

# Sustainable SVE Design/Optimization

Groundwater and soil remediation involve extracting soil vapor to remove contaminants from subsurface. A key element in the extraction process to overcome the Capillary forces and remove adsorbed contaminant from the soil matrix. Tools that are available for extraction require a solid understanding of the subsurface geology, and the physical and chemical properties of rocks and soil.

BERM's engineers and hydrogeologists developed a protocol to assess subsurface conditions to create maximum removal rate of contaminant using vapor extraction.

Our protocol includes the following steps:

1. Proper logging extraction zone during installation of borings or wells.
2. Collecting and testing the appropriate number of soil samples for capillary pressure curve and air permeability/hydraulic conductivity using ASTM methods.
3. Estimating the air flow, well flow per foot of screen interval and blower size for pilot test using the results of petro-physical testing.
4. Performing a pilot tests using appropriate blower and vapor treatment system.
5. Estimating zone of influence using the capillary pressure curve data and vacuum responses.
6. Estimating overall energy use of the equipment, O&M tech and emission from these sources.
7. Performing periodic rebound testing and sampling to verify effectiveness.
8. Performing confirmation soil sampling periodically to detect dead spots. .
9. Performing sustainability evaluation and termination studies to end the SVE or downgrade as necessary. .



### **BENEFITS OF USING CAPILLARY PRESSURE CURVES FOR EXTRACTION DESIGN**

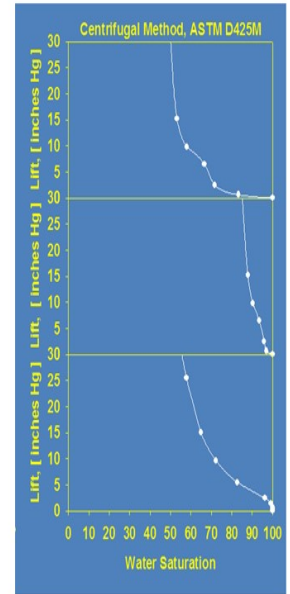
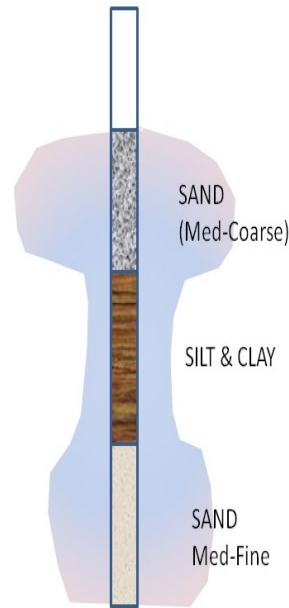
Capillary pressure curves have been used in the oil and gas industry for reservoir characterization and for recoverable oil calculations. Capillary pressure tests— done by petro-physical testing laboratories in accordance with the appropriate ASTM methods— yield information about the effective porosity, minimum entry/extraction pressure/vacuum, capillary rise, residual/ irreducible water saturation and the percent water saturation at different pressure levels. Based on these tests, we prepare a vapor flow model, and use the model to evaluate the extraction radius of influence. We calibrate the model during extraction to manage the extraction program for optimum results.

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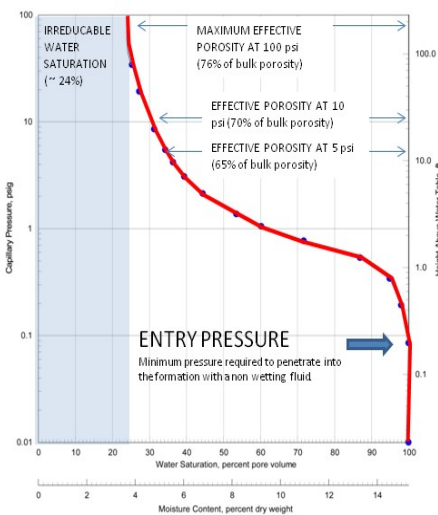
## CASE STUDY:

Crawfordsville, Indiana – Former Dry Cleaner site near Indianapolis, Indiana. SVE design and system operation and maintenance services. Used innovative design and system sizing approach using Capillary pressure curves and air permeability testing from the soil samples. Three distinct zones were identified (upper sand zone, middle silt zone and lower sand zone). One shallow and one deep SVE wells were installed with screen in the upper and the lower sand zone. SVE system was started with a 90-day pilot test and extended to 1.5 years upon successful outcome during the pilot operation and testing. Soil vapor concentrations reduced over 90% during the operation. Even the groundwater concentration declined about 80 % after 6 months of SVE operation. System was removed after 1.5 years of operation meeting all required clean up objectives and confirmation soil sampling objectives.

## USING CAPILLARY PRESSURE CURVES FOR INJECTION OPTIMIZATION



**For more information:** <https://baysgrp.net/berm-shared/BATTELLE--MCINTIRE-POSTER-2012.pdf>



**ADDITIONAL RESOURCES:** USACE, 2002, Engineering and Design, Soil Vapor Extraction and Bioventing, EM 1110-1-4001, June 3, 2002.

USEPA, 2017, How To Evaluate Alternative Cleanup Technologies For Underground Storage Tank Sites, A Guide For Corrective Action Plan Reviewers. EPA 510-B-17-003, October 2017.

**BERM** is a California State Certified Small Business. Our professionals have over 25 years of experience in performing soil vapor extraction, two phase extraction, multiphase extraction. Our president have two patents in two phase extraction and in-well striping and recirculation. BERM has the following California Contractor Licenses: General Engineering (A), Hazardous Material Removal (HAZ) and Water Well Drilling and Testing (C57).

**Bays Environmental Remediation Management**  
For a site evaluation and to get an estimate please call  
714-455-0057 or e-mail to [mp@baysgrp.net](mailto:mp@baysgrp.net) — [www.baysgrp.net](http://www.baysgrp.net)