AY-102 Recovery Project
ERSS Retrieval Briefing

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Manager, SST Retrievals

December 2016
AY-102 Recovery Project

1- Retrieval Mission Overview
2- Retrieval Project
3- Retrieval Hazards and Controls
4- Communications during Retrieval
River Protection Project Mission

Protect the public and the environment from the risk posed by 56 million gallons of radioactive and chemical waste stored in 177 tanks

Safely manage and retrieve waste from tanks and prepare the delivery system for the Waste Treatment Plant

Immobilize the waste at the Waste Treatment Plant

Remediation of the Leaking Double-Shell Tank AY-102

Revision 0 of December 1, 2016
AY-102 Retrieval Mission Overview
Hanford HLLW Tanks Challenges

- **1943-1964:** 149 single-shell tanks constructed
  - Up to 67 presumed to have leaked

- **1968-1986:** 28 double-shell tanks constructed
  - 1 leaking, waste contained within annulus

Disposition of **56** million gallons of radioactive and chemical waste
What is in the tanks?

- Waste temperatures range from 60°F to 160°F
- Highly caustic
- Moderate-to-high radioactivity
- No two tanks have the same waste contents
- Most waste produces some hydrogen

**Saltcake**

*23M gallons*

Mostly water-soluble salts; small amount of interstitial liquid

**Supernate**

*21M gallons*

Any non-interstitial liquid in the tanks - similar to saltcake in composition

**Sludge**

*12M gallons*

Water-insoluble metal oxides, significant amount of interstitial liquid - texture similar to peanut butter
AY-102 Retrieval Mission Overview
Tank History and Features

- Wastes from historic B Plant operations and strontium/cesium extraction
- 1 million gallons capacity
- 75 feet x 30 feet high, 15 feet below grade

View of the primary tank only
AY-102 Retrieval Mission Overview
Project Mission, Phases, and Key Milestones

• The October 2014 AY-102 Settlement Agreement between the Washington State Department of Ecology, DOE/ORP, and WRPS defines the project’s recovery actions and associated deadlines

• **Mission:** Retrieve the primary tank waste to the point where the leak site(s) can be investigated, and a determination can be made to either repair, or close the tank

<table>
<thead>
<tr>
<th>Project Phase &amp; Scope</th>
<th>Status 11/2016</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>FY14 FY15 FY16 FY17</td>
</tr>
<tr>
<td>Retrieval System Design</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Equipment Procurement</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Construction &amp; Installation</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Commissioning</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td><strong>SA-IIB3 - Ready to Pump by 3/4/16</strong></td>
<td>100% on 3/3/2016</td>
<td></td>
</tr>
<tr>
<td>Operations</td>
<td>Removed 95% vol.</td>
<td></td>
</tr>
<tr>
<td>AY-102 Supernatant removal</td>
<td>100% on 3/7</td>
<td></td>
</tr>
<tr>
<td>Sludge removal with Standard sluicers</td>
<td>100% on 5/2</td>
<td></td>
</tr>
<tr>
<td>Operations outage to switch to Extended Reach Sluicer configuration</td>
<td>100% on 11/9</td>
<td></td>
</tr>
<tr>
<td>Sludge removal with ERSS</td>
<td>Nov 2016 - Feb 2017</td>
<td></td>
</tr>
<tr>
<td><strong>SA-IIB5a - Waste removal completed by 3/4/17</strong></td>
<td>Feb 2017</td>
<td></td>
</tr>
</tbody>
</table>

**Projected date**

**Deadline**
AY-102 Recovery Project

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AY-102 Recovery Project Accomplishments
Retrieval and Transfer Process

1st Technology: sluicing
• Mobilize solids with sprayed liquid, pump slurry to a receiver tank
• Decant solids and recycle supernatant for further sluicing

2nd Technology: high-pressure water
• Breakdown residual hard heel waste in a slurry, pump slurry to receiver tank
AY-102 Recovery Project Accomplishments
Retrieval and Transfer System Layout

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AY-102 Recovery Project Accomplishments

Retrieval and Transfer System Installation

- Removed 5 obsolete pumps from AY-102 and AP-102
- Upgraded 7 pits to receive new equipment
- Designed, fabricated, installed and tested 3 new pumps, 2 sluicers, and 2,000 feet of hose-in-hose transfer line

Equipment installation completed in January 2016

Equipment removal and pit upgrades in 2014 - 2015

Pump installations in November 2015

Revision 0 of December 1, 2016
AY-102 Recovery Project Accomplishments
Retrieval Operations: AY-102 Sludge Retrieval

1st Phase of retrieval (March – April 2016)
- Removed 112,360 gal = 75% of the solids
- 41,360 gallons of sludge remaining

95% of the initial waste removed from AY-102 in less than 2 months
**AY-102 Recovery Project Accomplishments**

**Anticipated/Planned Response to the Increased Leak in the Annulus**

- On April 17, during sluicing operations, the leak increased and filled the annulus space with up to 8 inches of liquids. The annulus pump was operated to return the liquid to the primary tank.
- The annulus pump is installed and available for continued pumping.

