LA-UR-99-2367

Title: ***Environmental Technology Cost-Savings Analysis Project Summary Viewgraphs***

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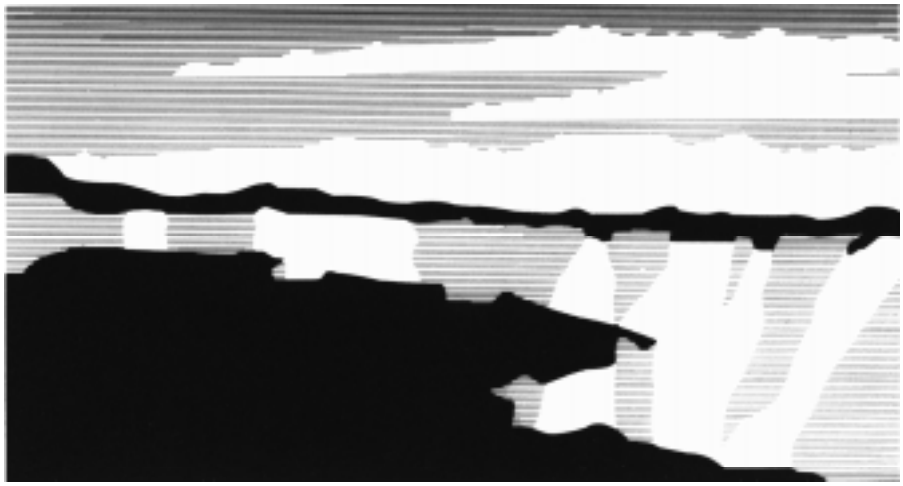

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Los Alamos National Laboratory

Energy and Environmental Analysis Group

Environmental Technology Cost-Savings Analysis Project

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Contents of Viewgraphs

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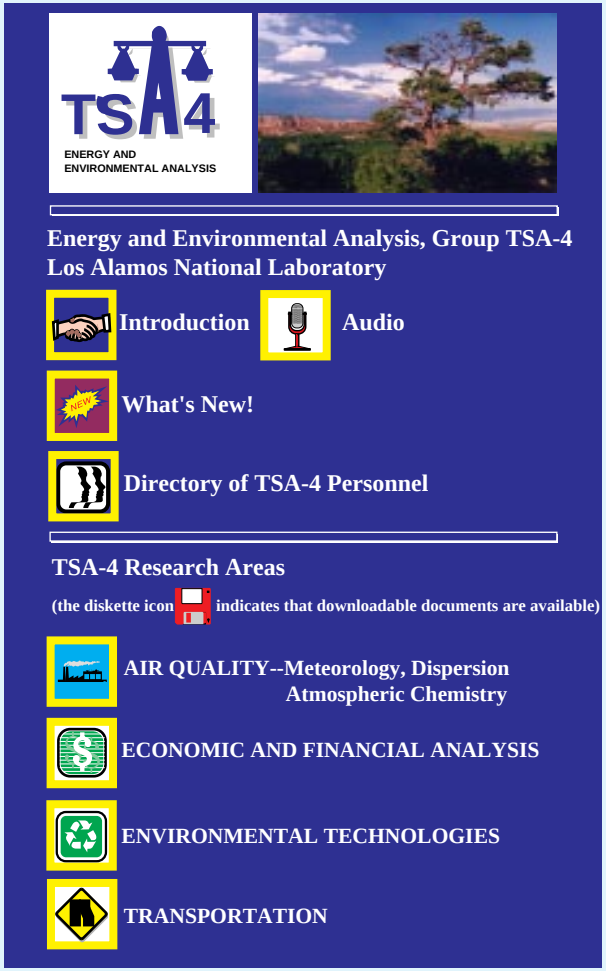
ETCAP Introduction

- ETCAP analyzes the potential cost savings that can accrue from successfully implementing innovative environmental technologies.
- Analysis involves comparing life-cycle costs of innovative technologies and conventional (baseline) technologies under comparable performance conditions.
- ETCAP has a standard methodology and guidelines for conducting cost-effectiveness analysis on new environmental technologies and return on investments. This methodology has been peer reviewed, published, and is accepted in the field.
- Our ETCAP home page can be accessed on the world-wide web via http://www-tsa.lanl.gov/TSA4/tsa4home.html



TSA-4 WWW Home Page

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ETCAP Staff

Seven years of established expertise in cost analysis for EM-50, supporting HQs, Integrated Demonstrations, and Focus Areas.

- Established team of experts applying a consistent methodology across numerous technologies.
- Team includes six senior technical staff members with an average of 19 years of experience, two graduate research assistants, and a data analyst. Team also includes nationally known engineering contractor, IT Corporation.
- Degrees include five PhDs in engineering, physics, and economics, two MSs in environmental science and engineering, one MA in business administration, and one BA in public health.
- Team members have experience at the Hanford Tanks project, EM-30, EM-50, and in economic impact modeling, process design, and nuclear engineering, design, and operations.

