

VOLATILIZATION TO INDOOR AIR PATHWAY (VIAP)

Evaluation of a Dispersed Vapor Source in Urban Fill Under Part 201

A common challenge for developers and property owners is evaluating the VIAP at sites with urban or historic fill (urban fill). A demonstration may be possible that contaminants are randomly dispersed (no point source release) and are not likely to pose a risk or unacceptable exposure through the VIAP. This document identifies options for that demonstration.

The evaluation described below is only applicable to the VIAP. It does not take the place of or eliminate the need to conduct additional characterization to appropriately evaluate all other relevant or complete exposure pathways, such as direct contact, the particulate soil inhalation, and the volatile soil inhalation. It also does not remove the need for appropriate land or resource use restrictions when applicable under Part 201, Environmental Remediation, of the Natural Resource and Recovery Act, 1994 PA 451, as amended.

The evaluation as described in this document is only appropriate if:

1. An adequately conducted Phase I Environmental Site Assessment (ASTM E1527) or similar site assessment has been performed and subsequent borings and sampling data indicate urban fill is a recognized environmental condition relevant to the VIAP;
2. The urban fill material that was deposited on site was contaminated prior to placement and contaminants within the fill material are in no way connected with a release on the property that may impact the VIAP; and
3. The non-native material and contaminants are dispersed throughout the area containing urban fill and a contiguous contaminant mass is not present.

Any person utilizing the evaluation process described in this document and submitting a report or plan for EGLE review and approval, must include the information listed above in the submittal. Other evaluations that may be appropriate can be proposed and considered on a site-specific basis. The Technical Support Unit of the Remediation and Redevelopment Division (RRD) can assist in the site-specific evaluations when needed.

Urban Fill less than or equal to 4' Below Ground Surface (bgs)

For urban fill at depths of 4-feet or less bgs, there are two possible approaches to evaluate the VIAP using soil data. Both approaches are based on the following conditions being met:

- Urban fill is not present at depths greater than 4-feet bgs;
- Urban fill has concentrations of volatile hazardous substances above the applicable unrestricted soil volatilization to indoor air criteria; and
- Urban fill is NOT present beneath a current or planned building.

NOTE: For existing structures, it is acceptable to have the fill present laterally to the structure.

When the conditions listed above are met, either of the following approaches may be appropriate to evaluate the VIAP at the property:

1. Incremental Sampling (IS) – IS should be conducted in accordance with EGLE’s [Incremental Sampling Methodology and Applications](#) document (2018). The decision unit (DU) must be representative of the entire thickness of the fill and may require collection of vertical increments at multiple depths. If there are plans for redevelopment, the DU must encompass the area of the footprint of the proposed building(s) which may result in larger and/or multiple DU areas.

The IS sample results are then compared to the applicable unrestricted soil volatilization to indoor air criteria to determine if a vapor source can be considered dispersed. If the detected concentrations in the IS sample(s) are below the applicable unrestricted soil volatilization to indoor air criteria, no further sampling or evaluation of the VIAP is necessary for the DU. All samples are to be analyzed for all volatile hazardous substances of concern.

2. Random Sampling Strategy – In accordance with EGLE’s S3TM - Sampling Strategies and Statistics Training Materials for Part 201 Cleanup Criteria document (2002), develop a systematic random sampling program. A minimum of nine borings per exposure unit is required. From each boring, a soil sample should be collected from a minimum of two pre-selected or field determined intervals within the urban fill and submitted for laboratory analysis. For large parcels or thicknesses less than 2-feet, a person may propose a different size exposure unit and/or a reduction in the number of borings or samples per exposure unit. All samples are to be analyzed for all volatile hazardous substances of concern.

Utilizing the sample results, a demonstration of a dispersed vapor source can be made when:

- The statistical calculations of the range, variance, and standard deviation documented in a submittal provided to EGLE support a high degree of variability in the concentration of volatile hazardous substances present in fill, and
- Those data are supported with appropriate maps and figures.

If a vapor source is demonstrated to be dispersed and is not located directly beneath a current or a proposed building, then the contamination within the urban fill does not pose a risk of unacceptable exposure through the VIAP and no further sampling or evaluation of the VIAP is necessary.

