



Vadose Zone Remediation by Passive Soil Vapor Extraction (PSVE)

Acknowledgements



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MicroBlower™

- Solar powered soil vapor extraction
- U. S. Patent 6,971,820



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MicroBlower™

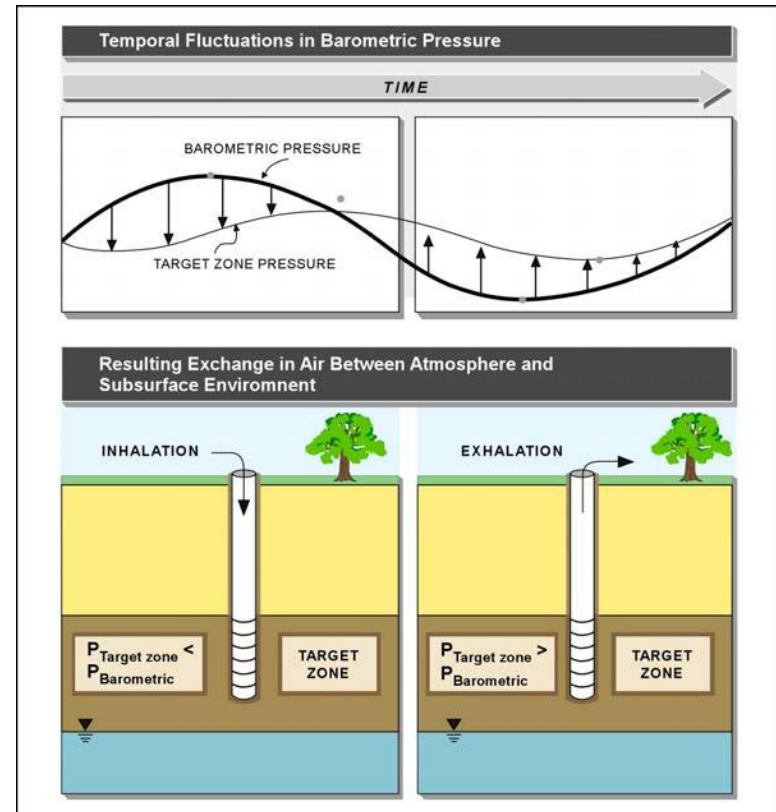
- Used to Enhance Soil Vapor Extraction
- Intermediate technology between traditional electric and barometric pumped systems



Barometric Pumping

- Dynamic flow of air from the zone of high pressure to the zone of low pressure

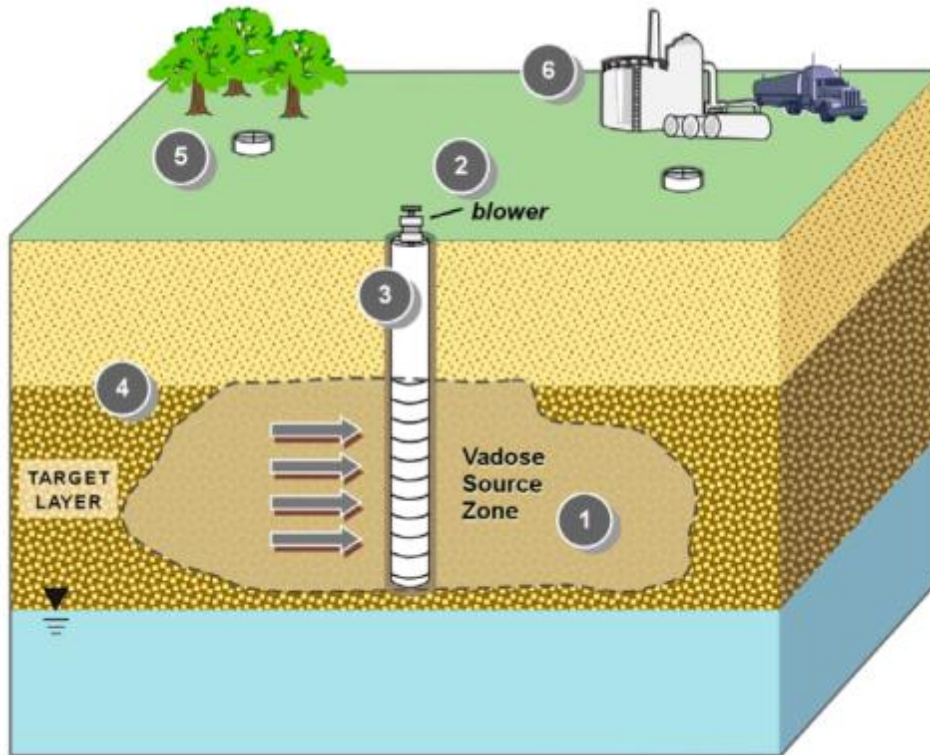
Conceptual Model for the 'Inhalation' and 'Exhalation' Phenomenon Vadose Zone Wells



Reference: SRNL-STI-2009-00571



Factors that Favor PSVE



Site Status

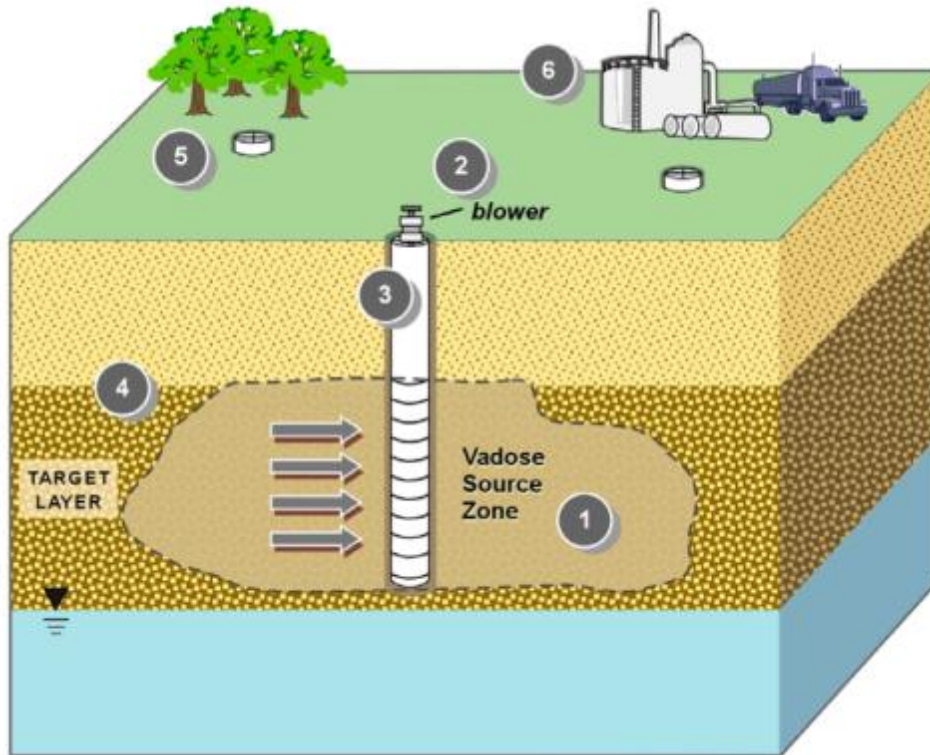
1. Active SVE has reached asymptote in performance