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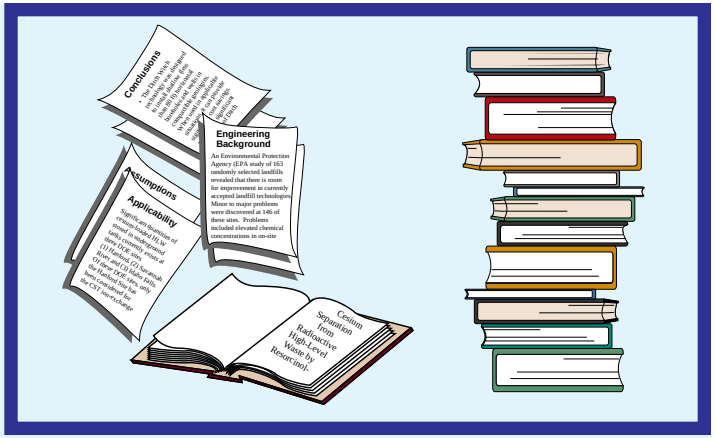
ETCAP History



- The ETCAP team has been doing cost-effectiveness and cost-benefit analysis since 1990.
- During this time we have produced over 80 reports and technology studies.
- Our team is part of the Technology Safety and Assessment Division, a multidisciplinary technical division of about 300 members with established mechanisms for peer review, and a division-wide charter to carry out honest, independent analyses. Our work is regularly submitted to external review.
- LANL is well suited to integration work not only because of cost-savings analysis capability, but because of high-level science and engineering skills both on the ETCAP team and in the extended LANL infrastructure. We are linked with resident hydrology and geophysical experts on plume transport in the soil and atmosphere. We have access to massive expertise at LANL in all physical sciences and analysis methodologies.

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ETCAP Capabilities

- We provide unbiased economic analysis of the cost effectiveness of innovative technologies compared to conventional technologies.
- ETCAP evaluations improve technology transfer packages and proposals.
- ETCAP studies provide important data for DOE decision-makers so they can evaluate the complex environmental options.
- The established ETCAP team with our comprehensive and well-accepted methodology can be utilized immediately--there is no time delay for methodology development.

- Our technical expertise and "infrastructure" is well prepared to tackle the many needed future studies for environmental clean up.

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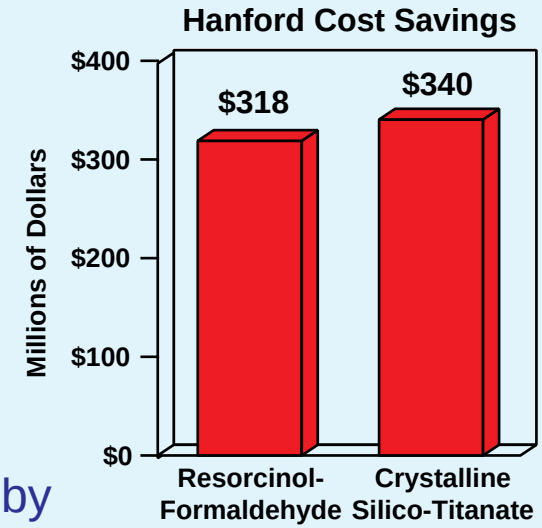
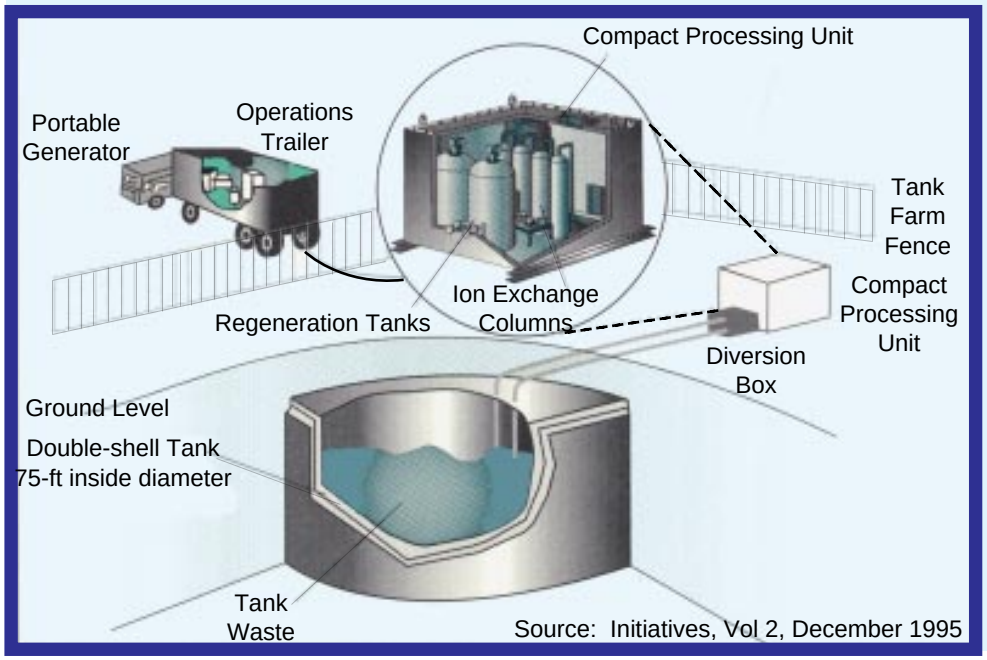
Cesium Separation From High-Level Waste



- Approximately 100 million gallons of HLW is stored in underground tanks at DOE sites.
- The volume of liquid-based HLW can be reduced by cesium separation.
- Liquid-based HLW at Hanford (~50 million gallons) includes supernate, saltcake, and slurry.



