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Petroleum Product Indoor Vapor Intrusion Guidelines (Interim)

Introduction

Indoor vapor intrusion (IVI) refers to vapors emanating from contaminated media (groundwater, soil, or free product) that migrate through the pore spaces of the soil in the unsaturated zone above the groundwater table and enter an occupied building through openings such as utility conduits and cracks in the foundation, resulting in the building occupants being exposed to vapors that could have health consequences from either acute (short term) or chronic (long term) exposure. The concentration of vapors which could be of concern due to chronic exposure may be very low and below the threshold of olfactory detection such that the building occupants may be unaware of the exposure. The consideration of this pathway of exposure to contamination is a relatively recent development in the practice of site assessment and remediation of contaminated sites.

Draft EPA guidance and other available literature on vapor intrusion evaluation suggests that there is a real possibility of indoor vapor intrusion occurring at buildings both on a contaminated site and buildings adjacent to or in close proximity to a contaminated site; however, it appears that the frequency of occurrence of problems of petroleum vapors entering off-site buildings through the building foundation is relatively low. The science related to vapor intrusion evaluation is still evolving and there will be a need for the petroleum cleanup program to refine the procedures for vapor intrusion evaluation in the future when greater knowledge about this pathway is available; however, the available information at this time on this subject indicates that it is prudent for the Bureau of Petroleum Storage Systems (BPSS) to establish interim procedures for evaluation of the potential for indoor vapor intrusion and identify measures of mitigation.

The current cleanup target levels for Petroleum Products' Contaminants of Concern in soil and groundwater to qualify for No Further Action without Conditions are believed to be adequately protective to prevent indoor vapor intrusion. However there is a concern that vapor intrusion may occur while a site assessment is being conducted, while the contaminated site is undergoing remediation by natural attenuation monitoring or active remediation or due to residual soil or groundwater contamination when a site receives closure by No Further Action with Conditions. The following procedures are intended to be protective of public health both while site assessment and remediation are underway and after final closure of a site with residual contamination remaining under the provisions of Chapter 62-770.680(2) or (3), F.A.C., for No Further Action with Conditions. The risk considerations and mitigation measures which may be appropriate for temporary conditions of possible vapor intrusion while site rehabilitation tasks are underway may be different than for a final closure in which a source of vapors could be present permanently and result in long term chronic exposure of building occupants to vapors in the affected buildings.

Applicability

At this time the BPSS is requiring these procedures to be applied to eligible sites being funded by the State of Florida only. The BPSS encourages responsible parties for non-funded contaminated sites to perform IVI screening voluntarily.

The most common scenario of a facility at which there is a discharge of petroleum products is a commercial petroleum fuel retail sales business with a single occupied building, such as a convenience store/retail petroleum product sales business on the source property. There may be buildings on other properties in the vicinity but are usually greater than 50 feet from the location of the discharge. The following procedures for evaluation of the vapor intrusion pathway and identification of appropriate mitigation measures are based on a facility with these characteristics. Such commercial properties are usually not very large compared to the infrastructure improvements such as the tanks, dispensers, and the building; and the features of the property are laid out for economical use of space such that the sources of a petroleum fuel discharge (tanks, dispensers, and integral piping) are usually in relatively close proximity to the occupied building on the property. Evaluation of the potential for human exposure to indoor vapors at the building located at the source property is complicated by the different phases of petroleum product contamination that may exist (contaminated soil, contaminated groundwater and free-phase product floating on the water table) near an occupied building at the property where the discharge occurred, and also due to the potential for preferential migration of vapors along underground utility lines, which commonly are surrounded by permeable aggregate in the utility trench leading to the occupied building. For these reasons, screening for vapor intrusion potential based on groundwater contamination concentrations at the source property is not reliable or appropriate.

