Liquid Waste
Top Ten Program Risks

Date: August 24, 2010

Presenters:
Pete Hill, Savannah River Remediation
Sonitza Blanco, Department of Energy

Event:
Citizen’s Advisory Board
Waste Management Committee Meeting
Program Risks relate to increase in overall cost or schedule of Liquid Waste Project

Integrated Safety Management System Manages Hazards
Liquid Waste Project
Risk Management Approach

• Consistent with typical Project Management Process

• Covers entire Liquid Waste lifecycle

• Multiple categories: Business, Technical, Programmatic, etc.

• Risks change over life of project

• Real-time evaluation of risks and monthly review

• Annual formal Top-to-Bottom update of risks
  - Revision 5 supports System Plan Revision 15
Current Top Ten

<table>
<thead>
<tr>
<th>Area of Concern</th>
<th>Strategy to Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Equipment Reliability</td>
<td>System Health Monitoring, Maintenance Program and Spare Parts</td>
</tr>
<tr>
<td>2. Major System Failure (for example, Melter or Evaporator)</td>
<td>System Health Monitoring, Spares, Development of Repair Techniques</td>
</tr>
<tr>
<td>3. Tank Space Availability when Needed</td>
<td>Integrated System Planning</td>
</tr>
<tr>
<td>4. Tank Leak Sites Reduce Useable Space</td>
<td>Structural Integrity Program</td>
</tr>
<tr>
<td>5. Characterization of Waste</td>
<td>Early sampling and analysis, Development of robust processes to accommodate varying composition</td>
</tr>
<tr>
<td>6. Technology Readiness</td>
<td>Testing, mock-up, lessons learned from DOE complex</td>
</tr>
<tr>
<td>7. Salt Waste Processing Facility Start-Up Delayed or Processing Rate Limited</td>
<td>Interim Salt Disposition Project, Supplemental Salt Treatment Processes</td>
</tr>
<tr>
<td>8. Meeting Tank Cleanliness Requirements for Closure</td>
<td>Use of new technologies included Enhanced Chemical Cleaning</td>
</tr>
<tr>
<td>9. Availability of Closure Documentation</td>
<td>Integrated Planning and Development with Stakeholders</td>
</tr>
<tr>
<td>10. Integration/Coupling of Execution Activities</td>
<td>Integrated System Planning, Integrated Operations and Projects Planning and Scheduling</td>
</tr>
</tbody>
</table>
Formal reporting via two formats
- Performance Monitoring Report (short form-monthly/quarterly frequency)
- System Health Report (Formal Report-annual or biannual)

Performance Monitoring Report Topics:
- Overall summary including System Status Grading
  - Green-Available with no degradation, minor corrective issues, no adverse trends
  - Yellow-Available, but in a degraded condition requiring compensatory actions. Has persistent issues requiring maintenance. Degradation trend noted, but no an immediate issue.
  - Red-System is unavailable. System has high equipment vulnerability such as end of life with no spares, near term failure likely
- Trend analysis-summary of key performance trends
- Maintenance Impacts-notification of significant material condition or performance issues and maintenance history
- System Walkdown Observations
- Actions-identify new actions based on current review

Purpose is to ensure systems are performing as required and define actions to keep it that way for the mission life (viability)
Considerations for System Health Reports

System Health Report Elements

General Information
- System Viability
- Basic System Description
- TSR/SAR/DSA/DA/DAJC
- Change Potential
- Material Cond. Assessment
- DNFSB VSS
- Performance Goals/Actuals (PM, CM, Total Maintenance, etc.)

1.0 Maintainability
- ORPS/SIRIM Occurrences
- Non-ORPS/SIRIM
- Equipment Degradation
- Maintenance Problems
- Recent Maintenance
  - PM of IP
  - Maintenance Delayed
  - Maintenance Deferred
- Observations
- Temporary Mods
- Spare Parts
- Maintenance Support
  - To Improve Maintainability

2.0 Reliability
- Tests & Inspections
- System Failures
- Component Failures
- Operator Rounds
- Operator Work Arounds
- Trending
- Predictive Maintenance Status
- Adverse Conditions
- Maintenance Support
  - To Improve Reliability

