Department of Energy
Washington, DC 20585

August 25, 2022

Dr. John Wagner
President and Laboratory Director
Battelle Energy Alliance, LLC
Idaho National Laboratory
2525 North Fremont Avenue
Idaho Falls, Idaho 83415-3695

WEL-2022-06

Dear Dr. Wagner:

The Office of Enterprise Assessments' Office of Enforcement has completed an evaluation into an event involving a heat transfer fluid expulsion from the Thermal Energy Distribution System (TEDS) at the Idaho National Laboratory (INL), as reported into the Department of Energy's (DOE) Noncompliance Tracking System under NTS-NE-ID-BEA-REC-2021-0010313, dated October 21, 2021. Based on this evaluation, the Office of Enforcement identified concerns that warrant management attention by Battelle Energy Alliance, LLC (BEA).

The heat transfer fluid expulsion event was a near miss with the potential for serious injury. The event occurred on August 12, 2021, during the commissioning of the TEDS. As the system was rising to the maximum operating temperature of 325 degrees Celsius (617 degrees Fahrenheit), approximately 10 to 15 gallons of heat transfer fluid was expelled from an open vent valve located on the top of a system expansion tank. A small quantity of fluid, with no noticeable heat, dripped onto a researcher below, along with a fluid discharge that extended to a height of approximately 23 feet above the valve. The fluid contacted the ceiling of the high bay room and dripped down onto equipment below. The high operating temperature of the equipment caused the transfer fluid to thermally decompose, producing acrid smoke that filled the high bay. The researcher immediately shut down the system with assistance from another worker, who subsequently called for an evacuation of the building. No workers were injured or became ill.

The fluid expulsion resulted from a multi-day effort to remove moisture contamination from the TEDS heat transfer system. During the commissioning process, a "popping" noise in the process piping and elevated pressure readings indicated the presence of water. Frost-covered alumina beads, introduced to the TEDS after outdoor storage, released water into the system. Workers opened an expansion tank vent valve and observed steam escaping. A determination was made to continue the commissioning process by opening the vent valve "a quarter turn," allowing the water to escape as steam. On the day of the event, a worker

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mistakenly opened the valve fully, unaware of the previous limitations, allowing the heat transfer fluid to be expelled.

The specific concerns from this event are listed below. The concerns relate to BEA's implementation of the requirements in 10 C.F.R. Part 851 (Part 851) *Worker Safety and Health Program* in the areas of hazard identification, assessment, prevention, and abatement.

- BEA did not appropriately store the alumina beads used in the TEDS heat transfer system. The bead manufacturer recommended storage to be "…in an environment which will keep the [bead] packages free from moisture…." In contrast to the manufacturer's recommendation, BEA stored the alumina beads outside in a covered structure, but open to the environment during periods of winter precipitation, resulting in the presence of frost and moisture on the beads at the time of their installation.

- BEA did not properly record or communicate changes to the hazards identification and assessment documentation concerning the TEDS commissioning activities. After discovering the "popping" noise in the process piping, the anomalous condition prompted a pause in the commissioning efforts and a discussion by the work group, including the laboratory manager. The resulting changes to the hazards analysis and the commissioning plan (i.e., expansion tank vent valve set position) were not documented or adequately discussed with all workers operating the TEDS. In addition, two-party verification checks to confirm the valve set positions were not documented, as required.

- BEA did not adequately address software faults that degraded the safety of workers. Errors in the valve control software (LabView) were discovered during the TEDS commissioning process (i.e., incorrect valve position indications). The software developer was contacted, instructing BEA to reinitialize the software to resolve the issue. However, when the issue reoccurred on the day of the event, BEA did not pause, shut down operations, and request permission to continue TEDS commissioning activities with the laboratory manager as required by the laboratory instruction.

- BEA did not adequately perform a post-event hazard assessment before reoccupying the commissioning facility. During the event, a building evacuation was initiated due to the ejection of the heat transfer fluid and the presence of acrid smoke caused by thermal decomposition; however, the Idaho Falls Fire Department was not contacted to evaluate residual fire risks or to provide clearance to reenter the building.

In addition to the specific concerns identified above, the Office of Enforcement's evaluation also revealed that during the TEDS commissioning planning process,

INL's Office of Nuclear Assurance (ONA) indicated that commissioning documents were not appropriate as operating or commissioning plans. ONA recommended that BEA prepare a more detailed process hazard analysis for review prior to the start-up of commissioning activities. Contrary to the ONA recommendation, BEA elected to continue start-up and commissioning of the TEDS under a previously approved laboratory instruction. BEA did not discuss this decision with ONA, and an appropriate TEDS commissioning plan was not developed. The result was a commissioning activity that relied heavily on the principal researcher's knowledge of the system.

The Office of Enforcement acknowledges that BEA completed a formal investigation into the heat transfer fluid event and developed a corrective action plan (CAP). The CAP appears to adequately address changes in the BEA commissioning process, particularly in relation to the transition from bench-scale scientific experiments to small-scale production operations. The facts and circumstances associated with the heat transfer fluid event bear similarities to a February 11, 2013, molten salt gasification event that resulted in thermal burns to a BEA worker. The molten salt event investigation concluded that BEA did not apply an appropriate level of rigor to process hazards analysis and work planning - a similar finding for the heat transfer fluid expulsion event. As such, heightened management attention and a continued evaluation of the corrective actions particular for hazard analysis and work planning is warranted. When fully implemented, a rigorous and formal equipment commissioning process, as well as continued improvement in facility-wide integration of the Conduct of Research principles, will likely reduce the potential for recurrence of this type of event.

The Office of Enforcement has elected to issue this Enforcement Letter to convey concerns with the TEDS heat transfer fluid expulsion event. Issuance of this Enforcement Letter reflects DOE's decision to not pursue further enforcement activity against BEA at this time. In coordination with the DOE's 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) 903-9981, or your staff may contact Ms. Shannon Holman, Acting Director, Office of Worker Safety and Health Enforcement, at (301) 903-0100.

Sincerely,

Robin M. Keeler
Deputy Director
Office of Enforcement
Office of Enterprise Assessments

cc: Robert Boston, DOE-ID
Sherry Kontes, Battelle Energy Alliance, LLC