However, the risk of vapor intrusion to off-site buildings located more than 50 feet from the discharge location does lend itself to an evaluation process in which initial screening for IVI potential may be accomplished in most cases using groundwater contamination concentration data, which need to be obtained for completing a site assessment under the existing provisions of Chapter 62-770.600, F.A.C. For this reason, initial screening for vapor intrusion potential at off-site buildings may be completed with existing site assessment data such that additional soil vapor sample collection for IVI evaluation may not be necessary in most cases. The reason for this circumstance is that petroleum vapors are highly biodegradable such that lateral migration of vapors significant distances from a vapor source (contaminated soil or free product at the discharge location) to an off-site building more than 50 feet away from the discharge location is unlikely. For petroleum contaminated sites, the most common vapor source for buildings on off-site properties is the off-site groundwater contaminant plume which moves in the direction of groundwater flow and may have migrated beneath an off-site building. For off-site buildings more than 50 feet from the location of the discharge, a screening process which assumes rates of attenuation during vertical migration of vapors between a groundwater plume and the foundation of a building overlying the groundwater contamination plume, using conservative assumptions of attenuation rates, is considered to be a reasonable and economical initial step for evaluation of IVI at the off-site buildings near petroleum contaminated sites.

As indicated above, this screening and mitigation process is based on the most likely scenario of a retail petroleum fuel facility with a convenience store building, and that other off-site buildings are located 50 or more feet away from the location of the discharge. For other scenarios of discharges in which occupied buildings on off-site properties are in close proximity to the location of the discharge, more immediate soil vapor assessment and also mitigation measures may be necessary.

Petroleum contaminated sites which already have active remediation underway , or that will have active remediation implemented within 6 months, which will include provisions for soil vapor mitigation for all areas potentially affected (e.g. – vapor extraction system) are exempt from these procedures. Other eligible sites in funding range must perform the IVI screening, and mitigation measures if appropriate.

The nature of vapor intrusion potential at non-petroleum contaminated sites, and in particular, chlorinated solvent discharge locations, may be very different from petroleum contaminated sites due to the chemical properties of the chlorinated chemicals and because they biodegrade much less readily than the chemicals found in petroleum products. For this reason, the Hazardous Waste Cleanup Section of the Bureau of Waste Cleanup has published separate IVI screening procedures which should be used for vapor intrusion screening at chlorinated solvent discharge sites.

Assessment of Vapor Intrusion Risk

Indicator Chemicals – Petroleum fuels are a mixture of many chemicals with varying chemical properties. The chemical properties that directly affect a chemical's potential to cause a health risk due to indoor vapor intrusion are volatility, solubility, and toxicity. For these reasons and due to the different fractions of chemicals in gasoline fuel compared to diesel fuel, sites with a gasoline discharge have a significantly higher likelihood of having IVI problems than sites with a diesel fuel discharge. Also, due to its relative abundance in gasoline fuels, and its volatility, solubility, and toxicity relative to other chemicals, benzene is the chemical in gasoline of most concern for the vapor intrusion pathway.

For this reason and because of the conservative assumptions of the Tier I screening process for off-site buildings described below, only off-site buildings adjacent to petroleum contaminated sites with a gasoline discharge will initially be subject to these interim screening procedures for IVI, and only benzene needs to be considered for the Tier 1 evaluation for gasoline discharges. If the site fails the tier 1 screening such that a more advanced screening evaluation for the off-site buildings involving collection and analysis of soil gas samples becomes necessary, other chemicals found in gasoline fuel and listed in Table I will also need to be considered.

For IVI screening at the building of the property where the discharge occurred, significant vapors may be generated from soil contamination or free-phase product associated with a diesel fuel discharge, and therefore, if soil vapor screening is conducted at the source property the vapors generated by a diesel fuel discharge need to be considered. The BPSS is still evaluating the need to conduct IVI screening for circumstances of an off-site building associated with an off-site groundwater plume from a diesel

discharge and will be collecting soil gas samples from the shallow soil above off-site diesel discharge plumes at selected sites to validate this presumption and will modify these procedures in the future to require IVI screening for off-site buildings associated with an off-site groundwater contamination plume from a diesel fuel discharge if appropriate.