3.0 Availability
- Open Items Status
- Safety Basis Impact
- Procedure Review
- NCR's
- STAR Issues
- Code/Std Compliance Changes
- Outage Concerns
- Past Outage Experience
- Maintenance Outages
- Forced Outage
- Modification Outage
- Sys Improvement/Planned Mods
- Maintenance Support
  - To Improve Availability
- Eng. Path(s) Forward Status
- Lay-up Plan Status
- Management Support
  - To Improve Availability
- Management Commitments
- Engineering Operations Maintenance
SRR System Health Performance

System Health Performance

SRR System Health

Percent of System Trends

1Q09 (Systems Tended: 97) 2Q09 (Systems Tended: 122) 3Q09 (Systems Tended: 88) 4Q09 (Systems Tended: 142) 1Q10 (Systems Tended: 102) 2Q10 (Systems Tended: 25) 3Q10 (Systems Tended: 0) 4Q10 (Systems Tended: 0)
Hiring additional maintenance mechanics to address growth in Corrective Maintenance backlog
Liquid Feed Variance

Dry Feed Variance

Mixer Packing

Foreign Material

Instrumentation Error

Unplanned Process Shutdowns

December 2009 through July 2010

Actions:
- Replaced Salt Feed Tank Pump
- Modified Pump Downcomer
- Modified Control Valve Operation Strategy

Actions:
- Dry Feed System Upgrade and Component Replacements

Actions:
- Dry Feed Screen Temporary Modification
Equipment Reliability Risk Examples
Risk #12

DWPF Equipment Failure (Excluding Melter)

Risk
- Equipment failure and lack of adequate equipment spares results in degraded facility performance and decreased canister production rates.

Handling
- Replenish assembled unit spares - In Progress
- Revalidate spare equipment list - Complete
- Verify spares are maintained on hand - In Progress
- Procure additional spares as needed - In Progress
- Projectize procurement of spares - In Progress
- Investigate system life extension - Complete

<table>
<thead>
<tr>
<th>Unmitigated Lifecycle Risk</th>
<th>Most Likely Residual Lifecycle Impact</th>
</tr>
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<tr>
<td>Very Likely - 1 Year</td>
<td>Likely - 6 Months</td>
</tr>
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</table>
Risk #11

Tank Farm Equipment Failure (Excluding Transfer Lines or 3H Evaporator Pot)

Risk
• Equipment failure and lack of adequate equipment spares or unavailability of utilities results in unplanned facility outages.

Handling
• Initiate HTF Utility Services Upgrade project - In Progress
• Revalidate spare equipment list - Complete
• Projectize procurement of spares - In Progress
• Investigate system life extension - Complete

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<tr>
<td>Very Likely - 3 Months</td>
<td>Likely - 2 Months</td>
</tr>
</tbody>
</table>
Tank Farm Transfer Line Failure

Risk
- Tank Farm transfer line outer jacket degrades and as a result the transfer line cannot be used as required.

Handling
- Develop and deploy transfer line repair technologies - In Progress
- Perform modifications to install additional protection - In Progress
- Identify an alternate 2H evaporator concentrate receipt tank and be staged to perform conversion in the event of a Tank 38 Gravity Drain Line outer jacket failure - In Progress

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<tr>
<td>Likely - 1 Year</td>
<td>Unlikely - 4 Months</td>
</tr>
</tbody>
</table>
Risk #289

DWPF Infrastructure Failure Forces DWPF Outage

Risk

- DWPF infrastructure (steam, HVAC, rail, power, etc.) degrades significantly and fails resulting in a DWPF production outage.

Handling

- Implement recommendations of system health evaluations - In Progress
- Perform life extension study on DWPF ventilation systems and implement identified upgrades - In Progress

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<td>Very Likely - 6 Months</td>
<td>Avoided</td>
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Major System/Component Failure Risk Examples
Tank 49 Feed Pump Failure

Risk
• Transfers from Tank 49 to SWPF will be required every 21 hours. Failure of the Tank 49 to SWPF transfer/feed pump will result in a reduction in the SWPF throughput.