If the urban fill will be directly below a proposed building and contains contaminants above the applicable unrestricted soil volatilization to indoor air criteria, then either of the following response activities should be conducted:

- a) removal of the urban fill prior to construction, or
- b) an evaluation and sampling of the building after construction as outlined below.

NOTE: For undeveloped properties, shallow soil gas samples (e.g. collected less than 4 feet bgs) collected over or within a shallow vapor source prior to the placement of a structure may not be representative of site conditions once a structure has been constructed.

Urban Fill Exists Beneath a Current Building

The presence of a potential vapor source beneath an existing building, regardless of the thickness of fill, could be evaluated through the installation and sampling of sub-slab vapor points to confirm or refute that the contaminants are randomly dispersed and do not provide sufficient mass to pose a risk to the VIAP. The recommended number of sub-slab vapor point locations based on the square footage of the building are identified in Table 1.

Table 1 – Building Size and Sampling Locations

Building Size	Sample Density
Less than 10,000 ft ²	2 + one additional sample per every 2,000 ft ² of building over 1,000 ft ²
Greater than 10,000 ft ²	7 + one additional sample per every 2,500 ft ² of building over 10,000 ft ²

The number of sub-slab vapor point sampling events depends on the hazardous substances and vapor sample results. If the vapor sample results are all below the applicable unrestricted soil volatilization to indoor air criteria for vapor, meet quality assurance and quality control (QA/QC) sampling standards, and do not include a potential acute hazard (Table 2), only one sampling event is necessary.

If a hazardous substance(s) listed in Table 2 is detected in the sub-slab vapor point sample, then at least two sampling events three months apart must be conducted. If the sample results are all below the applicable unrestricted soil volatilization to indoor air criteria for vapor for the sample events, it can be determined that the contamination does not pose a risk or unacceptable exposure for the VIAP and no further sampling or evaluation of the VIAP is necessary.

Table 2 – Hazardous Substances that may be an Acute Vapor Hazard


CAS No.	Hazardous Substance	CAS No.	Hazardous Substance
67641	Acetone	108101	4-Methyl-2-pentanone (MIBK)
98862	Acetophenone	75092	Methylene chloride
7664417	Ammonia	71238	Propyl alcohol*
78933	2-Butanone (MEK)	103651	n-Propylbenzene*
57749	Chlordane	127184	Tetrachloroethylene
95578	2-Chlorophenol	108883	Toluene*
108203	Diisopropyl ether	2303175	Triallate
64175	Ethanol*	71556	1,1,1-Trichloroethane
67561	Methanol*	79016	Trichloroethylene

*NOTE: The compound is aerobically degraded in the vadose zone; therefore, if the results are below applicable unrestricted VIAP criteria and greater than 2% oxygen is present, one sampling event is sufficient for the evaluation of the VIAP.

Urban Fill Greater Than 4' bgs

The presence of urban fill greater than 4-feet bgs allows for the construction and sampling of soil gas wells to evaluate the VIAP for a current or proposed building. For this scenario, one soil gas well per quarter acre should be installed across the site, at a minimum depth of 4-feet bgs, although 5-feet bgs is generally recommended. All soil gas wells must be constructed within the urban fill material. Sufficient characterization of the property must have been conducted to verify the conditions outlined above and determine if there are location(s) where contaminant concentrations are present in fill above the applicable unrestricted soil volatilization to indoor air criterion. Ideally, the soil gas sampling will be biased towards the locations where there are contaminant concentrations above applicable unrestricted soil volatilization to indoor air criteria in the fill. At locations where contaminant concentrations in soil vapor are greater than 100-times the applicable vapor criterion, additional soil gas wells (more than 1 per quarter acre) should be installed.

If the vapor sample results are below the applicable unrestricted soil volatilization to indoor air criteria for vapor and meet all required QA/QC sampling standards, only one sampling event is necessary. If one or more of the hazardous substances listed in Table 2 are present in the fill material at a soil concentration that exceeds the applicable unrestricted soil volatilization to indoor air criterion, at least two sampling events must be conducted. If the sample results are all below the applicable soil vapor volatilization to indoor air criteria for vapor, it can be concluded that the contamination present within urban fill is dispersed and does not pose a risk or unacceptable exposure for the VIAP and no further sampling or evaluation of the VIAP is necessary.

Approved: 
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