Initial Screening for short distance lateral vapor migration from contaminated soil or free product – This step applies to the source property building and off-site occupied buildings less than 50 feet from the discharge location. Contaminated soil and free product represent potential sources of relatively high concentrations of vapors compared to the maximum vapor generation which is possible due to dissolved petroleum contamination in groundwater. For this reason, occupied buildings located in close proximity to contaminated soil or free product requires special consideration for lateral migration of vapors through the unsaturated zone from the vapor source. Whenever 1) the location of the discharge is within 50 feet of an occupied building at the source property or 2) is greater than 50 feet from the building at the source property but the tanks and dispensers have a utility line connection with the occupied building, or 3) if there is an off-site occupied building within 50 feet of the discharge location, the initial phase of the site assessment should include collection of shallow soil vapor samples (subslab or near foundation shallow soil vapor) near the potentially affected building(s). Soil vapor samples should be collected while conducting other site assessment activities and must be collected in accordance with the attached soil vapor sample collection and field QA documentation protocol. The concentrations of Petroleum Products' Contaminants of Concern in the sample results should be compared with Schedule A of the attached screening Table 1. If the measured concentration is less than the screening criteria, the IVI pathway due to vapor migration laterally from contaminated soil or free product which exists at the location of the discharge is not considered to be complete and no further evaluation for IVI is necessary for these buildings. If the screening criterion for any chemical is exceeded, it is recommended that a vapor extraction system be immediately implemented at the source property to abate the source of the vapors, or that other mitigation measures be implemented at each affected building (see section on Mitigation below).

Funding of mitigation measures at sites with an eligible discharge - For funded sites, if the source property has an active petroleum storage system, interim mitigation measures to abate vapors near the building foundation prior to the implementation of active remedial action will not be funded by the FDEP. If there is no longer an active petroleum storage system at the source property, and the building at the source property is residential use or is a commercial building of a nature where the public may be exposed to vapors for an extended period of time (e.g. – school, day care, nursing home, hospital) interim vapor mitigation actions prior to the implementation of active remedial action will be an allowable cost for FDEP funding. For circumstances between these extremes, a decision as to whether funding should be provided for interim vapor mitigation until active remediation commences will be made on a case by case basis. If vapors which exceed the screening levels in Schedule A of Table 1 exist in the shallow soil in contact with the foundation of an occupied off-site building foundation due to lateral migration of vapors from the source area of the discharge (contaminated soil or free product) mitigation measures must be implemented immediately and will be an allowable cost regardless of the building type.

Occupied buildings at off-site properties in the direction of groundwater migration – For off-site properties with occupied buildings greater than 50 feet from the location of the discharge, the Tier I evaluation for potential for IVI due to the groundwater to indoor air pathway should be conducted during the ongoing site assessment and delineation of the groundwater plume that extends beyond property boundaries. The evaluation must be conducted immediately upon installation and sampling of representative monitoring wells which can be used to estimate the maximum groundwater concentration beneath buildings to conduct the vapor intrusion screening.

Explanation of basis for Tier 1 Screening - There is mounting consensus among persons that are knowledgeable regarding petroleum vapor intrusion evaluation that there is a very significant aerobic biodegradation contribution to attenuation of vapors between the groundwater table and the building foundation. However, quantitatively predicting the attenuation of petroleum hydrocarbon vapors between the groundwater table and the building foundation can be relatively complex, with considerations of soil type, gradation, and other geochemistry variables, concentration of target chemicals of concern (benzene) compared to total petroleum hydrocarbons in groundwater, background oxygen demand, and surface covering, among other considerations. Collecting data on these variables necessitates supplemental assessment and laboratory analysis which can be costly, delays the decision making, and still results in relatively high uncertainty remaining in the prediction of attenuation based on the data collected, which might result in the need for collection of soil gas samples near occupied buildings anyway. It is desirable to establish an initial screening step which is based on data which is collected for off-site groundwater plume delineation under the existing requirements for site assessment of Chapter 62-770.600 to determine the vapor intrusion pathway is not complete for a subset of the sites with off-site plumes beneath occupied buildings without incurring additional site investigation costs. The screening curve provided in this guidance for screening levels between depths of 5 feet below building foundation and 40 feet below building foundation based on benzene concentration and depth to groundwater is believed to be conservative based on assumptions of the different variables which may affect attenuation. The screening curve was developed with limited empirical data from contaminated sites in Florida and a relatively high reliance on various literature sources on theory of petroleum vapor intrusion and studies on petroleum vapor migration in the subsurface in other states. Therefore, at this time the Tier 1 screening curve is largely intuitively based. It is the intent of the BPSS to refine the Tier 1 screening curve based on data collected from contaminated sites in Florida following the implementation of these procedures. The Tier 1 screening curve will be revised based on data collected and as a result will become more empirically-based and less intuitively-based.

