Categorical Exclusion Posting No.: DOE-ID-INL-20-017 R6

Project Title: Enhanced Accident Tolerant Fuel (ATF) Commercial Nuclear Fuel (Byron NGS and Korea Electric Power Corporation Nuclear Fuel), Rev 6

Project Description and Purpose:

Revision 6

The ATF-2E experiment is a continuation of the Accident Tolerant Fuels (ATF) irradiation series conducted by Idaho National Laboratory (INL) in the Advanced Test Reactor (ATR) Loop 2A. This revision includes activities to support expanded testing of advanced nuclear fuel designs. The experiment involves a four-tier test train configuration with specimens provided by both domestic and international partners, including Westinghouse Electric Company (WEC), General Electric (GE), Framatome, General Atomics (GA), and international collaborators such as Japan Atomic Energy Agency (JAEA), Mitsubishi Heavy Industries (MHI), Hitachi-GE, Global Nuclear Fuel-Japan (GNF-J), and Nippon Nuclear Fuel Development (NFD). The goal is to evaluate fuel performance under reactor conditions to improve the safety and efficiency of nuclear power.

INL will be responsible for executing all new actions included in this revision to the ATF-2E experiment. These activities include designing and assembling the four-tier test train, managing irradiation of specimens from both domestic and international partners, and integrating new materials such as stainless-steel dummy pins and molybdenum surrogate fuel pellets. INL will also install and qualify the FIESTA Mk II nondestructive examination system in the ATR canal, support multiple experiment reconfiguration cycles at the Dual Advance Experiment (DAVE) station, and initiate irradiation beginning in ATR Cycle 177A. Additionally, INL will handle the shipment of irradiated specimens to the Hot Fuels Examination Facility (HFEF) using the BRR cask, prepare all necessary shipping documentation, and manage disassembly of the test train. Pacific Northwest National Laboratory (PNNL) will support the ATF-2E experiment by performing gas mass spectroscopy on fission gas samples. This off-site analytical work will help characterize the behavior of irradiated fuel specimens and contribute to the overall understanding of fuel performance.

During the ATF-2E experiment, several waste streams are expected to be generated during post-irradiation examination (PIE) activities. Approximately 5 gallons of low-level radioactive waste from PIE consumables will be generated at the Hot Fuels Examination Facility (HFEF) and the Irradiated Materials Characterization Laboratory (IMCL). An additional 10 gallons of low-level waste from consumables will be generated across HFEF, IMCL, and the Analytical Laboratory (AL). The activity will also produce 2 gallons of mixed low-level waste (radioactive combined with hazardous constituents) at HFEF and AL, and 1 gallon of transuranic (TRU) waste at HFEF and AL. All waste will be in solid form, and the handling category (contact-handled or remote-handled) will be confirmed prior to disposition. Waste Generator Services (WGS) will work closely with researchers to ensure proper characterization, packaging, and disposal of all waste streams in compliance with the Idaho National Laboratory Waste Management Program (WMP) requirements.

Revision 5

This revision involves the irradiation of six small test pins provided by Korean Electric Power Corporation (KEPCO) Nuclear Fuel (KNF) in the Idaho National Laboratory's (INL) Advanced Test Reactor (ATR). Following the irradiation, the fuel pins will be destructively examined at INL's Hot Fuels Examination Facility (HFEF). The test pins are approximately ten inches long with a six and a half inch fuel pellet column. The test pins consist of uranium oxide fuel pellets encased in a zirconium alloy cladding sheath. Destructive examination of the test pins involves cutting, mounting, polishing, mechanically testing, and dissolutions of test pin material to determine the properties and performance of the irradiated test specimens. The facilities and equipment needed to conduct this investigation are already in place at INL. The properties and performance data developed during the investigation will support the licensing and safety basis of commercial fuel designs made from the same materials used in this test program. The INL is leading this project and being supported by KNF.

INL Tasks

Task 1: Design of the experiment

Task 2: Shipment, Receipt and Storage

- INL will arrange, with the support of the KNF, shipment of the KNF fuel pellets and cladding segments of the appropriate dimension from the Republic of Korea (ROK) to the INL. All paperwork necessary to establish material traceability will be provided by the KNF to INL. INL will contract with an external shipping company to transport the pellets and cladding from the KNF facility at Daejeon to INL using an ES-3100 shipping container.

Task 3: Assemble the fuel pins for the irradiation testing

- INL will assemble the fuel pins for the irradiation test. The fuel pellets will be loaded into the cladding and all encaps, pin spacers, and plenum bellows will be fitted at the INL.

Task 4: Steady state irradiation and poolside non-destructive examinations

- Phase 1: The experimental fuel pins will initially be irradiated for 3 years at ATR. Each year of irradiation the test pins will be non-destructively examined in the ATR Canal to determine precise dimensions, surface conditions, and gamma signatures. This information gathered will be shared with KNF. During the third year of irradiation, 3 of the pins will be shuffled to a lower power position. Following the third non-destructive exam, three of the test pins will be removed from the test train. One will be shipped to INL hot cells for destructive examinations. The other two test pins will take part in a ramp irradiation during an ATR high power cycle subject to the development of ramp test capability. Following the ramp test these two pins will again be nondestructively examined in the ATR canal and then sent to HFEF for destructive evaluations.

- Phase 2: The additional three test pins will continue irradiation for four more years to reach the desired burnup target. During this time the pins will receive an annual non-destructive exam in the ATR canal. Following the fourth non-destructive exam, one of the test pins will be sent to HFEF for destructive examination, the other 2 pins will undergo a ramp irradiation before again being non-destructively examined prior to shipment to HFEF for destructive examinations.

Task 5: Ramp test irradiation

- Ramp tests on medium burnup test pins is planned in phase 1 while the ramp tests on high burnup test planned in phase 2.

Task 6: Cooling and shipping

- At completion of irradiation and non-destructive examination, the fuel pins will be cooled in the ATR canal until radiation and decay heat levels allow safe transport to the MFC for Post Irradiation Examination (PIE).

Task 7: Post Irradiation Examination (PIE)

- The KNF test pins will be subject to destructive examinations at HFEF following both initial irradiation and high burnup irradiation.

Task 8: Projects deliverable and reports

KNF Tasks

- Provide and ship the testing pins to the INL.

Waste may include:

INL:

- Approximately 0.75 kgs of transuranic (TRU) waste and 2kgs of low level waste (LLW). All wastes generated as the result of non-destructive and destructive examinations will be disposed of according to established waste management procedures at INL and all applicable state and federal regulations regarding the management of radioactive wastes.

KNF:

- No waste will be generated by KNF. KNF will only providing fuel pins to the INL and receiving and collaborating on data.

Revision 4

The scope of work associated with this project is the post-irradiation examination (PIE) at INL's MFC on the irradiated commercial fuel rods delivered in December 2023 and the shipment of subsequent batch's of irradiated nuclear fuel rods from Byron to INL. The PIE at the INL's MFC is divided into three general categories: 1) Non- Destructive Examinations (NDE), 2) Baseline Destructive Examinations, and 3) Advanced PIE. A list of exams in each category is included in Table 1 below for reference.

Table 1, Rev 4. Definitions of Various Categories of PIE at MFC

Baseline non-destructive	Baseline destructive	Advanced PIE
Neutron radiography	Rod internal pressure	SEM/EDX
Gamma scanning	Sectioning	FIB sectioning
Visual examination	Metallography sample preparation	TEM
Profilometry	Metallography analysis	EPMA
	Cladding hydrogen content analysis	
	Microhardness	Micro-Mechanical Testing
	Density Measurement via Helium pycnometry	
	Cladding Mechanical Testing (e.g., ring hoop tension, ring compression and tube axial tension)	Any other requested exams
	Radiochemical Burnup Analysis	

BEA performs PIE at various INL facilities, primarily located at the Materials and Fuels Complex (MFC). The Hot Fuels Examination Facility (HFEF) is a large, inert-atmosphere hot cell with the capability of performing much of the wide variety of destructive and nondestructive examinations Further characterization examinations will be performed at other facilities depending on the specific scope to be accomplished. Examples of such facilities are the Irradiated Materials and Fuel Complex (IMCL) and Analytical Research Laboratory (ARL).

The PIE Campaign will be executed in three phases, which are:

1. Non-destructive examinations
2. Baseline destructive examinations
3. Advanced destructive examinations

Detailed PIE plans will be prepared, which will provide details regarding testing activities as well as collection and transmittal of data.

Tasks

Phase 1: Non-destructive examinations.

INL will perform i) visual examinations, ii) axial qualitative gamma scanning and iii) profilometry on the rods.

Phase 2: Baseline destructive examinations

INL will perform rod internal volume measurements and rod internal pressure calculations on the rods. Upon puncturing, a sample from the rod internal gases will be collected and shipped to PNNL to perform gas mass spectrometry. Rough sectioning will be performed after gas puncturing per diagram developed by INL and approved in written by the customer. Rough sectioning of the rods is expected.

After rough sectioning, segment sectioning for destructive examinations and sample preparation will occur per diagram developed by INL and approved in written by the customer. The number of segments that will be sectioned per rod will be agreed based on the NDE data feedback and customer needs.

In addition, several segments of these rods will be sent to ORNL for testing in their SATS furnace.

Baseline destructive examinations in Table 1 will be selected for each rod according to the needs of the programs.

Phase 3: Advanced destructive examinations

INL will perform Scanning Electron Microscopy (SEM) with Energy Dispersive X-Ray Spectroscopy (EDS) on a minimum of two samples per rod. Moreover, a minimum of two samples from the selected rods will undergo Electron Probe Micro Analysis (EPMA). Additional research will be conducted with several of the rods, utilizing many of the capabilities at IMCL.

Revision 3:

This revision includes additional scope of work involving “Drop In Capsule Irradiation Design and Analysis”. It includes the design and analysis of a new drop in capsule experiment for General Atomic’s (GA’s) SiC-SiC cladding with ADOPT UO2 and a liquid tin bond. Design will utilize a finned capsule to minimize temperature (and associated) swelling variation on the cladding. Goal will be to insert the first cycle at the Advanced Test Reactor after CIC (core internal changeout) in late 2021.

