Application of Multiple Remedial Techniques and Approaches at a Former Pharmaceutical Manufacturing Facility

David J. Russell P.E., BCEE, LSRP

March 29, 31 and April 1, 2021
Cause, Discovery, Progression of Action

Sixty-Acre Pharmaceutical R&D and Pilot Plant Facility
(25 Buildings, 1 Million SF)

Extensive Environmental Investigations for 30 Years,
Active Remediation for 27 Years

1938
Initially 30 Acres Developed, Railroad Spur Constructed

1940s
Four Wastewater Surface Impoundments Constructed

1950s – 1980s
Additional Buildings Constructed, USTs Closed/Removed

1961
Additional 30 Acres Purchased to Southeast

1984
Environmental Investigations Initiated

1985
Initial ACO with NJDEP

1990s
WWTP Constructed, more USTs Closed/Removed

1991
NJPDES – DGW Permit Issued

1994
Groundwater Extraction System (GWES) Installed/Operational and Second ACO with NJDEP

1994
Discontinued use of last USTs. All other USTs removed prior to 1988

1997
Reduction in Site Production Well Pumping Regime

1998
USEPA Issues Draft HSWA Permit for Site

March 29, 31 and April 1, 2021
## Project Timeline

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 2000</td>
<td>Submitted Comprehensive Site Conditions Report (CSCR) to NJDEP/EPA Region II</td>
</tr>
<tr>
<td>May 2001</td>
<td>Commenced “Residual Contamination Areas” (RCAs) Remediation Pilot Testing</td>
</tr>
<tr>
<td>July 2001</td>
<td>Meeting with NJDEP and EPA – Bedrock Contamination Issues Raised by Agencies</td>
</tr>
<tr>
<td>October 2001</td>
<td>NJDEP Conditional Acceptance of CSCR</td>
</tr>
<tr>
<td>March 2003</td>
<td>Extended RCA Pilot Testing</td>
</tr>
<tr>
<td>November 2004</td>
<td>Full-Scale RCA Remediation Program Initiated</td>
</tr>
<tr>
<td>November 2007 and July 2008</td>
<td>Vapor Intrusion Assessments Conducted</td>
</tr>
<tr>
<td>October 2008</td>
<td>VP-51 Investigation Conducted</td>
</tr>
<tr>
<td>June 2009</td>
<td>VP-51 Area added to RCA Remediation Program</td>
</tr>
<tr>
<td>June 2010</td>
<td>NJDEP Approval of Vapor Intrusion Assessment</td>
</tr>
<tr>
<td>July 2010</td>
<td>Plant Closure</td>
</tr>
<tr>
<td>Ongoing</td>
<td>Continued GWES GW Monitoring Program, RCA Remediation Program &amp; RI Activities</td>
</tr>
</tbody>
</table>
SWMUs and Groundwater Extraction System (GWES)
Project Closure Strategy

• CSCR - Comprehensive Site Conditions Report
• Develop Cost Effective Site-Wide Remedial Strategy to Bring Site to Closure
• Obtain NJDEP/USEPA Acceptance of Proposed Strategy
• Implement Site-Wide Remedial Strategy
• Monitor Effectiveness and Update Strategy As Needed
ACO Compliance Strategy

• Maintain and Monitor Hydraulic Control with Groundwater Extraction System (GWES)

• Address Confirmed Site-Related Constituents that Contribute to GW Contamination:
  • Benzene
  • Toluene
  • Carbon Tetrachloride
  • 1,4-Dioxane
  • Chloroform
  • Methanol
  • Methylene Chloride
  • Chlorobenzene

• Remedial Objectives and Technologies Developed for Residual Contamination Areas (RCAs) to Reduce Concentrations to Allow Natural Attenuation of GW and Eventual Shut Down of GWES
Residual Contamination Areas (RCAs)
Cost-Benefit Analysis Conclusion

- Cost Savings realized if GWES operating period is reduced at least 15 years to a 25-year operational period
- Pilot Testing conducted to confirm feasibility and cost savings of more aggressive RCA remedial strategy
- Impact of GWES upgrades/replacement could easily accelerate cost of “status quo” and RCA Return on Investment
RCA Pilot Study

Conducted Pilot-Testing of Four Remedial Technologies to Remediate RCAs:
- Soil-Vapor Extraction
- Dual-Phase Extraction
- Air Sparging
- Enhanced Bioremediation (Biosparging)
RCA Remediation Implementation

- High Vacuum DPE at RCAs with High Toluene and Benzene to Address Mass Removal
- Enhanced Biosparging at RCAs with Toluene, Methanol, MTBE and 1,4-Dioxane (Cometabolic Biodegradation)
- Enhanced Biosparging Following DPE to Address Reduced Levels of Benzene and Toluene
RCA Remedial Systems
RCA Remedial Systems
High Vacuum Dual-Phase Extraction Well Couplet Design
Site-Wide Remedial Strategy

• Maintain Existing GWES to provide Hydraulic Control in Compliance with ACO
• Implement RCA Remediation to Address RCAs Contribution to Groundwater
• Remediate RCAs to Remedial Objectives that Comply with Natural Attenuation Remedy
• Shutdown GWES and Implement Monitored Natural Attenuation of Groundwater with a Classification Exception Area (CEA)
Cessation of Operations

NJDEP Site Remediation Reform Act
• Combined New ISRA Case with existing ACO
• RCRA 2020 GPRA Site with LSRP, NJDEP and USEPA Oversight
• Due Diligence Assessment
• Closure of Two RCRA Hazardous Waste Storage Facilities
• Closure of Nine Spill USTs, Deed Notice/Engineering Control and Remedial Action Permits (RAPs)
• Continued Implementation of Remedial Actions
Property Sale

Brownfield Developers/University/Train Station

• Liability Transfer
• Developer Assumes Remedial Strategy
• Proposed Mixed-Use Development
  • Issues
    • Multiple Stakeholders RP/USEPA/NJDEP/Developer/College
    • Demolition
    • Financial Assurance – NJDEP/USEPA
    • Vapor Intrusion
Proposed Redevelopment
Ongoing Redevelopment
Ongoing Redevelopment
Summary and Lessons Learned

• Site-Wide Strategy Development
  • Comprehensive Site Conditions Report
  • RCA Remediation in Concert with Groundwater Extraction and Treatment System
  • Mobile Remediation Trailers Addressed Multiple RCAs Cost Effectively

• Look Beyond Status Quo to Meet Remedial Action Objectives
• Effective Implementation Resulted in Sale and Redevelopment of the Brownfields Property