

CalClean Inc.

High Vacuum Dual Phase Extraction & Groundwater Treatment Systems

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Update Presentation to CA - UST Cleanup Fund

January 21, 2004

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Overview

- Remediation Capabilities
- CalClean's Performance Review
- New Remediation Techniques Learned
- New "Interruptible" Pricing Program
- Permits (Air & Water)
- Advantages of Using CalClean's Systems
- Recommendations

Remediation Capabilities

- Petroleum Hydrocarbons (Seven Truck-mounted 450-CFM High Vacuum Systems)
 - MtBE and Other Oxygenates (ETBE, TAME, DIPE, TBA, etc.)
 - BTEX
 - Other Aromatic Hydrocarbons
 - Fuels (gasoline, diesel, etc.)
- Onsite Groundwater Treatment (Ten Trailer-mounted 20-GPM Systems)

CalClean's HVDPE & Groundwater Treatment



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CalClean's Performance Review

Year 2000

- **One** HVDPE Truck
- **One** Water Treatment Trailer
- Recommended 5-Day Events
- Removed Approx. 113,000 pounds
- Cost/Pound Removed = **\$5.32**

CalClean's Performance Review

Year 2001

- **Three** HVDPE Trucks
- **Five** Water Treatment Trailers
- Recommended 15-Day Events
- Removed Approx. 346,000 pounds
- Cost/Pound Removed = **\$4.90**

CalClean's Performance Review

Year 2002

- **Five** HVDPE Trucks
- **Seven** Water Treatment Trailers
- Recommended 30-Day Events
- Began Full Scale Cleanups
- Removed Approx. 564,000 pounds
- Cost/Pound Removed = **\$4.44**

CalClean's Performance Review

Year 2003

- **Seven** HVDPE Trucks
- **Ten** Water Treatment Trailers
- **Seven** Auxiliary Fuel Trailers
- Recommended 30-Day Events
- Began Using Air Sparging w/HVDPE
- Removed Approx. 690,000 pounds
- Cost/Pound Removed = **\$4.38**

CalClean's Performance Review

Year 2004

- Recommend Multiple 30-Day Events
- Use Air Sparging w/HVDPE
- Implement "interruptible" rate program
- Concentrate on quality of "Up-Time"
- Better maintenance of systems
- Provide minimum up-time guarantee

CalClean's Performance Review

Average Cost Per Pound Summary

- Year 2000 - \$5.32 (113,000 pounds)
- Year 2001 - \$4.90 (346,000 pounds)
- Year 2002 - \$4.44 (564,000 pounds)
- Year 2003 - \$4.38 (690,000 pounds)

Total Pounds Removed = 1,713,000

Average Cost Per Pound = \$4.56

New Remediation Techniques Learned

- Use Air Sparging to enhance HVDPE
- Use HVDPE to remove diesel product
- Clean up contaminated vadose only sites quickly with high vacuum systems
- New well box and underground piping design for HVDPE operations
- Use periodic extractions (w/interruptible pricing) to address interim rebound
- Can extract from great depths (>270 feet)

Interruptible Pricing Program

- Timesharing with several other sites
- Minimum Contract - 120 Days
- Complete over 9 months
- Minimum 7-day events each return
- Address rebound on every return to site
- \$1,500/day pricing for HVDPE system
- Special lower pricing for water treatment

Various Locations Permits

- **Air Districts (Vapor Treatment)**
 - SCAQMD, BAAQMD (ISSUED)
 - SDAPCD, MBUAPCD, EDAPCD (ISSUED)
 - VCAPCD, MDAQMD, SLOAPCD (ISSUED)
 - PCAPCD, SJVUAPCD, GCAPCD (ISSUED)
 - SMAQMD, SBCAPCD, GBUAPCD (ISSUED)
 - MAQMD, ICAPCD (ISSUED)
 - OTHER AQMDs/APCDs (PENDING)
- **NPDES (Onsite Water Treatment and Discharge)**
 - SANTA ANA (RWQCB-8) (ISSUED)
 - CENTRAL COAST (RWQCB-3) (ISSUED)
 - OTHER RWQCBs (PENDING APPLICATION)

Advantages Of Using CalClean

- Most Cost Effective (lowest \$ / lb. HC Removed)
- No Capital or Maintenance Cost Outlays
- Can Mobilize Quickly to a Site
- No Shutdown of Station for Trenching
- Low Noise for 24-Hour Operations in Neighborhoods
- Occupies Less Space at Station
- High Capacity Equipment (SCFM and GPM)
- Various Locations Permits Already Obtained
- Consolidated Pricing & 100% Guaranteed Up Time
- Quality Technical Expertise and Supervision

Recommendations

- Aggressive Cleanup using interruptible pricing program
- Remedial well design/location is critical to effective cleanups around source area(s), add one or more air sparge wells near source area
- Allow consultants to lengthen HVDPE events to maximize effectiveness in certain cases
- Increase duration of Pilot Tests to 5 days
- Encourage NPDES or Sewer Discharge Permits vs. Offsite Transportation and Disposal

