Office of Enterprise Assessments Operational Awareness Record		Report Number: EA-WTP-HLW-2014-10-20	
Site: Hanford Site	**Subject:** Observation of the Waste Treatment and Immobilization Plant High Level Waste Facility Concentrate Receipt/Melter Feed/ Glass Formers Reagent Hazards Analysis Activities and Review of the Radioactive Liquid Disposal Hazards Analysis Event Tables		
Dates of Activity:	10/20/14 – 11/06/14	**Report Preparer:**	James O. Low

Activity Description/Purpose: Bechtel National, Incorporated (BNI) is implementing a Safety Basis Development Project Execution Plan (PEP) for the Waste Treatment and Immobilization Plant (WTP) High Level Waste (HLW) Facility (Ref. 7). The PEP provides a disciplined process to resolve technical issues, upgrade the HLW Facility Preliminary Documented Safety Analysis (PDSA), and initiate alignment between the safety basis and the on-going engineering design. The PEP includes safety basis activities that are planned to be performed through fiscal year 2016, as aligned with the BNI engineering work scope. BNI is performing Radioactive Liquid Waste Disposal (RLD) system hazard analysis (HA) activities to support control selection so that BNI can perform a safety basis change package (previously known as an Authorization Basis Amendment Request) to update the PDSA and be consistent with the HLW safety design strategy. The HA activities for the HLW Concentrate Receipt Process/HLW Melter Feed Process and Glass Formers Reagent Systems (HCP/HFP/GFR) are a resumption effort to support the HLW PDSA upgrade.

The Office of Environment, Safety and Health Assessments within the Office of Enterprise Assessments (EA) reviewed portions of the HCP/HFP/GFR and the RLD HAs. EA observed a portion of the HCP/HFP/GFR HA activities, reviewed HA event tables, and met with BNI personnel to discuss their responses to EA comments. EA also reviewed completed draft HA event tables that were developed for the RLD system and met with BNI personnel to discuss their responses to EA comments. This EA observation and draft document review is part of a planned multi-phase review (Ref. 1) for assessing the process and results of upgrading the HLW PDSA. EA's multi-phase review will evaluate select portions of the HLW PDSA including system descriptions; hazards analysis; accident analysis; controls selection; and functional classification of safety structures, systems, and components.

Result:

During this review period, EA observed the HLW HA team (HAT) analyze hazard events related to the HLW HCP/HFP/GFR systems. The HAT used the "what-if" analysis methodology to identify potential hazard events and perform the analysis, dividing the system into five study nodes: the external HCP transfer piping, GFR external to HLW, GFR internal to HLW, the internal HCP transfer piping, and HFP. EA observed the HAT perform the first part of the HA of the internal HCP transfer piping (Node 4). EA then reviewed the completed draft HA event tables for the GFR internal to HLW (Node 3) and the partially completed Node 4 event tables.

EA also reviewed the completed draft HA event tables for the RLD system, which is divided into four study nodes: the RLD bulges, the process vessel ventilation bulge, the wet process cell (WPC), and the RLD vessels in the WPC.

Consistent with previous EA reports (Refs. 2 through 6) for the Low Activity Waste Facility and the HLW RLD HA activities, the HCP/HFP/GFR HAT analysis focused 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). Consistent with established practices, the HAT analyzed the hazard events based on unmitigated event sequences, which led the HAT to identify generally reasonable sets of causes and candidate controls for worst case HA events (exceptions are noted below). The HAT provided adequate technical input during the

development of postulated events, generally defining physically meaningful scenarios and analyzing both abnormal and bounding events.

EA provided comments on the HCP/HFP/GFR system and the RLD system 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. BNI responses identified a number of actions to re-evaluate the HA event tables and resolve the EA comments (Ref. 8 and 9).

EA noted some positive aspects of the HLW HA process, specifically:

- The material-at-risk and consequence information was sufficient to start the HA.
- Radiological consequences were supported by draft calculations and methods.
- The HAT conservatively estimated the HLW hazard event consequences.
- The HAT identified and analyzed the appropriate hazards in the draft HA event tables.
- None of the EA team comments generated are related to previously identified potential concerns.
- The EA team identified no new potential concerns.

