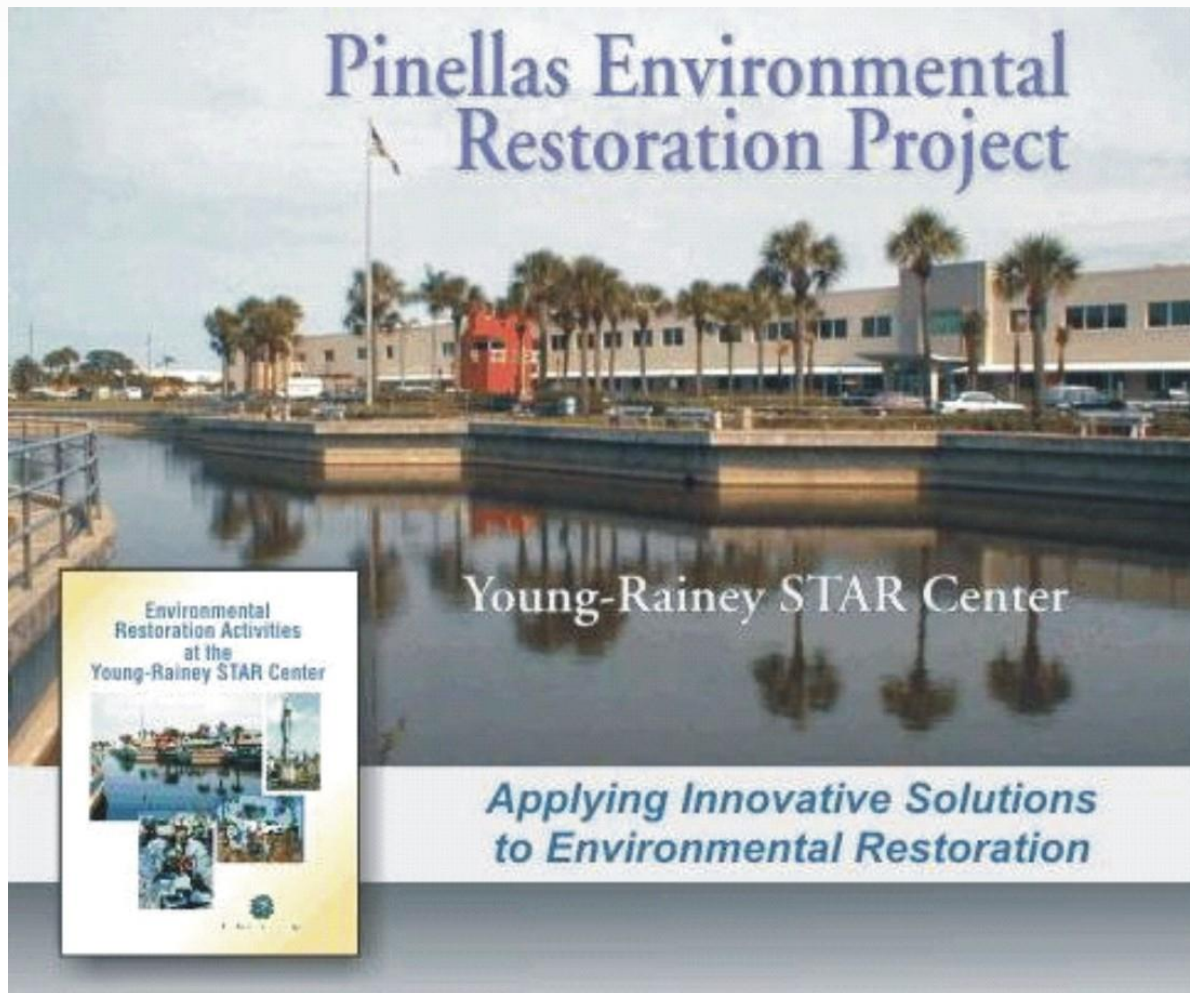


Young-Rainey STAR Centre ET-DSP™ Case Study



Case Study Outline

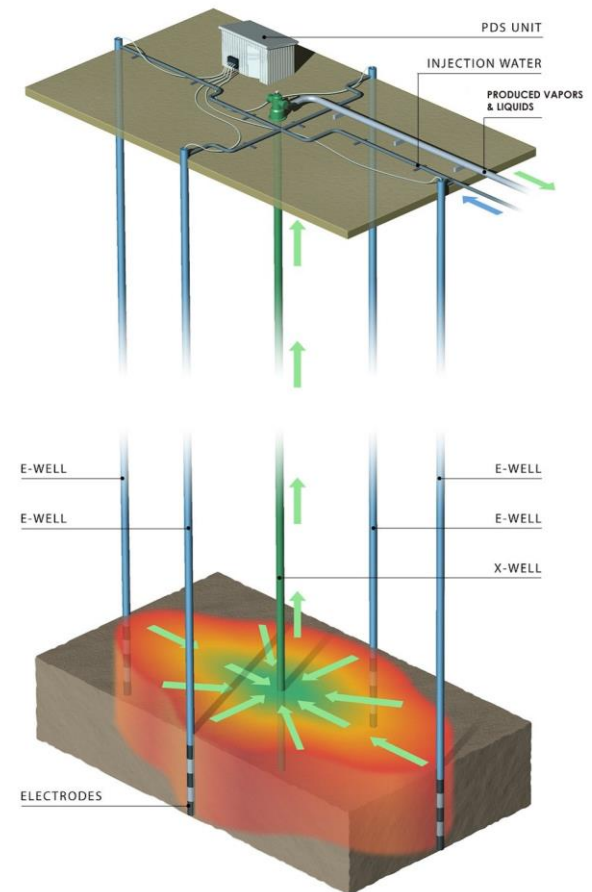
1. McMillan-McGee Background
2. Project Location
3. Background Information
4. Geologic Setting
5. Project Goals
6. ET-DSP™ System Design
7. Treatment System Design
8. Construction Phase
9. Operations & Maintenance
10. Results



McMillan-McGee (Mc²)



- Technology Company
 - ET-DSP™ Systems & services
 - Energy and Environmental
- 2,000 m² Facility
 - Manufacturing & testing
 - Thermal & electronics lab
- 100+ Years of experience in thermal remediation
- Completed >85 commercial thermal projects
- Fleet of 50 Power Delivery Systems
 - >40,000 kVA capacity



