

Petroleum Cleanup Program

REMEDIAL ACTION PLAN GUIDELINES

BUREAU OF PETROLEUM STORAGE SYSTEMS

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Signature and Date
PE ADMINISTRATOR

Signature and Date
BUREAU CHIEF

Pilot Studies

A pilot study for a vapor extraction system or multi-phase extraction system is not mandatory prior to design in a Remedial Action Plan (RAP), but consultation on this decision with the Department, or contracted local cleanup program, is necessary. A pilot study is recommended if the suitability of the site conditions for vapor extraction is marginal or if the performance of a pilot study will result in a more efficient design that would outweigh the cost of the pilot study. If there is another petroleum-contaminated site in close proximity, which is under remediation, the Department should be contacted to determine if there is useful vapor extraction pilot study information or full scale operational information available for the other site.

Prior to performing a pilot study, a proposal should be submitted to the Department or contracted local cleanup program for review and approval. If the size of the area of soil contamination and confidence in the site's suitability for vapor extraction or multi-phase extraction do not warrant performance of a pilot study, a proposal explaining the rationale for the decision to not perform a pilot study should be submitted to the Department, or to the appropriate local cleanup program, for review and approval. The Department (or contracted local cleanup program) will respond in writing approving the pilot study proposal, providing comments on the pilot study proposal, or

notifying the responsible party whether to proceed with RAP design without performing a pilot study. The following must be demonstrated to support a pilot study proposal and be presented in a RAP to support the vapor extraction or multi-phase extraction system design:

1. The Site Assessment Report (SAR) has been approved and a RAP is under development.
2. The SAR has concluded that active remediation is required to achieve the Department's soil cleanup target levels.
3. Information from the SAR on site lithology, type of petroleum contamination, and the degree and extent of contamination, generally support vacuum extraction or multi-phase extraction as a feasible and cost-effective remediation method.
4. That conducting a pilot study is cost-effective. If the area of contamination is relatively limited, and the scope of the full-scale vacuum extraction or multi-phase extraction system would be expected to be relatively small, it may not be appropriate to conduct a pilot study. Under these circumstances, it may not be possible to recoup the cost of the pilot study by the resulting greater efficiencies and optimization of design resulting from the pilot study information. As a general rule, if estimates of soil characteristics are considered moderately reliable as far as the ability to conservatively estimate the radius of influence, and the full scale vacuum extraction system is not expected to include more than three or four extraction wells, then a pilot study may not be appropriate. If the appropriateness of conducting a pilot study is in question, the Department (or local cleanup program) should be consulted.
5. That air emissions have been considered. The pilot study duration should be limited to eight hours or less, unless air emissions treatment is provided. Judgment should be used in providing air phase treatment on a system to be operated for less than eight hours if it is in close proximity to inhabited areas and likely to result in adverse health or nuisance conditions.

6. That the appropriate design information will be gathered. As a minimum, the results of the pilot study should provide design information to determine the number and locations of extraction wells, based on effective radius of influence, and the most cost-effective method of air emissions treatment, based on anticipated emissions concentrations and mass balance of hydrocarbons projected to be recovered. This would include the design vacuum, flowrate, and radius of influence.

Air Emissions Treatment

The Clean Air Act and its amendments establish the authority of the Environmental Protection Agency (EPA) to write and enforce regulations pertaining to air quality. There are two sets of criteria that have been established to protect air quality. These criteria are the National Ambient Air Quality Standards (NAAQS) and the National Emission Standards for Hazardous Air Pollutants (NESHAPs or HAPs). The NAAQS apply to air quality on an area-wide basis while the NESHAPs apply to specific emission sources. The EPA has delegated authority to enforce these federal regulations to the Department. The Department has further delegated this authority to several counties including, Dade, Broward, Palm Beach, Hillsborough and Duval. Department enforcement is managed through the District offices.

As part of enforcing these regulations, the Department has developed a permitting system that complements the federal regulations. For stationary sources, this permitting system has three major categories:

1. Exempt (no permit required)
2. Small/Large Area Source
3. Major Source (Title V Source)

The distinction between these categories is dependent on a variety of factors including: the pollutant, the type of equipment, the emission rate, and the duration of the emission. Remediation systems should be designed so as to be exempt from the permitting process. This means that remediation systems should be temporary in nature, that is, operational for five years or less. It also means that the total emissions from all remediation system components should not exceed 2,000 lbs./yr. of any HAP, or 5,000 lbs./yr. (13.7 lbs./day) of Total HAPs.

Contaminant Mass Emission Procedure

In order to prevent large mass emissions that last for less than one year, as is typical with many remediation systems, these emissions will be evaluated on a daily basis. Because petroleum is a complex mixture of many compounds, it is not practical on a program-wide basis to evaluate each compound individually. Also, it is nearly impossible at most petroleum sites for any individual contaminant to exceed the individual contaminant limit without exceeding the total emission limit first. As a result, evaluation of the HAP emissions at petroleum fuel contaminated sites will be limited to Total HAPs only. Therefore, the emission limit for remediation systems at petroleum cleanup sites is 13.7 lbs./day for total HAPs. Vapor extraction and multi-phase extraction systems, which typically have relatively high emissions initially, are required to have air emissions treatment for the first 30 days of operation, which may be discontinued if the measured emissions rate after 30 days will be less than 13.7 lbs./day.

