



Installation and Operation of an Air Sparge and SVE System Using Horizontal Directionally Drilled Wells



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Remediation of Chlorinated and Recalcitrant Compounds
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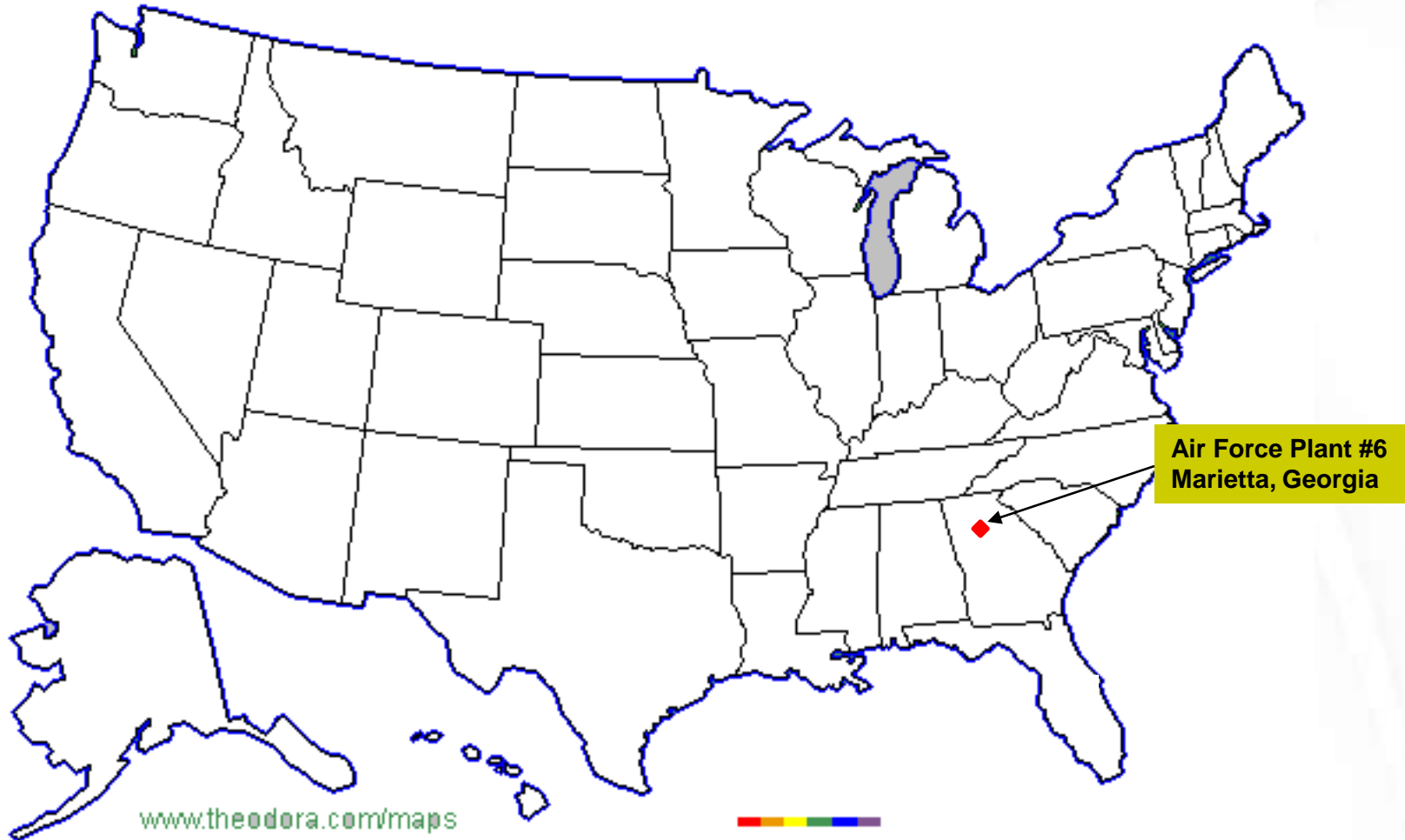


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Presentation Topics

- Site History
- Lithology
- Source Area Treatment Objectives
- AS/SVE Design
- AS/SVE Installation
- Tracer Testing
- Performance Results
- Conclusions and Path Forward