Mc² - Significant Accomplishments

- Operating the largest in-situ electro-thermal remediation project in the world
- Largest sole source DOE Contract ever awarded to a foreign national firm (Paducah GDP)
- >600,000+ cubic meters remediated
- Winner of the National Groundwater Association Project of the Year Award
- ET-DSP™ recognized as the 3rd viable process to recover bitumen from the Athabasca Oil Sands
- Zero recordable incidents 200,000+ M•hrs
- Winner of Deloitte 2010 Green 15 Award as one of Canada's leading GreenTech companies

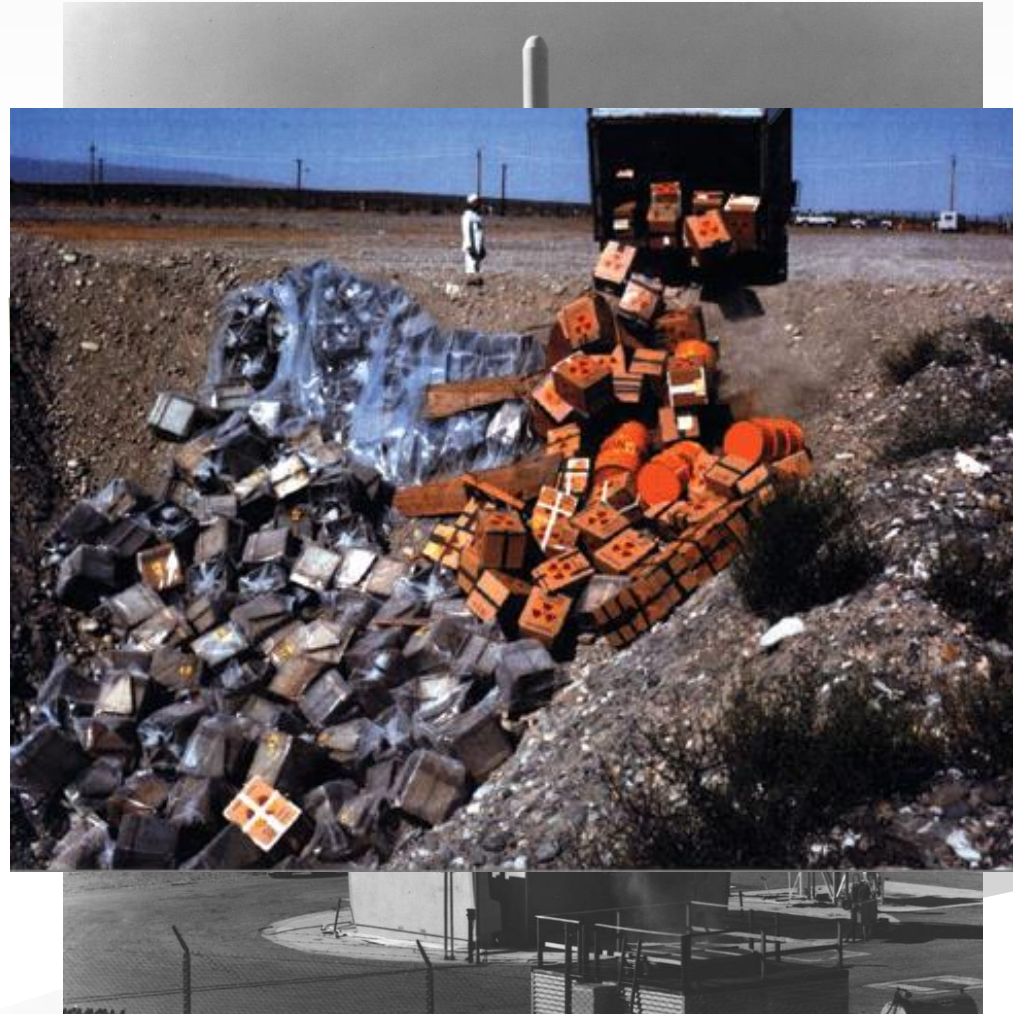


Project Location



Project Background

- US DOE Facility
 - Nuclear weapons research, development, and production
 - Constructed in 1950's
- LNAPL and DNAPL contamination
 - TCE, cis 1,2 DCE, Methylene Chloride, Toluene, TPH
 - Suspect waste handling
- DOE Legacy site, transition to STAR Center



Project Background

- Area: $\sim 4.000 \text{ m}^2$
- Depth: 10 - 12 m
- Volume: 44.000 m^3
- Groundwater table: 30 cm
- Mass Estimate: 6.900 kg
 - DNAPL
 - LNAPL



