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Agency

Environmental Monitoring
Systems Laboratory
P.O. Box 93478
Las Vegas NV 89193-3478

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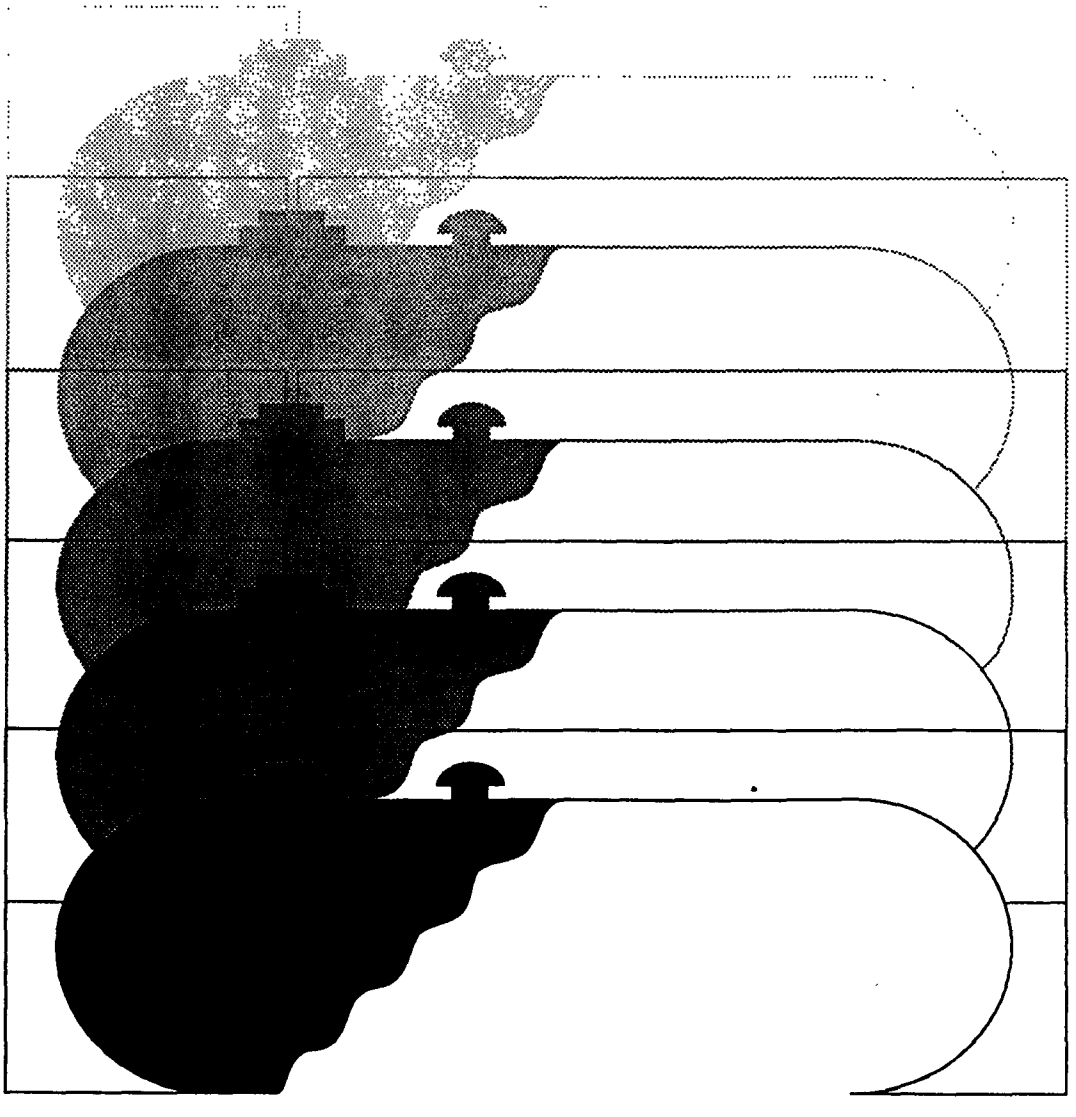
Underground Storage Tanks

EPA

Tank Issues

Design and Placement of Vapor Monitoring Wells

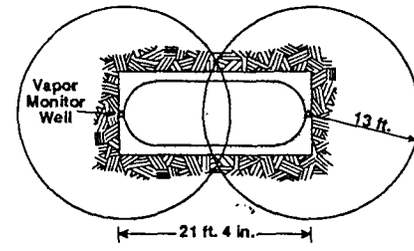


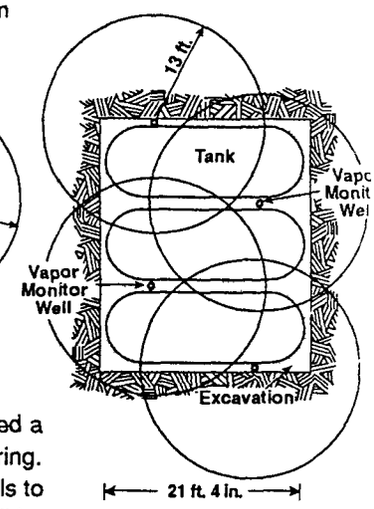
A series of informative articles of interest to tank owners and consultants concerned with management of underground tanks for storage of fuel.

