FY2025**	**FY2026**	**Post-FY2026**
	improve the inelastic scattering cross sections and to correct issues with the URR evaluation implemented in ENDF/B-VIII.0 (under DOE-SC funding).						
Water (H_2O)	LLNL/NCSU	LLNL/NCSU					
Basis	TSL evaluation. Water is this most important moderator and moderating reflector material for criticality safety and light water reactor physics. Problems with evaluations submitted by CAB at elevated temperatures (that were noticed during the ENDF/B-VIII.0 evaluation process) warrant re-evaluating this essential material using the latest methods developed under LLNL ND2, ND3.						
Hydrofluoric Acid (HF)	LLNL/NCSU						
Basis	TSL evaluation. HEU-SOL-THERM-039, "Mixture of Uranium (93%) Hexafluoride and Hydrofluoric Acid (Low H/U Ratio) in a Hot-Water-Reflected Spherical Tank," critical experiments overpredict k-eff from 2-6% regardless of cross-section library or code utilized. An appropriate thermal scattering law for the liquid Hydrofluoric acid (HF) moderator will likely resolve this calculational discrepancy.						
Calcium Hydride (CaH_2)	LLNL/NCSU	LLNL/NCSU					
Basis	TSL evaluation. Calcium hydride is a solid moderator material used in proposed advanced and micro reactor designs. Emergent need requested by micro reactor community.						
Reactor Grade Graphite (20% Porosity)	LLNL/NCSU	LLNL/NCSU					
Basis	TSL evaluation. Graphite is a moderator/reflector material used in advanced reactor designs and in fuel cycle facilities. The prior DOE-NE funded work to produce reactor grade graphite with 10% and 30% porosity will be extended to include 20% porosity per CSEWG request.						
Uranium Metal (U)	LLNL/NCSU	LLNL/NCSU					
Basis	TSL evaluation. Requested by the RPI for use in U-235 resonance parameter analysis.						
Uranium Carbide (UC)	LLNL/NCSU	LLNL/NCSU	LLNL/NCSU				
Basis	TSL evaluation. A common fissile compound under consideration for high-temperature advanced nuclear reactor fuel. A thermal scattering law for UC will improve Doppler broadening using advanced methods currently under development as LLNL ND5.						
Paraffin (C_nH_{2n+2})		LLNL/NCSU	LLNL/NCSU	LLNL/NCSU			
Basis	TSL evaluation. A common moderator and moderating reflector material for which there are numerous critical benchmarks in the ICSBEP Handbook. A thermal scattering law for paraffin will improve simulations through higher fidelity and reduce uncertainties.						
Triuranium Octoxide (U_3O_8)			LLNL/NCSU	LLNL/NCSU	LLNL/NCSU		
Basis	TSL evaluation. A common fissile compound for which there are numerous critical experiments in the ICSBEP Handbook. A thermal scattering law for U_3O_8 will improve Doppler broadening using advanced methods currently under development as LLNL ND5.						
Uranyl Fluoride (UO_2F_2)				LLNL/NCSU	LLNL/NCSU	LLNL/NCSU	
Basis	TSL evaluation. A common fissile compound for which there are numerous critical experiments in the ICSBEP Handbook. A thermal scattering law for UO_2F_2 will improve Doppler broadening using advanced methods currently under development as LLNL ND5.						
Uranium Silicide (U_3Si_2)					LLNL/NCSU	LLNL/NCSU	LLNL/NCSU
Basis	TSL evaluation. A common fissile compound in use in advanced nuclear reactor fuel. A thermal scattering law for U_3Si_2 will improve Doppler broadening using advanced methods currently under development as LLNL ND5.						
Plutonium Oxide (PuO_2)						LLNL/NCSU	LLNL/NCSU
Basis	TSL evaluation. A common fissile compound for which there are critical experiments in the ICSBEP Handbook. A thermal scattering law for PuO_2 will improve Doppler broadening using advanced methods currently under development as LLNL ND5.						
Lithium-7 Hydride (^7LiH)	NNL						
Basis	TSL evaluation. Super-moderator for use in critical mass studies. Evaluation funded by NR.						

Nuclear Data Evaluations							
Materials	**Pre-FY2022**	**FY2022**	**FY2023**	**FY2024**	**FY2025**	**FY2026**	**Post-FY2026**
Lithium-7 Deuteride (^{7}LID)	NNL						
Basis	TSL evaluation. Super-moderator for use in critical mass studies. Evaluation funded by NR.						
Beryllium Carbide (Be_2C)	NNL						
Basis	TSL evaluation. Super-moderator for use in critical mass studies. Evaluation funded by NR.						
Zirconium Hydride (ZrH_x, ZrH_2)	NNL						
Basis	TSL evaluations for delta-phase (ZrH_x) and epsilon-phase (ZrH_2) of zirconium hydride. Moderator and reflector used in TRIGA research reactors, SNAP 10A and several advanced reactors. Evaluation funded by NR.						
Beryllium Hydride (BeH_2)	NNL	NNL					
Basis	TSL evaluation. Super-moderator for use in critical mass studies. Evaluation funded by NR.						
Plutonium Hydride (PuH_{2+x})					NNL	NNL	
Basis	TSL evaluation. A common fissile compound in use in fissile material operations using hydride/de-hydride processes. A thermal scattering law for PuH_{2+X} will improve Doppler broadening using advanced methods currently under development as LLNL ND5. Evaluation funded by NR.						
Polystyrene $(C_8H_8)_n$	ORNL	ORNL					
Basis	Polystyrene is a moderator material found in several thermal systems (PCT001, PCT02, MCT012, MCT013, MCT014, MCT016). Currently, polyethylene is used as a surrogate to represent thermal scattering in polystyrene in neutron transport simulations. This measurement and evaluation will determine the validity of this approximation, as well as inform future substitutions for other hydrocarbons found in benchmarks. RPI could perform sub-thermal transmission measurements to support this TSL evaluation.						

