



Soil Vapor Extraction for Mitigation Control Real Data for Design

By: Preston Lee and Cliff Koenig

March 23, 2004

Meeting Design Parameters \neq Solution

- Initial System
- Upgrade Passive Vents & Header
- Upgrade with Blowers
- **Corrective Action completed in 2 years!**



Davis Landfill, Layton, Utah

- Integrated Solid Waste Management Utility
 - Waste-to-Energy Facility
 - Landfill
 - Various Recycling Facilities
- Owned & Operated by **Wasatch Energy Systems (WES)**



Landfill History

- Historic Unlined Landfill Cell
- Subtitle D-Compliant
- Operation Began Approx. 50 Years Ago as End-Dump Canyon Fill
- Closed During Fall 2000
- Gas Collection System Installed



Landfill History

- Installation of 11 Horizontal Wells to Collect Landfill Gas Accumulating Below Closure Cap
- Horizontal Wells Augmented 3 Vertical Wells
- Perimeter Probes Revealed Migration Off Site with Methane Concentration as High as 50% at Least 1000 Feet Beyond Property Line



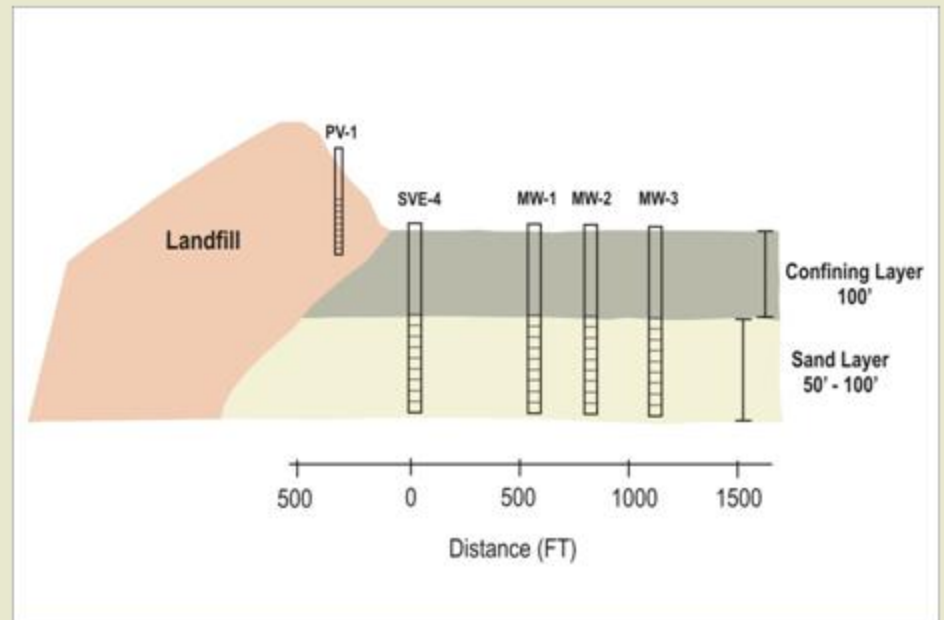
Landfill History

- SVE System
Designed and
Installed to Control
Migration of
Landfill Gas



Geology

- Landfill
Constructed against
Canyon Wall
- Methane Migrates
via Sand Layer
beneath a
Confining Layer



Initial System

■ Radius of Influence (R_i)

