Technology Presentation
NEIWPCC (2016)
Presenter: Noel Shenoi
(www.calclean.com)
Overview

I. Company Background
II. Equipment and Services
III. Technology
IV. System Comparison
V. System Advantages
VI. Enhanced Remediation Techniques
VII. Review of a Performance Based Contract (PBC)
VIII. Case Study using a PBC
IX. Question(s)/Comment(s)
X. Closing
CalClean has a close working relationship with numerous consultants and contractors throughout the USA to assist with the assessment, cleanup, and case closure of your site(s). We help manage the remediation project from beginning to end.

All data is provided to consultant on a weekly basis.

CalClean is interested in Performance Based Contract (PBC) projects anywhere in the USA.

With truck-mounted and trailer-mounted extraction systems and water treatment systems located in numerous areas throughout the USA, we can mobilize anywhere.

We handle your money like it is our own. There are no hidden mark-ups. We get your site to closure much faster without the big capital investment.
CalClean’s Fleet of High Vacuum Dual Phase Extraction and Groundwater Treatment Systems......

With a Convenient Storage Location near your site!

States with stored equipment

AZ  CA  CO  FL  ID  MO  NC  NJ  OH  TX  UT  WA

can mobilize anywhere!
Equipment
Large Fleet of Equipment ready to mobilize ANYWHERE!

Mobile Extraction Unit
Dimensions: 8 ft. Wide (12 ft. When Onsite and Open) 35 ft. Length
Fleet of Mobile Trucks mounted with 450-CFM High Vacuum Systems and 25 hp Liquid Ring Pumps (LRP); and Fleet of Mobile Trailer mounted systems with 10-25 hp LRPs.

Water Treatment Trailer
Dimensions: 8 ft. Wide 16 ft. Length
Onsite Groundwater Treatment: Fleet of Mobile Trailers mounted with 20-GPM Carbon Systems

Chlorinated Solvent Unit
Dimensions: 8 ft. Wide 16 ft. Length
Fleet of 20-25 hp Chlorinated Solvent Systems (Carbon)
Able to Handle Various Constituents

- Petroleum Hydrocarbons
  - Gasoline
- Heavier Hydrocarbons
  - Diesel
  - Jet Fuel
- Chlorinated Solvents
  - PCE
  - TCE
- Heavy Oil (Bunker C)
Technology
Flow Diagram

- FLEXIBLE VACUUM HOSE FROM WELL
- TEMPORARY STORAGE TANK
- INLET KNOCKOUT TANK
- EXTRACTED LIQUIDS
- EXTRACTED VAPORS

- PROCESS TANK
- ORIFICE FLOW TUBE (VAPOR)
- WATER SAMPLE PORT

- CARBON ADSORBER CANISTERS IN SERIES
- CANISTER A SAMPLE PORT
- CANISTER B SAMPLE PORT
- CANISTER C SAMPLE PORT

- HIGH-VACUUM PUMP
- THERMAL OXIDIZER
- VAPOR SAMPLE PORT
- TO ATMOSPHERE
- TO STORM DRAIN OR SEWER
Vapor and Groundwater Extraction

