



U.S. DEPARTMENT *of* ENERGY

Office of Environmental Management

Hanford Field Office



Navigating the Path to an End State: Insights and Challenges in 200W Pump & Treat Performance and the Carbon Tetrachloride Plume

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Agenda

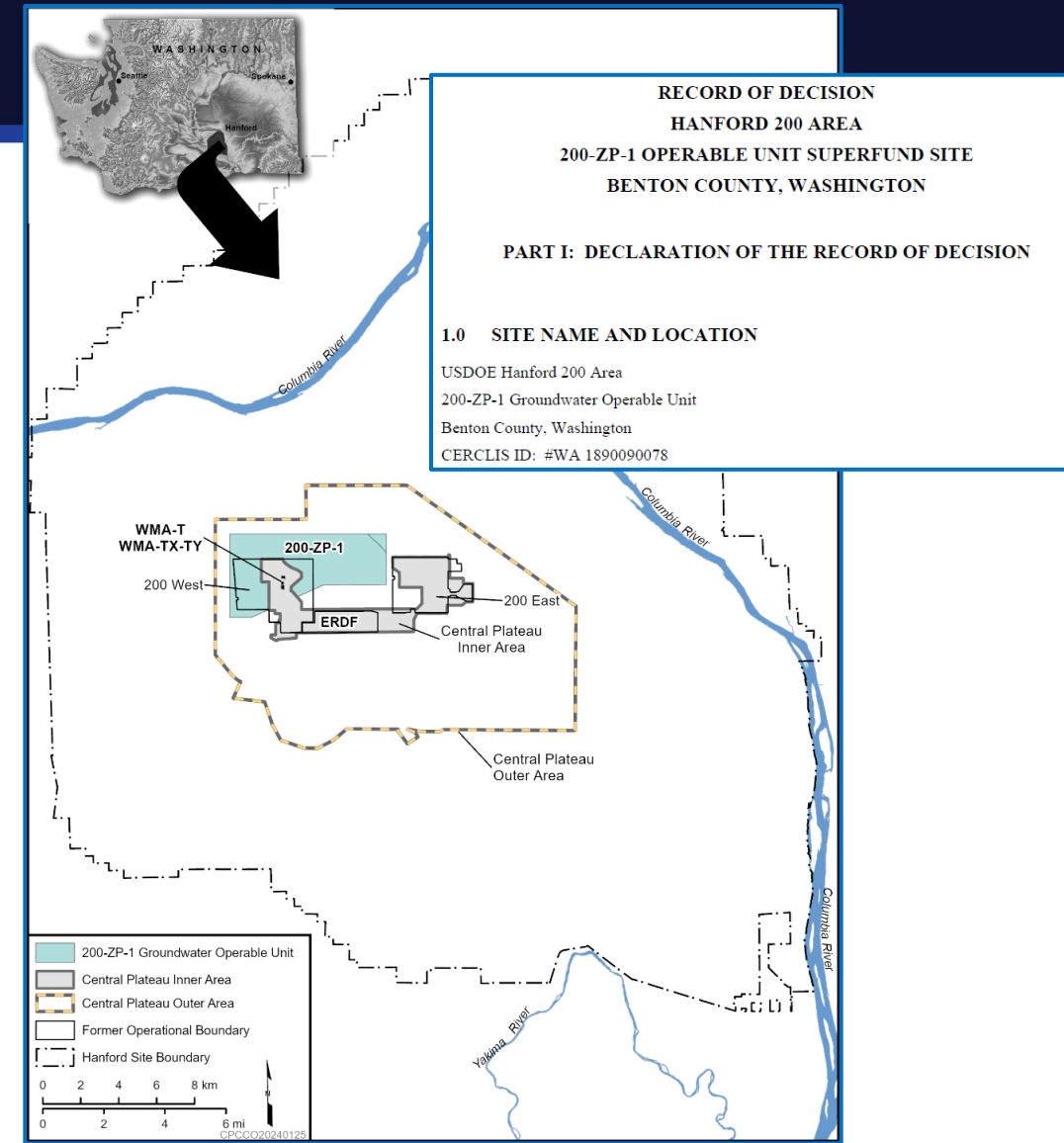
200 West Pump & Treat (200W P&T) Performance and carbon tetrachloride Plume within the context of Remedial Process Optimization (RPO)

