Preparing a Unique Facility for Demolition: Hanford's 100N Reactor Fission Product Trap

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Kyle Maloy Biography

• Graduate Research Assistant at Oregon State University from 2004 to 2006 and earned a Master’s degree in Health Physics from Oregon State University in 2006.

• Immediately following graduation, spent 6 months in Health Physics Engineering at San Onofre Nuclear Generating Station in San Clemente, CA.

• January ’07 to August ’09: Hired as a Radiological Engineer and promoted to Radiation Protection Manager for General Electric’s Fuel Manufacturing Operation in Wilmington, NC.

• Joined Washington Closure Hanford in August ’09 as a Radiological Engineer to support demolition and remediation of Hanford’s N-reactor and associated areas.
Outline

• 100-N Reactor Facility History/Overview
• Pre ISM entries and problems encountered
• DOE ISM Principles Utilized in 2009-10 entries
  – Safety Component of Design
  – Employee Engagement
• Safety Component of Design Effectiveness
• Employee Engagement Effectiveness
• Comments / Questions
N-Reactors History

- Operated from 1964 to 1986
- The only dual purpose reactor
  - Produce Plutonium
  - Generate electricity
- D4 (decommissioning, deactivation, decontamination, and demolition) began in 1994
- One of a kind design brings unique decommissioning strategies/concerns (including the Fission Product Trap)
Aerial View of 100N Reactor

May 2010
100-N Fission Product Trap (FPT)

- Comprised of Set of risers for elevating drainage and settling material from:
  - 24” low pressure flush line
  - 12” low pressure diversion effluent line
- Designed to remove large particulate from reactor coolant prior to discharging to liquid waste stream
- Facilities were provided at the trap for clean-out and removal of sludge and fission product material from the risers
- Cubicle Dimensions: 17’ x 19’ x 24’ deep
- Sump Dimensions: 11’ diameter, 8’ deep
- Cyclone Separator: Suspended ‘Vacuum’ canister 5’ high x 1.5’ diameter
- Radiological Postings: High Contamination Area, High Radiation Area, Airborne Radioactivity Area
100N FPT -21’ Access Tunnel

- Mobilization/Characterization
- Fixative Application
- Hazmat Removal
- Pipe Tapping and Draining
100-N Fission Product Trap (FPT)

- 5’ x 5’ Access Opening
- Cyclone Separator
- Fall Hazard
- > 1 R/hr HRA
100-N Fission Product Trap (FPT)

- 12" riser visible
- Cyclone Separator
- Sump
FPT Entries in 2006

• Multiple entries were made as part of pre-demolition scoping and characterization

• The access tunnel and FPT itself were not designed for routine access and the facility was poorly understood

• Airborne radioactivity and contamination were detected outside the posted ARA/CA on multiple entry occasions
  – Relied on ‘passive ventilation’
  – Moved ARA boundary postings in response to loss of control

• Electronic dosimeter (ED) alarm set point of 300 mR/hr were exceeded on the last entry in 2006
FPT Entries in 2006

• Due to the poorly understood nature of, and familiarity with the facility the cause of airborne radioactivity and the precise source of radiation causing ED alarms was not thoroughly determined during 2006 fact findings.

• After experiencing the apparent loss of control during the 2006 entries the FPT was abandoned and re-entry was postponed indefinitely.
FPT 2009 - WCH & Safety Component of Design

• Three years later, in 2009, Washington Closure Hanford (WCH) utilized ISMS Safety Component of Design to define and analyze the FPT work area, job scope, and potential hazards.

• WCH employed engineered containments and 4,000 cfm ventilation capacity to maintain the ARA boundary and avoid repeating the airborne radioactivity excursions encountered in 2006.

• This ventilation capacity provides 5 air changes per hour in the work area.

• Airborne radioactivity potential was further reduced by application of fixative to the FPT and -21' access tunnel.
FPT 2009 - WCH & Safety Component of Design

• On the initial entry into the FPT the primary focus was for the Radiological Control Technicians (RCTs) to characterize the radiological conditions inside the FPT.

• Three ‘hotspots’* were identified in the FPT access tunnel that were previously undocumented.

• Additional dose rate and contamination data were also collected.

• This allowed WCH to understand and further mitigate hazards in the work zone, and maintain Airborne radioactivity and personnel exposure ALARA.

* > 100 mrem/hr on contact and 5 times the general area dose rate
FPT Containment Structure (Oct 09)

— Provided means for accessing FPT
— Access point for ventilation
— Fixative Application
— Hoisting and removal of Cyclone Separator
FPT Containment

- Removal of cyclone separator (Feb 2010)
Grouting 105NE FPT (Feb 10)
FPT 2009 - WCH & Employee Engagement

- Employees selected long handled tools
- Telemetric Dosimetry
- Use of Mockups
- Extra set of outers for contamination control
- Use hairspray on PAPR hoods prior to doffing
- Remove outer set PCs prior to doffing respiratory protection
### FPT 2009 - WCH & Employee Engagement

<table>
<thead>
<tr>
<th>Planned Tasks</th>
<th>Estimated Dose (person-mrem)</th>
<th>Actual Dose (person-mrem)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobilize, Fixative, Air Barrier</td>
<td>1100</td>
<td>850</td>
</tr>
<tr>
<td>Tap &amp; Drain, Piping Fixative Application</td>
<td>840</td>
<td>690</td>
</tr>
<tr>
<td>Remove CS</td>
<td>500</td>
<td>160</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2440</strong></td>
<td><strong>1700</strong></td>
</tr>
</tbody>
</table>

- No PCEs
- No loss of airborne boundary
- No contamination spread
- Significant dose savings
Successes

• Once the engineered controls were implemented, WCH sought employee engagement for the performance of work tasks.

• The use of mockups and employee engagement was instrumental to the safe and successful completion of work in the FPT.

• It also presented opportunities to develop, practice, and improve on work performance outside the hazardous environment of the FPT.

• Utilized Lessons Learned and Employee engagement initiatives during Demolition Preps of Fuel Storage Basin Lift Station.
Conclusion

• The Safety Component of Design benefited the Fission Product Trap Demo-preparations by minimizing hazards encountered in the work area.

• Employee Engagement was instrumental to safe successful completion of FPT Demo-preparations by inviting and incorporating workers’ preferred methods and ultimately giving those performing the work the ownership and confidence in work practices to maintain the safest work environment possible.
Thank you, are there any questions?

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100-N Fission Product Trap (FPT)

- 12” riser visible
- Cyclone Separator
- Sump