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# Use of Chemical Oxidation Coupled with Bioaugmentation to Treat Groundwater Underneath a Day Care Facility

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# Site History

- Site developed between 1940–1951
- Mixed light industrial/commercial/residential area
  - Previous operations
    - Pyrometer Instrument Company
    - Alarm system manufacturer
    - Photo lab
- Currently daycare facility

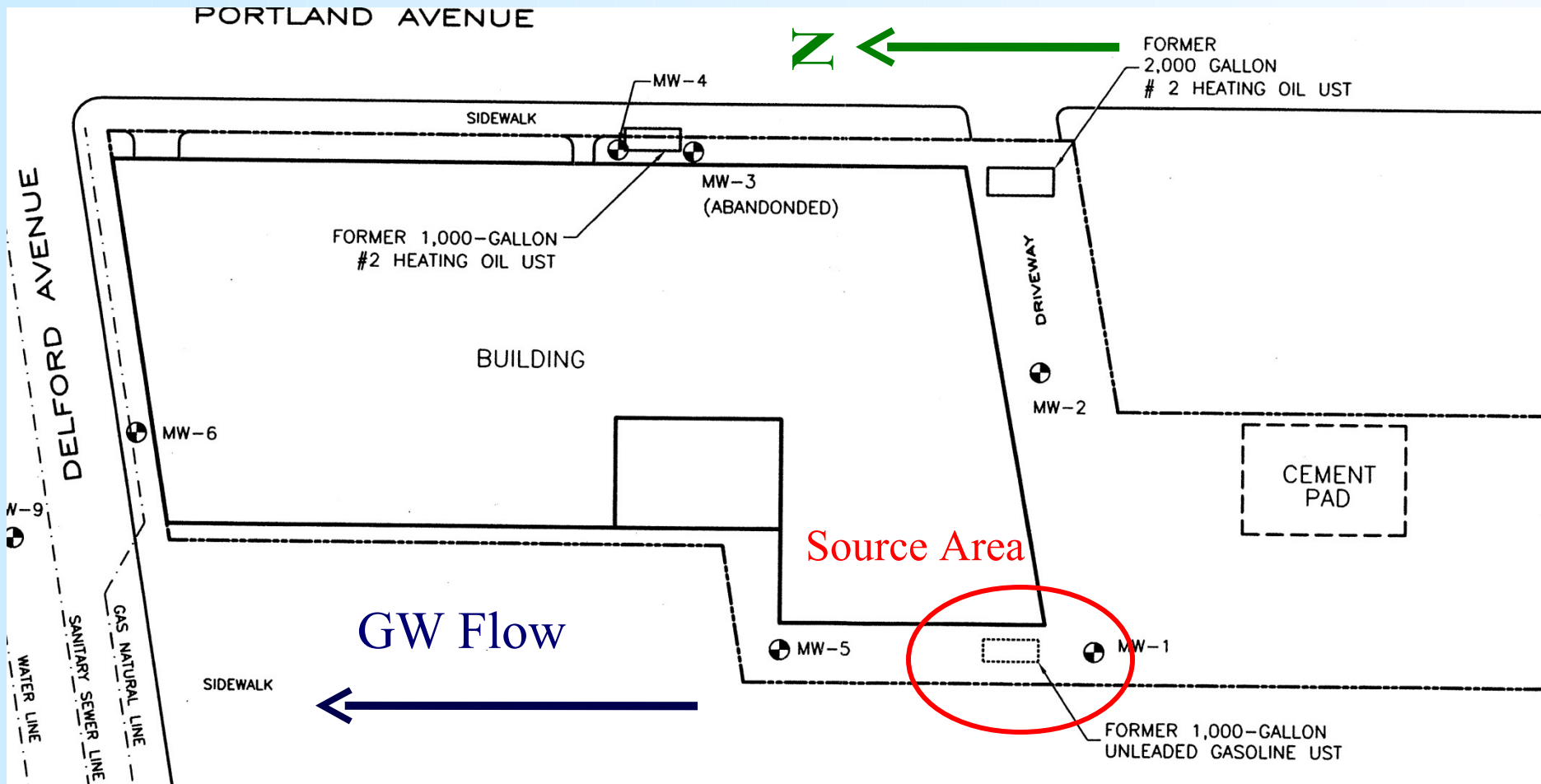
# Setting

- Industrial / Residential
  - Landscaped areas only pervious surfaces
  - No wetlands, streams, etc.
- Brunswick Formation
  - Soft red shale, mudstone, sandstone
- Shallow ground water 10-12 feet below ground surface

# Historical Investigation/Remediation

- 3 underground storage tanks removed/abandoned in place
  - 2,000 gal #2 Fuel Oil
  - 1,000 gal #2 Fuel Oil
  - 1,000 gal unleaded gasoline
- Soil/ground water investigations following tank abandonment/removal indicated remaining BTEX subsurface contamination
- **Vapor intrusion in daycare**

