

Lessons Learned from a Major Southern California Superfund Site



Session C5
Abstract #242

Michael Palmer



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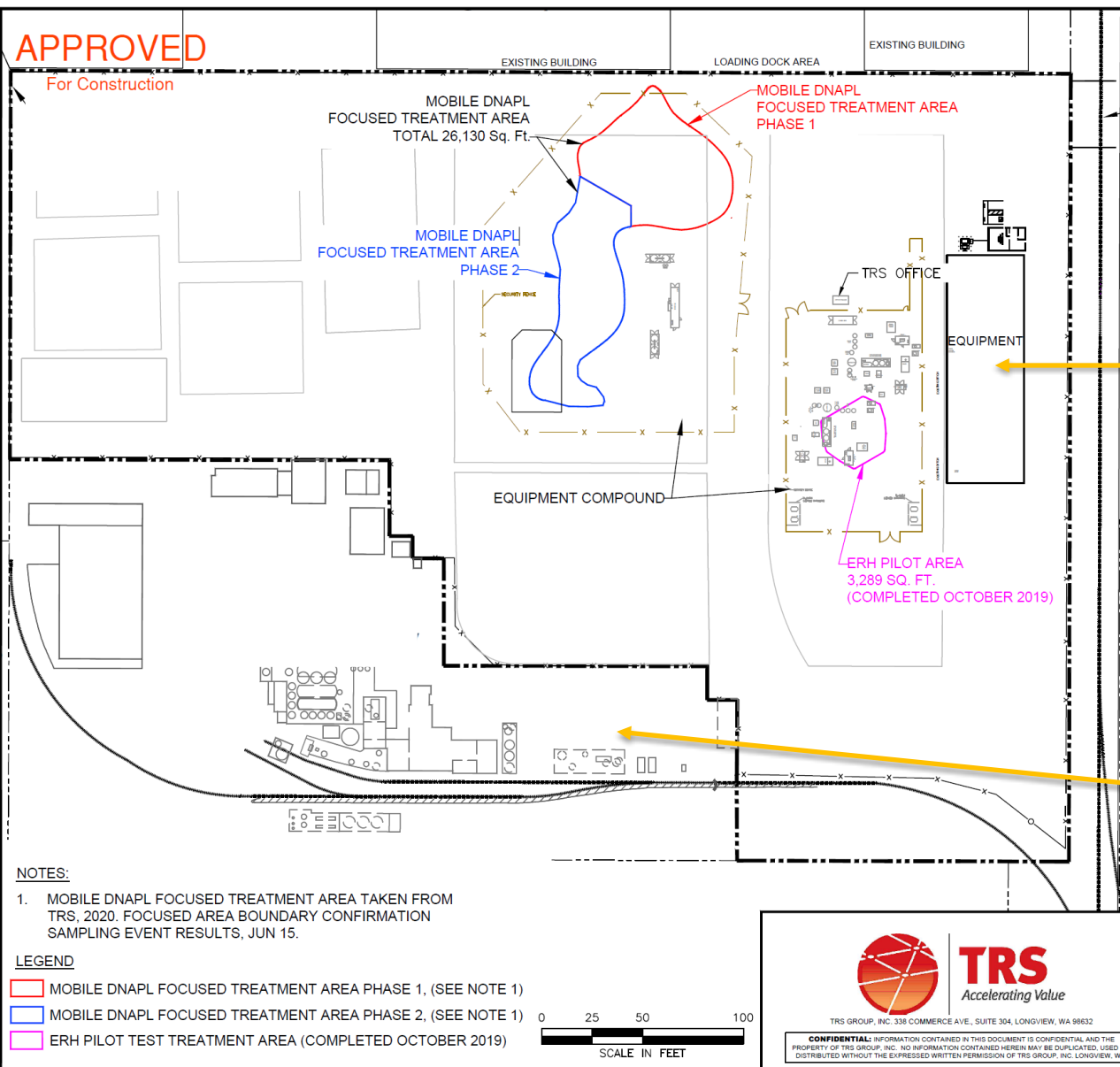
Site Background

