

EA-23-040 Predecisional Enforcement Conference NRC Region II Atlanta, Georgia

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Opening Remarks Jim Bittner Vice President and General Manager, NOG-L

BWX Technologies, Inc.



- On January 19, 2023 BWXT NOG-L's Uranium Recovery Operations experienced a process upset condition that led to low concentration organic waste solution being spilled to the floor and introduced to the ventilation system.
- Presentation Agenda:
 - Annular Organic Waste Tank & Ventilation Overview
 - Timeline of Event
 - Investigation
 - Corrective Actions
 - Safety Significance
 - Enforcement Perspective
 - Summary
 - Closing





Annular Organic Waste Tank and Ventilation System Overview

Bryan Thilking Uranium Recovery Operations Manager



- The Annular Organic Waste Tank is a favorable geometry, ~800 liter, tank used for storage of organic waste solution generated from the Recovery Extraction process.
- The tank is utilized as interim storage prior to the transfer of Organic Waste Solution back into Recovery for further processing ("washing") – uranium extraction.
- The NCS posting limits incoming concentration to $\leq 10 \text{ g U}^{235}$ / liter.





Front View – Floor Level



Top View – Mezzanine Level



Overflow







- The Ventilation System is designed to handle Uranium and is considered a fuel bearing system.
 - System Layout and Construction allows material (Condensation and Uranium) to be captured and re-introduced into the Recovery Process.
- The Safety Basis for the Recovery Ventilation accounts for Uranium in the system and is limited to 9.77 kg (9,770 g) U²³⁵ in the ventilation scrubber OR 1.5 kg (1,500 g) U²³⁵ per linear meter of ductwork.
- Items Relied on for Safety (IROFS):
 - Sampling of Ventilation Scrubber Discharge Solution each Shift
 - Continuous Sampling/Maintaining pH (acidic) Scrubber Solution
 - Daily Inspection of the T-Duct Collection Column
 - Weekly Ventilation Ductwork Inspection and Clean Outs
 - Annual Ventilation Ductwork Survey by Nuclear Material Control











Timeline of Event

Bryan Thilking Uranium Recovery Operations Manager



- 1999 Annular Tank installed as Blend Tank # 2 for HEU Downblend Production Process.
- 2006 Tank was taken out-of-service at the conclusion of the Downblend Program.
- 2011 A Safety Evaluation Request (SER) was submitted to convert Blend Tank # 2 for storage of Organic Waste.
 - Included a requirement for the ventilation tie-in (for ALARA purposes) on the Recovery Wet Ventilation system to include an air gap.
 - Included a requirement for an overflow to be present on the tank.
- 2013 The implementation was completed and the Annular Organic Waste Tank was released to operate.





- The Annular Organic Waste Tank was full. The concentration of the organic solution in the tank was ~2.8 g U²³⁵ / liter.
- Operator started transferring Organic Waste Solution (~0.43 g U²³⁵ / liter) from the Weigh Columns to an adjacent area for disposal, utilizing the Annular Organic Waste Tank's recirculation pump.
 - Procedure required four (4) valves to be closed in order to bypass the tank and transfer to adjacent area.
- Operator did not receive the expected flow.
- Operator checked the pump in the Annular Organic Waste Tank area and discovered
 ~20 liters of Organic Waste Solution on the floor at the tank location.
 - Operator immediately stopped the air diaphragm pump and isolated tank valves.
- Recovery Front-Line Manager (FLM) confirmed spill and identified valve misalignment. It was presumed Organic Waste Solution spilled to the floor from the Overflow Line.
 - FLM performed proper notification and initiated clean-up of the spill, per procedure.





- Recovery Unit Manager walked down the incident to determine potential cause(s) of the spill.
 - Annular Organic Waste Tank confirmed to be isolated and out-of-service, per *Conduct of Operations.*
- Operator performed Daily Inspection of the T-Duct Collection Column (IROFS) and identified the presence of ~3 liters of Organic Solution.
- Recovery Unit Manager was notified about Organic Solution in the T-Duct Collection Column.
- Nuclear Criticality Safety (NCS) personnel were notified of the presence of Organic Solution in the T-Duct Collection Column and walked down the process conditions.
- NCS personnel identified the Overflow & Ventilation Air Gap IROFS as degraded. The IROFS did not fully prevent solution from entering the ventilation system.
- NCS and Licensing & Safety Analysis determined that although the two IROFS were degraded, the performance criteria of 10 CFR 70.61 were maintained.



- Corrective Action Initialed.
- NCS Safety Concern Analysis was completed, documenting the conditions and analyzing the associated Safety Analysis Report (SAR) Accident Scenario. Identified Actions prior to return-to-service included:
 - Verifying the Annular Organic Waste Tank Overflow Line is not partially clogged.
 - Change the configuration of the Annular Organic Waste Tank Air Gap.
- February 3 While disassembling and inspecting the Overflow Line, an intact rupture disk was identified.
- February 3 A report was made to the NRC Operations Center because the IROFS function of the Overflow could not be credited in the accident sequence. As documented in the Integrated Safety Analysis, the performance criteria of 10 CFR 70.61 were not maintained.









