



Delaware Department of Natural Resources & Environmental Control
Site Investigation and Restoration Branch
Policy and Procedures

Subject: Policy concerning the investigation, risk determination and remediation for the Vapor Intrusion pathway

Issued: March 2007

The Department of Natural Resources and Environmental Control Division – Site Investigation and Restoration Branch (DNREC-SIRB) adopts this policy to provide guidance and consistency in the evaluation of vapor intrusion risk from investigation to remediation.

Definition of Vapor Intrusion

Acute Exposure – Exposure to a chemical or situation for a short period of time. (EPA 2007).

Vapor Intrusion (VI)- is the migration of volatile chemicals from the subsurface into overlying buildings. Volatile chemicals may include volatile organic compounds, select semi-volatile organic compounds and some inorganic analytes such as mercury and hydrogen sulfide. Methane should be considered where it is appropriate (ITRC 2007).

Preferential Pathway- An increased component of soil gas flow into a building due to natural conditions (gravel, etc.) or manmade conditions (utility corridors, sumps, drains, pits or elevator shafts, etc.) The presence of any of these does not necessarily indicate that a preferential pathway exists. (ITRC 2007)-

Chemicals of Potential Concern (COPC) - Chemicals that are potentially site-related and whose data are of sufficient quality for use in the quantitative risk assessment (EPA Risk Assessment Guidance for Superfund, Vol. I Part A, 1989).

Contaminants of Concern (COC) - chemicals or contaminants determined to be present at the site in sufficient concentrations to present a health risk (HSCA Guidance 1994).

Remedial Action – the containment, contaminant mass or toxicity reduction, isolation, treatment, removal, cleanup, or monitoring of hazardous substances released into the environment, or the taking of such other actions as may be necessary to prevent, minimize, or mitigate harm, or risk of harm to the public health, welfare, or the

environment which may result from a release or an imminent threat of a release of hazardous substances (HSCA Regulations).

Purpose

The General Assembly of the State of Delaware enacted the Hazardous Substance Cleanup Act (HSCA), (7 Del. C. Ch.91) in 1990 to eliminate or minimize the risk to public health, welfare and the environment from the release of hazardous substances.

The Act provided authority to the Department of Natural Resources and Environmental Control (DNREC) to enforce the provisions of the Act. The Secretary of DNREC was tasked to establish regulations by which to implement the provisions of the Act, which were generated and adopted in 1994 (Secretary's Order 94-SF-0013). Media-specific descriptions for the general risk levels used to determine the need for cleanup were specified in the regulations promulgated in 1996 as a cancer risk of 1×10^{-5} or a Hazard Index value of 1.0 for non-cancer risk (Section 9.0 – Cleanup Levels).

Vapor intrusion has only recently been recognized as a risk to human health. As a result, no media-specific description has been drafted for the previously -unrecognized VI Pathway, although all media at all sites are subject to the general provisions of Subsection 9.1.

This policy will:

- Identify VI as a pathway by which humans can be exposed to dangerous levels of invisible and otherwise unnoticeable toxic vapors
- To provide a temporary supplement to Section 9 of the HSCA Regulations – Cleanup Levels (other media-specific procedures are presented for groundwater, surface water, and soil).
- Determine when a vapor intrusion investigation should be conducted.
- To provide the procedures which serve to evaluate the Vapor Intrusion risk?

Policy

The following steps need to be performed for the evaluation of vapor intrusion risk from investigation to remediation stage. A flowchart depicting these steps is included in Attachment I.

After initial investigation and any step after, at the discretion of DNREC, the PRP may propose remediation.

A. Initial Evaluation – How Do I Determine Whether I Need to Evaluate VI on my Property?

- Step 1 Evaluate if hazardous vapor intrusion condition exists at the Site which require emergency response.** Emergency conditions exist if any one of the following is present:

- Odor
- High vapor concentrations (OSHA PELs or IDLH levels are being exceeded)
- Explosive levels are present
- Physiological effects of vapor intrusion
- Presence of a wet basement where NAPL is present
- Any other hazardous condition which requires immediate response

Contact 911

or DNREC Emergency Response Branch at **1-800-662-8802** and take immediate remedial actions as directed.

Step 2 Does Sufficient Data exist to evaluate if vapor intrusion could present a risk?

In this step, it is important to determine if the data is of sufficient quality and quantity to determine if vapor intrusion could present a risk. For instance, only one soil sample that has volatile organic chemicals is not enough to determine if a realistic risk exists at the Site. At this point it is appropriate to develop a conceptual site model (CSM). The model needs to include known or suspected sources, contaminant migration pathways, receptors, and exposure pathways. An example for the development for CSM is found in Appendix B of the November 2005 American Petroleum Institute document entitled "Collecting and Interpreting Soil Gas Samples from the Vadose Zone-A Practical Strategy for Assessing the Subsurface Vapor-to-Indoor Air Migration Pathway at Petroleum Hydrocarbon Sites". **The conceptual site model must be updated each time more information becomes available.**

Step 3 Identify sites which may have VI issue

Screen the list of chemicals of potential concern (COPC) against Table 1. If the COPCs are not listed on Table 1 as **both toxic and volatile** then the site is not a risk for vapor intrusion (Go to **Step 11**). Methane, radon and tert-butyl alcohol (TBA) are special exceptions to Table 1. Methane is a volatile chemical, which is not toxic but presents certain environmental risks. Radon is volatile and toxic but naturally occurring. TBA is not included on the Table 1 list but certain states, such as New Jersey, have chosen to include it as COPC. DNREC will evaluate the risk from these compounds on a site by site basis.

Step 4 Building and/or Preferential Pathway Location

Are there any current or future buildings within 100 feet of the contamination (groundwater or soil vapor)? Are there any preferential pathways near the contamination to present a potential risk, based on best professional judgment? If the answer is yes proceed to the next step. If no then go to Step 11.

Step 5 Screen available data

Evaluate the available data using the Johnson and Ettinger (J&E) Model (EPA 2003) or Table 2. Other models will be considered on a Site by Site basis.

There are three basic J&E model types- Groundwater, Soil Gas and Non-Aqueous Phase Liquid (NAPL) and soil. Either generic or advanced model may be used (based on the amount of data available at the Site). DNREC requires that the data used for screening is either the groundwater data or the soil gas data. Soil data should not be used as it does not represent soil gas conditions as well as the other data types. Generally as a conservative measure, the worst-case values should be used.