Figure 3-1 is a cutaway of the capsule, with the materials listed. The molybdenum, aluminum, and stainless steel components will be fabricated here. The rodlet components will be shipped to GA. The rodlet components will be assembled by GA, loaded with fuel and seal welded and returned to Materials and Fuels Complex to either the Experimental Fuels Facility or the Advanced Fuels Facility for assembly into the capsules. The basket will be fabricated from stainless and hafnium.

Following irradiation of the capsule, the capsule will be transported to MFC for post-irradiation examination (PIE).

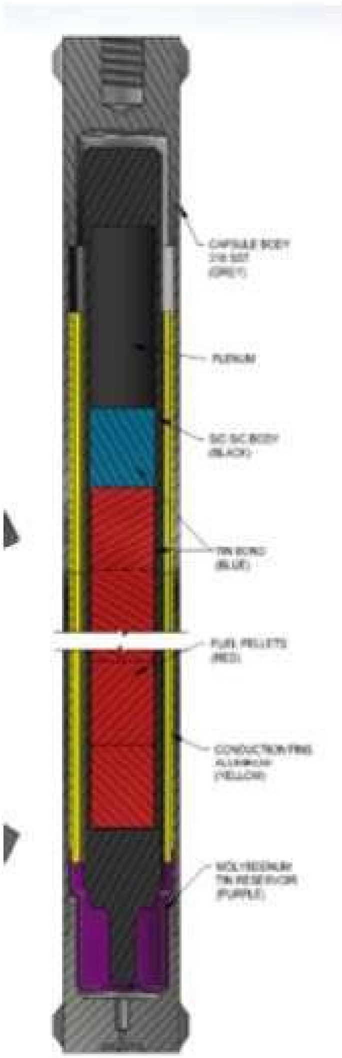
PIE will consist of non-destructive and destructive testing as described below:

Non-destructive:

- Leak check
- Dimensional check/mass check
- Thermal conductivity
- Micro-crack investigate (optical microscopy/dye penetrant)

Destructive:

- Temperature disks
- Fission gas release
- Sectioning - fuel relocation, chemical interactions
- Optical microscopy/EDS/SEM test to look at Sn-fuel interaction



Testing will be conducted at Hot Fuel Examination Facility (MFC-785), the Irradiated Materials Characterization Lab (MFC-1729), the Electron Microscope Laboratory (MFC-774), and the Analytical Laboratory (MFC-752).

The original EC and subsequent revisions to this revision remain valid.

Revision 2

This revision captures the additions in scope for project activities performed in collaboration with General Atomics (GA). GA is developing a SiC-SiC composite materials as a novel material for use in both current generation and advanced nuclear reactors. GA has been a key partner to Westinghouse Electric Company on multiple cooperative agreements with DOE for the purpose of pursuing and developing its SiC-SiC Accident Tolerant Fuel (ATF) concept. Below features the scope of work and the tasks associated with GA.

General Atomics (GA)

INL conducts irradiation experiments at both the Advanced Test Reactor (ATR) and the Transient Research Test (TREAT) Reactor. INL has, and is continuing to develop, a variety of experiment test trains at both reactors to meet the data needs of GA. Additionally, INL customizes irradiation tests to meet specific data needs as they arise. INL is currently planning to irradiate GA ATF concepts in drop-in-capsules as well as in the pressurized water loop of ATR. Additionally, two irradiations have taken place in separate effects tests holder (SETH) capsules at the TREAT reactor. These irradiations take place using small rodlets which are typical of LWR fuel in their radial dimensions but are typically shorter in their axial dimensions. A status summary of GA rodlets is described below in Table 1.

Table 1, Rev 2. Status of General Atomics Irradiations at INL

Rodlet / Capsule ID	Fuel system	Status	Baseline PIE non-destructive	Baseline PIE destructive
Drop-in-Capsule Irradiations				
Planning Phase				
Pressurized Water Loop Irradiations				
GA-M11	Moly / SiC-SiC	Insertion Pending		
GA-M44	Moly / SiC-SiC	Insertion Pending		
GA-M33	Moly / SiC-SiC	Insertion Pending		
TREAT Irradiations				
SETH-H	U3Si2 / SiC-SiC	TREAT Storage Pit		
SETH-I	U3Si2 / SiC-SiC	TREAT Storage Pit		

In Government fiscal year 2020 (FY20) three steady state irradiation cycles (166B, 168A, and 168B) are planned to take place at the ATR, each lasting approximately 60 days. In FY21 only one steady state cycle (169A) will take place prior to the ATR undergoing a yearlong outage known as core-internal-changeout (CIC). Operations at ATR will resume in FY22. After test rodlets reach their specified burn-up target, they are discharged from the reactor and allowed to cool before being shipped to INL's hot cell facilities for Post Irradiation Evaluation (PIE) or to the Transient Reactor Test (TREAT) facility for transient irradiations. In addition, rods coming from lead test rod (LTR) or lead test assembly (LTA) programs may be sent to INL for PIE or transient irradiations at TREAT. Post irradiation examination at INL's MFC is divided into three general categories: 1) Non-Destructive Examinations (NDE), 2) Baseline Destructive Examinations, and 3) Advanced PIE. A list of exams in each category are included in Table 2 below for reference.

Table 2, Rev 2. Definitions of Various Categories of PIE at MFC

Baseline non-destructive	Baseline destructive	Advanced PIE
Neutron radiography	Fission Gas Release	SEM/EDX
Gamma scanning	Sectioning	FIB sectioning
Visual examination	Defueling	TEM
Profilometry & Eddy current measurements	Metallography sample preparation	EPMA
Any other NDE requested exams	Metallography analysis	Thermal properties measurements
	Burnup chemical analysis Cladding hydrogen content analysis	Micro-Mechanical Testing
	Microhardness	Density measurements*
	Ring compression testing	Any other requested exams
	Cladding Mechanical Testing**	

*It will be considered part of the baseline destructive once the system is fully qualified for operation in hot cells, which is expected to occur by the end of 2019. Density refers to the density of the fuel.

**As additional cladding mechanical testing capabilities come online, they will be part of the baseline destructive PIE category. Tensile testing is expected to be available in mid to late 2020.

Irradiated rods coming from either ATR or commercial LTR/LTA programs may be refabricated at INL for their reinsertion into INL test reactors (ATR or TREAT). The purpose of these re-irradiation programs may be to extend the burnup of the rods, or to conduct transient irradiations mimicking operational transients, anticipated operational occurrences (AOOs) or design basis accidents (DBAs). INL is currently developing capabilities to refabricate rods and conduct a full suite of transient testing at both TREAT and ATR.

Tasks

1. Irradiation Experiments

Task 1 involves INL's support for the insertion of new steady state irradiation experiments which support GA ATF development. INL will continue to work with GA on any planned insertions following the ATR CIC. Task 1 has three subtasks as described below.

1.1 Inspection of SiC-SiC Pins in ATF-2

In cycle 168B, INL will consider the insertion of three additional rodlets into the pressurized water loop. The SiC-SiC rodlets will be delivered fully assembled on an agreed upon date prior to the startup of cycle 168B. These rodlets will contain molybdenum gamma heaters in place of Uranium Oxide pellets and will be labeled as GA-M11, GA-M33, and GA-M44. INL will require the as-built specifications for all rodlets not fabricated at INL.

1.2 Design and Analysis of Drop-in-Capsule Irradiation for SiC-SiC pins with Liquid Tin Bond.

Includes the design and analysis of a new drop in capsule experiment for GA's SiC-SiC cladding with ADOPT UO2 and a liquid tin bond. Design will utilize a finned capsule to minimize temperature (and associated) swelling variation on the cladding. Goal will be to insert the first cycle after CIC in late 2021.

2. Post Irradiation Examinations

Current PIE tasks are related to rodlets coming from TREAT experiments. Out Year PIE will be planned in more detail as more clarity is provided from irradiation testing programs.

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The SETH-H and SETH-I tests were conducted at TREAT in FY19 under separate funding from the Advanced Fuels program. The tests involve Uranium Silicide fuel in Silicon Carbide cladding. PIE was not performed on these tests. The SETH-H test included an energy deposition of ~400 J/g and was intended to assess the potentially improved behavior of Silicon Carbide cladding in surviving a high temperature transient and in containing molten fuel. The SETH-I test included a configuration with a reduced pellet cladding gap and an energy deposition of ~310 J/g and was intended to not melt the fuel, but cause pellet cladding mechanical interaction near the melting point of U3Si2.

PIE will include:

1. Disassembly of the experiment device
2. Visual examination of the fuel rodlet
3. Sectioning each rodlet for microscopy (it is anticipated that no more than 1 longitudinal and two transverse sections per rodlet are prepared). A total of 6 microscopy mounts are anticipated (3 per rodlet).
4. Mounting and polishing the sections microscopy
5. Optical microscopy on the 6 mounted sections
6. Scanning Electron Microscopy on no more than 2 mounted sections to provide additional information on fuel cladding interaction (OPTIONAL).
7. Data analysis and reporting

3. Autoclave testing SiC-SiC Rodlets

INL will perform tests in a flowing autoclave of SiC-SiC rodlets that are fabricated by GA and delivered to INL. The flowing autoclave tests will be conducted in coolant conditions that are representative of a pressurized water reactor (~15MPa, ~290 C). Radiolysis conditions will be mimicked by increasing the dissolved oxygen content in the loop. Prior to insertion in the autoclave the GA rodlets will be helium leak checked and weighed to determine baseline values. The autoclave will also be run for ~21 days without the rodlets to stabilize the oxygen content in the coolant.