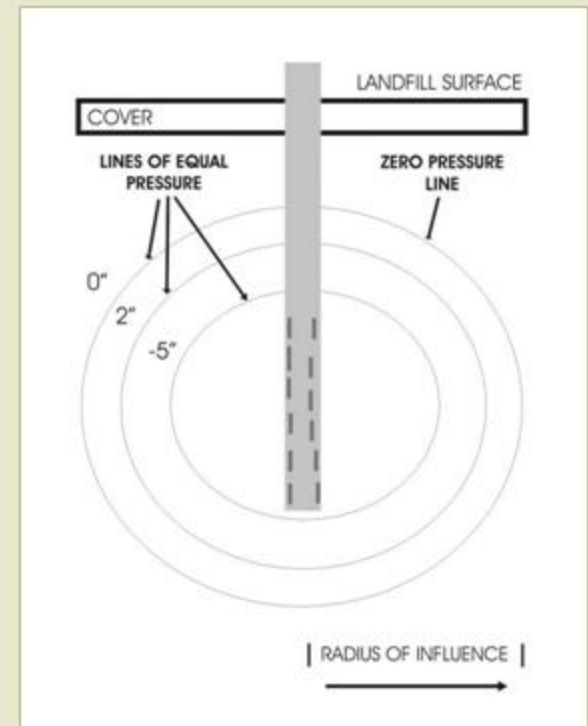
$$R_i = R_w \exp \left[\frac{(P_{ri}^2 - P_w^2)}{(P_r^2 - P_w^2)} \times \ln (r / R_w) \right]$$

■ Design:

- Set $P_w = -20'' \text{ H}_2\text{O}$
- $R_i = 1000 \text{ Ft}$
- P_r Calculated

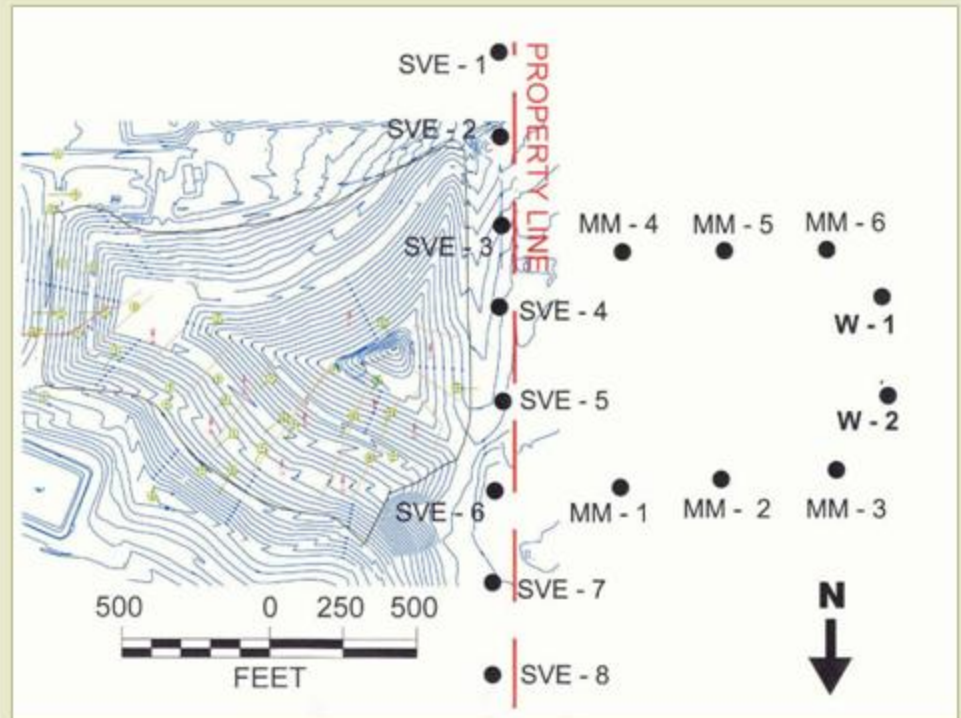
■ Actual:

- P_w from Sampling SVE Well
- P_r from Sampling Monitor Well
- R_i Calculated



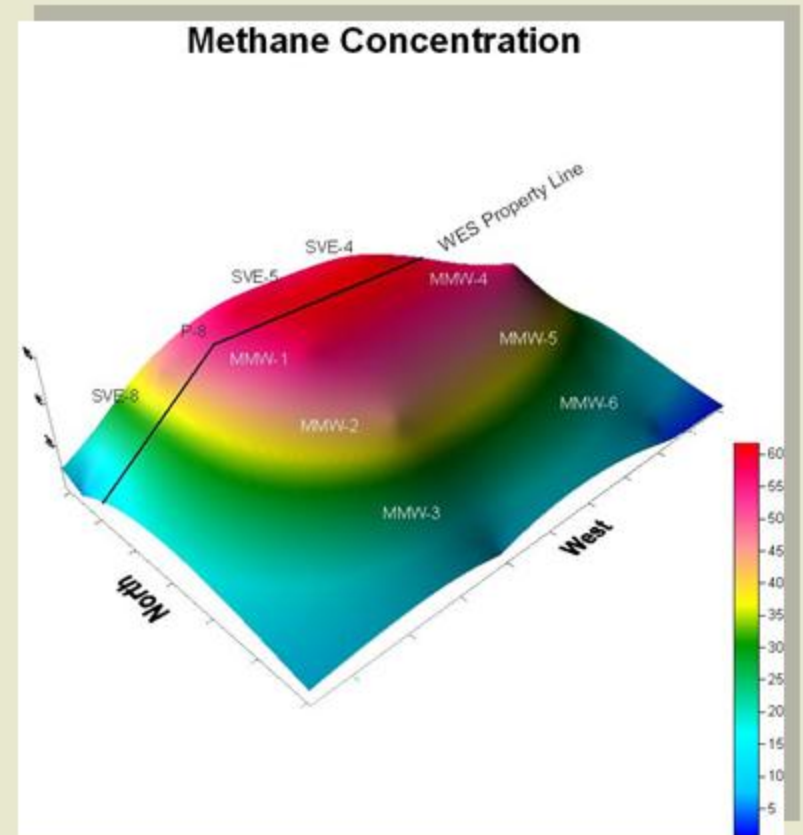
Initial System

- January 2002
- 8 SVE Wells Installed
Approximately 300
Foot Spacing On
Center
- 12 New Vertical Wells
Installed in Landfill



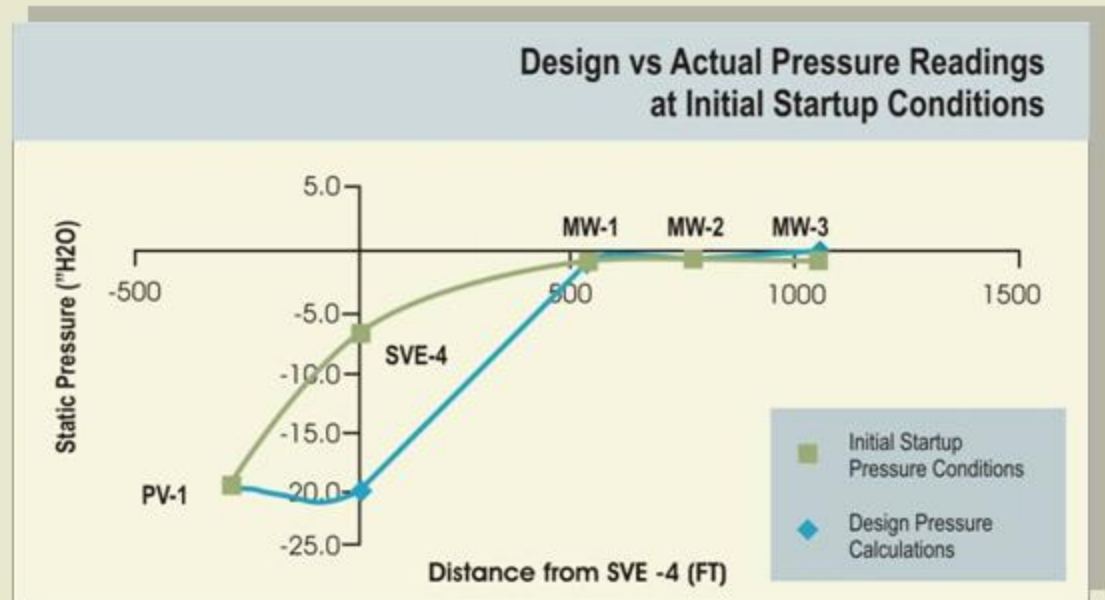
Initial System

- Methane Levels at Startup of System 2002
- Stopped Methane Migration, but Had Not Reduced Methane Concentration