- Introduction (review)
- 200W P&T performance since 2012
- Carbon tetrachloride plume changes over years
- 200-ZP-1 findings since current P&T startup
- Time to cleanup
- Optimization Study Plan and RPO
- Upcoming challenges



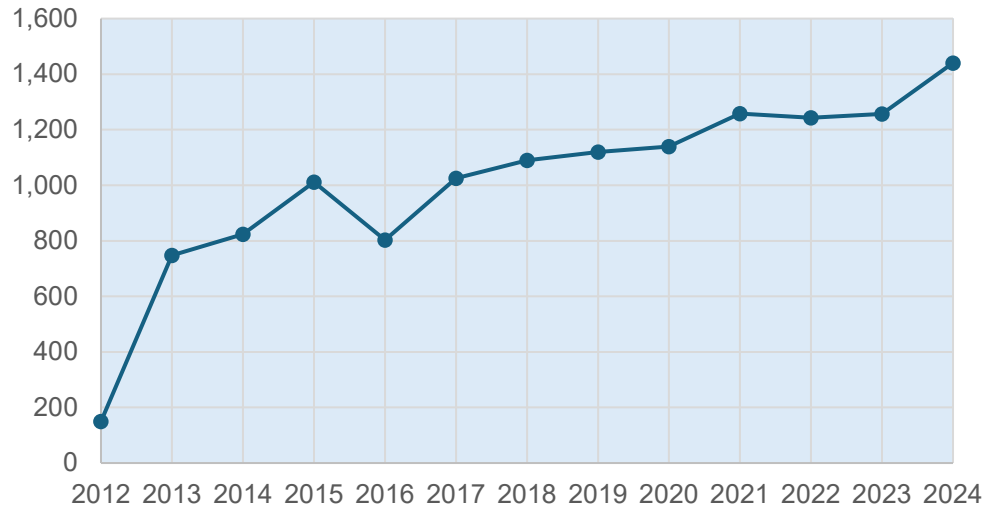
Introduction

- Remediation of 200-ZP-1 combines P&T, monitored natural attenuation, flow path control, and institutional controls
- Remediation timeframe for achieving cleanup levels in the 200-ZP-1 Record of Decision (ROD) was estimated at 125 years
- Carbon tetrachloride noted as the primary risk driver



200W P&T Volume Water Treated

200W P&T Extracted Volume (Million Gallons)



Calendar Year	Extracted Volume	
	Million Gallons	Million Liters
2012	149.67	566.56
2013	747.58	2,829.90
2014	823.78	3,118.35
2015	1,011.04	3,827.20
2016	802.69	3,038.51
2017	1,025.46	3,881.79
2018	1,089.91	4,125.76
2019	1,119.37	4,237.28
2020	1,139.70	4,314.23
2021	1,257.92	4,761.75
2022	1,243.28	4,706.33
2023	1,256.69	4,757.09
2024	1,440.39	5,452.47
2025 (through June 2025)	833.21	3,154.04
Cumulative (through June 2025)	13,940.70	52,771.29

Contaminants of Concern - Mass Treated

	Carbon tetrachloride (kg)	Nitrate (kg)	Hexavalent chromium* (kg)	Technetium-99 (Ci)	Trichloroethylene (Kg)	Uranium (Kg)
2012	612.35	37,968.17	18.08	0.29	8.36	0.00
2013	2,921.69	185,795.17	68.99	1.27	12.87	0.00
2014	2,741.04	247,893.48	68.67	1.25	12.21	0.00
2015	2,621.00	353,573.04	92.87	1.77	11.82	6.33
2016	1,678.02	334,130.09	63.40	2.30	9.28	19.55
2017	1,920.29	352,273.54	78.86	2.32	12.98	176.46
2018	2,243.14	426,370.26	99.72	2.37	13.66	116.81
2019	1,868.01	247,265.91	68.33	1.86	11.21	93.77
2020	1,913.26	0.00	8.71	1.94	11.43	73.90
2021	1,510.00	0.00	8.66	2.03	9.46	102.62
2022	1,325.64	0.00	7.07	1.71	8.65	91.29
2023	1,118.65	0.00	8.01	1.71	8.04	99.61
2024	1,585.60	0.00	6.76	1.67	10.99	82.45

