DOE-ID NEPA CX DETERMINATION

CX Posting No.: DOE-ID-21-011

SECTION A. Project Title: Irradiation of Silicon Carbide Ceramic Matrix Composite Cladding In Commercial Nuclear Reactors

SECTION B. Project Description

General Atomics proposes to progress fuel qualification of its silicon carbide (SiC) ceramic matrix composite (CMC) cladding by placing it in two commercial nuclear reactor cores for sustained periods of time. The two reactors are the Vogtle unit 1 operated by Southern Company and the Calvert Cliffs unit 2 operated by Exelon.

To perform this project, General Atomics will:

- Design and fabricate a set of cladding components that will enable an in-depth, quantitative assessment of the effects of irradiation in a commercial nuclear plant on corrosion, structural properties, and dimensional changes.
- Deliver composite specimens to the fuel vendors, meeting all needed quality requirements for reactor insertion.
- Fabricate test capsules that will contain the SiC specimens, insert the capsules into the fuel assemblies, and transport the fuel assemblies to the two reactors for subsequent insertion.
- Perform all needed capsule design, safety analysis, and licensing documentation to allow insertion of non-fueled composite into a commercial reactor.
- Perform out-of-pile mechanical testing, analysis using advanced finite element analysis (FEA)- based modeling methods, and in-pile bowing test specimens to better understand the implications of irradiation-induced bowing, addressing a known gap in cladding performance.

SECTION C. Environmental Aspects / Potential Sources of Impact

Radioactive Waste Generation: Test samples will start irradiation towards the end or just after program completion. These samples will be unfueled. The program will define method of waste disposal as a requirement before insertion of test articles into the nuclear reactors. The primary pathway is to have the rods shipped to a national lab for post-irradiation examination with commercial disposal as a backup.

Chemical Use/Storage: Fabrication of SiC rodlets requires the use of chemicals and gases (methyltrichlorosilane, hydrogen, argon, etc). Cleaning steps require the use of solvents (acetone, isopropanol, etc.).

Chemical Waste Disposal: Solvents are collected in approved containers and disposed of via commercial outfit. The work is covered by pre-approved Hazardous Work Authorization.

Hazardous Waste Generation: Solvents are used to clean SiC tubes including wipes and gloves. Used solvents are collected in approved containers as well as dry waste (gallon quantities).

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.

Justification: The activity consists of research activities to perform irradiation experiments of cladding in nuclear reactors.

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 4/1/2021