Hydrogeological Setting

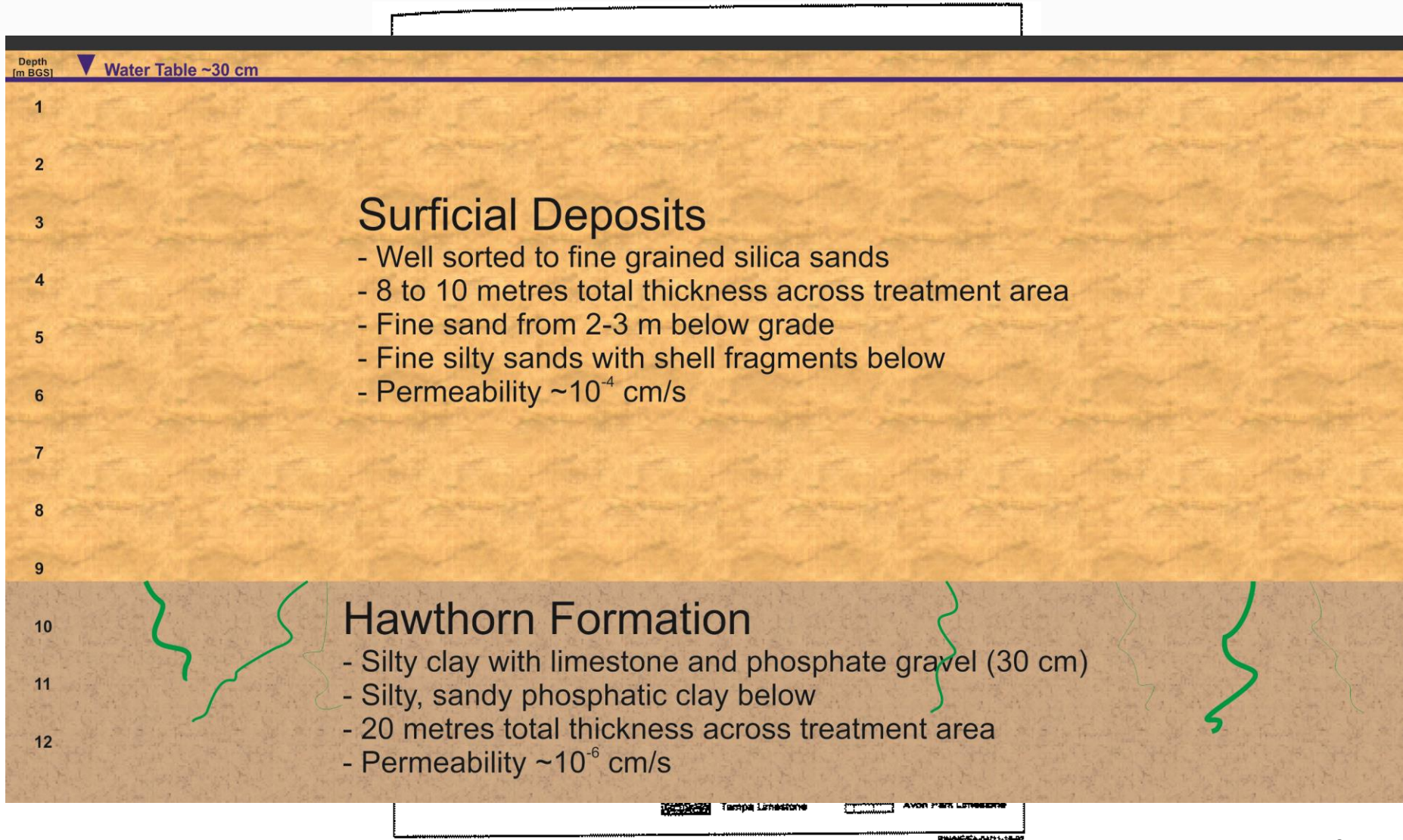


Figure 4.1. Generalized geologic cross section in the vicinity of the Pinellas Plant.

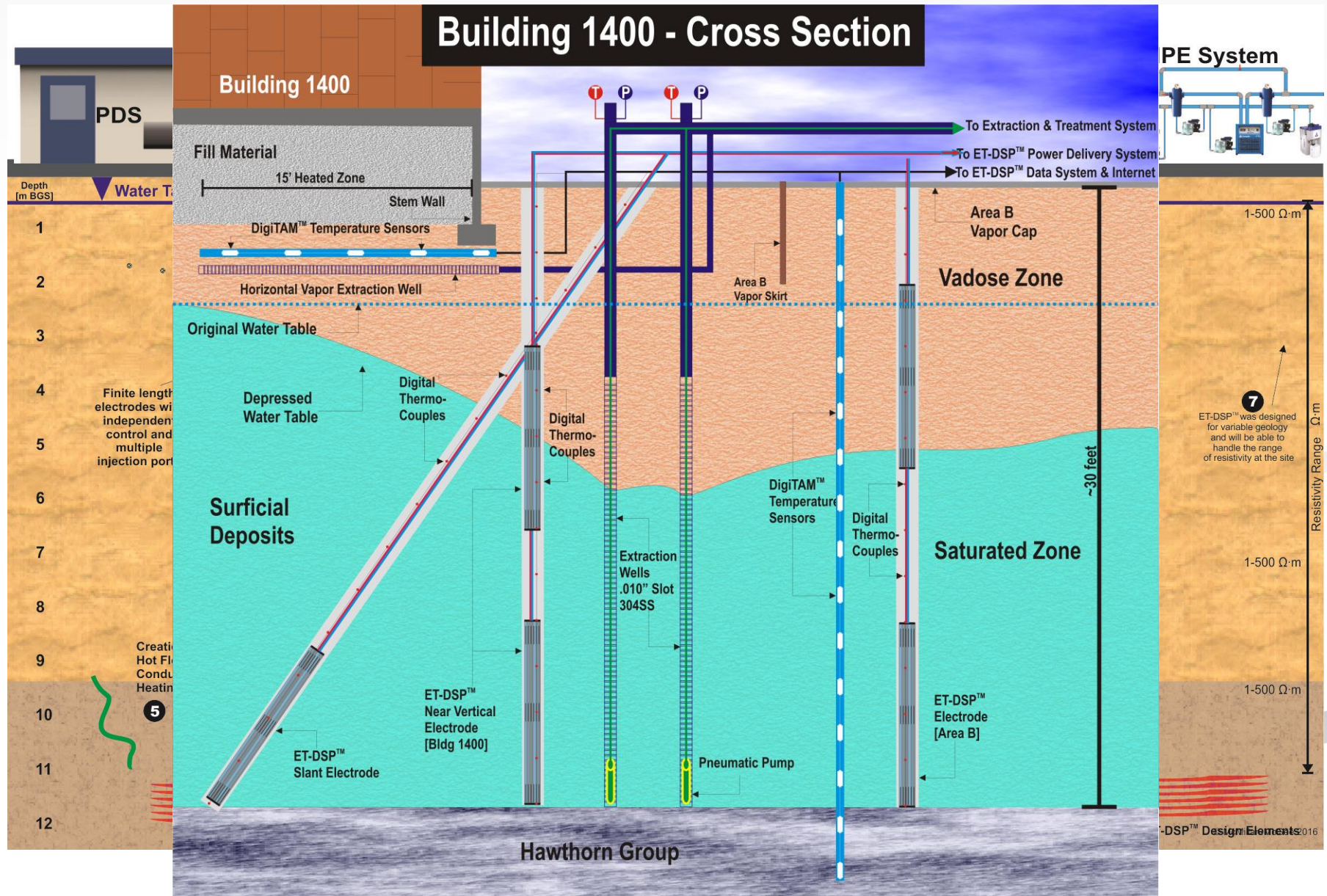
Project Goals

NAPL Component	Groundwater Goals (µg/L)	Soil Goals (mg/Kg)
TCE	11.000	20,4
cis-1,2-DCE	50.000	71
Methylene Chloride	20.000	227
Toluene	5.500	15
Petroleum Hydrocarbons	50.000	2.500