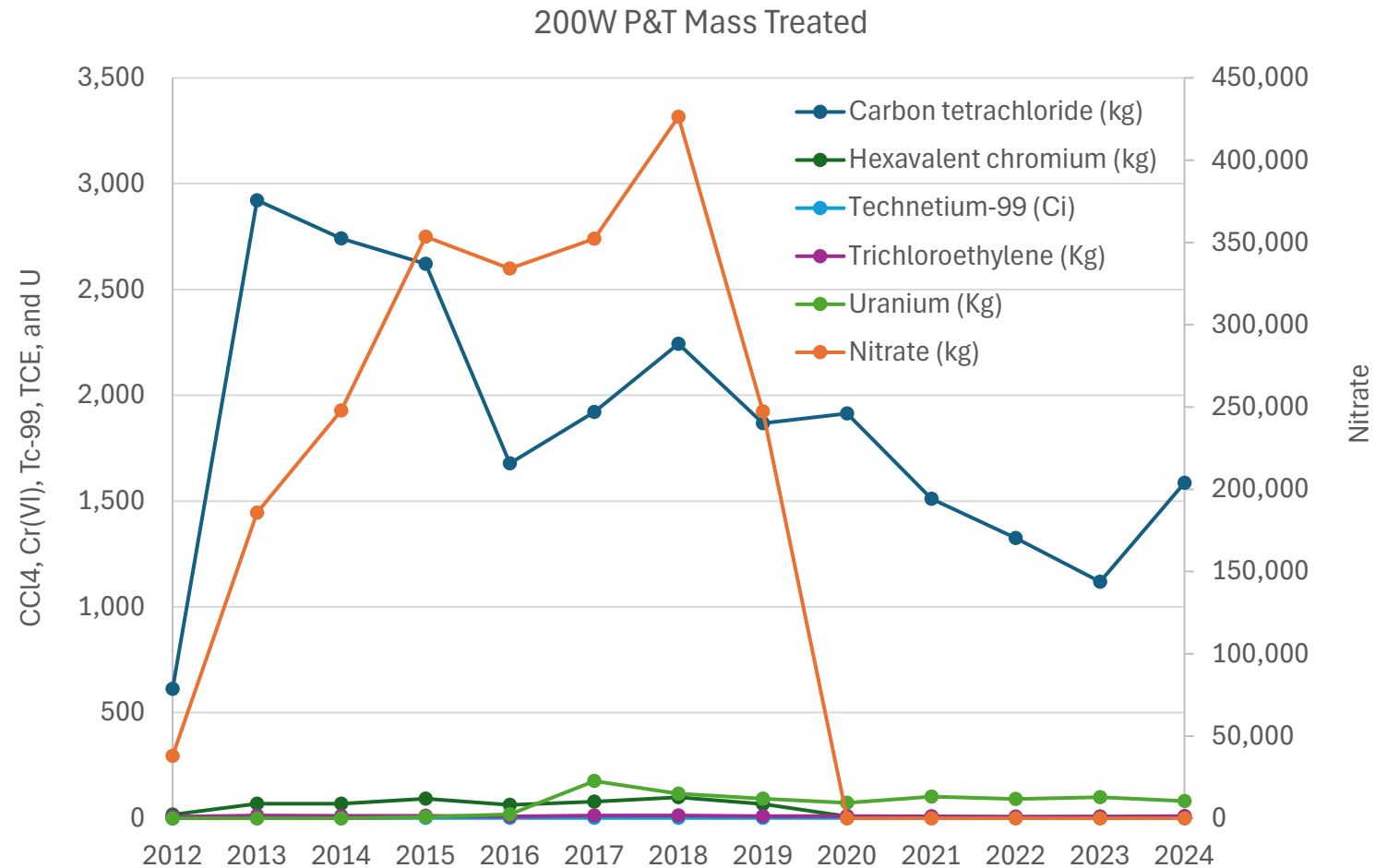
* : As of October 2019, nitrate treatment is suspended in accordance with the ZP-1 Optimization Study Plan.