List Legend	ORNL	RPI	LANL	LLNL/NCSU	IRSN	NNL	BNL

B-1 Differential Measurements and Evaluations
(The following list provides the specific milestones to refer to for each element work schedule in Table B-1)

- Beryllium (Be-9)
- Cerium (Ce)
- Cesium (Cs-133)
- Chlorine (Cl-35)
- Chromium (Cr-50,53)
- Copper (Cu-63,65)
- Fluorine (F-19)
- Hafnium (Hf-176,177,178,179,180)
- Iron (Fe-54,56,57)
- Lanthanum (La)
- Lead (Pb-204,206,207,208)
- Lithium (Li-6)
- Molybdenum (Mo-95)
- Neptunium (Np-237)
- Plutonium (Pu-238, 240, 241, 242)
- Plutonium (Pu-239) (LANL/IRSN plus ORNL/IRSN Collaboration)
- Plutonium (Pu-240)
- Samarium (Sm-151)
- Strontium (Sr-88)
- Tantalum (Ta-181)
- Uranium-233 (U-233)
- Uranium-234 (U-234)
- Uranium-235 (U-235)
- Uranium-238 (U-238)
- Vanadium (V-51)
- Zirconium (Zr-90, 91, 92, 94, 96)

Completed Work

- Calcium (Ca)
- Cobalt (Co-59)
- Copper (Cu-63, 65)
- Copper (^{nat}Cu) - scattering angular distributions
- Dysprosium (Dy-161, 162, 163, 164)
- Gadolinium (Gd-155, 156, 157, 158, 160)
- Lead (Pb-208)
- Nickel (Ni-58, 60)
- Oxygen (O-16)
- Tungsten (W-182, 183, 184, 186)
- Uranium-236 (U-236)

Completed Differential Measurements and Evaluations – Elements
(Evaluations have been submitted to NNDC and are candidates for the next ENDF release. Testing will be performed as part of ENDF release effort, and additional revisions may be requested by NNDC before evaluations are formally released. The GANTT charts are retained in the Five-Year Plan pending release of the new evaluations by NNDC.)

Table B-1. Differential Measurements and Evaluations

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
Beryllium (Be-9)	11/1/11	9/30/26		
Deliver an improved and more consistent evaluation to NNDC	11/15/19	9/30/20	LANL	
Finalize Evaluation and Deliver to NNDC	10/1/19	9/30/20	LANL	
Phase I Testing, Post to ENDF/A and Broadcast	10/1/20	2/1/21	BNL	
CSEWG Validation Testing	12/1/20	5/1/21	NDAG	
CSEWG Approval of Complete Evaluation	5/1/21	8/1/21	BNL	
Extend the upper end of the R-Matrix evaluation from 5 MeV to 10 MeV (including inelastic angular distributions), provide R-Matrix parameters, and deliver evaluation to NNDC	10/1/21	9/30/22	LANL	
Phase I Testing, Post to ENDF/A and Broadcast	10/1/22	2/1/23	BNL	
CSEWG Validation Testing	12/1/22	5/1/23	NDAG	
CSEWG Approval of Complete Evaluation	5/1/23	8/1/23	BNL	
Extend the upper end of the R-Matrix evaluation from 10 MeV to 15 MeV (including 4-body breakup reaction) and deliver evaluation to NNDC	10/1/22	9/30/26	LANL	
Phase I Testing, Post to ENDF/A and Broadcast	10/1/26	2/1/27	BNL:	
CSEWG Validation Testing	12/1/26	5/1/27	NDAG	
CSEWG Approval of Complete Evaluation	5/1/27	8/1/27	BNL	
Cerium (Ce-142)	11/01/11	10/30/20		
Transmission and Capture Measurements	11/15/19	12/30/20	ORNL (JRC-Geel)	Transmission and capture measurements were performed in FY19, however, additional transmission measurements for 142-Ce were needed to have better statistics.
Experimentalist Data Reduction and Testing	01/01/20	4/01/20	ORNL	
Resolved Resonance Region Evaluation	11/15/19	3/31/21	ORNL	
Assess Data for URR Evaluation and Complete URR Evaluation	6/01/19	3/31/21	ORNL	URR will be performed on the basis of available measured data if any
Finalize Resonance Evaluation and Deliver to NNDC	4/1/21	5/30/21	ORNL	
Phase I testing, Post to ENDF/A and Broadcast	6/1/21	6/15/21	BNL	
CSEWG Validation Testing	6/16/21	6/30/21	NDAG	
CSEWG Approval of Complete Evaluation	7/1/21	9/31/21	BNL	
Cesium (Cs-133)	10/1/22	9/30/25		
Perform transmission and capture measurements using	10/1/22	9/30/25	LANL	Currently Unfunded

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
DICER and DANCE at LANSCE, analyze results, publish data, and deliver evaluation to NNDC				
Chlorine (Cl-35)	10/1/20	9/30/23		
Perform (n,p) Measurements	10/1/20	9/30/21	ORNL	Funding source: ORNL ND1
Complete Lujan measurements of Cl-35 (n,p), finalize report on LENZ analysis, and deliver final experimental cross-sections to evaluators	10/1/22	9/30/24	LANL	Currently Unfunded
Resolve Resonance Region Evaluation	10/01/21	9/30/24	ORNL	
Finalize isotopic Evaluation Resonance Region Evaluation and Deliver to NNDC	9/30/23	10/15/24	ORNL	
Phase I testing, Post to ENDF/A and Broadcast	10/16/23	10/30/24	BNL	
CSEWG Validation Testing	11/01/23	11/15/24	NDAG	
CSEWG Approval of Complete Evaluation	11/16/23	12/30/24	BNL	
Chromium (Cr-50, 53)				The two links below describe the problem and motivation for the proposed work. In addition to ORNL plans to 1) to develop procedure to treat experimental effects such as neutron sensitivity and multiple scattering corrections with geometry different from cylindric. https://www.oecd-nea.org/dbdata/hprl/hprlview.pl?ID=518 and https://www.oecd-nea.org/dbdata/hprl/hprlview.pl?ID=519 . Measurements for both isotopes below 10 keV with diluted sample are needed to reduce or minimize the neutron sensitivity of the experimental set up and MS in the sample. Cr50 data over the whole energy ranges is needed.
Perform Capture Measurements	1/1/24	9/30/25	ORNL	
Perform SAMMY Analysis	1/1/24	9/30/26	ORNL	
Resolved Resonance Region Evaluation for Cr-50, 53				
Finalize isotopic Evaluation Resonance Region Evaluation and Deliver to NNDC				
Phase I testing, Post to ENDF/A and Broadcast	10/16/26	10/30/26	BNL	
CSEWG Validation Testing	11/1/26	11/15/26	NDAG	
CSEWG Approval of Complete Evaluation	11/16/26	12/30/26	BNL	
Cu (Cu-63,65)				A revised evaluation on copper isotopes is needed to improve the benchmark performance above 100 keV up to 300 keV. This will include a statistical analysis of the resonance
Perform Capture Measurements	N/A	N/A	–	
Perform SAMMY Analysis	10/1/19	9/30/22	ORNL	