- The use of organic-based Resorcinol-Formaldehyde ion exchange resin can save ~$318 million over the original TWRS baseline resin CS100 at Hanford.
- The use of inorganic-based Crystalline Silico-Titanate ion exchange resin can save ~$340 million over the original TWRS baseline resin CS100 at Hanford.

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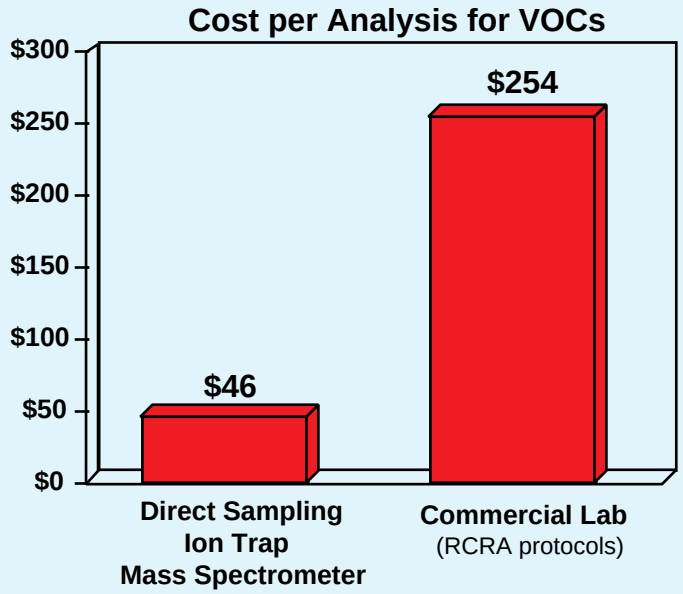
Direct Sampling Ion Trap Mass Spectrometer

- DSITMS can analyze water, air, soil, sediment, and some solid samples for a large number of VOCs.
- DSITMS can analyze all 34 VOCs on the EPA's target compound list and analyzes samples in less than 5 minutes.



- Introduction of the sample into the instrument does not require any preparation.
- Detection limits are within EPA's required range (parts per billion and even parts per trillion).
- DSITMS has the highest sample analysis capacity in comparison to other field-screening technologies.

Horizontal Wells

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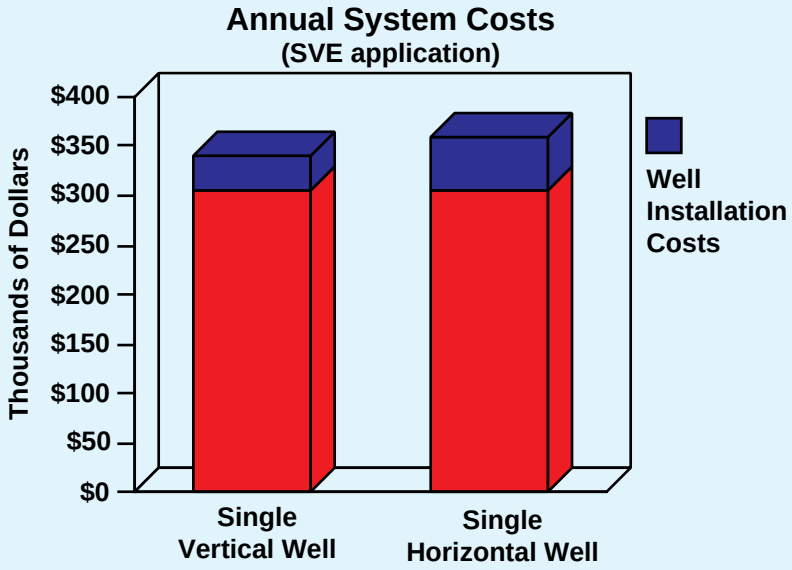
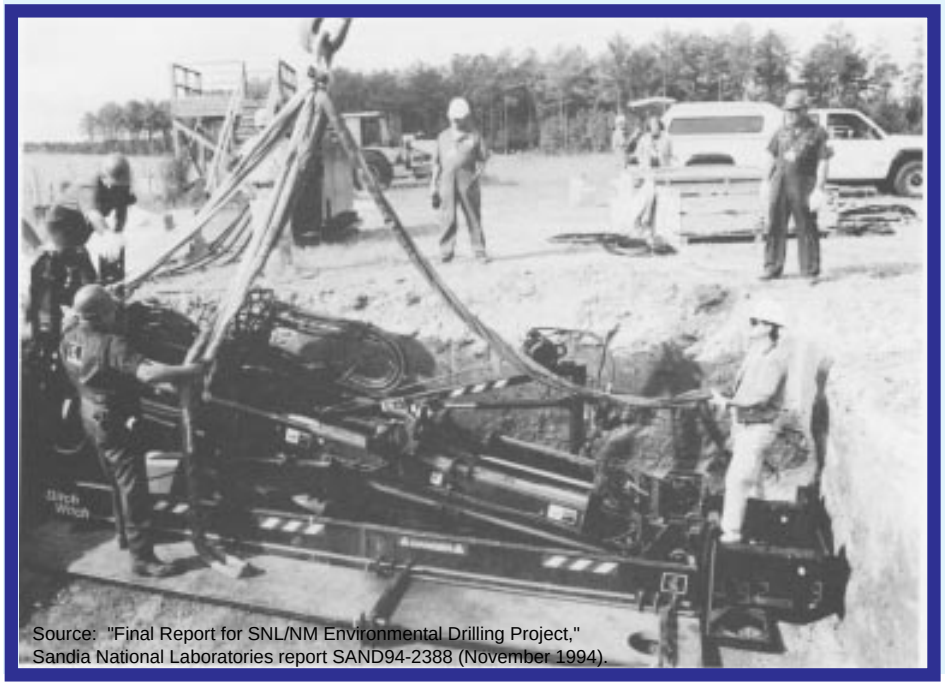


