# DOE-ID NEPA CX DETERMINATION
# Idaho National Laboratory



CX Posting No.: DOE-ID-INL-16-060

**SECTION A. Project Title:** Sample Preparation Laboratory

**SECTION B. Project Description and Purpose:**

The demand for clean, sustainable energy continues to increase in the United States (U.S.), and nuclear energy will play a major role in fulfilling that demand. Understanding nuclear fuel and material performance in the nuclear environment at the micro, nano, and atomic scale is critical to development of innovative fuels and materials required for future nuclear energy systems. Current post irradiation examination (PIE) capabilities will continue to serve basic needs for fuel examination, material handling, and waste disposal, but they are limited in their ability to function on smaller scales.

Most U.S. national laboratory PIE capabilities are located in 30 to 50-year-old hot cell facilities not designed for modern-day research tools and instruments. Modern research tools and instruments require facility spaces with flexibility to accommodate unique sensitivities to various environmental conditions, such as radiation field intensity, dust and contamination, noise and vibration, electromagnetic and radio-frequency interference, and temperature and humidity fluctuations. Current capabilities are able to serve basic PIE functions but are unable to adequately characterize the behavior of nuclear fuels and materials at the resolution (i.e., nanoscale and finer) needed to accomplish Department of Energy Nuclear Energy's (DOE-NE's) mission objectives.

Understanding nuclear fuel and material performance in the nuclear environment at the micro, nano, and atomic scale requires suitable nuclear facilities that can accommodate such research. Therefore, Department of Energy (DOE) proposes to construct a new, modern facility at the Materials and Fuels Complex (MFC) at Idaho National Laboratory (INL) to support these needed capabilities. The proposed facility, the Sample Preparation Laboratory (SPL), would provide needed capabilities by supplementing current capabilities at MFC (e.g., the Irradiated Materials Characterization Laboratory [IMCL] and Hot Fuel Examination Facility [HFEF]) with a functionally focused building dedicated to non-alpha sample preparation that would support deployment of equipment to study fuel and material performance in the nuclear environment at the micro, nano, and atomic scale.

The SPL would receive irradiated nuclear materials and aid in sample preparation for micro and nano-scale structural, chemical, mechanical, and thermal properties analyses. The laboratory would fulfill near-term advanced post-irradiation needs and serve as a center for advanced fuels and materials characterization and development of new processes, tools, and instruments to further DOE-NE Research, Development, and Demonstration (RD&D).

The new capabilities would improve overall sample throughput and quality by establishing dedicated sample receipt and preparation capabilities for beta and gamma-emitting materials. Non-alpha emitting samples would include solids and contained powders. Direct receipt of non-alpha containing structural material samples at the SPL would reduce decontamination efforts and associated waste generation currently required when these samples are processed through HFEF due to alpha contamination levels in the HFEF hot cells.

Equipment that would be deployed at the facility includes load frame and charpy testing machines, micro- and nano-hardness testers, scanning electron microscopes, surface science instruments, x-ray diffraction, electric discharge machines, focused ion beam, electron probe micro-analyzer, transmission electron microscope, and sample preparation machinery (lathes, mills, saws, metallurgical mounting equipment, and cutting or sizing equipment).

The facility would include shielded cell(s), gloveboxes, and hoods to support sample preparation of non-alpha bearing materials with the ability to receive small and medium-sized casks, and to sort, size, polish, mount and conduct initial analyses of material specimens. Advanced scientific instrumentation would be housed in enclosures specifically designed to support such instrumentation. Samples with non-fixed alpha contamination would continue to be managed at HFEF and IMCL.

The proposed action includes the following activities:

1. Constructing an approximately 44,000 sq ft building, in a previously disturbed area, that would include a general office area, laboratory area, shipping and receiving area, and areas for support equipment (e.g., heating, ventilation and air conditioning [HVAC]; electrical; and mechanical system; and monitoring systems, such as radiation area monitors, continuous air monitors, personnel monitors, building stack monitors, and ventilation) systems for control of contamination within the facility and high-efficiency particulate air (HEPA) filters to filter the air before release to the environment.
2. Tying into utilities at MFC, including potable water, fire water, sanitary and industrial waste, electrical power, telephone and data, and access security systems. The sanitary waste system or industrial waste system would handle effluents from the restrooms, sinks, and air conditioning condensate.
3. Constructing a dedicated non-alpha sample preparation hot cell, a mechanical properties testing cell, and several examination instrument enclosures
4. Installing a pneumatic transfer system to support material transfer within the facility and provide for future inter-facility transfer at MFC.

