DOE-ID NEPA CX DETERMINATION

CX Posting No.: DOE-ID-21-039

SECTION A. Project Title: Technical Basis of Microstructure Criteria and Accelerated Testing for Qualifying Additively-manufactured 316H Stainless Steel for High-temperature Cyclic Service – Auburn University

SECTION B. Project Description

Auburn University (AU) proposes to investigate the fundamental relationship for additively manufactured (AM) 316H stainless steel (SS) working at 500-750 ºC between AM microstructures and creep/creep-fatigue properties through a multiscale experimental and modeling approach. AU also seeks to establish the technical basis for the microstructure criteria and accelerated testing method to support near-term nuclear qualification. The study will focus on 316H SS fabricated by directed energy deposition (DED) AM due to its potential for producing large nuclear components, adding/repairing features, and enabling functionally graded design. The main research includes a) conducting creep and creep-fatigue tests, b) producing high-temperature material data, c) establishing the process-microstructure-property relationship, d) revealing mechanisms, and e) building a practical qualification framework. Key project milestones include: (1) complete sample fabrication; (2) complete creep and creep-fatigue experiments; (3) establish microstructure-property relationship; (4) obtain mechanistic understandings; (5) develop models; and (6) validate accelerated qualification framework. AU plans to use the outcomes of this work, including the material data package, microstructure criteria, and accelerated testing protocol, to serve as the technical basis and starting data to further code development and full nuclear qualification. If successful, the technology developed from this work could also be applied to a larger array of materials allowing for faster code acceptance.

SECTION C. Environmental Aspects / Potential Sources of Impact

The university has procedures in place to handle any waste that will be generated through this project. The action would not create additional environmental impacts above those already occurring at the university.

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). For purposes of this category, "demonstration actions" means actions that are undertaken at a scale to show whether a technology would be viable on a larger scale and suitable for commercial deployment. Demonstration actions frequently follow research and development and pilot projects that are directed at establishing proof of concept.

Justification: The activity consists of an investigation to address the technology gaps for qualifying AM 316H SS for high temperature nuclear use.

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

Approved by Jason Anderson, DOE-ID NEPA Compliance Officer, on 08/24/2021.