Tier I - The first evaluation tier is relatively simple and inexpensive but is based on conservative assumptions. This screening step is based on comparison of actual groundwater benzene concentration and depth to groundwater with a curve which indicates benzene concentrations at depths of between 5 feet below the building foundation and 40 feet below the building foundation for which it is assumed that petroleum hydrocarbon vapors will not reach the surface and contact the building foundation at concentrations of concern. If the groundwater is less than 5 feet below the building foundation and the

groundwater concentration exceeds the benzene groundwater CTL (1 ug/L), then the tier 1 screening step is not appropriate and instead the evaluation should proceed to tier 2. If the groundwater table depth is greater than 40 feet deep below the building foundation and the vapor source is dissolved phase groundwater contamination (not free product or soil contamination) then it is presumed that petroleum hydrocarbon vapors will not reach the building foundation in concentrations of concern regardless of the dissolved phase concentration of benzene or other petroleum chemicals.

This evaluation should start with the most likely impacted building (MLIB) outside of the property that was the source of the discharge. The MLIB will have characteristics of being located close to the centerline of the groundwater plume and relatively close to the source property such that the building foundation likely has a higher benzene concentration in the groundwater directly beneath the building than any other off-site building. As indicated above, if the depth to contaminated groundwater is less than 5 feet below land surface the Tier 1 evaluation is not appropriate and the IVI evaluation should proceed to Tier 2.

The concentration of benzene beneath the MLIB and the depth to groundwater below the building foundation should be estimated using groundwater monitoring data from wells in close proximity to the MLIB. Most buildings in Florida are slab on grade construction such that the depth of the groundwater below land surface is the same as the depth below the building foundation. However, the building construction needs to be verified by at least a cursory examination of buildings in the vicinity during groundwater sampling events to identify buildings with a basement. The Tier I screening should be performed using the attached Figure 1. The depth to groundwater below the building foundation and the benzene concentration coordinate for the MLIB should be plotted on the figure. If the depth to groundwater below the building foundation is greater than 40 feet or the plotted coordinate is to the right of the line on the figure the pathway is not considered to be complete for any off-site buildings. However, for funded sites, in order to collect data to validate the Tier 1 screening curve, shallow soil or subslab soil gas samples should be collected following the procedures described in Tier 2 below if the groundwater concentration is within 20% of the concentration which would result in failing the Tier 1 screening for that groundwater depth (e.g. – for 27' depth below building foundation, the Tier 1 curve screening threshold is approximately 5000 ug/L benzene. If the actual concentration for a site with the groundwater surface at 27 foot depth below the building foundation exceeds 4000 ug/L, soil gas samples should be collected anyway under the Tier 2 screening procedures described below). If the plotted coordinate falls to the left of the line on the figure, the evaluation of the MLIB must continue with the Tier 2 evaluation described below. If the MLIB fails the Tier 1 evaluation then other buildings ranked by decreasing likelihood of IVI potential based on the estimated groundwater concentration beneath the building foundation should have the Tier 1 evaluation performed until a building is identified for which the pathway is not complete. All buildings which failed the Tier 1 screening should proceed to Tier 2.

