

Memorandum

Florida Department of Environmental Protection

TO: Waste Program Administrators
District Tanks Supervisors
County Tanks Supervisors

FROM: Mike Sole

DATE: November 13, 1998

SUBJECT: Clarifications to "Guidelines for Site Suitability Determinations for External Monitoring" (SSD), dated February, 1998

Input from various professional engineers and geologists around the state whose services have been sought to implement SSDs have brought a recognition that the Department must clarify a few points in the SSD guidelines.

The first point is in the part subtitled "Excavation Evaluation", paragraph one, at the bottom of page 5 and top of page 6. Where the guideline reads " As a general rule, soil air permeability must be 1 darcy or greater...", this should read ten (10) darcys or greater. This brings the soil permeability for vapor monitoring wells in line with the federal requirement of 0.01 cm/sec for groundwater monitoring wells.

The second point to clarify is in the last section subtitled "Site Suitability Determination Completion Procedures" on page 9. It says that the SSD must be performed by a Professional Geologist. It should be pointed out, however, that nothing within these guidelines should be construed to prevent or prohibit the practice by Florida registered professional engineers as provided by Chapter 492, F.S.

Guidelines
for
Site Suitability Determinations
for
External Monitoring

February, 1998

SITE SUITABILITY DETERMINATIONS

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I. INTRODUCTION

Storage tank systems with external methods of release detection such as vapor or groundwater monitoring must be located in a site conducive to such a method. The nature of the regulated substance, the site's physical properties, and the method of monitoring must be assessed together to determine the site's suitability for external monitoring. The site suitability determination (SSD) must demonstrate that the method of external monitoring will detect a release from the storage tank system within 30 days.

Sites suitable for groundwater monitoring may not be suitable for vapor monitoring, or may be better suited for technologies such as fiber optics or the use of tracer compounds. The SSD must justify the choice of the method of external monitoring to be used at the site. In doing such, the SSD becomes a multi-faceted site assessment where the following must be examined:

1. Whether the physical properties of the stored regulated substance (product) allow for timely detection by external monitoring in the event of a release;
2. How the excavation design and conditions facilitate or hamper the transport of product or vapors to the detection devices;
3. Whether the detection devices are suitable in consideration of their location and construction;
4. How variations in groundwater depth and flow direction affect the transport of product or vapors.
5. How the variation of general site conditions influence external release detection.

Suitability of a site for external release detection is not solely dependent upon one characteristic. Site suitability is instead dependent upon on how well components such as monitoring equipment, the product's physical properties and the excavation conditions complement as well as compensate for each other. For example, the distance of the well or probe from the component being monitored may be further than 15-20 feet, yet the soil transmissivity may still allow a release to be detected within 30 days. Therefore, the inability of the site to meet one of the conditions specified within these guidelines does not necessarily preclude the use of external monitoring. The limiting condition can be compensated for by other excavation properties or monitoring methods.

In addition, in situations where the data does not directly demonstrate the suitability of a site for external monitoring, other options can be used. Some options that could be used in these situations are:

- diffusion calculations that address the movement of product or its volatile constituents through soil, as influenced by soil porosity and moisture content.
- tracer tests that use a known or marked volatile compound to mimic the movement of the volatile constituents of the product through the soil.
- empirical evidence that provides practical confirmation that a release will be detected in accordance with Chapter 62-761, F.A.C.

In order to fully understand the guidelines, a few introductory points need to be made.

These guidelines are applicable to both underground storage tank systems (USTs) and aboveground storage tank systems (ASTs). The guidelines also apply to sites with or without existing contamination.

The term "product," as used throughout these guidelines, refers to the stored regulated substance, and not any particular type of petroleum as defined in Chapters 62-761 and 770, F.A.C. The use of the term "site" refers to the storage tank system excavation and the area within its immediate proximity, not the facility as a whole. For example, a facility may have three separate sites. All other terms, such as "existing contamination" and "release", are in keeping with definitions of those Chapters.

Finally, historical monitoring data may be used to support the claim that the site is suitable for external release detection. However, site suitability cannot be solely justified by the use of the historical monitoring data documenting the times that a release has been detected. Sufficient documentation must be provided to establish that the external monitoring procedure minimizes the number of releases that may go undetected (i.e. false negatives).

PRODUCT EVALUATION

Though not typically seen as part of the "site", the nature of the stored product is the first indicator of whether external

methods of release detection are suitable or even possible at a site. Therefore, the SSD must include an evaluation of the physical properties of the product. Depending on the method of external release detection and the product that is stored in the storage tank system, the following factors should be addressed:

1. Viscosity: Products that are too viscous will not be detected in a timely manner after a release. Instead of flowing to the source of detection, the product instead may pool, allowing large amounts of product to be released before spreading sufficiently to be detected. However, for some products, such problems may be offset by placing more wells at a closer distance to the storage tank system, or by use of an external detection system such as electronic sensing or fiber optic cables located in close proximity to the storage tank system.