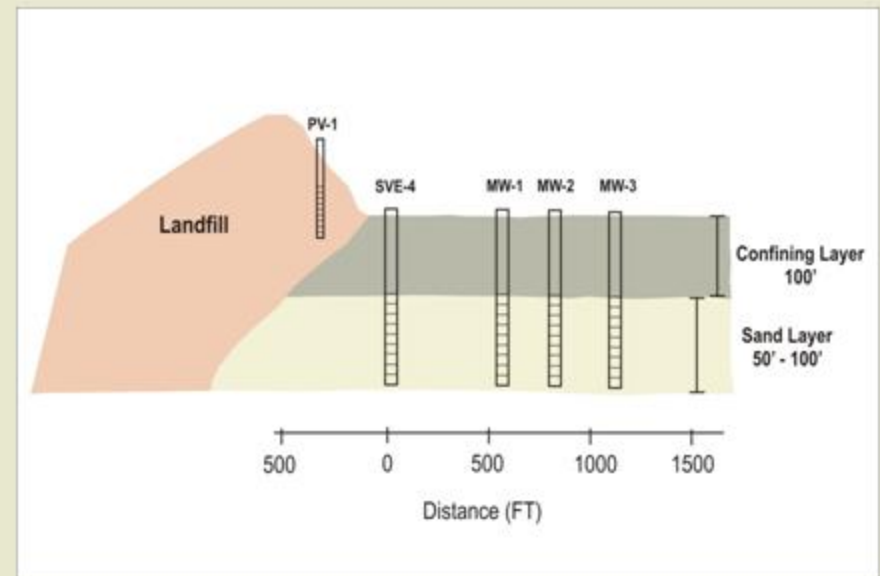
Initial System

- Designed System for 1000-Foot Radius of Influence (ROI)
- Initial Readings Agree, Showing Negative Static Pressure Nearly 1000 Feet from SVE System



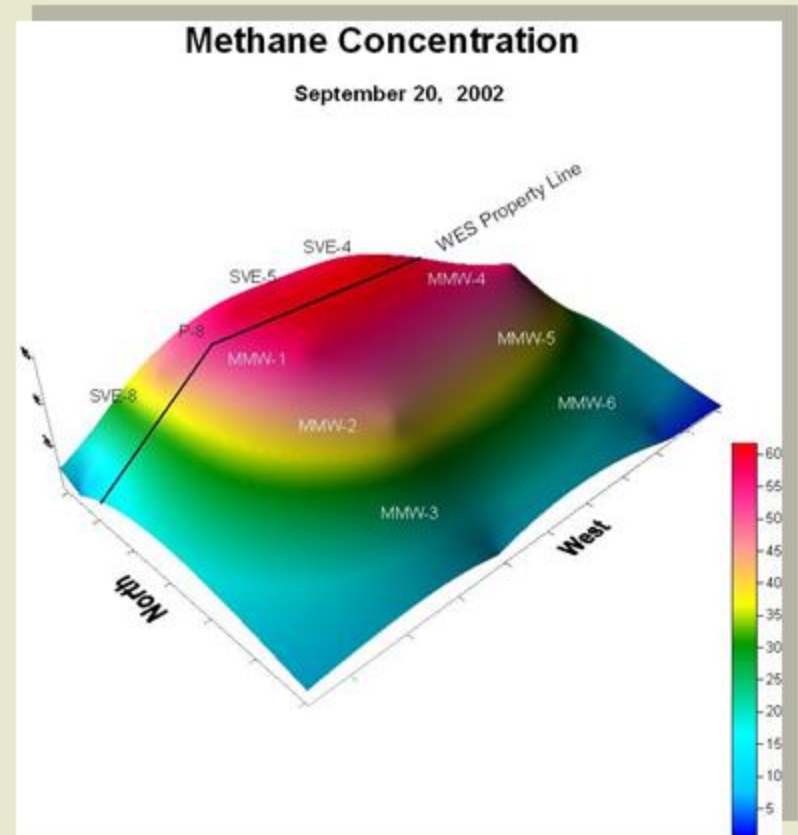
Initial System

- “Coke Bottle” Effect
 - No Evidence Sand Layer Out Cropped
 - Very Slow Air Diffusion through Confining Layer into Sand Layer
 - Thus Very Low Air Flow and Poor Ability to Purge Sand Layer