- Former manufacturing facility
- Site is impacted by DNAPL
- Target COC: chlorobenzene
- Depth to water ~54 ft bgs
- FS Estimated 473,000 to 780,000 pounds total DNAPL within treatment area
- SVE very effective in vadose zone soils



APPROVED

For Construction



Site Background

Onsite
groundwater
treatment plant

Adjacent facility

Remedial Objectives

- Chlorobenzene = contaminant of concern targeted for removal
- Primary focus is to Render DNAPL immobile in saturated zone

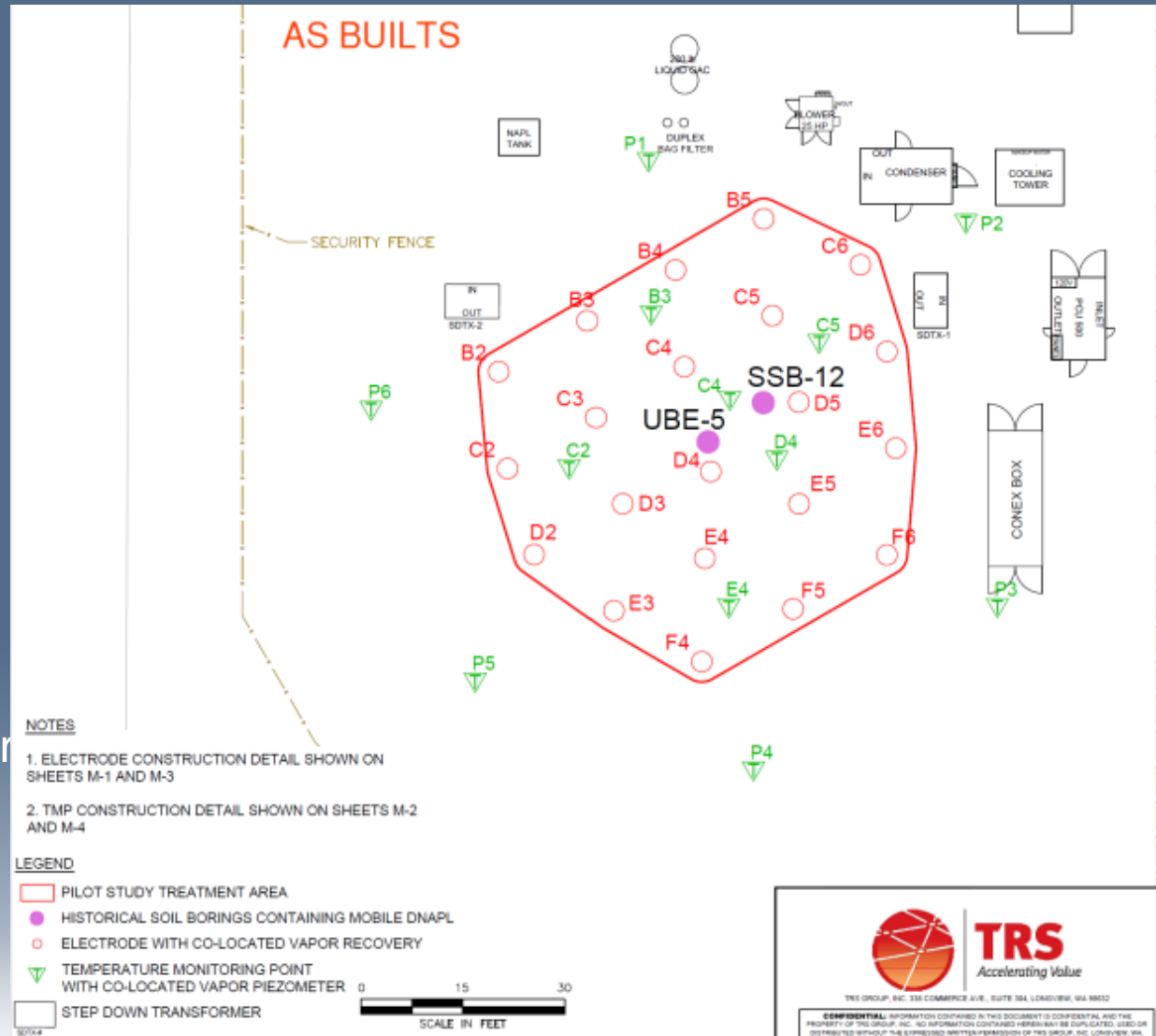
Remedial Approach

- Full scale DNAPL remedy combines:
 - SVE in vadose zone
 - ERH to render DNAPL immobile by removal of chlorobenzene
- ERH in “Focused Treatment Area” (FTA)
 - ~29,000 square feet



