



## **Oklahoma's Pay-For-Performance Program –April 2001**

### **Introduction**

Before 1996 we had numerous storage tank site cleanups underway, but very few of these sites were being cleaned up. Our tank owners' site cleanup funds were quickly being depleted while our environment was being threatened. Money was being paid out of the Indemnity Fund on a time-and-material basis, but the marketers were not getting the results they deserved – a site with petroleum constituents reduced to safe levels. These factors were instrumental in bringing change to our storage tank program. Oklahoma chose to take action by implementing a Pay-for-Performance approach to site remediation, adopting and customizing Oklahoma Risk Based Corrective Action (ORBCA) and requiring all case work to be pre-approved.

Our Performance Program began in 1996. The tank owner, operator or a responsible party (Regulatory Contact), the environmental consultant and the state sign contractual site remediation agreements. Each environmental consultant contractually guarantees that each site will be remediated to site-specific site cleanup goals at an agreed-upon, reasonable price. This process was voluntary at first, but with new legislation, revised rules and guidelines this Performance Program is now mandatory. To date 57 performance contracts have been signed with cleanup levels based on ORBCA standards. Reduction of groundwater contamination has progressed very quickly – on average, levels have reduced by 75% at 43% of the performance sites in 11 months. The 100% reduction goal has been attained at 14% of the sites in an average of 19 months.

Remediation expenses for many of these sites were previously based on time and materials invoicing before conversion to performance-based-remediation. For these conversion sites, we found an estimated \$6,629,000 of unnecessary expenses were incurred prior to obtaining cleanup guarantees at an agreed-upon, reasonable price.

Beneficiaries include large- and small-tank owners, consultants, the state and the environment. Each improvement has ultimately brought benefits to all parties involved, including all Oklahoma citizens. Better-designed remediation systems are now installed, cleanup goals are attained faster at our most difficult sites while costs are coming down, and funds are paid only when goals were reached. Cleanup results are guaranteed to owners and to the state without the possibility for disallowances if goals are reached. Owners now know the price and the duration of the cleanup. Paperwork is substantially reduced, as is the time to pay reimbursement claims, which now takes only a few days. Consultants can use new techniques or innovative remediation approaches to get faster results, make a reasonable profit for a job well done, and protect human health, safety and the environment.

## Technologies Used

As a result of the Performance Program current technologies are better applied and new technological innovations are researched and applied. Experience has shown that the most efficient and effective remediation approach applies three or four techniques to a single site. For example, bio-remediation is being applied after a mechanical system such as air sparge/soil vapor extraction (AS/SVE) becomes ineffective after two or three years of operation. Consultants are using creative means to reach cleanup goals, maximum profit, and to protect their professional reputation.

Since 1996 a total of 57 performance contracts have been signed. The remediation technologies used are AS/SVE, air sparge with dual phase extraction, bioslurping, free product removal, bio-remediation, bio-cell land farming and excavations. These technologies fall into five general categories, distributed as follows: 77% AS/SVE systems, 11% free product systems, 7% bio-remediation systems, 2% excavations and 4% general contracts (Table 1).

<b>Remediation Technology Summary Table</b>							
Technology	Progress Code					Totals	% By Tech
	1	2	3	4	5		
AS / SVE	4	4	15	7	14	44	77%
Free Product Removal	0	1	4	1	0	6	11%
Bio-remediation	1	0	1	2	0	4	7%
Dig & Haul	1	0	0	0	0	1	2%
General	2	0	0	0	0	2	4%
	8	5	20	10	14	57	
	14%	9%	35%	18%	25%	100%	

Code	Progress Code Key
1	Completed
2	Met Goal - In verification
3	In cleanup
4	In startup
5	Behind schedule