- **Max. level recorded**: ~ 8.5 inches
- **Pump suction breaks at**: ~ 3.5 inches
- **Refractory Pad Thickness**: ~ 8 inches
- **Primary Tank Floor**: ~ 15 inches
- **Average Residual Sludge Level as of 4/28/2016**: ~ 41 kGal
- **Initial Sludge level**: (51")
- **Initial Supernatant level**: (288")
- **Ø75 feet x 30 feet high**
Following first phase of retrieval, the retrieval system was reconfigured with four Extended Reach Sluicers.

Full-scale mockup of the AY-102 primary tank at the Cold Test Facility with a prototype ERSS to train retrieval operators.

Tank volume coverage:
Standard Sluicer vs ERSS

Standard Sluicer D
Standard Sluicer B

ERS A
ERS B
ERS C
ERS D

ERS D
ERS C
ERS B
ERS A

ERSS A
ERSS B
ERSS C
ERSS D
AY-102 Recovery Project

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AY-102 Retrieval Hazards and Controls
Project Safety Record

- 0.5M hours of work over 3 years
- 24 months of field work
- 2 months of retrieval operations
- More than 30,000 farm entries
- 5 first aid cases, and 11 AOP-15
AY-102 Retrieval Hazards and Controls

Integrated Safety Management

Feedback
- Communication plan
- Daily report
- Safety Startup
- Weekly president's message
- Pre-job briefings
- Additional hazards identified by workers

Define Work Scope for AY-102
- Install retrieval and transfer system
- Perform retrieval operations

Identify Hazards
- Industrial hazards
- Nuclear hazards
- Radiological hazards
- Chemical hazards

Perform Work
- Transfer procedure
- Plan-166
- RWP
- IH sampling and monitoring Plan
- Safety professional oversight

Hazard Control
- JHA
- Engineered controls
- Administrative controls
- PPE
AY-102 Retrieval Hazards and Controls

Industrial Safety

• Highly congested work space
• Restrictive PPE
• Winter weather

Focus on slips, trips, and falls
Prevention of waste leaks and misroutes during retrieval

- Containment in tanks and transfer lines
- Valve line-up controls
  - Transfer procedure (TO-270-925)
  - Rounds/checklists
  - Material balance
Engineered Controls
- Waste contained in tanks, transfer lines, and closed pits
- Shielding on pits and transfer lines
- Remotely controlled operations from control trailer outside of the farm
- Active ventilation with HEPA filtration of primary tank and annulus space

Administrative Controls
- Worker training, RWP
- Restricted access to farms and waste-transfer zones
- RCT/HPT coverage of all construction and operations activities
- Continuous monitoring of potential waste leak along transfer route

PPE
- Anti-contamination clothing and respiratory protection
### AY-102 Retrieval Hazards and Controls

**Chemical – Tank Vapors**

~ 5,800 data points collected and analyzed during 1<sup>st</sup> Phase of retrieval (March 11 - May 8, 2016)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>TOTAL READINGS</th>
<th>Total NH&lt;sub&gt;3&lt;/sub&gt; Readings</th>
<th>NH&lt;sub&gt;3&lt;/sub&gt; Readings &gt; Detection</th>
<th>Total VOC Readings</th>
<th>VOC Readings &gt; Detection</th>
<th>Total Hg Readings</th>
<th>Total Hg Readings &gt; Detection</th>
</tr>
</thead>
<tbody>
<tr>
<td>702 AZ</td>
<td>1088</td>
<td>371</td>
<td>1</td>
<td>370</td>
<td>10</td>
<td>347</td>
<td>223</td>
</tr>
<tr>
<td>AP FARM</td>
<td>276</td>
<td>93</td>
<td>0</td>
<td>93</td>
<td>3</td>
<td>90</td>
<td>39</td>
</tr>
<tr>
<td>AY/AZ/AX FARM</td>
<td>1796</td>
<td>841</td>
<td>6</td>
<td>829</td>
<td>32</td>
<td>126</td>
<td>83</td>
</tr>
<tr>
<td>NON-FARM</td>
<td>2593</td>
<td>886</td>
<td>6</td>
<td>887</td>
<td>53</td>
<td>820</td>
<td>358</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>NH&lt;sub&gt;3&lt;/sub&gt; &gt; AL</th>
<th>Peak NH&lt;sub&gt;3&lt;/sub&gt;</th>
<th>VOC &gt; AL</th>
<th>Peak VOC</th>
<th>Hg &gt; AL</th>
<th>Peak Hg</th>
</tr>
</thead>
<tbody>
<tr>
<td>702 AZ</td>
<td>0</td>
<td>2 ppm</td>
<td>0</td>
<td>0.050 ppm</td>
<td>0</td>
<td>658 ng/m&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>AP FARM</td>
<td>0</td>
<td>0 ppm</td>
<td>0</td>
<td>0.510 ppm</td>
<td>0</td>
<td>74 ng/m&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>AY/AZ/AX FARM</td>
<td>0</td>
<td>4 ppm</td>
<td>0</td>
<td>0.700 ppm</td>
<td>0</td>
<td>1067 ng/m&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>NON-FARM</td>
<td>0</td>
<td>2.1 ppm</td>
<td>2</td>
<td>2.2 ppm</td>
<td>0</td>
<td>50 ng/m&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>Action Limit</td>
<td>12 ppm</td>
<td>2 ppm</td>
<td>2 ppm</td>
<td>12500 ng/m&lt;sup&gt;3&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Direct Reading Instruments measurements:

