Operational Awareness Record (December 2014)	**Report Number:** EA-WTP-LAW-2014-06-02

Site: Hanford Site	**Subject:** Observation of Waste Treatment and Immobilization Plant Low Activity Waste Facility Reagent Systems Hazards Analysis Activities		
Dates of Activity :	06/02/14 - 06/19/14	**Report Preparer:**	James O. Low

Activity Description/Purpose:

The Office of Environment, Safety and Health Assessments within the Office of Enterprise Assessments (EA) reviewed the hazard analyses (HAs) for the reagent systems of the Waste Treatment and Immobilization Plant (WTP) Low Activity Waste (LAW) Facility. These systems include the ammonia reagent system (AMR), the carbon dioxide system (CDG), and the sodium hydroxide system (SHR). EA reviewed HA event tables developed for these reagent systems, observed a portion of the HA activities, and met with Bechtel National, Incorporated (BNI) personnel to discuss comments on the HA event tables. This EA observation is part of a planned multi-phase review (Ref. 1) focusing on the technical adequacy of select BNI-issued LAW HA reports (HARs) and subsequent submittal of the LAW documented safety analysis (DSA) and technical safety requirements (TSR) to the U.S. Department of Energy (DOE) Office of River Protection (ORP).

Result:

During this review period, EA observed the LAW reagents system HA team (HAT) analyze HA events related to the LAW AMR system and the LAW Melter Process (LMP) HAT conduct "clean-up" sessions to resolve internal review comments on the HA event tables. EA also reviewed the draft HA event tables for the LAW reagents systems (06/05/14 versions for CDG and SHR and 06/12/14 version for AMR). EA also met with BNI personnel to discuss the scope and schedule for upgrading the High Level Waste (HLW) Facility preliminary DSA (PDSA).

As described in previous EA activity reports (Refs. 2 through 6), the HA process performed by each BNI HAT focuses on identifying and evaluating potential events (i.e., process upset conditions that lead to adverse consequences to facility workers, co-located workers, or the public). For the AMR, CDG, and SHR systems, the HAT used the "what-if?" hazard evaluation methodology to identify potential HA events. EA provided comments on the LAW reagents systems HA event tables to BNI for written response. After reviewing the BNI responses, EA met with BNI personnel to establish a mutual understanding of the responses which led to their subsequent revision (Ref. 7). BNI responses identified a number of actions to reevaluate the hazard evaluation tables in order to resolve the comments.

EA observed the HAT conducting clean-up HA sessions of select LMP HA events to clarify the hazards of the glass-water reaction, maintenance operations, and potential criticality. The HAT discussed updated analysis to modify existing or develop additional specific HA events. The HAT technical discussion provided additional analytical rationale for select HA events that may be useful in developing the LMP HAR.

During this review, BNI was implementing a significant reorganization of the WTP nuclear safety function, as well as initiating changes to existing processes for developing HARs (Ref. 6). Currently, BNI is filling positions and revising existing HA process procedures. The resulting changes will affect the schedule for document submittals with the LAW DSA/TSR now targeted for submittal in fiscal year (FY) 2017. The schedule changes will be reflected in a revised LAW DSA development project execution plan (PEP).

EA noted some positive aspects of the HA process—specifically:

- AMR HA event consequences are conservatively estimated.
- No new potential events that would result in high consequences to the public or co-located workers were identified.
- HA event tables for the LAW Reagents Systems included accident types appropriate to the analyzed systems (e.g., fires, explosions, and loss of confinement).
- The HAT cross-checks of analyzed LMP HA events appeared to contribute to a comprehensive hazard evaluation.
- No new potential concerns of a systemic nature were identified.

EA review of the LAW reagent systems HA event tables and observation of the HAT activities on the AMR and CDG systems identified deficiencies that warrant further review in subsequent EA activities. These deficiencies are summarized as follows:

- Candidate controls related to the ammonia tanker truck were not identified or evaluated for some potential high-consequence events.