EA observed the HCP/HFP/GFR HAT's use of piping and instrumentation diagrams, solicitation of subject matter expert (SME) support, and engaged discussions of hazard events and candidate controls contributed to a comprehensive hazard evaluation. In addition, the HAT developed the event descriptions and content in a systematic, detailed manner.

The EA team did not identify additional hazards that would need to be developed into new hazard events. Discussions with BNI SMEs detailing the alternative methodology for analyzing fire events provide the technical basis to remove the potential concerns identified for the RLD system HA in Reference 6.
EA review of the HLW HCP/HFP/GFR and RLD hazard event tables and observation of the HAT activities on the HCP/HFP/GFR system identified discrepancies that warrant further review in subsequent EA HA oversight activities.

For HCP/HFP/GFR event tables, the discrepancies are summarized as follows:

- The HA event tables did not always appropriately characterize candidate controls with respect to preventive or mitigative features. EA noted several HA events where the tables inappropriately identified controls as preventive rather than mitigative. (Reference 9, Comments 1.d, 2.b, 11.a, 12.a, and 14)
- In a number of instances, the HA event tables inconsistently applied engineered candidate controls among similar events. (Reference 9, Comments 1.a, 2.c, 11.b, and 16)
- Candidate control safety functions did not always apply to the specified event. (Reference 9, Comments 1.b, 1.c, 2.a, 7, 8, 10.a, and 10.b)
- The HA event tables inconsistently identified some candidate administrative controls across similar events. (Reference 9, Comments 5, 12.b, and 13)
- The event descriptions sometimes lacked detail (i.e., unclear material at risk description). (Reference 9, Comments 3, 9, and 15)

For the RLD event tables, the discrepancies are summarized as follows:

- The RLD event tables did not always identify appropriate candidate preventive controls (based on the listed causes). (Reference 8, Comments 7 and 15)
- The candidate mitigative controls were sometimes mischaracterized as candidate preventive controls.

(Reference 8, Comments 4, 6, 8, 9, and 13)

- Some events required clarification of how the WPC radioactive waste inventory could backflow into the bulge. (Reference 8, Comment 18)

BNI intends to implement corrective actions as provided in revised responses.

EA Participants	References
1. James O. Low (lead)	1. DOE/HQ EA-31, *Plan for the Independent Oversight Review of the Hanford Site Waste Treatment Plant High-Level Waste Facility Preliminary Documented Safety Analysis Upgrade*, July 2014.
2. Kevin E. Bartling	2. 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.*
3. Roy R. Hedtke	3. 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.*
	4. 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.*
	5. DOE/HQ EA-31 Report Number: IEA-WTP-2014-06-02, *Operational Awareness Record for the Observation of Waste Treatment and Immobilization Plant Low Activity Waste Facility Reagent System Hazards Analysis Activities.*
	6. DOE/HQ EA-31 Report Number: IEA-WTP-HLW-2014-08-18, *Operational Awareness Record for the Observation of Waste Treatment and Immobilization Plant High Level Waste Facility Radioactive Liquid Disposal (RLD) Hazards Analysis Activities.*
	7. BNI Document Number: 24590-HLW-PL-ENS-12-0001, Rev. 1, *Safety Basis Development Project Execution Plan for the High-Level Waste Facility*, June 2014
	8. E-mail Mitchell Willadsen (BNI) to James Low, RE: *Review Comments*, 10/29/2014 6:24 PM (PST)
	9. E-mail Herbert Branham (URS) to James Low, RE: *Resolutions of EA-31 Comments*, 11/04/2014 4:48 PM (PST)

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

EA Follow Up Items

1. Conduct an independent assessment and issue an independent review report of the final HARs for the HLW RLD and HCP/HFP/GFR systems to determine the disposition of the identified discrepancies and conformance to DOE-STD-3009 requirements.

2. Perform focused observations of BNI's HA and control selection activities for select HLW systems pursuant to the reference (1) plan.