- Remediation of plumes under buildings and other valuable surface structures is only practical using horizontal wells.
- Cost comparisons are dependent on application and site characteristics.



Source: "Final Report for SNL/NM Environmental Drilling Project," Sandia National Laboratories report SAND94-2388 (November 1994).

- For most applications horizontal wells have better performance than even multiple vertical wells.
- Operations costs dominate remediation costs--wells with better performance will have lower lifetime costs.
- Compaction-tool and fluid-jet drilling technologies are least expensive for shallow applications.

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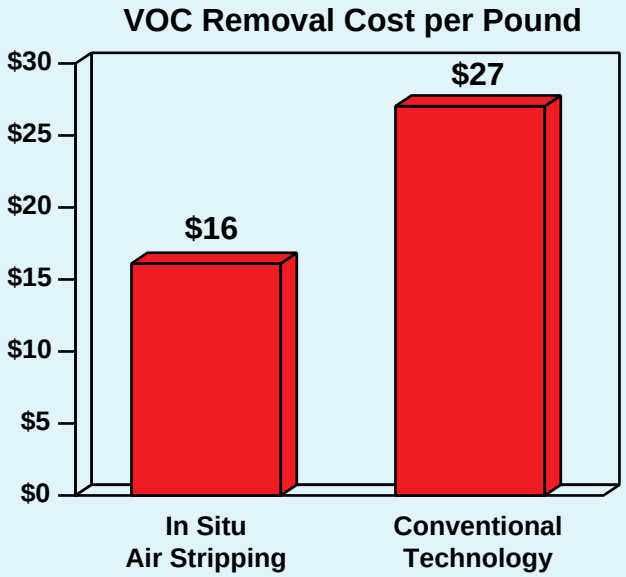
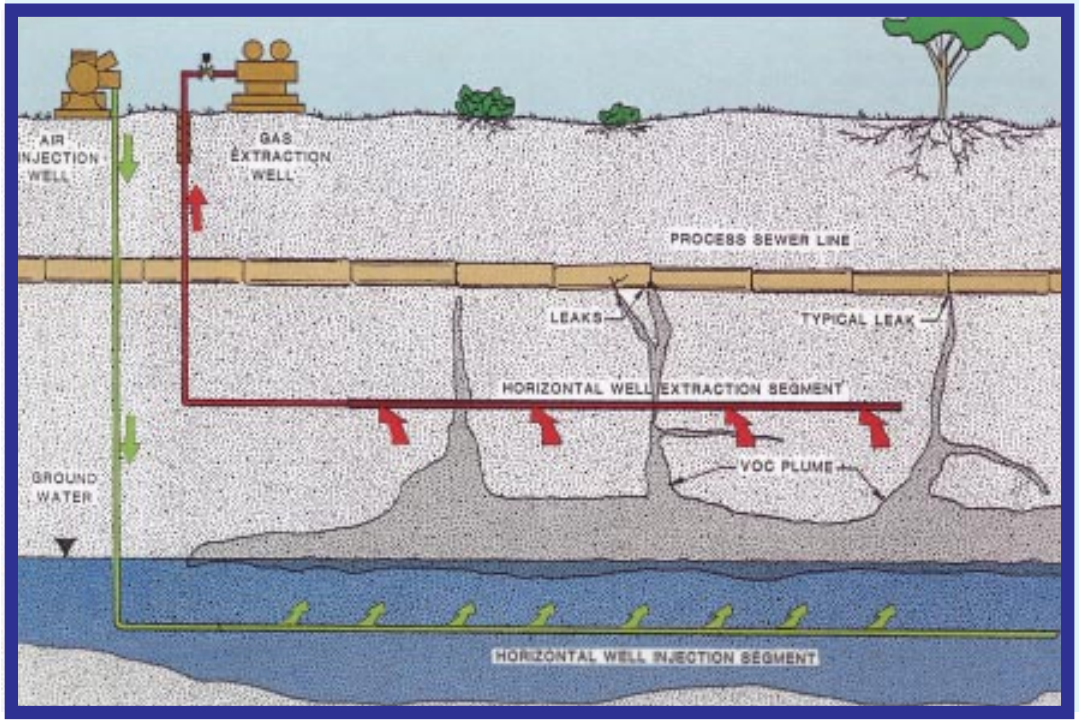
In Situ Air Stripping



