Petroleum Vapor Intrusion
Interim Technical Guidance for the District of Columbia

Introduction

This Interim Technical Guidance covers petroleum vapor intrusion (PVI) for Leaking Underground Storage Tank (LUST) Sites in the District of Columbia and provides technical guidance for complying with the District's Underground Storage Tank Regulations in Title 20 of the District of Columbia Municipal Regulations, Chapters 5500-7099. DOEE intends to incorporate this technical guidance into the next update of the District of Columbia Risk-Based Corrective Action Technical Guidance (DCRBCA).

In June 2015, the United States Environmental Protection Agency (USEPA) published two documents which provide significant guidance with regard to PVI concerns at LUST Sites. The *Technical Guide for Addressing Petroleum Vapor Intrusion at Leaking Underground Storage Tank Sites ("EPA PVI Guidance")*, and the *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air ("OSWER Vapor Intrusion Guidance")* both represent a significant resource for environmental professionals when establishing an investigation, remediation and mitigation approach at PVI sites. These documents have been adopted by DOEE and will be included as references in the next update of DCRBCA.

Although significant information is provided within the EPA PVI guidance documents, DOEE is providing additional detail with regard to the application of some of the newer concepts regarding PVI risk assessments which are now being adopted by DOEE. The intention is to help environmental professionals and stakeholders use the EPA guidance documents in a way that establishes a clear path forward for sites with the potential for PVI risk in the District of Columbia.

Separation Distances

The *EPA PVI Guidance* introduces the concept of utilizing vertical separation distances and lateral separation distances (also known as inclusion zone distance) to help initially screen potential PVI risk to a building. Among other things, the *EPA PVI Guidance* indicates that in many instances if fifteen (15) feet of clean biologically active soil is located above light non-aqueous phase liquids (LNAPL), and six (6) feet of clean soil is located above dissolved phase petroleum hydrocarbon (PHC) contamination, PVI risk can be considered not significant (see USEPA 2015a, p.77). These separation distances are based on the result of EPA's evaluation of data from multiple small service station sites across the country.

However, several instances exist where the vertical separation distances recommendations should **not** be used to assess PVI risk, and any such risk assessment will be rejected by DOEE. These situations are outlined in further detail in the *EPA PVI Guidance*, which should be read in its entirety, but are summarized for clarity below.

1) Separation distance cannot be used to discount PVI risk if any potential preferential pathway for soil vapor migration exists which could facilitate intrusion of soil vapors from the impacted zone into the building structure. Such preferential pathways could include, but are not limited to: areas of low permeability fill material, naturally occurring paleochannels, utility conduits, pipes, drains or any similar underground structures (see USEPA 2015a, p.20).

2) Separation distance cannot be used to discount PVI risk if soil or groundwater contain any detections of fuel additives 1,2 DCA or ethylene dibromide (EDB) (see USEPA 2015a, p.20). These compounds were not sufficiently investigated in the EPA study. Therefore, no valid assessment of risk can be completed at a site with 1,2 DCA or EDB. The vast majority of sites which sold gasoline in the District of Columbia have been in operation in the automotive filling or repair for greater than 35 years and are therefore likely to have used leaded gasoline and associated additives such as 1,2, DCA and EDB. Contamination at these sites often result from multiple releases over time rather than a single event. Therefore, all sites suspected of gasoline contamination in the District of Columbia should initially be evaluated for the presence of 1,2 DCA or EDB, especially if separation distances will be used as a line of evidence to eliminate a potential risk pathway. **Please note that the only appropriate laboratory analytical method for EBD analysis in groundwater is USEPA Method 8011 SIM, as per Table 4-1 of the DCRBCA guidance document. EPA methods routinely employed to assess other volatile organic compounds do not have sufficient detection limits for evaluation of EDB.**

3) Only "clean soil" can be used in the calculation of vertical separation distances. EPA states in the definition section of the *EPA PVI Guidance* that "In the context of a PVI investigation, clean soil does not necessarily mean that the soil is free from all contamination, but rather that any contamination present is at a concentration low enough that the biological activity of the soil is sufficient to biodegrade PHC vapors before they reach a receptor." (USEPA 2015a, p.118). **Please note that in order to demonstrate that "clean soil" is present above the area of significant impact, DOEE recommends collection of a minimum of two soil samples from each boring advanced within the presumed "clean soil" area.**