The J&E model can not be used when any of the following conditions are present:

- A preferential pathway exists.
- Building foundation is in contact with groundwater
- Very small building air exchange rates (e.g., <0.25/h)
- Buildings with crawlspace structures or other significant openings to the subsurface (e.g., earthen floors, stone buildings, etc.)
- Very shallow vapor sources (e.g., depths less than 5 ft below foundation level);
- Relatively shallow vapor sources (e.g., depths less than 15 ft below foundation level), and one or more of the following:
 - o buildings with significant openings to the subsurface (e.g., sumps, unlined crawlspaces, earthen floors), or
 - o significant preferential pathways, either naturally-occurring and/or anthropogenic (see discussion in Question 4), or
 - o buildings with very low air exchange rates (e.g., < 0.25/hr) or very high sustained indoor/outdoor pressure differentials (e.g., > 10 Pascals), or

When J&E model can not be used, the following options should be used:

- Use another model approved by DNREC
- Conduct field investigation per a DNREC approved work plan.

If the results exceed 1×10^{-6} or hazard index (HI) of 0.1 then proceed to field investigations. If it does not exceed then a risk does not exist (go to **Step 11**).

Step 6 Evaluate exceedances above DNREC's Screening Levels

If this screening indicates that a vapor intrusion into indoor exceeds 1×10^{-6} or HI of 0.1 then the screening process continues to conducting onsite investigation.

B. What To Do If Further Evaluation of VI is needed?

Step 7 Design/Perform Vapor Intrusion Investigation

Work Plan Development

Sampling requirements, analytical methods and sampling procedures will be covered in future DNREC guidance documents or policies.

Work plans must describe the number, location and depth of proposed samples. The work plan may differ for chlorinated solvents and petroleum contaminants as petroleum hydrocarbon vapors tend to degrade as they migrate vertically due to biological degradation. If preferential pathways are determined to exist, these need to be included in the field investigation.

Investigation Strategy

Investigation should proceed from an outside to indoor investigation in a systematic fashion. Other strategies will be evaluated on a Site by Site basis. The investigation should proceed along the lines presented below:

- 1) Delineate the vapor source (groundwater or soil gas)
- 2) Collect soil vapor samples adjacent to the footing of the building/house.
DNREC prefers four samples to be collected from around the perimeter of the building. More samples may be necessary based on the size of the building.
- 3) Collect subslab samples from the interior of the building. Prior to collecting any samples indoors, it will be necessary to obtain permission to sample indoors (access agreement for HSCA sites). If the building(s) use is as a residence, it will be necessary to talk to the DNREC public information officer and determine the strategy about how to talk to the home owner(s), etc.
- 4) Collect indoor air samples.

The reason for collecting indoor air samples last is that many common household items contain VOCs at levels sufficient to cause a background issue (i.e. Is the source from household products or from the subsurface). For this reason, prior to collecting any indoor samples, it is necessary to identify any potential issue with background by conducting a detailed survey of the interior of the building and removing or otherwise isolating any VOC containing products. Attachment IV is a copy of the draft survey form. A detailed list of VOC containing items can be found in the October 2005 New Jersey Department of Environmental Protection Vapor Intrusion Guidance (Appendix H).

Upon DNREC's discretion, additional or alternative investigations may be conducted to determine if vapors present a risk to indoor air. For instance, tracer gases may be used to determine the attenuation factor (ratio of indoor air concentration to subsurface concentration) of the concrete slab. This allows a concentration of subsurface gas to be reasonably extrapolated to an indoor concentration (subsurface X attenuation factor).

Step 8 Evaluate Data Quality

After the data is collected, update the CSM and evaluate if there are any data gaps. If there are any data gaps then go back to **Step 7**.

Step 9 Perform Risk Analysis

Evaluate the Site data using the J&E model, or other DNREC-approved model to determine the risk. DNREC will consider different input parameters to the site specific risk calculator to evaluate commercial buildings or other situations on a site by site basis.

Step 10 Evaluate the Risk Results

If the risk is below 1×10^{-5} or HI of 1.0 then proceed to **Step 11**.

If the risk exceeds 1×10^{-5} or HI of 1.0 then proceed to **Step 12**.

Step 11 No Further Action

DNREC will make a no further action determination.

OSHA Considerations

The Occupational Safety and Health Administration (OSHA) regulates worker exposure to volatile chemicals present in industrial workplaces. The Department will generally defer to OSHA's standards and requirements and forego corrective action in occupational settings where the contaminants of concern from vapor intrusion are the same as job related chemical exposures regulated by OSHA. These workers fall under the Hazard Communication requirements of OSHA and workplace exposure to chemicals is monitored and is likely to predominate over vapor intrusion exposure.

However, in some cases although the Site is industrial, it may be in a strip mall or adjacent to a higher risk use or group. For instance, dry cleaner in a strip mall next to residence or daycare. In this case, the lower risk-based numbers would be used.

In addition, other individuals and workers who are not exposed to chemicals as part of their normal employment (office workers, etc), are not included in the OSHA Hazard Communication program, and vapor intrusion may be their primary exposure pathway. The Department will employ its own risk-based numbers in these instances.

C. What To Do If Remediation of VI is needed?

Step 12 Evaluate the remedial options Conduct Remediation

Presumptive Remedial options:

- 1) Subslab Depressurization
- 2) Vapor Barrier with passive venting

Other remedial options considered on a case by case basis

A vapor barrier must consist of a barrier material and passive venting system (perforated piping under the slab and piping to the roof). The gas diffuses into the piping and being lighter than air rises out of the vent pipes on the roof. The reason for adding a passive venting system is that any small hole in the barrier or other imperfection in the barrier will allow vapors to enter the building. The passive venting will prevent vapors from collecting under the building. In addition, in the event that the passive venting system is determined to be ineffective, a small fan can be attached to change the system to an active venting system.

The determination that the passive system is ineffective will be determined by DNREC on a site by site basis (generally when periodic indoor sampling results indicates that a risk above 1×10^{-5} still exists in the building even with passive venting).

Vapor barrier design will not be considered complete without a venting system. Air permitting requirements from the DNREC Division of Air and Waste Management Air Quality Management Section are as follows:

- Less than 0.2 lbs/day- No permit
- 0.2 to 10 lbs/day- Self permit
- 10 lbs/day-permit required

However, as regulations may change, please contact the DNREC Air Quality Management Section to confirm that permits will not be required.

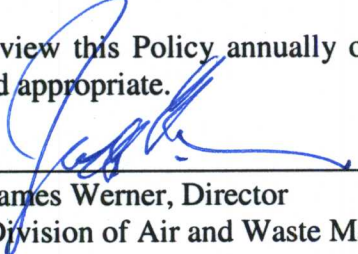
The design for the vapor mitigation system must be approved prior to installation. The design must be certified by a Delaware Professional Engineer or certified radon installer. DNREC will accept material as a vapor barrier from certified manufactures of vapor barriers. DNREC, upon its discretion, will also accept other materials as vapor barriers provided that they meet the following criteria:

- i. Permeability of the barrier or Permeance ASTM E 1745-97 (2004) less than 0.01 perms.
- ii. Strength of material- puncture resistance (ASTM D1709-04) and tensile strength (ASTM D882-00)
- iii. Resistance to COC on site- ASTM E154-99, Section 14

- iv. Test for leaks- Radon Reduction Techniques for Existing Detached Houses, Technical Guidance, Third Edition, EPA/625/R93/011, October 1993.

