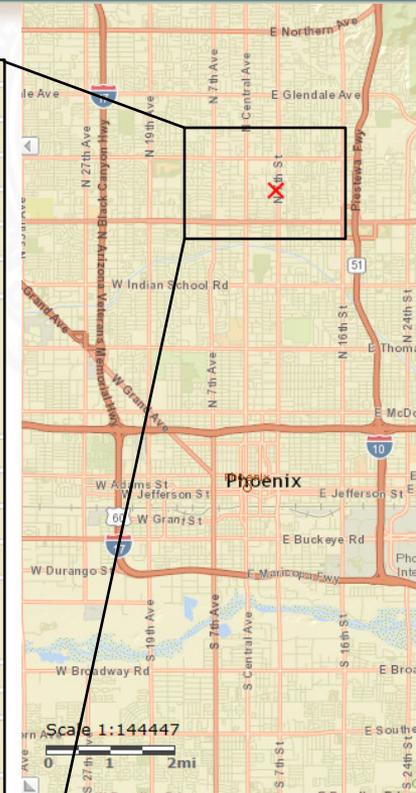
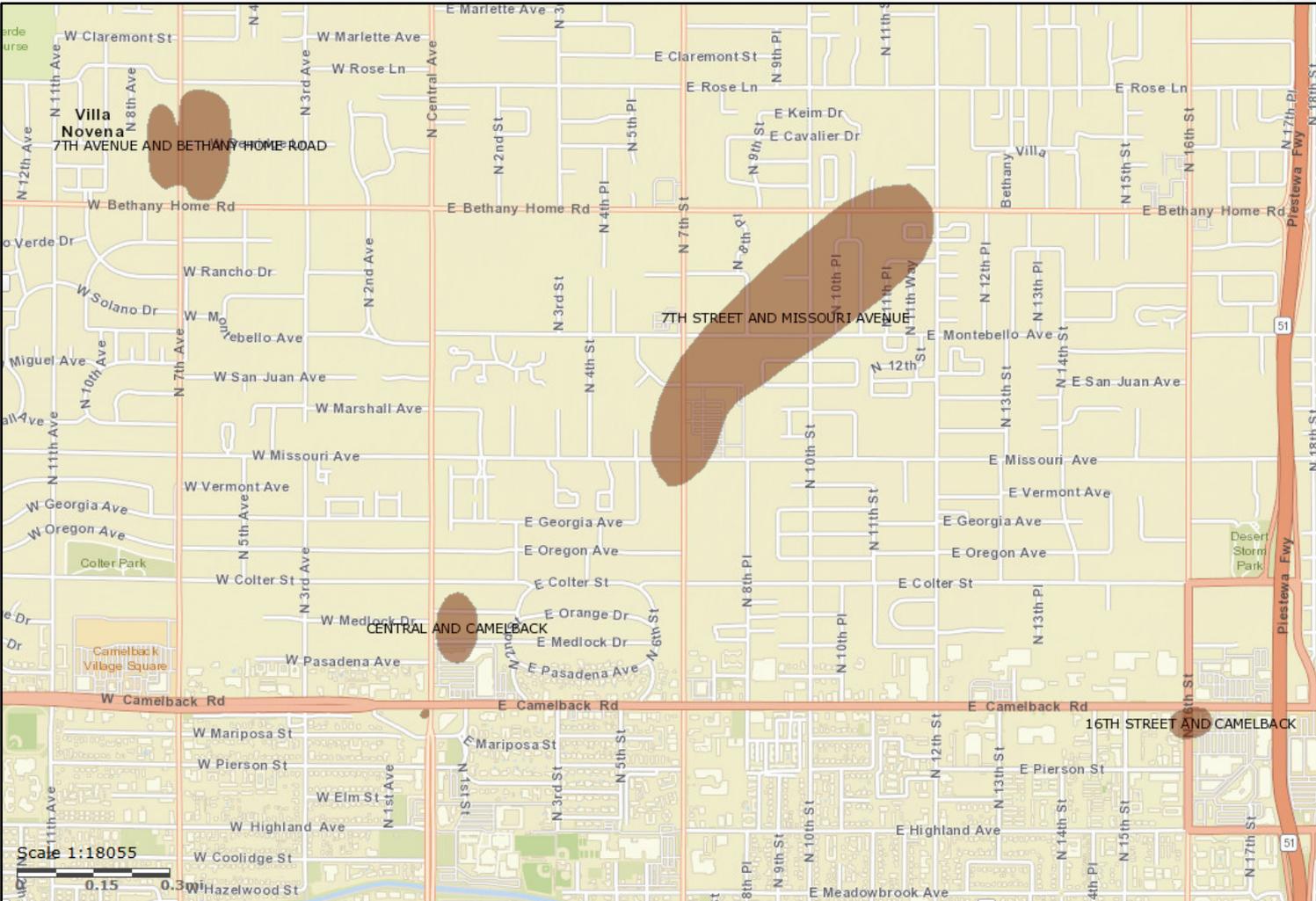