1st Upgrade – Passive Vents & Header

- Drilling of Wells
 - 2 Passive Wells Installed Past Furthest Portion of Migrated Methane
 - Completed and Sampled by September 20, 2002



1st Upgrade – Passive Vents & Header

- September 20, 2002
- Installation of Parallel 8” HDPE Header to Increase the Negative Static Pressure Being Applied to SVE Wells



1st Upgrade – Passive Vents & Header

- **Despite Upgrade Concerns Remained:**
 - Lack of Strong Enough Response in Migrating Methane Gas
 - Migration Plume Near in Size to Greatest Expanse
 - Continued Soil Pressure Fluctuations
- **Solution:**
 - Injection of Air into Sand Layer



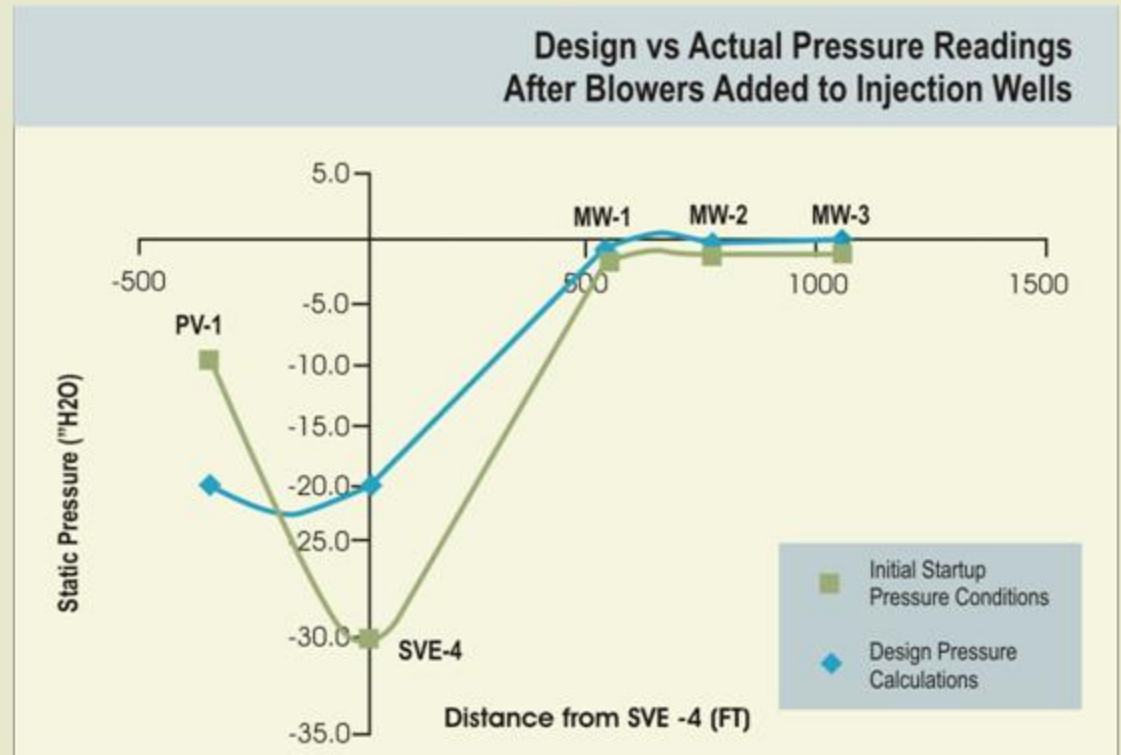
2nd Upgrade – Blowers Added

- October 1, 2002
- Injection of Air into Sand Layer
 - Two 8 hp Briggs and Stratton Motors
 - Connection to Two 24” Diameter Centrifugal Blowers
 - Connection to Injection Wells Heads via 4” Corrugated Pipe