Summary of HVDPE w/Air Sparging

<u>Location</u>	<u>Concentration w/o Air Sparging</u>	<u>Concentration w/Air Sparging</u>
Gardena	600 ppmv	10,000 ppmv
Dia. Tire	500 ppmv	11,000 ppmv
Glen Avon	200 ppmv	6,000 ppmv

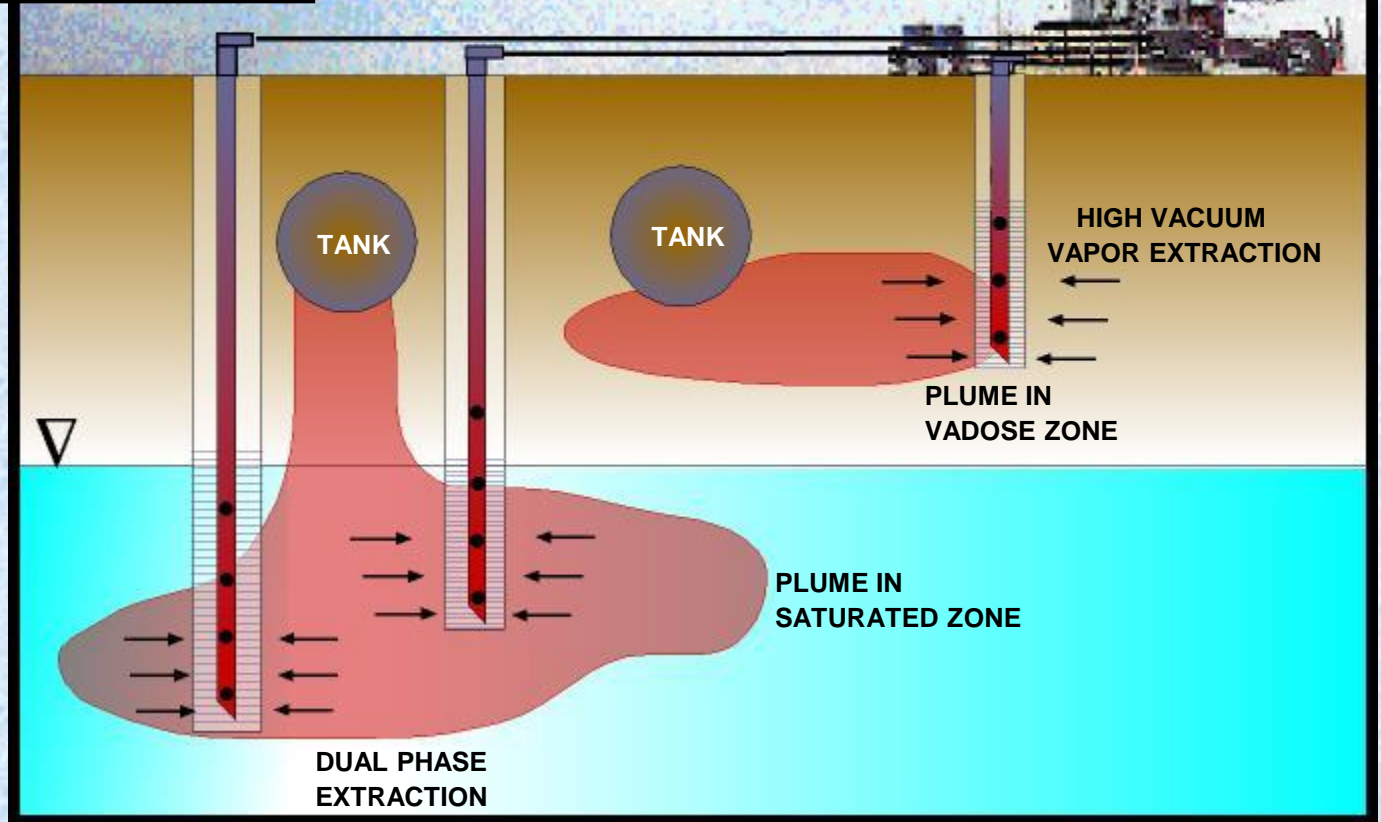
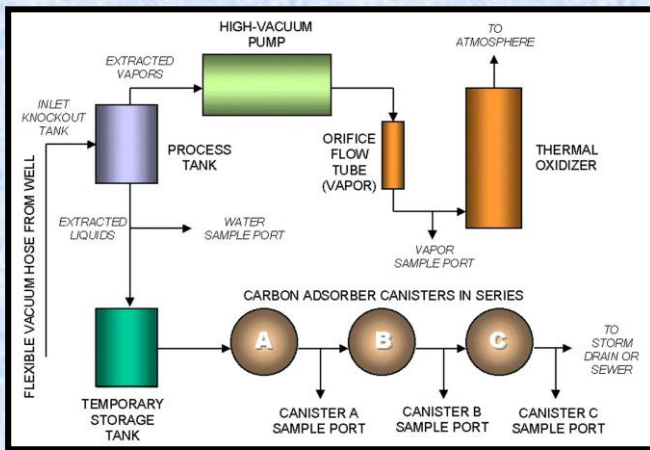
End of Presentation to USTCF on January 21, 2004