The samples will be tested for a minimum of 50 days with intermittent exams occurring at 5 days, 15 days, and 30 days. The intermittent exams will visual inspections, and determination of rodlet mass. At the conclusion of the50 days the rods will be removed from the autoclave. Further autoclave testing or transfer of rods to an irradiation test can occur at the end of the 50 days to exposure. At the conclusion of the test and in addition to the interim exams, the rodlets will undergo a helium leak check to determine any loss in hermiticity.

Revision 1

This revision captures changes to scope for project activities performed in collaboration with General Electric Research (GER, referred to as “GE” in previous environmental checklists [ECs]) in Section 1. Section 2 addresses proposed changes in scope and locations for work analyzed in previous ECs that EC INL-20-044 superseded.

Section 1. General Electric Research

Idaho National Laboratory (INL) conducts irradiation experiments at both the Advanced Test Reactor (ATR) and the Transient Research Test (TREAT) Reactor. INL continues to develop a variety of experiment test trains at both reactors to meet the GE’s data needs. In addition, INL customizes irradiation tests to meet specific data needs as they arise. INL is currently irradiating GE Accident Tolerant Fuel (ATF) concepts in both drop-in capsule irradiations and the pressurized water loop of the ATR. These irradiations take place using small rodlets which are typical of LWR fuel in their radial dimensions but are shorter in their axial dimensions. A status summary of GE rodlets is described below in Table R1.

Table 1, Rev 1. Status of GER ATF Irradiations at INL

Rodlet / Capsule ID	Fuel system	Status	Baseline NDE	Baseline PIE destructive
Drop in Capsule Irradiations				
ATF-06/GE01	Alloy 33/UO_2		Completed	On-going
ATF-07/GE02	Alloy 33/UO_2	In irradiation		
ATF-08/GE03	Kanthal APMT/UO_2		Completed	On-going
ATF-09/GE04	Kanthal APMT/UO_2	In irradiation		
Pressurized Water Loop Irradiations				
GE-ZR-18	Zr-2/UO_2	In irradiation		
GE-ZR-20	Zr-2/UO_2	In irradiation		
GE-A0-07	ARMOR/UO_2	In irradiation		
GE-A0-08	ARMOR/UO_2	In irradiation		
GE-A1-07	ARMOR/UO_2	In irradiation		
GE-A1-08	ARMOR/UO_2	In irradiation		
GE-IC-04	C26M/UO_2	In irradiation		
GE-IC-05	C26M/UO_2	In irradiation		
GE-IC-07	C26M/UO_2	In irradiation		
GE-IC-08	C26M/UO_2	In irradiation		
GE-IC-09	C26M/UO_2	In irradiation		
GE-IC-10	C26M/UO_2	In irradiation		

Within Fiscal Year (FY) 2020 (FY20) and FY21 three steady state irradiation cycles (166B, 168A, and 168B) are planned at the ATR, each lasting approximately 60 days. In FY21 only one steady state cycle (169A) will take place prior to the ATR undergoing a yearlong outage known as core-internal-changeout (CIC). Operations at ATR will resume in FY22. After test rodlets reach their specified burn-up target, they are discharged from the reactor and allowed to cool before being shipped to INL's hot cell facilities for Post Irradiation Evaluation (PIE) or to the TREAT facility for transient irradiations. PIE at INL's Materials and Fuels Complex (MFC) is divided into three general categories: 1) Non-Destructive Examinations (NDE), 2) Baseline Destructive Examinations, and 3) Advanced PIE. A list of exams in each category are included in Table R2 below for reference.

Table 2, Rev 1. Definitions of Various Categories of PI at MFC

Table R2. Definitions of Various Categories of PIE at MFC

Baseline non-destructive	Baseline destructive	Advanced PIE
Neutron radiography	Fission Gas Release	SEM/EDX
Gamma scanning	Sectioning	FIB sectioning
Visual examination	Metallography sample preparation	TEM
Profilometry &	Metallography analysis	EPMA
Eddy current measurements		
Any other NDE requested exams	Burnup chemical analysis	Thermal properties measurements
	Cladding hydrogen content analysis	
	Microhardness	Micro-Mechanical Testing
	Ring compression testing	Density measurements*
	Cladding Mechanical Testing**	Any other requested exams

*It will be considered part of the baseline destructive once the system is fully cualified for operation ir hot cells, which is expected to occur by the end of 2019. Density refers to the density of the fuel.
**As additional cladding mechanical testing capabilities come online, they will be part of the baseline destructive PIE category. Tensile testing is expected to be available in mid to late 2020.

Irradiated rods coming from either ATR or commercial LTR/LTA programs may be refabricated at INL for their reinsertion into INL test reactors (ATR or TREAT). The purpose of these re-irradiation programs is to extend the burnup of the rods, or to conduct transient irradiations mimicking operational transients, anticipated operational occurrences (AOOs) or design basis accidents (DBAs). INL is currently developing capabilities to refabricate rods and conduct a full suite of transient testing at both TREAT and ATR). Prior to deciding to implement facility modifications or other actions needed to section or remanufacture lead test rods (LTRs) or lead test assemblies (LTAs), this capability will be evaluated in compliance with NEPA and this EC will be revised.

In April 1995, DOE completed the Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement (DOE/EIS-0203) (hereafter, 1995 EIS) (DOE 1995a). The 1995 EIX contains an analysis of the potential environmental impacts associated with managing DOE's complex-wide spent nuclear fuel (SNF) Program from 1995 until 2035 and includes an analysis of a broad spectrum of fuel element designs.

In the June 1995 Record of Decision (ROD) for the 1995 PEIS, DOE selected Alternative 4a (Regionalization by Fuel Type) and decided to transport 165 Metric Tons of Heavy Metal (MTHM) in 1,940 planned shipments of SNF (including 575 Navy shipments) to the INL Site through the year 2035 [60 Federal Register (FR) 28680, June 1, 1995]. DOE issued an amended ROD in June 1996 for the 1995 PEIS, which lowered the number of planned shipments of SNF to the INL Site to 1,133 (575 shipments for the Navy and 558 planned shipments for DOE) (61 FR 9441, March 8, 1996).

At present, INL cannot accept irradiated fuel subject to the Idaho Settlement Agreement. In November 2019, DOE and the State of Idaho signed the Supplemental Agreement Concerning Conditional Waiver of Section D.2.e and K.1 of 1995 Settlement Agreement wherein the parties agree that DOE may resume the receipt of and plan for additional research quantities of commercial SNF at INL pursuant to the 2011 Memorandum of Agreement, the terms and conditions of which govern such additional shipments, upon successful production of at least 100 canisters of treated sodium bearing high-level waste (HLW) located at INL and so long as:

1. DOE is not in breach of any terms and conditions of the 1995 Agreement, or the 2008 Agreement other than those described in the Supplemental Agreement and

2. The Integrated Waste Treatment Unit (IWTU) is continuing sustained operations to treat the remaining Sodium Bearing HLW located at INL.

INL anticipates it will be able to accept the irradiated lead test rods by 2022. If INL cannot accept the irradiated lead test rods, another facility will complete PIE and other activities. The amount of irradiated fuel INL can receive remains subject to the limits established in the 1995 Agreement, —55 metric tons heavy metal (MTHM)—, and the INL Site has received 81 shipments of spent nuclear fuel that contained 27.8646 MTHM since 1995. DOE anticipates it will not reach the total number of shipments or MTHM limits identified in the MOA and amended ROD before 2035. Based on current planning, DOE anticipates the INL Site will receive less than 21 MTHM of additional SNF before 2035. Therefore, DOE would not exceed the 55 MTHM limit imposed through the Settlement Agreement by receiving the additional LFR or LTAs. However, prior to planning to receive or ship commercially irradiated materials to INL, this EC will be revised to verify material quantities and transportation routes have been evaluated in compliance with the National Environmental Policy Act (NEPA)

1. Irradiation Experiments

INL will support inserting new irradiation experiments which support GER ATF development. INL will continue to work with GER on any planned new insertions following the ATR CIC. No new rodlets are planned for irradiation in FY20. Plans for additional rodlet irradiations in either drop-in-capsules or in the pressurized water loop may be discussed later. For FY20 this work includes developing and testing new tooling designed to fit the larger diameter and larger pitch of the GE pins so they can be handled in the ATR canal. INL will also conduct an evaluation of options for conducting "dry-out" testing. The goal would be to conduct irradiation experiments which support the development of a cladding time at temperature limit in BWR AOO events.

2. Post Irradiation Examinations

No PIE activities are planned for FY20. Out year NDE activities will consist of conducting NDE on all the rodlets and capsules coming from ATR following their removal after cycle 170A. Additionally, NDE on LTR/LTA material will begin as rods are harvested from those programs. Out year destructive PIE will be planned in more detail as more clarity is provided from the NDE examinations and irradiation testing programs. INL capabilities in this area are planned to expand into cladding burst, creep, and, thermal fatigue testing. When these capabilities are available, they will be offered to GER in the Destructive PIE category.

3. Micro Mechanical Testing of ARMOR

INL will perform a series of small-scale mechanical testing on GER's ARMOR interface of coated cladding, enabled with the Gallium and Plasma dual-beam focused ion beams (FIB) and in-situ mechanical stages. These tests are designed to assess potential coating degradation and delamination following irradiation and high strain that may exist during accident conditions. Note that these are small scale tests, and the results are not intended to give bulk mechanical data but are designed to ascertain the impact of irradiation and high strain on the cohesive strength of the interface. However, in nano-structured materials, the mechanical properties can be in close agreement with bulk properties. Regions of interest will be characterized with Electron Backscatter Diffraction (EBSD) prior to mechanical testing such that the grain orientation is obtained (if possible), and interfaces appropriately selected for examination. The testing will include a subset of nano-indentation arrays, micro-pillar compression testing, and micro-tensile testing. Although the in-situ mechanical stages are capable of elevated temperature testing (up to 800°C), further development work is required on this capability at INL therefore, the proposed testing will be limited to room temperature only. The materials to be investigated will be provided to INL by GER and may include a subset of as-fabricated cladding and/or as irradiated cladding. While the specific scope may vary it is initially assumed that this work would involve 1 nano-indentation array, 9 micro-pillars, and 9 micro-tensile tests.