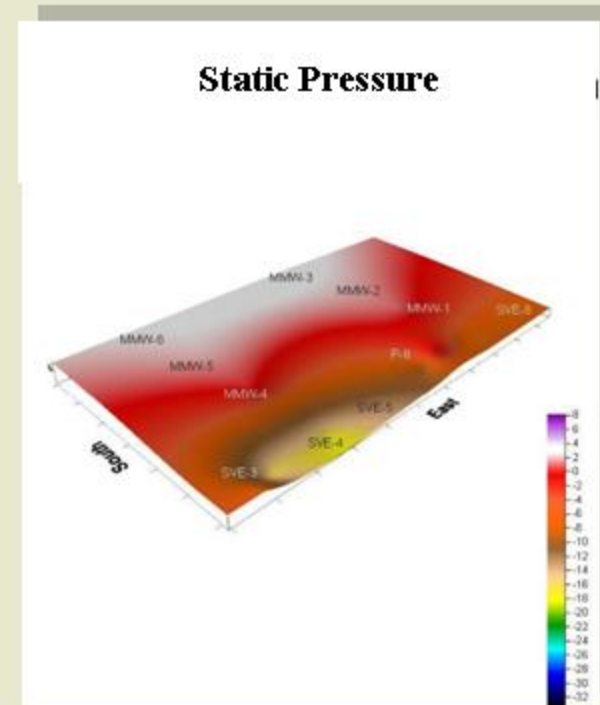
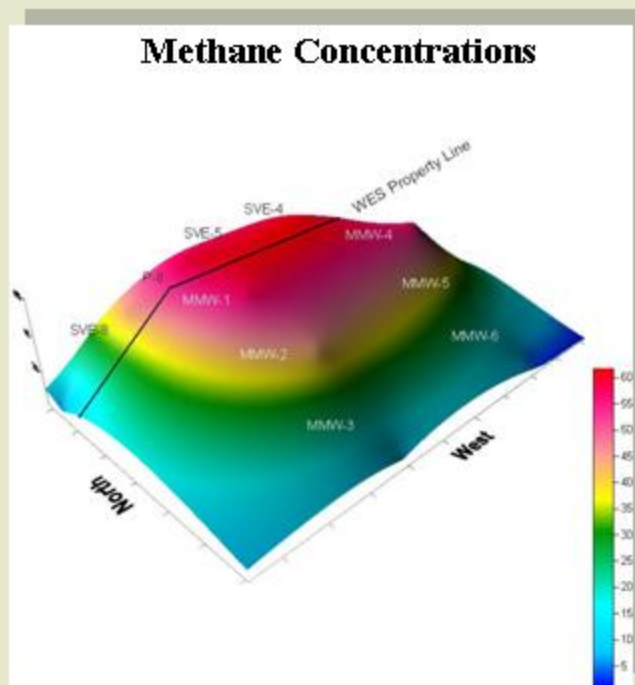
Overall Results