Tier II – There are two steps that may be followed for completing the Tier II evaluation and demonstrating that the IVI pathway is not complete. Because of the nature of the biodegradation process in the subsurface, the presence of elevated oxygen levels (near atmospheric levels) in the

shallow soil is a reliable indicator that petroleum vapors migrating upward from the groundwater table have been virtually completely degraded before reaching that depth. Therefore the initial step may be to measure the oxygen level in the shallow soil with a portable O2 meter. Beginning at the MLIB, soil gas sample probes (subslab for solid or paved surface, shallow soil vapor probe for unpaved surface) should first be installed following the attached procedures. If the measured O2 level in soil gas samples collected from the shallow soil or subslab probes is __% or higher, then this will be considered an acceptable demonstration that the petroleum vapors are not in contact with the building foundation and therefore the IVI pathway is not complete and the IVI evaluation is concluded. For eligible sites, soil gas samples will be collected if the measured O2 level is __% or less in order to collect empirical data to validate this screening criterion.

If the O2 reading is less than __%, this does not necessarily mean that the IVI pathway is complete but it will be necessary to collect soil gas samples for analysis to determine contaminant levels in the soil gas. Using the same soil vapor sample probes, samples should be collected following the attached soil vapor sample collection protocol and completing the soil gas sample log. The vapor sample results should be compared to the screening criteria in Schedule A of Table 1. If the allowable shallow soil vapor concentrations are not exceeded, the IVI pathway is considered to be incomplete and the IVI evaluation portion of the site assessment is concluded. If the concentrations in the shallow soil gas at the MLIB exceed the allowable concentrations shown in Schedule A of Table 1, then the IVI pathway may be complete and soil vapor samples should be collected at other buildings which failed the Tier 1 screening in an order ranked by decreasing likelihood of IVI potential based on the estimated maximum groundwater concentration beneath the building until all buildings which fail the Tier 2 screening are identified.

Mitigation

Within 30 days of identifying occupied buildings which have failed the Tier 2 evaluation, a recommendation for corrective action needs to be proposed to the FDEP. Any of the following is an acceptable strategy.

1. Request approval of alternative procedures to implement off-site vapor extraction, in advance of the implementation of the overall active remediation strategy, to immediately reduce vapor concentrations and air pressure in the subsurface near affected off-site buildings. If this strategy is recommended, the installation of the vapor extraction system must begin within 60 days of authorization by the FDEP.

2. Identify a schedule for expedited site assessment and preparation of a RAP for remediation of the source property such that remediation of the source property will commence within 6 months and will include off-site vapor extraction which will result in reduced vapor concentrations and air pressure in the soil beneath the affected buildings.

3. Install a subslab depressurization system at each building which failed the Tier 2 screening.

4. The allowable subslab and shallow soil gas concentrations are based on a foundation attenuation rate of .1, meaning that it is assumed the foundation (and other building characteristics) will allow vapor transmission to the extent that the vapor concentrations in the building may be 10% of the soil gas concentration immediately beneath the building; or in other words, the maximum allowable subslab or shallow soil vapor concentration to demonstrate the IVI pathway is not complete may be no greater than 10 times the allowable indoor air concentration. It may be possible to demonstrate the attenuation ability of the subslab is significantly greater than .1 (meaning attenuation coefficient is < .1) by performing a radon test. The radon level should be determined in the subslab gas and in the indoor air and the ratio of the two is the building specific foundation attenuation rate. If the measured attenuation rate is greater than .1 (ratio of indoor air radon level to subslab level is < .1), then site specific subslab or shallow soil gas concentration limits may be calculated by applying the measured foundation attenuation to the schedule B indoor air screening criteria. If the actual petroleum hydrocarbon concentrations in the subslab gas are less than the site specific subslab or shallow soil gas concentrations limits, the IVI pathway is not considered to be complete.