Handling
• Procure and install a redundant transfer/feed pump in Tank 49 - In Progress

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<tr>
<td>Very Likely - 1 Year</td>
<td>Avoided</td>
</tr>
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3H Evaporator Pot Failure

Risk

- Failure of the 3H Evaporator pot impacts DWPF sludge batch preparation

Handling

- Prepare procurement specification for spare 3H evaporator pot - In Progress
- Procure a spare 3H Evaporator pot - After RHS above

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<th>Unmitigated Lifecycle Risk</th>
<th>Most Likely Residual Lifecycle Impact</th>
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<tr>
<td>Very Unlikely - 18 Months</td>
<td>Very Unlikely - 3 Months</td>
</tr>
</tbody>
</table>
Risk #18

Saltstone Processing Facility major equipment failure

Risk
• Failure of an essential component impacts processing at Saltstone

Handling
• Identify and implement actions to optimize throughput to support ARP/MCU operations - Complete
• Identify and implement actions to optimize throughput to support SWPF operations - In Progress
• Evaluate alternatives to SPF to enhance capacity and reliability - In Progress
• Projectize procurement of spares - In Progress
• Investigate system life extension - Complete

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<th>Most Likely Residual Lifecycle Impact</th>
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<tbody>
<tr>
<td>Very Likely - 6 Months</td>
<td>Likely - 6 Months</td>
</tr>
</tbody>
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Replacement Melter Failure

Risk

• Following a melter replacement, the replacement melter prematurely fails (less than 6 years of operation).

Handling

• Utilize system health data to identify improvements for future melters - In Progress

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<th>Most Likely Residual Lifecycle Impact</th>
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<tr>
<td>Likely - 2 Years</td>
<td>Likely - 3 Months</td>
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</table>
Summary

• Risk changes over life of program
  - Real-time evaluation of risks and monthly review
  - Annual formal Top-to-Bottom update of risks
  - Risk profile is improving

• Equipment Reliability and Major Equipment failures are top areas of concern

• Specific risks are analyzed by subject matter experts who identify executable Risk Handling Strategies

• Risk Handling Strategies are included on an Integrated Priority List

• No risks prevent program completion
Questions?
Example Likelihood Criteria

Very Likely ≤ 10 years
Likely 10-25 years
Unlikely 25-50 years
Very Unlikely > 50 years

Example Consequence Criteria

Negligible < 3 month delay
Marginal 3-12 months delay
Significant 1-2 years delay
Severe >2 years delay

Figure 3 – Risk Level Matrix

* Normally limited to assessing residual risks with Very Severe (Crisis) consequences
<table>
<thead>
<tr>
<th>ID</th>
<th>Title</th>
<th>Risk Level</th>
<th>Review Date</th>
<th>Status</th>
<th>Minor Concern</th>
<th>Major Concern</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>034</td>
<td>DWFTE impacted by Chemistry/ECology of Sludge Waste Feed</td>
<td>Low</td>
<td>4/21/2010</td>
<td>Closed</td>
<td></td>
<td></td>
<td>Major performance improvements being investigated. Research has been performed and implementation of major Butler mixing is underway to be installed by September 2010.</td>
</tr>
<tr>
<td>030</td>
<td>Sampling and Analysis of Salt Feed to DWFTE Shows Low MAC Cannot be Met After Processing</td>
<td>Low</td>
<td>5/5/2010</td>
<td></td>
<td></td>
<td></td>
<td>Batches are being sampled and to date have met the WAC.</td>
</tr>
<tr>
<td>037</td>
<td>DWFTE impacted by Chemistry of Salt Waste Feed</td>
<td>High</td>
<td>4/21/2010</td>
<td></td>
<td></td>
<td></td>
<td>The need for additional characterization is being evaluated. Characterization data and operating lessons learned during AR1/AR2 operations will be used in optimizing sludge batch compatibility with the SWPF waste stream for processing at DWFTE.</td>
</tr>
<tr>
<td>040</td>
<td>Salt Dissolution Results in the Precipitation of Goblette</td>
<td>Moderate</td>
<td>5/5/2010</td>
<td></td>
<td></td>
<td></td>
<td>Investigating methods to avoid gobbled formation.</td>
</tr>
<tr>
<td>041</td>
<td>Formation of Sodium Aluminate in a Salt Tank</td>
<td>Moderate</td>
<td>5/5/2010</td>
<td></td>
<td></td>
<td></td>
<td>Developing flow sheets and mathematical models for salt removal that avoid instability.</td>
</tr>
<tr>
<td>042</td>
<td>Salt Waste Host or Tank Annual Waste Cannot be Processed</td>
<td>High</td>
<td>5/5/2010</td>
<td></td>
<td></td>
<td></td>
<td>Developing a new sheet with additional feed treatment or processing modifications.</td>
</tr>
<tr>
<td>045</td>
<td>Higher Clue Sludge Impacts DWFTE Conant Production</td>
<td>Low</td>
<td>5/5/2010</td>
<td></td>
<td></td>
<td></td>
<td>Sludge batch sampling, blending strategy development and qualification are being performed.</td>
</tr>
<tr>
<td>048</td>
<td>Sludge Physical Properties Cause Delays in Meeting Sludge Feed Objectives</td>
<td>Low</td>
<td>4/19/2010</td>
<td></td>
<td></td>
<td></td>
<td>Physical characteristics of waste are being determined and used in development of removal technologies that can tolerate variability in waste characteristics.</td>
</tr>
<tr>
<td>050</td>
<td>Higher Than Expected Ca Levels in Salt Solution Impact Processing</td>
<td>Low</td>
<td>5/5/2010</td>
<td></td>
<td></td>
<td></td>
<td>Batches are being sampled and no concerns have been identified to date.</td>
</tr>
<tr>
<td>070</td>
<td>Regulatory Constituents in SWPF Feed</td>
<td>Moderate</td>
<td>5/5/2010</td>
<td></td>
<td></td>
<td></td>
<td>Evaluating the need for additional sampling and testing and developing tank sequencing/blanking strategies.</td>
</tr>
<tr>
<td>071</td>
<td>Unknown Physical Properties in Heel Material during Mechanical Heel Removal</td>
<td>Low</td>
<td>4/20/2010</td>
<td></td>
<td></td>
<td></td>
<td>FCC is being deployed to handle this risk.</td>
</tr>
<tr>
<td>074</td>
<td>MCU Feed Requirements not met by ARP Processing Strategy (Filter Breakthrough)</td>
<td>Low</td>
<td>5/5/2010</td>
<td></td>
<td></td>
<td></td>
<td>Robust filter design provides protection and a basis to accept the risk.</td>
</tr>
</tbody>
</table>
## Example Risk Assessment Form