**Table 1:** Remediation System type and performance summary plus progress code key.

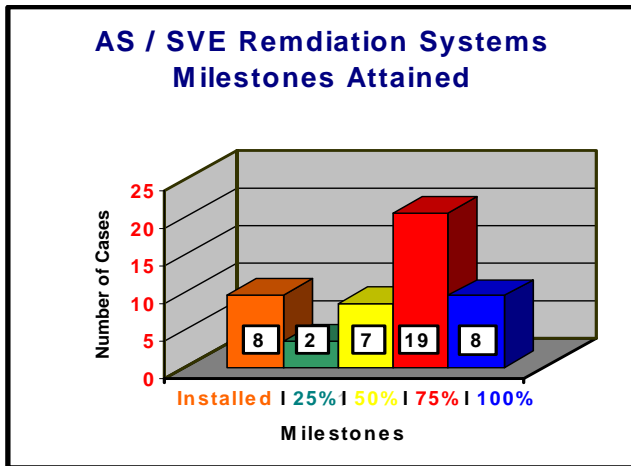
## Progress

Remediation progresses at various rates depending on lithology, plume concentrations, cleanup goals, and the technologies used. Of all the performance contracts, 14% have fulfilled the contract terms, 9% have met the contract goals and are in a verification period, 35% are in cleanup and are on schedule, 18% are in startup and 25% are behind schedule (Table 1)

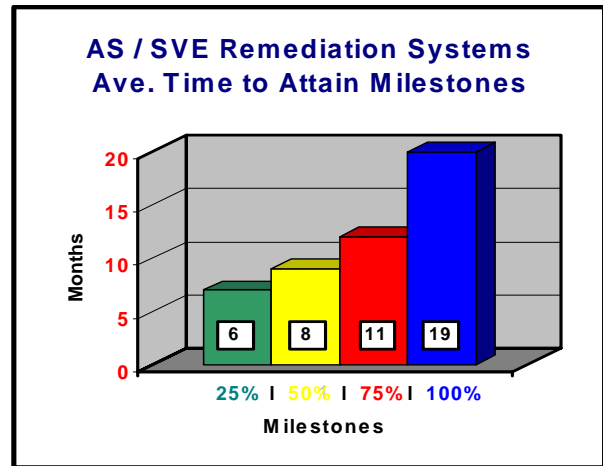
The most common remediation technique being used is AS/SVE, currently in use at 44 sites (Table 2). Groundwater hydrocarbon levels at 19 or 43% of these sites have been reduced by 75% since system startup. Levels at 8, or 18% of these sites have been reduced on average to the final cleanup goal or are in the final confirmation period (Table 2). These cleanups progress rapidly through the 75% groundwater milestone (Graph 1). It takes 6 months on average to reach the 25% milestone, 8 months to reach the 50% milestone and 11 months to achieve the 75% milestone. It has taken an average of 19

months for the 8 cases that reached the 100% milestone (Graph 2). This is by far the most difficult cleanup goal to attain.

Mechanical free product removal systems are in use at 6 sites. To date, free product thickness at one of these sites has been reduced by 25% since system startup. At another site, the final goal has been achieved and is in the final confirmation period (Table 2). These cleanups generally progress more slowly because clay-rich soils make product extraction very difficult.



**Graph 1:** Total cases per milestone attained.



**Graph 2:** Average time in months to achieve each milestone payment.

Bio-remediation techniques are in use at 4 sites. This technique has been in use for approximately 6 months, and no milestones have yet been attained (Table 2). Bio-remediation is being used as a primary technique and as a final site-polishing agent.

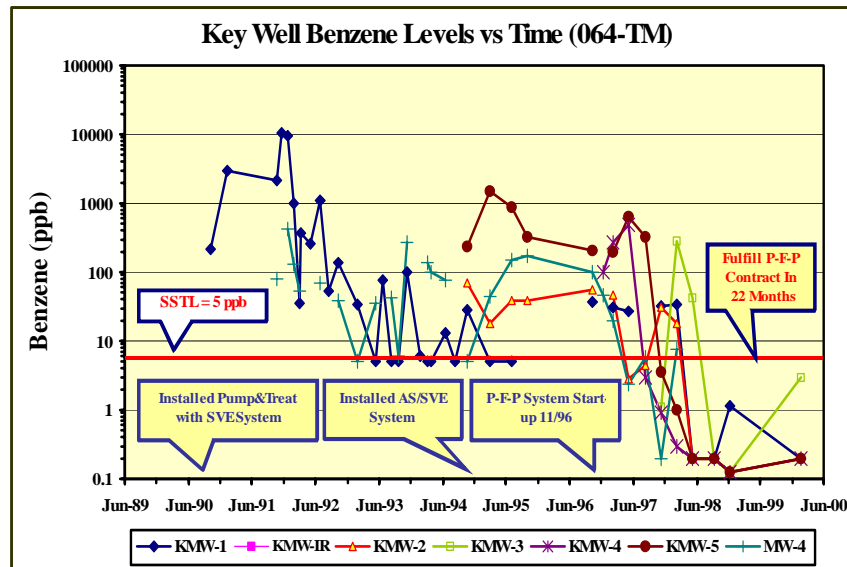
Technology Performance Summary Table						
Technology	Milestone Goals					Total
	Start-up	25%	50%	75%	100%	
AS / SVE	8	2	7	19	8	44
Percentage	18%	5%	16%	43%	18%	100%
Free Product	4	1			1	6
Percentage	67%	17%			17%	100%
Bio-remediation	4					4
Percentage	100%					100%
Dig & Haul					1	1
Percentage					100%	100%