The default analytical procedure for this evaluation is EPA Method 18, Measurement of Gaseous Organic Compound emissions by Gas Chromatography. EPA Method 18 does not provide information on the quantities of all individual HAPs that are found in petroleum fuels. EPA Method 18 may be run for a determination of either BTEX or Total Petroleum Hydrocarbons (TPH). The BTEX result does not include all HAPs that are present in petroleum fuels; therefore, running EPA Method 18 for BTEX only is not acceptable. Running EPA Method 18 for TPH will result in the inclusion of chemicals that are not on the EPA HAPs list; however, this value will be used as a default to obtain a conservative estimate of the HAPs present (see "Alternative Analytical Method Procedure" section below for an alternative procedure to measure HAP chemicals only). The TPH from Method 18 of the air sample from the remediation equipment should be used to estimate and report the Total HAPs for the emissions based on the equipment daily airflow rate. If the Total HAPs are expected to exceed 13.7 lbs./day, emissions treatment will be required for the first 30 days of system operation. Generally if there is more than one remediation equipment emissions source, for example vapor extraction system and an air stripper, the emissions control would be provided only on the more significant source (vapor extraction) such that the total emissions would be reduced to less than 13.7 lbs./day.

Alternative Analytical Method Procedure

EPA Method 18 was selected as the default air sample analysis method because the sample collection technique (tedlar bag) is familiar to the consultant industry, relatively simple and economical, and the analysis cost is also economical compared to other methods. The Department's experience has been that the majority of vacuum extraction systems experience a relatively rapid reduction in vapor concentrations in the first few weeks of operation and may discontinue operation of an air emissions treatment system after one or two months of operation because the emissions (of TPH as determined by EPA Method 18) are less than 13.7 lbs./day, even though the method is measuring other hydrocarbons in addition to the required HAPs. In some instances, at contaminated sites with a more significant extent and degree of contamination, however, elevated vapor concentration may persist for a longer period. In these instances, alternative analytical methods may be used to demonstrate that the HAPs have been reduced to less than 13.7 lbs./day. The following are the chemicals on EPA's HAPs list that are found in petroleum fuel products:

- Benzene
- Ethylbenzene
- Toluene
- Xylenes
- Naphthalene
- Hexane
- MTBE, and
- Polycyclic Organic Matter, which means all the PAHs (17 PAHs other than naphthalene are listed in Table A of Chapter 62-770, FAC)

EPA Method TO-14 may be used to quantify the following HAP chemicals found in petroleum fuels: BTEX, MTBE, Hexane, and Naphthalene. EPA Method TO-13 may be used to quantify the 17 PAHs found in petroleum fuels.

At the discretion of the consultant (with concurrence from the Department for funded program sites) these methods may be used as follows to measure HAPs as an alternative to EPA Method 18. For sites that are contaminated with gasoline only, EPA Method TO-14 may be used. For sites contaminated with both gasoline and diesel fuel, or only diesel fuel, both methods must be used. Based on the analytical results for the HAPs chemicals listed above, and the air flow rate of the system, the total daily air emissions of HAPs must be calculated. If the result of the calculation indicates the air emissions of HAPs will be less

than 13.7 pounds per day, discontinuation of the air emissions treatment system may be proposed to the Department.

A decision to use this alternative evaluation procedure should be based on a comparison of the cost of the sampling and analysis relative to the cost of continuing air emissions treatment. The sample collection for air samples to be analyzed with these alternative methods requires a vacuum canister be used rather than a tedlar bag, and the sample analysis cost itself is significantly higher than Method 18. Depending on whether use of both alternative analysis methods would be necessary, the cost for sample collection and analysis could be an order of magnitude greater than the use of the standard EPA Method 18 procedure. This could be justified though if a relatively expensive air treatment method, such as catalytic oxidation or thermal oxidation, is being used and it appears that several more months of continued operation would be necessary based on the EPA Method 18 results.

Emission Modeling Procedure

The lbs./day technique is the Department's preferred method of evaluating whether to discontinue air emissions treatment for vapor extraction (or multi-phase extraction) after 30 days. As an alternative to the contaminant mass emission procedure, the emission may be modeled using EPA's TSCREEN model. This procedure may be appropriate if particularly toxic compounds are present or exceeding the daily mass emission limit (but not the yearly limit) is likely. The procedures outlined in Attachment A should be followed to properly use the TSCREEN model. The method for determining concentrations for the model input values should be EPA Method 18.

Attachment A includes a table of the Ambient Reference Concentrations (ARCs) developed by the Division of Air Resource Management. This table includes columns for 8 hour, 24 hour, and annual ARCs. The 24 hour ARC is derived from occupational exposure levels such as the Permissible Exposure Levels (PELs) set by the Occupational Safety and Health Administration (OSHA) or the Threshold Limit Values (TLVs) that are set by the American Conference of Governmental Industrial Hygienists (ACGIH). Please note that the ARCs are for reference purposes only and do not have regulatory weight.