Location of Vapor Monitors or Sampling Points

- *Locate vapor monitoring wells in high permeability backfill*
- *Use one vapor monitoring well for each 10 to 15 foot radius*
- *Use closer spacing in fine-grained soils*
- *Use additional vapor monitoring wells for backup and to monitor piping systems*
- *Use additional vapor monitoring wells to help discriminate between leaks and surface spills*
- *Instrument each excavation separately*

The number of vapor monitoring wells needed to monitor a storage system of one or more tanks in a single excavation can range from one to four or more. Hydrocarbon vapors move relatively freely by diffusion in coarse-grained backfill. Although diffusion of hydrocarbon vapors will distribute the vapors in measurable amounts through the vertical section, because hydrocarbon vapors are heavier than natural soil gas and also because leaks commonly occur near the bottom of tanks, vapors will be detected earlier in the lower part of the excavation. One vapor monitor in dry coarse-grained backfill of a single excavation would be expected to detect a tank leaking gasoline within a distance of 10 feet in less than 30 days according to model studies (Schreiber, Levy, and Rosenberg, 1988). State and local agencies have adopted a variety of network design requirements for vapor monitoring. Although the requirements vary, they tend to require wells to be spaced no more than 10 to 17 feet apart. If the backfill is wet or of fine-grained material, the spacing between vapor sensors may need to be decreased. Additional detectors may be located to detect leaks from piping systems associated with the tank systems.





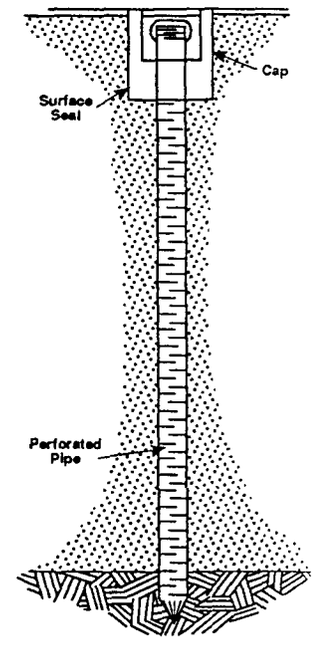
Leak detection devices in one excavation may not be relied upon to detect leaks in an adjacent, separate excavation. Leak monitors for each excavation should be considered as a separate and independent system. If the backfill of the tank excavation is not known or is of low permeability material, tracer tests can be made to determine if vapor monitors will provide adequate detection and, if so, the spacing required for monitors at the particular excavation.

Installation of Vapor Monitoring Wells

- *Install vapor monitoring wells above water table*
- *Slot vapor monitoring wells from bottom of casing to the surface*
- *Install vapor monitoring wells in permeable backfill of excavation*

Vapor wells or probes are typically constructed from 2- to 4-inch I.D. polyvinyl chloride (PVC) or stainless steel casing. Other materials which are used include cast iron, galvanized iron, polyethylene, polypropylene, fluorocarbon resins, and Teflon. The casing is generally installed by auger or hydraulic ram to a depth of about 1 foot below the bottom of the tank excavation. The casing should be slotted from the top of the plug in the bottom of the casing to the surface seal of the casing. The casing is sealed within 2 to 5 feet of the surface to prevent entry of liquids through the well bore annulus. The top of the casing should be fitted with a waterproof cap which is capable of being locked.

If the water table is within the zone of excavation, liquid monitoring of the floating product is commonly done. If vapor monitoring is used where the water table is within the zone of excavation, the point of vapor withdrawal or placement of the vapor detector must be above the water table.