** : Starting December 2019, Cr⁶⁺ removal tracked through the Tc-99 system.

Note: Values reflect calculations using the interpolated concentration method (see ECF-200W-23-0065 and ECF-200W-24-0064 for additional information). As additional concentration data become available, some values may be updated.

Contaminant of Concern – Mass Treated, cont.

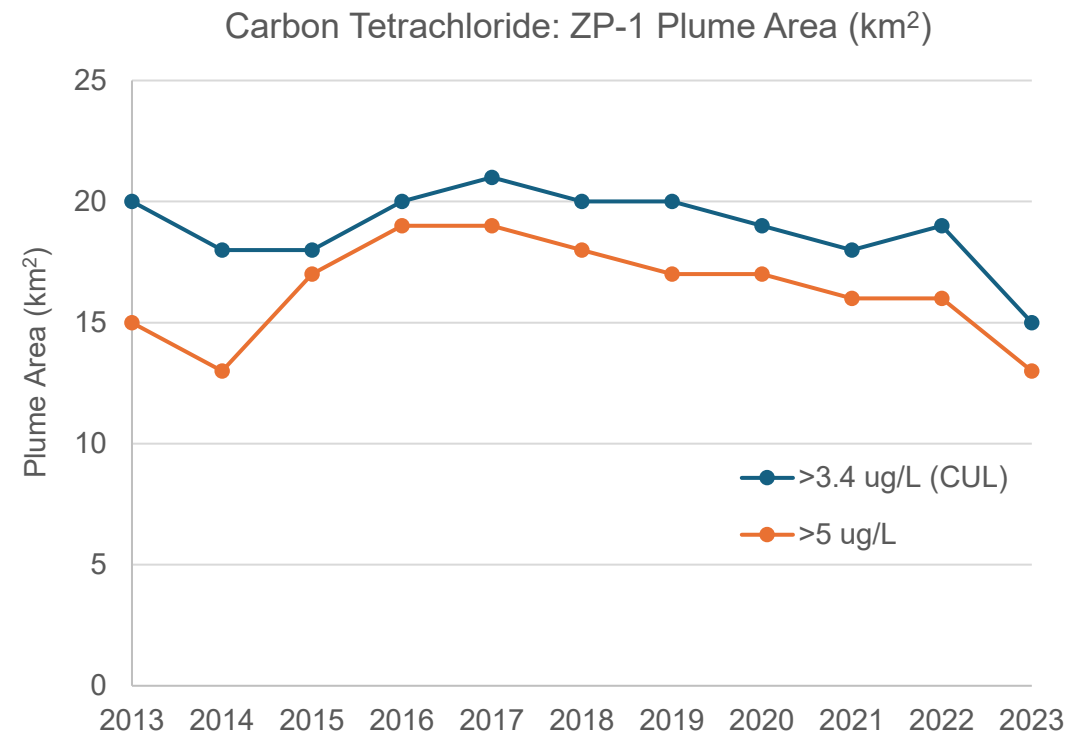
- Carbon tetrachloride overall decreasing trend with recent increase
- Nitrate drop in 2019 due to the Optimization Study Plan



