Operational Risk Control & Adaptive Change Management During an Accelerated In-Situ Thermal Treatment Schedule

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Project Site

Target Treatment Area (TTA)

Geology: silty clay Glacial till deposits that overlay highly variable dolomite bedrock
Vadose Zone (Groundwater >50' Bgs)

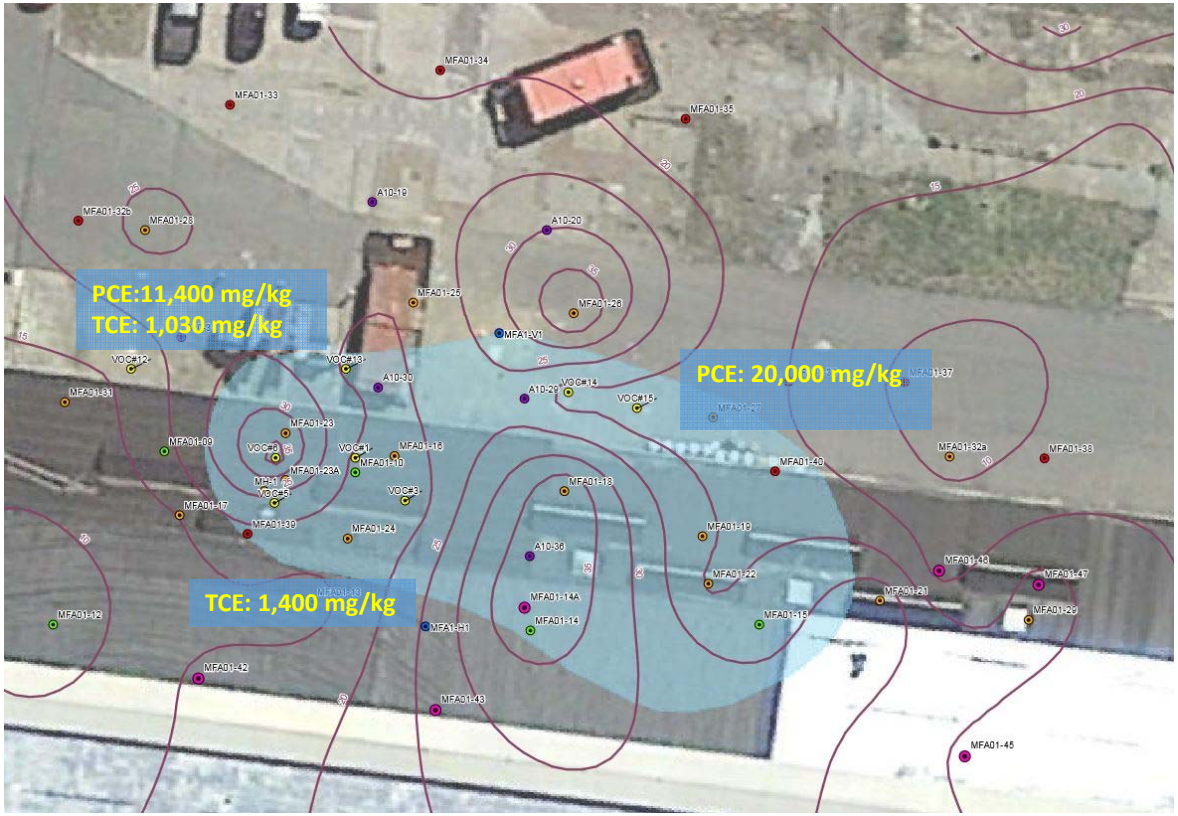
Contaminants of Concern (COC)

Tetrachloroethene (PCE)

Maximum concentrations- 20,000 (mg/kg)
Mean Concentrations – 680 (mg/kg)

Trichloroethene (TCE)

Maximum concentrations- 1,400 (mg/kg)
Mean Concentrations – 35 (mg/kg)