System Factors

2. Sites require a large number of wells because wellhead equipment is inexpensive, and commercially available
3. Sites with existing ASVE wells can be converted to PSVE wells while eliminating high maintenance infrastructure

Reference: SRNL-STI-2009-00571

Factors that Favor PSVE



Site Conditions

4. Lower permeability soils
5. Remote sites because of minimal power and O&M requirements
6. Sites with active operations where it is difficult to run surface infrastructure

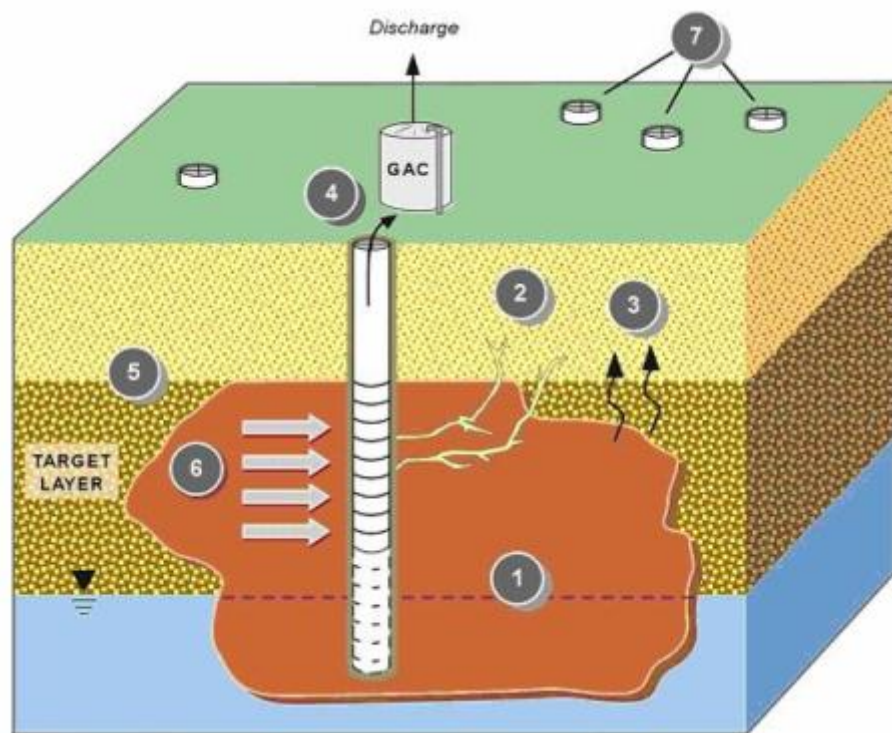
Reference: SRNL-STI-2009-00571

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Factors that could Preclude PSVE



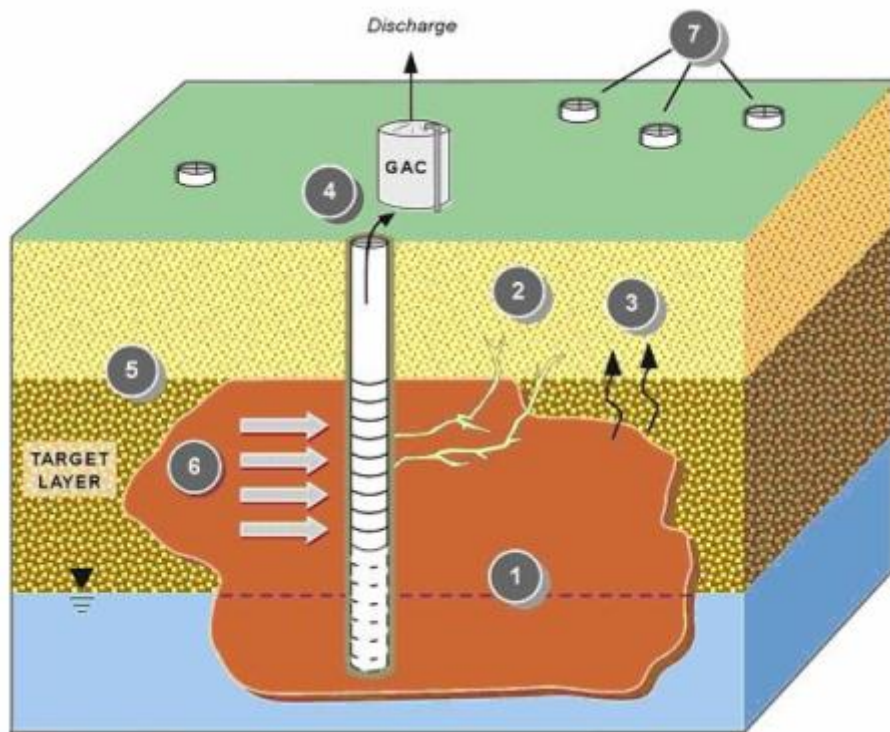
Reference: SRNL-STI-2009-00571

Site Conditions

1. Sites with soils that have high moisture levels
2. Sites with extensive preferential pathways
3. Sites with poor lithologic isolation of target layer
4. Sites with high VOC concentrations may necessitate aboveground treatment & increase costs



Factors that could Preclude PSVE



Reference: SRNL-STI-2009-00571

Remediation Timeframe

5. Removal of mass from target layer is slow and may not be suitable if short time cleanup is desired
6. Extraction rates are low-intermittent
7. Sites where a large number of new wells are required to provide adequate coverage of capture



MicroBlowers at SRNL



Over 50 MicroBlowers are in operation at the 300 square mile Savannah River Site in South Carolina.

Used as polishing after active SVE

Used as primary remediation for small sources

Primarily chlorinated solvents but one site is a mix of BTEX and chlorinated solvents

All permitted in RODS or interim actions.



MicroBlowers Staged for Deployment



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Microblowers Deployed at the C Area Burning Rubble Pit, SRS