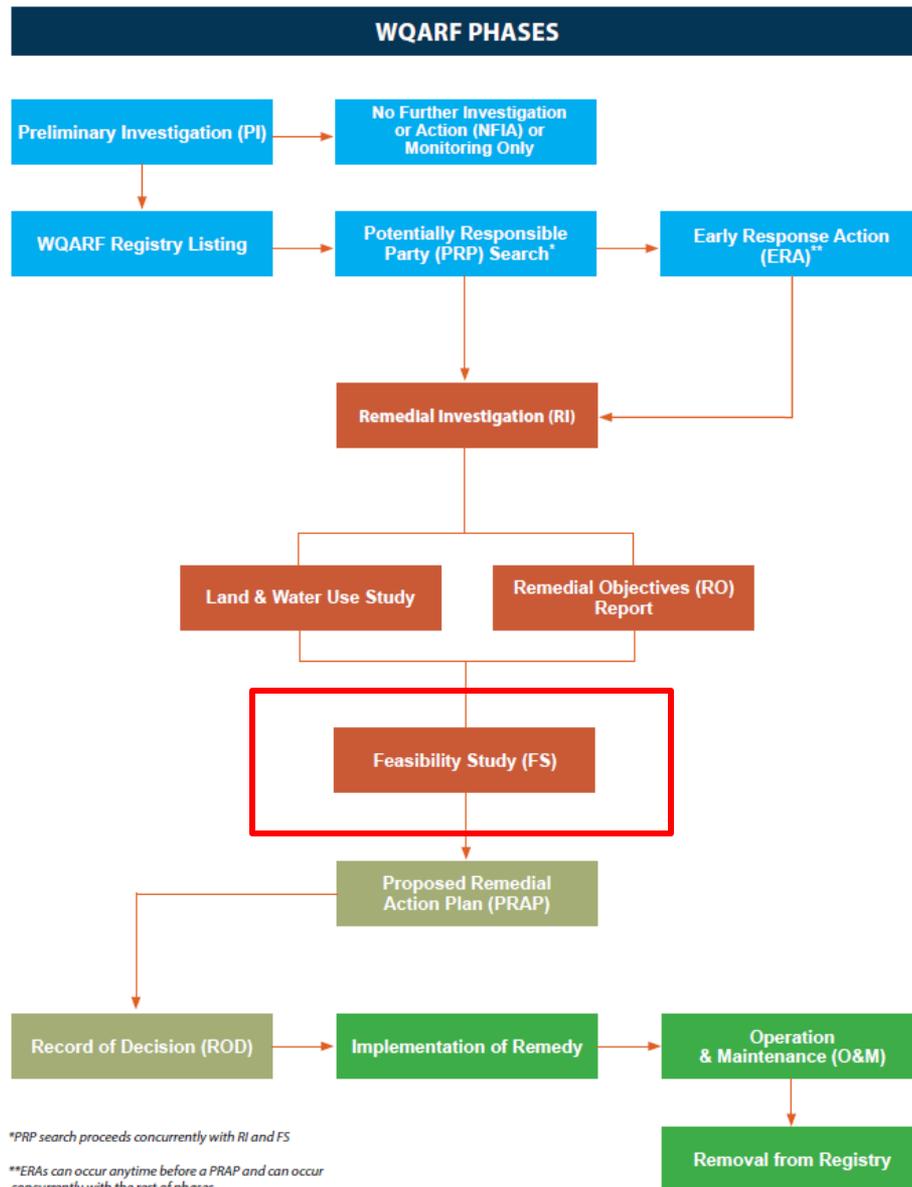
Feasibility Study
7th Street and Missouri Avenue
Water Quality Assurance Revolving Fund
Site