Emissions should be configured so as to fall below the appropriate ARC. For short term emissions lasting less than a few weeks, the 8 hr ARC should be used. For emissions lasting between a few weeks and five years, the 24-hour ARC should be used. The Annual ARCs can be used for evaluating emissions that last for more than five years. However, the delegated air program should be contacted for these evaluations. If the modeling procedure is used to demonstrate compliance and the Department concurs with the evaluation, an Order for Approval of Alternative Procedures and Requirements will be issued in accordance with Rule 62-770.890, FAC.

Minimum Treatment

For Soil Vapor Extraction (unless the RAP demonstrates that the system design parameters qualify as bioventing) and Multiphase Extraction systems, air emissions treatment must be maintained for at least the first 30 days of system operation. Following the 30 day period, the air emissions treatment may be discontinued if the total HAPs emissions rate will be less than 13.7 pounds per day as determined by EPA Method 18, or in accordance with the alternative analytical method procedure described above. A request to terminate emissions treatment for vapor extraction and multi-phase extraction may be submitted to the Department or contracted local cleanup program when the untreated emissions comply with the procedure outlined in this guidance.

Nuisance Considerations

The RAP should consider the location and concentrations of the air emissions relative to receptors in the vicinity. The RAP should include recommendations for equipment location, additional stack height, increased exit velocity, dilution, or air emissions treatment, to address potential concerns about odor, noise, and condensation. Local governments may have ordinances regarding odor nuisances.

Vapor Extraction Cleanup Criteria

Unsaturated zone soil must ultimately be remediated to the applicable direct exposure soil cleanup target levels (SCTLs) in Table II of Chapter 62-777, FAC, unless the responsible party is willing to agree to engineering and/or institutional controls. The unsaturated zone must also be remediated to the applicable

leachability SCTLs in Table II of Chapter 62-777, FAC, unless the responsible party is willing to consider applicable engineering and institutional controls, or a leaching test (SPLP) is used to demonstrate that contaminants will not leach, or the equilibrium partition equation is used to establish alternative SCTLs for leaching. However, it might not be practical or cost-effective to operate the vapor extraction system until those cleanup criteria have been achieved. At some point during remediation, an evaluation will have to be conducted to determine whether the applicable cleanup criteria have been achieved, or the vapor extraction operation has reached diminishing returns and soil remediation should be concluded by natural attenuation or some other means.

The following procedure is to be used to evaluate when a vapor extraction operation may be discontinued. It should be noted that these criteria identify the earliest point at which the vapor extraction should be taken out of service (unless alternative SCTLs are established). Shutdown is generally not required after the criteria have been met. There may be benefits to keeping the system operating. These include continued cleanup of soil with low concentrations of contaminants, enhancement of natural bioremediation through maintenance of aerobic conditions, and volatilization of hydrocarbons from the groundwater at the surface of the water table. If the contaminant mass emissions in the vapor extraction system exhaust stream have leveled off and are at a relatively low level such that further operation of the system may not be economically justified, the following steps should be taken before an active vapor extraction system is taken out of service.

1. Soil samples from representative areas of the contaminated vadose zone must be collected and analyzed with a field-screening instrument (e.g., OVA instrument using the soil headspace method).
2. When soil samples from condition number 1 above give negligible readings (generally <10 ppm), corrected for background levels, verification soil samples from the area should be collected and analyzed for contaminants of concern by the applicable EPA methods listed in Table B of Chapter 62-777, FAC. Based on the results of these laboratory analyses, an evaluation of the relative benefit of continued operation may be performed. If SCTLs (Table II of Chapter 62-777) are achieved, vapor extraction may be discontinued.

If concentrations remain above the applicable SCTLs, there are no standard criteria for the decision to discontinue operation of the vapor extraction system but the following should be considered:

- (a) If the direct exposure SCTLs, but not the leachability SCTLs, have been achieved, consideration should be given to performing a leaching test (SPLP) on representative samples to demonstrate that the Chapter 62-777 Table II SCTLs for leaching are not applicable, or alternately, to calculate site-specific leaching SCTLs based on site-specific soil properties, using the equilibrium partition equation as described in the Technical Report: Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, FAC.
- (b) If a decision has been made to monitor natural attenuation of groundwater to achieve groundwater cleanup target levels, consideration should be given to the current soil concentration levels relative to the Chapter 62-777, FAC, Table II SCTLs and whether natural attenuation of the soil to the soil cleanup target levels within the predicted time frame for groundwater cleanup by natural attenuation is feasible.
- (c) If the remaining soil contamination is relatively localized compared to the initial area of soil contamination, consideration should be given to modifying the vapor extraction system operation to focus on that area, installing an additional vapor extraction well in the area of remaining soil contamination, or implementing an alternative remediation method for the remaining recalcitrant soil contamination (such as limited excavation).
- (d) Consideration should be given to implementing engineering and/or institutional controls for the remaining soil contamination.

TC/tc

Attachment