Remaining slides for
information purposes only

Steps for Treatment and Discharge of MtBE Water

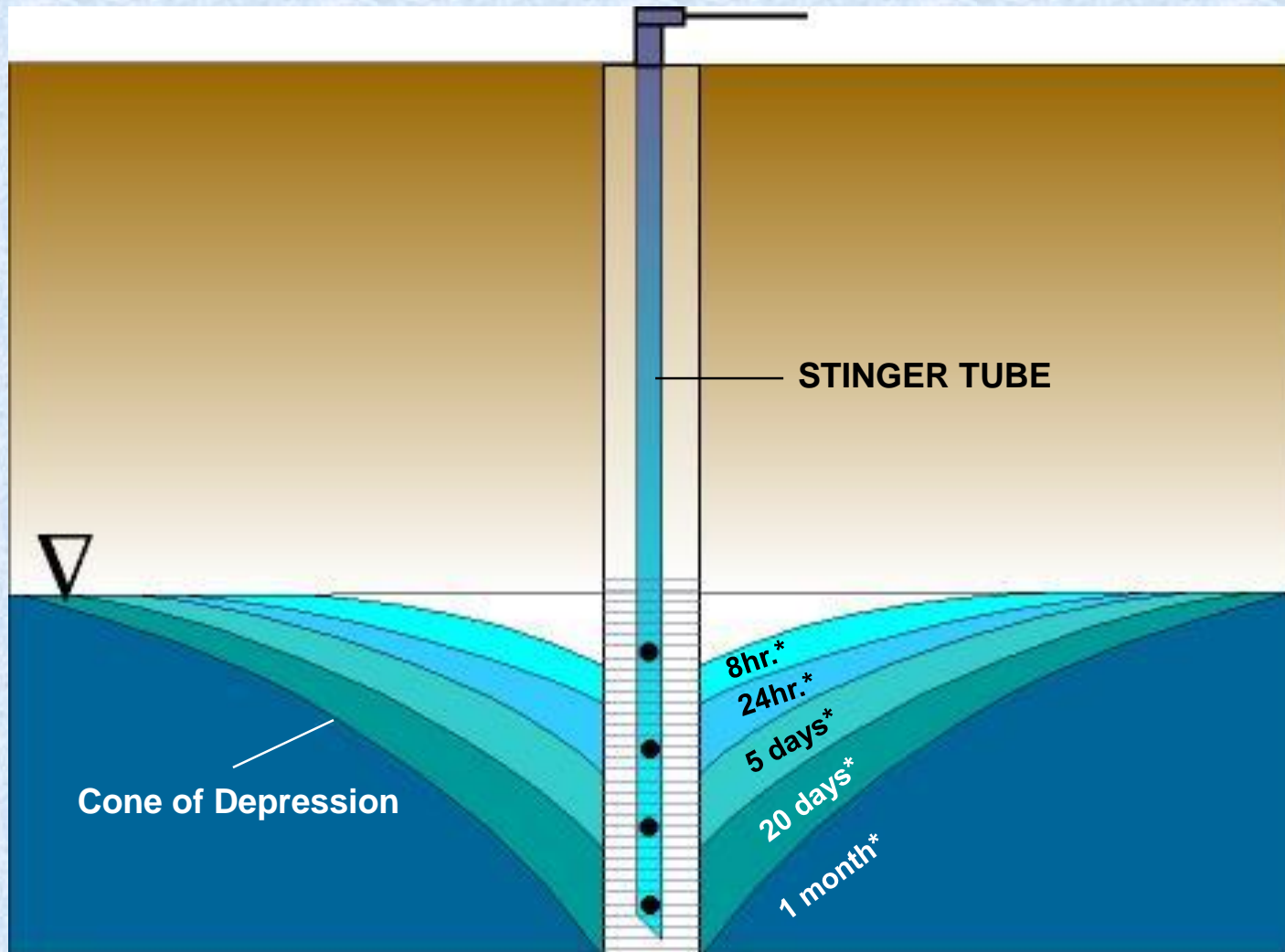
1. Extract affected water from ground
2. Process in aboveground HVDPE unit to remove most of the hydrocarbon concentrations
3. Polish with Activated Carbon & Discharge to storm drain / sewer system

EXTRACTION PROCESS



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Vapor and Groundwater Extraction