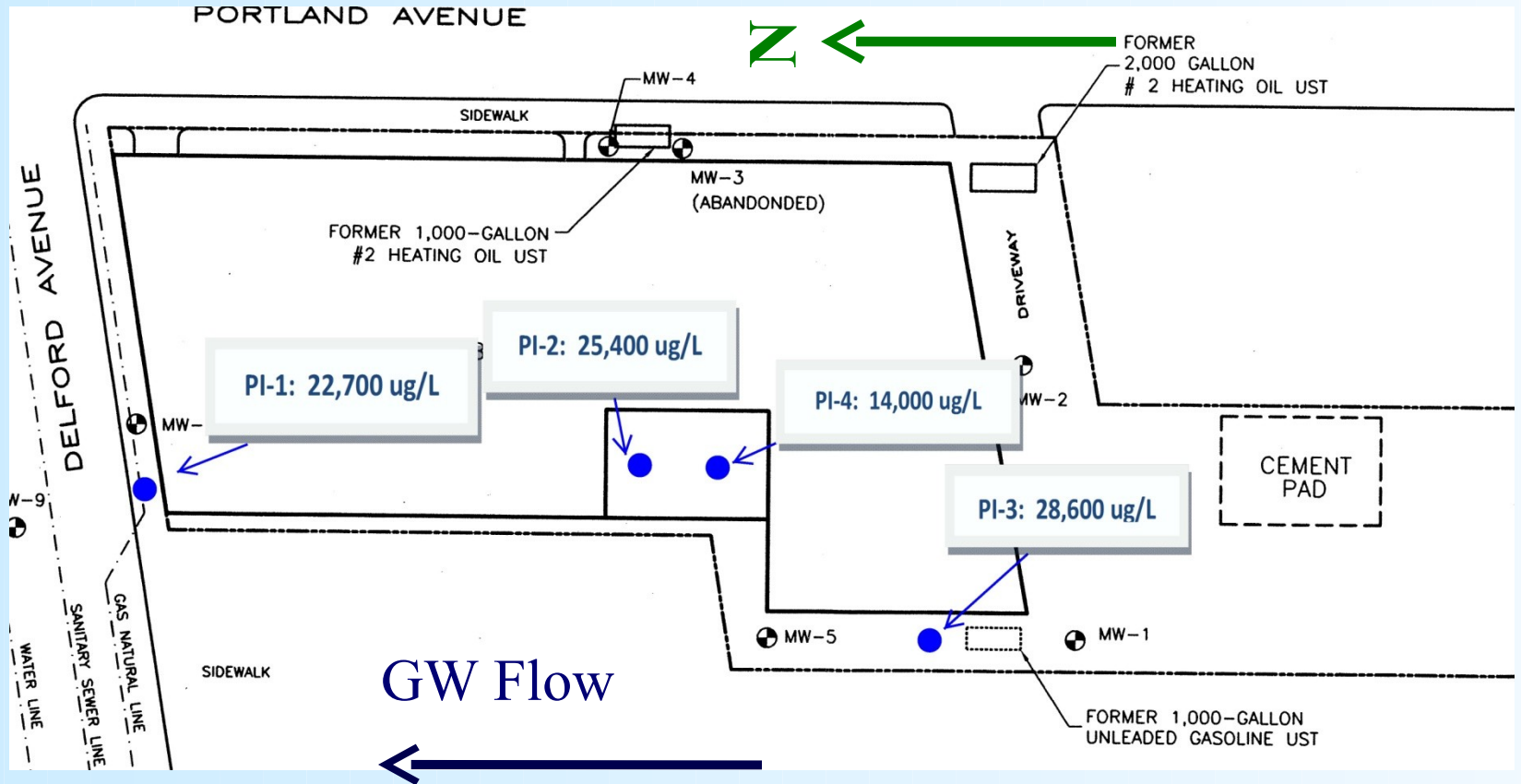
# Areas of Concern



# Remedial Alternatives

- Site was eligible for an NJDEP Hazardous Discharge Site Remediation Fund (HDSRF) grant for alternative technologies
  - Fund will pay up to 25% of total investigation/remediation cost
- Sodium persulfate chosen as alternative technology