- Once again Design ROI followed the Actual ROI of the System



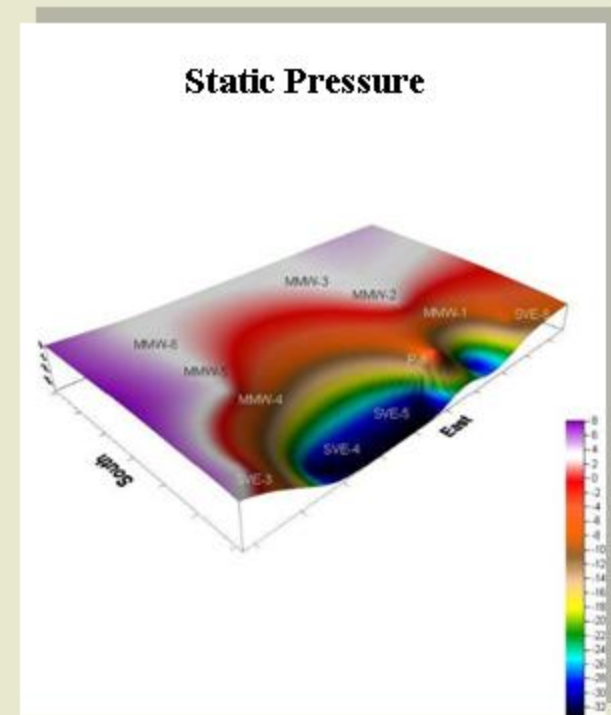
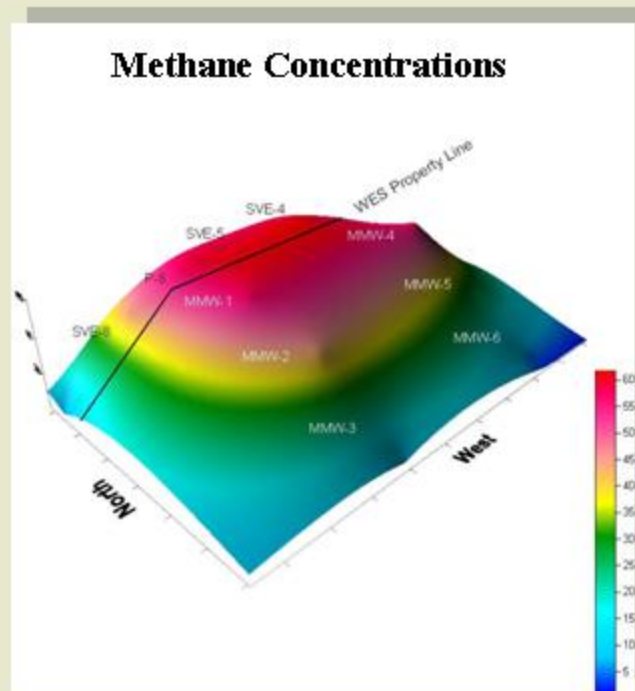
Overall Results

- **Initial System Conditions**



Overall Results

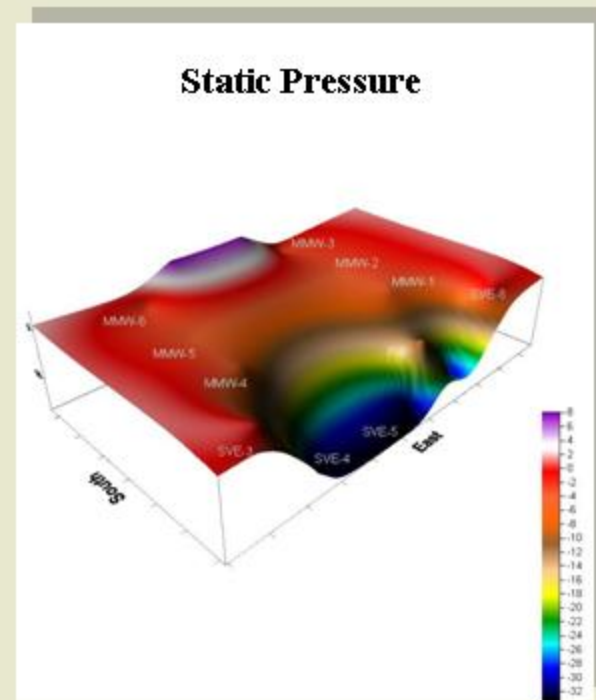
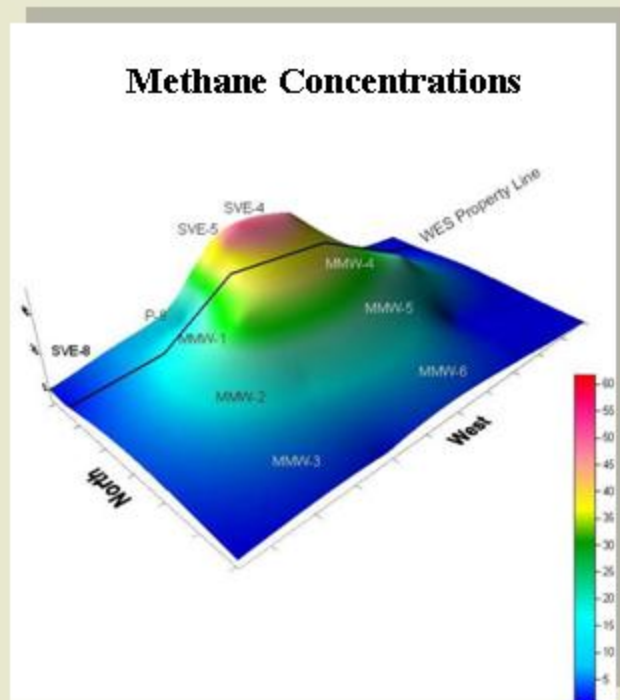
- 1st Upgrade – Passive Vents & Header