5. Collect indoor vapor samples to determine whether the pathway is complete to the interior of the buildings that failed the Tier 2 screening. This option is not recommended by the BPSS due to the confounding effects of background conditions in the building and the inability to control the indoor air sample environment of an occupied building. However, if this option is selected, the indoor air samples should be collected with 6 liter summa canisters fitted with a regulator to collect a composite sample over a 24 hour sample period. The results should be compared to Schedule B of Table 1 to determine whether the IVI pathway is complete. If the indoor air concentrations exceed the screening criteria of Schedule B of Table 1, one of the first 3 mitigation measures above must be implemented.

IVI Considerations at the Time of Site Rehabilitation Completion

If a site qualifies for No Further Action without Conditions for both soil and groundwater in accordance with the provisions of Rule 62-770.680(1), F.A.C., no further IVI considerations are necessary. However, if No Further Action with Conditions is proposed and soil exceeding soil CTLs remains, or groundwater exceeding groundwater CTLs remains which is less than 40 feet deep, then shallow soil or subslab soil gas samples must be collected in the shallow soil at every occupied building on each property which has residual contamination and is proposed to be included in the No Further Action with Conditions closure. If the concentrations are less than the criteria of Schedule A of Table 1, the Site Rehabilitation with Conditions may proceed. If the concentrations exceed the criteria in Schedule A of Table 1, then site remediation must continue until it is demonstrated that shallow soil vapor concentrations do not exceed the applicable criteria, or the engineering and/or institutional controls which are proposed will include a means to prevent vapors from entering occupied buildings on the affected properties.

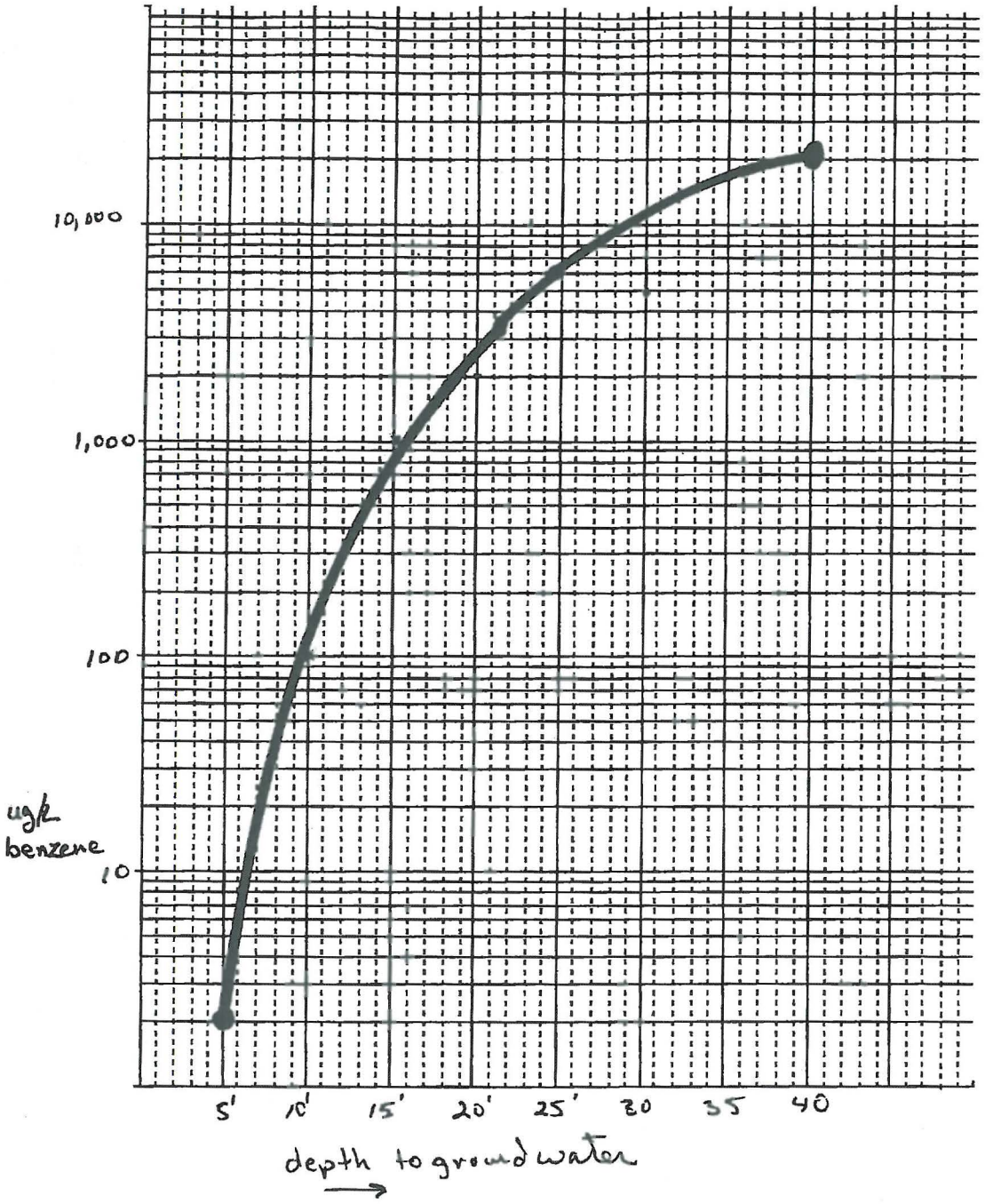
10,000
1,000
100
10
ug/L
benzene
5'
10'
15'
20'
25'
30
35
40
depth to groundwater

