HSS Independent Activity Report - Rev. 0		**Report Number:** HIAR-WTP-2014-01-27	
Site: Hanford Site	**Subject:** Office of Enforcement and Oversight's Office of Safety and Emergency Management Evaluations Activity Report for the Observation of Waste Treatment and Immobilization Plant Low Activity Waste Facility Off-gas Systems Hazards Analysis Activities		
Dates of Activity :	01/27/14 - 02/13/14	**Report Preparer:**	James O. Low

Activity Description/Purpose:

The Office of Health, Safety and Security (HSS), Office of Safety and Emergency Management Evaluations (Independent Oversight) reviewed a select set of Insight software hazard evaluation (HE) tables for hazard analyses (HAs) developed for the low activity waste (LAW) Melter Off-gas system; observed a portion of the HA activities; and met with responsible Bechtel National, Incorporated (BNI) personnel to discuss observations. This Independent Oversight observation is part of a planned multi-phase review (Ref. 1) focusing on the technical adequacy of BNI-issued LAW HA Reports (HARs) and subsequent submittal of the Waste Treatment and Immobilization Plant (WTP) LAW Facility documented safety analysis and technical safety requirements for the U.S. Department of Energy (DOE) Office of River Protection's review and approval.

Result:

The HA process, executed by each HA team (also known as the Safety Design Integration Team – SDIT), leads to identification of potential events (i.e., process upset conditions that lead to adverse consequences to facility workers, co-located workers, or the public) for analysis. These events are organized in hazard and operability (HAZOP) tables for the HA study node (or subnode) being analyzed. The HAZOP tables include physical parameters, such as pressure, temperature, and flow, and potential deviations in these parameters (e.g., high, low, or none) that, taken together, can lead to a possible event.

During this Independent Oversight observation, the SDIT was analyzing the events related to Off-gas system subnode 6b (Caustic Scrubber) and events related to ammonium nitrate hazards in the Off-gas system components and piping. Following the initial process and identification of possible events, most of the SDIT effort was directed toward completing the Insight software HE tables (i.e., event tables) for the possible events in the HA study node. The analysis process focused on describing the identified hazard events and characterizing the event parameters (e.g., causes, likelihood, consequences, methods of detection, and candidate preventive and mitigative controls) necessary to complete the Insight software HE event table.

Independent Oversight also reviewed a sample of the completed (draft) Insight HE event tables for Off-gas system nodes 4 (Mercury Mitigation), 5a (Thermo Catalytic Oxidizer), and 5b (Ammonia Dilution). Review comments were documented in a comment table and provided to BNI for written response. After reviewing the BNI responses, Independent Oversight and responsible BNI personnel held discussion sessions to establish a mutual understanding of the BNI responses and subsequent revisions to those responses (Ref. 6). The review comments identified opportunities to improve the level of detail and ensure technical defensibility of the HA event tables. The BNI responses identified actions to resolve a number of the comments.

Summarized below are Independent Oversight's observations concerning BNI's implementation of the HAZOP approach for the Off-gas system HAs completed this period. For the analysis observed by Independent Oversight, the SDIT identified appropriate hazards associated with the Off-gas system subnode and included them in the HE event table. Independent Oversight did not identify additional hazards that would require a new HE event table. The radiological and hazardous material at risk (MAR) and worker consequence information was sufficient for the HA and appeared to be appropriately conservative.

Independent Oversight noted that overall, Off-gas system hazard analysis processes have continued to improve. The SDIT analyzed events more systematically, and the daily presence of BNI plant engineers aided the SDIT analysis of the HA events. The SDIT used piping and instrumentation diagrams (P&IDs) and sketches more frequently than observed in past Independent Oversight reviews. In some cases, the SDIT completed events for minor process upsets and appropriately linked the HA events to more extensive, significant consequence events. The SDIT also identified a number of potential engineering improvements (not in current design) to the Thermo Catalytic Oxidizer skid, providing evidence of thorough analysis and attention to detail.

Independent Oversight noted some weaknesses in the HA activities. In particular, the observed SDIT practice for analyzing several unmitigated events assumes complete failure of any controls without describing those failures in the event table,

which could adversely impact the selection of safety controls and the identification of defense-in-depth controls during the follow-on control selection activities. Also, some comments on events reflected sporadic instances of failure to identify all the affected locations or candidate controls in the HE event table.

Although improvements were noted in the SDIT HA process and resulting HE tables, the observation of the SDIT HA activities and review of the Off-gas HE tables indicated that the potential concerns identified in these previous Independent Oversight Activity Reports (see Attachment 1 and Refs. 3, 4 and 5) have not been fully resolved.