Investigation

Bryan Thilking Uranium Recovery Operations Manager

Reviews & Investigation



- Human Performance Review Misalignment of Valves
 - Appropriate disciplinary action and retraining was conducted.
 - A lessons learned was shared with Uranium Processing and Research Reactor Operations personnel.
- Extent of Condition Air Gap & Overflow
 - Broad review of air gaps and overflows in Wet Uranium Processing Areas was performed.
 - The other two (2) Annular Waste Tanks were inspected and similar configurations were not identified.
 - No similar configurations were identified for other air gaps and overflows credited as IROFS for the prevention of a criticality in the ventilation system.





- The SER for repurposing Blend Tank # 2 did not include piping and instrumentation diagrams (P&ID's) for the proposed changes. The original drawings in the 1999 Downblend SER package identified the rupture disc.
- The overflow was visually verified prior to releasing to operation. Calculations were performed on sizing the overflow. No functional testing was performed.
- The air gap was visually verified prior to releasing to operation. The air gap's design changed from the original as part of the repurposing. No calculation or functional testing was performed.
- An as-built drawing of the Annular Organic Waste Tank was created following the release of the tank to operation. The piping and instrumentation diagram (P&ID) did not adequately capture the location of the Rupture Disc in the system and it was missed during the review.





Corrective Actions



- People:
 - Issue a Lessons Learned that details the importance of configuration management and emphasizes factors that were identified in this event's investigation.
- o Plant:
 - Process was Shutdown and Tank Locked-Out. (Immediate Action)
 - Removed the Rupture Disk. (Immediate Action)
 - Redesign the air gap on the Annular Organic Waste Tank and incorporate in the field.
- Process:
 - Corrective Action Level 1 Initiated. (Immediate Action)
 - Develop guidance specification for air gaps that are credited as IROFS to prevent inadvertent transfer of fissile solutions.
 - Revise the Safety Evaluation Request (SER) acceptance process and the Process Hazards Identification practice to strengthen the quality of information (e.g. design drawings) provided in change packages with emphasis on process flows and existing safety controls.
 - Strengthen the drawing standard for Uranium Processing and Research Reactors personnel to utilize for creating and verifying process drawings.



Safety Significance





- Actual Significance
 - ~20 liters of Waste Organic Solution spilled onto the floor.
 - ~3 liters of Waste Organic Solution accumulated in the ventilation T-Duct Collection Column.
 - No NCS limit was exceeded by the spill or the presence of the Waste Organic Solution in the ventilation system.
- Potential Significance
 - The NCS concentration limit for the Annular Organic Waste Tank is $\leq 10 \text{ g U}^{235}$ / liter.
 - ANS 8.1, Table 1, Single-Parameter Limit for Concentration is 11.6 g U²³⁵ / liter.
 - Any amount of Organic Waste Solution entering the ventilation system will remain subcritical.
- The Safety Significance of the Event is Low
 - The concentration of the Waste Organic Solution is Subcritical the typical concentration is ~26% of ANS 8.1's single-parameter limit.
 - The Ventilation System is considered a fuel bearing system and is equipped with IROFS to identify and avert the accumulation of material.



Enforcement Perspective





- 0700027/2023006-01: Failure to meet 10 CFR 70.61(b) due to failure to ensure an air gap control was available and reliable to prevent a high-consequence accident scenario.
- 07000027/2023006-02: Failure to meet 10 CFR 70.61(b) due to failure to ensure an overflow drain control was available and reliable to prevent a high-consequence accident scenario.



Grouping of Apparent Violations



- NOG-L's understanding of the NRC Enforcement Manual, Part 1, Section 1.3.5, Documenting Violations, indicates that it may be appropriate to group violations as examples of a single problem under the following condition:
 - Violations should only be grouped if they are closely related such as having a cause and effect relationship or
 - [being] directly related to the same event (e.g., failure to perform testing that results in a piece of equipment being rendered inoperable, loss of material and failure to report the loss)
- Each AV's root cause stems from the change management review for repurposing the tank.
 - The AV's are closely related, arising from the same root causes (out of the same change evaluation), and are not separate regulatory breakdowns.
 - The corrective actions are appropriate for both AV's.
- If each AV is considered independently, performance criteria of 10 CFR 70.61(b) is maintained.





- NOG-L's understanding of the NRC Enforcement Manual, Part 1, Section 1.2.9, Using Risk Significance, indicates risk is a relevant consideration in enforcement:
 - It may be appropriate to consider a lower severity level or enforcement action for issues that have low risk significance.
- The event's actual and potential safety significance is low. Controls remained in place to ensure the concentration is below the single-parameter limit.





Summary



- In consideration of:
 - Identifying and reporting the failed IROFS and degraded IROFS,
 - Extensive investigation and corrective actions,
 - Actual and Potential Safety Significance is Low.
- BWXT NOG-L asks:
 - The two violations be grouped as one,
 - Discretion be applied regarding final enforcement action.





Closing Remarks Jim Bittner Vice President and General Manager, NOG-L

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