Central Phoenix CAB Meeting
16 October 2019

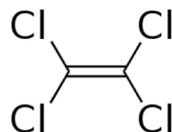
7th Street and Missouri Avenue Site location



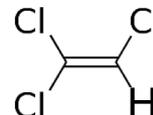
7th Street and Missouri Avenue Feasibility Study



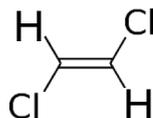
– Tetrachloroethene (PCE)



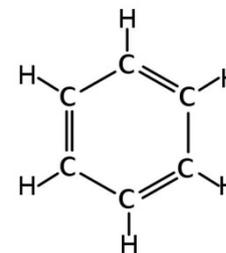
- Trichloroethene (TCE)



– 1,2-*cis*-dichloroethene (1,2-*cis*DCE)



- Benzene

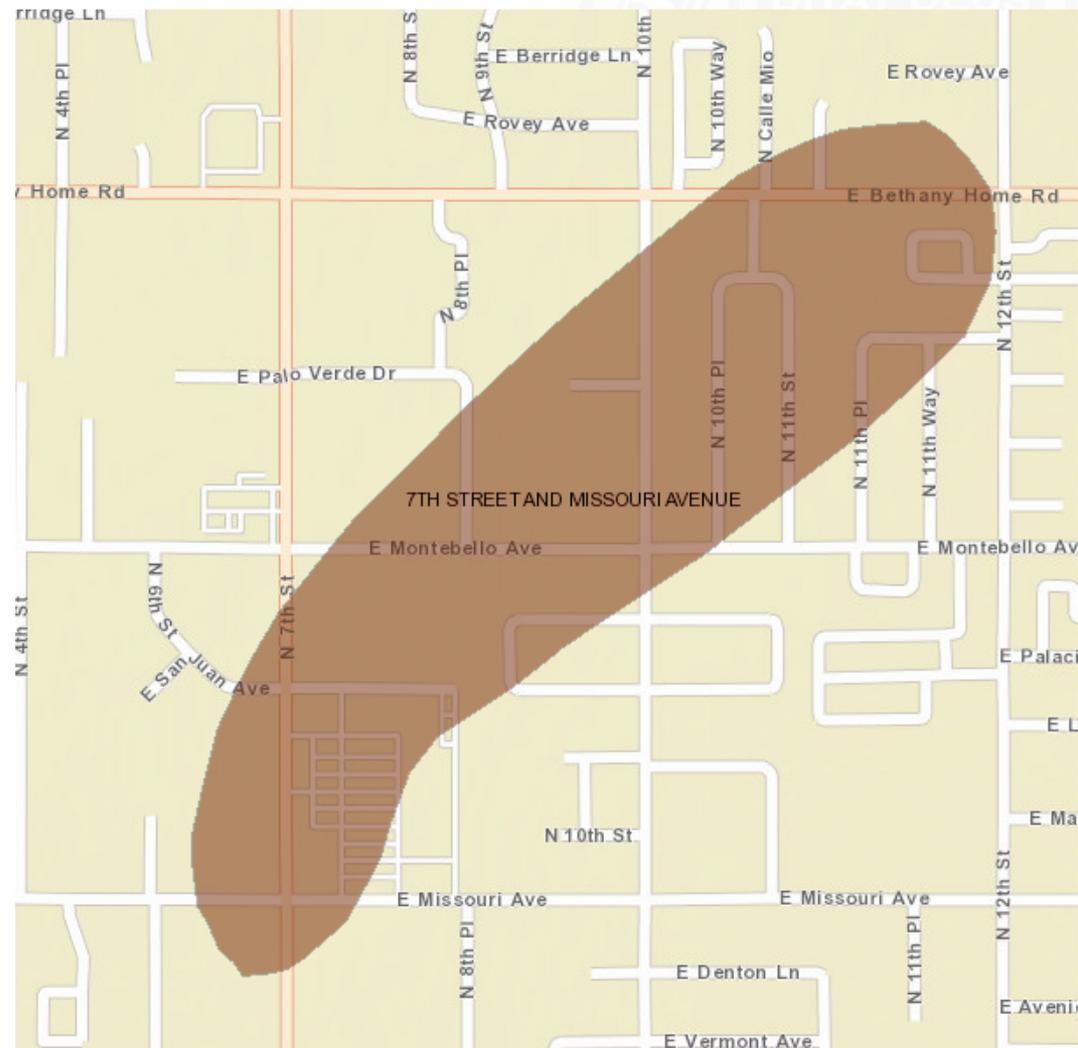


- PCE often used in dry cleaning
- TCE is a breakdown product of PCE; also used as a solvent