Carbon Tetrachloride Plume Changes

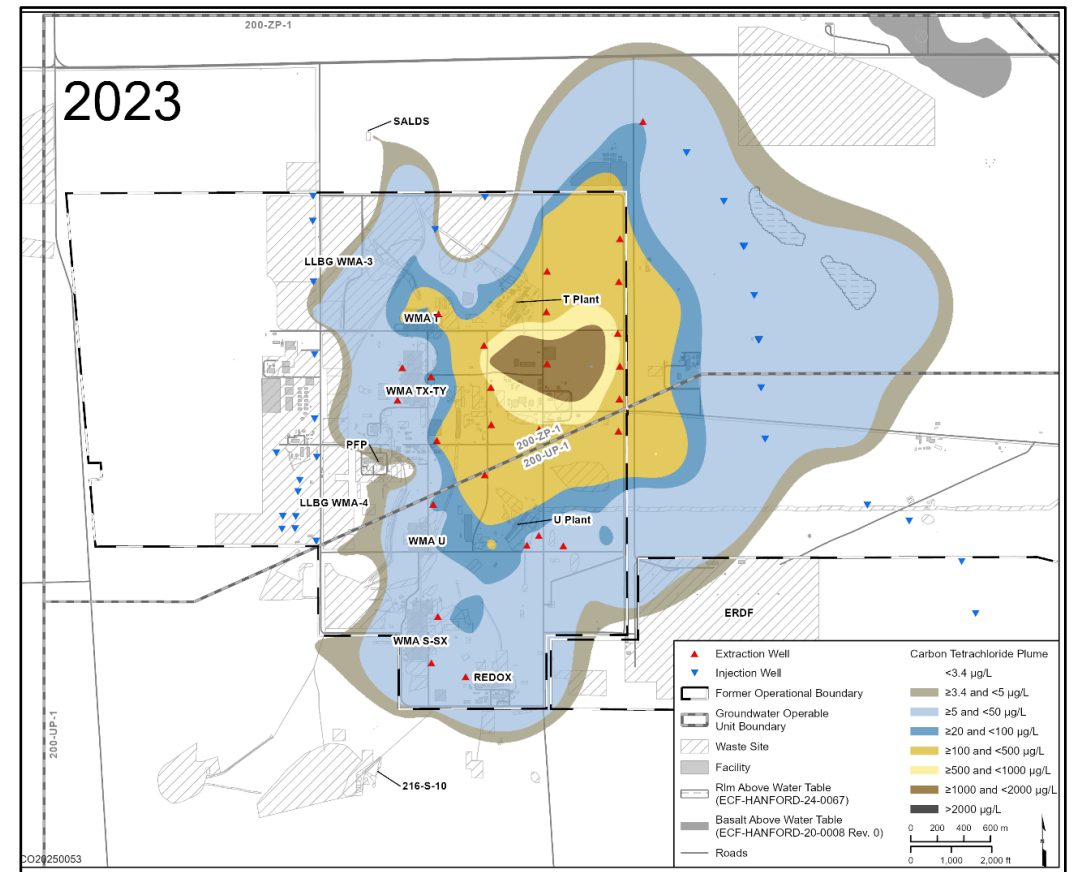
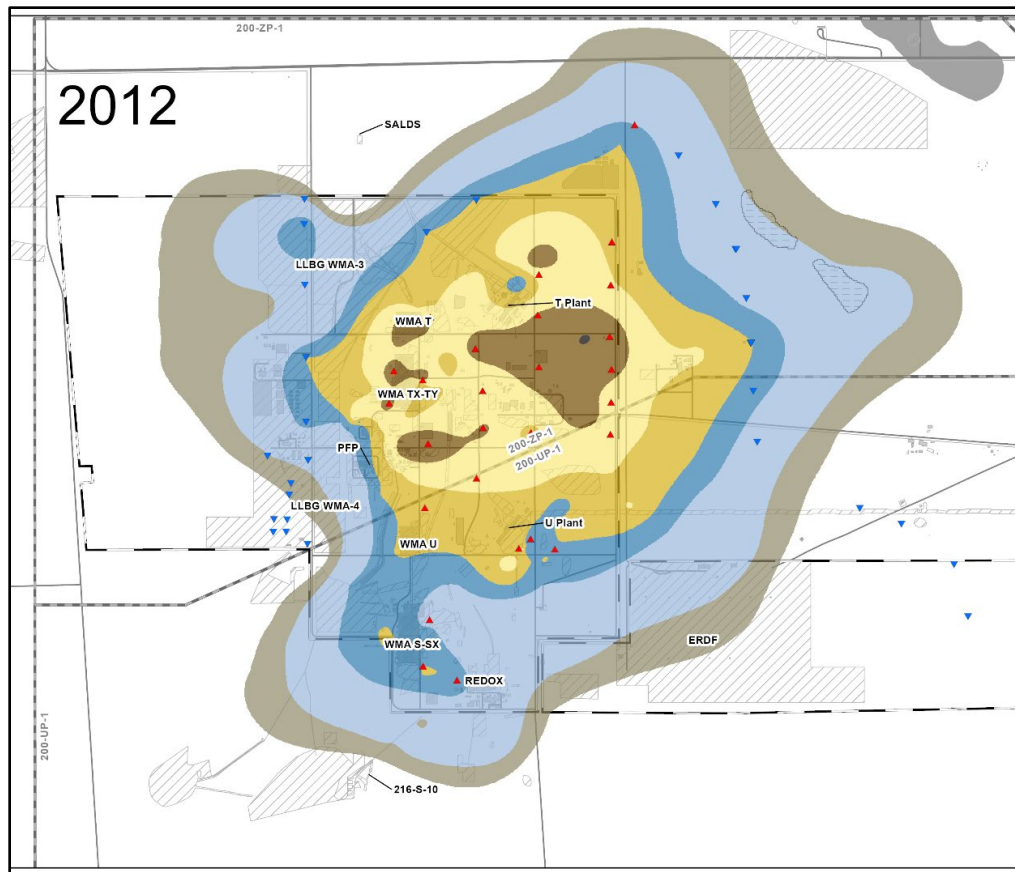
Carbon tetrachloride plume area greater than the cleanup level of 3.4 µg/L has decreased compared to 2013 (i.e., from 20 km² [7.7 mi²] to 15 km² [5.8 mi²])