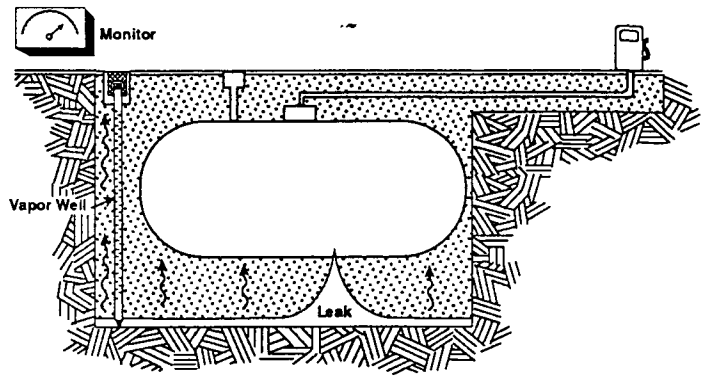
Introduction

Vapor monitors are relatively easy to install at many sites and may be suitable devices for monitoring underground storage tanks and piping systems for leaks. This paper discusses the use of vapor monitors at new and old tank installations for detecting leaks from underground hydrocarbon storage tanks. This paper discusses the site conditions under which vapor monitors can be effectively used and conditions which can mitigate or prevent the effective use of vapor monitors.

Migration and Monitoring of Hydrocarbon Vapor from Underground Leaks

- *Vapor monitors are useful devices for detection of leaks*
- *Vapor monitors detect hydrocarbons in soil air above water table*
- *Vapor monitors may determine leaks, usually not leak rates*

Hydrocarbon vapors are readily detected by vapor monitors. Fuel hydrocarbons leaking from underground storage tanks and piping are commonly released as liquid product. In the unsaturated zone above the water table, the product volatilizes and the vapors migrate rapidly in permeable soils, primarily by diffusion. Vapor monitoring may be the only suitable means of external detection where the water table is greater than 20 or 30 feet below grade. Vapor monitors employ devices which measure gaseous hydrocarbons in the soil air in the vicinity of underground storage tanks. Vapor monitoring detectors are used to detect leaks, but usually not to determine the rate of tank leak. The rate of tank leak may need to be determined by other methods such as inventory or internal monitoring methods. However, external vapor monitoring methods are capable of detecting small leaks that cannot be measured by inventory methods.



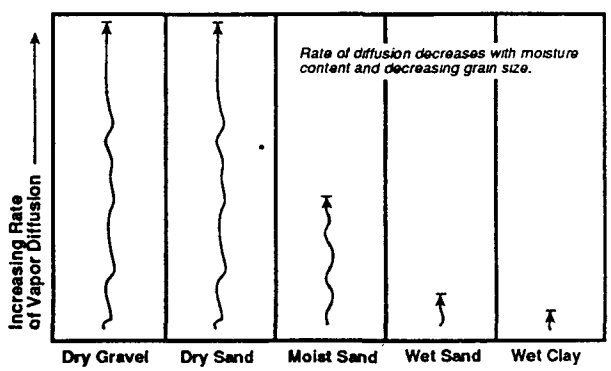
Leaking fuels volatitize, diffuse in the soil air, and are detected by hydrocarbon vapor monitors.

Natural and Engineered Site Conditions for Vapor Product Monitoring

- *Vapor monitors are most suitable where background hydrocarbon content is low or negligible*
- *Vapor monitors are located above water table*
- *Vapor monitors are located in coarse-grained, permeable backfill*

Existing tank installations may be difficult to monitor because of the presence of high content of residual hydrocarbons from previous spills or leaks. The problem of high background hydrocarbon vapor content may be overcome by the removal of hydrocarbon gases by soil vapor extraction methods (Hutzler, Murphy, and Gierke, 1989). Another solution may be by the addition of compound-specific tracers to fuels to identify leaks from the tanks being monitored.

The backfill material in which the vapor monitors are located must be relatively permeable to allow the hydrocarbon vapors to migrate rapidly by diffusion. High moisture content of soils reduces the gas permeability and the rate of diffusion of hydrocarbon vapors. Vapor monitors must, of course, be located above the water table where hydrocarbon vapors are free to migrate through the unsaturated material.



References

Hutzler, N. J., Murphy, B. E., and Gierke, J. S., 1989, Review of soil vapor extraction system technology: Soil Vapor Extraction Technology for Underground Storage Tank Sites Workshop, U. S. Environmental Protection Agency Risk Reduction Engineering Laboratory, Edison NJ, June 27-28, 1989, 25 p.

Schreiber, Robert, Levy, Benjamin, Rosenberg, Myron, 1988, Modeling vapor phase movement in relation to UST leak detection - Phase 1: Final Report, Environmental Systems Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Las Vegas, Nevada, 81 p.

Technical Editor, M. S. Bedinger

Project Officer, Phil Durgin

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"Tank issues," are short articles on the management of underground fuel tanks. These articles provide recommendations but are not regulations. All appropriate state, local, and federal regulations should be followed in installation and operation of leak detection devices and in management of underground storage tanks.

Environmental Monitoring Systems Laboratory
P. O. Box 93478
Las Vegas, NV 89193-3478

United States
Environmental Protection
Agency

Center for Environmental
Research Information
Cincinnati, OH 45268

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