Section 2. Gamma Radiation Resistance for Hardware

The proposed ATF-R experiment in the TREAT Facility uses a pre-irradiated specimen and requires hot cell assembly and disassembly. The experiment anticipates using hardware previously used for fresh fuel specimens and needs to characterize the gamma radiation resistance of these components to verify the hardware meets requirements for TREAT experiments.

The proposed action completes gamma irradiation testing on these non-radioactive hardware components (gaskets, orings, compression fittings, etc) at the MFC to characterize gamma radiation resistance. The proposed action irradiates specimens in the Fuels and Applied Science Building (FASB) gamma irradiator to achieve a specified dose. Given the recent availability of the new gamma irradiator at the Energy Innovation Laboratory (EIL), the project would like to include the new gamma irradiator as a potential alternative to the one at FASB. This would allow samples to be processed quicker since the dose rate is much higher. Depending on the specimen, the proposed action includes follow on on tests. Unsealed sources are not allowed at EIL. None of the components form a leak-tight seal or pressure boundary with any component during the gamma irradiation test. The proposed action irradiates the items in Table R3. The list of items identified in Table R3 is not all-inclusive of the items that will be irradiated during these tests. Additional items that are part of the ATF-R design may also be irradiated in the gamma irradiation chamber. These components will be documented in laboratory work control per LWP-20000.

Table 3, Rev 1. Specimens proposed for irradiation in the FASB gamma irradiator

Specimen Identifier	**Specimen Description**	**Minimum Test Quantity**	**INL Drawing-Item (If Applicable)**	**Follow-on Tests**	**Additional Specimen Information**
FKO-##	FFKM O-rings	3	810827-16	Visual, Functional Leak Test	
PTO-##	Pressure Transducer O-ring	6	818422-18	Visual, Functional Leak Test	MMC P/N 5233T114
TIC-##	Conax Teflon-Insulated Cable (TIC)	3	NA	Visual, Functional Leak Test	This cable will be pre-routed through a stainless steel MHM2 Conax compression fitting.
BDC-##	Boiling Detector Coating	3	818423-23	Visual	This item may be coated on a thin sheet of metal per 818423-3
PFR-##	Pyrometer Fiber	3	818423-14	Visual, Functional Test	Each pyrometer fiber will have an SMA connector (818423-28) epoxied on each end.
RTV-##	Room Temperature Vulcanizing (RTV) Gasket Maker	3	818422-36	Visual, Functional Leak test	Permatex Model ULTRA GREY RTV. This will be applied and pre-torqued to a hold-down gland (see Autoclave Engineers P/N 1040-7434) to form a seal with a burst disc.
GST-##	Grafoil National Pipe Thread (NPT) Sealant Tape	3	NA	Visual, Functional Leak Test	See Conax compression fitting catalog P/N 47-0040-001. These will be pre-wrapped to the external pipe threads of a Conax MHM2 compression seal fitting. These fittings will then be threaded into a SETH capsule top (810830).
CKV-##	Check valve	3	818422-16	Visual, Functional Leak Test	

CGS-##	Conax Grafoil Sealants	6	818422-19, -20	Functional Leak Test	These will be pre-assembled in a Conax MHM2 fitting per 818422-19.
KPW-##	Kapton Wire	6	NA	Visual, Functional Leak Test	CNC TECH P/N 600222 MW35-C
VEX-##	Vacuum Epoxy	6	818423-26	Functional Leak Test	This epoxy will be a subcomponent of the Pyrometer Fiber assembly. This epoxy will be applied within a capillary tube (818423-29) per Note 7. These capillary tubes will be passed through a Conax MHM2 compression seal fitting.

Gamma Irradiation Dose Parameters: Under the proposed action, the ATF-R components receive gamma radiation from the pre-irradiated rodlet and the hot cell environment.

The project assembles the following components and performs a baseline helium leak test of each component as described in TPR-13438 before shipping them to FASB or EIL:

- TIC (qty: 3) - Route Teflon wires through Conax compression fitting and torque Conax cap according to manufacturer specifications. See attached sketch.
- PFR (qty: 3) – Assemble pyrometer fiber, capillary tube, vacuum epoxy and connector similar to INL Dwg. 815701, -7 assembly and attached sketch.
- RTV (qty: 3) – Assemble leak test fitting, silicone RTV gasket maker, hold down ring, burst disc and hold down gland in accordance with attached sketch. Hold down gland will be torqued in accordance with manufacturer instructions.
- GST (qty: 3) – Assembly Conax compression seal fitting and grafoil sealant tape in accordance with attached sketch. Grafoil sealant tape will be applied to external threads of Conax fitting body (like PTFE tape) per Conax manufacturer instructions.
- CGS (qty: 3) – Assemble Conax MHM2 compression seal fittings with blank sealants. Torque Conax cap in accordance with manufacturer instructions.
- KPW (qty: 3) – Route Kapton cable through Conax compression seal fitting per attached sketch. Torque Conax fitting cap per manufacturer instructions.

The project leak tests the remaining unassembled components by arranging them on a M-SERTTA capsule top or bottom per INL Dwg 818422 and visually inspects the boiling detector plates for gamma irradiation damage.

Following irradiation at FASB, the project ships the specimens to EIL for inspection. Items irradiated at EIL will not have to be shipped.

The proposed testing has the potential to generate industrial waste.

Original EC

Following the Fukushima events in 2011, The Department of Energy Office of Nuclear Energy, Science, and Technology (DOE-NE), in collaboration with the nuclear industry, shifted the emphasis of research and development (R&D) activities on light water reactors (LWRs) from enhancing fuel performance for waste minimization and increased power density for power upgrades to accident performance of fuels under extended loss of active cooling and steam exposure. Subsequently, the congressional appropriation language for Fiscal Year (FY) 2012 included specific language directing DOE-NE to initiate an aggressive Research, Development, and Demonstration (RD&D) program for LWR fuels with enhanced accident tolerance. Fuels with enhanced accident tolerance are those that, in comparison with the standard system currently used by the LWR industry, can tolerate loss of active cooling in the core of the reactor for considerable time periods (depending on the LWR system and accident scenario) while maintaining or improving fuel performance during normal operations, operational transients, and design-basis events.

The purpose of the Accident Tolerant Fuels (ATF) program is to develop the next generation of LWR fuels with improved performance, reliability, and safety characteristics during normal operations and accident conditions and with reduced waste generation. Enhancing accident tolerance of the fuel is the focal point of the initiative. The initial RD&D efforts focus on applications in operating reactors or reactors with design certifications. What is learned and developed during this process may be applicable to the design of the next generation of LWRs.

Per congressional direction, the Fuel Cycle Research and Development Advanced Fuels Campaign’s goal is to support the insertion of lead test rods (LTRs) or lead test assemblies (LTAs) of an ATF into a commercial LWR within ten years (i.e., by the end of FY 2022). Since 2012, Idaho National Laboratory (INL) has supported the ATF program, including irradiation experiments in the Advanced Test Reactor (ATR) and the Transient Reactor Test (TREAT) Facility for assessing the performance of ATF concepts and demonstrating improved fuel and cladding concepts.

Irradiation Testing

The environmental impacts of INL activities supporting the ATF program have been evaluated in the following environmental checklists (ECs):

- INL-20-020 (OA 12) “Uranium Silicide/Nitride Fabrication Demonstration”
- INL-12-061 (OA 15) “Support EPRI's Development of LWR Fuels with Enhanced Accident Tolerance”
- INL-12-062 (OA 10 & 12) Support Westinghouse's Development of LWR Fuels with Enhanced Accident Tolerance”
- INL-13-059 “Irradiation Testing of Accident Tolerant Fuels (ATF) in the Advanced Test Reactor”
- INL-16-019 “Irradiation Testing of Accident Tolerant Fuels (ATF) in the Advanced Test Reactor (ATR) Water Loop” and Revisions 1-4.

These ECs evaluated INL ATF R&D efforts performed in cooperation with industry led teams from AREVA (now Framatome), General Electric (GE), and Westinghouse. Table 1 lists general activities associated with these efforts. One DOE team from Oak Ridge National Laboratory (ORNL) also furnished fuel rodlet samples for ATR insertion in 2015. The scope of this EC is limited to ATF effort at INL supporting Framatome (formerly Areva), General Electric (GE), and Westinghouse.

Table 1. Original ECP. Summary of Industry Led Accident Tolerant Fuel Development Projects.

Framatome (formerly AREVA)	GE	Westinghouse
Develop coated r-alloy cladding for improved accident performance Increase pellet conductivity: fuel with reduced stored energy that must be accommodated during design basis events (DBEs) Additives achieved: o SiC powder or whiskers o Diamond o Chrmia dopant	Develop advanced ferritic/martensitic steel alloys (e.g., Fe-Cr-Al) for fuel cladding to improve behavior under severe accident scenarios Objectives: o Characterize candidate steels o Study tube fabrication methods, neutronics, fuel economy, thermo-hydraulic calculations, regulatory approval path o Initiate ATR testing with UO_2 and two cladding materials	Cladding concepts: o SiC and SiC ceramic matrix composites High density/high thermal conductivity fuel pellets First batch of U_3Si_2 pellets were sintered using finely ground powder Pellets were pressed using pressures of 6,000-10,000 psi and sintered at temperatures of 1400°C

ATF-1 Test Series: Drop-in Capsule Testing in ATR

The ATF-1 test series investigates the performance of a wide variety of proposed ATF concepts under normal LWR operating conditions. The program uses data generated in this test series to assess the feasibility of certain ATF concepts and screen among concepts. The ATF-1 test series is a series of drop-in capsule tests irradiated in the ATR. INL initiated the ATF-1 test series in 2015 and began irradiating fuel rodlets isolated from the ATR primary coolant by a secondary capsule filled with an inert gas; the rodlet cladding does not contact reactor coolant water during irradiation. The ATF-1 test series investigates the irradiation behavior of new fuels (i.e., pellets/compacts) and their interaction with the cladding. The program did not design the ATF-1 series to assess the cladding interaction with reactor coolant water. The ATF-1 test series evaluates fuel behavior and fuel-cladding interaction to down-select one or more promising concepts to carry into the next phase of the irradiation testing program (i.e., ATF-2). ATF-1 is an early screening evaluation experiment series. Industry-led ATF fuel development teams at Framatome, GE, and Westinghouse supplied the initial complement of test fuels.