Carbon Tetrachloride - ZP-1 Plume Area (km ²)		
	>3.4 ug/L (Cleanup Level)	>5 ug/L
2013	20	15
2014	18	13
2015	18	17
2016	20	19
2017	21	19
2018	20	18
2019	20	17
2020	19	17
2021	18	16
2022	19	16
2023	15	13



Carbon Tetrachloride Plume Changes, cont.

Reduction of the higher concentrations within the interior of the plume



Important 200-ZP-1 Findings Since 2012

- Operations began at the 200 West P&T in July 2012, and remedy performance has been evaluated annually since
- Data and information acquired following issuance of the 200-ZP-1 ROD show that conditions are highly unlikely for carbon tetrachloride to reach the cleanup level in the timeframe specified in the 200-ZP-1 ROD, due to:
 - Improved knowledge of carbon tetrachloride distribution
 - Updated estimates of carbon tetrachloride abiotic degradation rate
 - A greater proportion of the carbon tetrachloride mass lies deep within the semi-confined aquifer
 - Difficulty was encountered in maintaining injection well capacity

Time to Cleanup

Remedial Action Objective (RAO) #1: Return 200-ZP-1 Operable Unit groundwater to beneficial use (restore groundwater to achieve domestic drinking water levels) by achieving cleanup levels.

- As mentioned, the 200-ZP-1 ROD cleanup timeframe will likely not be met
- 25 years of pumping (to 2037)
- 125 years of monitored natural attenuation
- The portion of the carbon tetrachloride not captured by the P&T, natural attenuation is intended to reduce concentrations to meet cleanup levels



Optimization Study Plan

- Based on EPA 542-R-13-008, the 200-ZP-1 Optimization Study Plan was approved on September 30, 2019
- Collect and interpret data to evaluate remedy performance enhancements and remedy configuration changes associated with P&T operations
- This study will provide the basis for recommendations on whether to permanently modify the treatment system and remedy configuration and the associated remedy decision documents

