

DOE-ID NEPA CX DETERMINATION

Idaho National Laboratory

SECTION A. Project Title: Testing for Hot Fuel Examination Facility (HFEF) Gas Sample Assay and Recharge (GASR) Upgrade at Idaho National Laboratory Research Center (IRC).

SECTION B. Project Description and Purpose:

An upgrade of the GASR is necessary to ensure system reliability for future fuel examination campaigns. Work in IRC would include setup and completion of the out of cell testing of the redesigned GASR which is necessary prior to installation of the system in the HFEF Main Cell. All work at the IRC would involve non-radioactive material.

The GASR System, located at window 4M in the HFEF Main cell, provides the ability to puncture cylindrical capsules or fuel rods in their plenum regions, to measure the free volume and pressure, and to gather a sample for fission gas composition and isotopic analysis. After a capsule or fuel rod is punctured with a laser and the fuel rod's pressure and volume have been measured, the capsule may be refilled with any specified gas and re-sealed. The GASR is approximately 30 years old. Since that time, it has not undergone a significant upgrade.

Major systems of the upgraded GASR include the following:

Laser System

The laser would be a Rofin LASAG LFS 150, an air cooled long pulse fiber laser

Laser Optics

Free space optics, simulated inside class 1 enclosure, would be used to transmit the laser pulse through a simulated cell wall using a coupler installed to allow transition from laser fiber to free space optics.

Sealing Head

A sealing head system would be used to receive the initial expansion of gas from the punctured fuel element. A fuel element is sealed to the seal head prior to puncture in order to provide containment for gas. Different seal heads may be designed to be removed and replaced to accommodate different fuel element geometries.

Manifold

A manifold would include transducers to record pressure readings of the fission gas within a known, calibrated volume. Connections and valves between the manifold and vacuum and sampling systems would allow isolation of different volumes for sampling, purge and refilling operations.

Vacuum System

A vacuum pump with connection to the manifold would be used to evacuate the system, prior to element puncture, and vented to the mechanical exhaust system.

Sampling system

A sampling system would be installed to allow gas samples to be collected into sample bottles. Valves would be used to control sample collection.

Purge and Tag Gas System

This system would consist of piping and fittings used to connect high pressure argon or helium gas to the system to accomplish the following:

1. Purge the system of trapped gases
2. Backfill the system to check the volume of the punctured capsule
3. Refill the punctured element prior to sealing
4. Pressurize a sealed element and check for leaks.

The system would be vented to the IRC mechanical exhaust system

Control Console

The control console would contain all of the controls necessary for GASR operation and pressure monitoring.

Data Acquisition System

The data acquisition system would record pressure and temperature during fission gas venting as well as system purge, refill and evacuation.

Laboratory Activities and Testing

Laboratory testing would be performed to verify the operation of all the major systems of the upgraded GASR. Assembly and testing of the GASR would include several iterations as the system is modified. Laser system optical alignment would be performed initially and as necessary as changes are made to the system during testing. Pressure transducers would be calibrated as necessary.

Laser drilling and/or sealing operations would be performed on nonradioactive samples of materials anticipated to be applicable to future fuel examinations. Materials may include the following:

DOE-ID NEPA CX DETERMINATION

Idaho National Laboratory

- Aluminum alloys
- Steel alloys
- Zirconium alloys
- Silicon Carbide and Composites (puncture only)
- Graphite (puncture only).

To ensure the upgraded GASR can perform backfilling, purging, sampling, and data acquisition operations and to assess the sealing capability of the system, tests would be performed on pressurized, sealed capsules. Fuel plenum volumes may range from 0.061 in³ to 3.00 in³ (1.0 cm³ to 49.2 cm³) and pressures may range from atmospheric to up to 500 psi. Sample capsules of different diameters, volumes, and internal pressures would be built with Swage-Lock components to test puncturing and resealing of a simulated fuel plenum as well as containment and collection of gasses. Sample capsules would be filled with mixtures of helium and argon. The typical experimental sequence for puncturing, sampling, backfilling, and re-sealing a sample capsule would include the following:

1. Capsule fabrication and preparation
2. Seal head and capsule installation
3. Sample bottle installation
4. System leak check
5. Capsule Puncturing
6. Gas Sample Collection
7. Backfill and expansion for system cleanup and for capsule volume determinations
8. Capsule inspection/examination
9. Gas sample analysis (this will occur at the MFC Analytical Laboratory and performed under other work control)
10. Backfill
11. Capsule sealing and testing.

Experimentation would be performed in an access controlled laboratory with laser interlocked doors.

As part of understanding the long term health of the lens and windows in the laser system, various tests would be performed placing "dust" or simulated contaminants such as metal filings and oil on the optics within the welding chamber. There is the possibility that the optics would fail and produce glass slivers. These failures would be contained in the sealed class 1 enclosure, and a vacuum would be present to remove the slivers.

SECTION C. Environmental Aspects or Potential Sources of Impact:

Air Emissions

Air emissions from this work are expected to include argon, krypton, helium and xenon. None of these are regulated air emissions.

Generating and Managing Waste

Small amounts of non-hazardous waste include wipes and common lab waste such as personal protective equipment (PPE). Scrap metal will be recycled to the extent practicable. All Solid waste will be managed by Waste Generator Services (WGS)

Using, Reusing, and Conserving Natural Resources

Scrap metal will be recycled to the extent practicable.

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 Department of Energy (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 Comprehensive Environmental Response, Compensation, and Liability Act (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, B2.4, "Equipment qualification"

Justification: Project activities are consistent with 10 CFR 1021, Appendix B, CX B2.4, "Activities undertaken to (1) qualify equipment for use or improve systems reliability or (2) augment information on safety-related system components. These activities include, but are not limited to, transportation container qualification testing, crane and lift-gear certification or recertification testing, high efficiency

DOE-ID NEPA CX DETERMINATION
Idaho National Laboratory

CX Posting No.: DOE-ID-INL-16-001

particulate air filter testing and certification, stress tests (such as "burn-in" testing of electrical components and leak testing) and calibration of sensors or diagnostic equipment."

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: 1/5/2016