THINK TANK

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It's Coming... $$$$$$$

by Jill Hall

The UST Branch is currently developing a low-interest loan program for underground storage tank owners and operators. The program expands upon the success of the UST Branch's first loan program launched in 1993 designed solely for small retail gasoline stations. The new program will not place restrictions on the size or type of business that may apply. The work eligible for financing under this program includes:

1. Removal or abandonment of existing USTs
2. Installation of spill containment, overfill protection and leak detection
3. Remediation of contamination resulting from a release from an UST
4. Installation of corrosion protection

The UST Branch expects to have the program operational by mid-November. Public service announcements will be made when applications are available. Stay tuned for further details in the next issue of *Think Tank*.■

Inexpensive Cleanup Option

by Matt Lesley

If you are faced with the task of cleaning up contaminated soil and groundwater at a gasoline leaking underground storage tank (LUST) site, and the geology is right, a soil vapor extraction (SVE) / air sparging (AS) / biofiltration system could be for you. Before settling on a remediation method for your LUST site, consider the following:

1) How It Works

Soil vapor extraction (SVE) and air sparging (AS) systems use air to remove volatile organic compounds (VOCs) from the subsurface. SVE systems evaporate petroleum from soils and remove the contamination through wells installed in soil above the water table. AS systems strip contamination from groundwater by bubbling air upward through the aquifer from injection wells. AS systems must be used in tandem with SVE systems to recover VOCs stripped from the aquifer.

The heart of a SVE system is one or more regenerative blowers. The heart of an AS system is usually an oil-free dynamic compressor, although a reciprocating machine can be used if oil is filtered out of the injected air. If the blower(s) and compressors are properly sized, the operational costs (e.g. electricity) can be kept to a minimum. Integrated systems can be placed in a utility shed and once installed, remediate the site with minimal disturbance to the surface.

After the petroleum is stripped and extracted from the subsurface, it must be treated to prevent releasing the contaminants to the air. Biofiltration is an air

Continued on p. 2

Cleanup - Cont. from p.1

pollution control process that employs millions of hungry hydrocarbon degrading bacteria to oxidize VOCs. The bacteria reside on a filter composed of a porous mixture of materials such as gravel, bark chips, and water. The filter and bacteria are contained in an air-tight container, known as a biofilter or bioreactor, attached to either the suction or discharge side of the SVE blower(s). As contaminated soil-vapor passes through the filter it is consumed by bacteria and converted to carbon dioxide and water. Supplemental nutrients and water are also supplied to help maintain a viable bacteria population.

Some biofilter designs have reportedly achieved VOC destruction efficiencies of up to 90%. However, depending on the flow rate and VOC concentration of the influent soil vapor, this efficiency may not be high enough to meet the daily VOC discharge limit of 2.4 pounds per day. Consequently, the use of a biofiltration system may require a complete air permit.

Biofilters allow the extracted VOC laden soil-vapor to be treated at a much lower cost than other conventional SVE VOC abatement technologies such as carbon adsorption or thermal oxidation. This is due to the high operating costs associated with the use of these systems. Zurlinden and Carmel (1994) performed a cost analysis of SVE systems coupled with bio-filtration, catalytic oxidation, thermal oxidation, and carbon ad-sorption. Figure 1 shows the cost advantage of biofilters used with a SVE system extracting 50 cubic feet per minute of soil vapor for three years, with an average VOC concentration of 200 PPM.

2) Where It Works

Knowledge of the geology of a LUST site is essential when choosing a remediation method. SVE and AS systems will not operate efficiently in low permeability soils such as silty clays. Low permeability inhibits the flow of soil vapor, thereby preventing the evaporation and extraction of VOCs. This limits the use of SVE and AS to sites with soils containing high percentages of sand. However, most of the land area in Delaware south of the C&D Canal is underlain by soils containing a high percentage of sand. If you have a gasoline LUST site south of the C&D Canal with soil and groundwater contamination, it could be a candidate for remediation by SVE, AS, and biofiltration.