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
Resolved Resonance Region Evaluation for Cu-63,65				parameters above 100 keV to quantify the impact of the missing resonances in the measured data as well as a guidance in the level spin assignment. Due to the importance of the copper being used in reactor applications as reflector, additional work on the angular distributions is needed. Moreover, since benchmark sensitivity extends above 300 keV, a careful analysis of the high energy cross sections might be needed.
Finalize isotopic Evaluation Resonance Region Evaluation and Deliver to NNDC				
Phase I testing, Post to ENDF/A and Broadcast	10/1/22	1/15/23	BNL	
CSEWG Validation Testing	1/16/23	1/31/23	NDAG	
CSEWG Approval of Complete Evaluation	2/1/23	3/30/23	BNL	
Work with the IER 537 design team to help optimize the nuclear-data return from the experiment and incorporate improvements into the evaluations. Deliver updated evaluations to NNDC.	1/1/21	9/30/24	LANL	
Phase I testing, Post to ENDF/A and Broadcast	10/1/24	1/15/25	BNL	
CSEWG Validation Testing	1/16/25	1/31/25	NDAG	
CSEWG Approval of Complete Evaluation	2/1/25	3/30/25	BNL	
Fluorine (F-19)	1/1/24	9/30/26		F-19 might be the main cause bias in ^{233}U solution benchmarks. There are no resonance parameters in the ENDF/B-VIII.0 library because the RRR evaluation was converted to point wise cross sections. There are no high-resolution measured data for F-19 inelastic scattering reaction channel, e.g. (n,n'), (n,n0), (n,n1), that in the current evaluation seems to be underestimated. Analysis and evaluation on the angular distributions in RRR is required.
Perform Inelastic Measurements (IRMM)	1/1/24	12/30/24	ORNL	
Perform SAMMY Analysis	12/30/24	9/30/26	ORNL	
Resolve Resonance Region Evaluation for F-19				
Finalize isotopic Evaluation Resonance Region Evaluation and Deliver to NNDC				
Phase I testing, Post to ENDF/A and Broadcast	10/1/26	10/15/26	BNL	
CSEWG Validation Testing	10/15/26	11/1/26	NDAG	
CSEWG Approval of Complete Evaluation	11/1/26	12/31/26	BNL	
Hafnium (Hf-176,177,178,179,180)	10/1/19			Resolved and unresolved resonance evaluations for Hf isotopes have been carried out mainly to address issues on benchmark results in the thermal energy region. IRSN and LLNL will be working on the development of the TEX-Hf experiments focusing in the epithermal energy region. Indeed, MORET calculations of the benchmark sensitive to Hf in the epithermal energy region have demonstrated discrepancies calculated and experimental multiplication factors result. The intent of the proposal is to review and re-evaluate the Hf cross sections in the resolved and unresolved resonance regions with additional covariance and uncertainty information. (ORNL is waiting for IRSN feedback)
Perform assessment of the available Hf evaluation in the resolved and unresolved resonance regions in the JEFF, ENDF and JENDL libraries; Perform detail study of the sensitivity of Hf cross sections in the calculations using the TEX-Hf benchmarks; Examine the results from different cross section libraries; Initiate resonance parameter evaluation in the resolved and unresolved resonance regions.	10/1/19	9/30/20	ORNL/IRSN	

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
Continue tasks initiated in previous year; Incorporate experimental differential data in the evaluation process as they become available; Continue evaluation using computer evaluation tool.	10/1/20	9/30/21	ORNL/IRSN	
Complete the resolved resonance and resonance parameter covariance evaluation; Use the evaluation for testing in benchmark calculation; Work with ORNL on the benchmark validation; Submit the evaluation to JEFF and ENDF for further testing;	10/1/21	9/30/22	ORNL/IRSN	
Initiate the unresolved resonance region evaluation; Incorporate experimental differential data in the evaluation process as they become available; Continue evaluation using computer evaluation tool;	10/1/22	9/30/23	ORNL/IRSN	
Complete the unresolved resonance and cross section covariance evaluation; Use the evaluation for testing in benchmark calculation; Work with ORNL on the benchmark validation; Submit the evaluation to JEFF and ENDF for further testing.	10/1/23	9/30/24	ORNL/IRSN	
CSEWG Approval of Complete Evaluations				
Fe (Fe-54, 56, 57)	1/1/13	12/31/23		Although the effort on the Fe isotopes was planned as joint effort between ORNL and IRSN, IRSN mainly led the evaluation effort and it is unclear the status of this set of evaluations. The ORNL contribution to 56-Fe was the generation of a preliminary ENDF file solving the problem with the benchmark performance. However, a rigorous evaluation work is still needed for the three major isotopes mainly for the assessment of the inelastic scattering reaction channel.
Perform Capture Measurements for Fe-54	10/1/21	9/30/23	RPI	
Perform SAMMY Analysis Finalize isotopic Evaluation Resonance Region Evaluation and Deliver to NNDC	1/1/21	9/30/23	ORNL	
Phase I testing, Post to ENDF/A and Broadcast	10/1/23	10/15/23	BNL	
CSEWG Validation Testing	10/16/23	11/1/23	NDAG	
CSEWG Approval of Complete Evaluation	11/1/23	12/31/23	BNL	
Lanthanum (La)				Updated from FY2019
Transmission and Capture Measurements	10/1/17	6/1/18	ORNL	
Experimentalist Data Reduction and Testing	6/1/18	9/30/19	ORNL	
Resolved Resonance Region Evaluation	10/1/21	6/30/22	ORNL	
Finalize Resonance Evaluation and Deliver to NNDC	7/1/22	9/30/22	ORNL	
Phase I Testing, Post to ENDF/A and Broadcast	10/1/22	10/15/22	BNL	
CSEWG Validation Testing	10/15/22	11/1/22	NDAG	