- ISAS remediates both the vadose zone and saturated zone (groundwater and sediments below the water table) contaminated with chlorinated solvents.
- It can remove VOCs for 60% of the cost of removal by a combination of conventional Pump and Treat and Soil Vapor Extraction.



- At a SRS test ISAS removed VOCs at a rate of 130 pounds per day.
- Over a 5-year life cycle, ISAS is expected to remove 135,780 pounds of VOCs at the SRS site.

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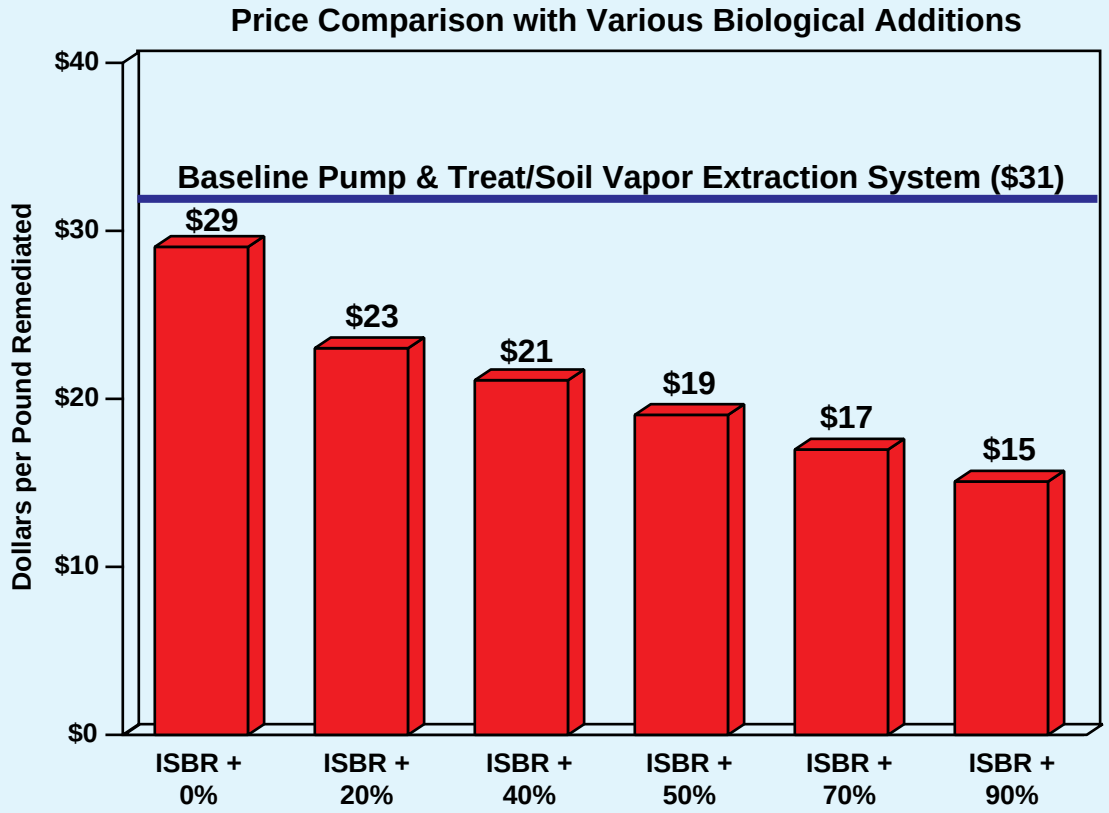
In Situ Bioremediation

- Cost of ISBR is sensitive to the biological component; as the biological addition increases, the VOC remediation cost per pound decreases.



- The baseline Pump and Treat/Soil Vapor Extraction system costs $31 per pound in the short term and has no possibility of a biological addition.
- As demonstrated, ISBR has a possible savings of $1 million at the SRID site alone.

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Passive Soil Vapor Extraction

- PSVE is less expensive than the baseline of Active Soil Vapor Extraction (ASVE) at low vapor concentrations.
- Has low capital and operating costs and no power requirements.
- Contaminant removal rates using PSVE are slower than for ASVE.
- Effectiveness of PSVE depends upon: 1) understanding atmospheric pressure relationships at the site and, 2) optimizing the natural process of barometric pumping.