- 1,2-*cis*DCE is a breakdown product of PCE/TCE
- Benzene is a common component in gasoline and other petroleum products. Also used in solvents

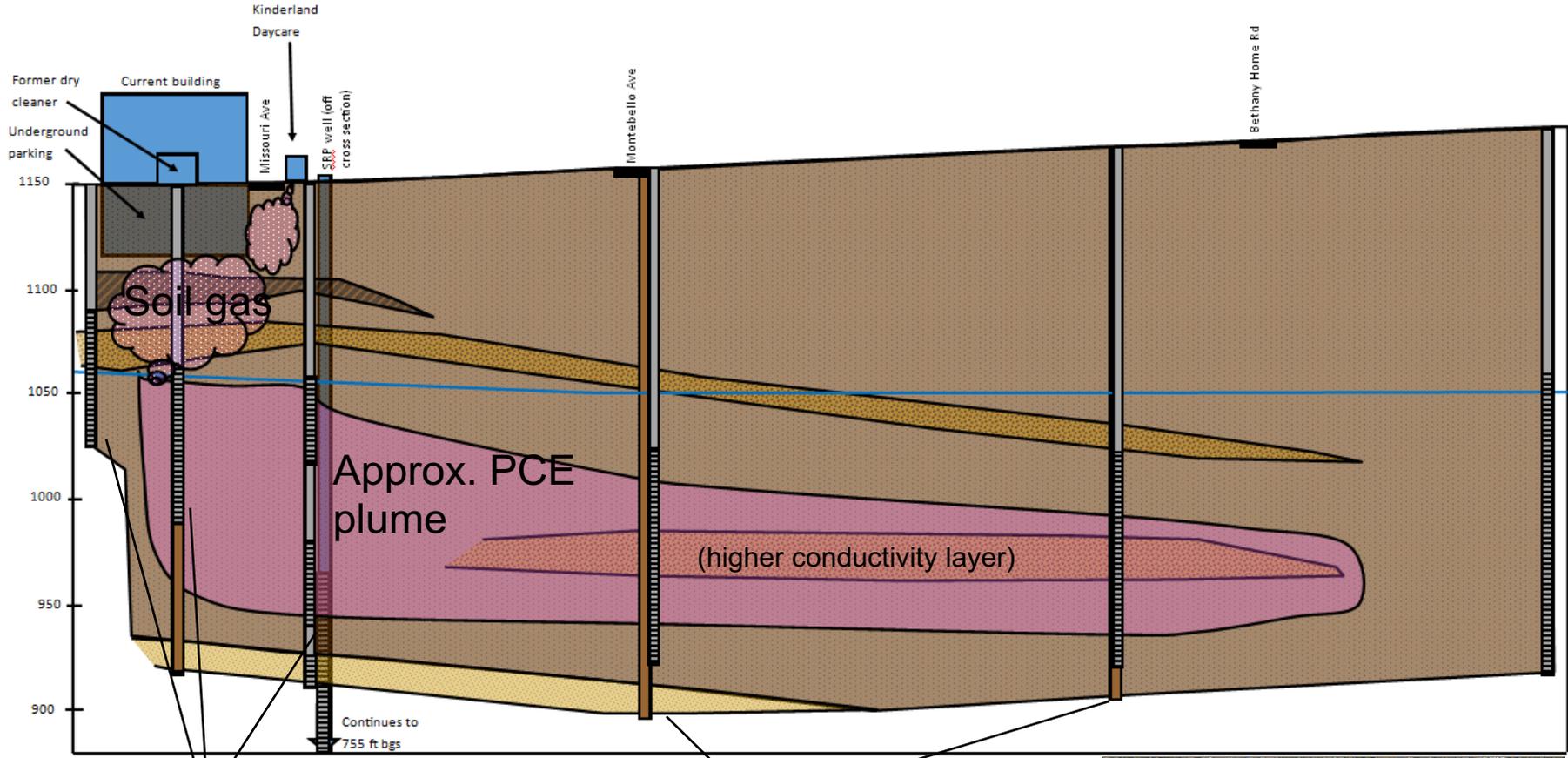
- Brief site history
 - 1995 – PCE reported in Circle K monitoring wells
 - PCE detected at Salt River Project (SRP) well 14.0E-9.6N
 - 2008 -2016- Preliminary investigation found two PCE plumes. Groundwater plumes are not combined
 - June 2016, one plume area enters Voluntary Remediation Program
 - June 2016, second plume area listed on WQARF registry