2. Solubility and Specific Gravity: Products that will mix with water or sink below the water table are not suitable for groundwater monitoring. Other methods of external release detection may be possible, as long as the groundwater table always remains below the storage tank system excavation being monitored.

3. Volatility: Volatility is an issue for both vapor monitoring and groundwater monitoring. Products that volatilize quickly, such as with some hazardous substances, may not remain in liquid form long enough to be detected through groundwater monitoring. Products of low volatility, however, may not produce sufficient vapors to be detected through vapor monitoring.

EXCAVATION EVALUATION

The evaluation of the excavation involves soil, groundwater and any conduits. For a UST the excavation is the area of backfill or soil that was displaced or replaced in the installation of the tank system. For ASTs where a foundation may or may not have been installed, the excavation means the ground between the tank and the detection equipment. For ASTs where the installation of a foundation has caused a disturbance of the natural soils under or around the tank, the same consideration for detection devices within and outside the excavation must apply.

1. The porosity of soils affects the speed and direction of the transport of product or vapors to the detection device. For vapor monitoring, the major factor of vapor transport is soil air permeability. As a general rule, soil air permeability must be 1 Darcy or greater, as determined by laboratory or field soil

permeability test, or be classified as a medium or coarser grain sand in accordance with the Unified Soil Classification System and by grain size analysis.

Soil hydraulic conductivity must be considered for both groundwater and vapor monitoring. The soil must be able to allow transport of product within a timely manner, as well as allow the drainage of water to minimize damping effects on product or vapor transport.

2. The SSD must include a description of the method of determining groundwater flow, as well as a map indicating the flow lines. A general site groundwater flow determination as is common to Contamination Assessment Reports (CARs) may not be sufficient, as the very presence of the storage tank system may alter the normal groundwater flow.

Groundwater depth must also be indicated in relation to the storage tank system. For a storage tank system that is within the groundwater table, the variation of the differential head between the storage tank system product and the groundwater table should be addressed.

3. Natural or manmade conduits such as sewer or utility lines and impermeable layers such as clay, fragmented rock, or limestone layers that transect or are in proximity to the excavation must be identified. These conduits or paths must not prevent the flow of product or vapors to the detection devices. The monitoring devices should be positioned to offset these problems. The SSD must include a map indicating these conduits or layers in relation to the storage tank system and monitoring devices.

4. The presence of existing contamination must not prevent the detection of a new release. A site where the monitoring wells or probes contain or contained free product or sheen must not use external monitoring until the Department determines that the site has no further need for remediation by way of the issuance of a Monitoring Only Plan Approval Order (MOP) or Site Rehabilitation Completion Order (SRCO). Elevated vapor readings within wells or probes should be examined to determine if the criteria with the Department's "Guidelines for Vapor Monitoring" can be met.

Remediation of the contamination must not interfere with the detection of a release. For example, changes in groundwater flow due to air stripping must not cause newly released product to flow to the recovery well instead of the monitoring well. Similarly, air sparging methods should not prevent vapor readings from indicating a new release. For remediation within or in

proximity to the excavation, the zones of influence must be indicated on a site map.

MONITORING WELLS OR VAPOR PROBES

When wells or probes are to be used, the SSD must contain a complete description of the construction and placement. Boring logs, etc. must be included as available. A map indicating placement of the wells or probes in relation to the storage tanks, underground piping, and any utility lines or other product pathways must be included. At a minimum the following criteria must be met:

1. Vertical wells must be constructed in accordance with Rule 62-761.640(2), F.A.C. Slot size should be chosen in consideration of the product and groundwater table. Slots that are too small may restrict the entry of more viscous product, or form a water layer where the product has to build in order to overcome the problems of water surface tension. In addition, a section of the slotted portion should remain above the groundwater table.

Some vapor detection systems use unslotted probes pushed into the ground to detect vapors or tracer compounds for release detection. If these probes are used in an area where groundwater would encroach on the probes, consideration should be given to using probes at multiple depths. The multiple depths would maximize release detection while insuring that as the water table rises, some probes remain open to allow for release detection.

2. Much discussion has been held over the distance between the well or probe. As a general rule, the wells should be located within 15-20 horizontal feet from any potential leak point. However, the actual distance is contingent upon the soil conditions, conduits, and the physical properties of the product.

3. Well spacing must be designed to afford complete detection capabilities. Again, placement is contingent upon the same factors as distance. In general, two wells should be used for a single tank, and three or more should be used for multiple tanks within an excavation.

4. The majority of wells for groundwater monitoring should be placed down gradient of the system. For vapor monitoring, consideration should also be given in placing the majority of wells downgradient since product tends to travel the same course as groundwater.