MicroBlower™ Installations



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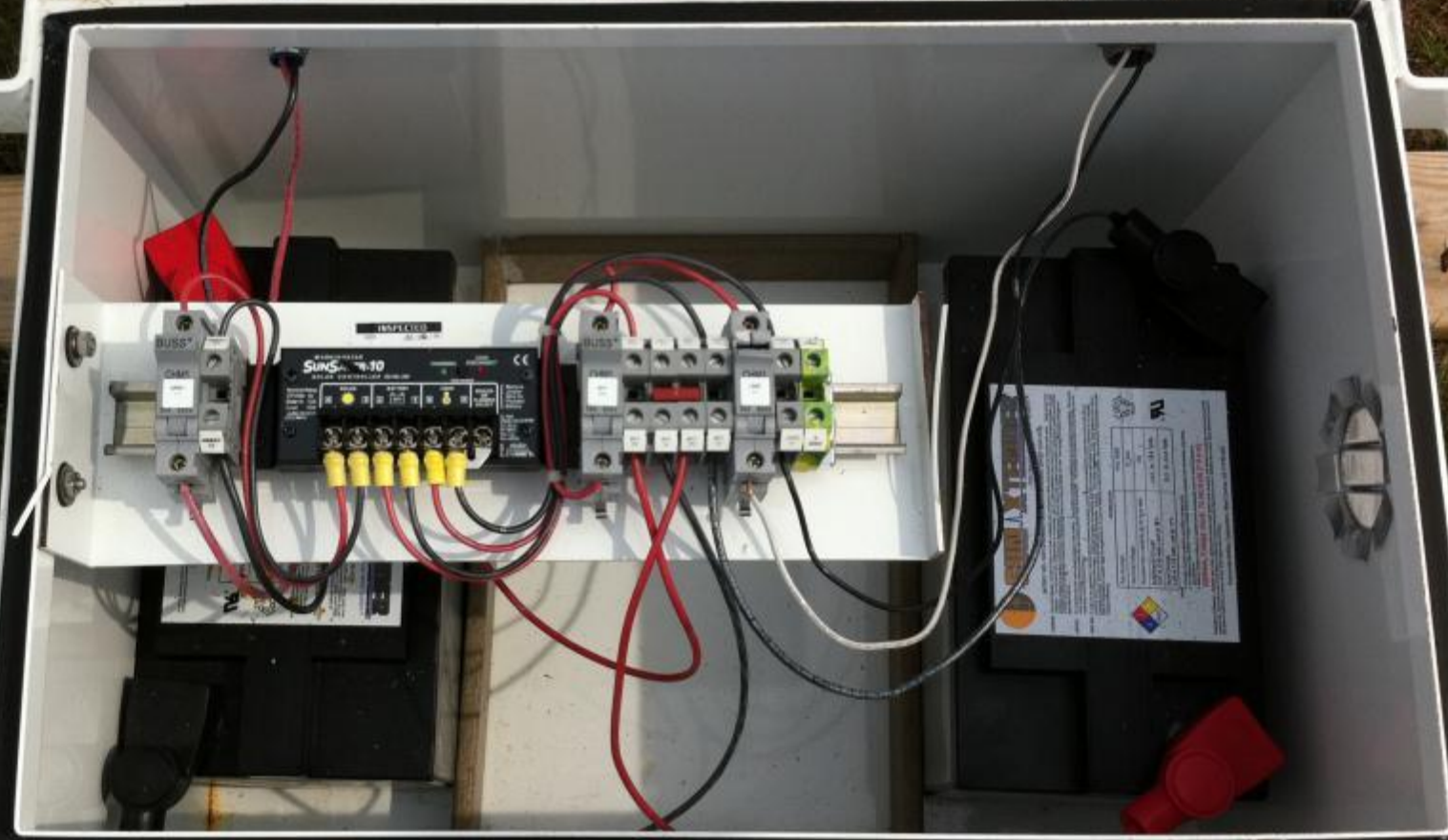


KYOCERA Solar, Inc.
SOLAR RATIO SYSTEM

WARNING

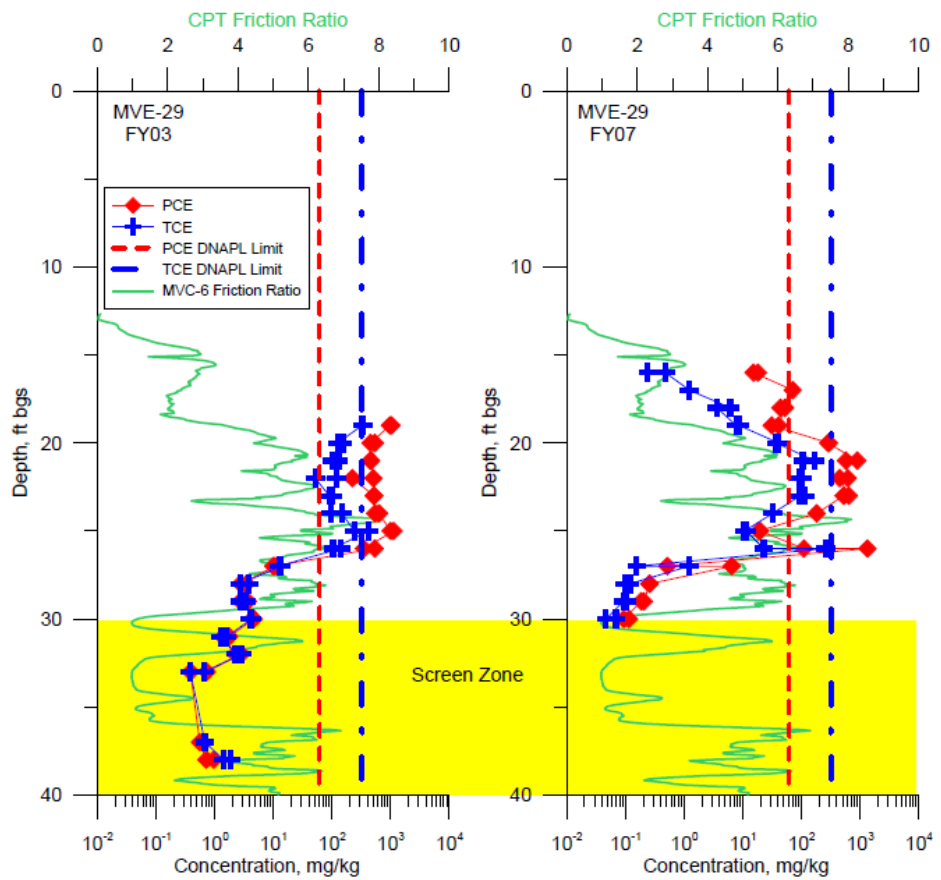
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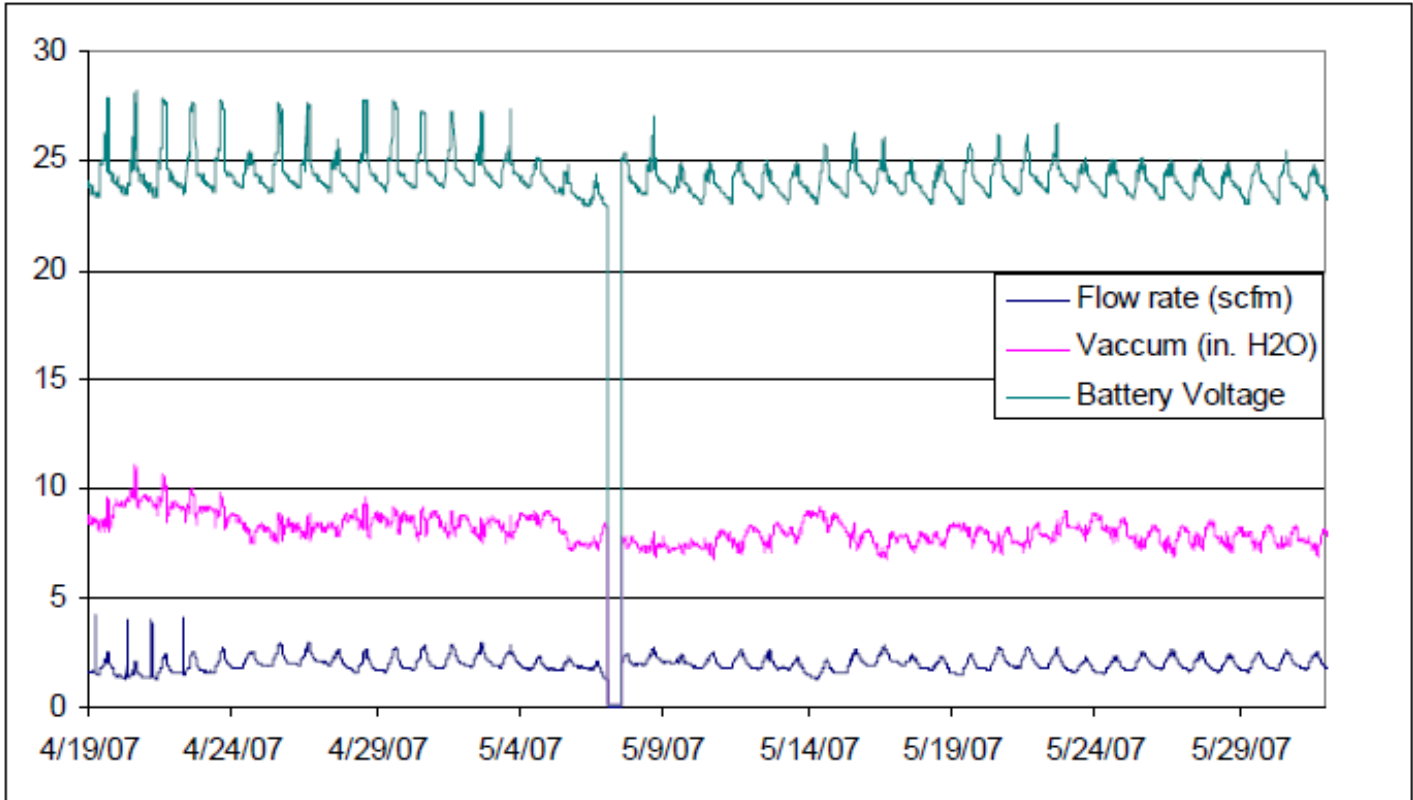