The SPL would be a three story, slab-on-grade, masonry block structure with steel roof joists and deck and a low-sloped, internally drained roof. The first floor would be reinforced, cast-in-place concrete. Portions of the floor in areas designated for examination enclosures may have thickened slabs to reduce vibration levels in those areas. The second and third floors would be steel deck with reinforced concrete.

Nuclear confinement ventilation would be designed in accordance with the requirements of Department of Energy Standard (DOE-STD)-1189 and Department of Energy Handbook (DOE-HDBK)-1169, Nuclear Air Cleaning Handbook. Air flow would be designed so air would flow from areas with lesser potential for contamination to areas of greater potential for contamination. Two stages of HEPA filtration would be provided in the final HEPA filter housings located in the HVAC room before exhausting to the facility stack. Filters would also be provided on the inlet to the hot cells and instrument enclosure to prevent back-flow of contaminated gas to the operating area. Additional filters would be provided on the outlets from the cells to reduce radiation from the ducting between the cells and the HVAC room. The facility stack would have emissions monitoring per the requirements of American National Standards Institute (ANSI)/Health Physics Society (HPS)-13.1. A separate ventilation system would be provided in the administration area for comfort ventilation and would operate at a slightly higher pressure than the rest of the facility to prevent contamination from being drawn into this area.

Water for domestic, industrial, and fire suppression would be provided by the single system at MFC. Potable uses would be protected from other uses by appropriate use of backflow prevention devices. The facility would include appropriate sanitary sewer piping and fixtures to connect to the MFC sanitary sewer system.

Large electrical loads (mainly HVAC equipment) would be supplied with 480-V, three-phase power. Motor control centers would be installed to supply power to pump, blower, fan, heater, and compressor motor loads. The motor control centers would have communications capability to interface with the building management system for metering functions. Variable frequency drives would be installed as close to the motor as possible. Drive isolation transformers would be used with variable frequency drives to lessen the harmonic and transient generation back into the facility power supply.

The 480-V distribution panels would supply 480-208/120-V step-down transformers to provide power for small 208-V three and single-phase loads, single-phase lighting, receptacle loads, and telecommunications equipment. The 208/120-V distribution panels would be installed throughout the facility to minimize branch circuit routing for the equipment loads. A 200-ampere, 208/120-V panel would be dedicated to the telecommunication room to supply power to information technology equipment.

INL telecommunication capabilities (i.e., voice, network, multimedia, and special services transport) would be provided in the facility. A new duct bank would be routed from the telecommunications manhole near the SPL to the telecommunication room in the facility. Conduit and ducts would be installed under the support facility floor slab and stub up and into the telecommunications room. The duct bank from the dial room, MFC-1728, to the manhole near the SPL is not part of the proposed action, but would be provided as part of MFC activities necessary for current and future operating infrastructure at the complex.

Fire alarm and emergency notification information would be supplied via single-mode fiber optics. Modular communication access points would be located throughout the SPL. Dedicated telecommunications raceways would be provided to minimize unintended signal noise in the administrative areas. A fire alarm and mass notification system would be provided throughout the facility meeting the requirements of National Fire Protection Association (NFPA)-72, “National Fire Alarm and Signaling Code."

Based on material quantity, facility processes, and primary radionuclides of concern, the SPL would be a Hazard Category 3 nuclear facility per DOE STD-1027-92 focused primarily on materials that emit beta and gamma radiation. Experiments accepted at the SPL would consist primarily of non-alpha, non-dispersible solids in the form of irradiated structural materials. Based on the primary radionuclides of concern, these materials primarily represent a direct radiation hazard. No alpha contamination would be generated from sample preparation activities. In some cases, very small quantities of non-dispersible alpha-emitting materials may be received in the form of metallurgical mounts for examination using the advanced examination capabilities at SPL. The quantity of non-dispersible alpha-emitting samples would be managed within the thresholds for a Hazard Category 3 nuclear facility and samples would be returned to the originated facility following analysis. Non-alpha emitting isotope material experiments that are currently processed through HFEF would normally be sent directly to the new SPL to improve sample preparation throughput and quality in both facilities.

Roughly 10% of historical throughput at HFEF was devoted to processing and examination of non-fueled experiments. Under the proposed action, non-fuel experiments would be handled in the SPL. Most non-fuel experiments would be derived from material irradiations conducted at the Advanced Test Reactor (ATR). These materials would be sent directly to SPL from ATR. Additionally, the proposed work at SPL is not dependent on capabilities housed at other MFC facilities.