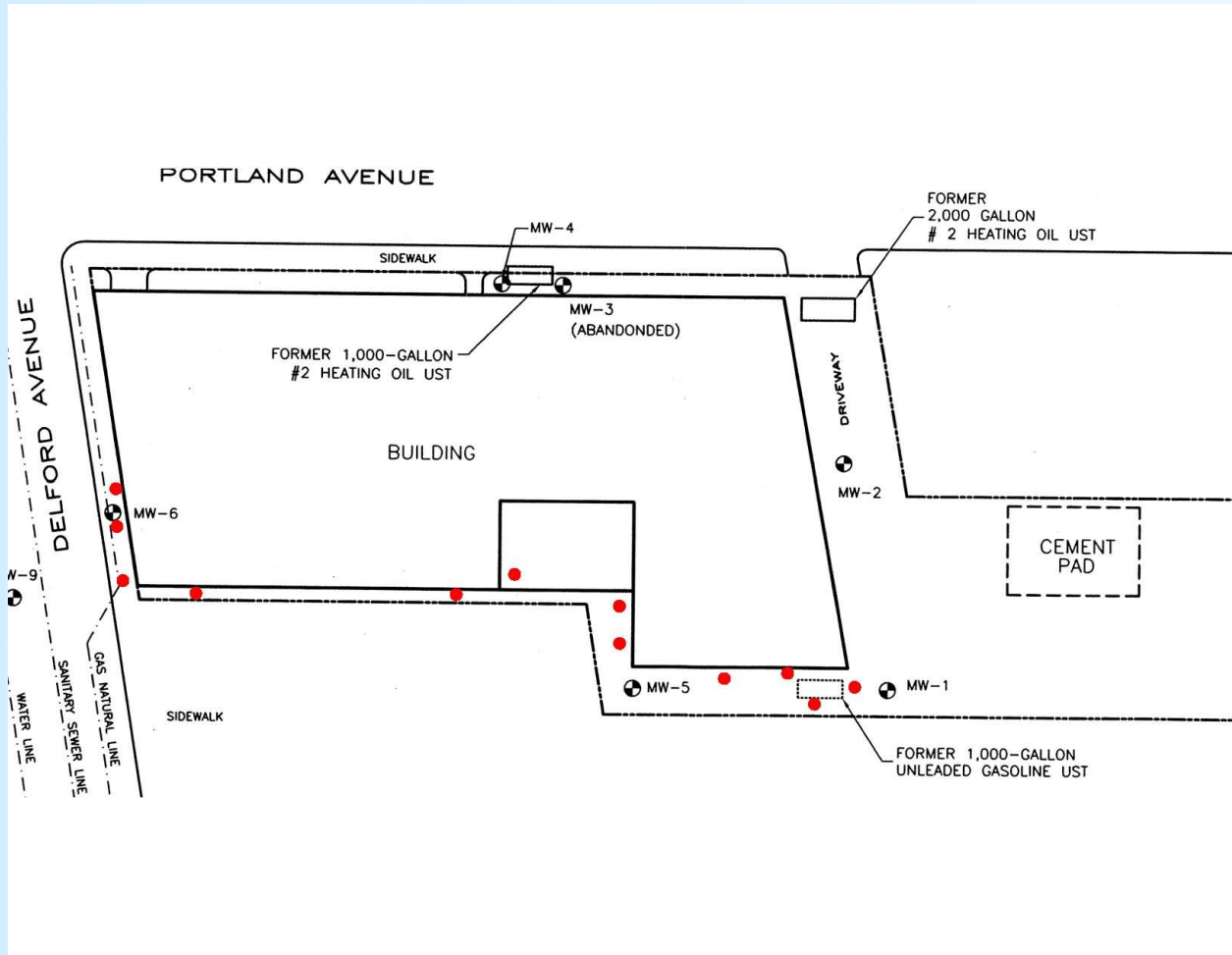
# Pre-Injection Data - Total BTEX



# Oxidant Injection Round 1

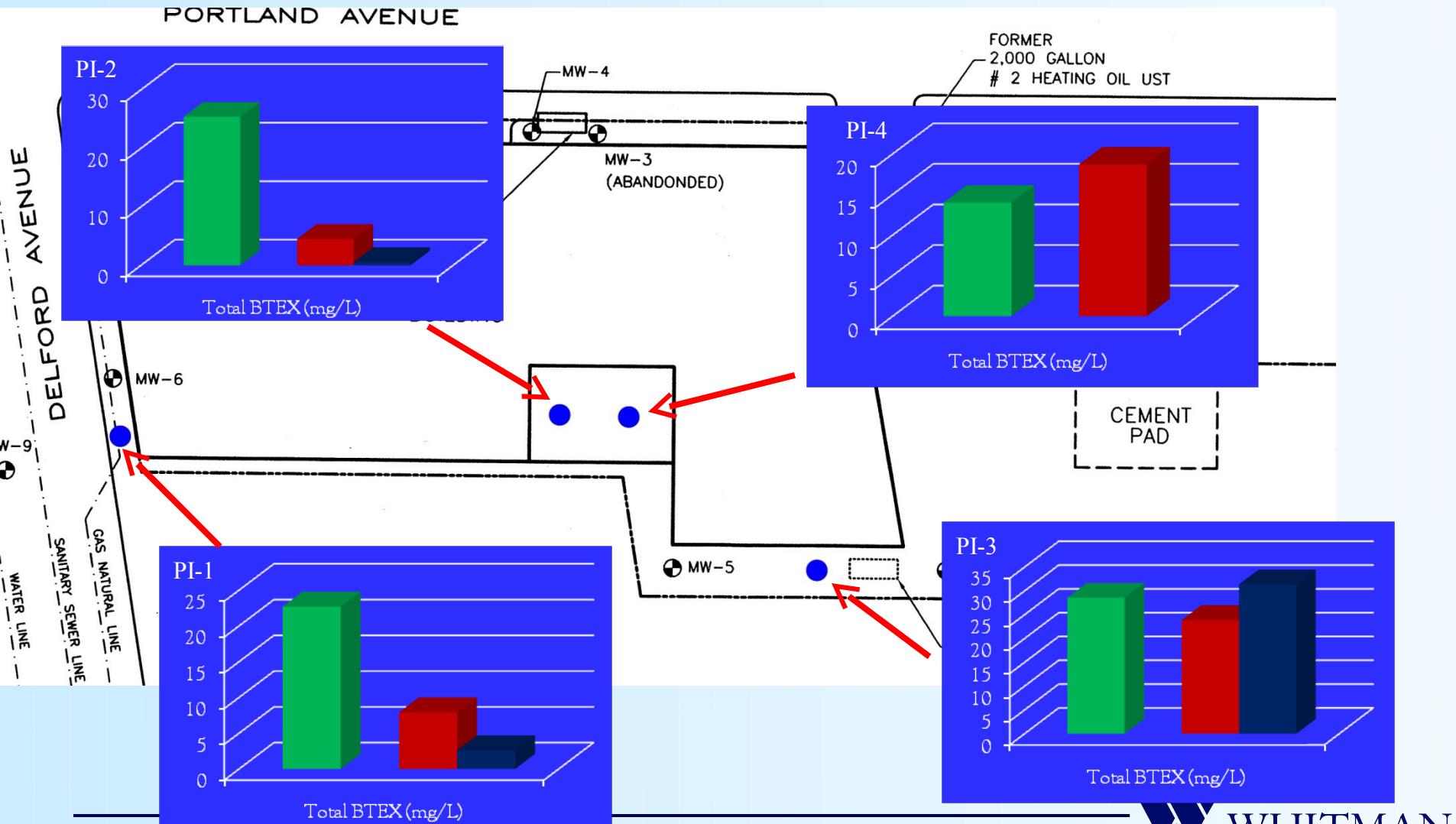
- 12 injection points via GeoProbe
- Concentrated around tank/product areas
  - 4360 gallons 25% sodium persulfate solution
  - 7273 lbs persulfate
- Performed post injection monitoring 2 weeks and 6 weeks following injection