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Table 1

Indoor Vapor Intrusion Screening Criteria

Schedule A - Shallow soil gas and subslab vapor screening criteria

Chemical	Residential (ug/m^3)	Commercial/Industrial (ug/m^3)
Benzene	3.1	15.5
Toluene	4,000	20,000
Ethylbenzene	22	110
Xylenes	210,000	1,050,000
MTBE	30,000	150,000
benzo(b)fluoranthene	0.12	0.6
naphthalene	30	150
2-methylnaphthalene	700	3,500

Schedule B - Indoor air screening criteria

Chemical	Residential (ug/m^3)	Commercial/Industrial (ug/m^3)
Benzene	0.31	1.55
Toluene	400	2000
Ethylbenzene	2.2	11
Xylenes	21,000	105,000
MTBE	3,000	15,000
benzo(b)fluoranthene	0.012	0.06
naphthalene	3	15
2-methylnaphthalene	70	350

Vapor Sampling Protocol

Vapor sample collection equipment:

The following equipment and materials will be utilized for assembling sampling apparatus for vapor sample collection after a vapor sample probe has previously been installed:

- Variable speed sampling air pump capable of < 100 ml/min flow rate or non-variable speed pump with throttling capability and flow meter
- Pressure gauge
- Vacuum gauge
- Tee-valve
- Shut off valve
- Teflon or polyethylene tubing *(1/8 inch or ¼ inch diameter?)*
- PID or FID *(PID preferable)*
- Portable helium detector
- Portable landfill gas meter for O2, CO2, and CH4
- 1 Liter Summa canister fitted by the laboratory with vacuum gauge and critical orifice flow regulation device sized to allow sample collection over a 10 minute sample collection time
- tedlar bag (optional)
- Canister of helium

Schematic of typical assembled sampling apparatus:

(Under development)

Purging and sampling procedure:

- Select a purging rate. Maximum flow rate for both purging and sampling will be 100 ml/minute or less. Purge rate = PR ml/minute
- Calculate system volume (SV) of downhole sampling tube to screen and volume of sample apparatus tubing – SV ml
- Calculate purge volume (PV) = 2X calculated SV, PV ml = 2X SV ml
- Calculate purge duration (PD) = (PV ml) / (PR ml/minute)