If SPL is constructed, HFEF’s throughput for other work could potentially increase by approximately 10%. However, the number of fueled experiments examined in HFEF is programmatically driven and current throughput is less than what has occurred in the past. The number of experiments examined at HFEF may increase above current levels but would remain within the historical levels of activities conducted at HFEF. Overall waste generation (including types of waste generated) and air emissions estimates for HFEF are not anticipated to change.

No revisions to the HFEF safety analysis report (SAR) are anticipated due to the potential ability to prepare more samples from a given fueled experiment or the ability to process more experiments through HFEF. Furthermore, anticipated experiments are not expected to increase the hazardous material inventory limits in HFEF.

The SPL would provide the ability to repackage non-alpha materials for shipment to other facilities--including facilities that are part of the Advanced Test Reactor National Scientific User Facility--and, in addition to the proposed mechanical properties testing and examination equipment, would provide space for future installation of instrument enclosures to support advanced PIE analytical capabilities. Future equipment installation may require revision to this Environmental Checklist (EC).

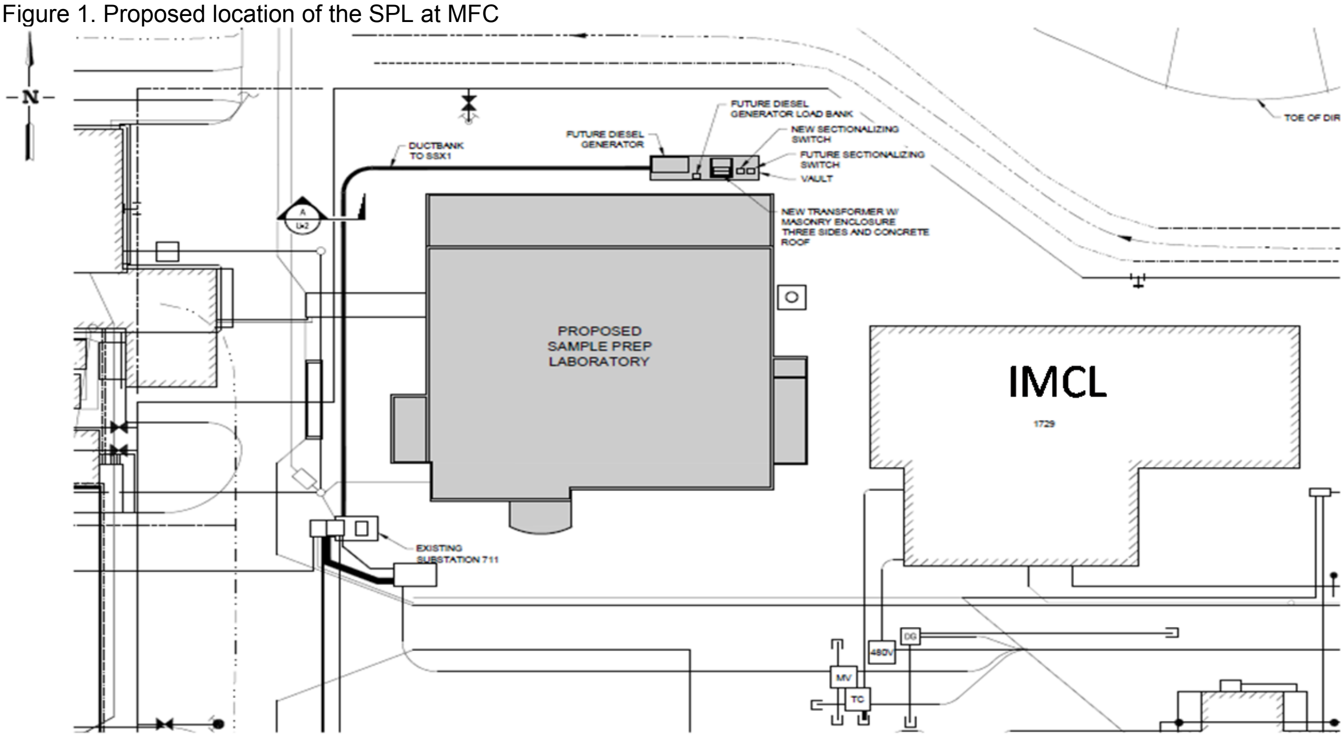
Materials would be transferred to the SPL via casks or other similar containers that provide appropriate radiation shielding and confinement. Thresholds for the SPL are listed below:

- Experiments or source material would consist of materials up to 4 ft in length. The capability to handle material of this size would facilitate direct shipment of experiments from ATR and to accommodate use of the HFEF-5 cask (and other similar casks) for direct disposition of wastes without the need to transfer wastes through HFEF for repackaging
- Materials processed through the sample preparation line would be limited to those that only emit beta and gamma radiation (non-alpha material). Limited quantities of samples of fixed alpha-emitting materials (prepared elsewhere) may be examined in the instrument enclosures.
- Storage would be provided for up 2000 samples.