ATF-2 Test Series: Loop Testing in ATR

The ATF-2 test series evaluates the most promising concept(s) from the ATF-1 series by completing loop testing in the ATR. In the ATR loop, experimental ATF rods directly contact high-pressure water coolant having active chemistry control to mimic PWR primary coolant conditions. In addition to continuing the fuel behavior and fuel cladding interaction investigations in ATF-1, the ATF-2 experiment series includes evaluating cladding-coolant interaction.

ATF-2 assesses the performance of ATF concepts under normal LWR operating conditions. Currently the experiment is being designed to accommodate as many instrumented fuel pins as possible accommodating both 12 inch (30.5 cm) and 6 inch (15.2 cm) fuel pin lengths.

The ATF-2 test series produces irradiated fuel rods for comprehensive non-destructive and destructive post irradiation examination (PIE). The project non-destructively examines a large portion of the irradiated fuel rods so they can be used as prototypic test articles in the next phase of the irradiation testing program (ATF-3). The program may also use irradiated fuel rods from this test series for out-of-pile experiments to simulate loss-of-coolant-accidents (LOCAs).

AFT-3 Test Series: Transient Testing of ATF-2 Rods in TREAT

The ATF-3 test series uses the most promising concept(s) from the ATF-2 phase for transient testing in TREAT. ATF-3 subjects experimental ATF rods to reactivity-initiated accident (RIA) scenarios in TREAT to investigate their integral performance under RIA conditions. The program anticipates beginning this testing phase with fresh (unirradiated) fuel rodlets/rods to assess performance under a beginning-of-life (BOL) scenario and progress to the irradiated fuel rodlets/rods having multiple burnup levels obtained from the ATF-1 and ATF-2 test series. The ATF-3 experiment series continues through the design phase over the next few years. DOE evaluated the environmental impacts of transient irradiations in the TREAT reactor, including 1) transporting experiment materials between MFC and TREAT, 2) pre- and post-irradiation radiography, 3) PIE of test components at HFEF or other MFC facilities, and 4) waste generation and disposal in the Environmental Assessment (EA) and Finding of

No Significant Impact (FONSI) for the Resumption of Transient Testing of Nuclear Fuels and Materials (DOE/EA-1954, February 2014).

CM-ATF-x: Lead Fuel Rod or Lead Fuel Assemblies Irradiated in Commercial Nuclear Power Plant

The near-term goal of the DOE Accident Tolerant Fuel development program is to insert a lead fuel rod or lead fuel assembly into a commercial nuclear power plant by 2022. This lead fuel irradiation will then progress for 1 to 3 years in the commercial nuclear power plant and then will be removed, examined, and subjected to further testing and qualification.

In April 1995, DOE completed the Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement (DOE/EIS-0203) (hereafter, 1995 EIS) (DOE 1995a). The 1995 EIS contains an analysis of the potential environmental impacts associated with managing DOE's complex-wide spent nuclear fuel (SNF) Program from 1995 until 2035 and includes an analysis of a broad spectrum of fuel element designs.

In the June 1995 Record of Decision (ROD) for the 1995 PEIS, DOE selected Alternative 4a (Regionalization by Fuel Type) and decided to transport 165 Metric Tons of Heavy Metal (MTHM) in 1,940 planned shipments of SNF (including 575 Navy shipments) to the INL Site through the year 2035 [60 Federal Register (FR) 28680, June 1, 1995]. DOE issued an amended ROD in June 1996 for the 1995 PEIS, which lowered the number of planned shipments of SNF to the INL Site to 1,133 (575 shipments for the Navy and 558 planned shipments for DOE) (61 FR 9441, March 8, 1996).

At present, INL cannot accept irradiated fuel subject to the Idaho Settlement Agreement. In November 2019, DOE and the State of Idaho signed the Supplemental Agreement Concerning Conditional Waiver of Section D.2.e and K.1 of 1995 Settlement Agreement wherein the parties agree that DOE may resume the receipt of and plan for additional research quantities of commercial SNF at INL pursuant to the 2011 Memorandum of Agreement, the terms and conditions of which govern such additional shipments, upon successful production of at least 100 canisters of treated sodium bearing high-level waste (HLW) located at INL and so long as:

- DOE is not in breach of any terms and conditions of the 1995 Agreement, or the 2008 Agreement other than Those described in the Supplemental Agreement and,
- The Integrated Waste Treatment Unit (IWTU) is continuing sustained operations to treat the remaining Sodium Bearing HLW located at INL.

INL anticipates it will be able to accept the irradiated lead test rods by 2022. If INL cannot accept the irradiated lead test rods, another facility will complete PIE and other activities. The amount of irradiated fuel INL can receive remains subject to the limits established in the 1995 Agreement, —55 metric tons heavy metal (MTHM)—, and the INL Site has received 81 shipments of spent nuclear fuel that contained 27.8646 MTHM since 1995. DOE anticipates it will not reach the total number of shipments or MTHM limits identified in the MOA and amended ROD before 2035. Based on current planning, DOE anticipates the INL Site will receive less than 21 MTHM of additional SNF before 2035. Therefore, DOE would not exceed the 55 MTHM limit imposed through the Settlement Agreement by receiving the additional LFR or LTAs. However, prior to planning to receive or ship commercially irradiated materials to INL, this EC will be revised to verify material quantities and transportation routes have been evaluated in compliance with the National Environmental Policy Act (NEPA).

ATF-4 Test Series: Transient Testing of LTR/LTA Rods in TREAT

The ATF-4 test series assumes that the irradiation of ATF concept(s) in a commercial LWR as part of an LTR/LTA program begins in FY22. The logical final phase of the irradiation test program is to subject a subset of these Lead Test Rods to transient testing in TREAT. Since LTRs will be much longer than can be accommodated in TREAT, either shorter, segmented rods will need to be included in the LTR/LTA program or a sectioning/remanufacturing capability will be needed in the PIE facility in order to prepare appropriate test rods for TREAT. As in the ATF-3 test series, it is anticipated that this phase of testing would begin with fresh (unirradiated) fuel rods, fabricated by the same vendor and process as used for the LTRs, and progress to irradiated LTR segments of multiple burnup levels.

INL is evaluating capabilities to refabricate rods and conduct a full suite of transient testing at both TREAT and ATR. INL may need to refabricate irradiated rods coming from either ATR or commercial LTR/LTA programs for reinsertion into INL test reactors (ATR or TREAT). The purpose of these re-irradiation programs may be to extend the burnup of the rods or to conduct transient irradiations mimicking operational transients, anticipated operational occurrences (AOOs) or design basis accidents (DBAs). Prior to deciding to implement facility modifications or other actions needed to section or remanufacture LTRs or LTAs, this capability will be evaluated in compliance with NEPA and this EC will be revised.

As noted, INL performs irradiation experiments at both the ATR and TREAT. INL develops a variety of experiment test trains at both reactors to meet the data needs of industry partners. INL also customizes irradiation tests to meet specific data needs as they arise. INL is currently irradiating ATF concepts in both drop-in capsule irradiations and in the ATR pressurized water loop. These irradiations use small rodlets having LWR fuel radial dimensions but are typically shorter in their axial dimensions. The Following discussion summarizes the status of ATF R&D efforts performed in cooperation with industry led teams from Framatome, GE, and Westinghouse:

Framtome

Table 2, Original ECP. Status of Framatome ATF Irradiations at INL.

Rodlet / Capsule ID	Fuel system	Status	Baseline PIE non-destructive	Baseline PIE destructive
Drop-in-Capsule Irradiations				
ATF-00/A01	UO_2 / Zr-4		Completed	Completed
ATF-01/A02	UO_2 / Zr-4	In irradiation		
ATF-02/A03	UO_2+SiC / Zr-4	In irradiation		
ATF-03/A04	UO_2+SiC / Zr-4		Completed	Completed
ATF-04/A05	UO_2+Diamond / Zr-4		Completed	Completed
ATF-05/A06	UO_2+Diamond / Zr-4	In irradiation		
Pressurized Water Loop Irradiations				
AR-01	UO_2 / M5	In irradiation		
AR-02	UO_2 / M5	In irradiation		
AR-03	UO_2 / M5	In irradiation		
AR-04	UO_2 / M5	In irradiation		
AR-11	UO_2+Cr_2O_3 / Cr Coated M5	In irradiation		
AR-12	UO_2+Cr_2O_3 / Cr Coated M5	In irradiation		
AR-13	UO_2+Cr_2O_3 / Cr Coated M5	In irradiation		
AR-14	UO_2+Cr_2O_3 / Cr Coated M5	In irradiation		
AR-15	UO_2+Cr_2O_3 / Cr Coated M5	In irradiation		
AR-16	UO_2+Cr_2O_3 / Cr Coated M5	In irradiation		
AR-17	UO_2+Cr_2O_3 / Cr Coated M5	In irradiation		

In FY20 INL has planned three steady state irradiation cycles (166B, 168A, and 168B) at the ATR, each lasting about 60 days. In FY21 INL only plans one steady state cycle (169A) prior to the ATR core-internal-changeout (CIC). ATR will resume irradiations in FY22. After test rodlets reach target burn-up, INL removes them from the reactor, allows the experiments to cool, then ships the materials to INL's hot cell facilities for Post Irradiation Evaluation (PIE) or to the Transient Reactor Test (TREAT) facility for transient irradiations. In addition, rods coming from Framatome LTR or LTA programs may be sent to INL for PIE or transient irradiations at TREAT. Post irradiation examination at INL's MFC is divided into three general categories: 1) Non-Destructive Examinations (NDE), 2) Baseline Destructive Examinations, and 3) Advanced PIE.