**Table 2:** Summary breakdown of cleanup milestone goals attained by remediation technology.

Site cleanup goals have been reached at the one site where the primary remediation method was to excavate and haul the impacted soil to a land farming area for processing.

## Conversion Sites

These are cases where the original remediation systems were replaced by performance systems. These systems were replaced because they were ineffective, environmental results were minimal or cleanup progress had stalled. In each case the original systems were installed and operated on a time and materials basis and had accumulated high operational costs. Each site had been in remediation for up to 5 years and \$150,000 to \$500,000 had been reimbursed per site without reaching the cleanup goals. After performance systems were installed hydrocarbon concentration levels decreased dramatically. A total of 20 performance systems have been installed. These include 13 AS/SVE systems, 5 free product removal systems and 2 bio-remediation systems.

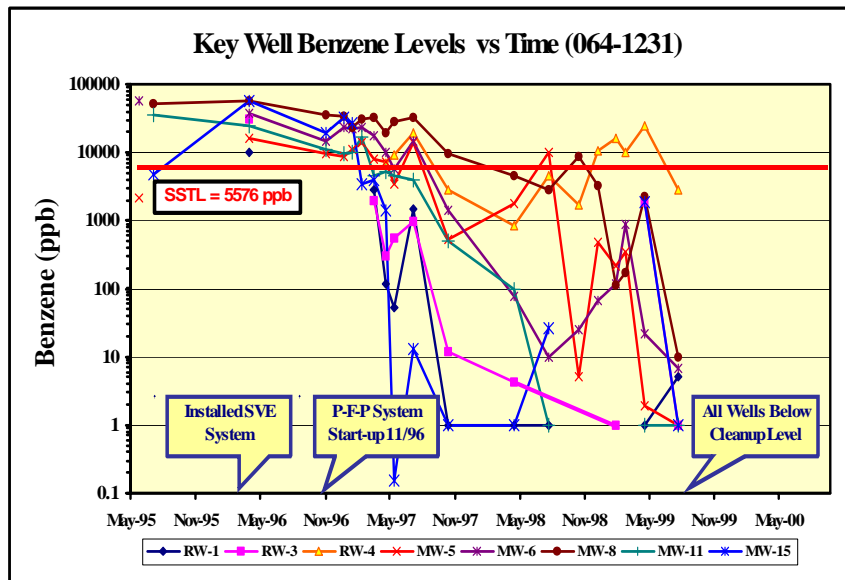


**Graph 3:** Conversion site groundwater benzene concentration reduction graph.

Dramatic reductions in groundwater hydrocarbon concentrations have been achieved very quickly on the majority of the AS/SVE systems conversion sites. These results, plotted on Graphs 3 & 4, show benzene groundwater concentrations vs. time trends for each site key monitoring wells. Note that in most cases, significant reductions in groundwater benzene levels were not achieved until after site conversion. Currently 8% of these AS/SVE systems have achieved the 25% milestone, 8% have achieved the 50% milestone, 54% are at the 75% milestone and 15% are completed.

