

SECTION A. Project Title: Irradiation Studies on Electron Beam Welded OM-HIP Pressure Vessel Steel – Purdue University**SECTION B. Project Description**

Purdue University proposes to assess the structural and mechanical integrity of electron beam (EB) weldments on powder metallurgy with hot isostatic pressing (PM-HIP) manufactured pressure vessel steel under service-relevant irradiation conditions. The objective of the proposed research is to qualify the combination of EB welding and PM-HIP technologies for pressure vessel construction by comparing EB-welded PM-HIP materials to conventional forged components. The experiments will use existing equipment at partner locations (INL and Westinghouse) to irradiate the samples and evaluate material properties.

SECTION C. Environmental Aspects / Potential Sources of Impact

Radioactive Material Use – Purdue will conduct neutron irradiations of metallic alloys and weldments at the Advanced Test Reactor (ATR) at Idaho National Laboratory (INL). A total of 100 miniature CT specimens will be irradiated, each having volume ~100mm³; 80 of these miniature CT specimens will be shipped to Westinghouse for in-hot cell fracture testing. A total of 60 TEM disc specimens will be also be irradiated, each having volume ~2.12 mm³; 16 of these TEM discs will be shipped to the INL Irradiated Materials Characterization Laboratory (IMCL) for shear punch testing, and 32 of these TEM discs will be shipped to the Center for Advanced Energy Studies (CAES) for various mechanical and microstructural examinations. All facilities being utilized (i.e. ATR, Westinghouse, IMCL, and CAES) already have established procedures in place for handling these quantities of radioactive materials. After completion of this project, specimens at Westinghouse will remain there, while all other specimens will be returned to ATR for long-term storage and availability to the scientific community via the NSUF Materials & Fuels Database.

Radioactive Waste Generation – Radioactive waste will be generated at INL during the performance of the work effort. Specifically, debris could be generated during post-irradiation polishing or preparation to ready the TEM discs for characterization and testing at IMCL and CAES. All involved INL facilities (i.e. ATR, IMCL, and CAES) have extensive expertise handling and disposing of this type of radioactive waste. All work will be performed to INL's site-specific procedures and regulatory guidelines. Further, all work will be supervised by the INL Environment, Health, and Safety team and by each facility's respective Radiation Safety Officer.

Mixed Waste Generation – Mixed waste may be generated at the INL ATR, IMCL, and CAES during the performance of the work effort. All of these facilities have extensive expertise handling and disposing of this type of mixed waste. All work will be performed to these facilities' site-specific procedures and regulatory guidelines. Further, all work will be supervised by the INL Environment, Health, and Safety team and by each facility's respective Radiation Safety Officer.

Chemical Use/Storage – Chemicals will be used in the Purdue during the performance of the work effort in order to prepare specimens for metallographic examination. Specifically, cleaning solvents (such as acetone and methanol) and electropolishing etchants will also be used. The Purdue laboratory has existing safety and handling procedures in place including standard operating procedures (SOPs) for electropolishing, etching, and chemical disposal, as well as appropriate MSDSs available in the laboratory.

Chemical Waste Disposal – Any chemical waste from the solvents, electropolishing, or etching solutions, generated in the Purdue laboratory will be disposed of in accordance with SOP guidelines established by the laboratory and approved by the Purdue University Radiation and Environmental Management (REM) group.

SECTION D. Determine the 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.

Note: 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, including requirements of DOE orders; 2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment 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) adversely affect environmentally sensitive resources. 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: 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 development.

DOE-ID NEPA CX DETERMINATION

Justification: The activity consists of university-scale research activities to qualify the EB welding technique for irradiation-facing applications.

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

Approved by Jason Sturm, DOE-ID NEPA Compliance Officer on 07/29/2019