This policy will be distributed to all approved HSCA consultants and appear on the DNREC-SIRB web page. The changes will appear in any new revision of the **Remediation Standards Guidance**.

DNREC will review this Policy annually or as new information become available and revise as deemed appropriate.

Approved by:  _____
James Werner, Director
Division of Air and Waste Management

Date: 16 MAR 2007

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EPA. June 2003. *User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings*
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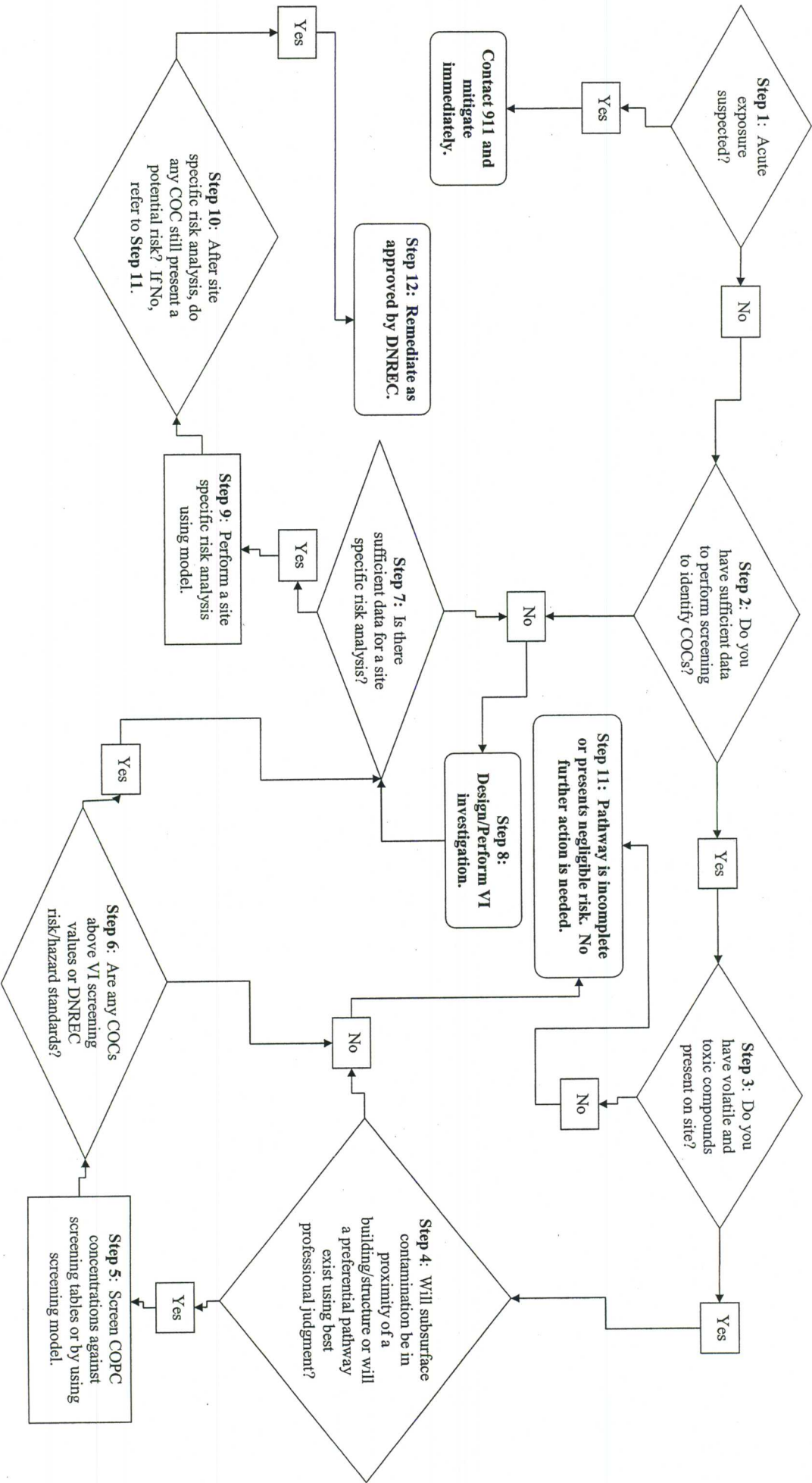
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**ATTACHMENT I
DECISION MAKING FLOWCHART
FOR EVALUATION OF VAPOR INTRUSION**

Decision Making Flowchart for Evaluation of Vapor Intrusion Pathway



**ATTACHMENT II
TABLE I COCS**

Table 1: Contaminant of concern for vapor intrusion (From EPA Guidance 2002)

CAS No.	Chemical	Is Chemical Sufficiently Toxic? ¹	Is Chemical Sufficiently Volatile? ²	Check Here if Known or Reasonably Suspected To Be Present ³
83329	Acenaphthene	YES	YES	
75070	Acetaldehyde	YES	YES	
67641	Acetone	YES	YES	
75058	Acetonitrile	YES	YES	
98862	Acetophenone	YES	YES	
107028	Acrolein	YES	YES	
107131	Acrylonitrile	YES	YES	
309002	Aldrin	YES	YES	
319846	alpha-HCH (alpha-BHC)	YES	YES	
62533	Aniline	YES	NO	NA
120127	Anthracene	NO	YES	NA
56553	Benz(a)anthracene	YES	NO	NA
100527	Benzaldehyde	YES	YES	
71432	Benzene	YES	YES	
50328	Benzo(a)pyrene	YES	NO	NA
205992	Benzo(b)fluoranthene	YES	YES	
207089	Benzo(k)fluoranthene	NO	NO	NA
65850	Benzoic Acid	NO	NO	NA
100516	Benzyl alcohol	YES	NO	NA
100447	Benzylchloride	YES	YES	
91587	beta-Chloronaphthalene	YES	YES	
319857	beta-HCH (beta-BHC)	YES	NO	NA
92524	Biphenyl	YES	YES	
111444	Bis(2-chloroethyl)ether	YES	YES	
108601	Bis(2-chloroisopropyl)ether	YES	YES	
117817	Bis(2-ethylhexyl)phthalate	NO	NO	NA
542881	Bis(chloromethyl)ether	YES	YES	
75274	Bromodichloromethane	YES	YES	
75252	Bromoform	YES	YES	
106990	1,3-Butadiene	YES	YES	
71363	Butanol	YES	NO	NA
85687	Butyl benzyl phthalate	NO	NO	NA
86748	Carbazole	YES	NO	NA
75150	Carbon disulfide	YES	YES	
56235	Carbon tetrachloride	YES	YES	
57749	Chlordane	YES	YES	
126998	2-Chloro-1,3-butadiene (chloroprene)	YES	YES	
108907	Chlorobenzene	YES	YES	
109693	1-Chlorobutane	YES	YES	
124481	Chlorodibromomethane	YES	YES	
75456	Chlorodifluoromethane	YES	YES	
75003	Chloroethane (ethyl chloride)	YES	YES	
67663	Chloroform	YES	YES	
95578	2-Chlorophenol	YES	YES	
75296	2-Chloropropane	YES	YES	
218019	Chrysene	YES	YES	
156592	cis-1,2-Dichloroethylene	YES	YES	
123739	Crotonaldehyde (2-butenal)	YES	YES	
98828	Cumene	YES	YES	
72548	DDD	YES	NO	NA
72559	DDE	YES	YES	
50293	DDT	YES	NO	NA
53703	Dibenz(a,h)anthracene	YES	NO	NA
132649	Dibenzofuran	YES	YES	
96128	1,2-Dibromo-3-chloropropane	YES	YES	
106934	1,2-Dibromoethane (ethylene dibromide)	YES	YES	
541731	1,3-Dichlorobenzene	YES	YES	
95501	1,2-Dichlorobenzene	YES	YES	
106467	1,4-Dichlorobenzene	YES	YES	
91941	3,3-Dichlorobenzidine	YES	NO	NA
75718	Dichlorodifluoromethane	YES	YES	