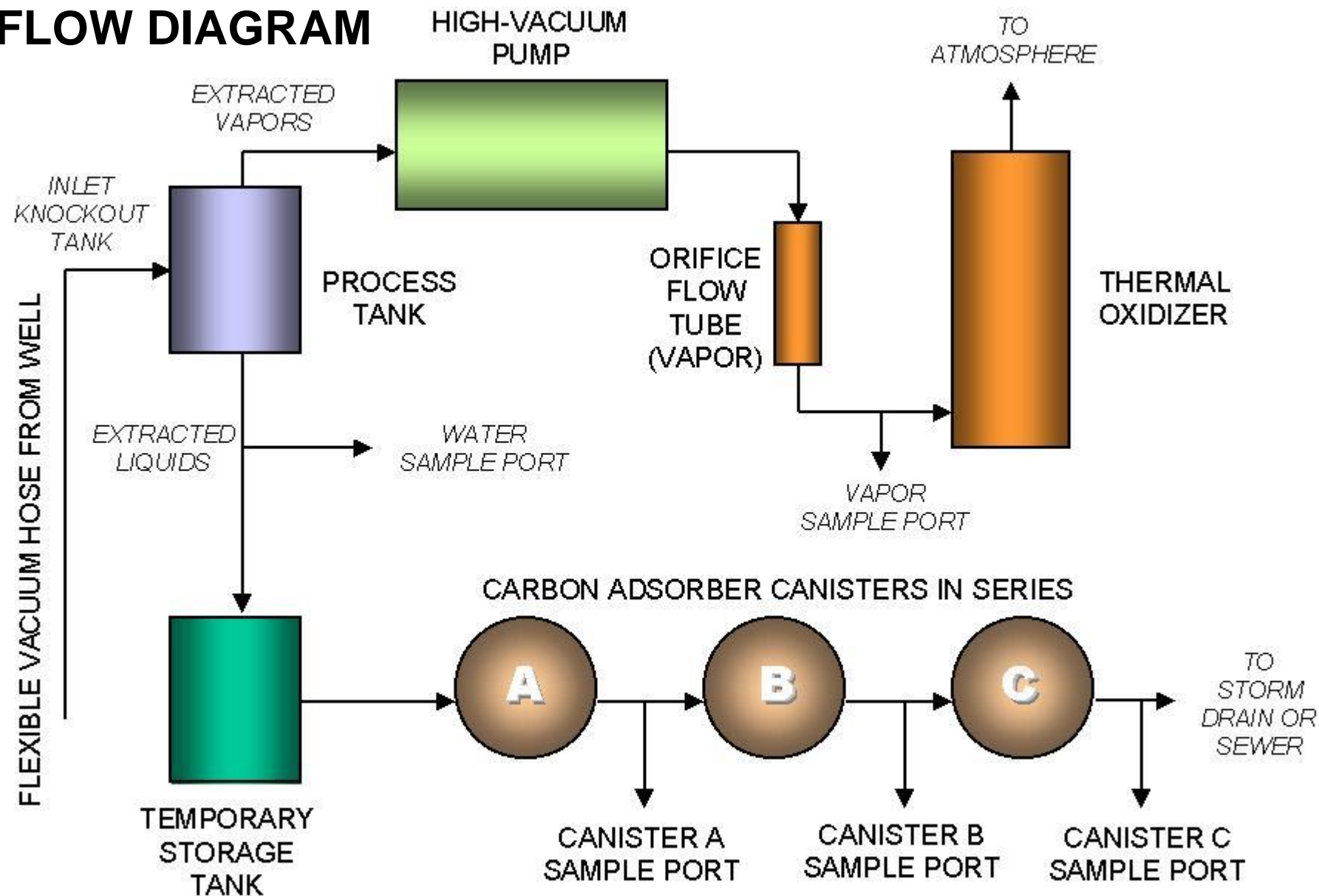


*** TIMING FOR ILLUSTRATIVE PURPOSES ONLY
(Longer Events usually increase Cone of Depression
and expose more saturated zone for vapor extraction)**

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FLOW DIAGRAM



Aggressive Source Control, Removal, and Treatment

1. Remove Groundwater by Vacuum Extraction
2. Lower Water Table, i.e. increase Cone of Depression
3. Extract Vapors from Exposed Zones - Vadose Zone, Capillary Fringe & Saturated Zone
4. Process Water in System to Reduce Concentrations
5. Polish Processed Water with Activated Carbon
6. Discharge Treated Water to Storm Drain (NPDES Permit) or Sewer (Sanitation Permit)
7. Vapor Destruction in permitted Thermal Oxidizer

Pricing for UST Cleanup Fund Projects

HVDPE Event (<u>w/o water treatment</u>)	Cost / Event	Cost/hr
8-hour day	Not Applicable	-
24-hour day	\$2,700	\$112
2 Days (48 hours)	\$5,340	\$111
3 Days (72 hours)	\$7,920	\$110
4 Days (96 hours)	\$10,440	\$109
5 Days (120 hours) <i>Recommended</i>	\$12,900	\$107
15 Days <i>Recommended</i>	\$34,200	\$95
30 Days <i>Recommended</i>	\$54,000	\$75
31+ Days	\$1,800/day	

(For 5 or more day events anywhere in California, Mob/Demob and Per Diem costs are included at no extra charge.)

Groundwater Treatment
(includes analyses)

\$150 Mob/Demob for Trailer
+ \$0.35 per Gallon**

****Projects longer than 5 days will be provided special pricing**

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Comparisons (Specifications)

CalClean HVDPE

Standard S.V.E.