3) Site Requirements

The depth of the local water table aquifer is another concern. If the water table occurs less than eight feet beneath your site for most of the year, SVE may not be effective with conventional extraction wells. Shallow extraction wells (£ 8 feet) can have small radii of influence because a large volume of the air entering each extraction well will be drawn from the surface a short distance from the well, thereby missing the targeted zone of contamination. This can be prevented by a low permeability cap such as blacktop or clay rich soils on the surface of the site.

If you don't know the location and distribution of the contamination, you won't know how best to attack it. Sites with small volumes of contaminated soil (< 100 cubic yards) that are accessible and free of subsurface obstructions may be more effectively remediated by simple methods such as over-excavation. Sites with large volumes of soil, soil beneath structures, or having both contaminated groundwater and soil can be excellent candidates for remediation via SVE, AS, and biofiltration.

4) Wrap-Up

Remediation technologies need not be any more complicated or expensive than is required to clean up a site. One does not use a howitzer to kill a fly. Engineered remediation systems can be expensive. Therefore design, installation, and operating costs, advantages and disadvantages must be weighed against the costs, advantages and disadvantages associated with methods like overexcavation and ex-situ remediation. However, if designed and installed properly, a SVE/AS/Biofiltration system can achieve regulatory cleanup goals while keeping the cost of cleanup to a minimum.■

Fig. 1 Cost analysis for four types of remediation options.

	Biofiltration	Catalytic oxidation	Thermal oxidation	Carbon adsorption
Capital Costs	$30,000	$45,000	$35,000	$20,000
Annual operating costs	$3,000	$9,000	$17,000	$15,000 - 20,000
Total costs	$39,000	$72,000	$86,000	$72,500

Assumptions:

- *50 cfm flow rate of untreated soil vapor*
- *initial average concentration of TPH in untreated soil vapor of 200 ppm declining to levels that do not need treatment in three years*
- *continuously extracted soil vapor*
- *75% removal efficiency*

(Data from Zurlinden and Carmel, 1994)

Part IV – Internal Lining

Delaware's 1998 Compliance Deadlines

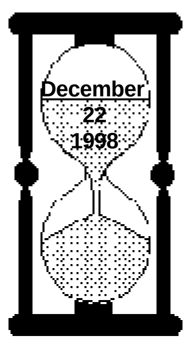
Previous articles in this series discussed tank testing requirements, cathodic protection and impressed current as options for meeting corrosion protection requirements. Internal tank lining is the last option that will be ad-dressed for meeting the December 22, 1998 deadline. On that date, all existing underground storage tank (UST) systems must meet corrosion protection requirements, or be removed or properly abandoned. A temporary solution would be to take the tank out of service for one year, followed by proper closure.

This discussion is aimed at owners and operators of existing bare steel tanks who will need to meet corrosion protection requirements in a little over two years. Our computer records show there are 1,539 bare steel tanks in Delaware which do not meet the 1998 requirements. Internal lining of a steel UST allows a tank owner to meet those requirements. It may also allow them to keep a tank that may have leaked, or is difficult or impossible to remove. And, it can also give an extra measure of security when done in addition to a cathodic protection upgrade.

Delaware's *Regulations Governing Underground Storage Tank Systems* state that a tank may be upgraded to meet the corrosion protection requirements by internal lining if the lining is installed in accordance with API 1631, *Recommended Practice for Interior Lining of Underground Storage Tanks* and National Leak Prevention Association Standard 631, *Entry, Cleaning, Interior Inspection, Repair and Lining of Underground Storage Tanks*.

Before any upgrade is undertaken, you must notify the department at least ten days prior to starting the work. Once we receive the notice, the owner will receive a letter from DNREC outlining information that must be provided to the UST Branch, i.e. the report of the tank condition upon inspection and repairs made to the tank prior to lining. If there is evidence of a release, such as holes in the tank, sampling will be required to determine the extent of contamination.

API 1631 requires that before lining a steel tank, an assessment must be made to identify whether that tank is suitable for lining. Determining the suitability of the tank for lining requires emptying the tank of all liquid, freeing the tank of explosive vapors, excavating to the top of the tank and cutting a hole in the tank large enough for a person to enter the tank.