CAS No.	Chemical	Is Chemical Sufficiently Toxic? ¹	Is Chemical Sufficiently Volatile? ²	Check Here if Known or Reasonably Suspected To Be Present ³
75343	1,1-Dichloroethane			
107062	1,2-Dichloroethane	YES	YES	
75354	1,1-Dichloroethylene	YES	YES	
120832	2,4-Dichlorophenol	YES	NO	NA
78875	1,2-Dichloropropane	YES	YES	
542756	1,3-Dichloropropene	YES	YES	
60571	Dieldrin	YES	YES	
84662	Diethylphthalate	YES	NO	NA
105679	2,4-Dimethylphenol	YES	NO	NA
131113	Dimethylphthalate	NA	NO	NA
84742	Di-n-butyl phthalate	NO	NO	NA
534521	4,6-Dinitro-2-methylphenol (4,6-dinitro-o-cresol)	YES	NO	NA
51285	2,4-Dinitrophenol	YES	NO	NA
121142	2,4-Dinitrotoluene	YES	NO	NA
606202	2,6-Dinitrotoluene	YES	NO	NA
117840	Di-n-octyl phthalate	NO	YES	NA
115297	Endosulfan	YES	YES	
72208	Endrin	YES	NO	NA
106898	Epichlorohydrin	YES	YES	
60297	Ethyl ether	YES	YES	
141786	Ethylacetate	YES	YES	
100414	Ethylbenzene	YES	YES	
75218	Ethylene oxide	YES	YES	
97632	Ethylmethacrylate	YES	YES	
206440	Fluoranthene	NO	YES	NA
86737	Fluorene	YES	YES	
110009	Furan	YES	YES	
58899	gamma-HCH (Lindane)	YES	YES	
76448	Heptachlor	YES	YES	
1024573	Heptachlor epoxide	YES	NO	NA
87683	Hexachloro-1,3-butadiene	YES	YES	
118741	Hexachlorobenzene	YES	YES	
77474	Hexachlorocyclopentadiene	YES	YES	
67721	Hexachloroethane	YES	YES	
110543	Hexane	YES	YES	
74908	Hydrogen cyanide	YES	YES	
193395	Indeno(1,2,3-cd)pyrene	NO	NO	NA
78831	Isobutanol	YES	YES	
78591	Isophorone	YES	NO	NA
7439976	Mercury (elemental)	YES	YES	
126987	Methacrylonitrile	YES	YES	
72435	Methoxychlor	YES	YES	
79209	Methyl acetate	YES	YES	
96333	Methyl acrylate	YES	YES	
74839	Methyl bromide	YES	YES	
74873	Methyl chloride (chloromethane)	YES	YES	
108872	Methylcyclohexane	YES	YES	
74953	Methylene bromide	YES	YES	
75092	Methylene chloride	YES	YES	
78933	Methylethylketone (2-butanone)	YES	YES	
108101	Methylisobutylketone	YES	YES	
80626	Methylmethacrylate	YES	YES	
91576	2-Methylnaphthalene	YES	YES	
108394	3-Methylphenol (m-cresol)	YES	NO	NA
95487	2-Methylphenol (o-cresol)	YES	NO	NA
106455	4-Methylphenol (p-cresol)	YES	NO	NA
99081	m-Nitrotoluene	YES	NO	NA
163404	4 MTBE	YES	YES	
108383	m-Xylene	YES	YES	
91203	Naphthalene	YES	YES	
104518	n-Butylbenzene	YES	YES	

CAS No.	Chemical	Is Chemical Sufficiently Toxic? ¹	Is Chemical Sufficiently Volatile? ²	Check Here if Known or Reasonably Suspected To Be Present ³
98953	Nitrobenzene	YES	YES	
100027	4-Nitrophenol	YES	NO	NA
79469	2-Nitropropane	YES	YES	
924163	N-Nitroso-di-n-butylamine	YES	YES	
621647	N-Nitrosodi-n-propylamine	YES	NO	NA
86306	N-Nitrosodiphenylamine	YES	NO	NA
103651	n-Propylbenzene	YES	YES	
88722	o-Nitrotoluene	YES	YES	
95476	o-Xylene	YES	YES	
106478	p-Chloroaniline	YES	NO	NA
87865	Pentachlorophenol	YES	NO	NA
108952	Phenol	YES	NO	NA
99990	p-Nitrotoluene	YES	NO	NA
106423	p-Xylene	YES	YES	
129000	Pyrene	YES	YES	
110861	Pyridine	YES	NO	NA
135988	sec-Butylbenzene	YES	YES	
100425	Styrene	YES	YES	
98066	tert-Butylbenzene	YES	YES	
630206	1,1,1,2-Tetrachloroethane	YES	YES	
79345	1,1,2,2-Tetrachloroethane	YES	YES	
127184	Tetrachloroethylene	YES	YES	
108883	Toluene	YES	YES	
8001352	Toxaphene	YES	NO	NA
156605	trans-1,2-Dichloroethylene	YES	YES	
76131	1,1,2-Trichloro-1,2,2-trifluoroethane	YES	YES	
120821	1,2,4-Trichlorobenzene	YES	YES	
79005	1,1,2-Trichloroethane	YES	YES	
71556	1, 1,1-Trichloroethane	YES	YES	
79016	Trichloroethylene	YES	YES	
75694	Trichlorofluoromethane	YES	YES	
95954	4,5 Trichlorophenol	YES	NO	NA
88062	24,6 Trichlorophenol	YES	NO	NA
96184	1,2,3-Trichloropropane	YES	YES	
95636	1,2,4-Trimethylbenzene	YES	YES	
108678	1,3,5-Trimethylbenzene	YES	YES	
108054	Vinyl acetate	YES	YES	
75014	Vinyl chloride (chloroethene)	YES	YES	

¹ A chemical is considered sufficiently toxic if the vapor concentration of the pure component (see Appendix D) poses an incremental Lifetime cancer risk greater than 10% or a non-cancer hazard index greater than

² A chemical is considered sufficiently volatile if its Henry's Law Constant is 1×10^{-5} atm-m³/mol or greater (US EPA, 1991).