Pump & Treat

Truck-Mounted Mobile Systems

Fixed Based Systems
(Few Mobile Systems)

Fixed Based Systems
(Few Mobile Systems)

High Capacity 450 CFM Systems
Can Extract 5-50 GPM Water

Typical System is 250 CFM
But Cannot Extract Water

Typical System is 2-20 GPM
But Cannot Extract Vapors

Can Extract & Destroy up to
130 pounds of Hydrocarbons per hour

Typical System can Destroy up to
40 pounds per hour of hydrocarbons

Cannot Destroy Hydrocarbon
Vapors.

Can Extract up to 29" Hg (394" H₂O)
i.e.. Large Radius of Influence, Less
Extraction Wells Required for Site

Typically Extracts up to 10" Hg
(136" H₂O) i.e.. Smaller Radius of
Influence, More Wells Required,
Greater Costs

Not Applicable For Vapors

Extract Vapor & Groundwater

Extract Vapor Only

Extract Groundwater Only

Can Lower Groundwater Table to
Address Vadose, Capillary Fringe
& Saturated Zones

Cannot Extract Groundwater

Can Only Remove Groundwater,
No Vapor

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Comparisons (\$\$)

CalClean HVDPE

Standard S.V.E.

Pump & Treat

System Manned At All Times
To Adjust Stinger Depths to
Maximize Recovery

System Unmanned, Cannot
Adjust Depths in Extraction
Wells

System Unmanned, Cannot
Adjust Depths In Extraction
Wells

No Capital Cost Outlay

High Capital Cost

High Capital Cost

Closures Can Be attained Earlier
(possibly in less than 1 year)

Closures Typically Take
3 to 10 Years

Closures Typically Take
5 to 30 Years

No Trenching Needed

Trenching Required

Trenching Required

No Shutdown Of Station

Shutdown Station for 2 - 4
Weeks - Loss of earnings

Shutdown Station for 2 - 4
Weeks - Loss of earnings

No Long Time Commitment
Needed For Use At A Site

Long Term Commitment is
Needed

Long Term Commitment is
Needed

No Cost Of Decommissioning

High Cost Of Decommissioning
And Loss Of Value Of System

High Cost Of Decommissioning
And Loss Of Value Of System

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Comparisons (misc.)

CalClean HVDPE

Standard S.V.E.

Pump & Treat

Can Mobilize To A Site Within Hours Of Call. Can Attack Source Immediately

Typically Takes 9-15 Months To Install System - Allows Plume Size To Increase

Typically Takes 6-15 Months To Install System - Allows Plume Size To Increase

Can Startup At A Site Quickly

Takes Many Months Before Startup

Takes Many Months Before Startup

Can Pull Offsite When Concentrations Drop Off To Allow For Rebound

Cannot Pull Offsite since fixed

Cannot Pull Offsite since fixed

Can Adjust Number Of Days Of Operation To Maximize Recovery

Cannot Adjust Days Of Operation

Cannot Adjust Days Of Operation

Constant Onsite Monitoring Of Influent Vapor Concentrations

No Onsite Monitoring Of Influent Vapor Concentrations

Not Applicable

Occupies Space At Station Only During Onsite Operation

Occupies Full-Time Space On Small Station Property

Occupies Full-Time Space On Small Station Property.

Low Noise Operation
(Great For Residential Areas)