ERH Pilot Test

- Mobile DNAPL in well UBE-5
- 3,289 sq ft
- 21 electrodes
- Interior and exterior temperature monitoring
- Interior and exterior vapor piezometers



ERH Pilot Test Results

- Successful ERH pilot test!
- 26,600 lbs VOCs removed
- Target temperatures achieved
- No DNAPL in well UBE-5 post pilot testing



ERH Pilot Test Design Confirmation

- Many design aspects unchanged:
 - Electrode design
 - Contingent electrode wetting system
 - Steam-regenerated granular activated carbon (SRGAC) unit
 - Liquid treatment
 - Discharge to on-site groundwater treatment system

ERH Pilot Test Design Confirmation

- Materials of construction confirmed compatible
- Removal characteristics of site COCs evaluated in vapor and water



ERH Pilot Test Lessons Learned

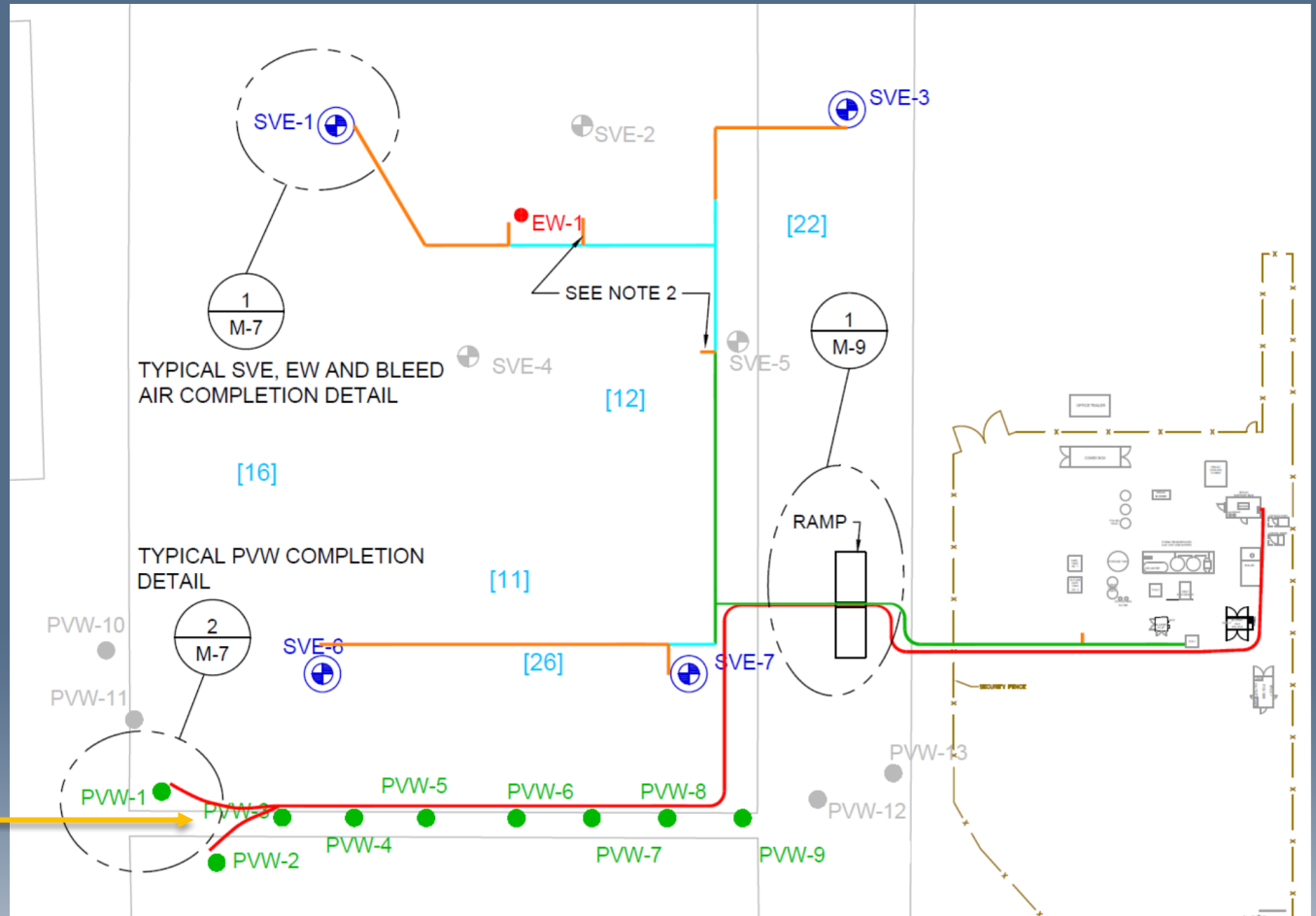
- Defined DNAPL mobility
- ERH effective for rendering DNAPL immobile
- High recovery from vadose zone above ERH treatment
- Efficient treatment with SRGAC
- “Bottom-Up” heating hindered mass recovery
- Evaluate contamination migration into treatment system

