DOE-ID NEPA CX DETERMINATION
Idaho National Laboratory

CX Posting No.: DOE-ID-INL-14-009

SECTION A. Project Title: Irradiated Materials Characterization Laboratory (IMCL) Equipment Installation Project

SECTION B. Project Description:

The Department of Energy (DOE) has committed to multi-year funding to install Post Irradiation Examination (PIE) equipment into the Irradiated Materials Characterization Laboratory (IMCL) at the Materials and Fuels Complex (MFC) at Idaho National Laboratory (INL). The proposed action would install a number of capabilities/instruments in IMCL to perform sample preparation and analysis, with a focus on radiological high dose rate specimens. To experiment with and analyze highly radioactive fuel and material samples in support of the research and development mission of INL, instruments must be paired with gloveboxes located inside shielded cells with remote operation capabilities. The scope of this environmental checklist (EC) is limited to the design, construction, procurement, and installation of gloveboxes, shielded-cells, manipulators and other equipment needed to carry out the mission of the IMCL. Scope, environmental aspects, and work activities associated with operation of the IMCL would be analyzed in project-specific ECs.

Equipment installation would follow a phased approach with a focus on relocating existing equipment located at MFC to IMCL and the purchase of new equipment in case of high programmatic demand on existing equipment. The pace at which IMCL can be populated with the desired instrumentation and equipment depends primarily on the yearly funding. Significant funding has been provided for fiscal year 2014. Out-year funding would be determined within the fiscal year planning process.

Funding would be applied to the following activities:

- Shielded Sample Preparation Area (SSPA): Install of the SSPA in IMCL with necessary facility utilities. SSPA is a small, heavily shielded hot cell specifically designed for detailed sample preparation.
- Focused Ion Beam (FIB): Procure a factory reconditioned instrument and install in IMCL (without shielding and confinement) with necessary facility utilities. The FIB would be used to mill micro-scale samples and perform electron microscopy.
- Electron Probe Micro-Analyzer (EPMA): Relocate the MFC EPMA from the Analytical Lab to IMCL and install in IMCL with necessary facility utilities. The EPMA would perform electron microscopy and chemical analysis.
- Support Glovebox and Hood: Initiate a design/build procurement contract for the design and fabrication of a facility glovebox and hood (to be paired with the SSPA). The glovebox and hood would be used for general sample preparation along with the SSPA.
- Shielding and Confinement for FIB and EPMA: Initiate a design/build procurement contract for the design and fabrication of radiological shielding and confinement followed by installation. Shielding and confinement is needed to support high dose rate material examinations using the FIB and EPMA.
- Transmission Electron Microscope (TEM): Initiate a procurement contract for the purchase of a new TEM and install in IMCL. The TEM would provide nano-scale analysis of specimens and chemical analysis.

An EPMA is a microbeam instrument used for the in situ non-destructive chemical analysis of minute solid samples. It is fundamentally the same as a Scanning Electron Microscope (SEM), with the added capability of chemical analysis. The primary importance of an EPMA is the ability to acquire precise, quantitative elemental analyses at very small "spot" sizes (as little as 1-2 microns). The spatial scale of analysis, combined with the ability to create detailed images of the sample, makes it possible to analyze materials in situ and to resolve complex chemical variation within single phases. The EPMA would require building utility support consisting of ventilation and power. Support systems would include gas supply (nitrogen for the glovebox and instrument, P10 mix gas (10% methane/90%argon) for the instrument detectors and oxygen for the EPMA carbon trap), Uninterruptible Power Source (UPS), air compressor, and a water to air chiller.

The SSPA is a shielded, remote handled manipulators glovebox which would be used to support sample preparation for analysis. The SSPA, which was originally purchased for installation for a new addition onto the Electron Microscopy Laboratory (EML), has been abandoned by the sponsoring program. As such, the SSPA would be moved to IMCL to support a variety of Lab programs. SSPA operation fits well within the mission need of the building. The SSPA would require building utility support consisting of ventilation and power.

A new FIB instrument would be purchased and installed in IMCL. The FIB would be used to prepare TEM and atom probe samples. Atom probe analysis takes place in the Center for Advanced Energy Studies (CAES) while TEM analysis could take place at MFC (EML) or CAES. Building utilities needed to support FIB operation includes ventilation and power. Additional support systems include UPS, air compressor, support gases and a closed loop chiller.

A new TEM would be purchased and installed in IMCL. TEM is a microscopy technique in which a beam of electrons is transmitted through an ultra-thin specimen, interacting with the specimen as it passes through. An image is formed from the interaction of the electrons transmitted through the specimen; the image is magnified and focused onto an imaging device, such as a fluorescent screen, on a layer of photographic film, or to be detected by a sensor such as a charged-couple device (CCD) camera. TEMs are capable of imaging at a significantly higher resolution than light microscopes. TEMs can also be used for chemical analysis.