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
CSEWG Approval of Complete Evaluation	11/1/22	12/31/22	BNL	
Lead (Pb-204,206,207,208)	10/1/21	12/31/23		Lead is a ubiquitous material in the nuclear industry. Lead possesses not only high photon attenuation properties, which make it almost a universal choice as a gamma-ray shielding material, but also desirable neutronic qualities. Our ability to match experimental data with Pb (reflectors and as a scattering target) is less that we desire. Pb-208 is the majority isotope of natural lead. The current ENDF evaluation is known to suffer from deficiencies in neutron angular distributions. The emphasis of the re-evaluation work is on these angular distributions. We will judge success of this work based on recent semi-integral measurements performed at RPI. ORNL proposed to revisit RRR to address angular distribution concerns
Resolved Resonance Region Evaluation	4/1/21	9/30/23	ORNL	
Phase I Testing, Post to ENDF/A and Broadcast	10/1/23	10/14/23	BNL	
CSEWG Validation Testing	10/15/23	10/31/23	NDAG	
CSEWG Approval of Complete Evaluation	11/1/23	12/31/23	BNL	
Lithium (Li-6)	10/1/21	8/1/25		
Perform data compilation and add EDA code capabilities to support new R-Matrix evaluation up to 20 MeV	10/1/20	9/30/22	LANL	
Deliver new evaluation using R-Matrix analysis to 20 MeV	10/1/22	9/30/24	LANL	
Phase I Testing, Post to ENDF/A and Broadcast	10/1/24	2/1/25	BNL	
CSEWG Validation Testing	12/1/24	5/1/25	NDAG	
CSEWG Approval of Complete Evaluation	5/1/25	8/1/25	BNL	
Molybdenum (Mo-95)	10/1/20	>FY24		
Reduce prior ORELA transmission and capture measurement data and submit to EXFOR	10/1/20	9/30/21	LANL	
Transmission and Capture Measurements	10/1/22	>FY24	RPI	
Experimentalist Data Reduction and Testing	TBD	TBD	RPI	
Resolved Resonance Region Evaluation	TBD	TBD	RPI/NNL	IRSN will collaborate on evaluation.
Finalize Resonance Evaluation and Deliver to NNDC	TBD	TBD	RPI/NNL	
Phase I Testing, Post to ENDF/A and Broadcast	TBD	TBD	BNL	
CSEWG Validation Testing	TBD	TBD	NDAG	
CSEWG Approval of Complete Evaluation	TBD	>FY24	BNL	
Neptunium (Np-237)	10/1/20	>FY26		

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
Assess needs for new Np-237 differential experiments at LANSCE	10/1/20	9/30/21	LANL	
Finalize Np-237 fission measurement at LANSCE	TBD	TBD	LANL	
Complete capture measurements at DANCE, finalize the analysis of the results, and publish the data	10/1/24	9/30/27	ORNL/LANL	Currently unfunded
Finalize Fast Region Evaluation and Deliver to NNDC	10/1/23	9/30/25	LANL	
Resonance Region Evaluation	10/1/23	9/30/25	ORNL	
Finalize Resonance Evaluation and Deliver to NNDC	10/1/23	9/30/25	ORNL	
Phase I Testing, Post to ENDF/A and Broadcast	TBD	TBD	BNL	
CSEWG Validation Testing	TBD	TBD	NDAG	
CSEWG Approval of Complete Evaluation	TBD	>FY25	BNL	
Nitrogen (N-14)	12/30/20	9/30/23		Nitrogen cross section are important in the reprocessing process and related analyses. Nitrogen was recently included as action item in the series of INDEN meetings for light nuclei evaluations. In the ENDF/B-VIII.0 library there are no resonance parameters for nitrogen.
Transmission and Capture Measurements	–	–		
Experimentalist Data Reduction and Testing	–	–		
Resolved Resonance Region Evaluation	12/30/22	9/30/24	ORNL	
Assess Data for URR Evaluation and Complete URR Evaluation				
Phase I Testing, Post to ENDF/A and Broadcast	10/1/24	10/15/24	BNL	
CSEWG Validation Testing	10/15/24	11/1/24	NDAG	
CSEWG Approval of Complete Evaluation	11/1/24	12/30/24	BNL	
Oxygen (O-16)	10/1/13	12/31/26		To be discussed by NDAG in FY2021. Not in App. B tables.
Update evaluation as part of Cielo Project	<FY19	6/30/21	ORNL	This milestones is based on the availability of the (n,a) measured at LANL. After several years, this data should be ready for release and put some light on the magnitude of the (n,a) reaction channel. Moreover, the quality of this evaluation is also linked to the updates in the SAMMY code regarding the multiple incident channel option.
Finalize Evaluation and Deliver to NNDC	7/1/21	9/30/21	ORNL	
Phase I testing, Post to ENDF/A and Broadcast	10/1/21	10/15/21	BNL	Define post evaluation process
CSEWG Validation Testing	10/15/21	11/1/21	NDAG	
CSEWG Approval of Complete Evaluation(s)	11/1/21	12/31/21	BNL	
Extend the upper end of the R-Matrix evaluation from 7 MeV to 10 MeV (including new data), provide R-Matrix parameters, and deliver evaluation to NNDC.	10/1/21	9/30/22	LANL	
Phase I testing, Post to ENDF/A and Broadcast	10/1/22	10/15/22	BNL	