³ Users should check off compounds that meet the criteria for toxicity and volatility and are known or reasonably suspected to be present.

**ATTACHMENT III
EPA TABLE 2**

Table 2c: Question 4 Generic Screening Levels and Summary Sheet 1
Risk = 1 x 10⁻⁶

CAS No.	Chemical	Compounds with Provisional Toxicity Data Extrapolated From Oral Sources	Basis of Target Concentration NC=noncancer risk	Target Indoor Air Concentration to Satisfy Both the Prescribed Risk Level and the Target Hazard Index (R=10 ⁻⁶ , HI=1) C _{Target} (ug/m ³) (ppbv)	Measured or Reasonably Estimated Indoor Air Concentration (if available) (specify units)	Target Shallow Gas Concentration Corresponding to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor=0.1 C _{Soil-gas} (ug/m ³) (ppbv)	Measured or Reasonably Estimated Shallow Soil Gas Concentration (if available) (specify units)	Target Deep Soil Gas Concentration Corresponding to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor=0.01 C _{Soil-gas} (ug/m ³) (ppbv)	Measured or Reasonably Estimated Deep Soil Gas Concentration (if available) (specify units)	Target Groundwater Concentration Corresponding to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor = 0.001 and Partitioning Across the Water Table Obeys Henry's Law C _{gw} (ug/l)	Measured or Reasonably Estimated Groundwater Concentration (if available) (specify units)
83329	Aerographene	X	NC	2.1E+02	3.3E+01	2.1E+03	3.3E+02	2.1E+04	3.3E+03	**	
75070	Acetaldehyde		C	1.1E+00	6.1E-01	1.1E+01	6.1E+00	1.1E+02	6.1E+01	3.4E+02	
67641	Acetone	X	NC	3.5E+02	1.5E+02	3.5E+03	1.5E+03	3.5E+04	1.5E+04	2.2E+05	
75058	Acetonitrile		NC	6.0E+01	3.6E+01	6.0E+02	3.6E+02	6.0E+03	3.6E+03	4.2E+04	
98862	Acetophenone	X	NC	3.5E+02	7.1E+01	3.5E+03	7.1E+02	3.5E+04	7.1E+03	8.0E+05	
107028	Acrolein		NC	2.0E+02	8.7E-03	2.0E+01	8.7E-02	2.0E+00	8.7E-01	4.0E+00	
107131	Acylofenite		C	3.6E+02	1.7E+02	3.6E+01	1.7E+01	3.6E+00	1.7E+00	8.5E+00	
309002	Adrin		C	5.0E+04	3.3E+05	5.0E+03	3.3E+04	5.0E+02	3.3E+03	7.1E+02	
319946	alpha-HCH (alpha-BHC)		C	1.4E+03	1.1E+04	1.4E+02	1.1E+03	1.4E+01	1.1E+02	3.1E+00	
100527	Benzaldehyde	X	NC	3.5E+02	8.1E+01	3.5E+03	8.1E+02	3.5E+04	8.1E+03	3.6E+05	
71432	Benzene		C	3.1E+01	9.8E-02	3.1E+00	9.8E-01	3.1E+01	9.8E+00	5.0E+00 ¹	
205992	Benzobifluoranthene	X	C	1.2E+02	1.1E-03	1.2E+01	1.1E-02	1.2E+00	1.1E-01	**	
100447	Benzylchloride	X	C	5.0E+02	9.7E-03	5.0E+01	9.7E-02	5.0E+00	9.7E-01	3.0E+00	
91587	beta-Chlorophthalene	X	NC	2.8E+02	4.2E+01	2.8E+03	4.2E+02	2.8E+04	4.2E+03	**	
92524	Biphenyl	X	NC	1.8E+02	2.8E+01	1.8E+03	2.8E+02	1.8E+04	2.8E+03	**	
111444	Bis(2-chloroethyl)ether		C	7.4E+03	1.3E+02	7.4E+02	1.3E+02	7.4E+01	1.3E+01	1.0E+01	
108601	Bis(2-chloroisopropyl)ether		C	2.4E+01	3.5E+02	2.4E+00	3.5E+01	2.4E+01	3.5E+00	5.1E+01	
542881	Bis(chloromethyl)ether		C	3.9E+05	8.4E+06	3.9E+04	8.4E+05	3.9E+03	8.4E+04	4.5E+03	
75274	Bromodichloromethane	X	C	1.4E+01	2.1E+02	1.4E+00	2.1E+01	1.4E+01	2.1E+00	2.1E+00	
75282	Bromoforn		C	2.2E+00	2.1E+01	2.2E+01	2.1E+00	2.2E+02	2.1E+01	8.3E+03	
108990	1,3-Butadiene		C	8.7E+03	3.9E+03	8.7E+02	3.9E+02	8.7E+01	3.9E+01	2.9E+03	
75150	Carbon disulfide		NC	7.0E+02	2.2E+02	7.0E+03	2.2E+03	7.0E+04	2.2E+04	5.6E+02	
56235	Carbon tetrachloride		C	1.6E+01	2.6E-02	1.6E+00	2.6E-01	1.6E+01	2.6E+00	5.0E+00 ¹	
57749	Chlordane		C	2.4E+02	1.5E-03	2.4E+01	1.5E-02	2.4E+00	1.5E-01	1.2E+01	
128998	2-Chloro-1,3-butadiene (chloroprene)		NC	7.0E+00	1.9E+00	7.0E+01	1.9E+01	7.0E+02	1.9E+02	1.4E+01	
108907	Chlorobenzene		NC	6.0E+01	1.3E+01	6.0E+02	1.3E+02	6.0E+03	1.3E+03	3.9E+02	
108693	1-Chlorobutane	X	NC	1.4E+03	3.7E+02	1.4E+04	3.7E+03	1.4E+05	3.7E+04	2.0E+03	
124481	Chlorodibromomethane	X	C	1.0E+01	1.2E+02	1.0E+00	1.2E+01	1.0E+01	1.2E+00	3.2E+00	
75456	Chlorodifluoromethane		NC	5.0E+04	1.4E+04	5.0E+05	1.4E+05	**	**	**	
75003	Chloroethane (ethyl chloride)		NC	1.0E+04	3.8E+03	1.0E+05	3.8E+04	1.0E+06	3.8E+05	2.8E+04	
67663	Chloroform		C	1.1E+01	2.2E-02	1.1E+00	2.2E-01	1.1E+01	2.2E+00	8.0E+01 ¹	
95578	2-Chlorophenol	X	NC	1.8E+01	3.3E+00	1.8E+02	3.3E+01	1.8E+03	3.3E+02	1.1E+03	
75296	2-Chloropropane		NC	1.0E+02	3.2E+01	1.0E+03	3.2E+02	1.0E+04	3.2E+03	1.7E+02	
218019	Chrysene	X	C	1.2E+00	1.2E+01	1.2E+01	1.2E+00	**	**	**	
155592	cis-1,2-Dichloroethylene	X	NC	3.5E+01	8.8E+00	3.5E+02	8.8E+01	3.5E+03	8.8E+02	2.1E+02	
123739	Crotaldehyde (2-butenal)	X	C	4.5E+03	1.6E-03	4.5E+02	1.6E-02	4.5E+01	1.6E-01	5.6E+00	
98828	Cumene		NC	4.0E+02	8.1E+01	4.0E+03	8.1E+02	4.0E+04	8.1E+03	8.4E+00	