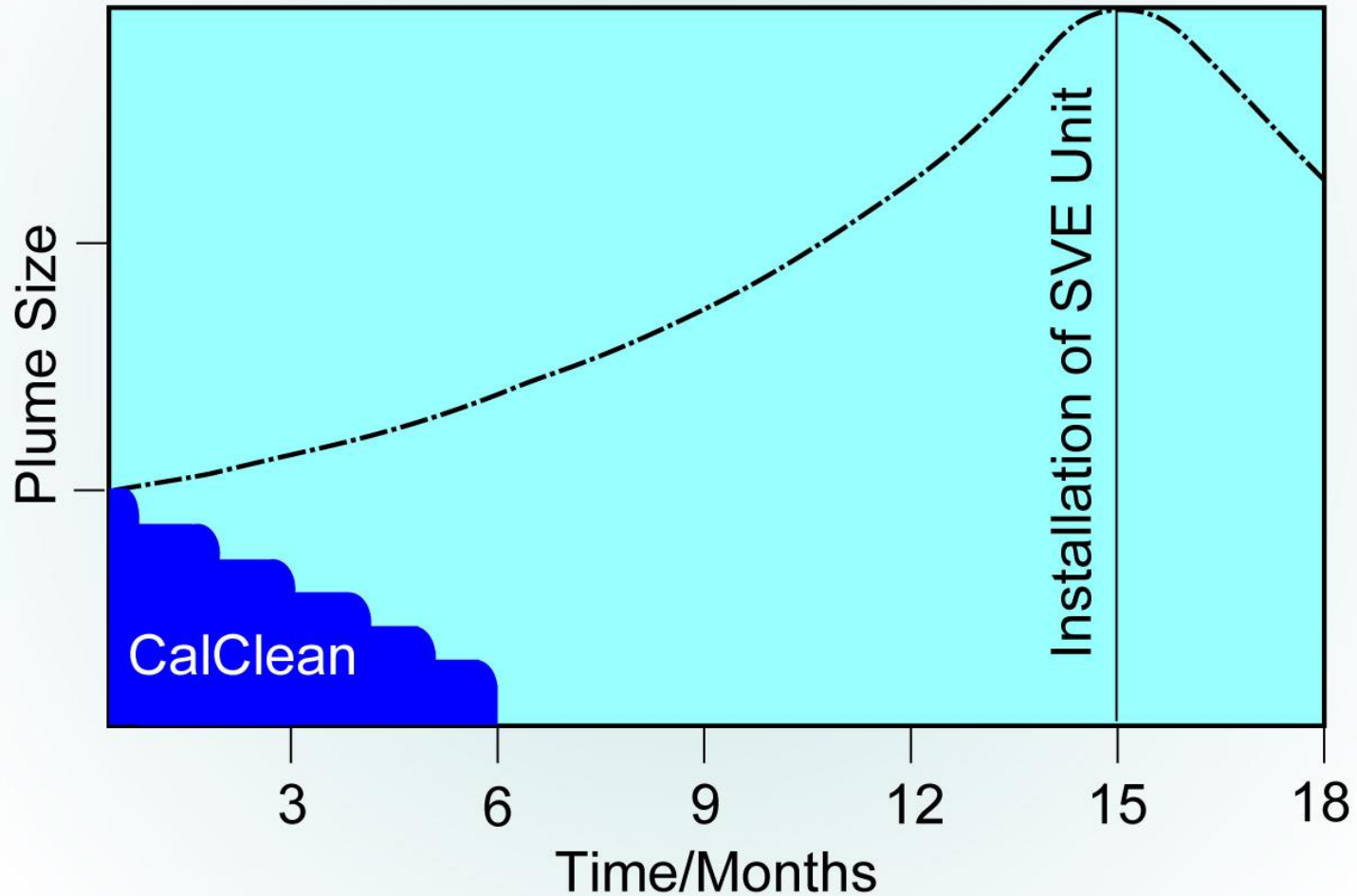
High Noise Systems
(Complaints From Neighbors)

Low Noise

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Comparison of Plume Size vs. Time for CalClean and Fixed Based SVE



\$/hr. Comparison For Services

- Principal Engineer \$105/hr.
- Senior Engineer/Geologist \$90/hr.
- Project Manager \$75/hr.

- Driller \$150-300/hr.
- On-site Lab \$1,100/day or \$150-200/hr.

- **CalClean** (Includes Engineer & H&S Manager Oversight and Reports)
 - Based on 24-hour event = \$112/hr.
 - Based on 5-day event = \$107/hr.
 - Based on 30-day event = \$75/hr.

COMPARISON OF HYDROCARBON REMOVAL EFFICIENCY CALCLEAN'S HVDPE vs. FIXED BASED SVE UNIT

Confidential Client - Service Station in Huntington Beach, CA

CalClean's Events in May 00 (450 cfm)	Equivalent Days for Fixed Based SVE Unit (250 cfm)
8 hours (2,400 gallons of water)	1 week (0 gallons)
24 hours (4,000 gallons of water)	1 month (0 gallons)
First 5-day (20,000 gallons of water) (approx. 1,000 pounds HC)	1 year (0 gallons)
Second 5-day (30,000 gallons of water) (approx. 1,500 pounds HC)	1-1/2 year (0 gallons)

COST COMPARISON

CalClean's 5-day event cost to client = \$13,550 (\$10 per pound HC)

Cost of Operation and Maintenance of the Fixed Based SVE Unit

For 1 year (including Electricity, Natural Gas, Maintenance, Depreciation,
Permanent Space at Site, etc.) = approx. \$40K - \$80K (\$40 - \$80 per pound HC)



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Case Study

Confidential Client/Site in Santa Ana RWQCB - Santa Ana Region

Groundwater Analytical Results

Scope:

CalClean was contracted to conduct a 24-hour dual phase extraction pilot test for a confidential client located within the Regional Water Quality Board - Santa Ana Region. The subject site exhibited elevated concentrations of petroleum hydrocarbons in the soil and groundwater beneath the site including the oxygenated gasoline additives methyl *tert*-butyl ether (MtBE) and *tert*-amyl methyl ether (TAME).

The lithology beneath the site consisted of sand/silty sand (0-15 feet below ground surface [bgs]), clayey silt/silty clay (15-55 feet bgs), and sand/gravelly sand (>55 bgs). Shallow groundwater was located in a thin saturated zone approximately 24 feet bgs.

Results:

The results of the dual phase extraction pilot test indicated an effective radius of influence of approximately 29 feet. Approximately 495 pounds of hydrocarbons were destroyed and extracted groundwater was treated utilizing CalClean's dual phase system and groundwater treatment trailer. The results of the groundwater samples are presented in Table 1.