Air Force Plant #6, Marietta, Georgia

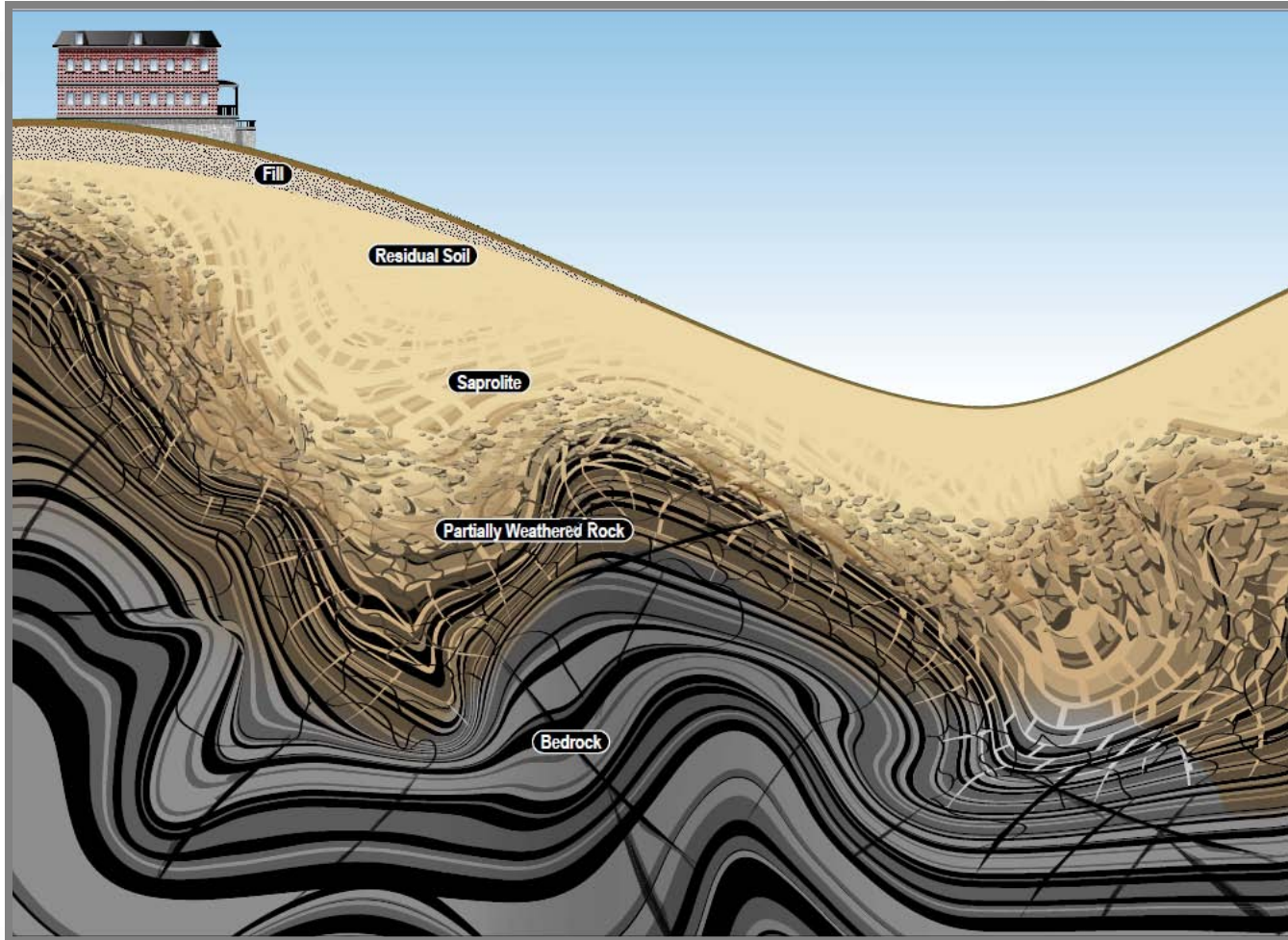


Site History

- Air Force Aviation Manufacturing and Maintenance Facility from 1942 to Present
- 720-acre property leased to LM Aero (part of 3,300+ acre complex)
- Site Contaminants – TCE and Daughter Products
 - 1,066 gallon TCE spill
 - Over 70 releases between 1974 and 1996
 - TCE concentrations greater than 250 ppm in source area

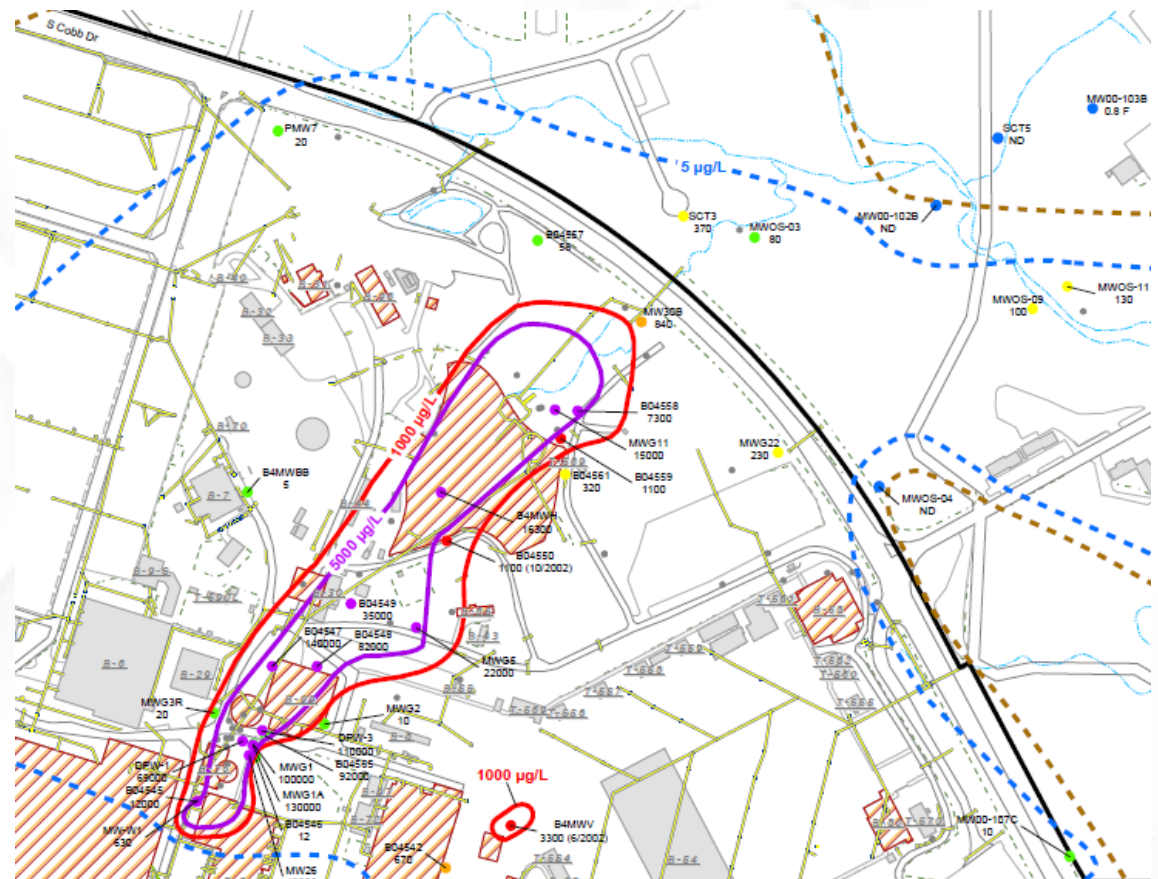


Site Lithology



Source Area Treatment Objectives

- 1) Volatilize TCE in groundwater and collect vapors with SVE under buildings
- 2) Reduce Mass flux in saprolite by 50%
- 3) MCLs within 30 years