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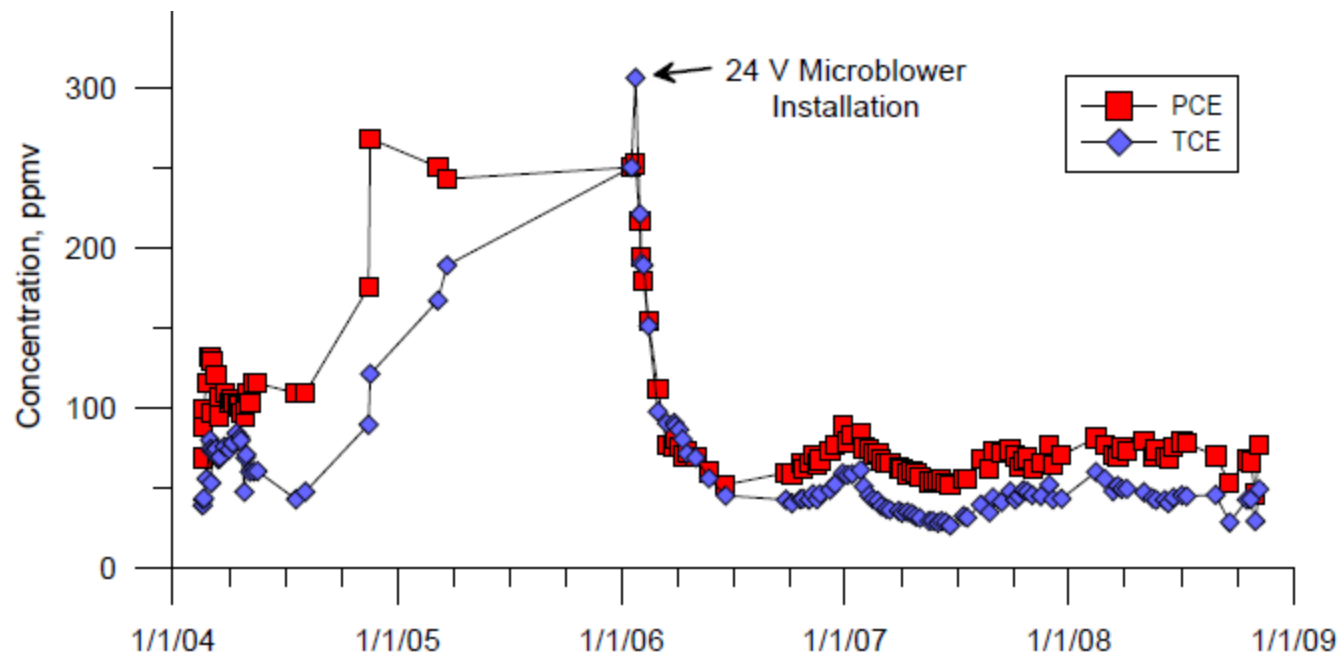
Sediment Concentration Profiles from MVE-29