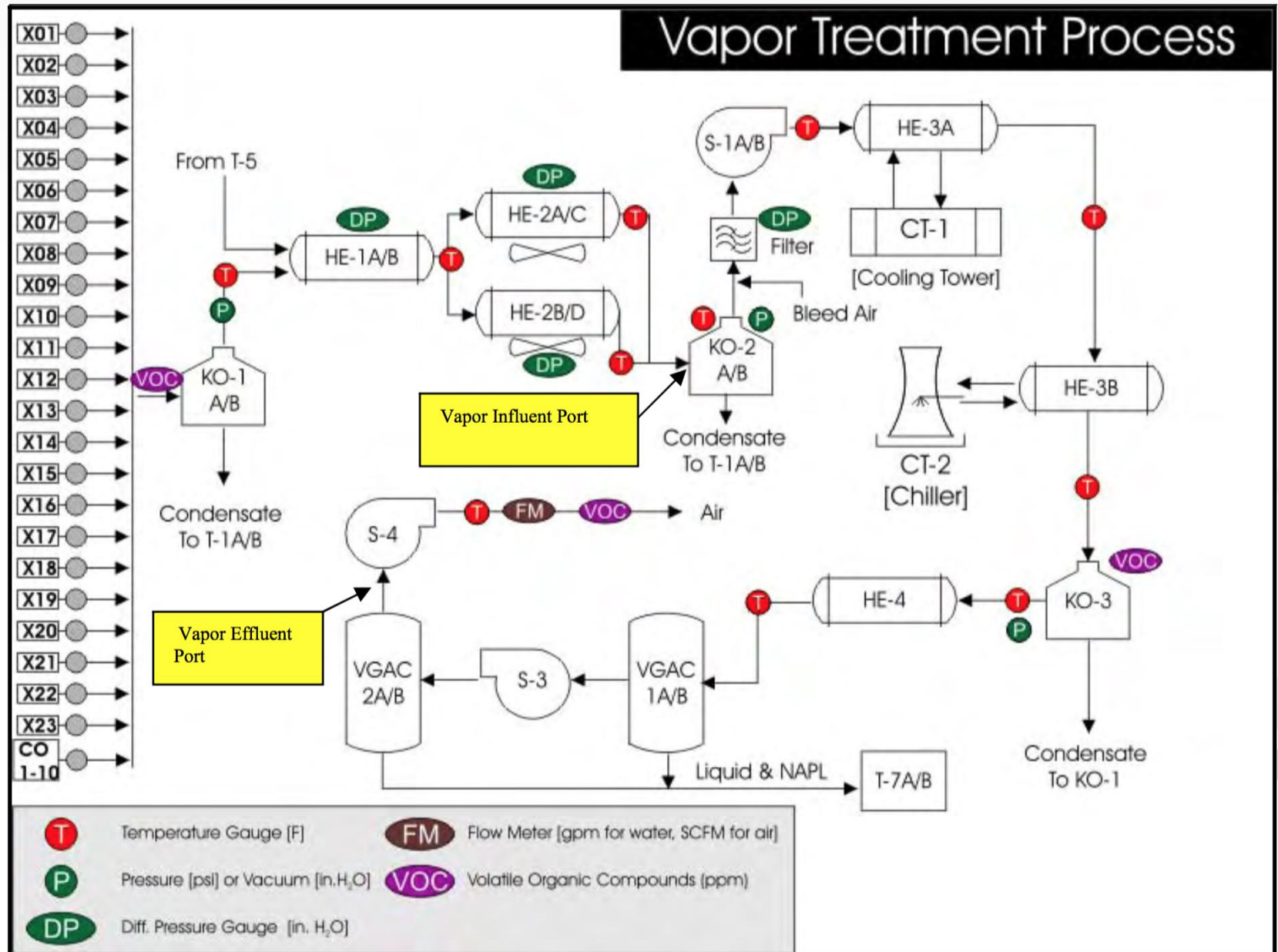
Secondary Goals

1. Post-treatment sampling: 6-12-24 weeks
2. Goals must be maintained over 3 sampling periods
3. 90 % Upper Confidence Limit
4. Maintain hydraulic control at all times
5. Maintain a minimum 85°C in treatment area
6. Maximum of 40°C outside of treatment area