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Table 2c: Question 4 Generic Screening Levels and Summary Sheet 1
 Risk = 1 x 10⁻⁶

CAS No.	Chemical	Compounds with Provisional Toxicity Data Extrapolated From Oral Sources	Basis of Target Concentration Cancer risk	Target Indoor Air Concentration to Satisfy Both the Prescribed Risk Level and the Target Hazard Index (R=10 ⁻⁶ HI=1) C _{Target} (µg/m ³)	Measured or Reasonably Estimated Indoor Air Concentration (if available) (specify units)	Target Shallow Gas Concentration Corresponding to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor=0.1	Measured or Reasonably Estimated Shallow Soil Gas Concentration (if available) (specify units)	Target Deep Soil Gas Concentration Corresponding to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor=0.1	Measured or Reasonably Estimated Deep Soil Gas Concentration (if available) (specify units)	Target Groundwater Concentration Corresponding to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor = 0.001 and Partitioning Across the Water Table Obeys Henry's Law C _{gw} (µg/L)	Measured or Reasonably Estimated Groundwater Concentration (if available) (specify units)
75959	DDE	X	C	2.9E-02	1.9E-03	2.5E-01	1.9E-02	2.5E+00	1.9E-01	2.9E+01	
132649	Dibenzofuran	X	NC	1.4E+01	2.0E+00	1.4E+02	2.0E-01	1.4E+03	2.0E+02	**	
99128	1,2-Dibromo-3-chloropropane		NC	2.0E-01	2.1E-02	2.0E+00	2.1E-01	2.0E+01	2.1E+00	3.3E+01	
108934	1,2-Dibromoethane (ethylene dibromide)		C	1.1E-02	1.4E-03	1.1E-01	1.4E-02	1.1E+00	1.4E-01	3.6E-01	
541731	1,3-Dichlorobenzene	X	NC	1.1E-02	1.7E+01	1.1E+03	1.7E-02	1.1E+04	1.7E+03	8.3E+02	
95501	1,2-Dichlorobenzene		NC	2.0E-02	3.3E+01	2.0E+03	3.3E-02	2.0E+04	3.3E+03	2.6E+03	
108467	1,4-Dichlorobenzene		NC	8.0E-02	1.3E+02	8.0E+03	1.3E+03	8.0E+04	1.3E+04	8.2E+03	
75718	Dichlorodifluoromethane		NC	2.0E-02	4.0E+01	2.0E+03	4.0E-02	2.0E+04	4.0E+03	1.4E+01	
75343	1,1-Dichloroethane		NC	5.0E-02	1.2E+02	5.0E+03	1.2E+03	5.0E+04	1.2E+04	2.2E+03	
107062	1,2-Dichloroethane		C	9.4E-02	2.3E-02	9.4E-01	2.3E-01	9.4E+00	2.3E+00	5.0E+01	
75354	1,1-Dichloroethylene		NC	2.0E-02	5.0E+01	2.0E+03	5.0E-02	2.0E+04	5.0E+03	1.9E+02	
78875	1,2-Dichloropropane		NC	4.0E+00	8.7E-01	4.0E+01	8.7E+00	4.0E+02	8.7E+01	3.5E+01	
542756	1,3-Dichloropropene		C	6.1E-01	1.3E-01	6.1E+00	1.3E+00	6.1E+01	1.3E+01	8.4E-01	
60571	Dieldrin		C	5.3E-04	3.4E-05	5.3E-03	3.4E-04	5.3E-02	3.4E-03	8.6E-01	
115297	Endosulfan	X	NC	2.1E+01	1.3E+00	2.1E+02	1.3E-01	**	**	**	
108898	Endosulfathin		NC	1.0E+00	2.6E-01	1.0E+01	2.6E+00	1.0E+02	2.6E+01	8.0E+02	
60297	Ethyl ether	X	NC	7.0E-02	2.3E+02	7.0E+03	2.3E+03	7.0E+04	2.3E+04	5.2E+02	
141786	Ethylacetate	X	NC	3.2E+03	8.7E+02	3.2E+04	8.7E+03	3.2E+05	8.7E+04	5.6E+05	
100414	Ethylbenzene		C	2.2E+00	5.1E-01	2.2E+01	5.1E+00	2.2E+02	5.1E+01	7.0E+02	
75218	Ethylene oxide	X	C	2.4E-02	1.4E-02	2.4E+01	1.4E-01	2.4E+00	1.4E+00	1.1E+00	
97632	Ethylmethacrylate	X	NC	3.2E+02	6.8E+01	3.2E+03	6.8E-02	3.2E+04	6.8E+03	9.1E+03	
86737	Fluorene	X	NC	1.4E+02	2.1E+01	1.4E+03	2.1E-02	**	**	**	
110009	Furan	X	NC	3.5E+00	1.3E+00	3.5E+01	1.3E-01	3.5E+02	1.3E+02	1.6E+01	
58899	gamma-HCH (Lindane)	X	C	6.6E-03	5.5E-04	6.6E-02	5.5E-03	6.6E-01	5.5E-02	1.1E+01	
76448	Heptachlor		C	1.9E-03	1.2E-04	1.9E-02	1.2E-03	1.9E-01	1.2E-02	4.0E-01	
87683	Hexachlor-1,3-butadiene		C	1.1E-01	1.0E-02	1.1E+00	1.0E-01	1.1E+01	1.0E+00	3.3E-01	
118741	Hexachlorobenzene		C	5.3E-03	4.5E-04	5.3E-02	4.5E-03	5.3E-01	4.5E-02	1.0E+00	
77474	Hexachlorocyclopentadiene		NC	2.0E-01	1.8E-02	2.0E+00	1.8E-01	2.0E+01	1.8E+00	5.0E-01	
67721	Hexachloroethane		C	6.1E-01	6.3E-02	6.1E+00	6.3E-01	6.1E+01	6.3E+00	3.8E+00	
119543	Hexane		NC	2.0E-02	5.7E+01	2.0E+03	5.7E-02	2.0E+04	5.7E+03	2.9E+00	
74908	Hydrogen cyanide		NC	3.0E+00	2.7E+00	3.0E+01	2.7E-01	3.0E+02	2.7E-02	5.5E-02	
78831	Isobutanol	X	NC	1.1E+03	3.5E+02	1.1E+04	3.5E-03	1.1E+05	3.5E+04	2.2E+06	
743976	Mercury (elemental)		NC	3.0E-01	3.7E-02	3.0E+00	3.7E-01	3.0E+01	3.7E+00	6.8E+01	
128987	Methacrylonitrile		NC	7.0E-01	2.6E+00	7.0E+00	2.6E+00	7.0E+01	2.6E+01	6.9E+01	
72435	Methoxychlor	X	NC	1.8E-01	1.2E+00	**	**	**	**	**	
72209	Methyl acetate	X	NC	3.5E-03	1.2E+03	3.5E+04	1.2E+04	3.5E+05	1.2E+05	7.2E+05	
96333	Methyl acrylate	X	NC	1.1E+02	3.0E+01	1.1E+03	3.0E-02	1.1E+04	3.0E+03	1.4E+04	