7th Street and Missouri Avenue Background

- Remedial Investigation (RI) finalized November 2018
- RI identified PCE source area as the southwest corner of 7th St and Missouri Ave
- Benzene also found above AWQS on northwest corner of 7th St and Missouri Ave
- RI determined little current risk, but future risk due to impacted SRP well that will be used for future municipal use

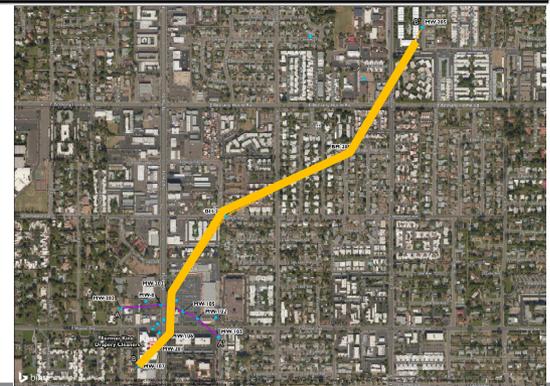


7th Street and Missouri Avenue Cartoon Conceptual Site Model



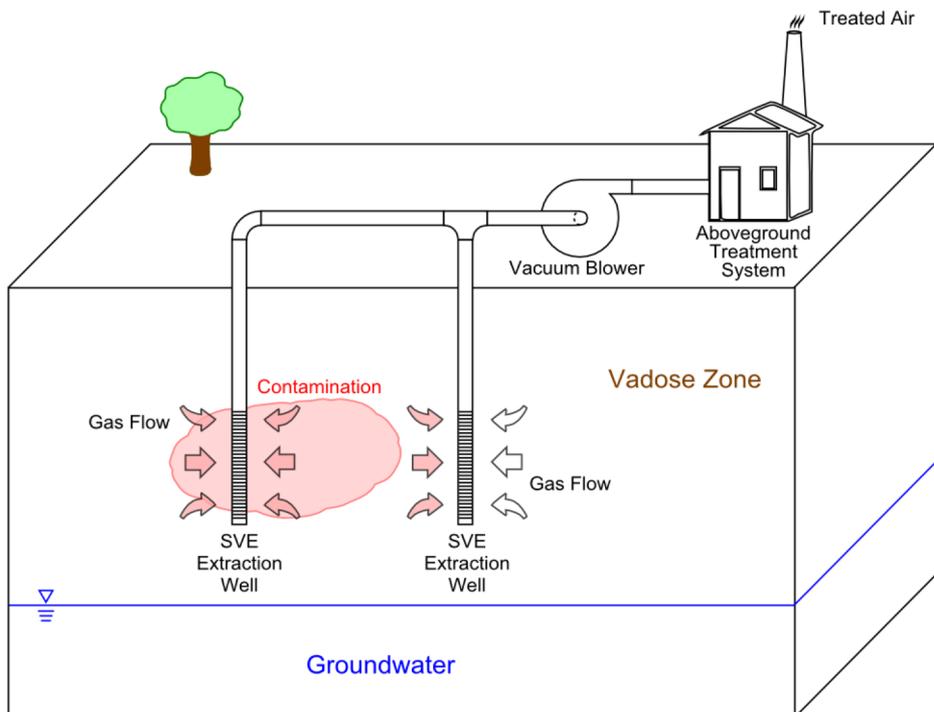
Monitoring wells

Boreholes



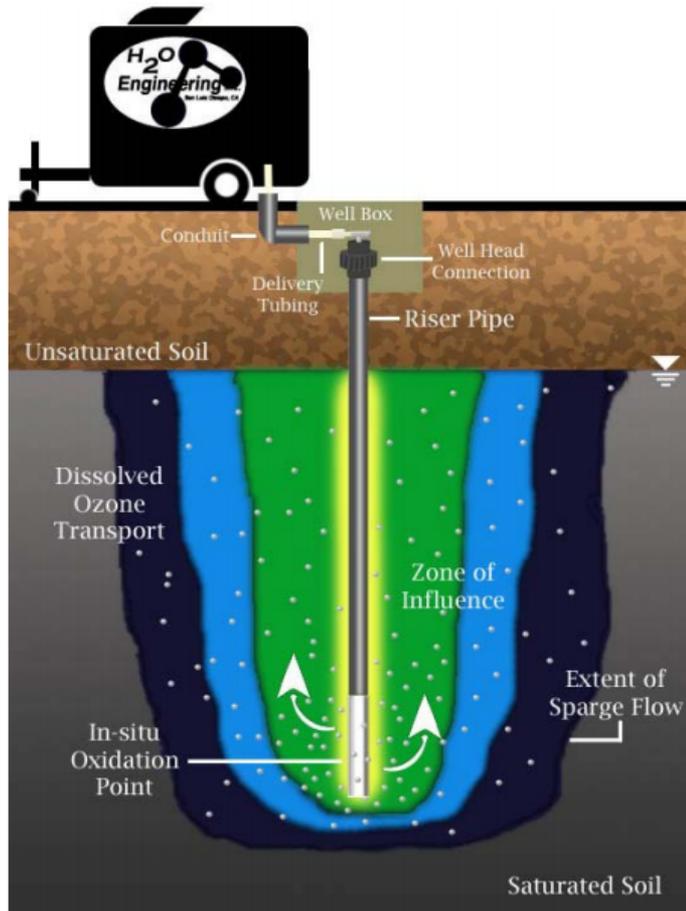
7th Street and Missouri Avenue Remedial actions to date

- June 2018 – Soil Vapor Extraction (SVE) Pilot Test, estimated 1.65 lbs PCE removed