- > 85% under detection limit
- Two peak readings above the action limit for VOCs were observed near the 702-AZ control room
- Both readings were responded to and sweeps indicated all levels were below the action limit
VCZ (Vapor Control Zone)

- Boundary established during retrieval
- Based on minimum requirement on the Action Level and source configuration (stacks)
- Supplied air **required upon entry**
- Posted with stanchion, chain and signs
- IHT monitoring required upon entry and for down posting (if necessary)

Supplemental Respiratory Protection Zone

- Setup to conservatively provide protection beyond VCZ boundary,
- Based on discussions with HAMTC
- Supplied air **required upon entry**
- Posted with stanchion, chain and signs
- IHT monitoring required for down posting and upon request

Authorized Access Area

- Administrative **Restricted Access** boundary established to notify workers of the potential for increased odors
- Posted with reader boards
- Authorization granted by briefing
- Central Shift Manager access authorization for all non pre-approved personnel
- No PPE required, voluntary upgrade will be supported
- Unless directly involved with work activities, you are not to locate in proximity to the VCZs, Supplemental Zones, and Tank Farm boundaries
AY-102 Retrieval Hazards and Controls

Chemical Vapors: IH Strategy

Hierarchy of Controls

<table>
<thead>
<tr>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Eliminate the Hazard</strong></td>
</tr>
<tr>
<td>Retrieval to be performed on backshifts and weekends only*.</td>
</tr>
<tr>
<td>Access restricted to “Authorized Personnel Only” during retrieval*.</td>
</tr>
<tr>
<td><strong>Engineered Systems</strong></td>
</tr>
<tr>
<td>Retrieval operations only when AY/AZ and AP Farms ventilation operating.</td>
</tr>
<tr>
<td>AY-102 Annulus exhauster off.</td>
</tr>
<tr>
<td>Ventilation cross-tie installed between annulus space and primary tank to provide ventilation path thru primary tank exhauster.</td>
</tr>
<tr>
<td><strong>Administrative Controls</strong></td>
</tr>
<tr>
<td>Establish Vapor Control Zones (VCZ) and Supplemental Protection Zones*</td>
</tr>
<tr>
<td>IH monitoring and sampling.</td>
</tr>
<tr>
<td>AOP-15 response to reported unusual vapor odors/worker vapor exposure symptoms.</td>
</tr>
<tr>
<td><strong>PPE</strong></td>
</tr>
<tr>
<td>Supplied-air respirators required in AY and AP farms, VCZ’s, and supplemental zones*.</td>
</tr>
</tbody>
</table>

Note:
- Controls implemented specifically for the AY-102 Retrieval operations, as a result of discussions with HAMTC, in response to the HAMTC demands communicated in the Letter, D.E. Molina, HAMTC, to M. A. Lindholm, WRPS, and K. Smith, ORP, “Tank Farm Vapors and Worker Safety”, 16024000, dated June 20, 2016.

Revision 0 of December 1, 2016
Aerial view of the AY-102 Retrieval Vapor Control Zones and Supplemental Respiratory Protection Zones
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AY-102 communications during retrieval

- Pre-retrieval briefings with workforce, site contractors, and other stakeholders
- Communications during retrieval:
  - In the field
    - Area postings
    - Reader boards
  - SOEN messages
  - Project status reports
  - WRPS Employee Messages
  - Solutions weekly newsletter
  - Hanfordvapors.com website

http://hanfordvapors.com/
We’re ready to complete the mission!

Thank you for your time and attention!