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
CSEWG Validation Testing	10/15/22	11/1/22	NDAG	
CSEWG Approval of Complete Evaluation(s)	11/1/22	12/31/22	BNL	
Extend the upper end of the R-Matrix evaluation from 10 MeV to 15 MeV (including additional data) and deliver evaluation to NNDC.	10/1/22	9/30/26	LANL	
Phase I testing, Post to ENDF/A and Broadcast	10/1/26	10/15/26	BNL	
CSEWG Validation Testing	10/15/26	11/1/26	NDAG	
CSEWG Approval of Complete Evaluation(s)	11/1/26	12/31/26	BNL	
Rhodium (Rh-103)	6/30/21	1/1/23		Reprioritized to FY21-FY23.
Assess data for Resolved Resonance Region Evaluation	6/30/21	9/30/23	ORNL	NNL & IRSN will collaborate
Finalize Resonance Evaluation and Deliver to NNDC			ORNL	
Phase I Testing, Post to ENDF/A and Broadcast	10/1/23	10/15/23	BNL	Define post process evaluation
CSEWG Validation Testing	10/15/23	11/1/23	NDAG	
CSEWG Approval of Complete Evaluation(s)	11/1/23	12/31/23	BNL	
Minor Plutonium Isotopes (Pu-238, Pu-240, Pu-241, Pu-242)	10/1/21	12/31/26		
Attempt a consistent nu-bar evaluation supported by a model code to provide better evaluated nu-bar for minor Pu-isotopes	10/1/21	9/30/23	LANL	
Attempt a consistent PFNS evaluation supported by a model code to provide better evaluated PFNS for minor Pu-isotopes	10/1/24	9/30/26	LANL	
Finalize Evaluation and Deliver to NNDC	7/1/26	9/30/26	LANL	
Phase I testing, Post to ENDF/A and Broadcast	10/1/26	10/15/26	BNL	
CSEWG Validation Testing	10/15/26	11/1/26	NDAG	
CSEWG Approval of Complete Evaluation(s)	11/1/26	12/31/26	BNL	
Plutonium (Pu-239)	10/1/10	9/30/24		IRSN to collaborate with ORNL evaluation work.
Deliver p(nu) Data in ENDF/B format	10/1/12	9/30/13	LANL	
Update Prompt Fission Neutron Spectra Based on LANSCE Low-Energy Emission Data	10/1/18	3/31/20	LANL	
Deliver Multiplicity-Dependent Fission Spectra	10/1/13	9/30/14	LANL	
Deliver Prompt Fission Gamma Spectra	10/1/14	3/31/16	LANL	
Update Prompt Fission Neutron Spectra Based on LANSCE High-Energy Emission Data	10/1/18	3/31/20	LANL	

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
WPEC SG34 Improved Resonance Evaluation	<FY19	TBD	ORNL	
URR Evaluation using Hwang-Leal Methodology	TBD	TBD	ORNL	
Finalize Resonance Region Evaluation and Deliver to NNDC	TBD	9/30/24	ORNL	
Phase I testing, Post to ENDF/A and Broadcast	TBD	TBD	BNL	
CSEWG Validation Testing	TBD	TBD	NDAG	
CSEWG Approval of Complete Evaluation	TBD	TBD	BNL	
Finalize a report assessing our methodology to evaluate PFNS and multiplicity consistently, including angular information about prompt neutrons	4/1/19	9/30/20	LANL	
Evaluate PFNS and multiplicity consistently, including angular information about prompt neutrons	10/1/19	9/30/22	LANL	
Update Fission Cross-Section Based on TPC Results (based on Pu239/U235 ratio data)	10/1/19	9/30/22	LANL	
Update Evaluation Based on LANL Updates and CSEWG & WPEC Testing	10/1/20	>FY24	ORNL	
Procure samples for LANSCE DICER experiment	10/1/23	9/30/23	LANL	
Perform transmission measurements at LANSCE DICER	10/1/23	9/30/24	LANL	
Analyze and publish the results of the LANSCE DICER measurement and transmit to IRSN	10/1/24	9/30/25	LANL	
Plutonium-240 (Pu-240)	10/1/19	8/1/25		
Procure a Pu-240 target for PFNS measurements	10/1/19	9/30/20	LANL	
Fabricate, assemble, and test the Pu-240 PPAC target and fission detector components	6/1/20	8/31/21	LLNL	
Obtain final experimental results for Pu-240 PFNS at LANSCE, finalize data analysis, and deliver data to evaluators	9/1/21	9/30/22	LANL	
Update evaluation to include new LANSCE / Chi-Nu prompt fission neutron spectra	3/30/22	3/30/24	LANL	
Resolved Resonance Region Evaluation	10/1/22	9/30/24	ORNL	
Phase I Testing, Post to ENDF/A and Broadcast	10/1/24	2/1/25	BNL	
CSEWG Validation Testing	12/1/24	5/1/25	NDAG	
CSEWG Approval of Complete Evaluation(s)	5/1/25	8/1/25	BNL	

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
Samarium (Sm-151)	10/1/26	9/30/28		
Perform transmission and capture measurements using DICER and DANCE at LANSCE, analyze results, publish data, and submit to EXFOR.	10/1/26	9/30/28	LANL	Currently Unfunded
Strontium (Sr-88)	10/1/21	12/31/23		
Resolved Resonance Region Evaluation	10/1/21	9/30/23	ORNL	
Assess Data for URR Evaluation and Complete URR Evaluation	10/1/23	9/30/23	ORNL	
Finalize Resonance Evaluation and Deliver to NNDC	10/1/23	10/15/23	ORNL	
Phase I Testing, Post to ENDF/A and Broadcast	10/16/23	10/30/23	BNL	
CSEWG Validation Testing	11/1/23	11/15/23	NDAG	
CSEWG Approval of Complete Evaluation	11/16/23	12/30/23	BNL	
Strontium (Sr-86,87)	10/1/25	12/30/28		
Transmission and Capture Measurements (Geel)	10/1/25	9/30/27	ORNL	
Experimentalist Data Reduction and Testing	10/1/27	3/30/28	ORNL	
Resolved Resonance Region Evaluation	4/1/26	9/30/28	ORNL	
Finalize Resonance Evaluation and Deliver to NNDC	10/1/28	10/15/28	ORNL	
Phase I Testing, Post to ENDF/A and Broadcast	10/16/28	10/30/28	BNL	
CSEWG Validation Testing	11/1/28	11/15/28	NDAG	
CSEWG Approval of Complete Evaluation	11/16/28	12/30/28	BNL	
Tantalum (Ta)	10/1/15	1/1/23		ORNL is/was not part of the measurement campaign. However, ORNL is working with NNL to generate an evaluation in the RRR.
Transmission and Capture Measurements	10/1/15	9/30/21	RPI	
Experimentalist Data Reduction and Testing	10/1/21	9/30/22	RPI	
Resolved Resonance Region Evaluation	10/1/18	9/30/22	NNL/ORNL	
Assess Data for URR Evaluation and Complete URR Evaluation			NNL/ORNL	
Finalize Resonance Evaluation and Deliver to NNDC			NNL/ORNL	
Finalize updates to high-energy portion of the ENDF evaluation and coordinate with resonance work at ORNL and NNL to deliver a final product validated with critical experiments	10/1/20	9/30/22	LANL	
Phase I Testing, Post to ENDF/A and Broadcast	10/1/22	10/15/22	BNL	
CSEWG Validation Testing	10/15/22	11/1/22	NDAG	