In addition, benchtop instruments consisting of a hardness tester, microscope, SEM, and a shielded sample storage cabinet would be installed. Optical microscopes would be used to determine the effectiveness of sample preparation. Micro-hardness testers apply known force to produce a physical indentation. The information would be used to determine the hardness of a particular specimen.

Radiological shielding and confinement would be applied to the instruments as necessary. Instruments would require facility modifications to supply utilities (exhaust, power, pressurized gases, etc.). As glovebox and instruments require inert gas, a 1500 gallon liquid nitrogen supply tank would be installed to provide dry nitrogen gas to the facility gloveboxes and instruments.

Safety basis documentation for the facility identifies the hazards associated with the facility and identifies preventative and mitigative controls to protect workers and the public from those hazards. Formal agreements between the operating contractor and DOE have been established to govern the safe operation of the facility. The proposed action is consistent with safety basis documentation, procedures, and accident analyses.

SECTION C. Environmental Aspects or Potential Sources of Impact

Air emissions: Project activities may generate fugitive dust. Combustion equipment such as generators, portable heaters, ventilation equipment, and heavy equipment fueled with diesel may be used during project activities. Stationary equipment/instruments (other than benchtop instruments) would be filtered through a high-efficiency particulate air (HEPA) grade filter in accordance with IMCL air permit requirements.

In August of 2011, the IMCL was granted an Approval to Construct (ATC) from EPA Region 10, followed by a Permit to Construct (PTC) from the State of Idaho in January of 2012 These approvals provide permission to construct and operate a nuclear materials characterization laboratory. Operation of equipment to be installed as described in this EC is well within the bounds of the PTC and the ATC .

The ATC/PTC evaluated the effects of radionuclide, toxic, and criteria pollutant releases. As stated in the application, the primary function of the IMCL is to provide a state-of-the-art laboratory that is efficient and flexible for the analysis and characterization of irradiated and nonirradiated nuclear material samples. The facility will provide research areas to house future programs and provide nuclear material scientific research instruments. To meet this function, the IMCL can accommodate a series of modular and reconfigurable enclosures, glove boxes, fume hoods and bench top types of analysis. A continuous sampling system that complies with ANSI/HPS N13.1-1999, “Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities,” is installed in the stack to ensure compliance with 40 CFR 61, Subpart H.

Generating and Managing Waste: Installation activities could generate industrial waste. All waste generated from this activity would be managed in accordance with laboratory procedures. Pollution prevention would be implemented where economically practicable to reduce the volume of waste. All waste would be transferred to Waste Generator Services (WGS) for appropriate disposition.

Releasing Contaminants: Waste products would be disposed of in accordance with Laboratory policy as well as state and federal regulations. There are a number of other instruments/capabilities that will be in IMCL to support sample characterization and analysis. As described previously, these will focus on electron microscopy analysis (SEM, TEM, FIB and EPMA). Radiological shielding and confinement would be applied to the instruments as necessary to protect the worker, off-site public, and environment. Instruments would require facility modifications to supply utilities (exhaust, power, pressurized gases, etc.). Stationary equipment/instruments (other than benchtop instruments) would be filtered through a HEPA grade filter in accordance with IMCL air permit requirements.

Using, Reusing, and Conserving Natural Resources: All applicable waste would be diverted from disposal in the landfill when possible. Project personnel would use every opportunity to recycle, reuse, and recover materials and divert waste from the landfill when possible. The project would practice sustainable acquisition, as appropriate and practicable, by procuring construction materials that are energy efficient, water efficient, are bio-based in content, environmentally preferable, non-ozone depleting, have recycled content, or are non-toxic or less-toxic alternatives.

SECTION D. Determine the Recommended Level of Environmental Review (or Documentation) and Reference(s): Identify the applicable categorical exclusion from 10 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 which would affect the significance of the action, and the action is not “connected” nor “related” (40 CFR 1508.25(a)(1) and (2), respectively) to other actions with potentially or cumulatively significant impacts.

References: 10 CFR 1021, Appendix B to subpart D, item B1.31

Justification: Project activities described in this EC are consistent with 10 CFR 1021, Appendix B to Subpart D, item B1.31 "Installation or relocation and operation of machinery and equipment (including, but not limited to, laboratory equipment, electronic hardware, manufacturing machinery, maintenance equipment, and health and safety equipment), provided that uses of the installed or

relocated items are consistent with the gerneral missions of the receiving structure. Covered actions include modifications to an existing building within or contiguous to a previously disturbed or developed area, that are necessary for equipment installation and relocation. Such modifications would not appreciably increase the footprint or height of the existing building or have the potential to cause significant changes to the type and magnitude of environmental impacts."

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: 5/21/2014