

# 242-A Evaporator: 2010 Facility Operation, Ammonia and Upgrades



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# Hanford Advisory Board Questions



- ***“Why is the evaporator having so much difficulty starting? What is the nature of the problems?”***
- ***“How are the evaporator engineers handling the excess ammonia in the condensate stream if the ammonia is above specifications and is eating away at the off-gas system equipment?”***
- ***“Have there been any efforts to document the frequency of past equipment failures since the evaporator was built?”***

# Start-Up & Operations



***“Why is the evaporator having so much difficulty starting? What is the nature of the problems?”***

- Dynamic environment
- Increased FY2010 Campaigns
- Planning Integration
- Authorization Basis Implementation
- Slurry Line Issues
- Other Technical Issues
- Maintenance

# Startup & Operation



- Conducted 3 campaigns in fiscal year 2010; an increase of 2 campaigns over contract baseline planning
- Campaign 10-CR was conducted with water only
  - Campaign started May 17, 2010; completed May 28, 2010
  - New equipment operational tested
  - Validated revised operating procedures set
  - Ensured personnel training and proficiency
- Campaign 10-01 processed 1<sup>st</sup> pass waste feed from AW-106
  - Campaign started August 26, 2010; completed September 10, 2010
  - Achieved 299,000 gallons (33%) of pre-flush waste volume reduction
- Campaign 10-02 processed 2<sup>nd</sup> pass waste feed from AW-106
  - Campaign started September 26, 2010; completed October 10, 2010
  - Feed staging transfer performed between 10-01 and 10-02
  - Achieved additional 224,000 gallons (40%) pre-flush waste volume reduction

# 242-A Evaporator FY2010 Startup, Cont.



- Accelerated first FY2011 campaign to improve schedule integration and operating efficiency:
  - Significant increase in upgrade projects in Tank Farms and 242-A impacted both FY2010 and FY2011 campaign planning. Upgrades include but are not limited to:
    - ✦ 242-A Raw Water System
    - ✦ 242-A Instruments
    - ✦ AW Densitometers
    - ✦ AP Valve Pit
    - ✦ 242-A HVAC upgrade
  - Performing campaigns back-to-back achieves nearly \$1M and 3-4 months in operating and maintenance efficiencies
  
- Implemented a new Tank Farm safety basis, impacting campaign associated transfer systems
  - Numerous procedure changes required
  - Modified and tested additional jumpers in AW Farm
  - Significant engineering analysis required to document qualification of safety significant systems and components

# 242-A Evaporator FY2010 Operations, Cont.



- Implemented 242-A Procedure Improvement Initiative
  - Major revisions to primary operating procedures in response to FY2009 campaign lessons learned
  - Significantly improved operating experience for Campaigns 10-01/10-02
  
- Modified safety significant 242-A slurry line over pressure protection system in response to Tank Farm Potential Inadequacies in the Tank Farm Safety Basis (PISA)
  - Existing system determined not to be ASME code compliant
  - Re-design and modification of pump room jumpers and components was required
    - ✦ Component availability (12+ week lead time for new components)
    - ✦ Extensive engineering analysis and calculations required to support design effort
    - ✦ Slurry system to sump discharge jumper redesigned, removing pressure relief valve PSV-PB2-1 and isolation valve HV-PB2-1 from the 21-26 jumper
    - ✦ Slurry jumper C-4-5-21 required replacement of safety significant rupture disk, PSE-PB2-1
    - ✦ Tank Farm safety basis and implementing documents and procedures required revision

# 242-A Evaporator FY2010 Operations, Cont.



- **Tested slurry transfer line in resolve potential freezing of secondary containment**
  - Liquid held up in secondary containment may have frozen during removal of the cleanout boxes on slurry transfer line SL-167 (winter 2009-10)
  - Pressure hold test required to confirm integrity of safety significant Tank Farm transfer line and associated valves
  - Testing successfully completed in August 2010
  
- **Second PISA identified when newly installed safety significant rupture disk burst during initial SL-167 pressure hold test**
  - Performed Campaign 10-CR while technical evaluations conducted.
  - Modified Tank Farm safety basis, establishing new defense in depth control to prevent pressure transients
  - Engineering analyses conducted to ensure pressure transient issue did not exist for other Tank Farm and 242-A piping systems
  - 242-A slurry jumper redesigned to replace rupture disk with a safety significant pressure relief valve
  - Field work protracted due to high heat index during July-August

## 242-A Evaporator FY2010 Operations, Cont.



- Various routine preventive maintenance and corrective maintenance activities performed prior to each of the campaigns
  - Critical maintenance and upgrades impacted resource availability
  - Low frequency of operation and aging equipment impact both preventive maintenance and corrective maintenance requirements
  - Post-campaign investigative surveys in the pump and evaporator rooms will be performed following future campaigns

# 242-A Ammonia Question



***“How are the evaporator engineers handling the excess ammonia in the condensate stream if the ammonia is above specifications and is eating away at the off-gas system equipment?”***

- Ammonia Issues Pre-date 2004
- Feed sampling and analysis
- Process condensate sampling and analysis
- Vessel vent monitoring
- Ammonia well within limits
- IQRPE confirmed system integrity
- Low Risk to Operation