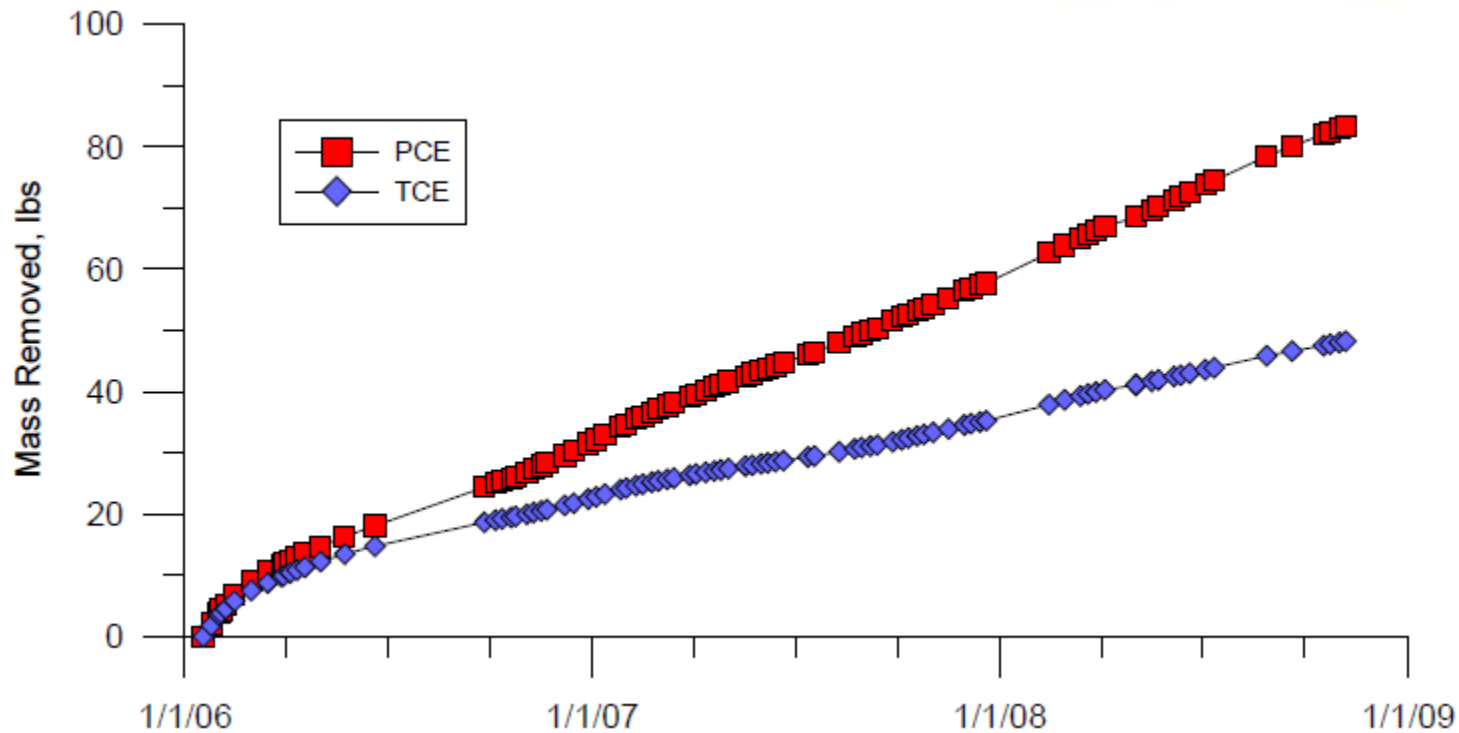
MicroBlower™ Data Savannah River Site



Soil Gas VOC Concentrations



VOCs Removed

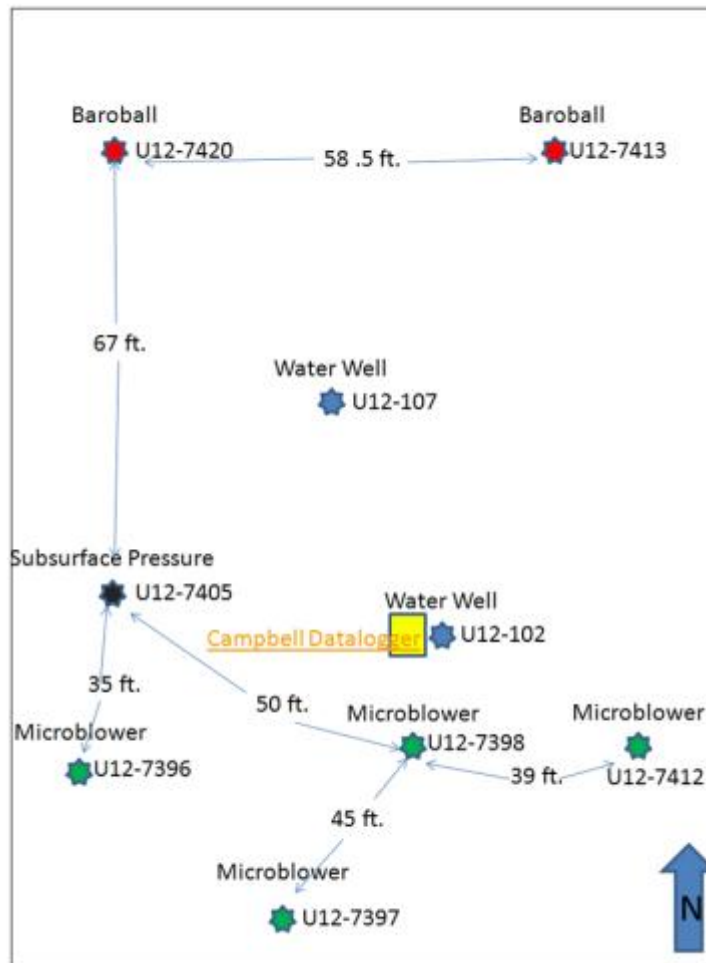


234 pounds removed in 10 months



Passive SVE Demonstration at AF Site

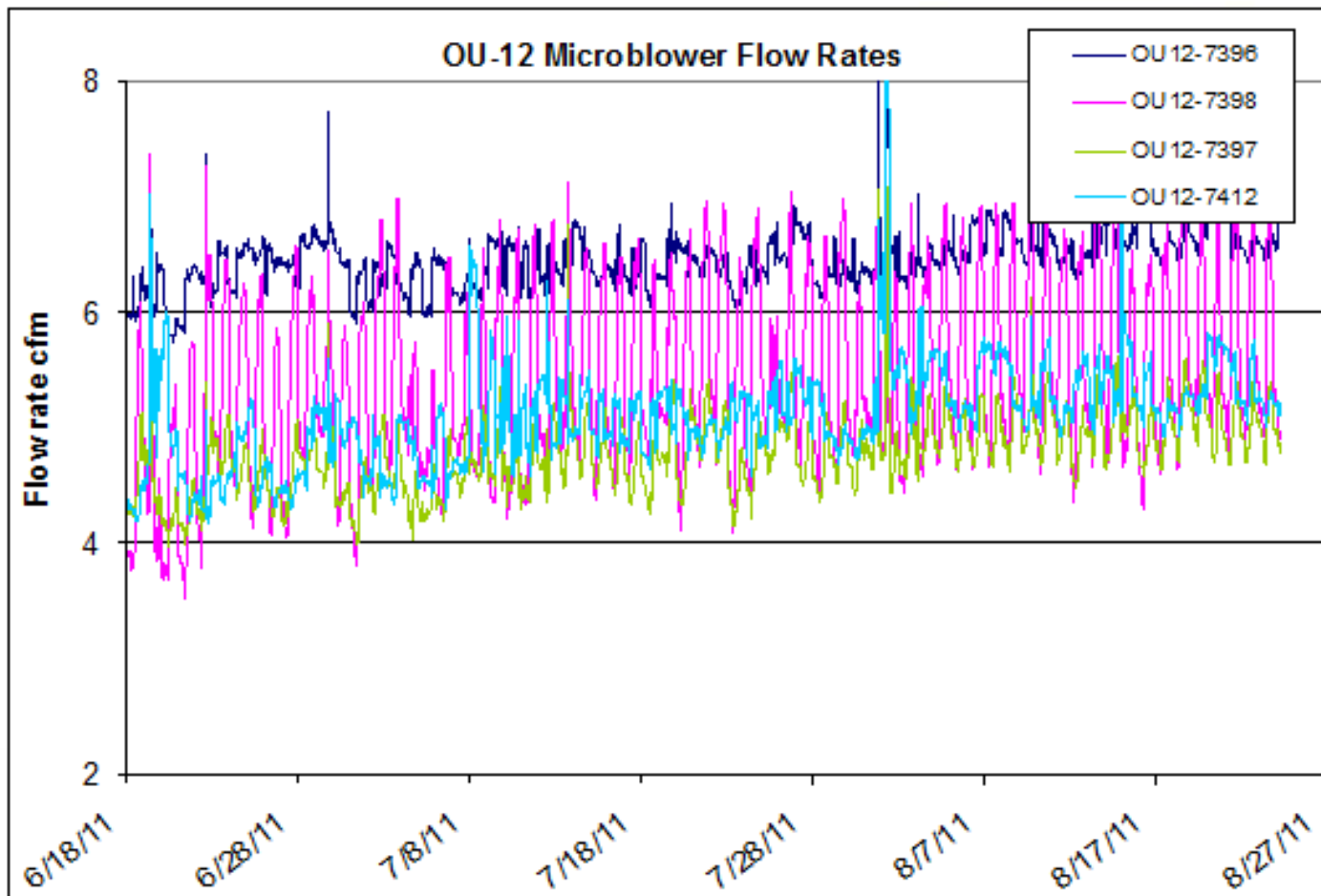
Well Layout



Average Soil Gas Flow Rate and Calculated Mass of TCE Removed

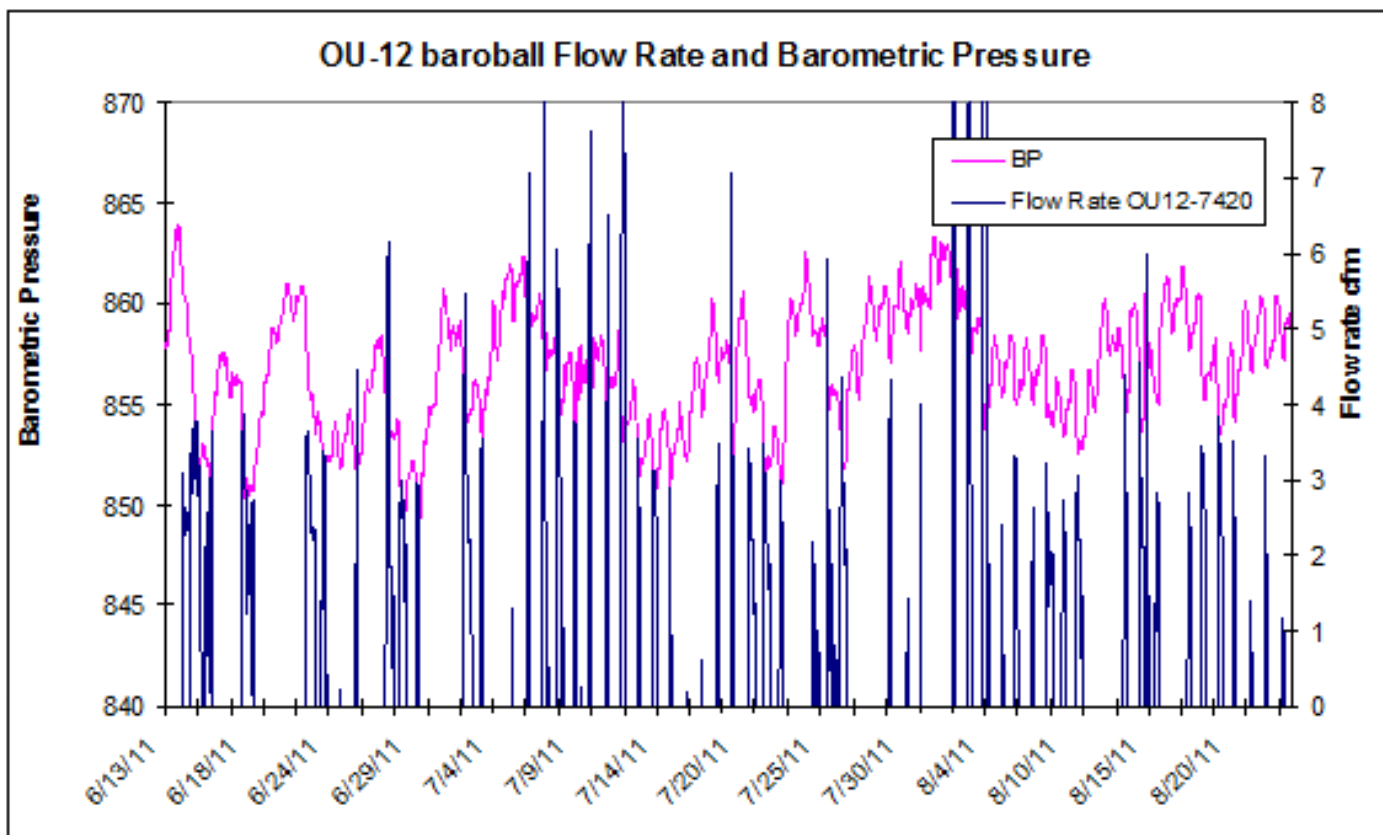
PSVE Type	Microblower				Baroball	
Well	OU-12-7396	OU12-7397	OU12-7398	OU12-7412	OU12-7413	OU12-7420
<i>Data collected between 6/29/2011 – 8/09/2011 (42 days)</i>						
Average Flow Rate ¹ (cfm)	6.4	5.3	4.7	5.1	0.4	0.6
Average Conc. (mg/m ³)	1365	1507	1603	2354	897*	3114**
Ibs. TCE Removed ² between 6/29 – 8/9/2011	33	30	29	45	1.3	7.5
<i>Data collected since startup (6/14/2011 – 8/09/2011; 56 days)</i>						
Average Flow Rate ¹ (cfm)	6.4	5.3	4.8	5.1	0.4	0.7
Average Conc. (mg/m ³)	1355	1502	1768	2318	897*	2409**
Ibs. TCE Removed ³ since startup	44	41	42	61	2*	9**