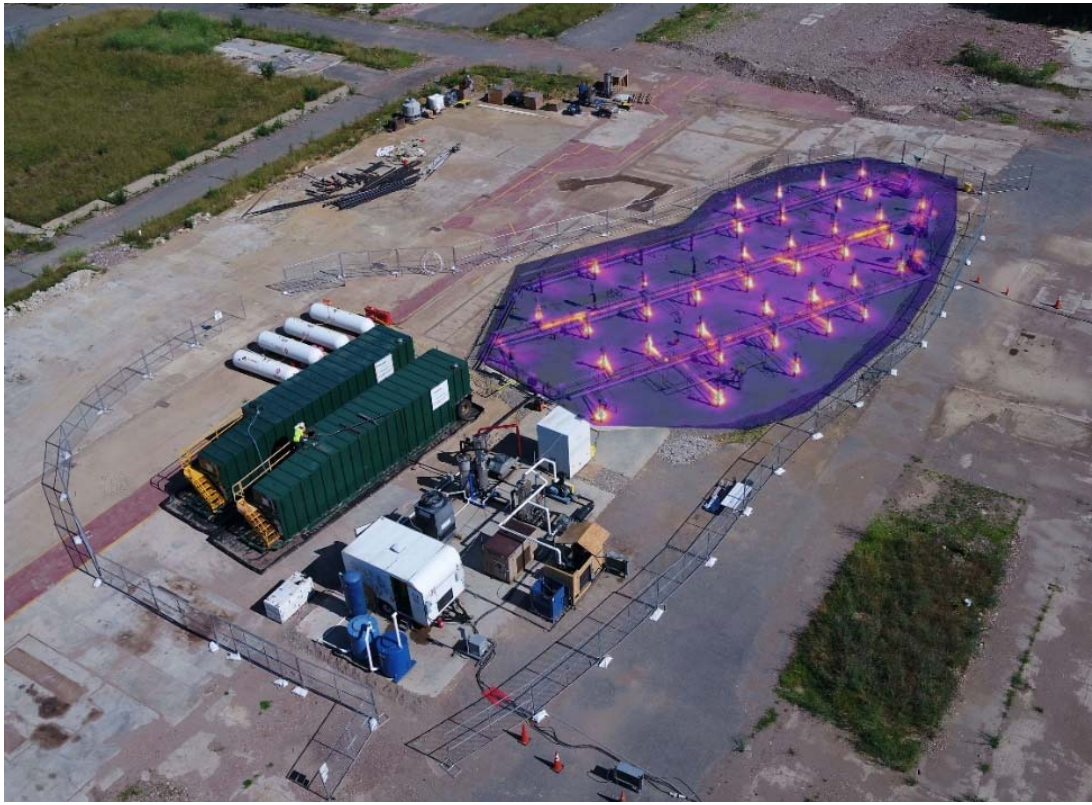
Remedial Goals

Defined in the RAP

- Mean reduction in soil PCE and TCE concentration of 75% throughout the TTZ;
- Single point soil PCE and TCE concentration reduction of at least 75% for soil sample locations where pre-remediation concentrations exceeded 1,000 ppm;
- Single point soil PCE and TCE concentration reduction of at least 50% for soil sample locations where pre-remediation concentrations were 1,000 ppm or less.
- Maintain site redevelopment schedule.

Remedial Technology

- **In Situ Thermal Remediation**: Thermal Conduction Heating (TCH) powered by liquified petroleum gas in temporary onsite tanks.
- **Vapor Extraction & Treatment**: Extraction from wells at three vertical intervals throughout the treatment zone to remove volatilized contaminants and in-situ steam while maintaining pneumatic control. A condensation-based vapor treatment unit with granular activated carbon was deployed.
- **Water Treatment**: Condensed liquids from the steam-laden extracted vapor was collected and treated onsite, pending offsite non-haz disposal.