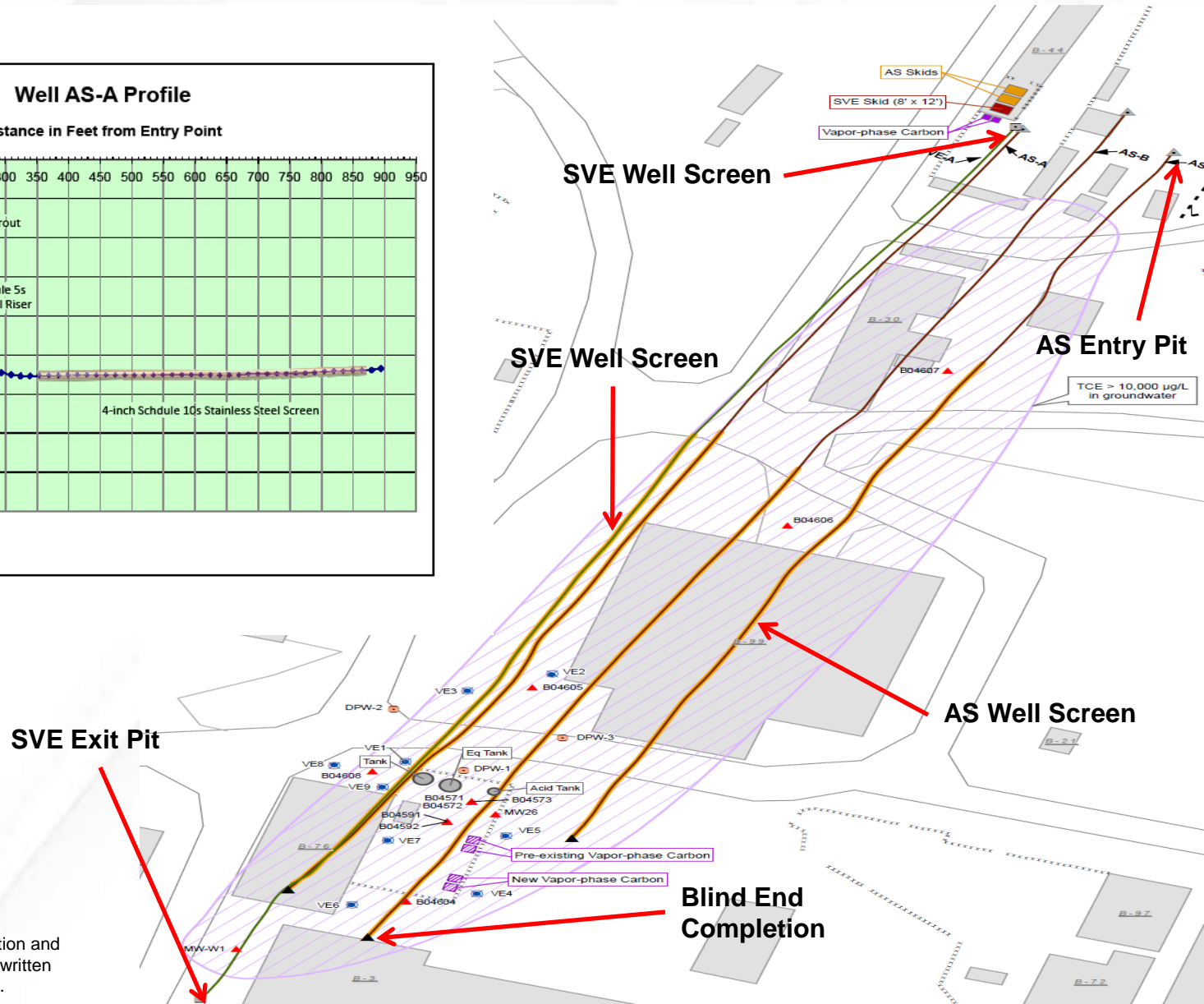
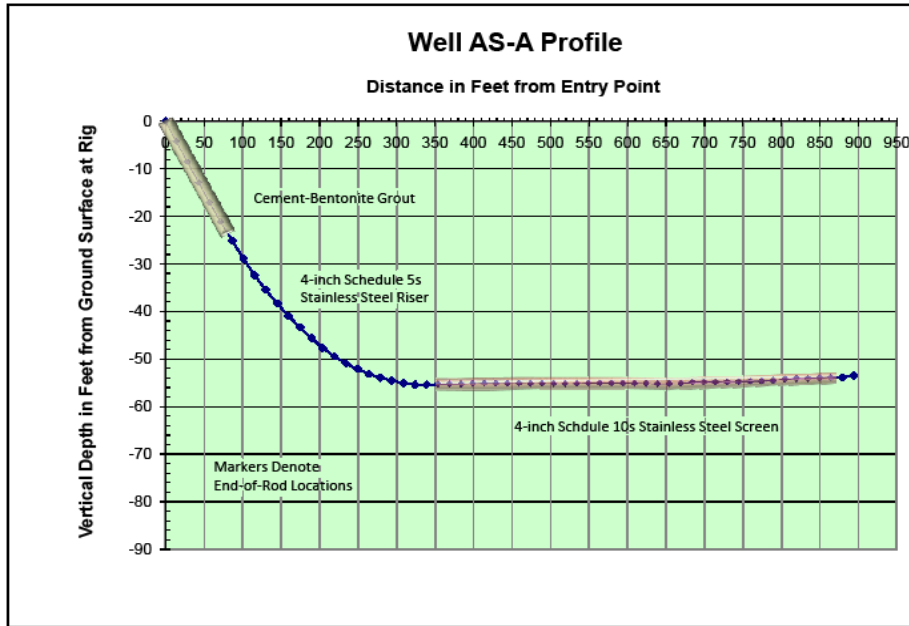


AS/SVE System Design

Well ID	Screen Depth	Total Length	Screen Length	Diameter
Horizontal Wells				
AS-A	70'	880'	520'	4"
AS-B	86'	940'	540'	4"
AS-C	68'	750'	520'	4"
SVE-A	20'	1000'	600'	6"
Vertical Wells				
VE1 – VE10	20 – 30'	30' (deep)	10'	4"

- Designed for uniform distribution of air using finite difference model
- Input: formation characteristics, pipe specifications and operation parameters
- Output: air flow distribution, pressure drop, and slot shape and distribution
- Blind end construction of AS wells; entry-exit SVE well

AS/SVE Layout



AS/SVE Installation - Timeline



- April – July 2008
 - Well and system piping installation
- October 2008
 - Equipment delivery and connections
- December 2008
 - Startup activities
- March 2009 - present
 - Online system operations
 - Quarterly groundwater monitoring
- January 2010
 - Tracer Study

Horizontal Well Construction Details

- 6-inch pilot boring reamed to 10-inch diameter using Vermeer® D80X100 Series II Navigator HDD rig
- Bentonite and polymer (No-Sag® and Quick-Trol® LV) drilling mud to keep boring open and remove cuttings
- Battery-operated and wire-line tracking used to for cutting head location
- Phosphate-free liquid polymer dispersant solution (Aquaclear PFD™) used to develop wells



AS/SVE System Equipment



← B44 AS/SVE System (New)

- 3 horizontal AS wells
- One horizontal SVE well
- Two air compressors
 - 250 cfm @ 100 psi
 - 500 cfm @ 100 psi
- PD Blower - 600 cfm @ 8" Hg
- 10,000 lb GAC