ET-DSP™ System Design



Treatment System Design



Construction Phase - Drilling



Construction - Surface

PIPE SYSTEM

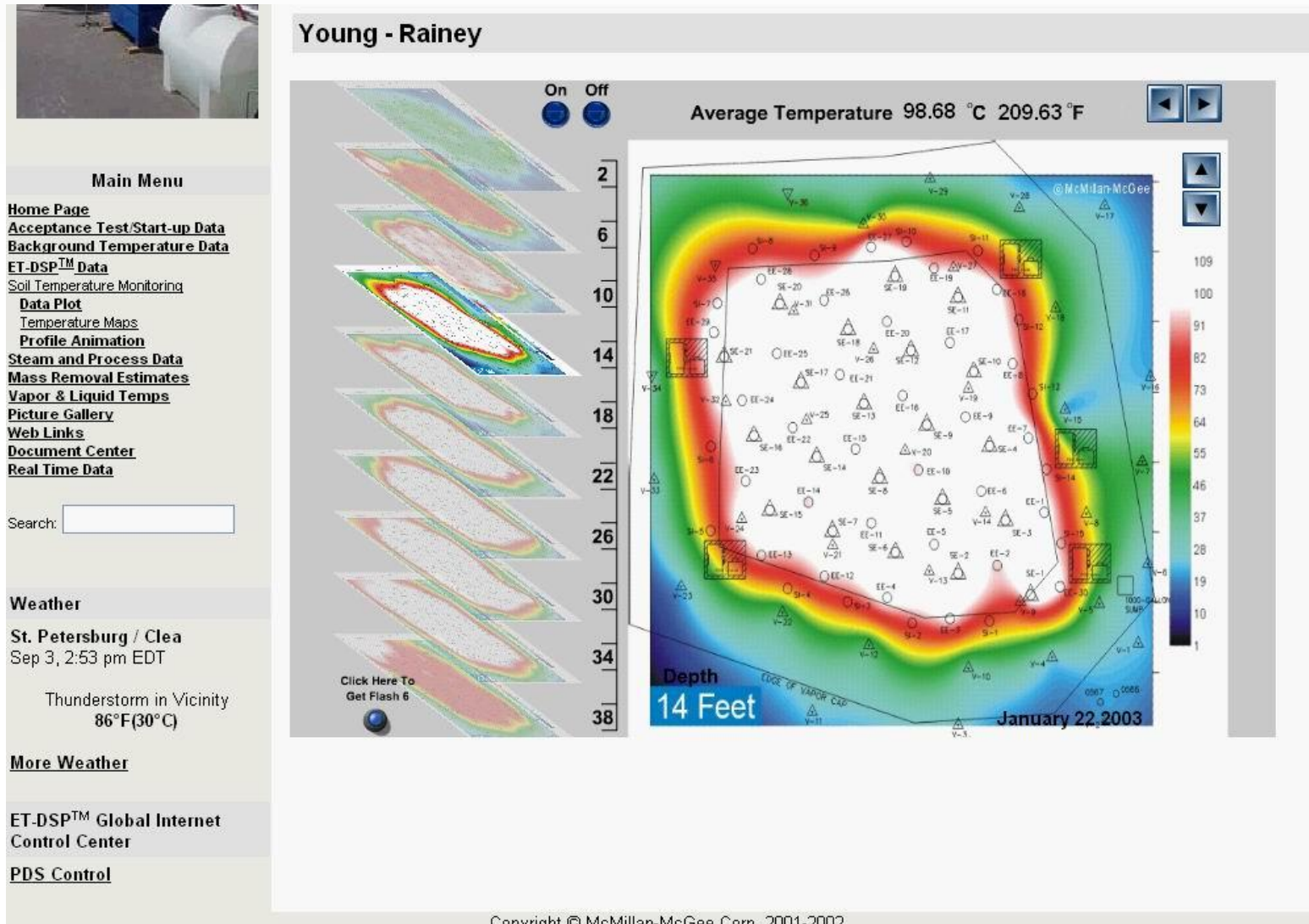
ELECTRICAL SYSTEM

TREATMENT SYSTEM



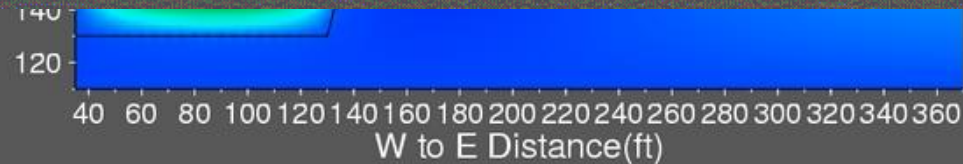
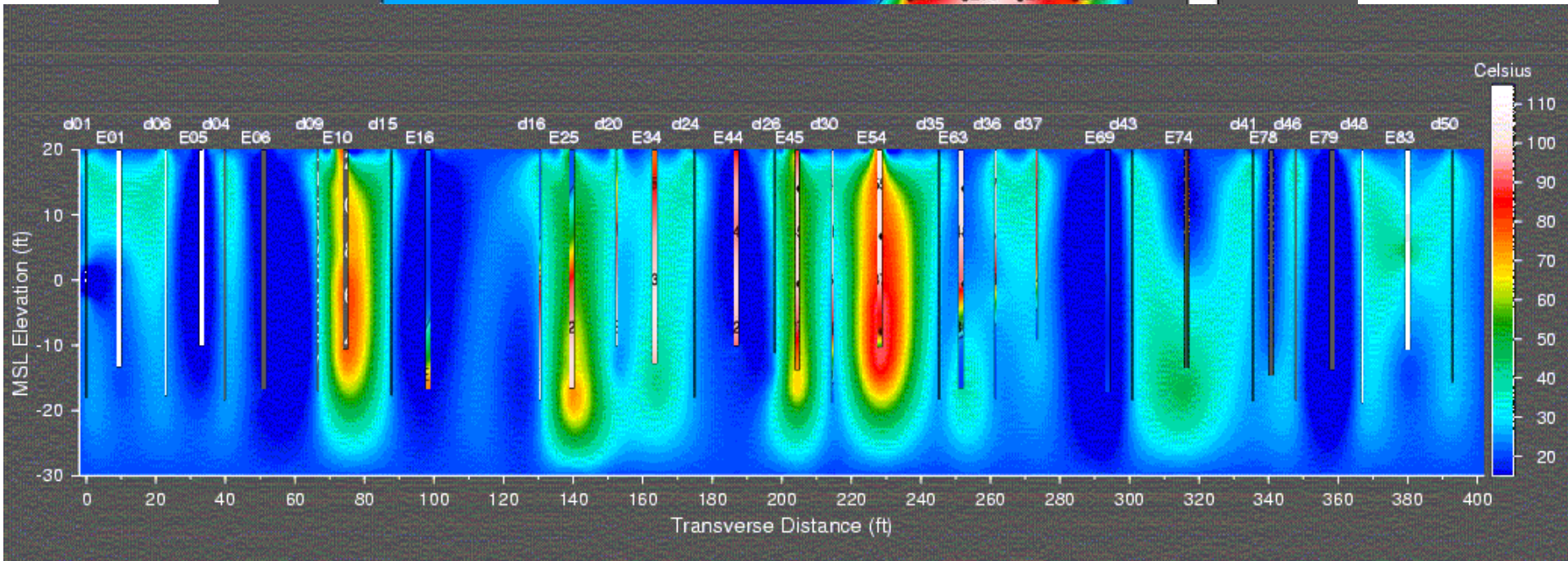
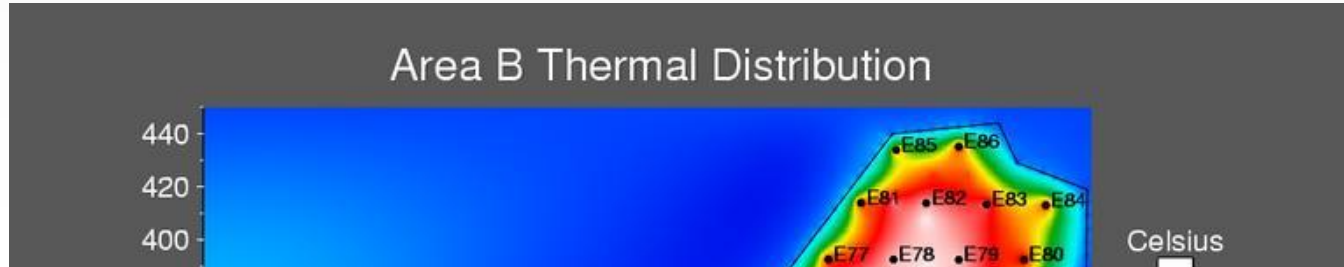
Operations