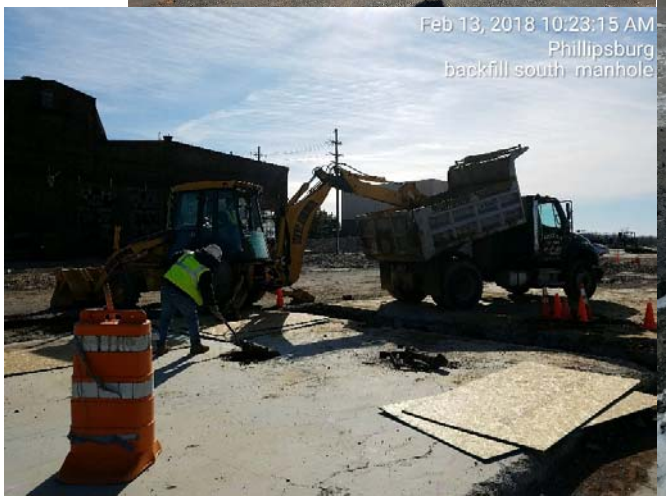
Challenge – Subsurface Utilities

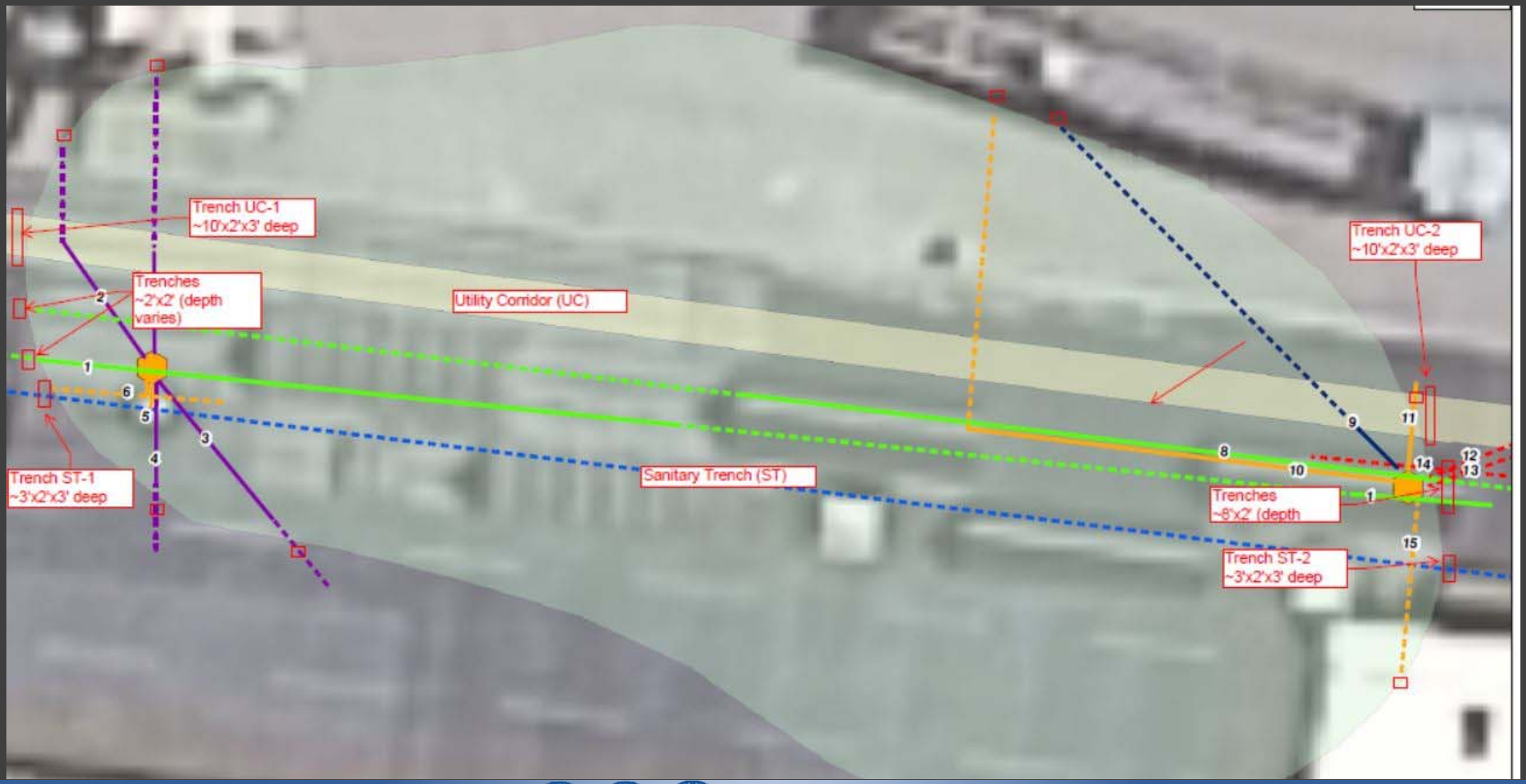
- Concern: Vapor Migration

- Utilized historical facility master map

- Conducted GPR/ Line Tracing

- Utility Abandonment Proceure




Trench UC-1
~10'x2'x3' deep
Trenches
~2'x2' (depth
varies)
Utility Corridor (UC)
Trench UC-2
~10'x2'x3' deep
Trench ST-1
~3'x2'x3' deep
Sanitary Trench (ST)
Trenches
~8'x2' (depth
Trench ST-2
~3'x2'x3' deep
1
2
3
4
5
6
8
9
10
11
12
13
14
15