B76 SVE System (Existing) →

- 10 vertical SVE wells
- PD Blower - 340 cfm @ 9" Hg
- 10,000 lb GAC

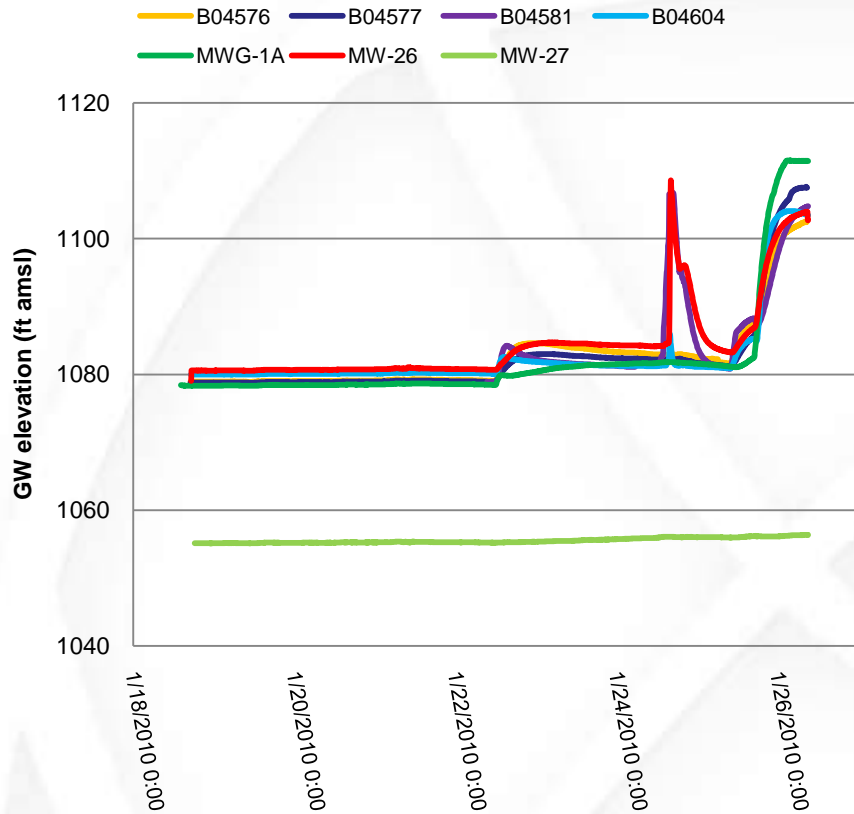


Air Sparge Tracer Study

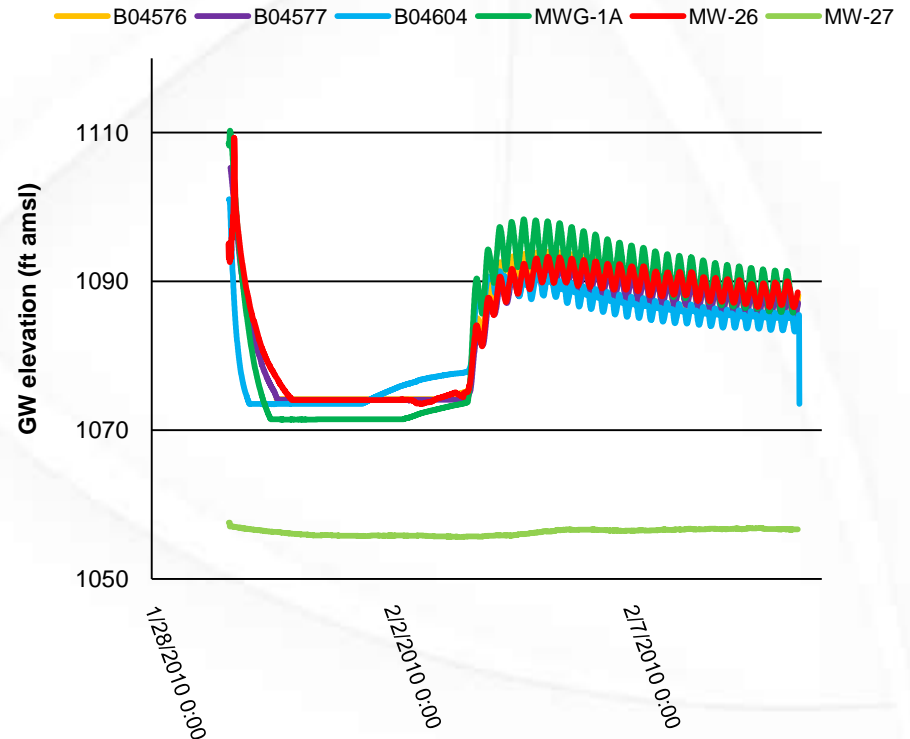
- Water level transducers in vertical observation wells
- Wellhead pressures in observation wells
- Helium tracer
 - 5% of injection flow – one hour
 - Monitored helium concentrations using field instrumentation
- Sulfur Hexafluoride tracer
 - 0.1% of injection flow – 24 hours
 - Collected groundwater samples and analyzed for SF6 concentration