Table 2c: Question 4 Generic Screening Levels and Summary Sheet¹
Risk = 1 x 10⁻⁶

CAS No.	Chemical	Compounds with Provisional Toxicity Data Extrapolated From Oral Sources	Basis of Target Concentration Cancer risk	Target Indoor Air Concentration to Satisfy Both the Prescribed Risk Level and the Target Hazard Index (R=10 ⁻⁶ , HI=1) C _{target} ^{Indoor} (µg/m ³)	Target Indoor Air Concentration to Satisfy Both the Prescribed Risk Level and the Target Hazard Index (R=10 ⁻⁶ , HI=1) C _{target} ^{Indoor} (ppbv)	Measured or Reasonably Estimated Indoor Air Concentration (if available) (specify units)	Target Shadow Gas Concentration Corresponding to Target Indoor Air Concentration When the Soil Gas to Indoor Air Attenuation Factor=0.1	Target Deep Soil Gas Concentration Corresponding to Target Indoor Air Concentration When the Soil Gas to Indoor Air Attenuation Factor=0.1	Measured or Reasonably Estimated Deep Soil Gas Concentration (if available) (specify units)	Target Groundwater Concentration Corresponding to Target Indoor Air Concentration When the Soil Gas to Indoor Air Attenuation Factor=0.001 and Partitioning Across the Water Table Obey's Henry's Law	Measured or Reasonably Estimated Groundwater Concentration (if available) (specify units)
74839	Methyl bromide		NC	5.0E+00	1.3E+00		5.0E+01	1.3E+01		2.0E+01	
74873	Methyl chloride (chloromethane)		C	2.4E+00	1.2E+00		2.4E+01	1.2E+01		6.7E+00	
108872	Methoxychlorhexane		NC	3.0E+03	7.5E+02		3.0E+04	7.5E+04		7.1E+02	
74933	Methylene bromide	X	NC	3.5E+01	4.9E+00		3.5E+02	4.9E+01		9.9E+02	
75092	Methylene chloride		C	5.2E+01	1.5E+00		5.2E+01	1.5E+01		5.8E+01	
78933	Methyl ethyl ketone (2-butanone)		NC	1.0E+03	3.4E+02		1.0E+04	3.4E+03		4.4E+05	
108101	Methylisobutylketone		NC	8.0E+01	2.0E+01		8.0E+02	2.0E+02		1.4E+04	
80626	Methylmethacrylate		NC	7.0E+02	1.7E+02		7.0E+03	1.7E+03		5.1E+04	
91576	2-Methylnaphthalene	X	NC	7.0E+01	1.2E+01		7.0E+02	1.2E+02		3.3E+03	
163404	MTBE		NC	3.0E+03	8.3E+02		3.0E+04	8.3E+03		2.3E+05	
108333	m-Xylene	X	NC	7.0E+03	1.6E+03		7.0E+04	1.6E+04		7.0E+05	
91203	Naphthalene		NC	3.0E+00	5.7E+01		3.0E+01	5.7E+00		1.5E+02	
104518	n-Butylbenzene	X	NC	1.4E+02	2.6E+01		1.4E+03	2.6E+02		2.6E+02	
99953	Nitrobenzene		NC	2.0E+00	4.0E+01		2.0E+01	4.0E+00		2.0E+03	
79469	2-Nitropropane		C	9.0E-04	2.5E-04		9.0E-03	2.5E-03		1.8E+01	
924163	N-Nitroso-d-n-Butylamine		C	1.5E-03	2.4E-04		1.5E-02	2.4E-03		1.2E+01	
103651	n-Propylbenzene	X	NC	1.4E+02	2.8E+01		1.4E+03	2.8E+02		3.2E+02	
88722	o-Nitrotoluene	X	NC	3.5E+01	6.2E+00		3.5E+02	6.2E+01		6.8E+04	
95476	o-Xylene	X	NC	7.0E+03	1.6E+03		7.0E+04	1.6E+04		3.3E+04	
106423	p-Xylene	X	NC	7.0E+03	1.6E+03		7.0E+04	1.6E+04		2.2E+04	
129000	Pyrene	X	NC	1.1E+02	1.3E+01		**	**		**	
139998	sec-Butylbenzene	X	NC	1.4E+02	2.6E+01		1.4E+03	2.6E+02		2.5E+02	
100425	Styrene		NC	1.0E+03	2.3E+02		1.0E+04	2.3E+03		8.9E+03	
98066	tert-Butylbenzene	X	NC	1.4E+02	2.6E+01		1.4E+03	2.6E+02		2.9E+02	
639206	1,1,1,2-tetrachloroethane		C	3.3E-01	4.8E-02		3.3E+00	4.8E-01		3.3E+00	
79345	1,1,2,2-tetrachloroethane		C	4.2E-02	6.1E-03		4.2E+01	6.1E-02		3.0E+00	
127184	Tetrachloroethylene		C	8.1E-01	1.2E+01		8.1E+00	1.2E+01		5.0E+00	
108893	Toluene		NC	4.0E+02	1.1E+02		4.0E+03	1.1E+03		1.5E+03	
156605	trans-1,2-Dichloroethylene	X	NC	7.0E+01	1.8E+01		7.0E+02	1.8E+02		1.8E+02	
76131	1,1,2-Trichloro-1,2,2-trifluoroethane		NC	3.0E+04	3.9E+03		3.0E+05	3.9E+04		1.5E+03	
120821	1,2,4-Trichlorobenzene		NC	2.0E+02	2.7E+01		2.0E+03	2.7E+02		3.4E+03	
79005	1,1,2-Trichloroethane		C	1.5E-01	2.8E-02		1.5E+00	2.8E-01		5.0E+00	
71556	1,1,1-Trichloroethane		NC	2.2E+03	4.0E+02		2.2E+04	4.0E+03		3.1E+03	
79016	Trichloroethylene ^{††}	X	C	2.2E-02	4.1E-03		2.2E+01	4.1E-02		5.0E+00	
75694	Trichlorofluoromethane		NC	7.0E+02	1.2E+02		7.0E+03	1.2E+03		1.8E+02	
96184	1,2,3-Trichloropropane		NC	4.9E+00	8.1E+01		4.9E+01	8.1E+00		2.9E+02	
95536	1,2,4-Trimethylbenzene		NC	6.0E+00	1.2E+00		6.0E+01	1.2E+01		2.4E+01	