5. Vertical well depth is highly contingent upon the component of the storage tank system being monitored, as well as the

condition of the surrounding soils. Typically, the well depth should be no greater than 5 feet below the underground storage tank and associated piping. For aboveground storage tank systems, the well depth should be sufficient to provide enough screened surface for the horizontal spread of product or vapor, while considering the vertical spread of product. However, well depth must be no greater than 20 feet, and must not intersect any natural or manmade confining layer, such as clay bases or liners.

6. For wells or probes placed outside the storage tank excavation, detection of releases is further limited by the natural barrier caused by the change in porosity and density of the different soils. Product may tend to pool along the barrier before sufficient quantities for detection reach the monitoring device.

7. Groundwater and vapor monitoring wells using the placement of sensors or probes in vertical, horizontal, or directionally-drilled wells shall be designed and installed in accordance with the manufacturer's requirements.

GENERAL SITE CONDITIONS

Each site must be assessed outside the excavation for changes in environmental conditions that may interfere with the monitoring method (for example, seasonal changes in the water table depth). The SSD must describe these conditions, and provide data assessing any time-related variations in site conditions. For characteristics such as background vapors and stormwater flooding events a calendar year's worth of data will be needed.

1. The site elevation with respect to stormwater flooding and drainage must be considered to evaluate how the saturation of soils may suppress the detection of a release. Product or vapor transport may be restricted by the lack of porosity or permeability in soils saturated with stormwater. Drainage must be sufficient to counteract these effects.

2. For vapor monitoring, the presence of background vapors such as methane and sulfide gases must be assessed. Elevated background vapor readings can mask the true vapor reading and prevent the detection of a release. The data should be gathered in time increments of no greater than 30 days.

3. Changes in groundwater depth and subsurface temperature may also affect the vapor readings. Much like background vapors, these conditions may suppress or elevate vapor readings and prevent the detection of a release. Again, time increments for the data sets should generally be no greater than 30 days.

4. Existing contamination outside the excavation or even offsite should be examined. Contamination that travels into the excavation may mask the detection of a new release, or even falsely indicate a release. A site map delineating the areas of contamination must be included. Remediation of the contamination must not interfere with the detection of a release. Any onsite remediation must have the zones of influence indicated on a site map.

SITE SUITABILITY DETERMINATION COMPLETION PROCEDURES

The SSD must be performed by a Professional Geologist (PG) licensed in the State of Florida in accordance with Chapter 492, Florida Statutes. The SSD must be kept on site as a record in accordance with Rule 62-761.710, F.A.C. Any change in site conditions that adversely affects external release detection at a site will require modification of the Site Suitability Determination by a Professional Geologist. This modification shall be kept as a record. Sites that have been using external monitoring as the method of release detection may continue to use external monitoring during the development of the Site Suitability Determination. Sites that elect to use external monitoring as a new method of release detection after the adoption of these guidelines must use another approved method of release detection until the completion of the SSD.

If the results of a SSD indicate that external monitoring will not be acceptable as a means of release detection at a facility, another approved method of release detection must be utilized.

REFERENCES

- Abdul, Abdul S, Sheila F. Kia, and Thomas L. Gibson, 1989. Limitations of Monitoring Wells for the Detection and Qualification of Petroleum Products in Soils and Aquifers. *Ground Water Monitoring Review*, vol. 9, no. 2, p 90.
- Bedinger, M.S., Ed., 1993. Design and Placement of Floating Liquid Monitoring Wells. *Tank Issues*, March 1993, U. S. Environmental Protection Agency, Washington, D.C.
- Bedinger, M.S., Ed., 1993. Site Characterization for External Leak Monitoring. *Tank Issues*, February 1993, U. S. Environmental Protection Agency, Washington, D.C.
- Geraghty & Miller, 1988. Capabilities and Limitations of Wells for Detecting and Monitoring Product Releases. *Free-Product Release Detection for Underground Storage Tank Systems*, vol. 1, U. S. Environmental Protection Agency Office of Underground Storage Tanks, Washington, D.C., EPA Contract No. 68-01-7383.
- Pederson, Tom A. and James T. Curtis, 1991. *Soil Vapor Extraction Technology*. Noyes Data Corporation, Park Ridge, N.J., pp. 15-40.
- Robbins, Gary A, 1996. A Summary of Vapor Monitoring Issues Related to Release Detection Monitoring Using Total Organic Vapor Detector Instruments and Gas Chromatography In Florida and Recommendations For Resolving These Issues: Final Report. Florida Department of Environmental Protection, Tallahassee, Florida, Contract No. GC 348.
- Schnoor, Jerald L, 1996. *Environmental Monitoring: Fate and Transport of Pollutants in Water, Air, and Soil*. John Wiley and Sons, Inc., New York, pp. 455-521.
- U. S. Environmental Protection Agency, 1995. Leak Detection Methods For Petroleum Underground Storage Tanks and Piping. *Straight Talk On Tanks*, July 1995, U. S. Environmental Protection Agency, Washington, D.C.