- October 2018 – Early Response Action soil vapor extraction system (ongoing), estimated 542 lbs PCE removed Oct - June



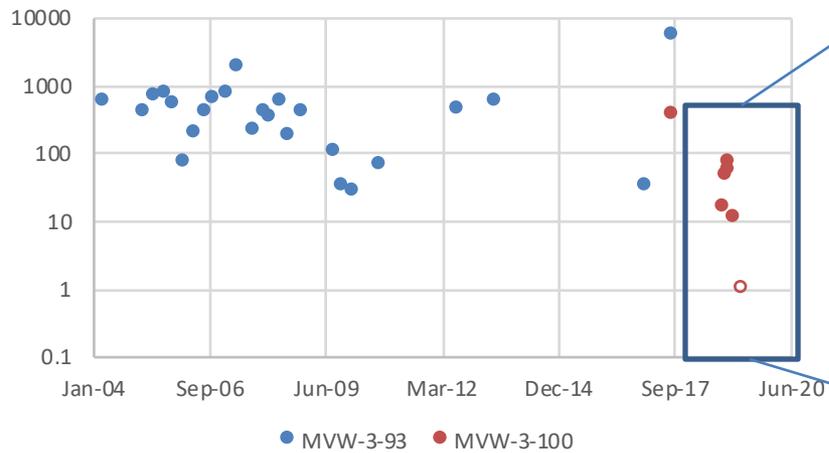
7th Street and Missouri Avenue Remedial actions to date

- December 2018 - Ozone sparge pilot test for groundwater (ongoing)



Example from: Plummer et al., Ozone Sparge Technology For Groundwater Remediation, Innovative Manufacturing Technology
<http://www.ecosafeusa.com/documents/Ozone%20Documentation/Soil%20Remediation/OZONE%20SPARGE%20TECHNOLOGY%20FOR%20GROUNDWATER%20REMEDICATION.pdf>

7th Street and Missouri Avenue Preliminary pilot test results



Purpose of an FS

- Figure out what remedy is going to work best at the site

Process:

- Identify a reference remedy and alternative remedies that:
 - Achieve the Remedial Objectives (ROs)
 - Meets Remedial Action Criteria (A.R.S. 49-282.06)
 - Protect public health and the environment
 - Allow for maximum beneficial use of waters of the state
 - Be reasonable, necessary, cost-effective, and technically feasible
- One remedy must be less aggressive, and one more aggressive than the reference remedy

Process Continued:

- After putting together a reference remedy and two alternatives, evaluate the different remedies based on the comparison criteria
 - Practicality
 - Risk
 - Cost
 - Benefit
- Suggest proposed remedy

Soil Remedial Objective

- To restore soil conditions at the site to remediation standards for non-residential use as specified in A.A.C. R18-7-204 (background remediation standards), A.A.C. R18-7-205 (pre-determined remediation standards), or A.A.C. R18-7-206 (site-specific remediation standards) that are applicable to the hazardous substances identified. The concentrations remaining in soil after remediation standards are met will not cause or threaten to cause a violation of groundwater remediation standards specified in A.A.C. R18-7-203. This action is needed for the present time and for as long as the level of soil contamination exceeds applicable cleanup standards.

Groundwater Remedial Objective

- To restore, replace, or otherwise provide for water for its designated municipal use that is lost or impaired by contamination associated with the 7th Street and Missouri Avenue WQARF site. This action is needed for the present time and for as long as the need for the water exists, the resource remains available and the contamination associated with the 7th Street and Missouri Avenue WQARF site prohibits or limits the designated municipal use of groundwater

7th Street and Missouri Ave Remedy analysis

Technology	Retained?	Reason
No Action	No	Would not remove risk or achieve ROs
Institutional Controls	Yes, in conjunction with other remedial measures	Needed in event residential standards cannot be achieved for the Site soils
Monitored Natural Attenuation (MNA)	Yes, in conjunction with other remedial measures	For dilute plumes (e.g., < 100 µg/L PCE) MNA is often the only technically feasible solution
Soil Vapor Extraction	Yes	Current system is successful in cost effectively removing VOC mass from the vadose zone
Air Sparging	No	For aerobic degradation of some VOCs, typically better suited to enhancing the volatilization of non-chlorinated VOC. Would not be effective at degrading VOCs impacts once they reach low concentrations
Pump and Treat (Groundwater Extraction and Treatment)	Yes	Highly implementable for high-concentration source zone treatment or plume containment. Also retained as well head treatment option
Enhanced Reductive Dechlorination	Yes	Cost prohibitive for overall plume due to predominantly aerobic groundwater conditions, low VOC concentrations; retained for potentially targeted treatment areas
In Situ Chemical Reduction (ISCR)	No	Technically and economically infeasible due to thickness of impacted groundwater zone and the size and depth of the plume
In Situ Chemical Oxidation (ISCO)	Yes	Cost prohibitive for overall plume due to relatively small radius of influences. Retained for potentially targeted treatment areas, including using ozone

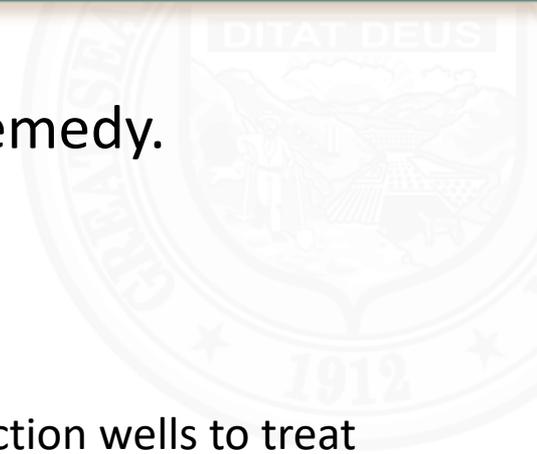
Remedial Alternative	Method	Contingencies	Remedial Objectives Met?
Reference Remedy	<ul style="list-style-type: none"> • Larger SVE System (up to three years operation) • Expanded ISCO Using Ozone • MNA Semiannual Monitoring 	<ul style="list-style-type: none"> • Additional SVE well/run time • DEUR if residential SRLs not achieved • Additional ozone systems if plume moves • Wellhead treatment for SRP/COP wells 	Yes: expanded SVE system will likely achieve residential SRLs. Ozone will likely achieve AWQS at source area. MNA time for diffuse plume greatly reduced
More Aggressive Remedy	<ul style="list-style-type: none"> • Expanded SVE System (including additional wells) • Continued ISCO Using Ozone • Pump & Treat (Groundwater Extraction and Treatment System) • MNA Semiannual Monitoring 	<ul style="list-style-type: none"> • Additional SVE well/run time • DEUR if residential SRLs not achieved • Additional ozone systems if plume moves • Wellhead treatment for SRP/COP wells • Additional P&T well • Additional monitoring 	Yes: SVE as above. Ozone as above. P&T will treat source area and some of dilute plume, and MNA will provide data for continued evaluation of the plume.
Less Aggressive Remedy	<ul style="list-style-type: none"> • Larger SVE System (up to two years operation) • Continued ISCO Using Ozone (up to two years) • MNA Semiannual Monitoring 	<ul style="list-style-type: none"> • Additional SVE well/run time • DEUR if residential SRLs not achieved • Wellhead treatment for SRP/COP wells • Additional monitoring wells 	Yes: SVE as above – if residential not reached, DEUR required AWQS will likely be achieved as the source area - however, this remedy may result in at least 30 years of MNA and implementation of contingencies