Case Study

Confidential Client/Site in Santa Ana RWQCB - Santa Ana Region

Groundwater Analytical Results - Table 1

Parameter	Prior To Extraction	After CalClean's Treatment Process	Percent Reduction	Carbon Polishing Post Treatment	Percent Reduction
MtBE	360,000 µg/L	6,740 µg/L	98%	ND (<0.5 µg/L)	100%
TPHg	228,000 µg/L	11,300 µg/L	95%	ND (<50 µg/L)	100%
TAME	2,590 µg/L	25.3 µg/L	99%	ND (<0.5 µg/L)	100%
Benzene	33,700 µg/l	267 µg/l	99%	ND (<0.5 µg/L)	100%
Toluene	52,700 µg/L	987 µg/L	98%	ND (<0.5 µg/L)	100%
Ethylbenzene	6,580 µg/L	162 µg/L	98%	ND (<0.5 µg/L)	100%
Xylenes	40,900 µg/L	1,497 µg/L	96%	ND (<1.0 µg/L)	100%
Napthalene	10,200 µg/L	147 µg/L	98%	ND (<0.5 µg/L)	100%

MtBE - Methyl *tert*-Butyl Ether

TPHg - Total Petroleum Hydrocarbons - Gasoline Range

TAME - *tert*-Amyl Methyl Ether

ND (<0.5 µg/L) - Not Detected Above the Laboratory Reporting Limit of 0.5 µg/L



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Case Study

Confidential Client/Site in Chino RWQCB - Santa Ana Region High Vacuum Dual Phase Extraction

Scope:

CalClean was contracted to conduct a 96-hour HVDPE pilot test, a 15-day event, and two 7-day events for a confidential client located within the Regional Water Quality Board - Santa Ana Region. The subject site exhibited elevated concentrations of petroleum hydrocarbons in the soil and groundwater beneath the site including the oxygenated gasoline additives methyl *tert*-butyl ether (MtBE). Several municipal wells were within 1,000 feet of the site.

Results:

The results of the dual phase extraction pilot test indicated an effective radius of influence of approximately 60 feet. During the four events at the site, approximately 13,200 pounds of hydrocarbons were destroyed. In addition, 61,060 gallons of extracted groundwater were treated utilizing CalClean's dual phase system and groundwater treatment trailer. TPH-G in groundwater has reduced from 125,000 ug/L to 8,440 ug/L, Benzene has reduced from 7,560 ug/L to 143 ug/L, and MtBE has reduced from 2,170 ug/L to 1,920 ug/L. Monthly 10-day events are currently being performed to reduce concentrations to regulatory satisfaction for closure. The cost of HVDPE so far has been \$87,000, which is approximately \$6.60 per pound HC.

Case Study

Confidential Client/Site in Irvine RWQCB - Santa Ana Region

High Vacuum Vapor Extraction

Scope:

CalClean was contracted to conduct weekly 24-hour high vacuum vapor extraction events for a confidential client located within the Regional Water Quality Board - Santa Ana Region. The subject site exhibited elevated concentrations of petroleum hydrocarbons in the soil beneath the site including the oxygenated gasoline additive methyl *tert*-butyl ether (MtBE). The Orange County Health Care Agency had required a fixed-based system to be installed at the site. As an interim remedial measure until permits to install site utilities were obtained, CalClean performed a 24-hour event every week over 28 consecutive weeks.

Results:

The results of the weekly high vacuum vapor extraction indicated an effective radius of influence of approximately 55 feet. Approximately 11,100 pounds of hydrocarbons were extracted. TPH-G vapor concentrations were reduced from 53,000 ppmv to 1,900 ppmv, Benzene vapor concentrations were reduced from 1,200 ppmv to 9.2 ppmv, and MtBE vapor concentrations were reduced from 1,100 ppmv to 48 ppmv. The total cost for CalClean's operations was \$75,000 (or \$6.80 per pound). The Client is still being required to install a fixed-based system at a cost of around \$180,000. Inefficient operation and high O&M costs to remove the remaining low concentrations are not cost-effective.

Case Study

Confidential Client/Site in Orange RWQCB - Santa Ana Region

High Vacuum Dual Phase Extraction

Scope:

CalClean was contracted to conduct HVDPE events for a confidential client located within the Regional Water Quality Board - Santa Ana Region. The subject site (valued at around \$4 million) exhibited elevated concentrations of petroleum hydrocarbons in the soil and groundwater beneath the site. The Orange County Health Care Agency approved mobile HVDPE to clean up the site to closure. At first, HVDPE was performed for a total of 44 days to clean up the groundwater, cap fringe and saturated zone. Then, a trailer-mounted HVDPE system (7.5 hp LRP) was used continuously over a one year period to clean up the vadose zone. Finally, a truck-mounted system (25 hp LRP) was used intermittently over a three week period to polish off the remaining hydrocarbons at the site.

Results:

The results of the high vacuum dual phase and vapor extraction indicated an effective radius of influence of approximately 80 feet. Approximately 55,000 pounds of hydrocarbons were extracted over 2 years. TPH-G soil vapor concentrations were reduced from 125,000 ppmv to 130 ppmv, Benzene vapor concentrations were reduced from 4,000 ppmv to 5 ppmv. The total cost for HVDPE and high vacuum vapor extraction operations was around \$600,000 (or around \$10.90 per pound). Verification boring samples taken week of June 10 were non-detect and closure is being applied for.