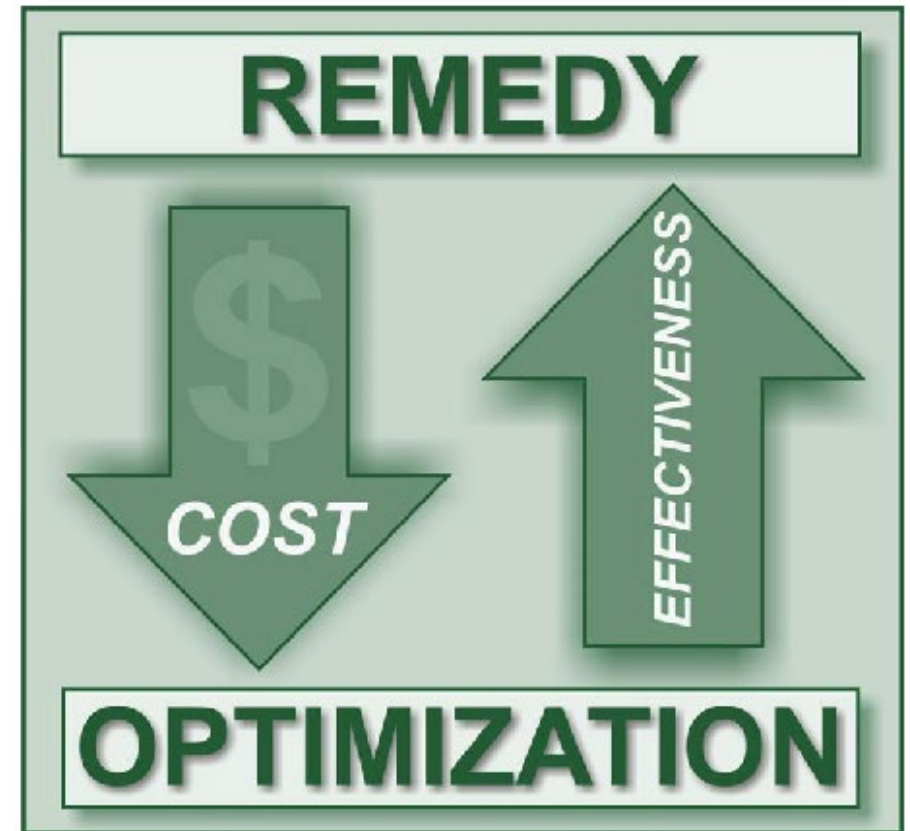
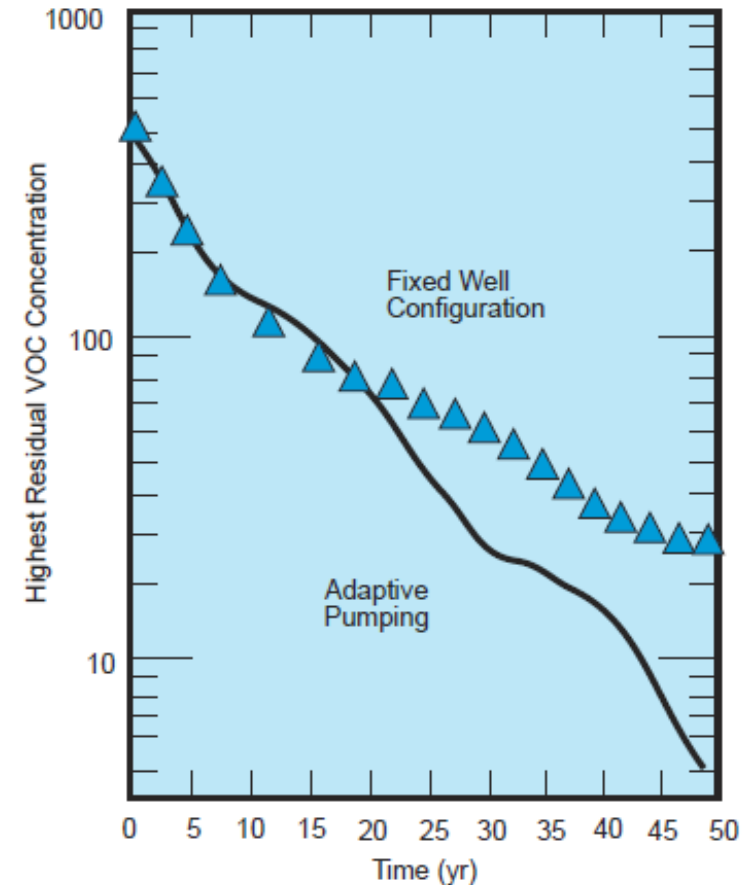