Challenge - Energy

Utility Restrictions at Site

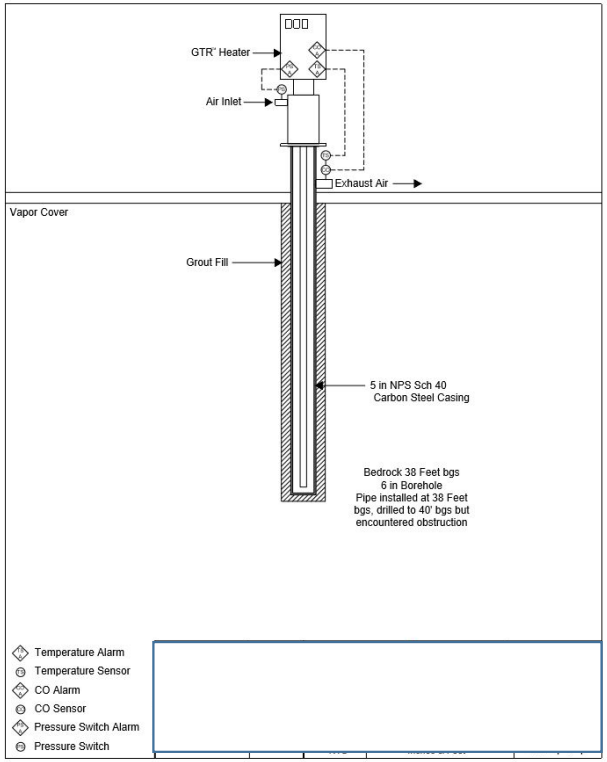
Majority of utilities were disconnected

- No Electricity
- No Natural Gas
- Water > 300 ft away
- No Sewer

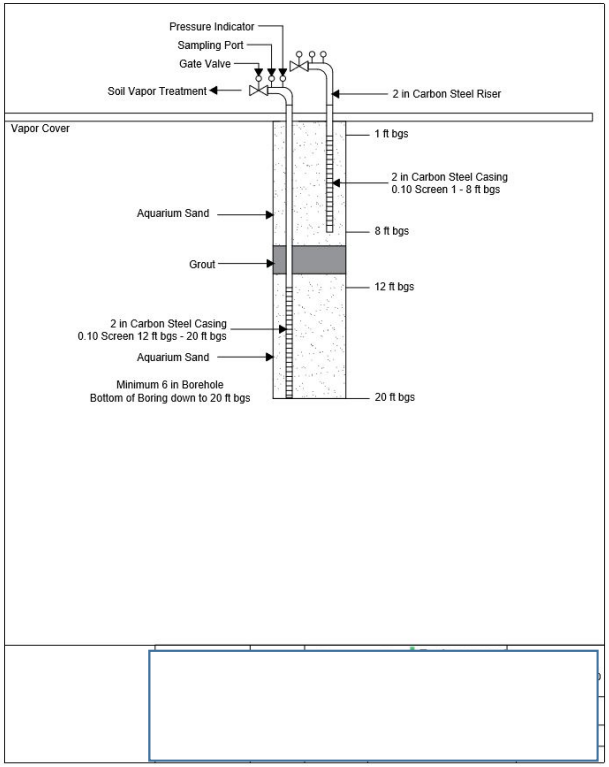
Propane was chosen for accessibility and affordability.

Remedial Design

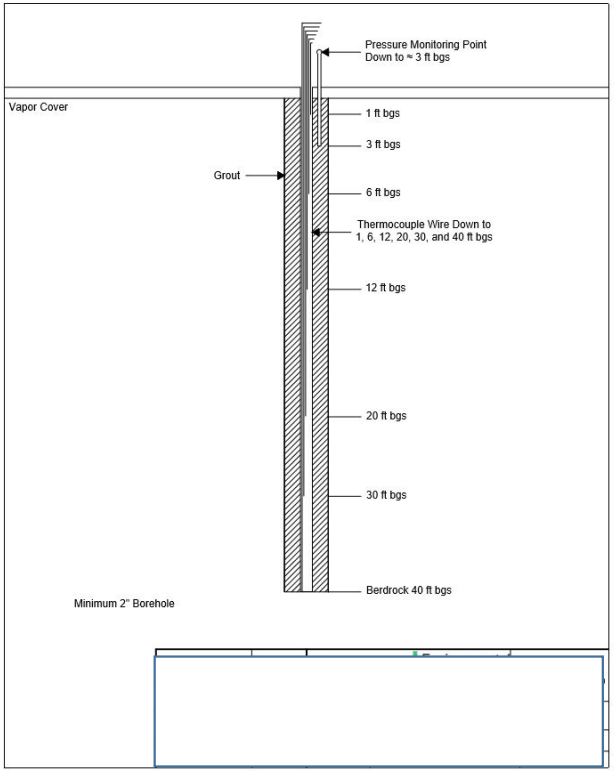
Thermal Conductive Heater (TCH)



Dual - Nested Soil Vapor Extraction



Temperature Pressure Monitoring Point (TPMP)