INL supports the following Framatome ATF efforts:

Steady State Irradiation Experiments:

INL supports inserting new steady state irradiation experiments which support Framatome ATF development. This task has three subtasks as described below.

Inspection, Insertion, and Irradiation of Chrome Coated Pins in ATF-2

Following cycle 166B when INL removes Framatome rodlets AR-01, AR-02, AR-11 and AR-14 from the pressurized water loop, INL will replace the rodlets with like-for-like replacements having rodlet designations AR-05, AR-06, AR-18, and AR-19. INL will insert these rodlets into ATR cycle 168A. Rodlets AR-05 and AR-06 will be UO2 / M5 rodlets, and rodlets AR-18, and AR-19 will be UO2+Cr2O3 / Cr Coated M5 rodlets. Framatome has also discussed with INL the possibility of inserting SiC-SiC clad rods into cycle 169A. INL will evaluate this possibility with Framatome and make plans for their insertion pending further discussions.

Design and Analyze Drop-in-Capsule Experiment with High Thermal Conductivity Pellets

In cycle 170A (the cycle following 168B), Framatome plans to insert nine new drop-in-capsule rodlets, which test a new fuel design that includes a chrome additive to the UO2 matrix. Framatome aims to improve the thermal conductivity of the fuel with this design. The text matrix involves two chrome additive levels and baseline UO2. INL will irradiate rodlets at similar linear heat generation rates (LHGRs) with target fuel temperatures of less than 1600°C. Rodlets are planned to reach 10, 30, and 50 GWD/MTU burnup. INL will not irradiate these rodlets until FY21, but INL plans experiment design, analysis, and assembly activities to take place in FY20.

Fabrication and Insert Capsules with High Thermal Conductivity Rodlets

In FY20, INL will receive Framatome rodlets proposed for high thermal conductivity experiments in cycle 169A in FY21. INL will inspect and green tag the rodlets for insertion in cycle 169A. INL will also fabricate drop-in capsules based on as-built dimensions of the received rodlets and load the rodlets into capsules for insertion in cycle 169A.

General Electric Global Research (GE)

General Electric Global Research (GE) proposes continuing development efforts for the ATF Program. GE plans to expand and continue research and development related to ATF related concepts at INL in ATR, TREAT, and in out of pile tests and commercial reactors with prototypic segments and rods. The project also proposes to develop a licensing plan for future Nuclear Regulatory Commission (NRC) approval for initial commercial partial core loading in the mid-2020s. INL support to GE includes the following tasks:

1. Fundamental research, characterization and testing
2. Irradiation studies
3. Fabrication of tubing and rods
4. Modeling and simulation
5. Interface with utilities
6. Regulatory activities

GE efforts under the ATF program include collaborations with GE Global Research, Global Nuclear Fuels (GNF),and several national laboratories such as Oak Ridge National Laboratory (ORNL), INL, and Los Alamos National Laboratory (LANL). The GE ATF concept focuses mainly on developing iron-chromium-aluminum (FeCrAl) cladding for urania fuel. GE FeCrAl cladding has been trade named IronClad. The project has been expanding to include coatings for zirconium alloys, trade-named ARMOR (initially developed for fretting resistance), and silicon carbide (SiC) ceramics for fuel channels.

GE and GNF aim to install a second LTA into a commercial power reactor (Clinton Unit 1 plant) in the fall of 2019 and to obtain neutron irradiation data for FeCrAl material to advance manufacturing processes for ferritic alloys. GE plans to expand the scope of the project to coating Zircaloy tubes to increase fretting and corrosion resistance and to developing silicon carbide compatible with 300 °C water to be used for the fuel channels. The national laboratories (Idaho, Los Alamos, and Oak Ridge) offer academic insight on nuclear materials behavior including manufacturing, resistance in reaction with superheated steam, and neutron irradiation damage. The national laboratories also perform modeling and simulation to predict changes in the reactor core from using IronClad in place of a zirconium alloy.

Table 3, Original ECP. Main Tasks for GE ATF

Table 3, Original ECP. Main Tasks for GE ATF

Tasks	Responsibility
1—Fundamental Research, Characterization and Testing	
1.1 Nuclear grade closed metal confinements (CMCs) for channels	GE Global Research
1.2 Isothermal corrosion of CMCs, IronClad, welds and tubes	GE Global Research
1.3 Zircaloy channel coating development	GE Global Research
1.4 Crud Deposition on rods	GE Global Research
1.5 Material properties and deformation and tube fabrication studies	GE Global Research
1.6 Method optimization for weld inspection	GE Global Research
1.7 Project management and technical support to commercial sector	GE Global Research
1.8 Development of a UO_2 -cermet fuel	LANL
1.9 Corrosion/oxidation investigations	ORNL
1.10 Normal operation cladding performance	ORNL
2—Irradiation Studies	
2.1 ATF-1 and Post Irradiation Examination (PIE) of early rodlets	INL
2.2 ATF-2 testing at ATR and TREAT	INL, GNF
2.3 ATF-3 TREAT testing	INL, GNF
3—Fabrication of tubing and rods	
3.1 Additive manufacturing of caps and other components	GE Global Research
3.2 Laser welding method development	GE Global Research
3.3 Tubing production development	GNF
3.4 Fuel rod fabrication development	GNF
3.5 NDT Inspection Development	GNF
4—Modeling and Simulation	
4.1 Conceptual fuel assembly design	GNF
4.2 Prototype mechanical design	GNF
4.3 Plant safety and performance analysis	GNF
4.4 Properties for fuel modeling	ORNL
4.5 Thermal mechanical methods and advanced modeling	GNF
4.6 Computational materials modeling	GNF
4.7 Thermal-hydraulic testing	GNF
5—Interface with Utilities	
5.1 Insertion of a fueled LTA in Cycle 20 at Clinton	GNF & Exelon
5.2 IronClad poolside irradiated fuel inspections	GNF & Southern Nuclear
5.3 PIE of IronClad Tube	GNF
5.4 Transportation	GNF
6—Regulatory Activities	
6.1 LTA licensing	GNF
6.2 Licensing plan	GNF

INL support to GE for ATF includes:

1. Rodlet design and experiment reconsiderations (FY19).
2. Receive, from GNF, and pre-irradiation test 6 ATF-2 UO2 fueled GE rodlets (FY19).
3. Transport 4 pins batch (ATF-1) from ATR to HFEF (FY19).
4. Transport 4 pins (ATF-1) from ATR to HFEF (FY20 and FY21) for PIE analysis or TREAT for transient studies.
5. Baseline PIE testing of ATF-1 rodlets (FY19).
6. Dry capsule test, in a Separate Effects Test Holder (SETH) capsule, 3 cladding types (Zircaloy Clad, FeCrAL Clad, and ARMOR Clad) in FY19. Each test is five separate transients to determine the enthalpy needed to cause cladding breach. Tests will be followed by PIE to determine the radiation effect from each transient (FY18 & 19).

7. Wet capsule test, in Minimal Activation Retrievable Capsule Holder (MARCH)-Static Environment Rodlet Transient Test Apparatus (SERTTA) capsules, 3 cladding types (Zircaloy Clad, FeCrAL Clad, and ARMOR Clad) with DOE-owned fresh fuel. Each test will be 5 transients and simulate reactivity insertion accidents (RIA) for different cladding to determine the enthalpy needed for cladding breach. Tests will be followed by PIE to determine radiation effect from each transient (FY20 and FY21). Natural circulation flow test, in Super-SERTTA capsules, 1 of three cladding types (Zircaloy Clad, FeCrAL Clad, and ARMOR Clad) with DOE-owned fresh fuel in FY21. Each test will be 2 transients. These tests simulate Loss of Coolant Accidents (LOCA) and will be followed by PIE to determine the radiation effect from each transient (FY21).
8. Natural circulation flow test, in Super-SERTTA capsules, 1 of three cladding types (Zircaloy Clad, FeCrAL Clad, and ARMOR Clad) with DOE-owned fresh fuel in FY21. Each test will be 2 transients. These tests simulate Loss of Coolant Accidents (LOCA) and will be followed by PIE to determine the radiation effect from each transient (FY21).
9. Redesign, analyze, and fabricate new ATF-2 tier and pin holders for switching from the baselined .374 size pins to .404 pins (FY19).