# Round 1 Injection Locations





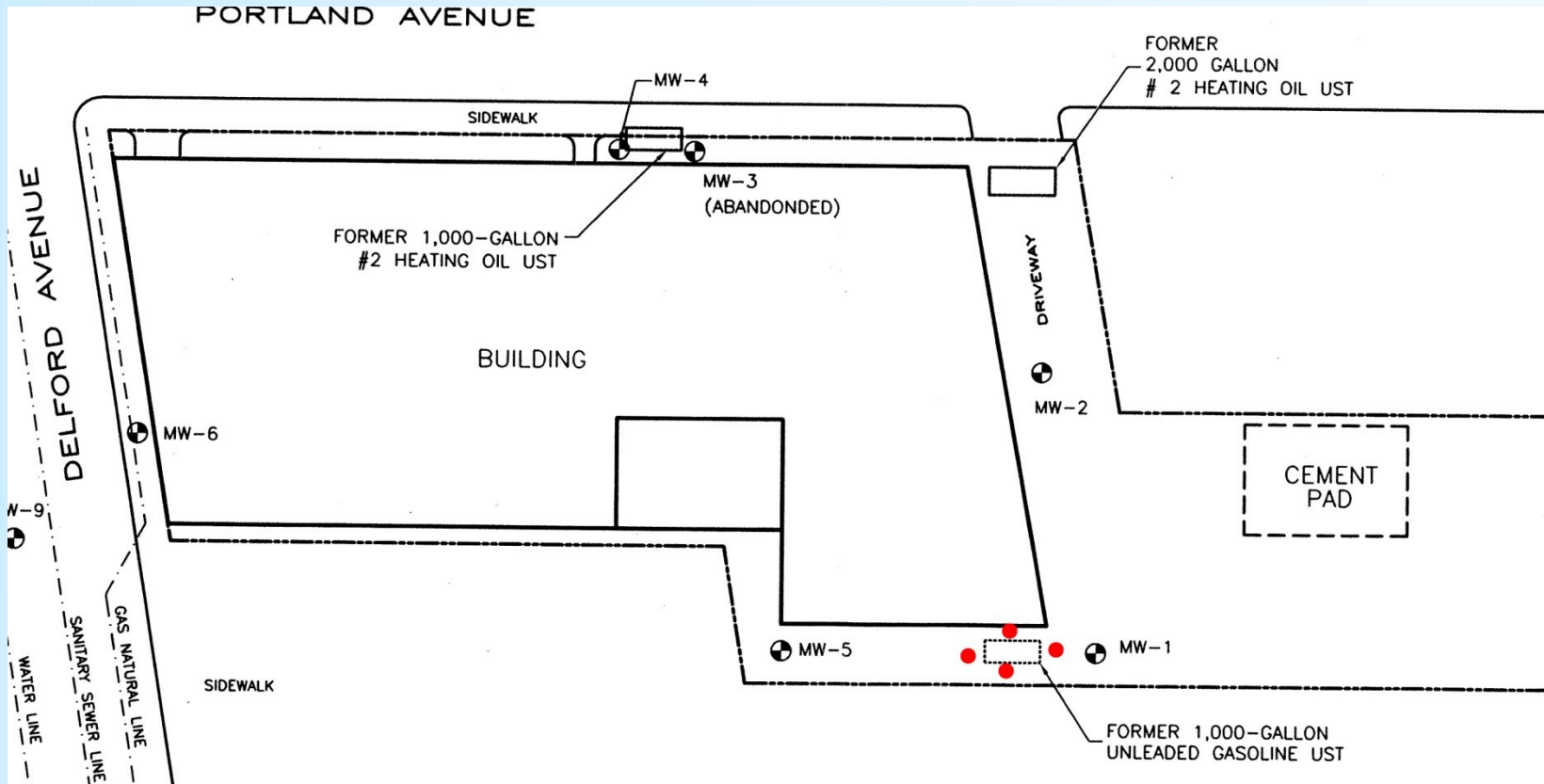
# Data Post Injection 1



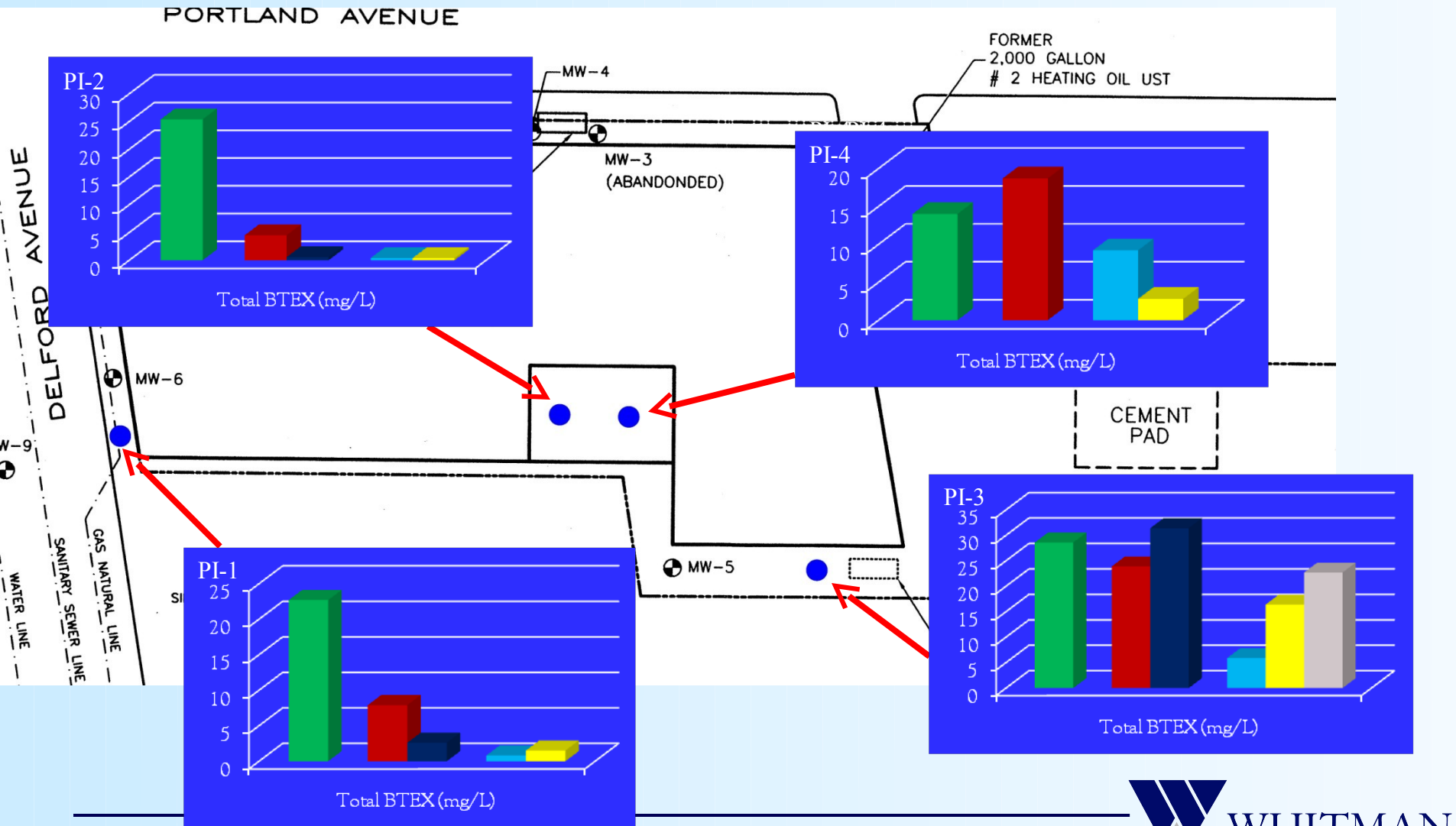
# Oxidant Injection Round 2

- 3 months after first injection
- 4 injection locations
- Concentrated around former 1,000 gal gasoline UST and basement
  - 790 gallons 28% sodium persulfate solution
- Performed post injection monitoring 3 weeks, 7 weeks and 7 months following injection