The SPL would be designed and constructed using sustainable building considerations in accordance with DOE Guide 413.3-6, "High Performance Sustainable Building," and INL/EXT-10-17808, "INL High-Performance Building Strategy." As a minimum, the facility design would include provisions for meeting the Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings per Executive Order 13693. In addition, the building would be designed, to the extent practical considering nuclear facility requirements, to be Leadership in Energy and Environmental Design (LEED) certified, with "Gold" certification as a goal.

The SPL would be constructed to the west of the IMCL at MFC (see Figure 1).

Figure 1. Proposed location of the SPL at MFC




Source material received at the SPL would undergo the following process:

The irradiated material would be shipped to SPL in casks ranging in size from the IMCL shielded cask (a local cask for shipping small samples) to the Battelle Energy Alliance (BEA) Research Reactor (BRR) cask, which weighs about 32,000 pounds. Casks would be off-loaded from trucks and transporters in the truck lock on the north side of the SPL and transferred into the cask docking cave below the transfer cell. These casks are mated to connections to the transfer cell in the sample preparation line where the contents are removed from the cask, decontaminated of alpha contamination, if necessary, and passed on to the sizing, grinding and polishing (SGP) cell where the material would be reduced in size, experiments disassembled, and samples removed from the source material or experiment assembly. Sized and prepared samples would be transferred to the decontamination cell where the samples would be decontaminated and passed on to the storage and transfer cell (S&T cell). In the S&T cell, the samples would be placed in shielded storage or transferred to the mechanical properties test cell (MPTC), the shielded instrument enclosures, or other locations via a pneumatic transfer system.

The MPTC would be a single, large concrete cell with three outfitted stations and a fourth station for future use. The three outfitted stations would provide the following:

1. A universal testing machine for obtaining information about tensile and compressive characteristics of materials
2. A pendulum impact testing machine to determine the amount of energy dissipated during fracture of material
3. A material conditioning furnace, hardness tester, and digital microscope.

The shielded instrument cells house scientific instruments that would examine prepared samples at the micro- and nano-meter scales. Waste material would be transferred back to the transfer cell and placed into the appropriate cask or shielded drum for transport to a handling or disposal facility. Waste items with relatively high radiation levels would be transferred to HFEF for repackaging and transfer to a storage or disposal facility if required.

The Total Project Cost is projected to be <$100M, and construction could begin as early as FY 2018.

**SECTION C. Environmental Aspects or Potential Sources of Impact:**

**Air Emissions**

Construction phase - Excavation activities for the building foundation may generate fugitive dust emissions. Reasonable precautions (water, dust suppressant chemicals, etc.) will be taken by the subcontractor to prevent dust from becoming airborne during construction. The subcontractor will record dust control activities in their daily logs. These records will be used to show compliance to section 2.2 of the INL's Title V air permit.

The Subcontractor may bring on mobile generators, welders and compressors during construction. Equipment will be required to meet the visible emissions/opacity requirements or will be shut down and either repaired or removed from the INL. These non-road sources will be located at the project for less than a year.

Refrigerants will be used in HVAC equipment. The Subcontractor will be required to use Certified Refrigeration Technicians with appropriate Environmental Protection Agency (EPA) authorized equipment when using refrigerants. Records of installation/maintenance on the refrigeration units will be part of the project record and will be turned over to the facility owners.

SPL Operations - It is anticipated SPL operations will result in a new source of radiological, criteria pollutant, and toxic air emissions. Therefore, an exhaust stack and monitoring system will be required. Design requirements for the off-gas monitor will be based on the estimated SPL Operations.

**Disturbing Cultural or Biological Resources**

Construction activities would be conducted within facility boundaries and may involve soil disturbance activities that has the potential to impact cultural and biological resources (e.g., such as arrowheads, bone fragments, or any other cultural artifact).

**Generating and Managing Waste**

Construction phase - Industrial waste in the form of concrete, asphalt, scrap wood, scrap metal, packaging material, resource conservation and recovery act (RCRA) empty chemical containers, rags, insulation, wire, carpet scrap, tile scrap, drywall, pipe scrap, etc., will be generated during the project. Hazardous waste generation is not anticipated although paint waste, adhesive waste, and spill material have the potential for being hazardous. All waste generated during the project will be characterized, stored, and disposed at the direction of Waste Generator Services (WGS).