Westinghouse

INL supports Westinghouse by conducting irradiation experiments on Westinghouse's ATF concepts and examining irradiated ATF materials to develop data sets supporting Westinghouse ATF concept design and licensing. INL is currently irradiating Westinghouse ATF concepts in both drop-in-capsule irradiations and the pressurized water loop of the ATR. These irradiations use small rodlets typical of LWR fuel in their radial dimensions but are typically shorter in their axial dimensions. Table 4 shows a status summary of Westinghouse ATF irradiations at INL

Table 4, Original ECP. Status of Westinghouse ATF Irradiations at INL

Rodlet / Capsule ID	Fuel System	Status	Baseline PIE non-destructive	Baseline PIE destructive
Drop in Capsule Irradiations (ATF-1)				
ATF-10/W01	U_3Si_2 / **ZIRLO®**		On-going	
ATF-11/W02	U_3Si_2 / **ZIRLO**	In irradiation		
ATF-12/W03	U_3Si_2 / **ZIRLO**	In irradiation		
ATF-13/W04	U_3Si_2 / **ZIRLO**		Completed	Completed
ATF-14/W05	U_3Si_2 / **ZIRLO**	In irradiation		
ATF-15/W06	U_3Si_2 / **ZIRLO**		Completed	Completed
ATF-29/WB1	UN-30%wt U_3Si_2 / **ZIRLO**	In irradiation		
ATF-30/WB2	UN-30%wt U_3Si_2 / **ZIRLO**		On-going	
ATF-31/WB3	UN-30%wt U_3Si_2 / **ZIRLO**	In irradiation		
ATF-32/WB4	UN-30%wt U_3Si_2 / **ZIRLO**	In irradiation		
ATF-33/WB5	UN-30%wt U_3Si_2 / **ZIRLO**	In irradiation		
ATF-34/WB6	UN-30%wt U_3Si_2 / **ZIRLO**		On-going	
Pressurized Water Loop Irradiations (ATF-2)				
W-01	UO_2/Cr-coated **Optimized ZIRLO™**	Shipment to MFC Pending		
W-02	UO_2/Cr-coated **Optimized ZIRLO**	Shipment to MFC Pending		
W-03	UO_2/Cr-coated **Optimized ZIRLO**	Shipment to MFC Pending		
IW-01	Cr-coated **Optimized ZIRLO**	In ATR Canal		
IW-02	Cr-coated **Optimized ZIRLO**	In irradiation		
IW-03	Cr-coated **Optimized ZIRLO**	In irradiation		
IW-04	Cr-coated **Optimized ZIRLO**	In irradiation		
W2-01	Cr-coated **Optimized ZIRLO**	Awaiting Initial Insertion		
W2-02	Cr-coated **Optimized ZIRLO**	Awaiting Initial Insertion		
W2-03	Cr-coated **Optimized ZIRLO**	Awaiting Initial Insertion		

Westinghouse plans three steady state irradiation cycles (166B, 168A, and 168B) in FY20 in the ATR, each lasting approximately 60 days and one in FY21. (169A) prior to the ATR CIC. After test rodlets reach their specified burn-up target, INL discharges them from the reactor and allows them to cool before being shipped to INL hot cell facilities for PIE.

INL will refabricate irradiated rods from ATR or commercial LTR and LTA programs for re-insertion into ATR or TREAT. The purpose of these re-irradiation programs may be to extend the burnup of the rod, or to mimic operational transients, anticipated operational occurrences (AOOs) or design basis accidents (DBAs).

INL supports the following Westinghouse ATF efforts:

INL supports reactor insertion of new steady state irradiation experiments for Westinghouse ATF development. The following tasks describe Westinghouse irradiation experiments at INL:

Fabrication, Insertion, and Irradiation of Chrome Coated Pins in ATF-2

In cycle 168A, INL will insert three new Westinghouse rodlets into the ATR pressurized water loop. The rodlets will be about 12 in. long, one rodlet will be uranium dioxide (UO2)/Cr-coated Optimized ZIRLO ATF concept, and two rodlets will be ADOPT™-UO2/Cr-coated optimized ZIRLO ATF concept. Westinghouse will supply INL with the Crcoated optimized ZIRLO cladding, UO2 fuel, and end cap material necessary to fabricate the rodlets prior to the 168A cycle. Westinghouse subrecipient General Atomics plans to insert SiC-SiC rods into ATR cycle 168B. If this insertion is unsuccessful, Westinghouse rods IW-02, IW03, and IW04 will remain in the reactor for additional irradiation.

New ATF-2 Test Train Design with Wireless Sensors

In future irradiations, Westinghouse plans to use in-pin sensors to accelerate information acquisition on fuel pins. These sensors use transceivers outside the pins to wirelessly send and receive signals.

Post Irradiation Examination:

PIE is an essential component of the fuel development effort in that it provides data on material irradiation performance that feeds back to fabrication variables and provides data to help qualify the down-selected fuel system that meets performance requirements. INL performs the following types of PIE in HFEF:

Blister Anneal Testing

This test requires that the fuel component be heated to the point where the first failure threshold has been reached as indicated by raised areas (blisters) on the surface of the component. This is required for fuel qualification since blistering is conservatively presented as a precursor to a breach of the fuel cladding, the primary containment of the fuel and fission products. Blister anneal testing can be performed in simple furnaces provided the temperatures can reach a maximum of 550°C. This is a destructive examination

Burn-up and Scanning Electron Microscope (SEM)/Transmission Electron Microscope (TEM) Sample Preparation

Sample preparation involves sectioning of irradiated components, packaging and transferring materials to appropriate facility. This is a destructive examination.

Disassembly

Disassembly of the capsules is done only to remove the fuel rodlets from the external capsules. Every effort is made to do so without damaging the internal fuel rodlets. A lathe would be used to cut the endcaps off the capsules. The rodlets are then pushed out of the capsule tube using an appropriately sized drill rod. This is non-destructive (to the rodlet) process.

Eddy Current (Oxide)

Eddy current measurements are taken to estimate the oxide thickness that has grown on the fuel components. This is a non-destructive examination.

Fission Product Release

Data obtained from fission gas release may be used in the fuel qualification report. The purpose is to identify the failure thresholds and measure fission product release to define the allowable safety margins for monolithic and dispersion fuel utilization. Specifically source term data is determined based on the type and movement of various fission product inventories. These examinations can be performed in a furnace that can accommodate the sample size and that is capable of reaching at least 2000°C. This is a destructive examination.

Gamma Scanning

All irradiated experimental components are scanned using the precision gamma scanner (PGS). Gamma scan results are used to determine the relative 2-D fission density gradient over a surface. This is a non-destructive examination.

Immersion Density

Immersion density data provides fuel swelling values for the material. This information is used in the fuel qualification report as a fundamental fuel behavior property. This is a non-destructive examination.

Metallography

Metallography is both a qualitative and quantitative measure. This is a destructive examination of irradiated materials requiring sectioning and mounting small pieces of the irradiated fuel for examination in the microscope.

Microhardness

Microhardness testing is done on the system installed in the HFEF met box. This is a destructive examination of irradiated materials requiring sectioning and mounting small pieces of the irradiated fuel.

NRAD

Neutron radiography is performed to identify any cracking in the fuel foil prior to sectioning. This is a nondestructive examination.

Profilometry

Profilometry data is used to determine local fuel swelling and is vital to the fuel qualification report. This is a nondestructive examination.

Visual Examination

The visual examinations of materials at HFEF would be performed to identify any anomalies, changes or defects that may have occurred during irradiation or shipping. The examination is performed using a telephoto lens and camera, taking photos through the HFEF hot cell window. Photographs are taken of the front, back, and end of all capsules. This is a non-destructive examination.

Some samples may be sent to the Analytical Laboratory, Electron Microscopy Laboratory (EML), Irradiated Materials Characterization Laboratory (IMCL), Radiochemistry Laboratory, or the Sample Preparation Laboratory (when available) at MFC for additional analysis.

After PIE, irradiated test pin segments and PIE remnants will be stored with other similar DOE-owned irradiated materials and experiments at MFC, most likely in the HFEF or the Radioactive Scrap and Waste Facility (RSWF) in accordance with DOE's Programmatic SNF Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement (FEIS) and ROD (DOE/EIS-0203, 1995) and supplemental analyses (DOE/EIS-0203-SA-01 and DOE/EIS-0203-SA-02) and the Amended Record of Decision (February 1996). Ultimate disposal of the irradiated test pin segments and PIE remnants will be along with similar DOE-owned irradiated materials and experiments currently at MFC. Categorizing this material as waste is supported under Department of Energy Order (DOE O) 435.1, Att. 1, Item 44, which states "…Test specimens of fissionable material irradiated for research and development purposes only…may be classified as waste and managed in accordance with this Order...".

In addition, to complete proposed work activities, it is necessary for the project to use the HFEF hot cell which contains both defense and nondefense related materials and contamination. Project materials will come into contact with defense related materials. It is impractical to clean out defense related contamination, and therefore, waste associated with project activities is eligible for disposal at the Waste Isolation Pilot Plant (WIPP). National Environmental Policy Act (NEPA) coverage for the transportation and disposal of waste to WIPP are found in Final Waste Management Programmatic Environmental Impact Statement [WM PEIS] (DOE/EIS-0200-F, May 1997) and Waste Isolation Plant Disposal Phase Supplemental EIS (SEIS-II) (DOE/EIS-0026-S-2, Sept. 1997), respectively. The 1990 ROD also stated that a more detailed analysis of the impacts of processing and handling transuranic (TRU) waste at the generator storage facilities would be conducted. The Department has analyzed transuranic (TRU) waste management activities in the Final Waste Management Programmatic Environmental Impact Statement (WM PEIS) (DOE/EIS-200-F, May 1997). The WM PEIS analyzes environmental impacts at the potential locations of treatment and storage sites for TRU waste; SEIS-II addresses impacts associated with alternative treatment methods, the disposal of TRU waste at WIPP and alternatives to that disposal, and the transportation to WIPP.

Packaging, repackaging, transportation, receiving, and storing used nuclear fuel and R&D for used nuclear fuel management is covered by DOE's Programmatic Spent Nuclear Fuel (SNF) Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement (EIS) and Record of Decision (DOE/EIS-0203, 1995) and supplemental analyses (DOE/EIS-0203- SA-01 and DOE/EIS-0203-SA-02) and the Amended Record of Decision (February 1996). The analyses include those impacts related to transportation to, storage of, and research and development related to used nuclear fuel at the INL (see Tables 3.1 of the SNF Record of Decision (May 30, 1995) and Table 1.1 of the Amended Record of Decision [February 1996].

The environmental impacts of transferring LLW from the INL Site to the Nevada National Security Site were analyzed in the 2014 Final Site-Wide Environmental Impact Statement for the Continued Operation of the Department of Energy/National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada (DOE/EIS-0426) and DOE's Waste Management Programmatic EIS (DOE/EIS-200). The fourth Record of Decision (ROD) (65 FR 10061, February 25, 2000) for DOE's Waste Management Programmatic EIS established the Nevada National Security Site as one of two regional LLW and MLLW disposal sites.

The potential for transportation accidents was analyzed in the SNF EIS (Section 5.1.5 and Appendix I-5 through I-10).

