

HSS Independent Activity Report - Rev. 0**Report Number:** HIAR-WTP-2013-10-21**Site:** Hanford Site**Subject:** Office of Enforcement and Oversight's Office of Safety and Emergency Management Evaluations Activity Report for Observation of Waste Treatment and Immobilization Plant Low Activity Waste Melter and Melter Off-gas Process System Hazards Analysis Activities**Dates of Activity :** 10/21/13 - 10/31/13**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 the Insight software hazard evaluation (HE) tables for hazard analysis (HA) generated to date for the Waste Treatment and Immobilization Plant (WTP) Low Activity Waste (LAW) Melter and Off-gas systems, observed a limited portion of the HA for the LAW Secondary Off-gas System, and met with Bechtel National, Incorporated (BNI) responsible individuals to discuss both previous (Ref. 3) and more recent (Ref. 4) HSS observations. Independent Oversight conducted this observation after BNI had provided formal training to the HA teams on Hazards and Operability (HAZOP) analysis techniques and BNI's recent implementation of changes to HA approaches intended to streamline the HA process. An additional purpose was to follow up on BNI's disposition of opportunities for improvement (OFIs) identified by Independent Oversight in the 2012 LAW Melter Processing (LMP) System HA (Ref. 3).

This Independent Oversight observation is part of a planned multi-phase review (Ref. 1) that focuses on the technical adequacy of BNI-issued LAW HA reports (HARs) and subsequent submittal of the LAW documented safety analysis (DSA) and technical safety requirements for the Department of Energy (DOE) Office of River Protection's review and approval.

Result:

Generally, the initial steps of the HA process being executed by the HA teams (also known as Safety Design Integration Team – SDIT) lead to identification of potential events (i.e., process upset conditions that lead to adverse consequences to: facility workers, co-located workers, the public, or the environment) for analysis. These events are arranged in either What-If or HAZOP tables for the HA study node (or subnode) being analyzed. The SDIT uses What-If methodology only for relatively simple HA study nodes. 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. Following the initial process and identification of possible events, most of the SDIT effort is directed toward completing the Insight software HE tables (i.e., event records) for the possible events in the HA study node. During this Independent Oversight observation, the SDIT was analyzing the HAZOP table events related to off-gas system study node 4, the LAW Vessel Vent Process (LVP) mercury mitigation system. The analysis process focused on describing the identified hazard events and characterizing the event parameters, such as causes, likelihood, consequences, methods of detection, and candidate preventive and mitigative controls, necessary to complete the Insight software HE table event.

At the end of Independent Oversight's observation period, eight sub-nodes comprising the balance of the LVP system remained to be analyzed; BNI estimated the LAW Primary Off-gas process system LOP/LVP HA activity was 40 percent complete. Given the limited activities observed for one study node (the mercury mitigation system) of the technically complex LOP/LVP systems, this Independent Oversight observation constituted a narrow sample of a lengthy HA process for a complex LVP system.

The Independent Oversight team also reviewed BNI's responses to the OFIs contained in the Independent Oversight LAW LMP HA report (Ref. 3), reviewed the nearly completed Insight software HE tables for the LAW Melter, observed two brief Melter SDIT meetings, and met with responsible BNI personnel to discuss the results of these reviews and observations.

Summarized below are Independent Oversight's observations concerning BNI's implementation of the revised HAZOP approach for the LMP, LOP, and LVP HAs completed this period. Independent Oversight observed the SDIT HA activities for study node 4 of the LVP and reviewed a sample of the completed (draft) Insight HE tables for the LMP, the LOP (sub-nodes 1a – film cooler, 1b – submerged bed scrubber, and 1c – wet electrostatic precipitator), and the first two LVP nodes: 2 – vessel vent, 3a – high efficiency particulate air (HEPA) filter pre-heaters, and 3b – HEPA filters. Independent Oversight also held discussions with responsible BNI personnel.

For the analysis observed by Independent Oversight, the SDIT identified appropriate hazards associated with the LVP system sub-nodes and included them in the HE. Independent Oversight did not identify additional hazards that would need to be developed into a new HE table event. The radiological and hazardous material at risk (MAR) and worker consequence information was sufficient for the HA and appeared to be appropriately conservative. The Independent Oversight team noted

that BNI technical organizations have developed a number of supporting analyses needed to provide a technical basis for the consequence estimates since the previous Independent Oversight observation.