- Candidate controls have not always been appropriately characterized with respect to preventive or mitigative features. EA noted several HA events where controls were inappropriately identified as mitigative rather than preventative (e.g., pressure relief valves). Identifying some controls as mitigative can result in misunderstanding the role and importance of these controls in preventing high consequence events.
- EA observed that 17 of the 23 review comments on the reagent system HA event tables were examples of previously identified Potential Concern 1 (Ref-7 comments A-6/7, A-8/9, C-3, C-6, C-7), Potential Concern 3 (Ref-7 comment A-15), and Potential Concern 4 (Ref-7 comments A-1, A-10, A-12, A-13, A-14, A-16, C-2, C-4, C-5) (see Attachment 1).
- For some potential high-consequence events, such as those involving boiling-liquid/expanding-vapor explosions, the HAT did not exhibit a thorough understanding of the system design and operation or physical phenomena

BNI intends to implement corrective actions as indicated in Ref. 7 comment responses.

In preparation for future EA activities at the WTP HLW Facility, EA met with BNI personnel to discuss the status of the HLW Safety Basis Development PEP. The draft PEP describes the 2-year (FY-14 thru -16) work scope, process and schedule to incorporate the HLW Safety Design Strategy (SDS) into the HLW PDSA, and initiate HAs to develop HARs that will be focused to support PDSA upgrades. The WTP strategy is to resolve previously identified issues and findings related to the PDSA and eventually have a complete hazard/accident analysis to allow for efficient transition into the HLW DSA. BNI is preparing a revised draft PEP, incorporating recent ORP comments on the HLW SDS. PDSA upgrade PEP scheduled activities include:

- Developing a gap analysis of the PDSA.
- Updating the PDSA to incorporate the gap analysis and SDS.
- Developing a focused HA for radioactive liquid waste disposal (RLD) vessels to support a Justification for Continued Design, Procurement, and Installation.
- Resuming work on existing HAs for specific systems and initiating HAs for other systems.

EA 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, *IEA 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-2013-05-13, *Activity Report for Waste Treatment and Immobilization Plant Low Activity Waste Melter Off-gas Process System Hazards Analysis Activity Observation.*
4. Daniel Schwendenman	4. 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.*
5. Kevin Bartling	5. DOE/HQ HS-45 Report Number: HIAR-WTP-2014-01-27, *Activity Report for the Observation of Waste Treatment and Immobilization Plant Low Activity Waste Facility Off-gas Systems Hazards Analysis Activities.*
	6. DOE/HQ EA-30 Report Number: IAR-WTP-2014-3-31, *Office of Environment, Safety and Health Assessments Activity Report for the Observation of the Waste Treatment and Immobilization Plant Low Activity Waste Facility Hazards Analysis Activities.*
	7. E-mail: Kraig Wendt to James Low, subject: EA 31 comments and responses for NH3, CO2 and NaOH HE Tables, June 17, 2014 1:50 PM (PDT).

Were there any items for EA follow up? ☒Yes ☐No	
EA Follow Up Items	

1. Conduct an independent assessment of the final HAR volumes for the LAW AMR and CDG systems to determine the disposition of the identified deficiencies and conformance to DOE-STD-3009 requirements. Issue independent review reports for the AMR and CDG system HAR volumes.
2. Perform focused observations of HA development for the LAW Integrated Control Network/Programmable Protection System and LAW facility-wide (natural phenomena hazards and facility-based HA). These may lead to additional independent assessments of the final HAR volumes for these systems.
3. Perform focused observations of BNI's control selection processes for LAW systems.
4. Update the EA assessment plan to reflect revised (when issued) WTP LAW DSA development PEP.
5. Develop and issue the EA assessment plan for HLW safety basis development activities.

Attachment 1 – **Potential Concerns excerpt from Ref. 5 (revised)**	**Report Number: EA-WTP-LAW-2014-06-02**

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 EA 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: 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 3: The development and documentation of HA event tables is not always in sufficient detail to lead to full analysis of all process parameter deviations that could potentially affect 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 (see Ref. 5) 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 record contained unstated assumptions that could affect the identification of event causes and corresponding candidate controls. Potential Concern 3 has been revised to delete the original specific instance.