4) Moisture content in the "clean soil" area above the source must not be less than 2% as measured by dry weight in order to facilitate sufficient levels of biodegradation (see USEPA 2015a, p.75). **Please note that DOEE recommends that two soil samples be analyzed for moisture content from each boring location from the presumed "clean soil" area above the source. Please note that moisture content is already reported as part of many EPA laboratory analytical methods for potential contaminants of concern. Most locations in the District will have sufficient moisture to facilitate**

biodegradation. However, the metric should be reported when separation distances are proposed as a line of evidence in risk assessments.

5) Certain geologic materials cannot be included in the calculation of separation distances. These include coarse sand and gravel with low silt and clay content, fractured bedrock and karst geology (see USEPA 2015a, p.76). Such layers should be subtracted out from any assessment of vertical separation. Soils with high organic content (e.g., peat) that exert a high oxygen demand may also preclude use of separation distances.

6) When LNAPL is identified or indicated at a site separation distances can only be used to discount PVI Risk if a building has at least one side shorterthan 66 feet (see USEPA 2015a, p. 5 and p.67). Note that the determination of the presence of LNAPL is not solely based on observations of LNAPL in monitoring wells. The presence of LNAPL in the subsurface should be determined as per the EPA recommendations (see USEPA 2015a P. 58 and 59). Larger buildings may not allow sufficient transfer of oxygen limiting aerobic degradation of soil vapors (see USEPA 2015a, p.69). Similarly, significant impermeable cover such as concrete, asphalt and building foundations should not be present, as these can also limit the transfer of oxygen into the vadose zone slowing biodegradation rates (see USEPA 2015a, p.69).

7) Separation distances cannot be used in the evaluation of PVI risk at any current or former bulk storage site. Such sites were not included within the EPA PVI study used to establish the separation distances.

8) Separation distances cannot be used to discount PVI risk for any new release which contains ethanol additives. Methane generation from ethanol was not considered in the EPA study; therefore, sites with ethanol contaminants are not suitable for this type of risk assessment.

9) Separation distances must be implemented for use as per Table 3 of the *EPA PVI Guidance*(see USEPA 2015a, p.52).

PVI Sampling Requirements

The EPA PVI Guidance documents support the use of vertical and lateral separation distances to evaluate potential PVI risk at certain conforming LUST sites. DOEE endorses this screening method; however, it views the use of vertical and horizontal separation distances as one line of evidence to be used in conjunction with other risk assessment techniques. Tier 2 DCRBCA assessments, soil vapor sampling and potentially indoor air sampling, should all be considered when conducting a PVI investigation, and evaluating cases for closure. Please note that DOEE's endorsement of the USEPA PVI Guidance Document opens a pathway to LUST case closure which was not previously available under the current DCRBCA Guidance. While additional investigation may not be required over and above that which is required to assess EPA PVI screening distances, endorsement of this new means of risk assessment as a pathway toward closure in no way limits DOEE from requiring additional investigation if deemed necessary. As always, the specifics of the case and the conceptual site model will dictate what methods of investigation are most appropriate for assessing risk at any given site.

If a Site fails a DCRBCA Tier 2 assessment, and does not meet the minimum separation distances established by EPA, then approaches to conduct additional site investigations should include soil vapor sampling, sub-slab sampling, near-slab sampling, or indoor air sampling (or a combination of each) and should be completed as per the recommendations in Section 8 of the *EPA PVI Guidance* (see USEPA 2015a, p.70).

PVI Mitigation Systems for New Construction

As recommended by EPA in the *OSWER Vapor Intrusion* Guidance, DOEE also adopts the preference for a long-term response to the potential intrusion of vapors into buildings by eliminating or substantially reducing the level of source contamination in the subsurface vapor-forming chemicals to acceptable risk-levels, thereby achieving a permanent remedy (see USEPA 2015b, p.143). However, in certain instances, such reductions may not be possible prior to site development. Therefore on sites with new construction where residual contaminants exceed DOEE Tier 1 levels for vapor inhalation risk, some form of PVI mitigation system will typically be required.