Water Level Transducers

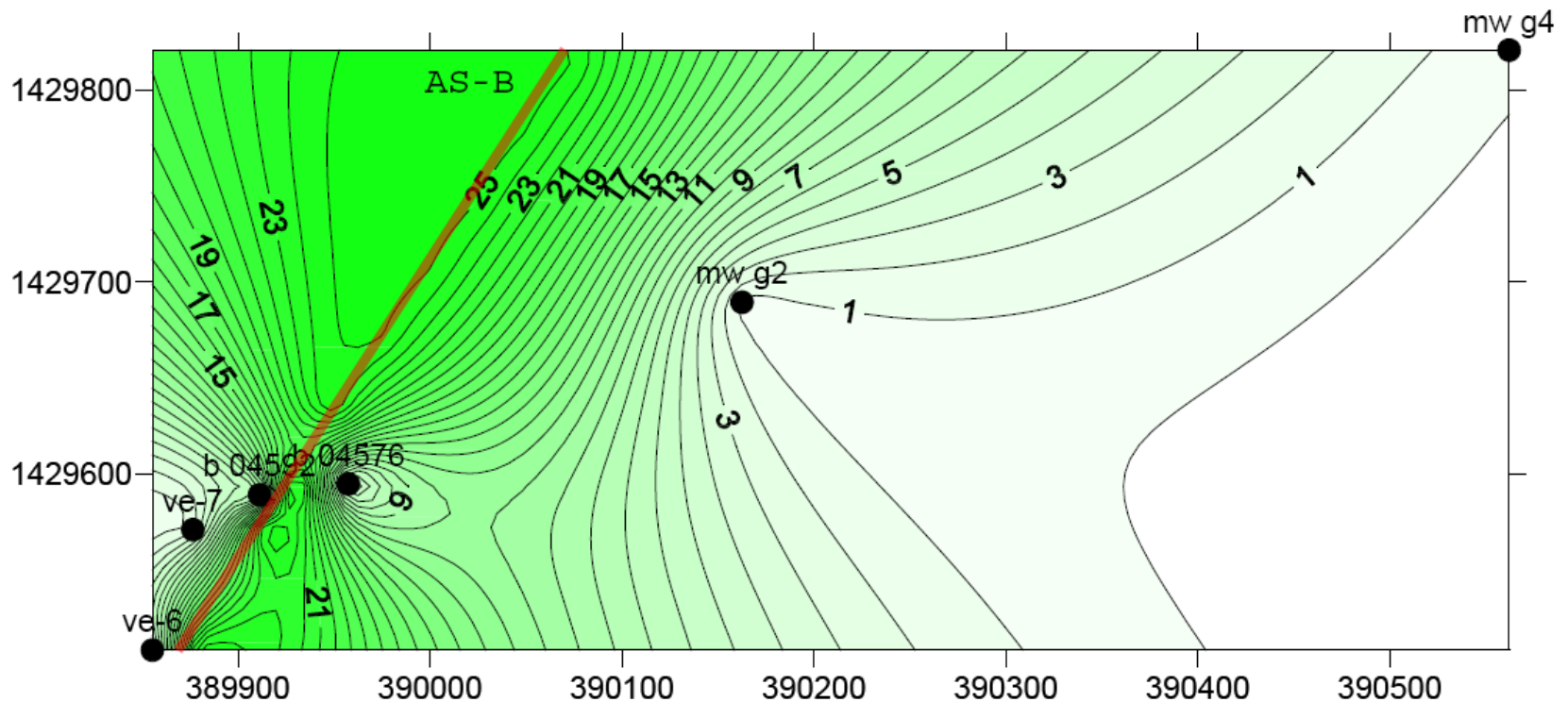
Groundwater Response during AS Activation



Groundwater Response during AS Shutdown and Pulsed Operations



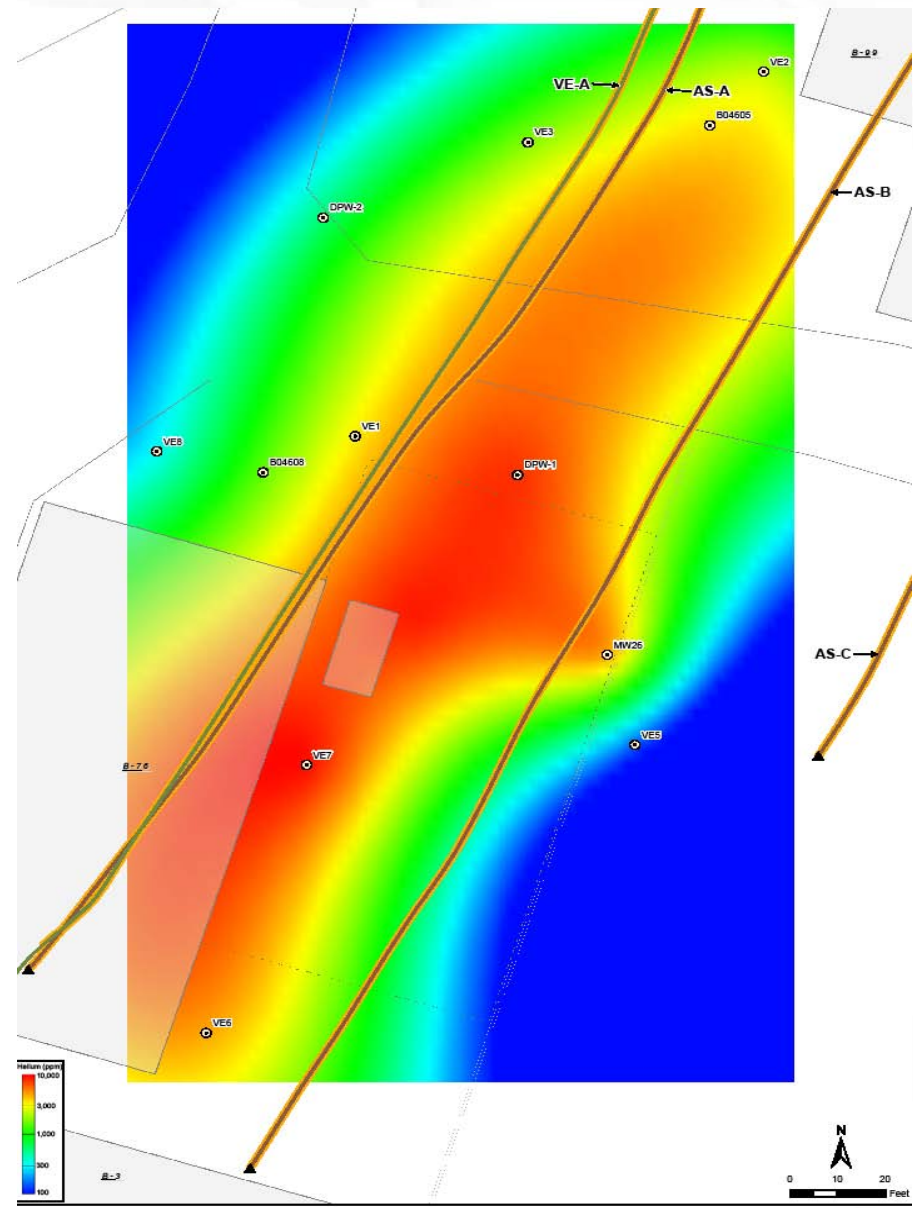
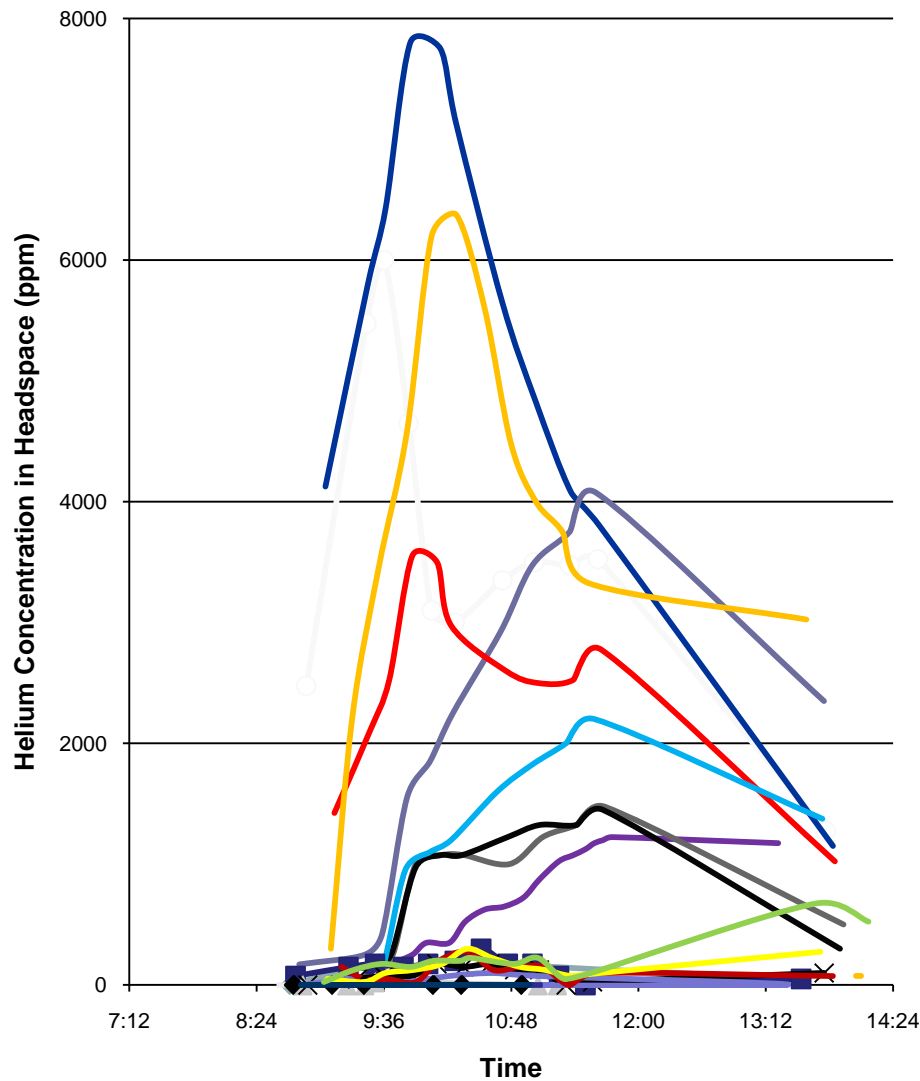
Wellhead Pressure