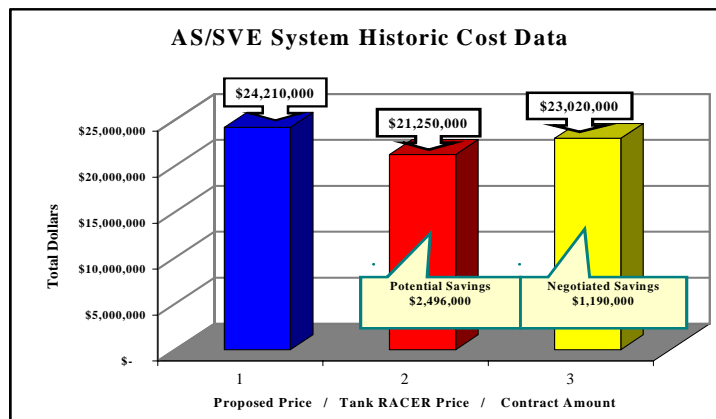
## Project Prices

We are now achieving environmental results at a reasonable price on sites where previously very little to no reduction in hydrocarbon concentrations was occurring. Performance contracts have provided the incentive to change an ineffective way of doing business. Efforts are now focused on achieving quicker cleanup results to close cases and maximize efficiency. A reasonable price is determined before site remediation begins, which eliminates future price disputes. No money is paid until environmental goals are attained. This is a pyridine shift from a decade of conducting business on a time-and-materials basis.



**Graph 4:** Conversion site groundwater benzene concentration reduction graph.

The final site remediation price is determined through negotiations between the state and the environmental consultant. By using parametric price build-up software, Tank RACER 99, a reasonable price is determined. To adjust this price, the consultant must justify any costs exceeding it. Using Tank RACER as a basis to determine reasonable remediation price, the cumulative final contract price for the 57 performance contracts has been \$2,496,000 less than the consultant’s proposed prices (Graph 5). This allows available funds to be used for other site investigations and restoration work.

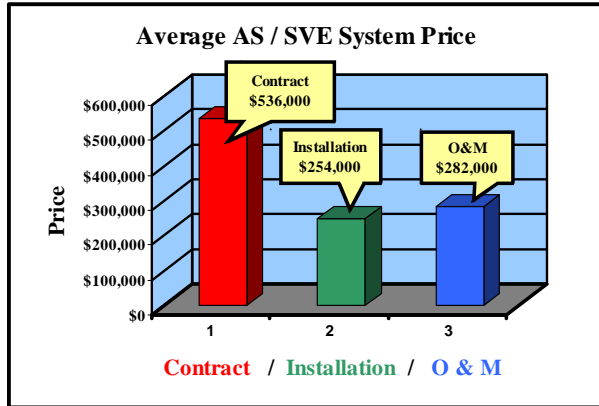


**Graph 5:** Total program savings for AS/SVE remediation systems has been \$2,796,000 by negotiating the final performance contract price.

### Contract Terms and Cleanup Prices

The performance cleanups have a time limit and a guarantee in the contract terms. These include a 2 to 3-year primary contract term where the operator is compensated for all operational expenses and a 1 to 2-year warranty period where the remediation continues solely at the consultant’s expense.

The average contract price for an AS/SVE system is \$536,000. Of this amount, 47% or \$254,000 is for system design and installation and 53% or \$282,000 is for operation and maintenance (Graph 6). These contracts have a 3-year primary contract term in most cases with a 1 or 2-year warranty period. The average cleanup volume is 28,175 yd<sup>3</sup> at a price of \$19.03 per yd<sup>3</sup>.



**Graph 6:** Typical prices for AS/SVE performance systems including total contract, installation and operation & maintenance.

The average contract price for a free product recovery system is \$292,300. Of this amount, 49% or \$144,700 is for system design and installation and 51% or \$147,600 is for operation and maintenance. These contracts have a 3-year primary contract term in most cases with a 6-month or 1-year warranty period. The average cleanup volume is 6,137 yd<sup>3</sup> at a price of \$47.63 per yd<sup>3</sup>.

The average contract price for a bio-remediation system is \$566,700. Of this amount, 70% or \$400,900 is for system design and installation and 30% or \$165,800 is for operation and maintenance. These contracts have a 2 to 3-year primary term in most cases with a 6 or 12-month warranty period. The average volume of the cleanups is 43,696 yd<sup>3</sup> at a price of \$12.97 per yd<sup>3</sup>.