Vapor Barrier Pilot Test

- Concern for migration of contaminants into ERH Pilot Test system
- Testing of Passive Vent Well (PVW) system
- 85,000 lbs total VOC in 9 months via SVE
- Completed ERH boundary confirmation of FTA during install



Vapor Barrier Pilot Test



Passive vent well
system

Vapor Barrier Pilot Test Lessons Learned

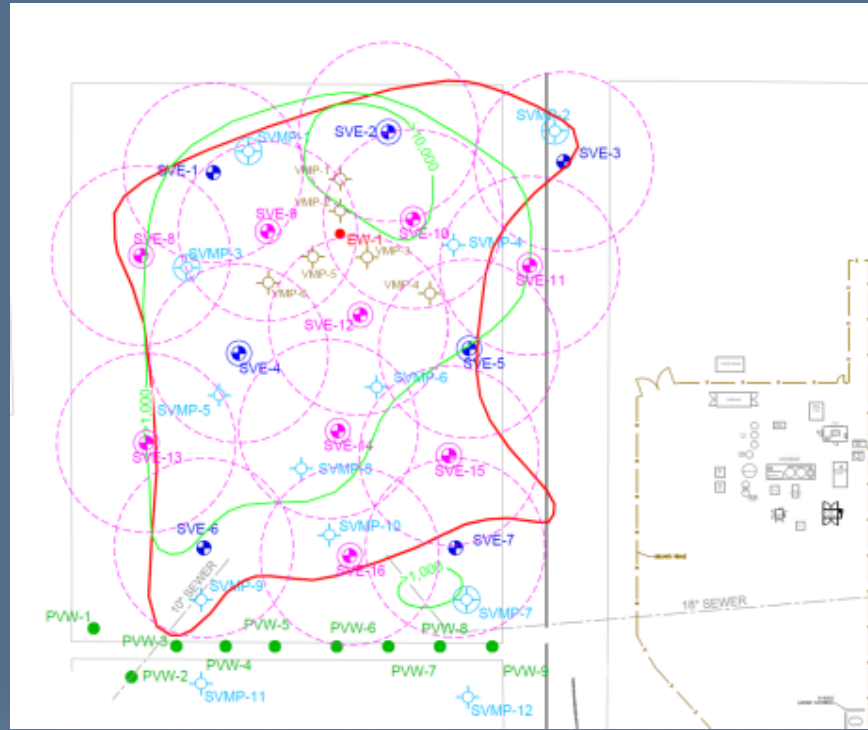
- Successful mitigation of risk of contaminant migration
- High mass recovery from vadose soils with SVE



Field Screening Evaluation

- Chloroform has a low VGAC adsorption efficiency
- PID equipped with 10.6 eV lamp generates no response to chloroform (11.42 eV)
- PID with 11.7 eV lamp successfully screens for chloroform but generates extremely high reaction to chlorobenzene
- FID determined to be highly effective for field screening

