Insights on Risk-Reduction Mechanisms from 12 Years of Operation of a Pump-and-Treat System at the Botany Chlorinated Hydrocarbon "Mega-Site"

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Background

• Botany Industrial Park (BIP)
  • 20 shallow/deep bores on 2\textsuperscript{nd} Street
  • 40 shallow/intermediate/deep bores on 1\textsuperscript{st} Street

• Primary Containment Area (PCA)
  • 12 deep bores
  • Originally included 2 bores in C1 plume core to accelerate mass removal

• Secondary Containment Area (SCA)
  • 27 Shallow bores
  • 14 Deep bores
Hydraulic Containment Performance

• Low Rate Extraction (up to 1 ML/day) Commenced in 2004.
• System fully operational (approximately 6 ML/day) in 2007.
• Operation of extraction system is reviewed regularly:
  • Fortnightly review of individual pump operation
  • Quarterly/Biannual/Annual review of aquifer water levels
• Detailed review of hydraulic containment undertaken in accordance with “A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems” (USEPA 2008) in 2012 and 2017
Hydraulic Containment Performance

• Six Step Process:
• Step 1: Review site data, site conceptual model, remedy objectives
• Step 2: Define “Target Capture Zones”
• Step 3: Water Level Maps
• Step 4: Simple Horizontal Capture Zone Analysis
• Step 5: Particle Tracking and Concentration Trends
• Step 6: Interpret Actual Capture and Compare to Target Capture Zone
Wellfield Operational Issues

- Well fouling/rehabilitation
- Well Failure
- Corrosion
- Salinity
- Accessibility (SCA)
- Pump/pipe fouling
Risk Reduction Mechanisms

• Regulatory/administrative controls
• Decreased vapour risk due to improved shallow groundwater quality
• Decreased risks associated with significantly improved surface water quality in Springvale Drain
• Direct groundwater discharge - past or current?
Plume Distribution

- Plume maps show maximum concentration at any depth
- Significant changes over ten years
- Concentrations in the upper 4 m of the aquifer largely non-detect
Vertical Gradients

Commencement of pumping at southlands
Springvale Drain Water Quality Improvement

• Springvale Drain is a man made drainage channel
• Constructed to drain swampland (i.e. intercept groundwater)
• Significant decreases in contaminant concentrations have occurred since the commencement of GTP operation.
Springvale Drain Flows Early 2006

- Flows measured prior to full extraction
- V-notch weir
- Significant baseflow
- Implies mass flux of >3 tonnes per year of EDC
Springvale Drain Flows 2007

- Flows reassessed following commencement of full extraction
This side is a mess
Springvale Drain
Springvale Drain Ambient Air Quality

- Ambient air monitoring program
- Improvement in air quality directly related to water quality
- Risks to human health from volatilization of contaminants in surface water now negligible
Summary

• The hydraulic containment system has satisfied the requirements of the regulatory notice

• The comprehensive monitoring program has identified reductions in risks to ecological and human receptors

• Key reductions are the result of improved shallow groundwater quality and improved water quality in Springvale Drain

• These reductions have occurred more rapidly than expected or were not predicted/considered by the regulatory notice or design of the wellfields/GTP