### Time and Materials Excessive Expenditures

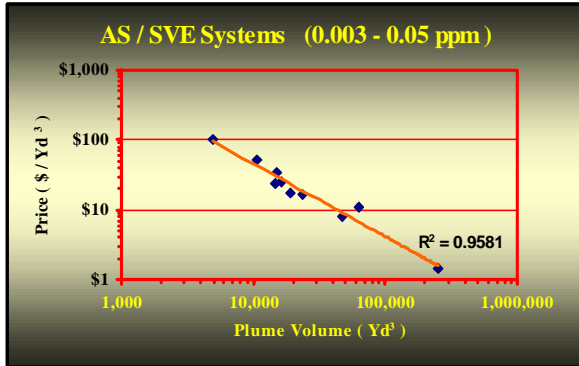
Projections show that Program funds could have been saved if Risk Assessment, Pre-approval and Performance Programs had been in place from the inception of the storage tank program. Since an average reasonable site delineation price was determined to be \$50,000 under the time-and-materials system, reimbursed expenses prior to signing a performance contract that exceed \$50,000 are considered excessive. Excess expenses based on time-and-materials invoicing at conversion sites were found to be \$5,027,200 for 33 AS/SVE systems, \$841,200 for 6 free product removal systems and \$760,700 for 3 bio-remediation systems. These costs total \$6,629,000 for only 43 cases or \$154,200 per case (Table 3). This could amount to excess program expenses of \$23,000,000 or more if expenses are not monitored and budgeted carefully for only 150 cases.

Summary: Cases with Excess Spending			
Cases with Excess Cost	Technique	Total Savings	Ave Savings / Site
33	AS / SVE	\$5,027,219	\$152,340
6	Free Product	\$ 841,157	\$140,193
3	Bio-Remediation	\$ 760,668	\$253,556
	<b>Total</b>	<b>\$6,629,044</b>	

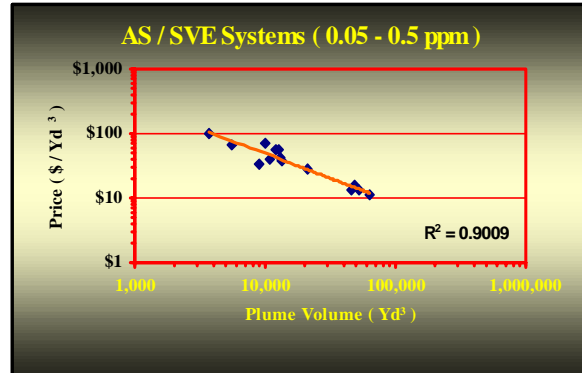
**Table 3:** Potential savings to the UST Fund if a Performance Program had been implemented from the inception. A total of \$50,000 was used as a reasonable site assessment price.

## Plume Size Drives Price

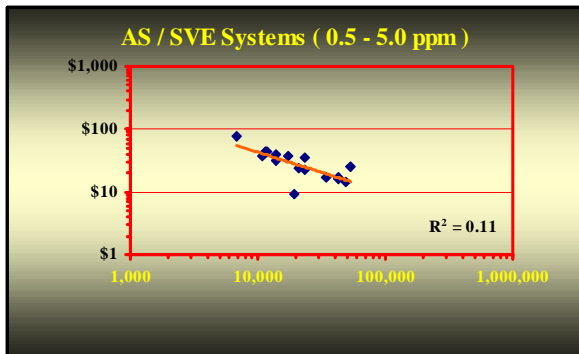
Analysis of the performance contract price data showed a strong relationship between plume volume in cubic yards and the price per cubic yard. It was concluded that an accurate remediation price could be predicted for a site by plotting these volumetric data on a graph with logarithmic scales; for example, a 10,000 cubic yard plume vs. \$15 per cubic yard totals \$150,000. This is true for AS/SVE systems, (Graphs 7, 8, 9 & 10) free product removal systems (Graph 11 & 12) and bio-remediation systems. By knowing the surface area and thickness of the plume, the vertical treated area or the maximum free product thickness; an accurate remediation price projection can be made.



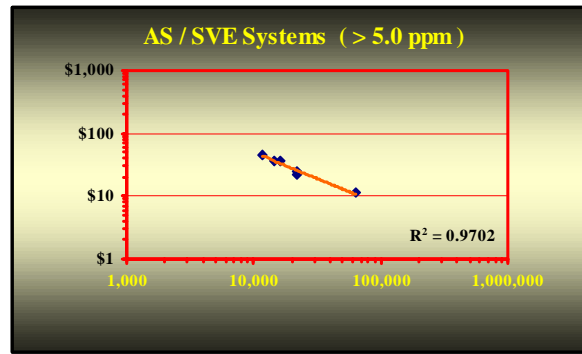
**Graph 7:** Remediation price projection based on plume volume and 0.003– 0.05ppm benzene cleanup levels for AS/SVE systems.