Microblower Flow Rates Since Startup in June 2011



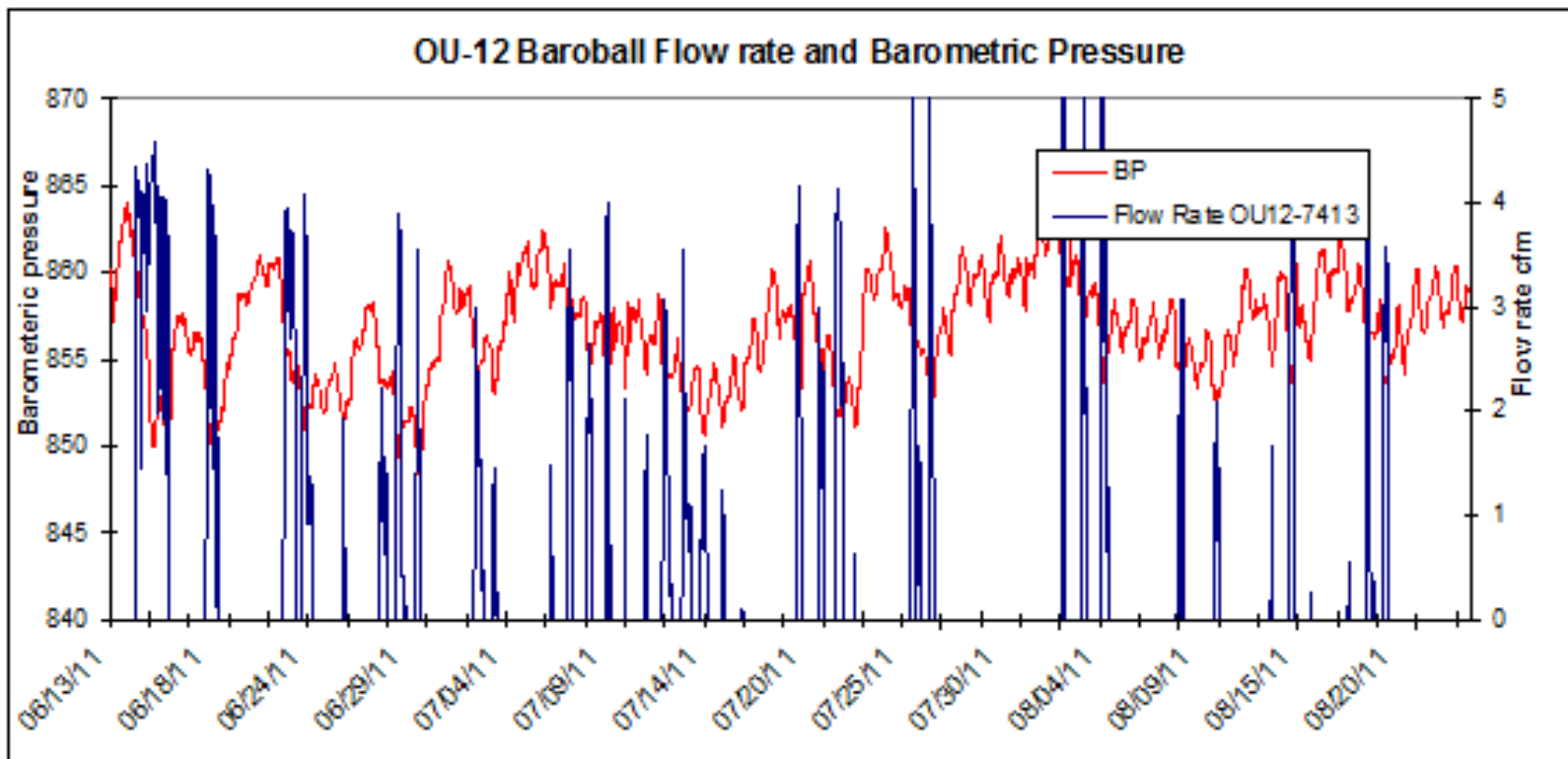
Flow Rate (cfm) from Baroball Wells

OU12-7420

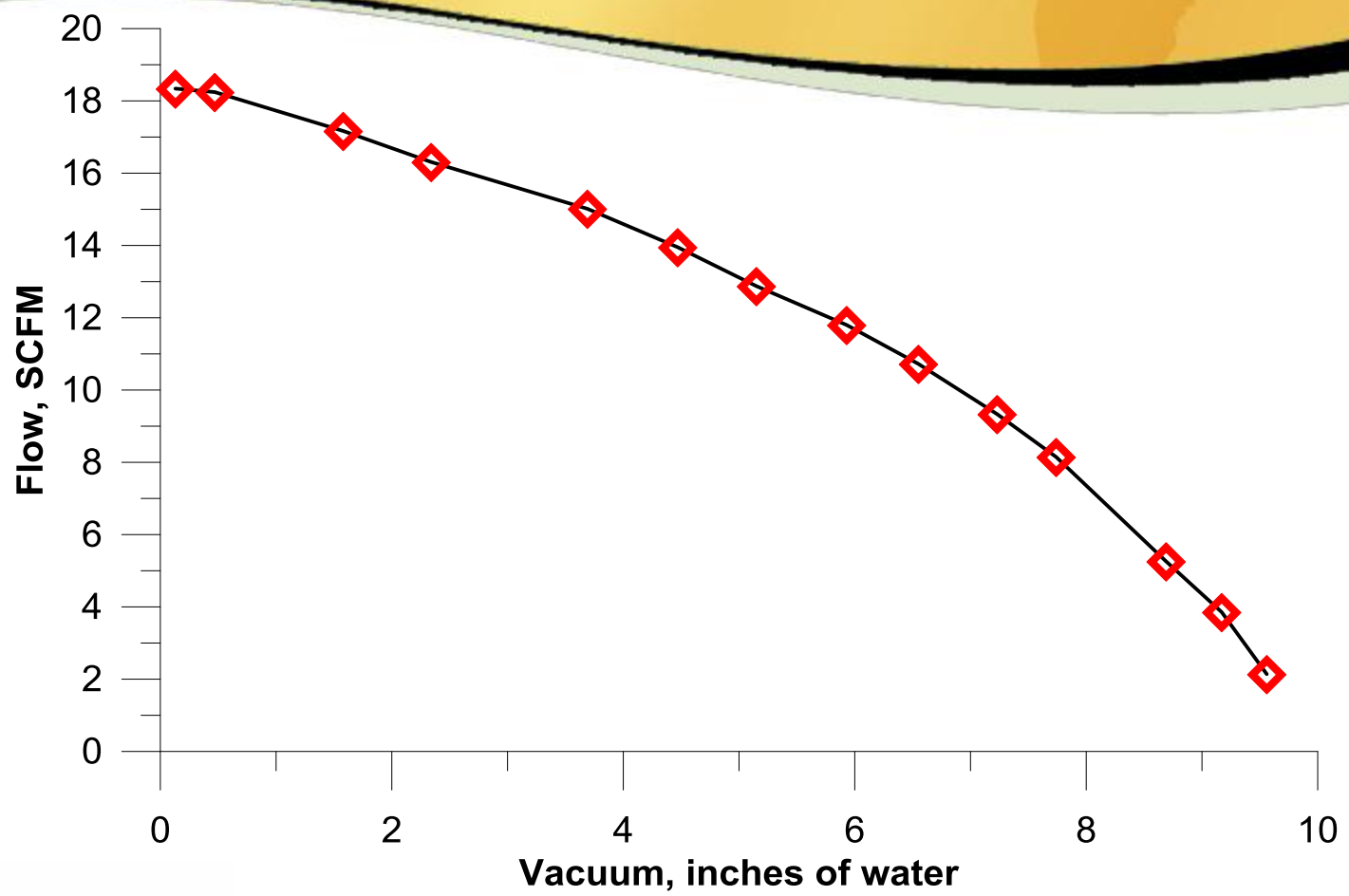


Flow Rate (cfm) from Baroball Wells

OU12-7413