# Round 2 Injection Locations



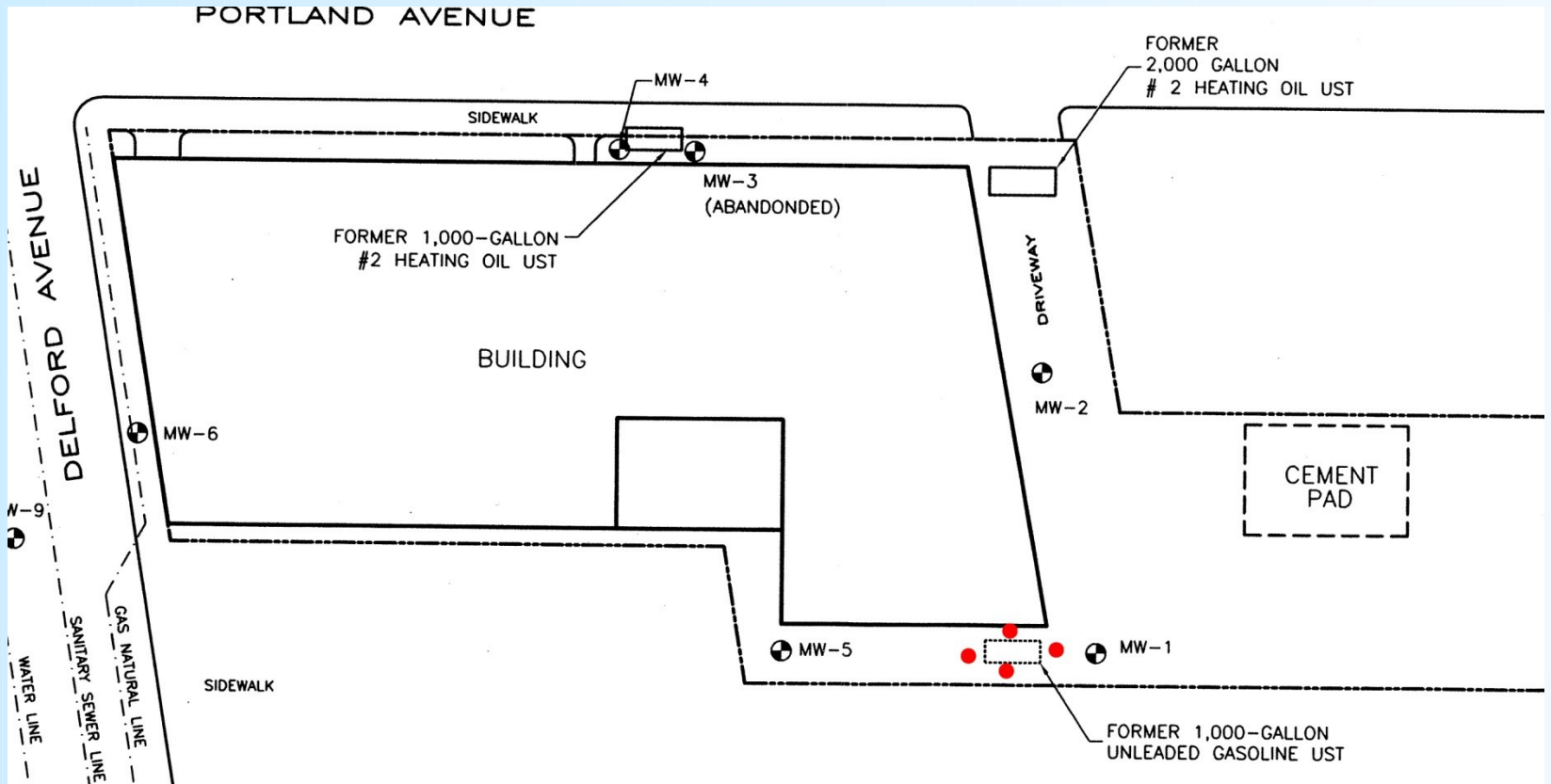
# Data Post Injection 2



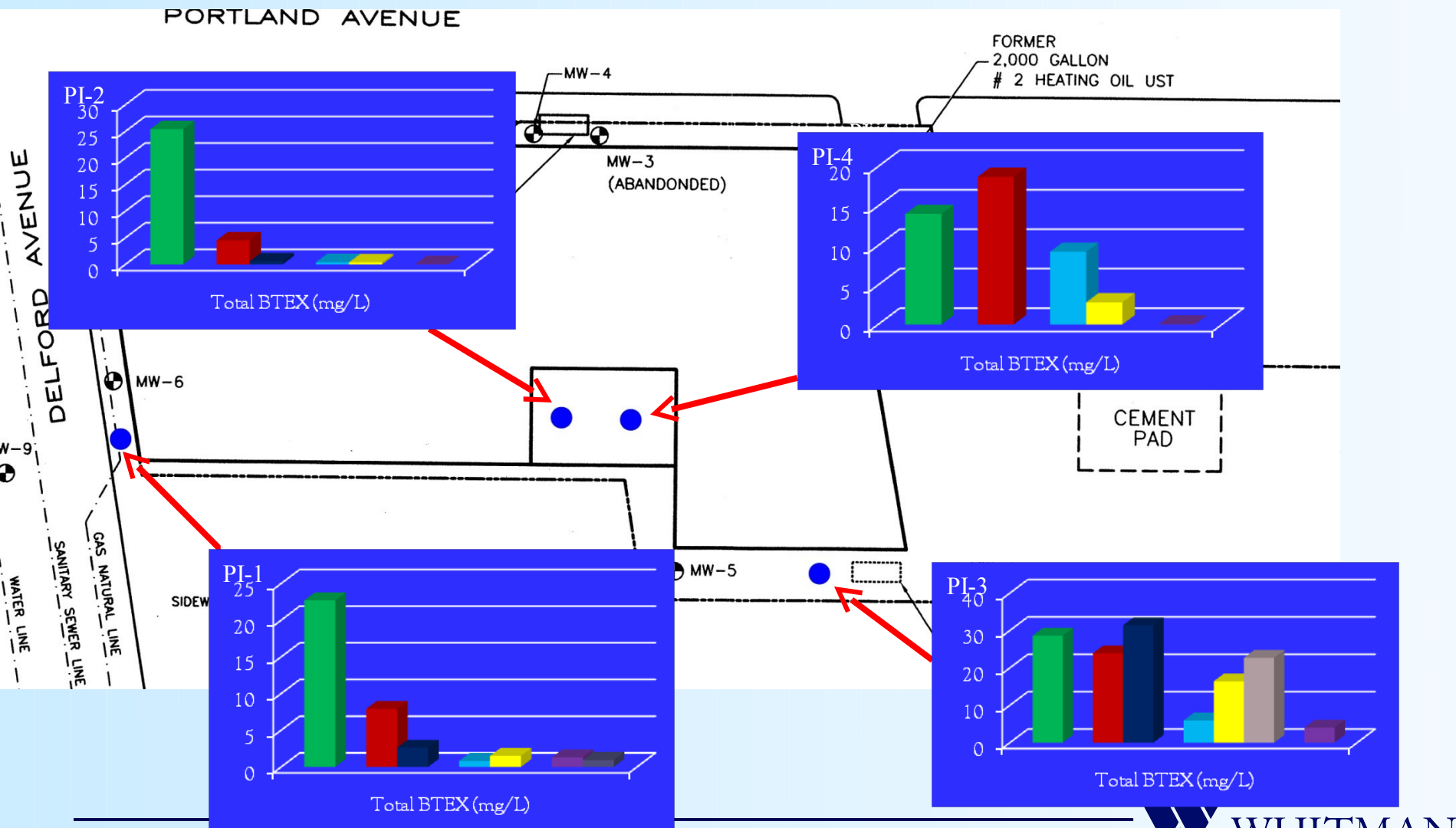
# Oxidant Injection Round 3

- 7 months after second injection
- 4 injection locations
- Concentrated around former 1,000 gal gasoline UST and basement
  - 1,210 gallons 25% sodium persulfate solution
- Performed post injection monitoring 2 weeks, 8 weeks and 8 months following injection