**Graph 8:** Remediation price projection based on plume volume and 0.05– 0.5 ppm benzene cleanup levels for AS/SVE systems.



**Graph 9:** Remediation price projection based on plume volume and 0.5 – 5.0ppm benzene cleanup levels for AS/SVE systems.

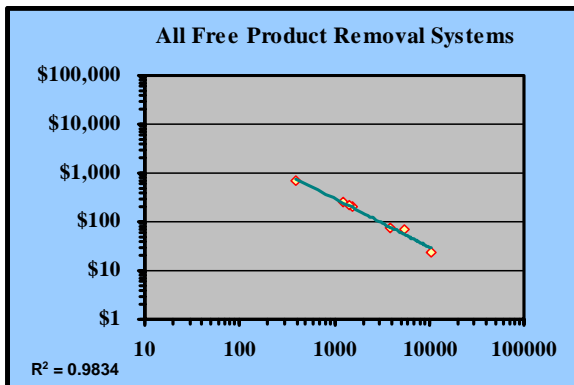


**Graph 10:** Remediation price projection based on plume volume and >5ppm benzene cleanup levels for AS/SVE systems.

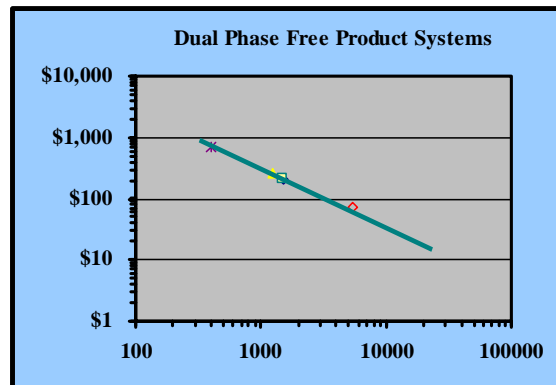
Pricing for soil and groundwater plume cleanups using AS/SVE systems can be subdivided by cleanup goal brackets (for example, 0.003 – 0.05 ppm benzene), thus accurate price projections can be made for sites with different cleanup goals. This concept holds true for AS/SVE systems, bioslurping systems and air sparge systems with dual phase liquid extraction

Conversion site cleanup results where mechanical free product removal systems are used generally progress slower because clay-rich soils make product removal more difficult. To date, there are 5 free product removal conversion sites. Product thickness at one site has been reduced by 25% from the baseline product thickness. At another site, product thickness has been reduced to the final goal and is in the confirmation period to verify that free product does not reappear after the removal system has been shut down.

Bio-remediation techniques are being used at 4 sites where mechanical systems were inefficient or where the costs to install and operate mechanical remediation systems were too high. This technique has been used for less than 6 months at these sites thus no milestones have yet been reached.



**Graph 11:** Remediation price projection based on free product plume volume and system technology for free product recovery.



**Graph 12:** Remediation price projection based on free product plume volume and system technology for free product recovery.

**Beneficiaries Distributed Among All Owners**

Tank owners with businesses of all sizes are benefiting from the Performance Program. The small business owners are benefiting the most. The performance contracts are distributed between the owners as follows: 61% are small businesses, 26% are medium sized and 13% are large marketers. The case distribution for conversion sites is very similar. For these sites, 60% are small-scale businesses, 20% are medium-scale and 20% are large marketers.

Our Performance Program provides a mechanism for storage tank owner’s to be guaranteed that their petroleum impacted sites will be remediated to cleanup standards which are protective of human health, safety and the environment at an agreed to reasonable price and provides a better way to conduct business for all. This system benefits the citizens of our state, storage tank business owners of all sizes, the consultant, the state and the environment.

For additional questions or comments please contact Mr. Tom Tucker, Director or Mr. Dave Kelley, Deputy Director of the Petroleum Storage Tank Division of the Oklahoma Corporation Commission at 405-521-4683. Send correspondence their attention at the Petroleum Storage Tank Division, Oklahoma Corporation Commission, Jim Thorpe Building, 2101 North Lincoln, Oklahoma City, Oklahoma, 73105.