Case Study

Confidential Client/Site in Orange RWQCB - Santa Ana Region

High Vacuum Dual Phase Extraction

Scope:

CalClean was contracted to conduct monthly 2-day high vacuum dual phase extraction events for a confidential client located within the Regional Water Quality Board - Santa Ana Region. The subject site exhibited elevated concentrations of petroleum hydrocarbons in the soil beneath the site including the oxygenated gasoline additive methyl *tert*-butyl ether (MtBE). The Santa Ana RWQCB wanted a fixed-based system to be installed at the site. However, as an interim remedial measure, CalClean performed five 2-day events over 5 months. [The Client had previously used another firm with a mobile HVDPE system that was powered by a 20 hp liquid ring system (in comparison to CalClean's 25 hp system)]

Results:

The results of the weekly high vacuum vapor extraction indicated an effective radius of influence of approximately 55 feet. Approximately 1,000 pounds of hydrocarbons were extracted. TPH-G vapor concentrations were reduced from 4,200 ppmv to 1,100 ppmv, Benzene vapor concentrations were reduced from 5.4 ppmv to ND, and MtBE vapor concentrations were reduced from 13 ppmv to ND. The total cost for CalClean's operations was \$27,000. The Client is resisting regulatory requirement to install a fixed-based system (which could cost around \$180,000). Due to CalClean's more powerful LRP, every 2-day event with CalClean's system was equivalent to previous firm's 5-day HVDPE event with respect to pounds HC vapor extracted and gallons groundwater extracted.

Case Study

Confidential Client/Site in Cambria RWQCB - Central Coast Region

High Vacuum Dual Phase Extraction

Scope:

CalClean was contracted to conduct 15-day high vacuum dual phase extraction events for a confidential client located within the Regional Water Quality Board -Central Coast Region. The subject site exhibited elevated concentrations of petroleum hydrocarbons in the soil beneath the site. Region 3 wanted a fixed-based system to be installed at the site. As an interim remedial measure, CalClean performed four 15-day events at the site.

Results:

The results of the HVDPE events indicated an effective radius of influence of approximately 12 feet. Approximately 21,600 pounds of hydrocarbons were extracted. TPH-G vapor concentrations were reduced from 12,000 ppmv to 3,100 ppmv, and Benzene vapor concentrations were reduced from 78 ppmv to ND. The total cost for CalClean's operations was \$140,000 (which is \$6.48 per pound). CalClean's strategy was to extract the HC vapor, before the groundwater gets further contaminated. Across the street, another firm has installed equipment over \$1.0 million. Their strategy has been to let the groundwater get contaminated with MtBE, extract the contaminated groundwater, and haul the extracted water to their refinery in N. California. It has been reported that approximately 5 pounds of MtBE have been removed to date at a cost of around \$2.0 million (or \$400,000 per pound!!).

Case Study

Confidential Client/Site in Artesia RWQCB - Los Angeles Region High Vacuum Dual Phase Extraction

Scope:

CalClean was contracted to conduct six 15-day and two 21-day HVDPE events for a confidential client located within the Regional Water Quality Board -Los Angeles Region. The subject site exhibited elevated concentrations of petroleum hydrocarbons in the soil beneath the site. As an interim remedial measure, CalClean extracted HC vapor and groundwater from several monitoring wells onsite.

Results:

The results of the HVDPE events indicated an effective radius of influence of approximately 30 feet. Approximately 35,000 pounds of hydrocarbons were extracted. The total cost for CalClean's operations was \$430,000 (which is \$12.29 per pound). CalClean had been extracting from existing monitoring wells at the site. These wells were installed to 40 feet, approximately 14 feet below the deepest contamination. While HC vapor and groundwater were being extracted from several monitoring wells, CalClean's operations would have been more efficient if remedial wells screened only the hot zone were used for extraction. The deeper wells yielded clean water along with contaminated water, thus increasing the overall cost of the project for water treatment. A new consultant has used a specialized boring rig to determine the location of the contamination and will install the appropriate remedial wells in the next few weeks. These wells will only be drilled to the deepest contamination so that additional HVDPE will be efficient and cost-effective.

Lessons Learned

- Perform 5-day HVDPE pilot tests at sites with fixed-based systems and shutdown the ineffective systems
- Pre-approve budgets provided by consultants for entire scope approved by regulatory agencies
- Allow consultants to increase duration of HVDPE events as needed to maximize effectiveness (provide guidelines for notification)
- Install remedial wells around source area to remove HC from vadose, capillary fringe and saturated zone
- To maximize efficiency of HVDPE system, perform HVDPE only in source area wells; use down-hole pumps to extract HC-affected water in other wells

PFP Projects

- CalClean is interested in PFP projects anywhere in California.
- We can work with existing consultants, or provide a new consultant to a responsible party.
- We are willing to accept the PFP for just the “Contractor” portion of the cleanup.
- With trucks and water treatment systems located in N. and S. California, we can mobilize for PFP projects anywhere in California.
- With a single owner, CalClean’s finances are able to work with several PFPs at one time.