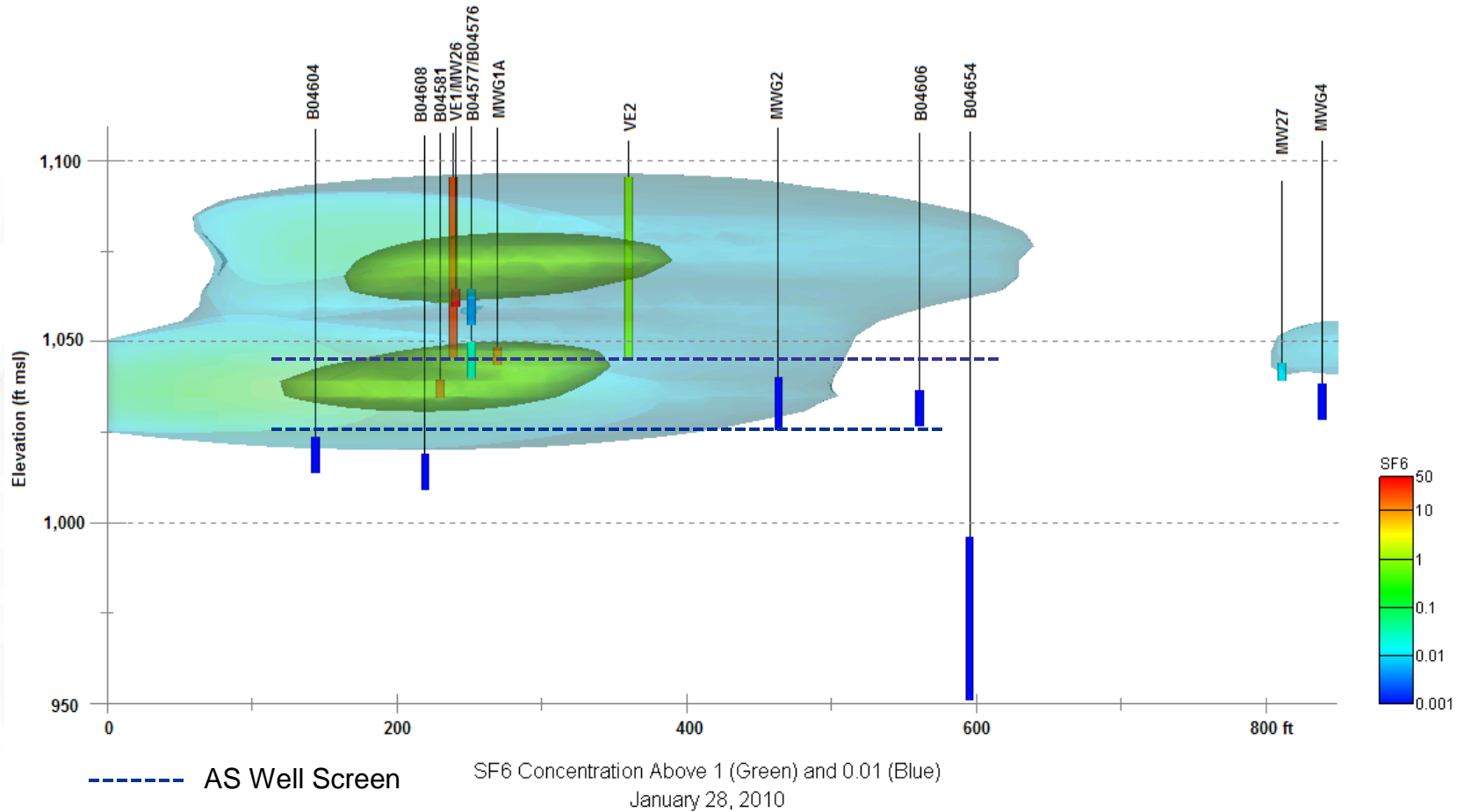
Pressure increases greater than 10-inches of water column observed up to 100 feet from the injection well