# Round 3 Injection Locations



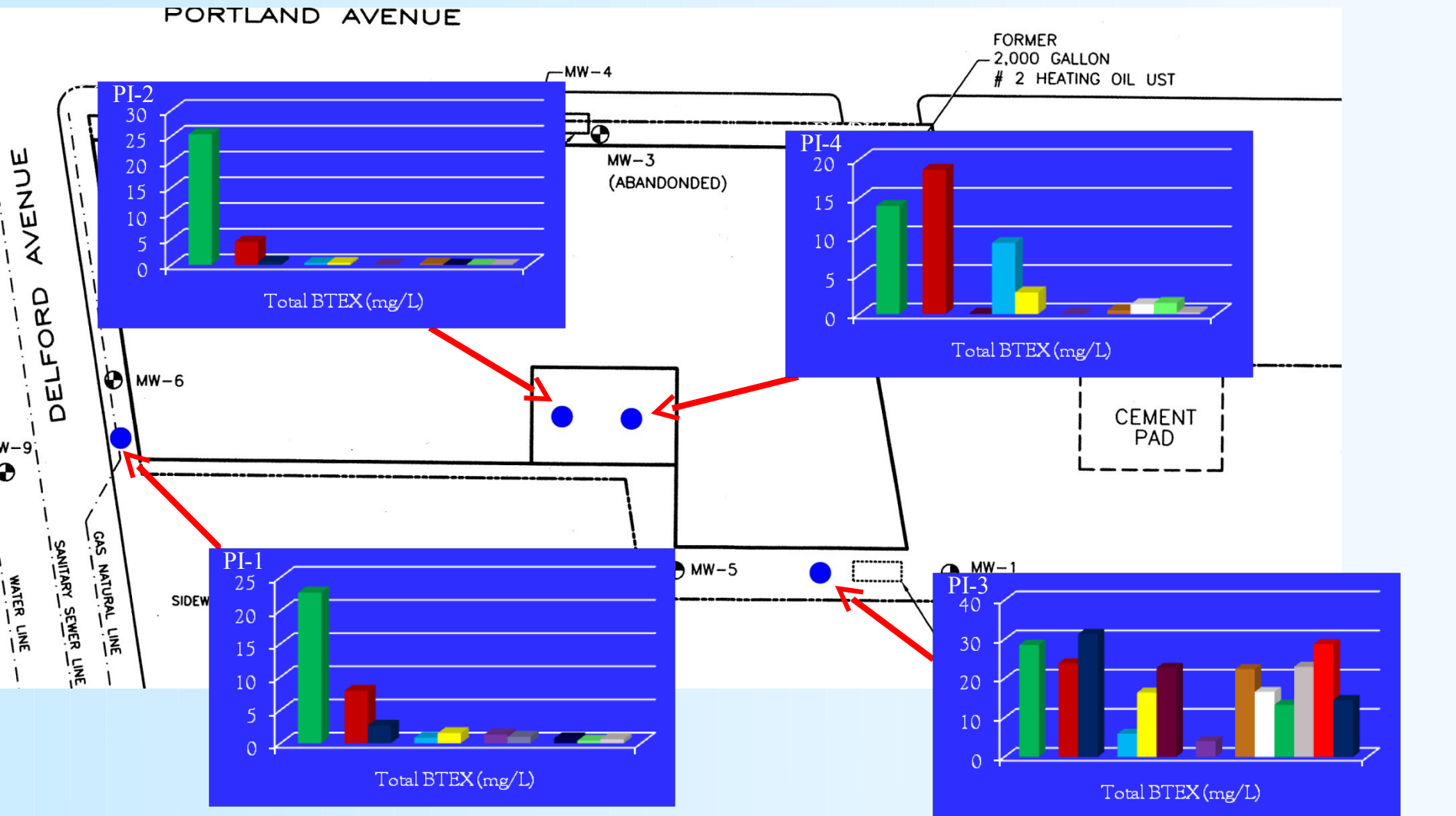
# Data Post Injection 3



# Bioaugmentation

- Ground water analysis for microbial counts (D A P I DNA staining ) ranged from  $1.54 \times 10^6$  –  $5.49 \times 10^6$  cells/ml
- Petrox<sup>TM</sup> (C L -Solutions, L L C )
  - Pseudomonas and “anti-oxidative” stress
- 3 injection points concentrated around 1,000 gallon gasoline U S T
- Performed post injection monitoring 2 weeks, 7 weeks, 5 months and 1 year

# Data Post Bioaugmentation



# Results

	CONTAMINANT REDUCTION			
	INJECTION			BIOAUGMENTATION
	1	2	3	
<b>PLUME</b>				
PI-1	88.5%	93.4%	95.8%	97.4%
PI-2	97.8%	98.5%	99.9%	100%
PI-4	-33.6%	80.0%	100.0%	98.5%
<b>SOURCE AREA</b>				
PI-3	-9.8%	20.6%	86.0%	49.3%

# Conclusion



- Combination of chemical oxidation/bioaugmentation effectively treated constituents within the contaminant plume
- **Vapor intrusion no longer concern**
- Currently planning monitored natural attenuation
- Source area may require additional treatment