No new potential concerns were identified.

At the end of Independent Oversight's observation period, the Off-gas system exhauster and stack node remained to be evaluated and several action items on specific technical issues for various Off-gas system nodes were still open. Completion of these activities, as well as report development, review, and approval, will conclude the HA process for the LAW Off-gas system.

HSS Participants	**References**
1. James O. Low (lead)	1. DOE/HQ HS-45, Plan for the Independent Oversight Review of the Hanford Site Waste Treatment Plant Low Activity Waste Facility Documented Safety Analysis Development, April 22, 2013.
2. David Odland	2. DOE/HQ HS-40 Letter, JS Boulden III to SL Samuelson, *Independent Oversight Review of the Hanford Site Waste Treatment & Immobilization Plant Low Activity Waste Melter Process System Hazard Analysis Activity*, dated December 21, 2012.
3. Mary Miller	3. DOE/HQ HS-45 Report Number: HIAR-WTP-2013-03-18, Activity Report for Follow-up of Waste Treatment and Immobilization Plant Low Activity Waste Melter Process System Hazard Analysis Activity Review.
4. Dan Schwendenman	4. DOE/HQ HS-45 Report Number: HIAR-WTP-2013-05-13, Activity Report for Waste Treatment and Immobilization Plant Low Activity Waste Melter Off-gas Process System Hazards Analysis Activity Observation.
	5. DOE/HQ HS-45 Report Number: HIAR-WTP-2013-10-21, Activity Report for Observation of Waste Treatment and Immobilization Plant Low Activity Waste Melter and Melter Off-gas Process System Hazards Analysis Activities.
	6. E-mail: Kraig Wendt (BNI) to James Low, "Responses: HS-45 Comments to WTP LAW LOP/LVP System Hazard Analysis" February 12, 2014 7:41 AM (PST).

Were there any items for HSS follow up? ☒Yes ☐No

HSS Follow Up Items

1. Continue to review BNI actions in response to the observations and potential concerns identified in this and previous reports related to LAW Melter and Off-gas systems HAs.
2. When issued, review the Insight software HE tables generated for the LAW Melter and Off-gas systems.
3. Conduct an independent review of the final HAR volumes for the Melter and Off-gas systems to determine the disposition of the potential concerns and other identified deficiencies as well as overall conformance to DOE-STD-3009 requirements. Issue Independent Review reports for these HAR volumes.
4. Perform focused observations of HA development for the LAW Integrated Control Network/Programmable Protection System and LAW facility (natural phenomena hazards and facility-based HA). These may lead to additional independent reviews of the final HAR volumes for these systems.
5. Perform focused observations of BNI's control selection team processes for the above specified systems.

Attachment 1 – **Potential Concerns excerpt from Ref.4 (revised)**	**Report Number: HIAR-WTP-2014-01-27**

HIAR-WTP-2013-05-13, Activity Report for Waste Treatment and Immobilization Plant Low Activity Waste Melter Off-gas Process System Hazards Analysis Activity Observation, included the following potential concerns about the interim results of the analysis. The items identified by the Independent Oversight team were labeled as potential concerns because the analysis process is incomplete until the HA reports are completed, internally reviewed, and approved by BNI, and thus ready for DOE review. Nonetheless, the following potential concerns, which involve event tables with unmitigated high consequences to facility workers or co-located workers, could lead to weaknesses in the final HA reports:

- Potential Concern 1: For several hazard events the described sequence of events did not link directly to the identified causes; for example, by assuming non-mechanistic or unstated equipment failures or implied operator errors. An unclear sequence description may adversely impact subsequent identification of candidate controls.

- Potential Concern 2: Multiple event sequences and release locations were combined in several hazard events. Different event sequences and different locations may require different candidate controls.

- Potential Concern 3: The development and documentation of the HAZOP matrix table for the subnode 1a (film cooler) was not performed in sufficient detail to lead to full analysis of all process parameter deviations that could potentially affect the Off-gas system performance.

- Potential Concern 4: Some hazard events did not identify all of the related causes, and the hazard events did not always have a clear relationship between identified causes and subsequent candidate controls.

Note: Potential Concern 1 was revised to clarify that the event sequence description is not always defined sufficiently to allow the identification of appropriate candidate controls. In some cases, non-mechanistic failures were assumed such that the described sequence of events did not lead to an identified cause. In other cases, the event table contained unstated assumptions that could affect the identification of event causes and corresponding candidate controls.