Soil Vapor Extraction for Mitigation Control : Real Data for Design

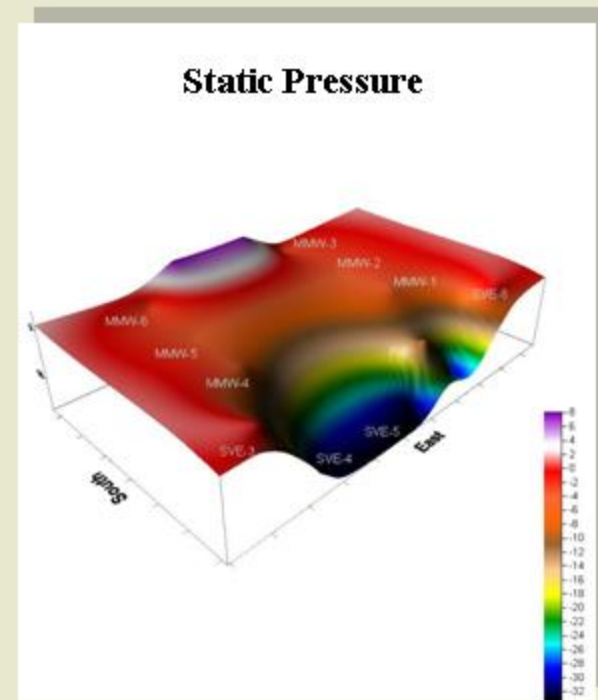
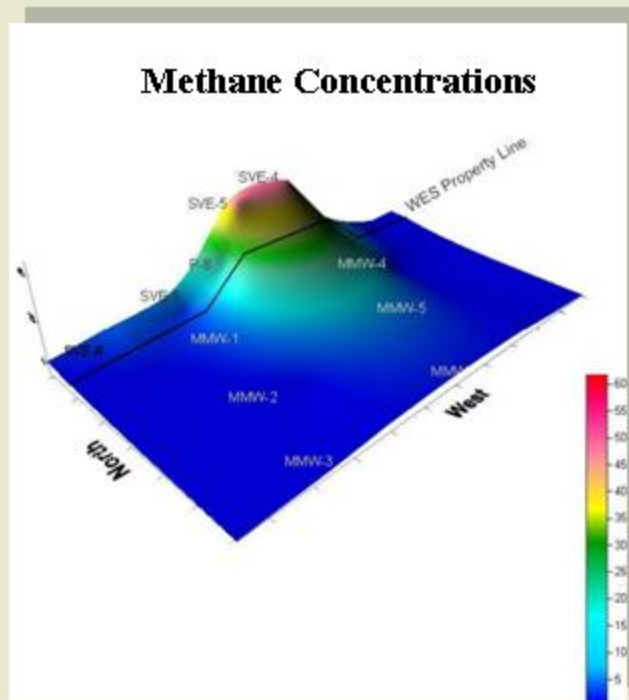
Overall Results

- 2nd Upgrade – Blowers Added



Overall Results

- **Conditions at End of 2003**



Overall Results

- **State Approved Completion of Corrective Action in June 2004, 1 to 3 years ahead of plan**
- **Future Use of SVE Wells : Monitoring Only; Quick Reactivation if Needed**
- **Vacuum on Extraction Portion of System will be Increased in Order to Compensate for Closure of SVE Wells**
- **Landfill Gas to Electricity Project Nearing Completion**

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