- Web-based control and display



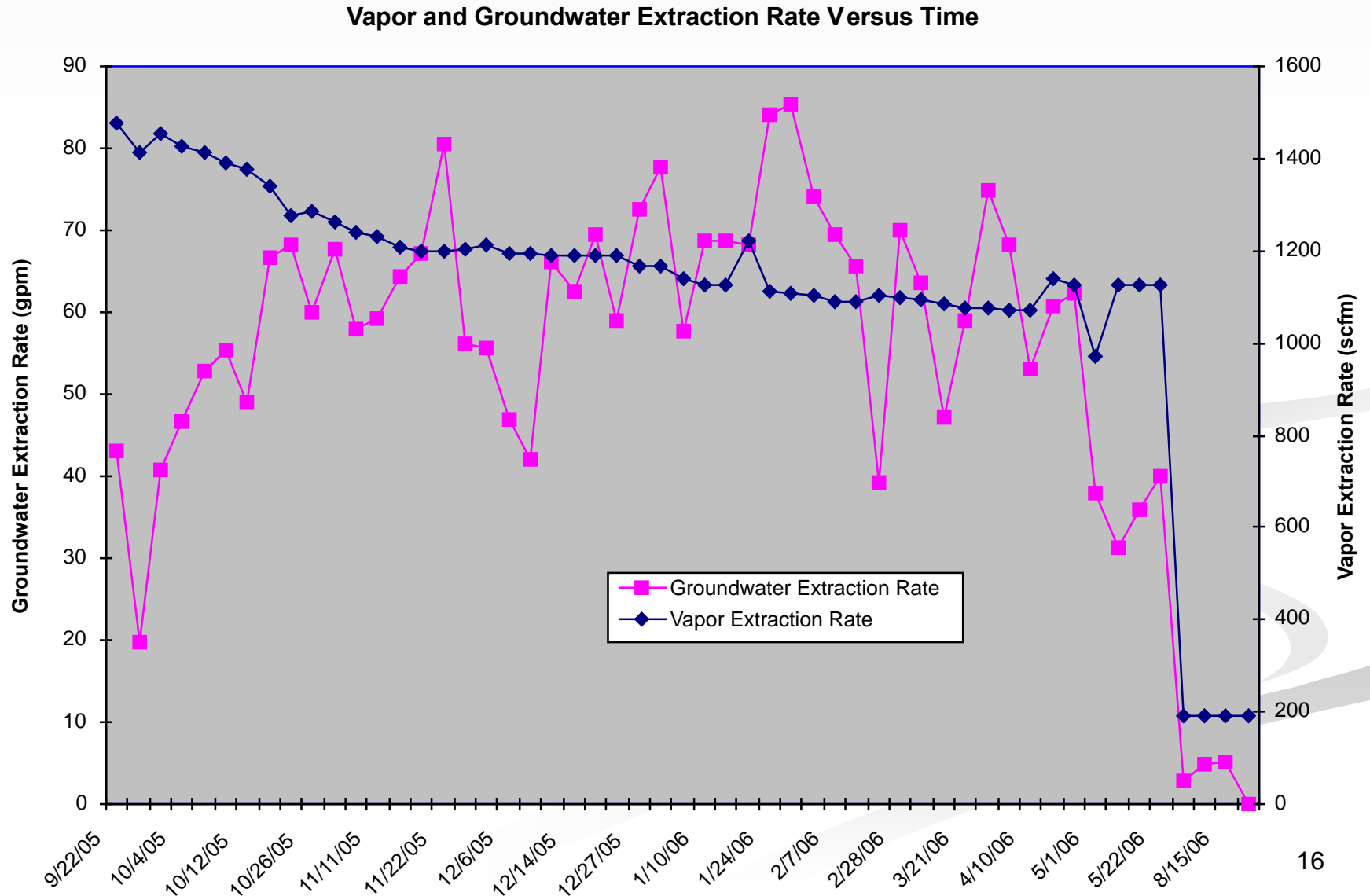
Operations

- Temperature Increase



Operations

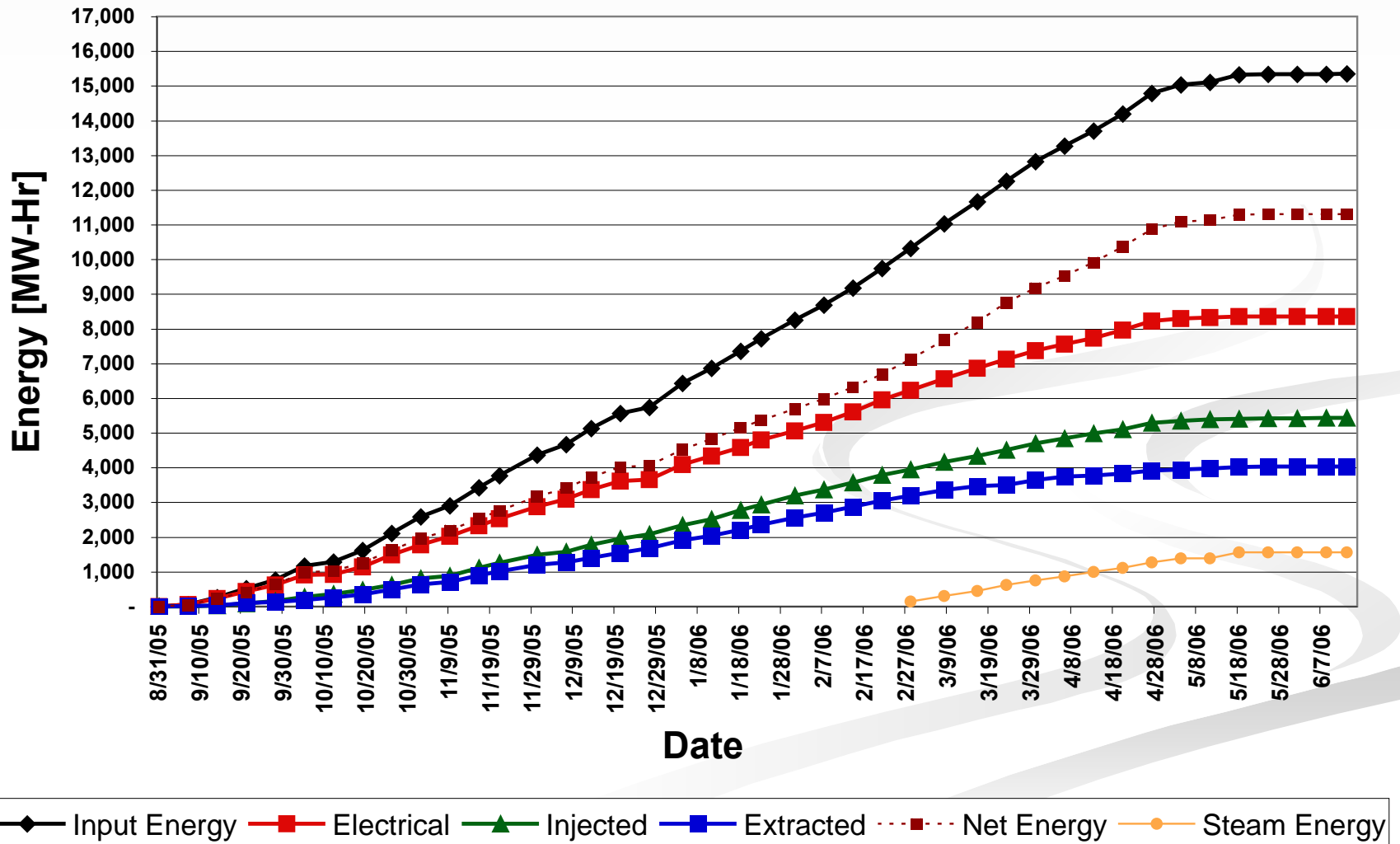
- Extraction Rates Over Time



Operations

- Energy Balance

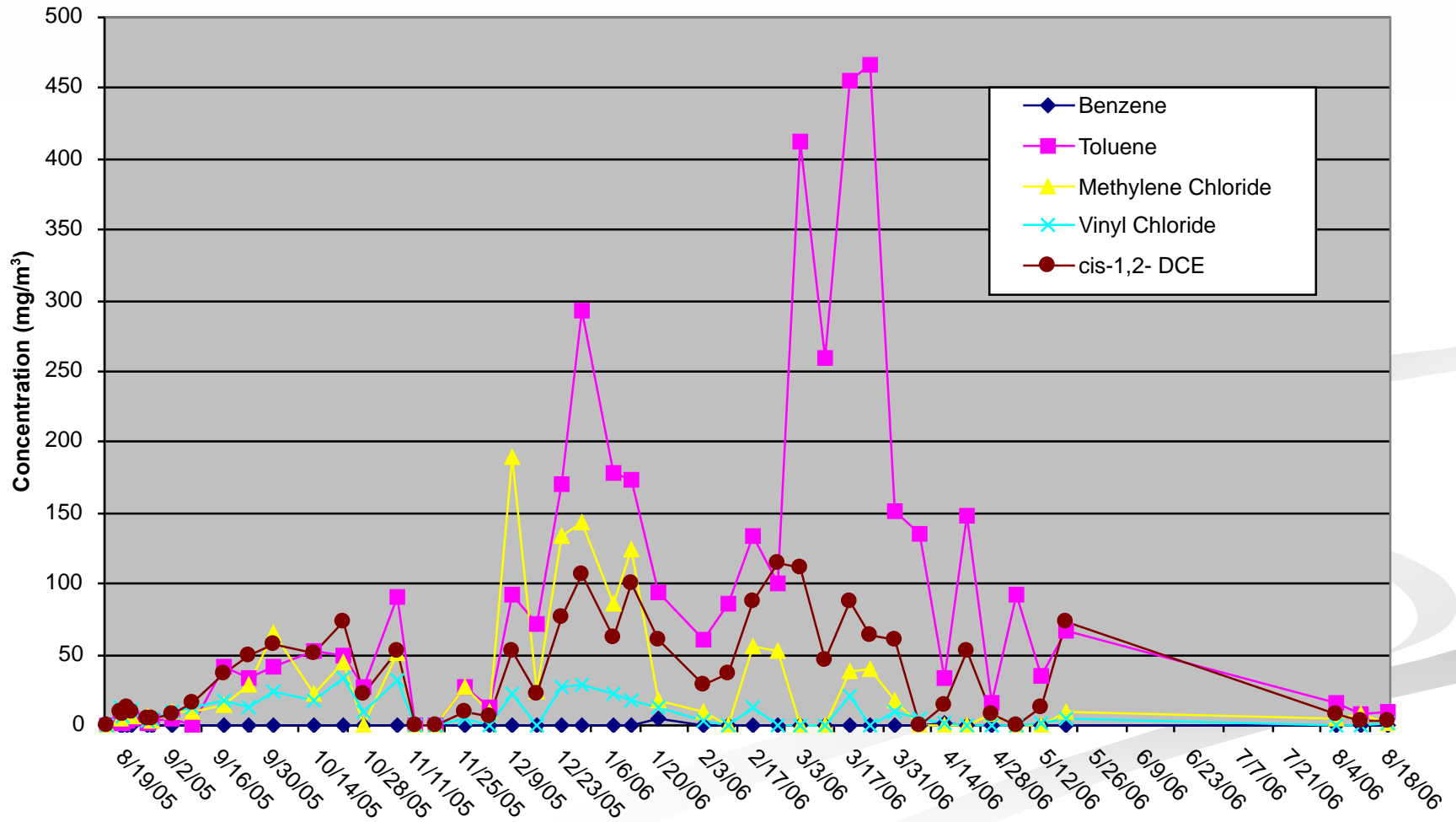
Energy Balance



Operations

■ Influent Concentrations