Full-scale SVE Installation



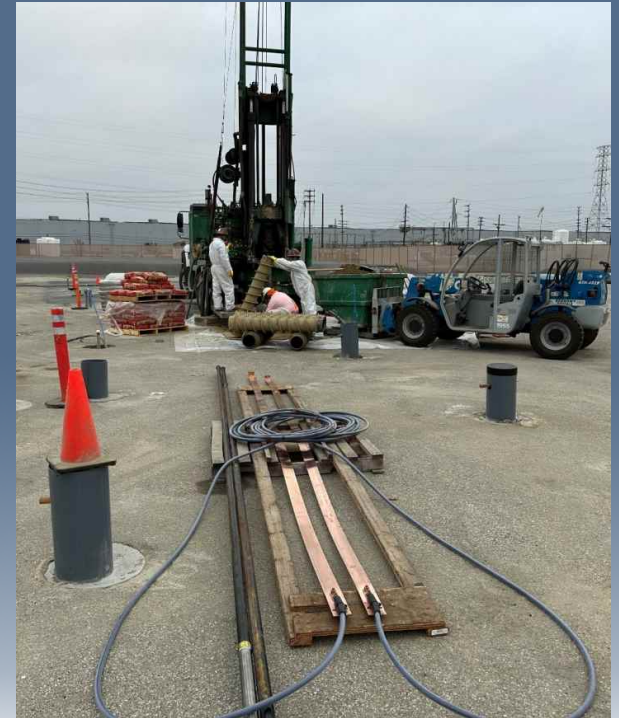
Full-scale SVE Operations

- Over 390,000 pounds total VOC removed to date via SVE
- Operation of the SRGAC in lieu of traditional carbon use and disposal methods saved < 3 million pounds of carbon from disposal to date