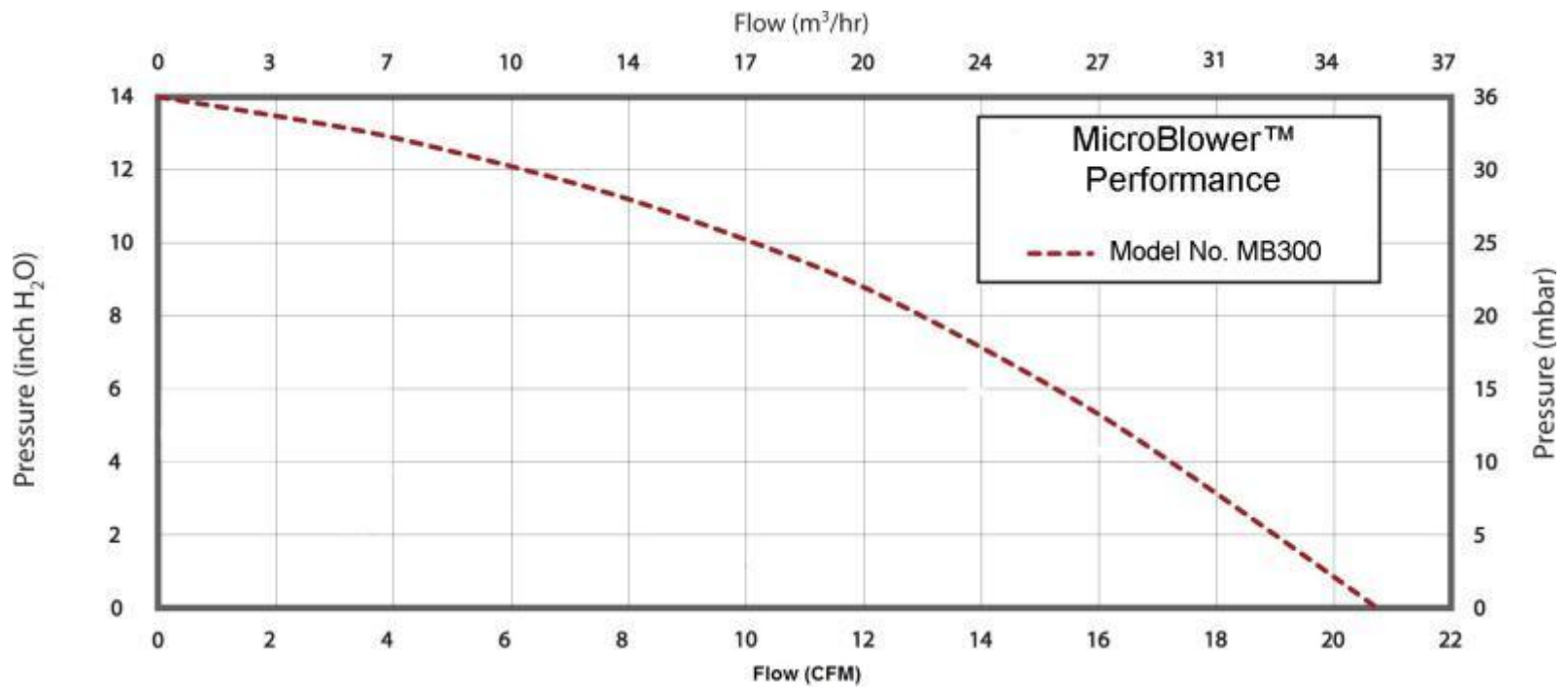
Performance Curve



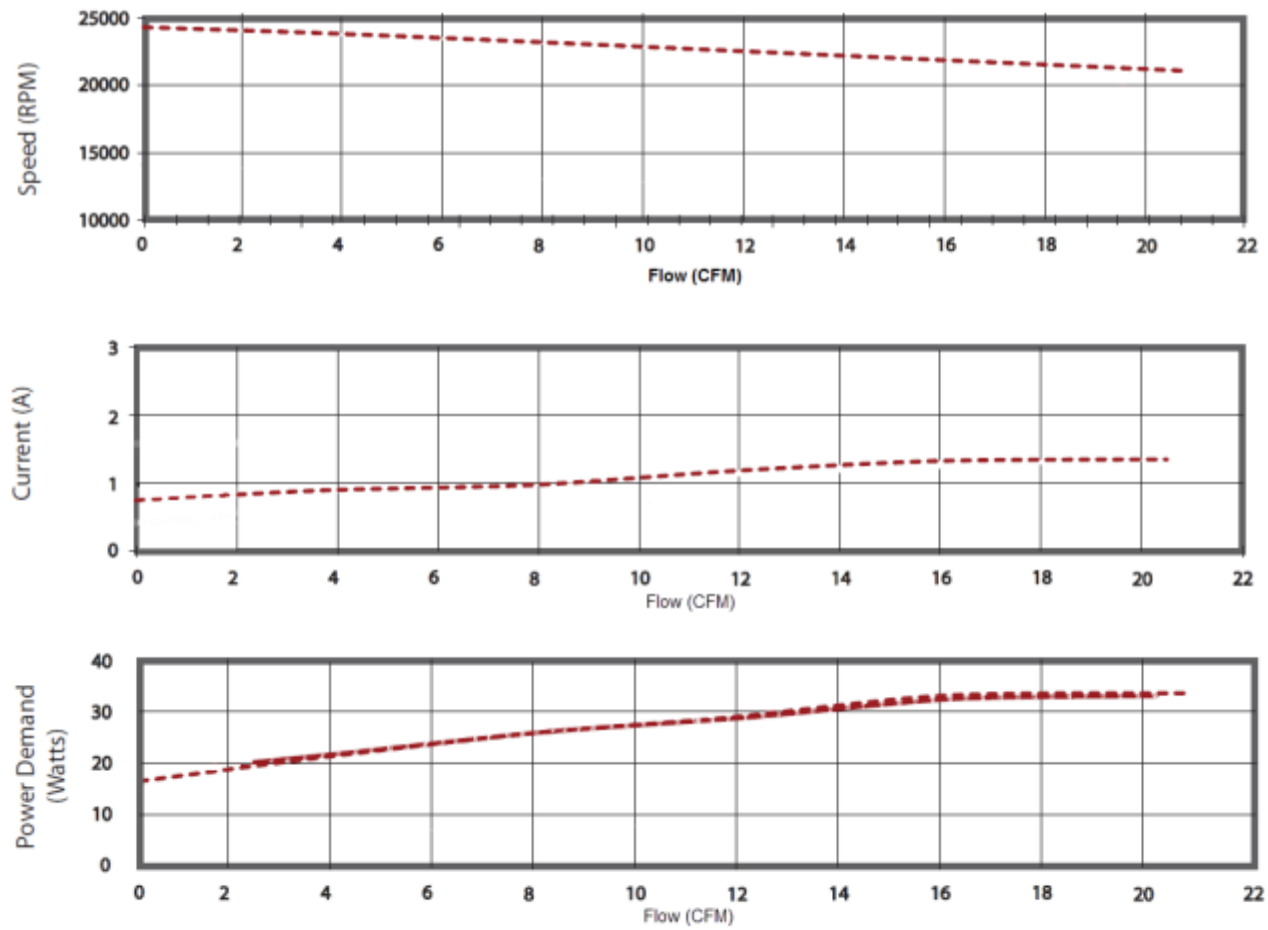
24 V System



Model No. MB300 Performance Curves



Model No. MB300 Performance Curves



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