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
CSEWG Approval of Complete Evaluation	11/1/22	1/1/23	BNL	
Uranium (U-233)	10/1/2019	1/1/28		
Complete review of previous "thin" target U233 measurements and finalize specifications for new "thick" U233 target	10/1/2019	6/30/20	LANL	The measurements will be performed on the basis of the cross section evaluation and the performance with the benchmarks
Complete fabrication of new "thick" U-233 target	7/1/20	6/30/21	LANL	
Finalize acquisition of U-233 thick target capture data, finalize data analysis, and deliver data to evaluators	7/1/21	9/30/22	LANL	
Resolved Resonance Region Evaluation	4/1/20	9/30/23	ORNL	IRSN will collaborate
Assess data for Unresolved Resonance Region Evaluation	10/1/23	9/30/24	ORNL	
Finalize Fast Region Evaluation, including new DANCE capture data, and Deliver to NNDC	10/1/22	9/30/24	LANL	
Phase I testing, Post to ENDF/A and Broadcast	10/1/24	2/1/25	BNL	
CSEWG Validation Testing	12/1/24	5/1/25	NDAG	
CSEWG Approval of Complete Evaluations	5/1/25	12/30/248/1/25	BNL	
Complete PFNS measurements at Chi-Nu, finalize the analysis of the results, and publish the data	10/1/23	9/30/26	LANL	Currently Unfunded
Incorporate new PFNS data into evaluation and deliver to NNDC	4/1/25	9/30/27	LANL	
Phase I testing, Post to ENDF/A and Broadcast	10/1/27	10/15/27	BNL	
CSEWG Validation Testing	10/15/27	11/1/27	NDAG	
CSEWG Approval of Complete Evaluations	11/1/27	1/1/28	BNL	
Uranium (U-234)	10/1/11	9/30/24		
Finalize Resonance Evaluation and Deliver to NNDC	10/1/11	9/30/14	ORNL	
Phase I testing, Post to ENDF/A and Broadcast	10/1/14	9/30/17	BNL	
CSEWG Validation Testing	10/1/17	12/31/17	NDAG	
CSEWG Approval of Complete Evaluations	10/1/15	12/31/16	BNL	
Revisit capture cross section and covariance based on new DANCE data	4/1/18	3/31/20	LANL	
Update U-234 evaluation based on new capture cross section and deliver to NNDC	10/1/19	9/30/20	LANL	
Phase I testing, Post to ENDF/A and Broadcast	10/1/20	2/1/21	BNL	

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
CSEWG Validation Testing	12/1/20	5/1/21	NDAG	
CSEWG Approval of Complete Evaluations	5/1/21	8/1/21	BNL	
Check the status the RRR evaluation	10/1/23	9/30/24	ORNL	
Uranium (U-235)	10/1/11	8/1/24		
Deliver p(nu) Data in ENDF/B Format	10/2/12	9/30/13	LANL	
Deliver Multiplicity-Dependent Fission Spectra	10/2/13	9/30/14	LANL	
Deliver Prompt Fission Gamma Spectra	10/1/14	3/31/16	LANL	
Review the evaluation of U-235 capture and fission cross sections based on new measurements at LANSCE	4/1/16	9/30/17	LANL	
Resolved Resonance Capture Evaluation Per WPEC SG29 Recommendations	10/1/11	9/30/14	ORNL	
CSEWG Validation Testing	10/1/14	9/30/17	NDAG	
CSEWG Approval of Complete Evaluation(s)	10/1/17	12/31/17	BNL	
Update Prompt Fission Neutron Spectra Based on LANSCE Low-Energy Emission Data	10/1/15	9/30/18	LANL	
Finalize prompt fission neutron spectra based on LANSCE high-energy emission data from Chi-Nu	10/1/20	3/31/22	LANL	
Finalize a report assessing our methodology to evaluate PFNS and multiplicity consistently, including angular information about prompt neutrons	4/1/19	9/30/20	LANL	
Evaluate PFNS and multiplicity consistently, including angular information about prompt neutrons	10/1/19	9/30/22	LANL	
Update fission cross section and covariance evaluation based on new TPC results (from U235/U238 ratio data)	10/1/18	9/30/19	LANL	
Update fission cross section based on TPC Results (from Pu-239/U-235 ratio data)	10/1/20	9/30/21	LANL	
Develop consistent evaluation of fission yields, neutron multiplicity, and spectra from thermal to 20 MeV	10/1/19	9/30/22	LANL	
Revisit elastic and inelastic cross sections based on planned LANSCE experiments using Chi-Nu	10/1/21	9/30/23	LANL	

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
Finalize evaluation and deliver to NNDC	7/1/23	9/30/23	LANL	
Phase I testing, Post to ENDF/A and Broadcast	10/1/23	2/1/24	BNL	
CSEWG Validation Testing	12/1/23	5/1/24	NDAG	
CSEWG Approval of Complete Evaluations	5/1/23	8/1/24	BNL	
Uranium (U-236)	10/1/26	2/1/30		
Transmission measurements at LANL or GELINA	>2026		ORNL	
Resonance evaluation	>2027		ORNL	NNL will collaborate
Finalize RRR evaluation and deliver to NNDC	TBD	TBD	ORNL	
Phase I testing, Post to ENDF/A and Broadcast	TBD	TBD	BNL	
CSEWG Validation Testing	TBD	TBD	NDAG	
CSEWG Approval of Complete Evaluations	TBD	2/1/30	BNL	
Uranium (U-238)	10/1/12	3/31/23		
Unresolved Resonance Region Evaluation Using the Hwang-Leal Methodology	10/1/13	12/31/15	ORNL	
Finalize URR Evaluation and Deliver to NNDC	1/1/16	1/1/16	ORNL	
Deliver p(nu) Data in ENDF/B Format	10/1/12	9/30/13	LANL	
Deliver Multiplicity-Dependent Fission Spectra	10/1/13	9/30/14	LANL	
Deliver Prompt Fission Gamma Spectra	10/1/14	3/31/16	LANL	
Phase I Testing, Post to ENDF/A and Broadcast	1/1/16	1/15/16	BNL	
CSEWG Validation Testing	1/16/16	12/31/16	NDAG	
CSEWG Approval of Complete Evaluation(s)	1/1/17	2/28/17	BNL	
Revisit fission cross section and covariance evaluation based on new TPC data (based on U238/U235 ratio data)	10/1/17	9/30/19	LANL	