Vapor Influent Contaminant Concentrations versus Time



Operations

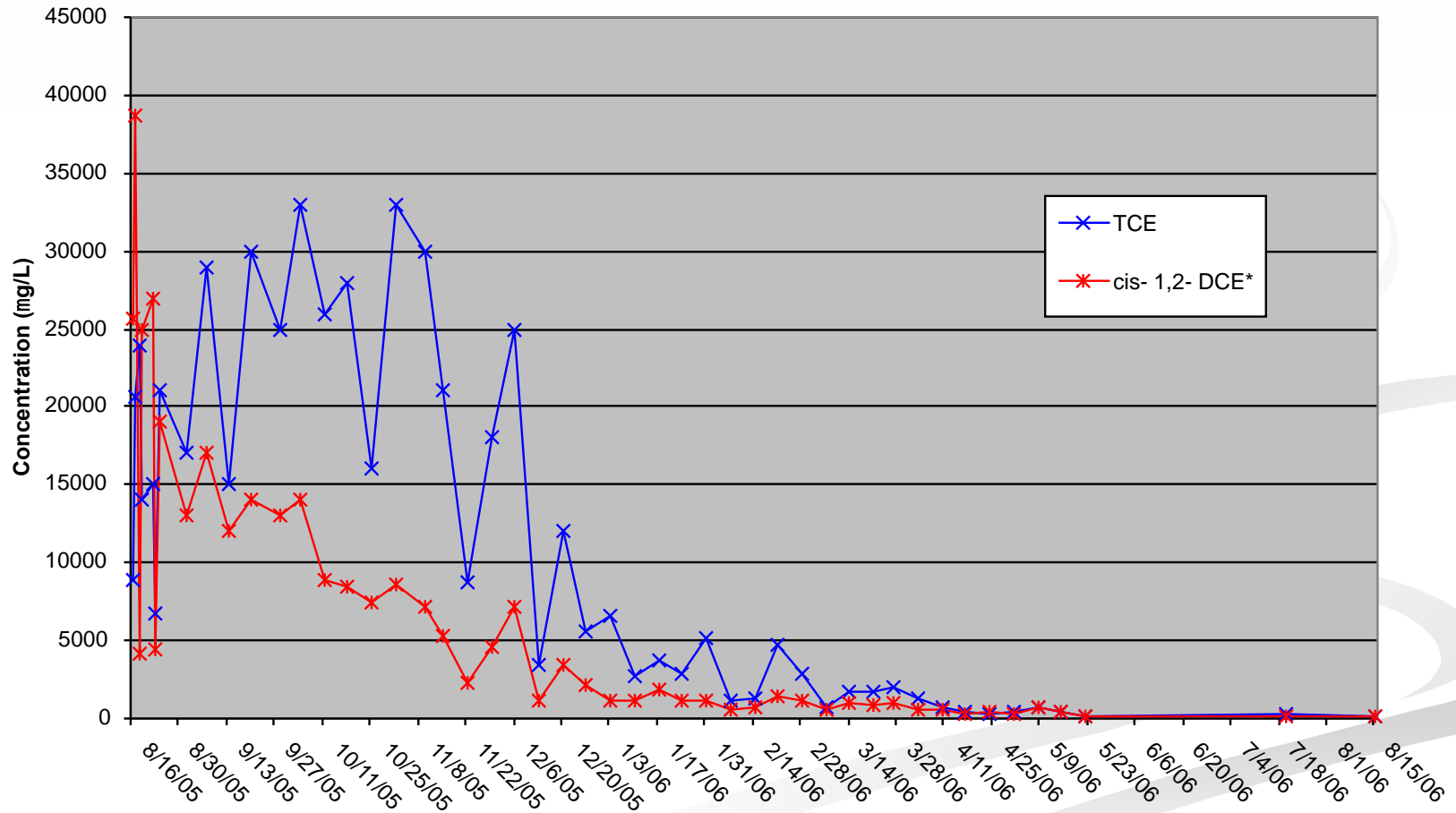
- Contaminant recovery



Results

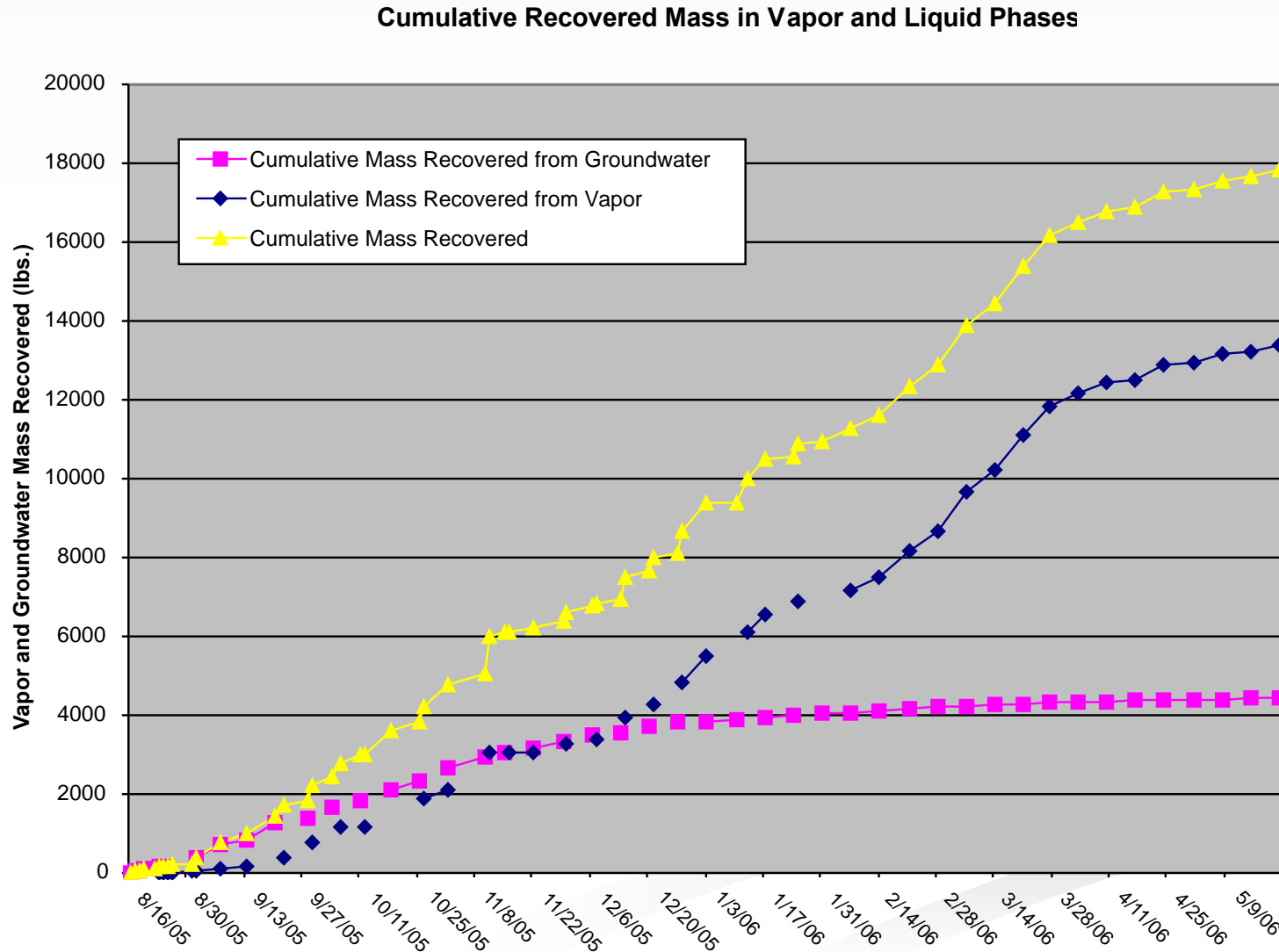
- Groundwater Recovery

Groundwater Influent Concentration versus Time



Results

- Total Mass Recovery



Results

Contaminant	Mass Removed [kg]	Remedial Goals [µg/L]	Average Post Treatment Concentrations [µg/L]	Removal Efficiency [%]
Toluene	1.340	11.000	135	98,3
Methylene Chloride	555	50.000	177	99,4
TCE	4.860	20.000	12	99,8
cis 1,2-DCE	861	5.500	71	96,3
TPH	248	50.000	300	99,2
Total	7.864			99,1

Acknowledgments



Questions