In addition to disposal of the irradiated fuel that will be generated as described above, industrial, mixed, and low level waste will be generated throughout the R&D process. This waste will be classified and disposed in accordance with INL procedures and DOE regulations/requirements.

Environmental Aspects or Potential Sources of Impact:

Air Emissions

Project activities have the potential to release ozone depleting substances and greenhouse gases.

The proposed action has the potential to generate radiological and chemical emissions from irradiation in ATR and PIE at MFC (Analytical Laboratory, EML, HFEF and IMCL). Air emissions are anticipated to be minor, and concentrations would not exceed the current monitored/calculated air emissions from these facilities.

The ATR irradiation activities are not modifications in accordance with Idaho Administrative Procedures Act (IDAPA) 58.01.01.201 and 40 Code of Federal Regulation (CFR) 61 Subpart H. ATR radionuclide emissions are sampled and reported in accordance with Laboratory Wide Procedure (LWP)-8000 and 40 CFR 61 Subpart H. All experiments will be evaluated by Environmental Support and Services staff. All radionuclide release data (isotope specific in curies) directly associated with this proposal will be calculated and provided to the Environmental Support organization.

The irradiated specimens will be delivered to the MFC HFEF for disassembly and then undergo routine PIE at (Analytical Laboratory, EML, and IMCL). All radionuclide release data at HFEF will be recorded as part of the HFEF continuous stack monitor. Emissions from the PIE examination at Analytical Laboratory, EML, and IMCL would be tracked and in accordance with 40 CFR 61, Subpart H. These activities are considered routine and not a modification in accordance with Idaho Administrative Procedures Act (IDAPA) 58.01.01.201 and 40 Code of Federal Regulation CFR) 61 Subpart H.

In 2023, the effective dose equivalent to the offsite MEI from all operations at the INL Site was calculated as 2.90E-02 mrem/yr, which is 0.29% of the 10-mrem/yr federal standard.

In 2019, the effective dose equivalent to the offsite maximally exposed individual (MEI) from all operations at the INL Site was calculated as 5.59 E-02 mrem/yr, which is 0.56% of the 10-mrem/yr federal standard and was calculated using all sources that emitted radionuclides to the environment from the INL site. The emissions are bounded by the analysis in the 1995 EIS, which estimated the annual cumulative doses to the maximally exposed worker, offsite maximally exposed individual (MEI), and the collective population from DOE's decision to implement the preferred alternative (DOE/EIS-0203). The potential air emissions and human health impacts associated with the proposed action would be smaller than and are bounded by the impacts presented in the 1995 EIS.

Discharging to Surface-, Storm-, or Ground Water

NA

Disturbing Cultural or Biological Resources

NA

Generating and Managing Waste

Irradiated sample debris and PIE waste are expected to generate research and development related TRU waste and mixed TRU waste. TRU waste generated for the ATF experiments will be limited to 4 kgs. Categorizing this material as waste is supported under DOE O 435.1, Att. 1, Item 44, which states "…Test specimens of fissionable material irradiated for research and development purposes only…may be classified as waste and managed in accordance with this Order...".

The proposed action has the potential to generate small amounts of hazardous waste from cleaning solvents, solders, metals; scrap metal (held for recycle whenever appropriate). Waste Generator Services (WGS) will evaluate, characterize, and manage hazardous waste. In addition, WGS may establish satellite accumulation areas to manage hazardous waste.

Small amounts of low-level waste would be generated in the form of personal protective equipment (PPE) and towels used for cleaning and polishing.

Project activities would also result in the generation of small amounts of industrial waste such as waste from machining/fabrication processes.

Project personnel would work with WGS to properly package and transport regulated, hazardous or radioactive material or waste according to laboratory procedures.

Releasing Contaminants

Chemicals will be used and will be submitted to chemical inventory lists with associated Safety Data Sheets (SDSs) for approval prior to use. The Facility Chemical Coordinator will enter these chemicals into the INL Chemical Management Database. All chemicals will be managed in accordance with laboratory procedures. When dispositioning surplus chemicals, project personnel must contact the facility Chemical Coordinator for disposition instructions.

Using, Reusing, and Conserving Natural Resources

NA

Determination:

References: B3.6 "Small-scale research and development, laboratory operations, and pilot projects"
Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement and Record of Decision (DOE/EIS-0203, 1995) and supplemental analyses (DOE/EIS-0203-SA-01 and DOE/EIS- 0203-SA-02) and the Amended Record of Decision (1996).

Final Environmental Impact Statement for the Waste Isolation Pilot Plant (DOE/EIS-0026, October 1980) and Final Supplement Environmental Impact Statement for the Waste Isolation Pilot Plant (SEIS-I) (DOE/EIS-0026-FS, January 1990).

Final Waste Management Programmatic Environmental Impact Statement [WM PEIS] (DOE/EIS-0200-F, May 1997) and Waste Isolation Plant Disposal Phase Supplemental EIS (SEISII) (DOE/EIS-0026-S-2, September 1997).

Final Site-Wide Environmental Impact Statement for the Continued Operation of the Department of Energy/National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada (DOE/EIS-0426, December 2014).

Justification:

DOE evaluated the environmental impacts of transient irradiations in the TREAT reactor, including 1) transporting experiment materials between MFC and TREAT, 2) pre- and post-irradiation radiography, 3) PIE of test components at HFEF or other MFC facilities, and 4) waste generation and disposal in the Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) for the Resumption of Transient Testing of Nuclear Fuels and Materials (DOE/EA-1954, February 2014).

After PIE, irradiated test pin segments and PIE remnants will be stored with other similar DOE owned irradiated materials and experiments at MFC, most likely in the HFEF or the Radioactive Scrap and Waste Facility (RSWF) in accordance with DOE's Programmatic SNF Management and Programs Final Environmental Impact Statement (FEIS) and ROD (DOE/EIS-0203, 1995) and supplemental analyses (DOE/EIS-0203-SA-01 and DOE/EIS-0203-SA-02) and the Amended Record of Decision (February 1996). Ultimate disposal of the irradiated test pin segments and PIE remnants will be along with similar DOE-owned irradiated materials and experiments currently at MFC. Irradiated sample debris and secondary waste could total as much as 20-30 Kg. Categorizing this material as waste is supported under Department of Energy Order (DOE O) 435.1, Att. 1, Item 44, which states "…Test specimens of fissionable material irradiated for research and development purposes only…may be classified as waste and managed in accordance with this Order...".

NEPA coverage for the transportation and disposal of waste to WIPP are found in the Final Waste Management Programmatic Environmental Impact Statement [WM PEIS] (DOE/EIS-0200-F, May 1997) and Waste Isolation Plant Disposal Phase Supplemental EIS (SEIS-II) (DOE/EIS-0026-S-2, Sept. 1997), respectively. The 1990 ROD also stated that a more detailed analysis of the impacts of processing and handling TRU waste at the generator-storage facilities would be conducted. The Department has analyzed TRU waste management activities in the Final Waste Management Programmatic Environmental Impact Statement (WM PEIS) (DOE /EIS-200-F, May 1997). The WM PEIS analyzes environmental impacts at the potential locations of treatment and storage sites for TRU waste; SEIS-II addresses impacts associated with alternative treatment methods, the disposal of TRU waste at WIPP and alternatives to that disposal, and the transportation to WIPP.

The environmental impacts of transferring LLW from the INL Site to the Nevada National Security Site were analyzed in the 2014 Final Site-Wide Environmental Impact Statement for the Continued Operation of the Department of Energy/National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada (DOE/EIS-0426) and DOE's Waste Management Programmatic EIS (DOE/EIS-200). The fourth Record of Decision (ROD) (65 FR 10061, February 25, 2000) for DOE’s Waste Management Programmatic EIS established the Nevada National Security Site as one of two regional LLW and MLLW disposal sites.

B3.6 Small-scale research and development, laboratory operations, and pilot projects. Siting, construction, modification, operation, and decommissioning of facilities for small-scale research and development projects; conventional laboratory operations (such as preparation of chemical standards and sample analysis); and small-scale pilot projects (generally less than 2 years) frequently conducted to verify a concept before demonstration actions, provided that construction or modification would be within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible). Not included in this category are demonstration actions, meaning actions that are undertaken at a scale to show whether a technology would be viable on a larger scale and suitable for commercial deployment.

The proposal fits within the classes of actions listed in Appendix B to 10 CFR Part 1021 or Appendix B and C of DOE’s NEPA Implementing Procedures and satisfies the conditions that are integral elements of the classes of actions therein. The proposal does not: (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health, or similar requirements of DOE or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment facilities (including incinerators), but the proposal may include categorically excluded waste storage, disposal, recovery, or treatment actions or facilities; (3) disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that preexist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources, including, but not limited to, those listed in paragraph B(4) of 10 CFR Part 1021, Appendix B; (5) involve genetically engineered organisms, synthetic biology, governmentally designated noxious weeds, or invasive species, unless the proposed activity would be contained or confined in a manner designed and operated to prevent unauthorized release into the environment and conducted in accordance with applicable requirements, such as those listed in paragraph B(5) of 10 CFR Part 1021, Appendix B.

There is no extraordinary circumstance related to the proposal that is likely to cause a reasonably foreseeable significant adverse effect or for which DOE does not know the environmental effect. Extraordinary circumstances are unique situations presented by specific proposals, including, but not limited to, scientific controversy about the environmental effects of the proposal; uncertain effects or effects involving unique or unknown risks; and unresolved conflicts concerning alternative uses of available resources.

The proposal has not been segmented to meet the definition of a categorical exclusion. Segmentation can occur when a proposal is broken down into small parts in order to avoid the appearance of significance of the total action. However, segmentation does not include proposals that are developed and potentially implemented over multiple phases where each phase results in a decision whether to proceed to the subsequent phase.

Based on my review of the proposed action, I have determined that the proposed action fits within the specified class(es) of action, the other regulatory requirements set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

Approved by Robert Douglas Herzog, DOE-ID NEPA Compliance Officer on: 2/23/2026