SPL Operations - Waste from operations at the SPL are conservatively estimated (not expected to exceed) as follows:

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| contact handled low level waste (LLW): | 166 $ft^3$ per yr |
| mixed LLW: | 39 $ft^3$ per yr |
| remote handled LLW: | 78 $ft^3$ per yr |

Waste estimates were calculated using waste generation figures for HFEF based on data from the Integrated Waste Tracking System (IWTS) and applying appropriate scaling factors to develop an estimate for the SPL. The proposed action is not anticipated to generate new waste streams and is not expected to increase waste volumes across INL.

Transuranic (TRU) waste would not be generated. All waste will be characterized and managed by WGS personnel.

**Releasing Contaminants**

Construction phase - Typical construction chemicals such as fuels, lubricants, adhesives, paints, concrete, concrete cure, asphalt, refrigerants, etc., will be used on the project. The subcontractor will be required to submit initial, quarterly, and final chemical inventory lists with associated Safety Data Sheets (SDS's) for approval in the vendor data system prior to use. The Construction Chemical Coordinator will enter these chemicals into the INL Chemical Management Database. The subcontractor will be required to take precautions to prevent spills from these chemicals. If a spill occurs the subcontractor will be responsible for cleanup and will report the spill to the Construction Field Representative immediately. The Spill Notification Team will be notified of all applicable spills.

Potable water systems that are located in radiological areas must meet the backflow prevention requirements established in INL Technical Interpretation, Environmental Support and Services (ES&S)-Technical Interpretation (TI)-027. This includes safety shower and eye wash stations. ES&S-TI-027 must be made available to the Subcontractors in the specifications during the bidding process. Drinking water design packages must be reviewed and approved by Brad Andersen (Drinking Water Technical Point of Contact [TPOC]) and Dave Morrow (Backflow prevention TPOC).

The project will not disturb any known Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites. If suspect sites are identified, the Subcontractor will stop work and notify the Construction Field Representative immediately.

SPL Operations - Project activities have the potential to release small amounts of potentially hazardous radioactive and chemical contaminants into the air.

**Using, Reusing, and Conserving Natural Resources**

The SPL will be designed and constructed using sustainable building considerations. The SPL facility design will include provisions for meeting the Guiding Principles for Federal Leadership in High Performance Sustainable Buildings per Executive Order 13693.

**SECTION D. Determine Recommended Level of Environmental Review, Identify Reference(s), and State Justification:** Identify the applicable categorical exclusion from 10 Code of Federal Regulation (CFR) 1021, Appendix B, give the appropriate justification, and the approval date.

For Categorical Exclusions (CXs), the proposed action must not: (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environmental, 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 or facilities; (3) disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that pre-exist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources (see 10 CFR 1021). In addition, no extraordinary circumstances related to the proposal exist that would affect the significance of the action. In addition, the action is not “connected” to other action actions (40 CFR 1508.25(a)(1) and is not related to other actions with individually insignificant but cumulatively significant impacts (40 CFR 1608.27(b)(7)).

**References:** 10 CFR 1021, Appendix B to subpart D, items B3.6, "Small-scale research and development, laboratory operations, and pilot projects"

**Justification:** Project activities are consistent with 10 CFR 1021, Appendix B, B3.6, "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."

Adherence to appropriate environmental documents, test plans, safety plans, Safety Data Sheets (SDS), Department of Energy regulations, and State and Federal law during construction and operation of the SPL would 1) not threaten a violation of applicable statutory, regulatory, or permit requirements; 2) not require expansion of waste storage, disposal, recovery, or treatment facilities; 3) not disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that preexist in the environment that would result in an uncontrolled or unpermitted release; 4) not have the potential to cause significant impacts on environmentally sensitive resources, e.g., historic properties; state or federally listed sensitive, threatened, endangered, or candidate species; floodplains and wetlands; areas having special designation, e.g., designated wilderness, national parks, national monuments, etc.; and 5) not involve genetically engineered organisms, synthetic biology, governmentally designated noxious weeds or invasive species. Additionally, there are no extraordinary circumstances related to the proposed action that would affect the significance of the environmental effects of the proposal.

Is the project funded by the American Recovery and Reinvestment Act of 2009 (Recovery Act) ☐ Yes ☒ No

Approved by Jack Depperschmidt, DOE-ID NEPA Compliance Officer on: 6/9/2016