* TIMING FOR ILLUSTRATIVE PURPOSES ONLY
(Longer Events usually increase Cone of Depression and expose more saturated zone for vapor extraction)
System Comparison
Comparison of Plume Size vs. Time for CalClean and Fixed Based SVE
<table>
<thead>
<tr>
<th>CalClean HVDPE</th>
<th>Standard S.V.E.</th>
<th>Pump &amp; Treat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truck-Mounted Mobile Systems</td>
<td>Fixed Based Systems (Few Mobile Systems)</td>
<td>Fixed Based Systems (Few Mobile Systems)</td>
</tr>
<tr>
<td>High Capacity 450 CFM Systems</td>
<td>Typical System is 250 CFM But Cannot Extract Water</td>
<td>Typical System is 2-20 GPM But Cannot Extract Vapors</td>
</tr>
<tr>
<td>Can Extract &amp; Destroy up to 130 pounds of Hydrocarbons per hour</td>
<td>Typical System can Destroy up to 40 pounds per hour of hydrocarbons</td>
<td>Cannot Destroy Hydrocarbon Vapors</td>
</tr>
<tr>
<td>Can Extract up to 29” Hg (394” H2O) i.e., Large Radius of Influence, Less Extraction Wells Required for Site</td>
<td>Typically Extracts up to 10” Hg (136” H2O) i.e., Smaller Radius of Influence, More Wells Required, Greater Costs</td>
<td>Not Applicable For Vapors</td>
</tr>
<tr>
<td>Extract Vapor &amp; Groundwater</td>
<td>Extract Vapor Only</td>
<td>Extract Groundwater Only</td>
</tr>
<tr>
<td>Can Lower Groundwater Table to Address Vadose, Capillary Fringe &amp; Saturated Zones</td>
<td>Cannot Extract Groundwater</td>
<td>Can Only Remove Groundwater, No Vapor</td>
</tr>
<tr>
<td>CalClean HVDPE</td>
<td>Standard S.V.E.</td>
<td>Pump &amp; Treat</td>
</tr>
<tr>
<td>----------------------------------------------------</td>
<td>-------------------------------------------------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Can Mobilize to a Site within Hours of a Call. Can Attack Source Immediately</td>
<td>Typically Takes 9-15 Months To Install System - Allows Plume Size To Increase</td>
<td>Typically Takes 6-15 Months to Install System - Allows Plume Size to Increase</td>
</tr>
<tr>
<td>Can Startup at a Site Quickly</td>
<td>Takes Many Months Before Startup</td>
<td>Takes Many Months Before Startup</td>
</tr>
<tr>
<td>Can pull offsite when Concentrations Drop off To Allow for Rebound</td>
<td>Cannot pull off-site since fixed</td>
<td>Cannot pull off-site since fixed</td>
</tr>
<tr>
<td>Can Adjust Number of Days of Operation to Maximize Recovery</td>
<td>Cannot Adjust Days of operation</td>
<td>Cannot Adjust Days of operation</td>
</tr>
<tr>
<td>Constant On-site Monitoring of Influent Vapor Concentrations</td>
<td>No On-site Monitoring of Influent Vapor Concentrations</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Occupies Space At Station “Only” During On-site Operation</td>
<td>Occupies Full-Time Space on Small Station Property</td>
<td>Occupies Full-time Space on Small Station Property</td>
</tr>
<tr>
<td>Low Noise Operation (Great for Residential Areas)</td>
<td>High Noise Systems (Complaints from Neighbors)</td>
<td>Low Noise</td>
</tr>
<tr>
<td>CalClean HVDPE</td>
<td>Standard S.V.E.</td>
<td>Pump &amp; Treat</td>
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</tr>
<tr>
<td><strong>System Manned To Adjust Stinger Depths to Maximize Recovery</strong></td>
<td>System Unmanned, Cannot Adjust Depths in Extraction Wells</td>
<td>System Unmanned, Cannot Adjust Depths in Extraction Wells</td>
</tr>
<tr>
<td><strong>No Capital Cost Outlay</strong></td>
<td>High Capital Cost</td>
<td>High Capital Cost</td>
</tr>
<tr>
<td><strong>Closures Can Be attained Earlier (possibly in less than 1 year)</strong></td>
<td>Closures Typically Take 3 to 10 Years</td>
<td>Closures Typically Take 5 to 30 Years</td>
</tr>
<tr>
<td><strong>No Trenching Needed</strong></td>
<td>Trenching Required</td>
<td>Trenching Required</td>
</tr>
<tr>
<td><strong>No Shutdown Of Station</strong></td>
<td>Shutdown Station for 2 - 4 Weeks - Loss of earnings</td>
<td>Shutdown Station for 2 - 4 Weeks - Loss of earnings</td>
</tr>
<tr>
<td><strong>No Long Time Commitment Needed For Use At A Site</strong></td>
<td>Long Term Commitment is Needed</td>
<td>Long Term Commitment is Needed</td>
</tr>
<tr>
<td><strong>No Cost Of Decommissioning</strong></td>
<td>High Cost Of Decommissioning And Loss Of Value Of System</td>
<td>High Cost Of Decommissioning And Loss Of Value Of System</td>
</tr>
<tr>
<td><strong>No Weekly O&amp;M Cost(s)</strong></td>
<td>Highly Weekly O&amp;M Cost(s)</td>
<td>High Weekly O&amp;M Cost(s)</td>
</tr>
<tr>
<td><strong>Faster Closures = Quicker Release of Liability</strong></td>
<td>Slower Closures = Long Time Liability</td>
<td>Slower Closures = Long Term Liability</td>
</tr>
</tbody>
</table>
System Advantages
System Advantages

- Most Cost Effective (Lowest $ / lb. Hydrocarbon Removed)
- No Capital Or Maintenance Cost Outlays
- Can Mobilize Quickly and Make Adjustments On The Fly
- No Shutdown Of Operations Do To Installation Of Trenching
- Low Noise For 24-Hour Operations In Neighborhoods
- Occupies Less Space at Station
- High Capacity Equipment (CFM and GPM)
- Can extract from depths of >270 feet
- Various Locations Permits Already Obtained
- 100% Guaranteed Up Time
- Quality Technical Expertise And Supervision
- Mobile Fleet Of Truck And Trailer Mounted Extraction Systems
- Faster Clean-up = Quicker Release Of Long Term Liability
Enhanced Remediation Techniques
HVDPE Enhancements