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
Finalize Prompt Fission Neutron Spectra Based on LANSCE Chi-Nu Data	10/1/21	3/31/23	LANL	
Finalize a report assessing our methodology to evaluate PFNS and multiplicity consistently, including angular information about prompt neutrons	4/1/19	9/30/20	LANL	
Evaluate PFNS and multiplicity consistently, including angular information about prompt neutrons	10/1/20	9/30/22	LANL	
Vanadium (V-51)	10/1/14	12/31/24		Additional task for measurement was described above
Complete Resonance Region Capture Measurements (Geel)	12/30/21	9/30/22	ORNL	Due to enhanced neutron scattering and MS of the thin V sample, experiments with a diluted sample are needed for the energy region below 10 keV.
Perform SAMMY Analysis	12/30/21	9/30/24	ORNL	The evaluation work should be started on the basis on the additional needed measurements
Finalize Resonance Evaluation and Deliver to NNDC	9/30/24	9/30/24	ORNL	
Phase I Testing, Post to ENDF/A and Broadcast	10/1/24	10/15/24	BNL	
CSEWG Validation Testing	10/16/24	10/31/24	NDAG	
CSEWG Approval of Complete Evaluation(s)	11/1/24	12/31/24	BNL	
Zirconium (Zr-90,91,92,94,96)	9/30/14	12/30/24		Capture and transmission Experiments with different nat-Zr samples have been performed
Deliver Updated High-Energy Evaluation of Zr-90	10/1/14	9/30/15	LANL	
Phase I Testing, Post to ENDF/A and Broadeast	10/1/15	10/15/15	BNL	
CSEWG Validation Testing	10/16/15	10/31/16	NDAG	
CSEWG Approval of Complete Evaluations	11/1/16	12/31/16	BNL	
Transmission and Capture Measurements	3/30/20	3/30/25	ORNL	Delay due to COVID-19
Experimentalist Data Reduction and Testing			ORNL	
Resolved Resonance Region Evaluation	3/30/21	6/30/26	ORNL	
Assess Data for URR Evaluation and Complete URR Evaluation	TBD	TBD	ORNL	
Finalize Resonance Evaluation and Deliver to NNDC	TBD	TBD	ORNL	

B-2 Differential Measurements and Evaluations – Compounds
(The following list provides the specific GANTT chart to refer to for each element work schedule)

- Paraffin (C_nH_{2n+2})
- Plutonium Oxide **(**PuO_2)
- Polystyrene $(C_8H_8)_n$
- Calcium Hydride (CaH_2)
- Reactor Grade Graphite (20% porosity)
- Uranium Metal (U)
- Uranium Carbide (UC)
- Uranyl Fluoride (UO_2F_2)
- Triuranium Octoxide (U_3O_8)
- Uranium Silicide (U_3Si_2)
- Water (H_2O)
- Polyethylene $(C_2H_4)_n$ – subthermal transmission
- Polystyrene $(C_8H_8)_n$ – subthermal transmission
- Yttrium Hydride (YH_x) – subthermal transmission
-

<u>Completed Work</u>

- Lucite **(**$C_5O_2H_8$)
- Polyethylene $(CH_2)_n$
- Beryllium (metal)
- Beryllium Oxide (BeO)
- Crystal Graphite
- Reactor Graphite
- Silicon Carbide (SiC)
- Silicon Dioxide (SiO_2)
- Uranium Dioxide (UO_2)
- Uranium Nitride (UN)
- Hexagonal Ice (H_2O) – evaluated by NNL
- Yttrium Hydride (YH_2) – evaluated by NNL
- FLiBe liquid
- Paraffinic Oil
- Uranium Hydride (UH_3) – evaluate by NNL
- Hydrofluoric Acid (HF)

Table B-2. Thermal Scattering Measurements and Evaluations - Compounds

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
Water (H_2O)	10/1/17	12/31/21		
Thermal Scattering Evaluation	10/1/17	9/30/21	NCSU	
Finalize and Deliver Evaluation to NNDC	TBD	9/30/21	NCSU	
Phase 1 Testing, Post to ENDF/A and Broadcast	TBD	TBD	BNL	
CSEWG Validation Testing	TBD	TBD	NDAG	
CSEWG Approval of Complete Evaluation	TBD	12/31/21	BNL	
Calcium Hydride (CaH_2)	10/1/19	9/30/22		Emergent request from micro reactor community
Thermal Scattering Evaluation	10/1/19	9/30/21	NCSU	
Finalize and Deliver Evaluation to NNDC	TBD	9/30/21	NCSU	
Phase 1 Testing, Post to ENDF/A and Broadcast	TBD	TBD	BNL	
CSEWG Validation Testing	TBD	TBD	NDAG	
CSEWG Approval of Complete Evaluation	TBD	9/30/22	BNL	
Reactor Grade Graphite (20% porosity)	10/1/19	9/30/22		
Thermal Scattering Evaluation	10/1/19	9/30/21	NCSU	
Finalize and Deliver Evaluation to NNDC	TBD	9/30/21	NCSU	
Phase 1 Testing, Post to ENDF/A and Broadcast	TBD	TBD	BNL	
CSEWG Validation Testing	TBD	TBD	NDAG	
CSEWG Approval of Complete Evaluation	TBD	9/30/22	BNL	
Uranium Metal (U)	10/1/19	12/31/21		Replaced hydraulic fluid.
Thermal Scattering Evaluation	TBD	TBD	NCSU	
Finalize and Deliver Evaluation to NNDC	TBD	TBD	NCSU	
Phase 1 Testing, Post to ENDF/A and Broadcast	TBD	TBD	BNL	
CSEWG Validation Testing	TBD	TBD	NDAG	
CSEWG Approval of Complete Evaluation	TBD	12/31/21	BNL	
Uranium Carbide (UC)	10/1/20	12/31/22		
Thermal Scattering Evaluation	TBD	TBD	NCSU	
Finalize and Deliver Evaluation to NNDC	TBD	TBD	NCSU	
Phase 1 Testing, Post to ENDF/A and Broadcast	TBD	TBD	BNL	
CSEWG Validation Testing	TBD	TBD	NDAG	
CSEWG Approval of Complete Evaluation	TBD	12/31/22	BNL	