- Conduct initial leak test of sampling apparatus – With valves at Summa canister and sampling probe both at the closed position, turn on sampling pump and check for whether air flow rate is detected. If air flow is detected, check fittings or replace tubing and recheck until no air flow rate. Record vacuum gauge reading.
- Conduct purging by opening sample port and running air pump for calculated PD at PR (100 ml/minute or less)
- Measure and record O2, CO2, and CH4 during purging
- Near the end of the purging period check the VOC vapors with a PID or FID by running purge air through the OVA. Purge flow rate may briefly increase above 100 ml/min while OVA reading is determined. Record OVA reading.
- Prior to sample collection a hood constructed of a box, plastic bag or similar device should be placed around the top of the vapor probe. Enrich the air inside of the hood with tracer gas (helium). Alternatively, a rag may be saturated with isopropanol and placed around surface seal of sampling port.
- Shut off purging air pump. Record initial Summa canister vacuum reading and open valve on Summa canister. Record start time of sample collection. Check helium readings during sample collection. (If reading indicates air concentration is > 10 % helium suspend the sample collection and reseal sample port. Start over with a new summa canister.) Summa canister will be fitted by the laboratory with vacuum gauge and critical orifice flow regulation device sized to allow sample collection over a 10 minute sample collection time. Shut off Summa canister valve between 8 and 9 minutes so that there is residual vacuum left in the Summa canister. Residual vacuum should be approximately 1 to 5 inches of Hg. Record residual vacuum. Calculate volume of sample collected (sample time X sample flow rate) and record.
- If sampling with a tedlar bag instead of Summa canister, connect tedlar bag downstream of air pump after purging is concluded and continue sample collection at < 100 ml/min pumping rate.
- Complete sampling log and chain of custody form and send sample to lab for analysis with EPA method TO-15.
- Thoroughly decontaminate valves, fittings, vacuum gauge, air sampling pump and other meters with "zero" air provided by laboratory. Discard apparatus tubing downstream of sampling port and use new tubing for next sample event.

SOIL GAS SAMPLING LOG

FACILITY NAME:	FDEP FACILITY ID #:
FACILITY LOCATION:	DATE:
AIR TEMPERATURE (°F):	BAROMETRIC PRESSURE (inches Hg):
PRECIPITATION (inches):	WIND CONDITIONS:
SAMPLE LOCATION / IDENTIFICATION:	SAMPLE DEPTH (inches):
FIELD PERSONNEL: NAME(S) (print) / AFFILIATION:	SIGNATURE(S):

PURGING DATA

TUBING MATERIAL:	TUBING INTERNAL DIAMETER (inches):
TUBING LENGTH (inches):	TUBING VOLUME (πR^2 X tubing length):
EQUIPMENT VOLUME = SAMPLING APPARATUS VOLUME + TUBING VOLUME = (recommended purging volume = 2 times equipment volume)	
PURGING INITIATED AT:	PURGING ENDED AT:

PURGE RATE (mL/min) [maximum 100]:		TOTAL VOLUME PURGED (mL):		OVA READING AT END OF PURGE (ppm):	
O_2 % or ppm (circle one)		CO_2 % or ppm (circle one)		METHANE % or ppm (circle one)	
Time	Reading	Time	Reading	Time	Reading

TUBING INTERNAL DIAMETER CAPACITY (milliliters/linear foot): 1/8" = 2.3; 3/16" = 5.3; 1/4" = 9.8; 5/16" = 15.1; 3/8" = 22.7; 1/2" = 37.9; 5/8" = 60.6

For other diameters – (R^{-2}) X 618 = ml/linear foot

SAMPLING DATA

SAMPLE CONTAINER TYPE (circle one):	TEDLAR BAG	SUMMA CANISTER	
SAMPLE CONTAINER SIZE (circle one)	1 LITER	6 LITER	OTHER (specify):
SAMPLING INITIATED AT:	SAMPLING ENDED AT:	SAMPLE CONTAINER FLOW RATE (mL/min):	
SUMMA CANISTER ONLY :	STARTING VACUUM PRESSURE:	inches Hg or inches H_2O (circle one)	
	ENDING VACUUM PRESSURE:	inches Hg or inches H_2O (circle one)	
TRACER MATERIAL USED (circle one):	HELIUM	ISOPROPANOL	OTHER (specify):
LEAKS OBSERVED (circle one):	YES (provide details below)	NO	
REMARKS:			

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