This person then cleans any remaining sludge out of the tank and carefully sandblasts the entire inside surface of the tank. A visual inspection of the tank is made for holes, weld defects and structural integrity. A determination of the tank wall thickness is made by either sounding for thin areas and poking through to determine thickness (and repairing) or by ultrasonic or radiographic methods. If the tank has too many holes, they are too large, the walls are too thin, or the tank isn't round, indicating the tank is collapsing, then the tank is not suitable for lining and must be properly closed.

If the inspection shows that the tank is sound, it is lined with either an epoxy or polyester resin to a nominal thickness of $\frac{1}{8}$ inch. The entry hole is then sealed and the tank upgrade is complete. It must be tested for tightness after lining and before placing it back into service.

Regulations require that within ten years after lining and every five years thereafter, the lined tank must be inspected internally. The tank must be structurally sound at the time of inspection and must comply with the original design specifications. Any damage found must be repaired in accordance with standard engineering practice. If the tank can not be brought up to the original design specifications, it must be properly closed. Tanks that are upgraded with cathodic protection at the same time they are internally lined are not required to be inspected internally.

Internal lining of a tank does not stop the external corrosion process from occurring, but in theory, the tank will not leak even if the outside tank shell does de-velop point corrosion. Another point to keep in mind is that steel tank lines are not protected by tank lining. So if the tank piping is steel, it must be cathodically protected or replaced with non-corroding piping such as fiberglass or flexible plastic.

Which ever option you choose; internal lining, cathodic protection, impressed current, or replacement for your existing UST system, as a tank owner and operator you are responsible for meeting the corrosion protection deadline. We urge you to take action early to upgrade your tanks. This will avoid the last minute rush, avoid potential leaks from aging tanks, and avoid any potential for enforcement action.□

THINK TANK

Gary Charles, Editor

Contributing Staff

Matt Lesley
Jill Hall
Emil Onuschak, Jr.
Barbara McGuigan
Matt Higgins
Ravi Rangan

DNREC UST Branch
715 Grantham Lane
New Castle, DE 19720–4801
Tel:(302) 323-4588
Fax:(302) 323-4561

Kathy Calloway – Program Manager – UST/LUST
Mick Butler – Program Manager – UST
Ellen Malenfant – Program Manager – LUST

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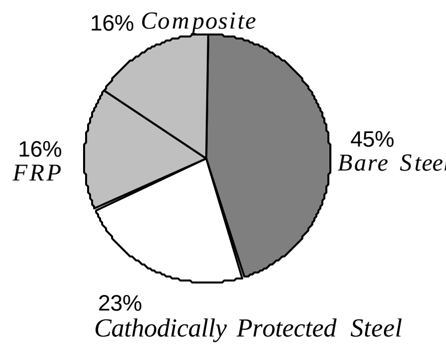
Tank Statistics

Currently, there are 3,389 active registered tanks in Delaware. Of those tanks, 1,539 are bare steel and will need upgrading by December 22, 1998, when all USTs and their associated piping must meet corrosion protection requirements set by the USEPA and the State of Delaware. That works out to approximately two tanks per day, seven days a week for the next two years.

If you are an owner of one of these tanks, plan your upgrade early to avoid the expected rush. As of September 1, there are 65 companies certified to properly close your tanks, 43 certified to install new tanks, 39 certified to upgrade tanks, and 2 companies certified to internally line tanks. If you need a list of these companies, please call the UST Branch to have a copy mailed or faxed to you.

Delaware USTs
by material of construction



Announcements

Matt Lesley, an UST Branch hydrologist, was married August 18. He and wife Amy are off for a honeymoon in Australia and Tahiti. We have it on good authority that Matt was checking out the leaking tank situation down under and may not return. If the Lesleys decide to return from paradise, they will live in Newark.

DNREC/UST Branch
715 Grantham Lane
New Castle, DE 19720–4801
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Corrosion Protection Required