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
Paraffin (C_nH_{n+2})	10/1/21	12/31/23		
Thermal Transmission Measurements	TBD	TBD	RPI	
Thermal Scattering Evaluation	TBD	TBD	NCSU	
Finalize and Deliver Evaluation to NNDC	TBD	TBD	NCSU	
Phase 1 Testing, Post to ENDF/A and Broadcast	TBD	TBD	BNL	
CSEWG Validation Testing	TBD	TBD	NDAG	
CSEWG Approval of Complete Evaluation	TBD	12/31/23	BNL	
Triuranium Octoxide (U_3O_8)	10/1/22	12/31/24		
Thermal Transmission Measurements	TBD	TBD	RPI	
Thermal Scattering Evaluation	TBD	TBD	NCSU	
Finalize and Deliver Evaluation to NNDC	TBD	TBD	NCSU	
Phase 1 Testing, Post to ENDF/A and Broadcast	TBD	TBD	BNL	
CSEWG Validation Testing	TBD	TBD	NDAG	
CSEWG Approval of Complete Evaluation	TBD	12/31/24	BNL	
Uranyl Fluoride (UO_2F_2)	10/1/23	12/31/25		
Thermal Transmission Measurements	TBD	TBD	RPI	
Thermal Scattering Evaluation	TBD	TBD	NCSU	
Finalize and Deliver Evaluation to NNDC	TBD	TBD	NCSU	
Phase 1 Testing, Post to ENDF/A and Broadcast	TBD	TBD	BNL	
CSEWG Validation Testing	TBD	TBD	NDAG	
CSEWG Approval of Complete Evaluation	TBD	12/31/25	BNL	
Uranium Silicide (U_3Si_2)	10/1/24	12/31/26		
Thermal Transmission Measurements	TBD	TBD	RPI	
Thermal Scattering Evaluation	TBD	TBD	NCSU	
Finalize and Deliver Evaluation to NNDC	TBD	TBD	NCSU	
Phase 1 Testing, Post to ENDF/A and Broadcast	TBD	TBD	BNL	
CSEWG Validation Testing	TBD	TBD	NDAG	
CSEWG Approval of Complete Evaluation	TBD	12/31/26	BNL	
Plutonium Oxide (PuO_2)	10/1/25	12/31/27		.
Thermal Scattering Measurements	TBD	TBD	NCSU	
Thermal Scattering Evaluation	TBD	TBD	NCSU	
Finalize and Deliver Evaluation to NNDC	TBD	TBD	NCSU	
Phase 1 Testing, Post to ENDF/A and Broadcast	TBD	TBD	BNL	

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
CSEWG Validation Testing	TBD	TBD	NDAG	
CSEWG Approval of Complete Evaluation	TBD	12/31/27	BNL	
Uranium Silicide (U_3Si_2)	10/1/24	12/31/26		
Thermal Transmission Measurements	TBD	TBD	RPI	
Thermal Scattering Evaluation	TBD	TBD	NCSU	
Finalize and Deliver Evaluation to NNDC	TBD	TBD	NCSU	
Phase 1 Testing, Post to ENDF/A and Broadcast	TBD	TBD	BNL	
CSEWG Validation Testing	TBD	TBD	NDAG	
CSEWG Approval of Complete Evaluation	TBD	12/31/26	BNL	
Polystyrene $(C_8H_8)_n$	10/1/19	9/30/22		
Procure Samples	10/1/19	6/30/20	ORNL	
Write Proposal for Beamtime	3/30/20	3/30/20	ORNL	
Experiment Preparations	6/30/20	6/30/20	ORNL	
Differential Thermal Scattering Measurements at SNS	7/1/20	12/31/20	ORNL	Experiments may be delayed due to COVID-19
Data Reduction & Analysis of SNS Data	7/1/20	2/28/21	ORNL	
Sub thermal Transmission Measurements at RPI	1/1/21	4/1/21	ORNL/RPI	Dependent on progress of sub thermal moderator at RPI, which is experiencing COVID-19 related delays.
Data Reduction & Analysis of RPI Data	1/1/21	5/1/21	ORNL/RPI	
Prepare Experimental Data for Submission to EXFOR	5/1/21	7/31/21	ORNL	
Submit Experimental Data to EXFOR	7/31/21	7/31/21	ORNL	
Perform Thermal Scattering Evaluation	6/1/20	7/1/22	ORNL	
Finalize and Deliver Evaluation to NNDC	7/15/22	7/31/22	ORNL	
Phase 1 Testing, Post to ENDF/A and Broadcast	8/1/22	8/14/22	BNL	
CSEWG Validation Testing	8/15/22	8/30/22	NDAG	
CSEWG Approval of Complete Evaluation	9/1/22	9/30/22	BNL	
Polyethylene $(C_2H_4)_n$	10/1/20	9/30/21		
Sub-thermal transmission measurements at RPI	10/1/20	9/30/21	RPI	
Data reduction and analysis	10/1/20	9/30/21	RPI	
Submit Experimental data to EXFOR	9/1/21	9/30/21	RPI	
Yttrium Hydride (YH_x)	10/1/20	9/30/22		
Sub-thermal transmission measurements at RPI	10/1/20	9/30/21	RPI	

Isotope(s)	Start Date	End Date	Responsible Laboratory	Comments
Data reduction and analysis	10/1/20	9/30/22	RPI	
Submit Experimental data to EXFOR	9/1/22	9/30/22	RPI	