SAME

DCHWS

Design and Construction Issues at Hazardous Waste Sites

March 29, 31 and April 1, 2021

Results Summary

- Total of 117 Days of extraction

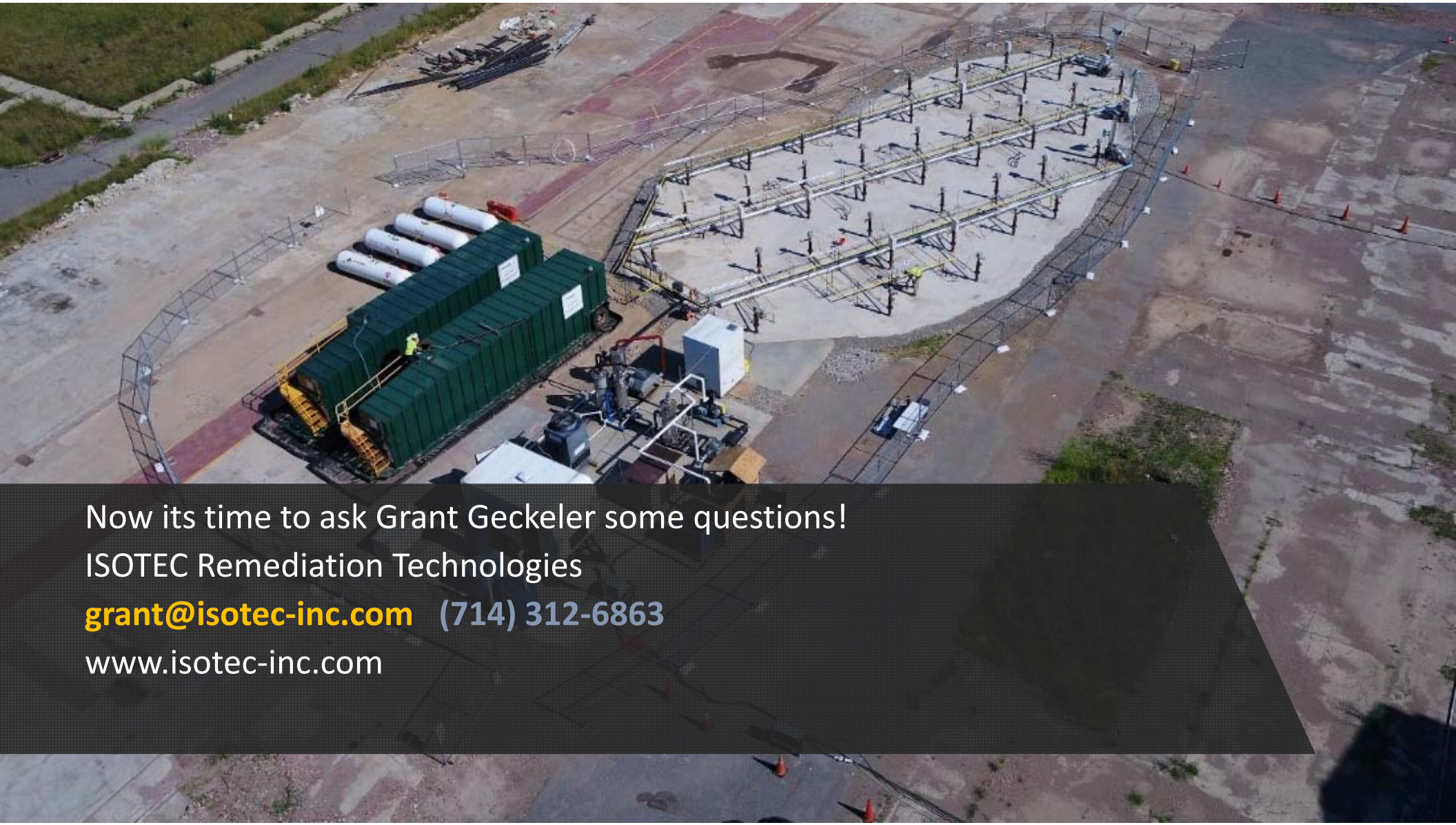
- COC Mass Removal:
  - 31,761 lbs. of PCE
  - 1,400 lbs. of TCE

-NAPL Footprint Lab Results:
  80% PCE
  19% TCE

-38,000 gallons of water produced

-Project Completed on time and on budget

Performance Parameters	Estimated	Actual	Difference (%)	Summary
Heating days	102	102	--	--
Total Fuel Usage (Gallon)	7.00E+05	7.89E+05	+12.7%	Slight overage due to more TCH linear footage than estimated TCH length
Total Electricity Usage (KWh)	4.91E+05	3.27E+04	-33.4%	Less electricity used than budgeted
Vapor Extraction Rate (CFM)	200-300	150-300	in range	Similar to estimation based on temperature evolution.
Accumulated Water (Gallon)	38,000	35,000-50,000	in range	Similar to estimation based on temperature evolution and vapor flow.



Now its time to ask Grant Geckeler some questions!

ISOTEC Remediation Technologies

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