Figure Courtesy of EPA 542-R-07-007

Optimization Study Plan and Remedial Process Optimization

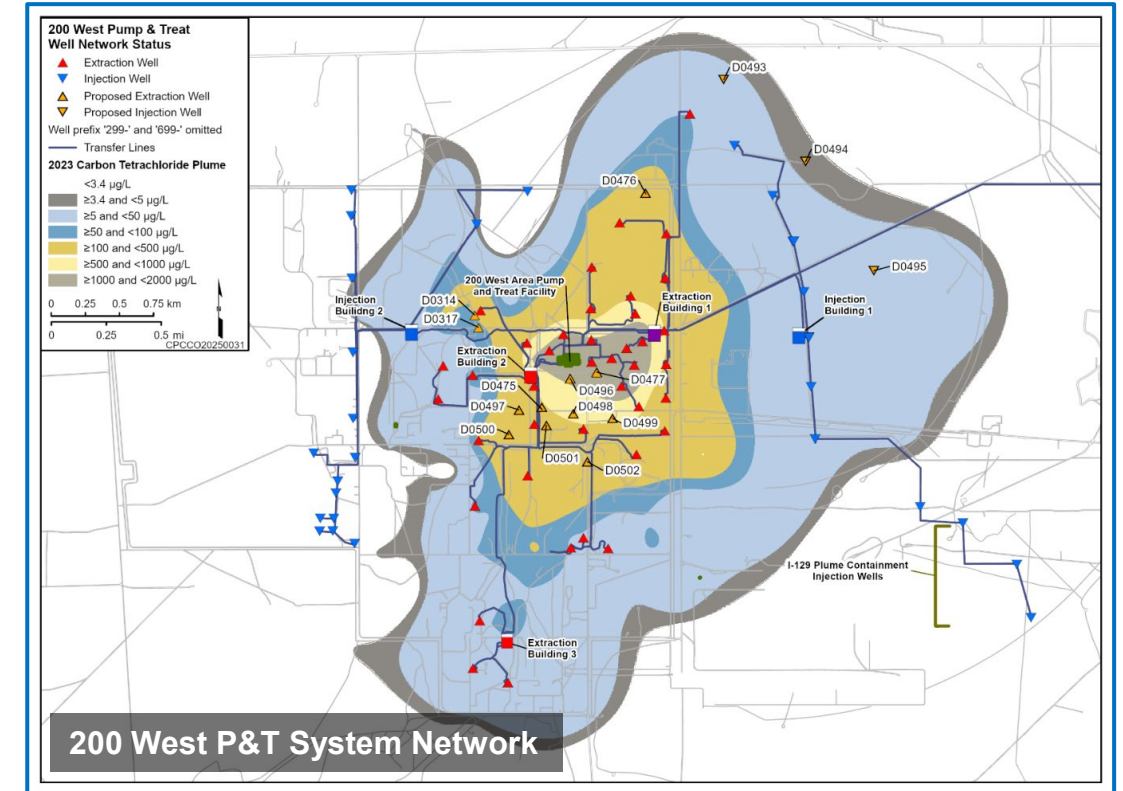
- Also called “smart” or “flexible” management
- Vary extraction and injection over time to remediate plumes as fast as possible
- Investigate via conceptual scenarios and formal optimization over the next few years



Pump-and-Treat Ground-Water Remediation A Guide for Decision Makers and Practitioners, EPA/625/R-95/005

Optimization Study Plan and Remedial Process Optimization

- Iterative evaluation of groundwater data, concentration data and modeling are used to place extraction wells for remedy optimization
- Since the initiation of the Optimization Study Plan in 2019, 14 extraction wells have been added to the P&T well network
- Annual RPO (or more frequent, as needed) to review and optimize the P&T system



Upcoming Challenges

Continuing the Optimization Study Plan will feed into annual Remedial Process Optimization efforts and can be used to address future technical challenges:

- Overall water level decline due to increase pumping
 - Increased gradient may result in changes to extraction well capture zones
 - Monitoring wells becoming sample dry
- P&T maintenance and equipment upgrades
- Modeling updates and refinements



Wrap Up

- As of 2024, the 200 West P&T system has operated for nearly half (12 years) of the lifecycle proposed for the P&T component of the remedy in the ZP-1 ROD
- Despite cleanup progress made, modeling suggests the pre-Optimization Study remedy will not recover 95% of initial carbon tetrachloride mass by 2037
- The 200 West P&T system is capable of operating beyond nominal design capacity of 7,600 L/min (2,000 gal/min)
- A final Optimization Study report will be prepared to summarize the results of optimization modeling and data collected, and provide remedy recommendations
- Long-term RPO efforts will drive optimization in the future

Questions?

