



## Department of Energy

Washington, DC 20585

March 27, 2020

Dr. Mark Peters, President  
Battelle Energy Alliance, LLC  
Idaho National Laboratory  
1955 N. Fremont Avenue  
Idaho Falls, Idaho 83415

WEL-2020-03

Dear Dr. Peters:

The Office of Enterprise Assessments' Office of Enforcement has completed an evaluation of the safety implications associated with several control room electrical relay failure events at the Idaho National Laboratory's (INL) Advanced Test Reactor (ATR), with the most recent event occurring on February 23, 2019. This evaluation also considered information from prior relay failure events at the ATR, including relay failures on June 24, 2018, and June 23, 2017. Battelle Energy Alliance, LLC (BEA) reported noncompliances revealed by the 2018 event into the Department of Energy's (DOE) Noncompliance Tracking System under NTS-NE-ID-BEA-ATR- 2018-0006637, dated August 17, 2018. Based on this evaluation, the Office of Enforcement is conveying feedback for your consideration and broader application across INL operations. This feedback is intended to support BEA's implementation of the hazard identification, assessment, prevention, abatement, and emergency response requirements of 10 C.F.R. Part 851, *Worker Safety and Health Program*.

On June 23, 2017, when the ATR was shut down in support of an outage, operators observed smoke from a failing electrical relay in a relay cabinet. During the initial response, fire department personnel conducted thermal imaging of the cabinet and assisted with clearing smoke from the area, due to facility ventilation being secured. No flames were observed during the event.

BEA developed a technical evaluation, *CR-120A Relay Failure Analysis*, following the 2017 event that identified several prior relay failure events and provided recommended actions. Based on the analysis in the technical evaluation, BEA established actions to evaluate relay operating parameters (e.g., typically applied voltages, ambient operating temperatures), test relay operability, introduce cabinet cooling, institute periodic thermography at a maximum one-year interval, and establish a data-driven relay replacement process. These appear to be appropriate actions to extend the remaining life of the relays, restore operational reliability, and reduce the likelihood of relay failures from a long-term perspective.

The technical basis for these actions was based, in part, on a service information letter (SIL) issued by GE Nuclear Energy in 1994. The SIL describes one possible failure mode in which aging coil wire insulation deterioration can result in shorted winding turnings, leading to



additional heating and continued degradation over an indeterminate time period, and does not provide guidance to predict the time interval over which this process occurs. In addition, the SIL notes that, in some instances, the relay failures may result in fires. Although thermography may identify a failing relay in advance, reliance on intermittent thermography without a basis for the speed under which this failure mode occurs limits the opportunity to identify degraded relays before complete failure. Unless the time span between thermographic imaging is less than the period between increasing coil temperature and eventual failure, some of these relays could potentially fail without warning. In addition, the failure mode described in the SIL does not rule out other failure modes that can occur with little warning. As a result, the actions implemented through the Technical Evaluation, although appropriate in many respects, did not fully address the potential for relay failures before eventual replacement.

During the June 24, 2018, electrical relay fire event, the incident occurred during shift turnover, resulting in nine individuals being present in the control room instead of the standard four or five. Attempts to extinguish the fire with an ABC-rated hand-held extinguisher were hampered by a lack of available information needed to de-energize the circuit; re-ignition of the fire occurred twice. Concurrently, operators initiated a manual reactor scram (insertion of safety rods) and reverse (insertion of the neck shim rods and outer shim control cylinders) as well as manual discharge of the Halon fire suppression system. The discharge exposed eight employees to Halon above the National Institute for Occupational Safety and Health's immediately dangerous to life and health (IDLH) level. Workers were also potentially exposed to Halon decomposition products, such as hydrogen fluoride and hydrogen bromide. Three of the eight employees experienced throat irritation. Worker training prior to the event did not adequately address the hazards associated with remaining in the space after Halon discharge, and response procedures at the time did not require evacuation of the space to avoid personnel exposure and allow sufficient contact time to ensure that Halon effectively extinguished the fire.

During the February 23, 2019, relay failure event, operators discharged a hand-held fire extinguisher in the area of the smoking relay, de-energized the circuit, and initiated a manual reactor scram and reverse. The fire department was notified by telephone, in lieu of activating the pull box alarm. This notification process pulled an operator from control room activities for approximately five minutes and delayed fire department response to the scene. Following this event, BEA enhanced its response procedures to ensure that personnel use the pull box alarm for prompt fire department notification. A facility modification is being pursued to allow, and then silence, the local audible alarm in the control room so that the alarm does not impede control room operation communications.

The Office of Enforcement acknowledges that BEA had taken actions to begin obtaining replacement relays following the 2017 event and recognizes the challenges associated with that process. Relay replacement began after the 2018 event, with prioritization based on data obtained through thermographic monitoring. BEA has replaced all high priority relays, and the remaining lower priority relays will be replaced in fiscal year 2020. After the 2018 event, BEA installed powder-free clean agent extinguishers near electrical equipment, labeled circuit disconnects, established evacuation protocols if the Halon system is activated, evaluated training, and provided instructions to operators to clarify employee response actions and hazards associated with a Halon release. BEA also completed an extent-of-condition assessment for all Halon and other gaseous fire suppression agents at the INL. Those actions improved the response to the 2019 event, except as noted above. In addition, BEA performed an extent-of-condition review that evaluated

the Transient Reactor Test Facility and the Neutron Radiography Reactor to identify any CR-120A or similarly aged relays that should be replaced. In October 2019, BEA communicated their operating experience with the 2017 and 2018 relay failures through the DOE Lessons Learned Database.

Although these actions will enhance ATR operations, BEA did not fully consider opportunities to improve the underlying hazard analyses and emergency response procedures after the 2017 relay failure to address the broader programmatic weaknesses ultimately revealed by these events. Actions taken to evaluate relay conditions did not fully address the potential for relay failures prior to eventual replacement. Additional compensatory measures to mitigate the remaining risk of failure were not developed or implemented. In addition, despite the heightened awareness of potential relay failure, emergency response planning did not result in adequate preparation (i.e., explicit evacuation procedures, adequate training on hazards related to Halon exposure and byproducts produced by Halon's chemical suppression mechanism, relay de-energization procedures) prior to the subsequent relay failure and fire 12 months later. BEA should ensure that subsequent improvements are sufficiently comprehensive to address the underlying emergency response program weaknesses and prevent recurrence across all INL operations.

The Office of Enforcement has elected to issue this Enforcement Letter to convey feedback on the ATR control room fire and response activities. Issuance of this Enforcement Letter reflects DOE's decision to not pursue further enforcement activity at this time. In coordination with the Office of Nuclear Energy, the Office of Enforcement will continue to monitor BEA's efforts to maintain a safe workplace.

This letter imposes no requirements on BEA and no response is required. If you have any questions, please contact me at (301) 903-7707, or your staff may contact Mr. Robert Hailstone, Director, Office of Worker Safety and Health Enforcement, at (301) 903-0100.

Sincerely,



Kevin L. Dressman

Director

Office of Enforcement

Office of Enterprise Assessments

cc: Robert Boston, NE-ID  
Sherry Kontes, BEA