Helium Tracer Results

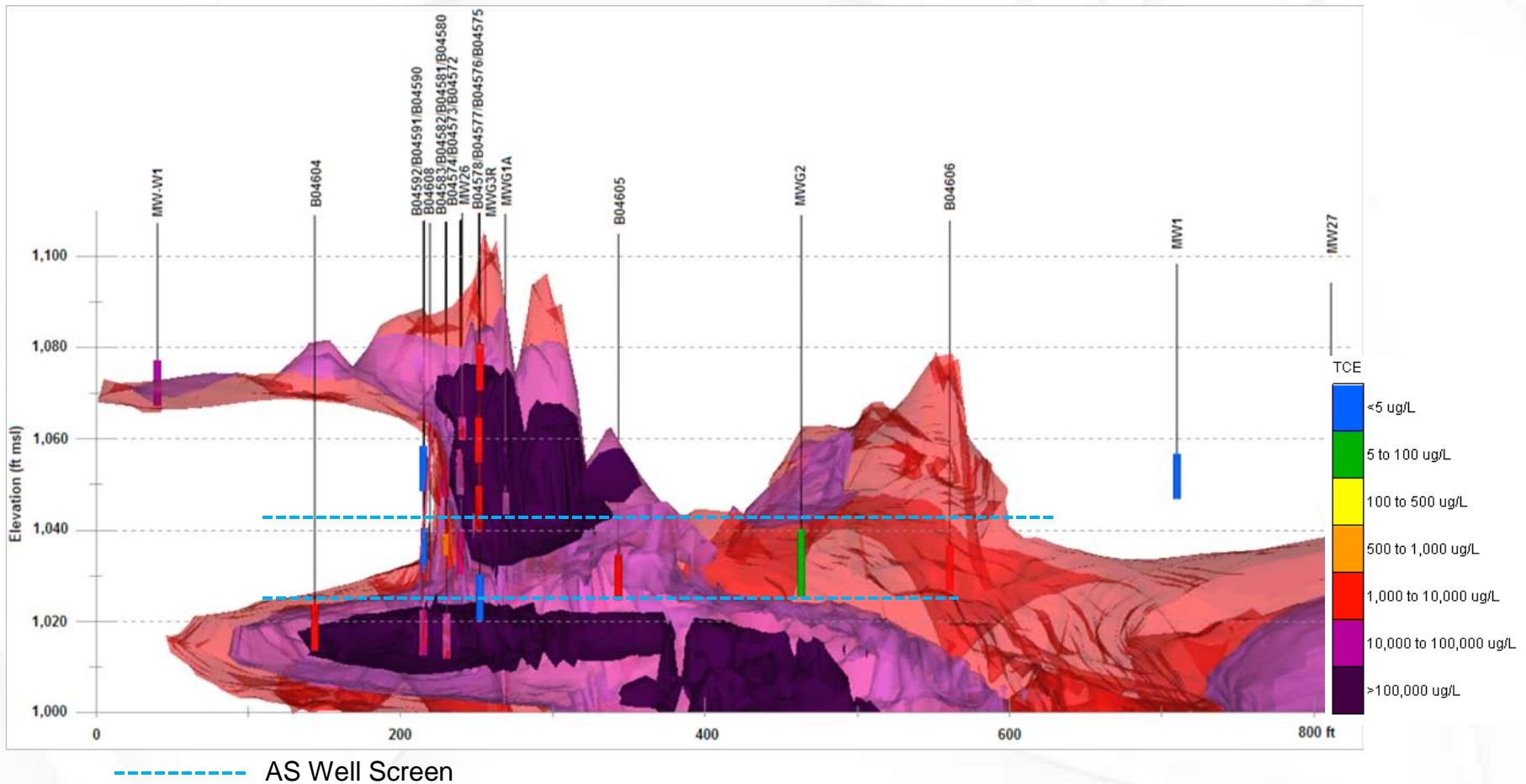
Helium Concentration vs. Time



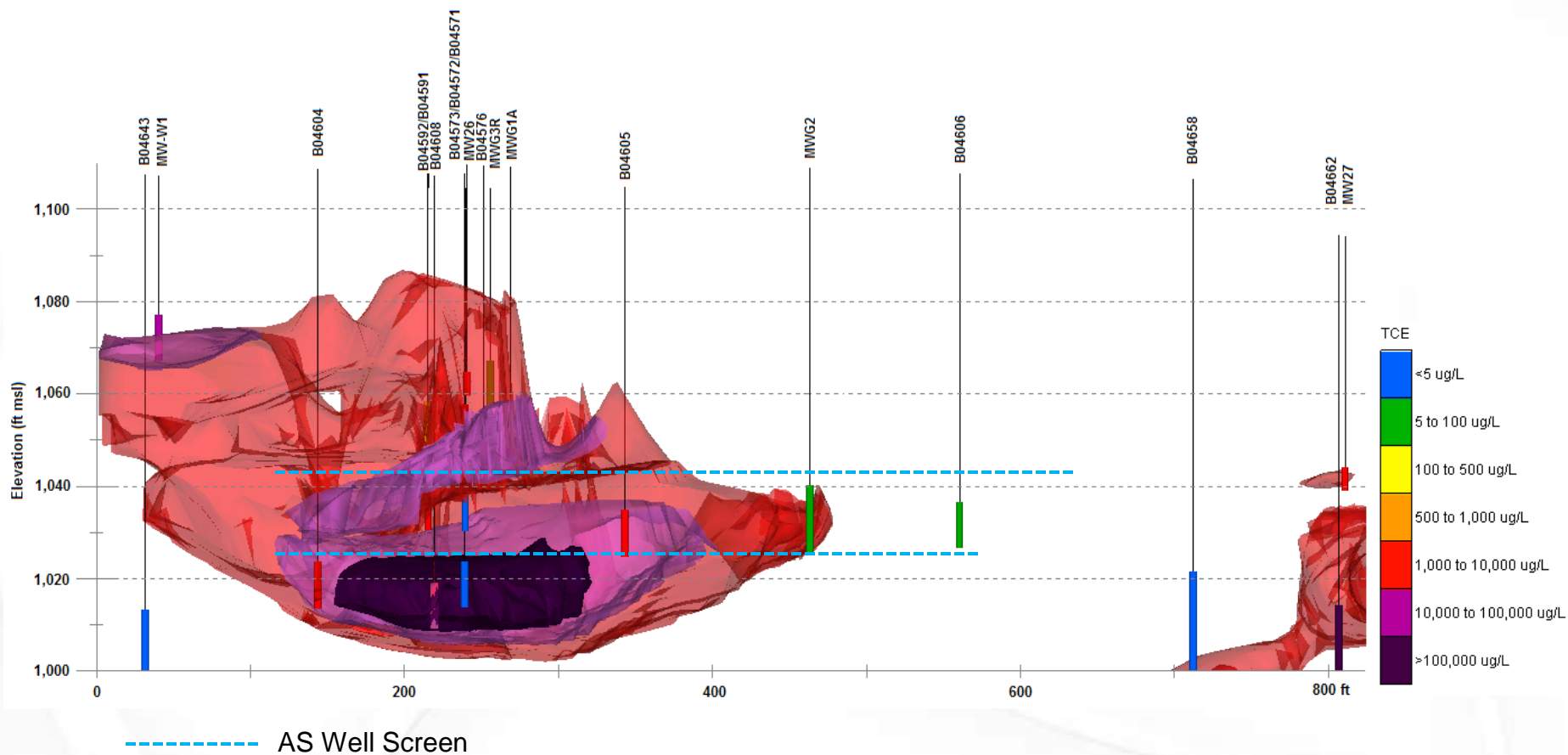
Sulfur Hexafluoride Tracer Results



Performance Results – Pre-Sparging

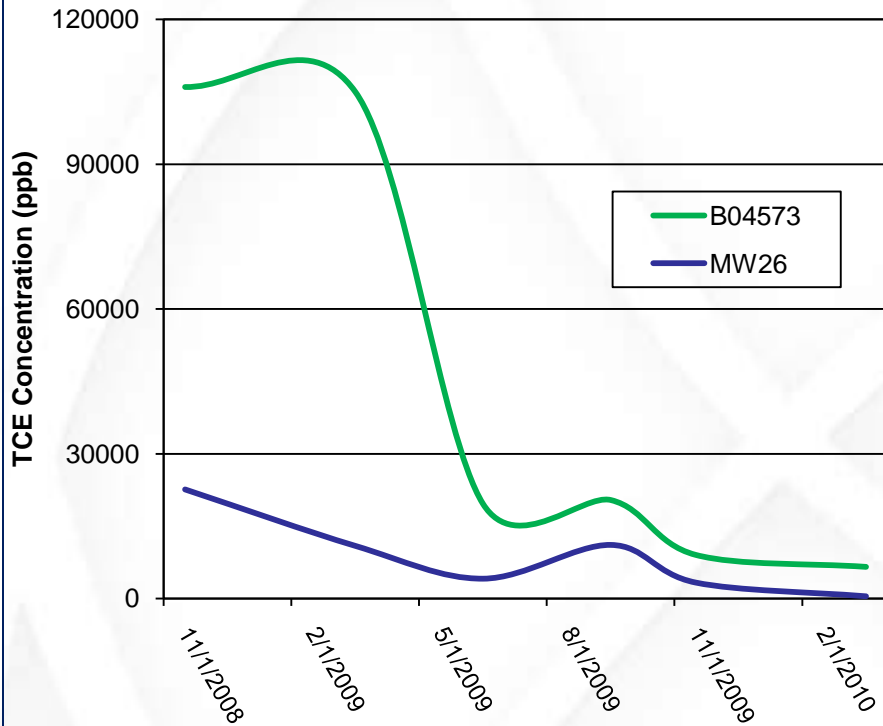


Performance Results – December 2009

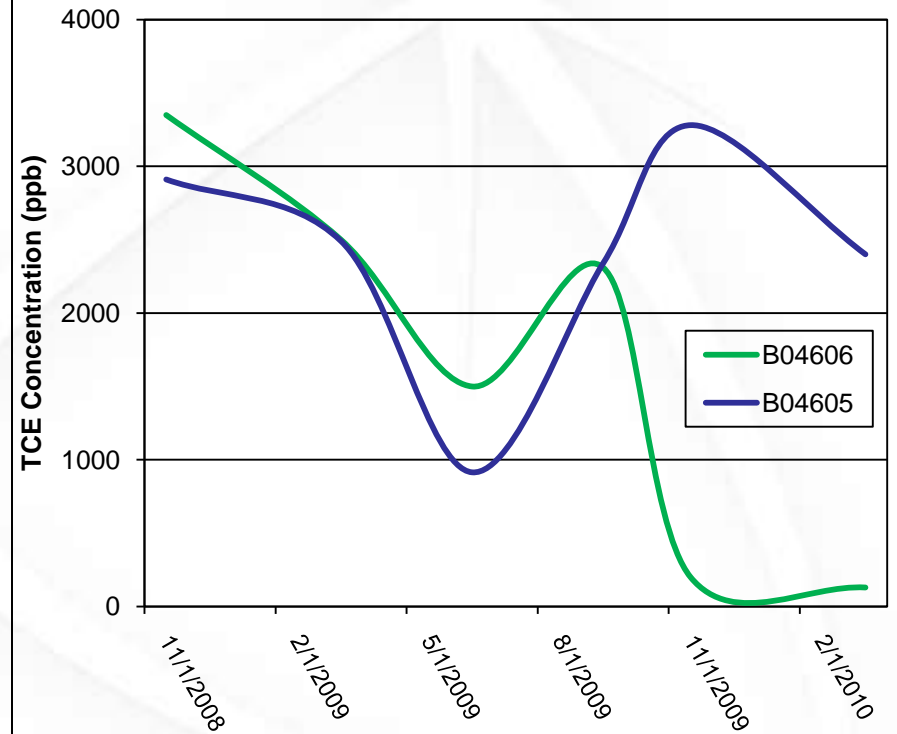


Monitoring Well Performance

Monitoring Wells Screened 45' - 65' BLS



Monitoring Wells Screened 65' - 85' BLS



~ 40% Reduction in TCE concentration in source area saprolite wells from baseline

Conclusions and Path Forward

- Heterogeneity influences well installation process and air distribution
- SF6, helium, and wellhead pressure data indicate elliptical zone of influence develops up to 100 feet from the wells within 3 hours of injection
- Evidence of air distribution along entire screen length
- Order of magnitude reduction in VOC concentrations
- B76 SVE equipment to be replaced in June 2010

Questions?

- Special thanks to contributors
 - Tim Clendenin, Aeronautical Systems Center (ASC) – Acquisition Environmental Safety and Health
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