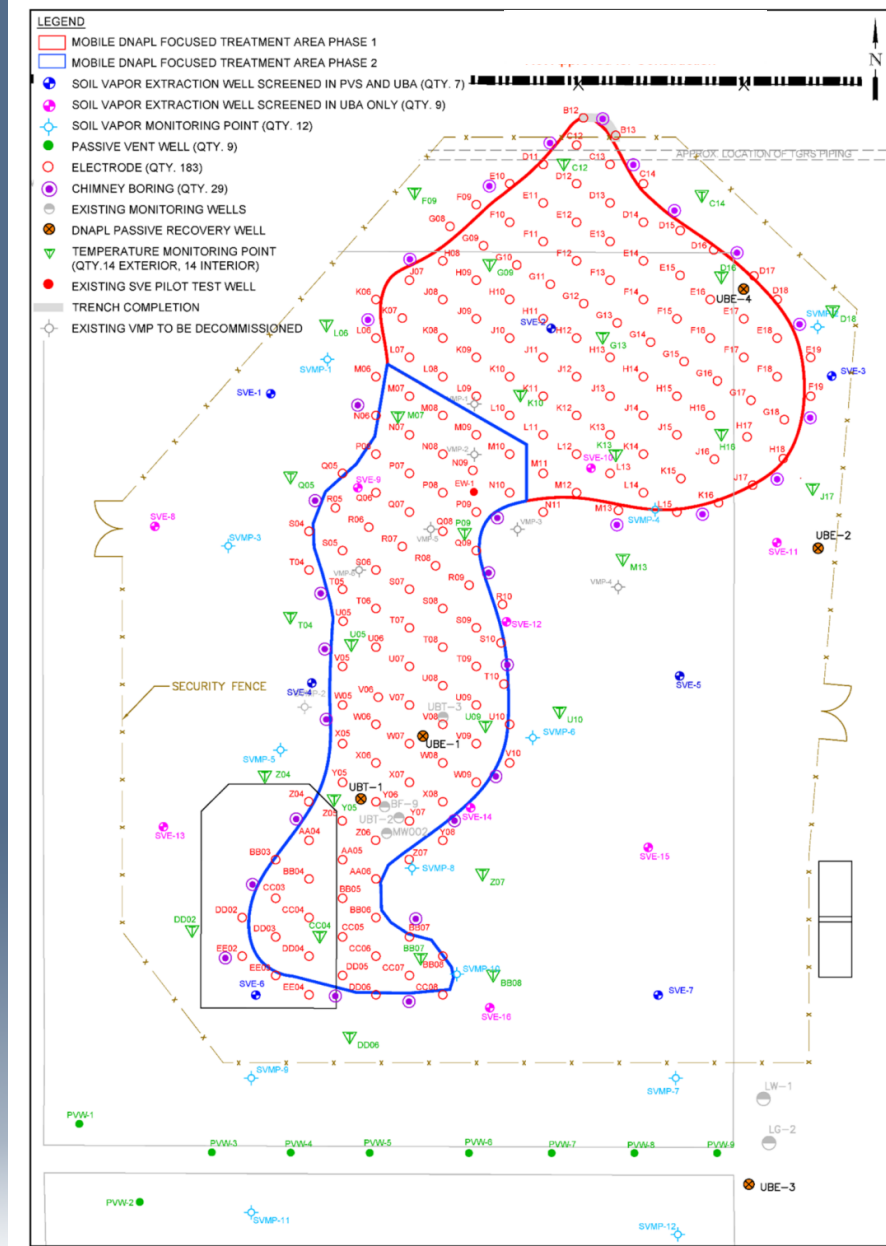
Full-Scale ERH Design Modifications

- Supplemental vapor recovery added around the treatment volume
- Additional SRGAC system for mass recovery
- Additional DNAPL storage added
- Continued use of passive vent well system



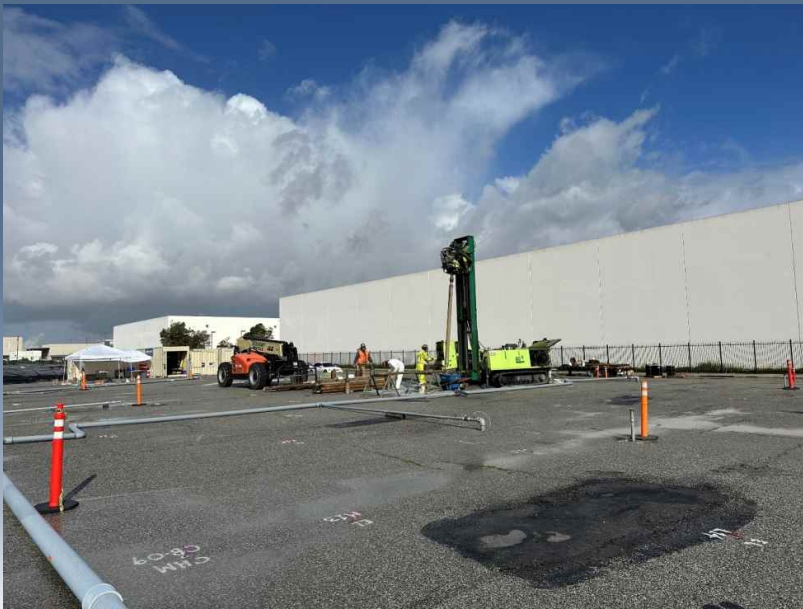
Full-Scale Operational Modifications

- SVE application in the vadose zone **prior** to ERH
- Two-phase approach to ERH operation
- No “bottom-up” heating
- Flexibility of two (2) SRGAC systems
 - Any combination of SVE & ERH
- Vapor treatment system field screening by FID



ERH Installation

- Construction of full-scale ERH system completed in 2023
 - 240 subsurface installations
 - ~4.5 miles of drilling
- SVE operations continued through construction



Conclusions



- Start-up anticipated in 2024
- 8 months of ERH operations in two phases
- Pilot testing confirmed successful remedial approach
- Valuable modifications to full-scale design implemented
- Over 420,000 lbs VOC removed to date via ERH + SVE

Contact Information

Michael Palmer
de maximis, inc.

mpalmer@demaximis.com

Cell: 619-316-0924

Patrick Joyce

TRS Group

pjoyce@thermalrs.com

Cell: 775-309-7832

www.thermalrs.com

www.demaximis.com



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