- Use Air Sparging to enhance HVDPE
- Use HVDPE to remove diesel free product
- Introduce Surfactants to assist with diesel cleanups
- Clean up contaminated groundwater sites quickly with high vacuum systems
- New extraction and injection well design for HVDPE operations
- Use periodic extractions (w/interruptible pricing) to address interim rebound
### Examples of HVDPE w/Air Sparging

<table>
<thead>
<tr>
<th>Location</th>
<th>Concentration w/o Air Sparging</th>
<th>Concentration w/Air Sparging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gardena</td>
<td>600 ppmv</td>
<td>10,000 ppmv</td>
</tr>
<tr>
<td>Diamond Tire</td>
<td>500 ppmv</td>
<td>11,000 ppmv</td>
</tr>
<tr>
<td>Glen Avon</td>
<td>200 ppmv</td>
<td>6,000 ppmv</td>
</tr>
</tbody>
</table>
Review of Performance Based Contracts
Review of Performance Based Contracts

- Reduces Overall Project Costs
- Quicker Cleanups (able to use multiple systems at the same time)
- Better For the Environment
  - Guaranteed Results
  - Cutting Edge Technology Used
- More States Moving Toward PBC/PFP
  - Lowers Administrative Costs
    - Florida has seen a 64% savings
  - Funds Easier to Control
- **Risk Transferred to Contractor**
Case Study using a Performance Based Contract
Kennett Conoco, Missouri (PBC)

- LNAPL present up to >3 ft. in 18 wells onsite and offsite on 4 properties
- MTBE affected city drinking water wells ½ mile from site - wells are shut down
- Lithology consists of sand with some silt
- CalClean utilized 4 powerful HVDPE systems simultaneously to extract from multiple wells onsite and offsite
- LNAPL removed after ~4 months of operation
- 5 air sparge wells were added after LNAPL was removed, which increased mass removal rates
- 2.95 million gallons of groundwater was removed in ~12 months, reducing dissolved groundwater concentrations below DTLs/RBTLs for most wells
- Approximately **391,000 lbs. (~63,000 gallons)** of vapor-phase gasoline was removed in ~12 months of operation (as of 6/30/16)
Kennett, Missouri

Former Kennett Conoco Station
Recommendations

- Conduct **30-day long** term event(s) instead of 3-day events (cost of one 30-day event is same as six 3-day events!)
- Get sewer **permit** for discharge of treated groundwater
- **Occasional** vac truck use will prolong projects and potentially allow plume(s) to migrate further
- CalClean and consultant to meet and **work together**
- Aggressive Cleanup using **interruptible** pricing program to keep costs low
- **Remedial well design/location** is critical to effective cleanups around source area(s), add one or more air sparge wells near source area
- Use **appropriate consultants** along with CalClean to maximize effectiveness
- Conduct **30-day events** to take sites to closure
- Obtain Sewer Discharge **Permits vs. costly** Offsite Transportation and Disposal
CalClean’s Report Card

*In Sixteen (16) Years*

Over 500 CASE CLOSURES* and Counting

* With most closures coming in CA and FL, some of the hardest states to get even one closure
End of Presentation to NEIWPC (2016)

Thank you
Case Summaries
A soil gas sample contained up to 2,700 µg/L PCE.
The highest dissolved phase concentration of PCE was 625 µg/L.
Soil beneath the site consist of silty sand and silt interbedded with sand and gravel.
Unconfined groundwater is present at a depth of 90 to 95 feet below grade.
CalClean initiated SVE activities in August 2015 using two 300 cfm liquid-ring blower and 6x 1,000 lb vapor carbon vessels.
Over the initial 4 months of HVSVE, CalClean removed 1,025 lbs of PCE.
SVE activities are still ongoing and are anticipated to last 6-12 more months in order to achieve case closure levels.

Former Dry Cleaner Facility

Pacific Palisades, California
A soil gas sample at 5 ft bgs indicated that PCE was present at 2,900 µg/L

Site is underlain by fine-grained horizons of silt and clay with interbedded layers of sands and groundwater was from 9.6-11.4 ft bgs

CalClean utilized a system with a 300 cfm liquid-ring blower & 2x 1,000 lb carbon vessels

Over 30 days, CalClean removed 28 lbs of PCE

Total influent concentrations decreased to 0.36 µg/L

Soil vapor sample results showed that PCE did not present a vapor intrusion risk

Site submitted for case closure
Ventura, California

Active Dry Cleaner Facility

- A soil gas sample at 5 ft bgs indicated that PCE was present at 3,600 µg/L
- Site consists of a mixture of silty clay and sandy clay in the upper vadose zone
- CalClean utilized a system with a 300 cfm liquid-ring blower & 3x 1,000 lb carbon vessels
- Over approximately 5 months, CalClean removed 60 lbs of PCE
- Rebound testing indicated that concentrations decreased to 1.36 µg/L
- Soil vapor sample results showed that PCE did not present a vapor intrusion risk
- Site received case closure