As per the *OSWER Vapor Intrusion Guidance*, passive PVI barriers (sometimes referred to simply as "vapor barriers") as stand-alone technologies may not adequately reduce vapor intrusion owing to difficulties in their installation, potential perforations of the barrier before or after installation, and material degradation (see USEPA 2015b, p.150).

Therefore, in the District, an active depressurization technology (ADT) in conjunction with a PVI barrier is the preferred technology for mitigating risk from residual contaminants that cannot be adequately remediated prior to construction. DOEE currently recommends active sub-slab depressurization systems (SSDS) as a presumptive ADT remedy in cases where significant PVI risk is deemed to exist. The full SSDS system design should be presented to DOEE for review **prior to implementation** as part of a Corrective Action Plan (CAP) or as a stand-alone document. The design of each system will vary based on site specifics, but all PVI barriers utilized as part of the SSDS should be a minimum of 30 mil in thickness (60 mil is preferred) and proven to be compatible with all known contaminants of concern as documented by manufacturer specifications. In some instances of new construction where the lowest level of a building may be used solely for vehicle parking, DOEE will consider requests to use only an approved PVI barrier without the incorporation of sub-slab depressurization. In any such request the air exchange rates for the parking level should be provided to DOEE in support of the request.

Given the preference for source remediation and a permanent remedy over vapor mitigation strategies, ADT systems in conjunction with a PVI barrier should be proposed with the following measures and considerations:

1) Remediation of source contaminants including LNAPL should be completed to the maximum extent practicable, regardless of the presence of the SSDS. Methods of remediation will depend on the current best available technology, the building construction, and the type of remediation required. The actual depth of removal will depend on site-specific characteristics, taking into consideration any sheeting and shoring

requirements for the proposed building structure. Mitigation systems should be designed in such a way as to not substantially hinder the ongoing ability to remove LNAPL from the subsurface (see USEPA 2015b, p.143).

2) A DCRBCA evaluation must show that the soil leaching to groundwater pathway will not remain a significant concern post-construction. If soil leaching to groundwater is anticipated to remain a concern post-development, additional remediation or mitigation of impacted soil is likely to be required. DOEE understands that limitations may exist in association with excavation of impacted soil. Therefore alternative means of remediation or risk mitigation should be presented to DOEE when excavation of contaminated soil is considered technically infeasible. .

3) Any contaminant plume (LNAPL or dissolved phase contaminants) associated with a LUST case must be stable or decreasing and not impacting any significant receptor. If a contaminant plume is not stable, ADT systems must be designed to protect human health during a worst case scenario for contaminant plume migration. If the contaminant plume is shown to be impacting a significant receptor DOEE will likely require additional remediation and/or mitigation measures as typical for any LUST case.

4) A minimum of one round of indoor air sampling, in conjunction with sampling of ambient air is recommended for completion prior to occupation after the approved SSDS is installed (see USEPA 2015b, p.153).

5) Sites which mitigate PVI risk through the ongoing use of a SSDS are eligible for No Further Action (NFA) closure upon DOEE approval of an environmental covenant on the property. The environmental covenant should include, at a minimum a statement that any alteration to the building structure, SSDS, or demolition of the building which materially affects the operation or effectiveness of the PVI mitigation system may result in the case being re-opened for additional evaluation. In instances where parking structures exist on the lowest floor of a development and a SSDS is not employed, an environmental covenant would be required which limits human occupation on the lowest level of the building.

6) Sites which mitigate PVI risk through the use of a SSDS must have a written plan for the ongoing operation, monitoring and maintenance of the system (see USEPA 2015b, p.156). The plan should remain on file with the building management and maintenance personnel and made available to future users or tenants. Any repairs or maintenance of the SSDS which result in the system becoming inoperable for greater than 24 hours should be documented within twenty-four (24) hours and reported to DOEE within 72 hours. Notification requirements should be included in any environmental covenant associated with the property in order to ensure that future users or tenants are adequately informed of these obligations.