	Active Soil Vapor Extraction		**Passive Soil Vapor Extraction**		
ppm CCl4	**500 cfm GAC, offsite $/lb CCl4**	**500 cfm GAC, onsite $/lb CCl4**	**10 cfm $/lb CCl4**	**5 cfm GAC, offsite $/lb CCl4**	**1 cfm $/lb CCl4**
5	$1,046	$1,325	$411	$813	$4,040
50	$110	$140	$49	$89	$412
100	$58	$73	$29	$49	$211
200	$32	$39	$19	$29	$110
500	$16	$17	$13	$17	$49
1,000	$11	$10	$11	$13	$29
5,000	$7	$3	$9	$10	$13

- Costs for both PSVE and ASVE are highly dependent on soil-gas concentration.
- PSVE is useful to complement ASVE once low, steady-state concentrations are achieved.

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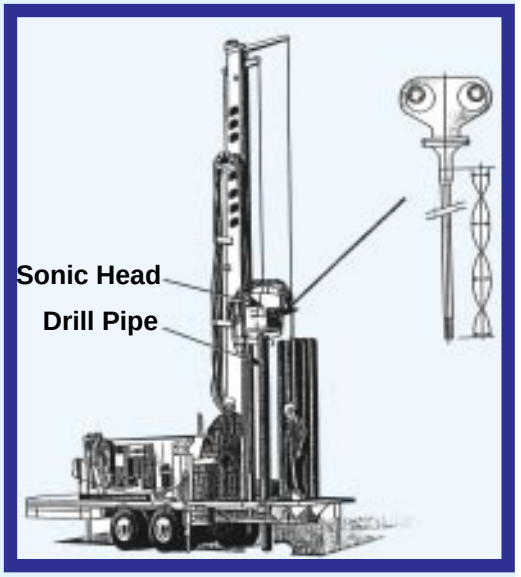
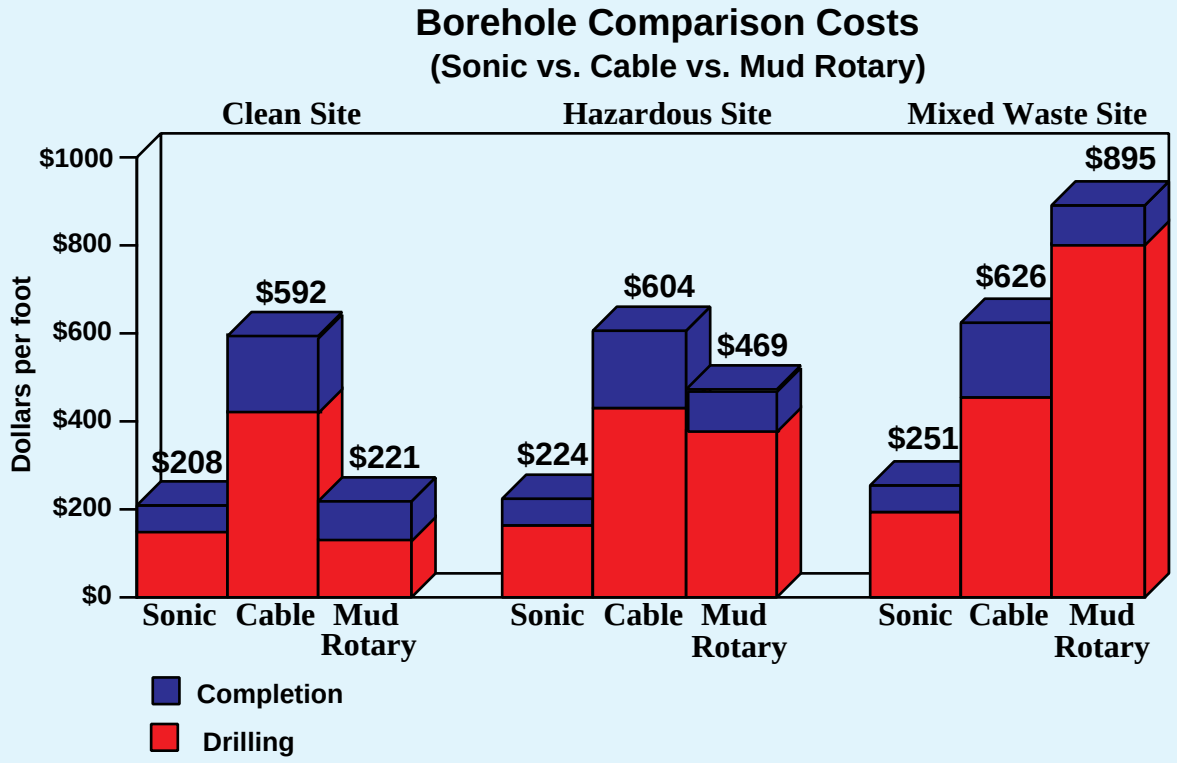
Resonant Sonic Drilling



- Sonic drilling rates are comparable to those for conventional mud rotary.
- Because no drilling mud is used, sonic drilling produces much less waste when drilling in contaminated soils.