# 242-A Ammonia Question, Cont.



- Ammonia is controlled through feed analysis. Feed is not accepted if limits are exceeded
  - Waste Analysis Plan limits ammonia in the feed to less than 6800 mg/L
  - Liquid Effluent Retention Facility limits discharges of process condensate to less than 13,600 mg/L
  - Ammonia discharges via the vessel vent are limited to less than 100 lbs/day
- Highest concentrations of ammonia historically found in PUREX ammonia scrubber feed
  - Majority of PUREX wastes processed in the 1990's, diluted or the ammonia has passively evaporated in the tank storage system
  - Since 2003, the highest concentrations of ammonia was found in the SY-101 feed (Campaigns 03-04 and 07-01/07-02). Ammonia concentrations were less than 2000 mg/L; well within waste acceptance limits
- No vessel vent equipment or material compatibility issues have been identified
  - No corrosion or other indication of material compatibility issues has been identified during vessel vent preventive or corrective maintenance activities

# 242-A Ammonia Question, Cont.



- Potential material compatibility issues in the process condensate recycle system were identified in the 242-A Life Extension Study (HNF-3327) and were subsequently discussed in the 2007 Integrity Assessment (RPP-RPT-33306)
  - A number of the affected brass valves on the process condensate system were replaced prior to FY 2003 as noted in the 2007 Integrity Assessment Report
  - Pipe codes for both process condensate recycle and other systems such as raw water (which is also seeing increased failure rates due to chemical treatment) have been revised
- The Life Extension Study concluded “*Brass or bronze wetted components are no longer acceptable with the observed levels of ammonia concentrations. Thirty-nine valves have currently been identified in the system to be replaced or rebuilt.*”
  - Currently identified as “low risk” for operations due to actions taken to date
  - Proposed upgrade not scheduled to be performed within the contract performance period
  - Any equipment identified as degrading will be evaluated and addressed through corrective maintenance or the planned upgrade will be accelerated

## 242-A Ammonia Question, Cont.



- The 2007 Integrity Assessment Report concluded that, *“The 242-A Evaporator unit was found to be adequately designed and to have sufficient structural strength and compatibility with the wastes stored and treated that it will not collapse, rupture, or fail.”*
- No material compatibility issues have been identified by the IQRPE, ORP or WRPS that require expedited action

# 242-A Ammonia Question, Cont.



## Vessel Vent Ammonia Discharge: Projected vs. Actual

<b>242-A Evaporator Campaign</b>	<b>Operating Duration (days)</b>	<b>Projected (lb/day)</b>	<b>Actual (avg lbs/day)</b>	<b>Campaign Type</b>
10-01/10-02	40	5	0.5	Waste processing
10-CR	14	1	0	Cold Run (water only)
09-01/09-02	96	8	0.6	Waste processing
08-CR	7	1	0	Cold Run (water only)
07-01/07-02	62	73	3.8*	Waste processing
06-01	12	9	2	Waste processing
06-CR	10	1	0	Cold Run (water only)
05-01	11	9	1.2	Waste processing
04-01	20	29	0.5	Waste processing
03-04	8	42	14*	Waste processing

\* Campaigns 03-04 and 07-01/07-02 processed SY-101 waste

# 242-A Life Extension



***“Have there been any efforts to document the frequency of past equipment failures since the evaporator was built?”***

- Operability of the 242-A Evaporator remains a critical priority and acknowledged risk for ORP and WRPS
- Monitoring of the “health” of the facility multi-faceted
- 242-A Life Extension upgrades and corrective maintenance activities FY2010 & FY2011

# 242-A Life Extension



- Operability of the 242-A Evaporator remains a critical priority and an acknowledged risk for ORP and WRPS
  - Operation anticipated into the early 2040's
  - American Reinvestment and Recovery Act (ARRA) funding is being used to accelerate upgrades
  - Alternatives to 242-A including Wipe Film Evaporator are being evaluated
- Planned and proposed 242-A Life Extension upgrades and maintenance activities are based on:
  - Independent engineering evaluation of systems and components such as the 2007 Integrity Assessment
  - Results of maintenance history included in Life Extension Studies
  - Post-Campaign system health evaluations
  - Identified equipment deficiencies
  - Operational experience
  - Other sources such as changes to the authorization envelop

# 242-A Life Extension, Cont.



- **FY2010 Upgrades & Maintenance**
  - Electric Compressor Replaced
  - Raw Water System Upgraded
  - Process Condensate Leak Detection System Upgraded
  - Decontaminated the Condenser Room
  - 36 Instrument Upgraded
  - Slurry Over Pressure Protection System Modified
  - HV-CA1-9 Repaired
  - Routine preventive maintenance
  - Other corrective maintenance

# 242-A Life Extension, Cont.



- **FY2011 Upgrades & Maintenance**
  - Spare Parts Inventory Upgrade
  - Instrument Upgrades
  - Building Ventilation Exhauster Upgrade
  - Condenser Room Duct Work – Asbestos Abatement
  - Modification of the TBX-1 Panel
  - Design & Procure 26 Control Valves
  - Install Manual Dip Tube Flush Manifold
  - Refurbish spare P-B-1 Recirculation Pump
  - Procure Spare P-B-2 Slurry Pump
  - Procure Spare AW-102 Feed Pump
  - Sanitary Drain System Upgrade (Baseline Funded)
  - Routine preventive and corrective maintenance
  
- **FY 2011 Projects - Pending Funding**
  - Sampling Station for secondary effluents (currently unfunded in FY2011 baseline)
  - Reboiler Condensate System Upgrade (being accelerated from FY2012 baseline)