A Multi-Pronged Approach for Multiple Contaminated Media

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Standard Chlorine of Delaware Superfund Site Background

- Over 65 acre site including chemical plant built in 1965
- Producer of chlorobenzene compounds and nitrobenzene
- Multiple releases
  - 1976 – Wastewater catch basin found to be leaking
  - 1981 – 5,000 gallons of chlorobenzene spilled during tank car loading accident
  - 1986 – 569,000 gallons of chlorobenzenes released in tank collapse
- Site abandoned in 2002
- Four Operable Units (OUs) with two RODs in place
Media/Portions of Site Affected by Contamination

- Groundwater underlying entire site
- Surface and subsurface soil in Former Manufacturing Area
- Soil gas in area south of Sedimentation Basin
- Sediments in Sedimentation Basin
- Sediments and slurry wall spoils in Temporary Soil Storage Area (TSSA)
- Wetlands sediments
Interim Groundwater Remedy (OU-1)

- ROD specified containment to prevent spread of site contaminants to Red Lion Creek

- Remedy constructed in 2006/7
  - Mile long, 65 ft deep slurry wall
  - Could not capture entire plume because of constructability issues
  - GETS to lower hydraulic head and cause inward and upward gradient
Former Manufacturing Facility (OU-3)

- Risk from surface and subsurface soil contamination (VOCs, SVOCs, dioxins, and metals)
- Soil gas risk from VOCs including benzene, chlorobenzene, and dichlorobenzenes
- OU-3 ROD specified construction of cap covering ~23 acres with gas collection
OU-1 Remedy Problems to Deal With

- 70M Gallons extracted but no head decrease
- Uneven water levels observed within containment area
Pumping Test to Confirm Barrier Leak

- Conducted pumping test concentrating on areas with evidence of leakage
  - Step test
  - 48 hr pumping test
  - 36 hr recovery test
- Identified three areas with exterior response to interior pumping
Impacts of Not Repairing the Identified Leaks

- Uncontaminated water entering containment area although no evidence of contaminants exiting
- Higher GETS O&M costs
- OU-3 Design calls for cap to tie in to slurry wall
- $600k Repair would have been much more expensive (and impractical) if not completed before the $16M OU-3 Cap construction
Slurry Wall Repair Preparation

- Determine length of repair and depth to key-in layer
- Identify utility and property conflicts/constraints
- Develop plans and specifications
- Develop Erosion and Sediment Control Plan
- Procure subcontractor(s)
  - Site prep and restoration could be done with local companies
  - Trenching requires specialty firm
- Test proposed backfill mix permeability/compatibility
- Construct work platform
Trenching to Minimize Site Impact

- One-Pass trenching eliminated need for separate slurry pond and ex situ mixing area
- Minimizing project footprint:
  - Simplified E&S requirements
  - Reduced repair preparation schedule/costs
  - Reduced impacts on subsequent construction
Pumping Test Signs of Success

- Pumping tests no longer show drawdown response outside the Containment Area
Remedy Integration Approach

- Tie OU-3 cap in to OU-1 slurry wall to reduce potential for gas migration
- Modify GETS components
- Incorporate sediments from initial wetland cleanup response and spoils from slurry wall construction
- Ensure OU-3 Cap slope suitable for possible placement of solar panels to power GETS.
- Allow access for future work on other OUs.
Remedy Integration Progress

- Tie OU-3 cap in to OU-1 slurry wall – Subbase built within limits of repaired wall
- GETS Modifications – Extraction wells extended; piping, electrical wiring, and utilities rerouted
- Incorporate sediments and spoils from slurry wall – ROD amended and TSSA material incorporated into subbase
- Ensure cap suitable for solar panels – Slope limited to 4%
- Allow access for future work – New access road installed to east of OU-3 Cap
<table>
<thead>
<tr>
<th>Action</th>
<th>Result</th>
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<tbody>
<tr>
<td>Reduced amount of piping required for gas collection system</td>
<td>Cost savings of over $230K</td>
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<tr>
<td>Replaced 2 ft clay layer of cap with GCL</td>
<td>Cost savings of over $2M and reduced construction schedule</td>
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<tr>
<td>Redesigned gas collection valves</td>
<td>Allows easier maintenance access/less likely to leak</td>
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<tr>
<td>Modified stormwater pond emergency spillway</td>
<td>Improves vehicle access for GETS maintenance and other activities</td>
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Lessons Learned

- Timing of work can influence decision whether to perform it
  - $600k repair before cap construction cheaper than tearing up new cap to complete the repair later

- Splitting site prep and restoration work from specialized subcontracting can allow use of local companies

- Don’t be afraid to take another look at a “finished” design
  - Over $2.2M in capital savings from construction reviews
  - Lower anticipated O&M costs
  - Elimination of possible confined space maintenance
Still to Come

- **OU-1 Interim Groundwater Remedy – Fold into OU-4**
- **OU-2 Wetlands Sediment and Off-facility Soil**
  - ROD specified approaches include LTTD, in situ bioremediation
  - Initial design phases including treatability studies
- **OU-3 Former Facility Area**
  - Completion of cap
  - Operation of gas collection and treatment system
- **OU-4 Final Groundwater Remedy**
  - Currently in FS phase
  - Multiple approaches likely to be combined
Questions?

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