Sonic drilling costs are:

1) 35 - 40% of cable-tool costs,

2) the same as mud rotary in clean sites,

3) 45 - 55% of mud rotary in hazardous waste sites, and

4) 25 - 30% of mud rotary in mixed-waste sites.

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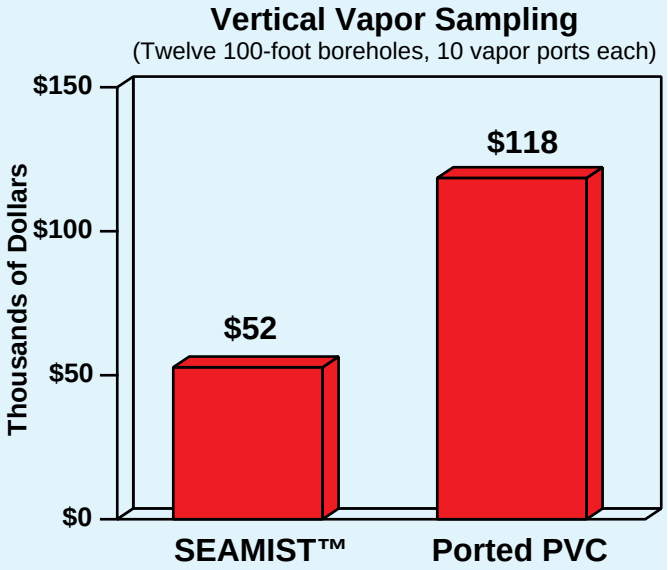
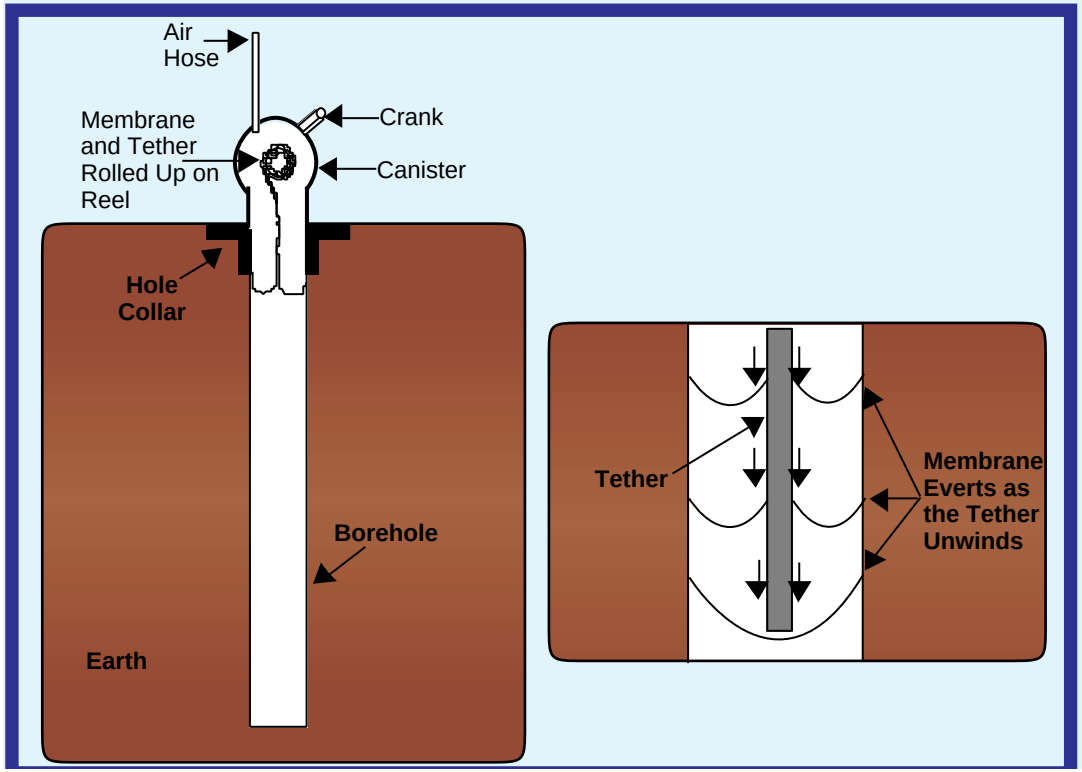
SEAMIST™



- SEAMIST™ can facilitate measurements of soil-borne contaminants in horizontal and vertical boreholes.
- Uses an airtight membrane pneumatically emplaced inside the borehole with attached sampling or measuring equipment.



- Cost savings of SEAMIST™ increase as contamination depth and contaminant variety increase.
- Savings are from 16% to 74% of the cost of using conventional technologies.