**PBS SR-0014 Risk Assessment Form**

<table>
<thead>
<tr>
<th>ID Number: 012</th>
<th>Revision: 03</th>
<th>Last Date Evaluated: 8/12/2009</th>
<th>Status: Active</th>
</tr>
</thead>
</table>

**Statement of Residual Risk:** Premature failure of installed spare equipment leads to canister production downtime while a new replacement is procured.

- **Residual Likelihood:** Likely  
  **Basis:** Based upon the 20+ years of remaining operation of the DWPF, the potential for a premature failure of an installed spare is likely.

- **Residual Consequence:** Significant  
  **Basis:** Premature failure of an installed spare is estimated to cause a canister production outage period judged to be up to 1 year in duration. Out-year residual impact of 1 year schedule delay, near-term residual impact of $10M to procure a new major equipment spare.

- **Residual Risk Level:** Moderate

### NEAR TERM Residual Impact

<table>
<thead>
<tr>
<th>Residual Cost Impact ($K):</th>
<th>Best Case</th>
<th>Most Likely</th>
<th>Worst Case</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10,000</td>
<td>10,000</td>
<td>10,000</td>
</tr>
</tbody>
</table>

| Residual Schedule Impact : | 0 | 0 | 0 |

### OUT YEAR Residual Impact

<table>
<thead>
<tr>
<th>Residual Cost Impact :</th>
<th>Best Case</th>
<th>Most Likely</th>
<th>Worst Case</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>225,000</td>
<td>450,000</td>
</tr>
</tbody>
</table>

| Residual Schedule Impact (Mos): | 0 | 6 Mths | 12 Mths |

### LIFE CYCLE Residual Impacts (total of Near Term and Out Year)

<table>
<thead>
<tr>
<th>Residual Cost Impact :</th>
<th>Best Case</th>
<th>Most Likely</th>
<th>Worst Case</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10,000</td>
<td>235,000</td>
<td>460,000</td>
</tr>
</tbody>
</table>

| Residual Schedule Impact (Mos): | 0 | 6 Mths | 12 Mths |

**Risk Assumptions:** DWPF will produce canisters at maximum throughput for the duration of the program (based on achievable melt rate, planned outages, and waste loading for sludge being processed). DWPF near-term canister production is based on revised sludge mass values. Production of salt-only cans is acceptable to DOE.

**Event Comments:** The risk of a premature DWPF melter failure is addressed under Risk 021. The failure to provide a spare DWPF melter is addressed under Risk 022.