Independent Oversight noted that overall, the HA processes have improved. The procedural HA guidance provided to the SDIT, along with individual understanding of the guidance, has improved. The HA guidance continues to evolve as experience is gained in executing the HAZOP process. BNI actions over the past few months, including the HAZOP training, have led to a number of observed improvements: better levels of detail in the event descriptions (including event sequences), improved efficiency in completing the event analyses and HE tables, better facilitation of subject matter expert discussion during the team meetings, and more frequent use of sketches and drawings to support the discussion. Independent Oversight also observed that the participation of HA team members has increased in both quantity and quality, and when the LAW Plant Engineering Manager and LAW Preliminary DSA author were present, the overall level of discussion was considerably enhanced. It is also noted that following Independent Oversight’s discussion of the Melter HE tables, the Melter SDIT chair proactively proposed new HA events to the SDIT.

The previous Independent Oversight observation (Ref. 4) identified four potential concerns. No new potential concerns were identified during the current observation; however, the continued lack of a BNI chemical process engineer, who would be directly responsible for and expert in the process flow sheets, to support the SDIT may lead to insufficient evaluation of some process parameters that could be relevant to the chemical hazards being evaluated.

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 the previous Independent Oversight Activity Report (see Attachment 1 and Ref. 4) have not been fully resolved. For example:

- Some non-mechanistic failures are being assumed in the analysis of node 4 chronic erosion/corrosion events (Ref. 4, Potential Concern 1).
- Further improvements are needed in delineating the Sequence of Events, MAR, Consequences, and Notes in order to readily correlate the consequences/risk ranks with the location of the release and to facilitate control selection (Ref.4, Potential Concern 2).
- Several opportunities to further improve the detailed evaluation of specific process deviations that could potentially affect the Off-gas system performance were noted (Ref. 4, Potential Concern 3).
- In some HE table events, some potential additional causes and/or candidate controls were identified during the review (Ref. 4, Potential Concern 4).

Review comments were documented in an Independent Oversight WTP Off-gas System Hazard Analysis Comment Sheet and provided to BNI for review. BNI’s responses (Ref. 5) to the comments were subsequently discussed to facilitate understanding of the comment and BNI’s response. These review comments identified some opportunities to improve the level of detail and ensure technical defensibility of the HA. BNI’s responses indicated agreement with Independent Oversight’s comments, and BNI identified various actions to resolve the comments in a timely manner.

BNI provided Independent Oversight with a table of revised responses, including actions taken or planned, to the OFIs identified in the previous review of the Melter HA. The Independent Oversight team’s review of the responses and Melter HA activities this year found that many (42 of 53) of the OFIs previously identified by Independent Oversight for the Melter HA have achieved satisfactory resolution or responses. In addition, the responses for 11 of 53 OFIs have partially addressed the stated issue, and future activities may result in satisfactory resolution. Seven of those 11 OFIs relate to additional analysis needed to resolve flammability issues and/or technical resolution of assumptions in flow sheets. After reviewing BNI’s responses, the Independent Oversight team and BNI personnel held two discussion sessions in order to establish a mutual understanding of BNI’s responses and the corresponding Independent Oversight comments. Independent Oversight subsequently provided its working notes on the OFIs to BNI management (Ref. 6).

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-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.
3. Mary Miller	3. DOE/HQ HS-40 Letter, JS Boulden III to SL Samuelson, <i>Independent Oversight Review</i>

	<i>of the Hanford Site Waste Treatment & Immobilization Plant Low Activity Waste Melter Process System Hazard Analysis Activity, dated December 21, 2012.</i>
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. E-mail: Andrew Hill (BNI) to James Low, "Draft HSS Comments Off-gas," October 29, 2013, 6:55 PM (EST).
	6. E-mail: James Low to Andrew Hill (BNI), "Draft Response Disposition for HSS Melter HA OFI," October 29, 2013, 5:35PM (EST).

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 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 LMP, LOP, and LVP 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 directly affecting LMP and LOP performance, such as the LAW Integrated Control Network/Programmable Protection System and LAW facility (natural phenomena hazards and facility-based HA). These observations 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.

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, approved by BNI, and thus ready for DOE review. Nonetheless, the following potential concerns, which involve event records with unmitigated high consequences to facility workers or co-located workers, could lead to weaknesses in the final HA reports:

- Potential Concern 1: Non-mechanistic failures were assumed for several hazard events such that the described sequence of events did not lead directly to the identified cause. 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.