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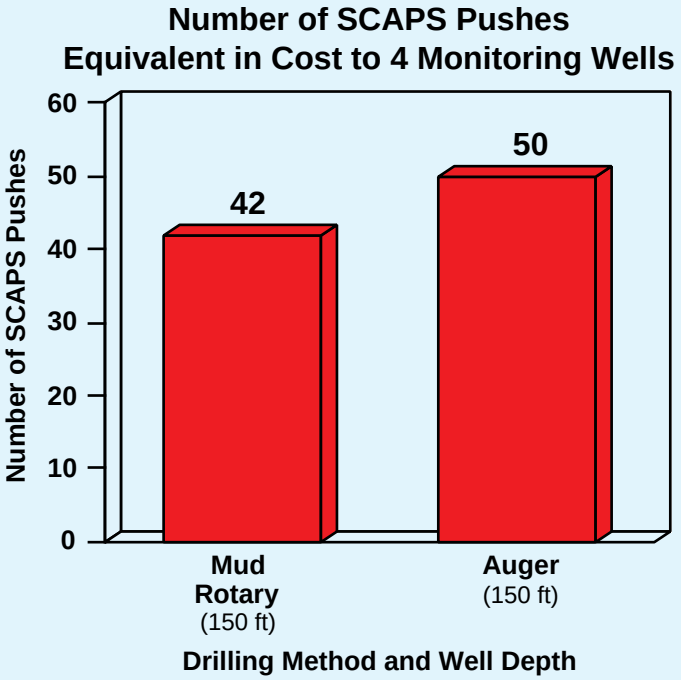
Site Characterization and Analysis Penetrometer System

- SCAPS is effective in characterization and assessment of contaminated sites.
- SCAPS data is used to guide drilling, sampling, and monitoring efforts.



- SCAPS acquires significant data (42 to 92 pushes) for the same cost as four conventional monitoring wells.
- Cost savings of 30% to 50% are possible.
- Avoids cost of installation, monitoring, and abandonment of nonuseful wells.

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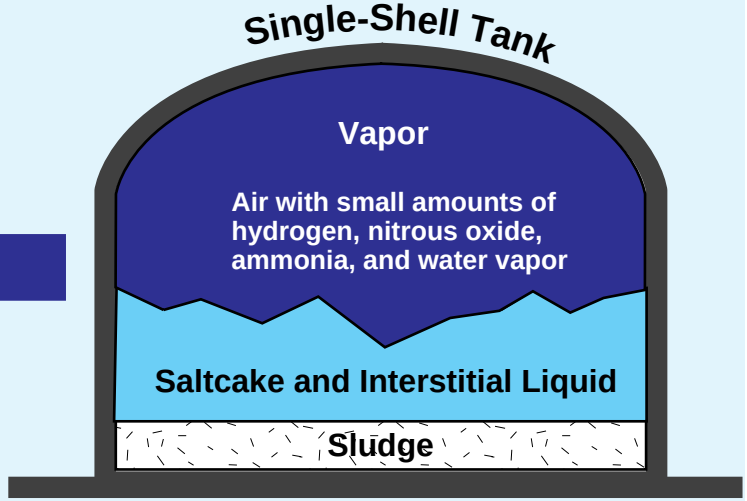
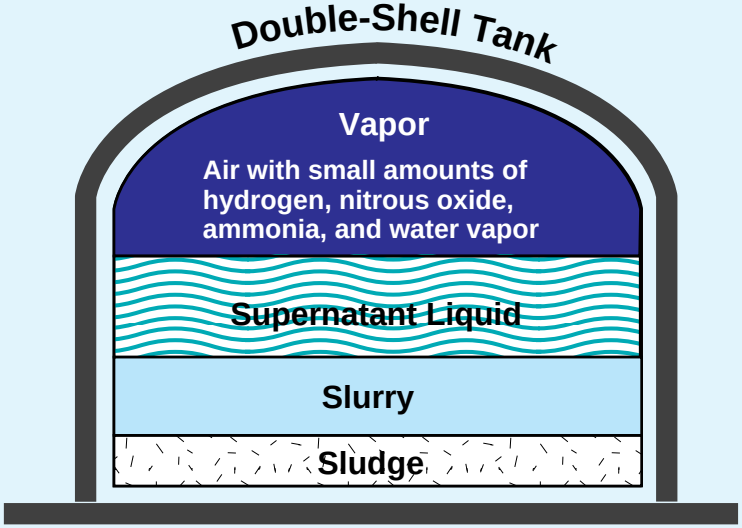
Sludge Washing of High-Level Waste





Source: "Hanford Tank Clean Up: A Guide to Understanding the Technical Issues," Pacific Northwest Laboratory report PNL-10773. (Pictures not to scale)

- Approximately 100 million gallons of HLW is stored in underground tanks at DOE sites.
- Approximately 15 million gallons of HLW in underground tanks at Hanford will be processed as solids.
- The volume of solids-based HLW can be reduced by caustic washing.
- A dilute caustic wash primarily removes interstitial liquid-based HLW, whereas a more concentrated caustic wash can preferentially partially dissolve nonradionuclide solids-based HLW.
- A more concentrated caustic wash known as Enhanced Sludge Washing can save $8.7 million over the dilute caustic wash at Hanford.