7th Street and Missouri Ave

Comparison criteria

	PRACTICABILITY	RISK	COST	BENEFIT
Reference Remedy	<ul style="list-style-type: none"> • Very feasible, base of systems already in place • SVE and ozone with MNA known and reliable • Effective for short and long term • Ozone will quickly reduce VOC concentrations, and ultimately reduce the number of years for monitoring 	<ul style="list-style-type: none"> • Reduces possibility of residual VOCs acting as long-term source to groundwater or vapor intrusion • Reduces VOC concentrations at the source and immediately downgradient, monitors for impacts to production wells 	<ul style="list-style-type: none"> \$ 936,000 - Capital Costs \$ 870,000 – annual O&M for 3 years \$ 4,406,000 – all contingencies \$ 1,806,000 – Total no contingencies \$ 6,200,000 – Total including contingencies 	<ul style="list-style-type: none"> • SVE provides continued reduction of VOC concentrations and mass in the vadose zone • Ozone injection would result in achieving the groundwater RO within a relatively short period of time • Mitigates potential expansion of the plume • Monitors for the potential need of implementing wellhead treatment as a contingency for the production wells
More Aggressive	<ul style="list-style-type: none"> • SVE and continued ozone very feasible • P&T moderately feasible - Siting the location of groundwater extraction wells and a treatment system would have potential challenges • All proposed treatments known, reliable, and effective 	<ul style="list-style-type: none"> • As above, with added diffuse plume control 	<ul style="list-style-type: none"> \$ 1,175,000 – Capital Costs \$ 2,147,000 – annual O&M for 3 years \$ 4,900,000 – all contingencies \$ 3,322,000 – Total no contingencies \$ 8,200,000 – Total including contingencies 	<ul style="list-style-type: none"> • As above, with groundwater extraction system mitigating further downgradient PCE migration
Less Aggressive	<ul style="list-style-type: none"> • Very feasible, systems already in place. • SVE and MNA known and reliable • Long-term effectiveness would need assessment, with additional monitoring wells required 	<ul style="list-style-type: none"> • Continues to monitor and evaluate Site contamination • Contingencies likely, especially SRP or COP wellhead treatment 	<ul style="list-style-type: none"> \$ 150,000 – Capital Costs \$ 1,660,000 – monitoring for 30 years \$ 4,780,000 – all contingencies \$ 1,810,000 – Total no contingencies \$ 6,800,000 – Total including contingencies 	<ul style="list-style-type: none"> • SVE as above • Current ozone injection would reduce source zone mass • MNA monitoring would provide data to evaluate VOC concentrations throughout the PCE plume and monitor for the potential need of implementing wellhead treatment as a contingency for either SRP or COP wells

- The recommended remedy is the Reference Remedy.
 - Vadose zone area
 - Installing larger SVE system on current well network
 - Groundwater treatment
 - Expand current ozone system and install additional injection wells to treat source area
 - MNA for diffuse plume
 - Contingencies for additional ozone and wellhead treatment options



Questions?



Contact us!

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