Table 2c: Question 4 Generic Screening Levels and Summary Sheet¹
 Risk = 1×10^{-6}

CAS No.	Chemical	Compounds with Provisional Toxicity Data Extrapolated From Oral Sources	Basis of Target Concentration C=noncancer risk C	Target Indoor Air Concentration to satisfy Both the Prescribed Risk Level and the Target Hazard Index $[R=10^{-6}, H=1]$ C_{Target} (µg/m ³)	Measured or Reasonably Estimated Indoor Air Concentration (if available) (specify units)	Target Shallow Gas Concentration Corresponding to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor=0.1 $C_{\text{Soil-Gas}}$ (µg/m ³)	Measured or Reasonably Estimated Shallow Soil Gas Concentration (if available) (specify units)	Target Deep Soil Gas Concentration Corresponding to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor=0.01 $C_{\text{Soil-Gas}}$ (µg/m ³)	Measured or Reasonably Estimated Deep Soil Gas Concentration (if available) (specify units)	Target Groundwater Concentration Corresponding to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor = 0.001 and Partitioning Across the Water Table Obey's Henry's Law C_{gw} (µg/L)	Measured or Reasonably Estimated Groundwater Concentration (if available) (specify units)
108678	1,3,5-Trimethylbenzene		NC	6.0E+00	1.2E+00	6.0E+01	1.2E+01	6.0E+02	1.2E+02	2.5E+01	
108054	Vinyl acetate		NC	2.0E+02	5.7E+01	2.0E+03	5.7E+02	2.0E+04	5.7E+03	9.6E+03	
75014	Vinyl chloride (chloroethene)		C	2.8E-01	1.1E-01	2.8E+00	1.1E+00	2.8E+01	1.1E+01	2.0E+00 [†]	

¹ AF = 0.1 for Shallow Soil Gas Target Concentration
 AF = 0.01 for Deep Soil Gas Target Concentration
 AF = 0.001 for Groundwater Target Concentration
 * Health-based target breathing concentration exceeds maximum possible chemical vapor concentration (pathway incomplete)
 ** Target soil gas concentration exceeds maximum possible vapor concentration (pathway incomplete)
 † The target groundwater concentration is the MCL. (The MCL for chloroform is the MCL for total Trihalomethanes. The MCL listed for m-Xylene, o-Xylene, and p-Xylene is the MCL for total Xylenes.)
 †† The target concentration for trichloroethylene is based on the upper bound cancer slope factor identified in EPA's draft risk assessment for trichloroethylene (US EPA, 2001). The slope factor is based on state-of-the-art methodology, however the TCE assessment is still undergoing review. As a result, the slope factor and the target concentration values for TCE may be revised further. (See Appendix D.)

**ATTACHMENT IV
DRAFT SURVEY FORM**

DNREC SIRB Vapor Intrusion Policy

Field Sampling Form

Project #: _____ Sample #: _____ (Attach Sample Map)
Project Name: _____
Sampled By: _____
Date Sampled: _____ Time: _____

General Site Conditions:

Atmospheric Data:

_____ Source of Data
_____ Precipitation during sampling
_____ Amount of Precipitation
_____ Barometric Pressure
_____ Temperature
_____ Wind Speed
_____ Wind Direction

Sampling System (check one)

Sample Type

- | | | | |
|--------------------------|--------------------------------------|--------------------------|---------------------------|
| <input type="checkbox"/> | Whole-Air active approach | <input type="checkbox"/> | Direct Field Sample Field |
| <input type="checkbox"/> | Whole-Air passive approach | <input type="checkbox"/> | Blank Travel |
| <input type="checkbox"/> | Sorbed contaminants-active approach | <input type="checkbox"/> | Blank Sample Container |
| <input type="checkbox"/> | Sorbed contaminants-passive approach | <input type="checkbox"/> | Blank |
| <input type="checkbox"/> | Headspace or extraction approach | <input type="checkbox"/> | Sample Probe Blank |
| <input type="checkbox"/> | soil pore liquid headspace approach | <input type="checkbox"/> | Sample Replicate |

Spiked _____ with _____ cc of _____
Potential reaction products due to spiking: _____

System Purge Volume: _____ Volumes Purged: _____ Sample Volume: _____
Sorbent _____

Device: Installed: _____ Date/time
Recovered: _____ Date/time

Sample Container Type: _____ Sample Container #: _____

Analytical Method: _____ (Chain of Custody Attached)

Integral _____ Detector: _____ (attach equipment calibration, detections)

Analyzer:

to this form)

Analyzer

Result:

Surface

cover:

Sample

Depth:

Sampling

rate

Sample Horizon data visual estimates:

Vadose Zone Make-up:

Soil Composition:

Native

soil+rock

fill

rock

Clay

Soil Organic matter

Fine Granular Material

Coarse Granular

Material

%

%

%

%

Moisture Content:

Other characteristics:

free water present

indurated

Free

product

soil discoloration

probable

connection to

surface macropores

contaminant odors

poor perm. To vapor

near slope or vent



**STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL
CONTROL**

INDOOR AIR BUILDING SURVEY & SAMPLING FORM

Survey Completed by: _____ Date: _____

Site Name: _____
DE#: _____

Part I - Occupants

Building Address: _____

Property Contact: _____
_____ Owner/Renter/Other: _____

Contact's Phone: home () _____ work () _____
cell () _____

Contact's Email: _____

Building occupants: Children under age 13 _____ Children age 13-18 _____ Adults

Special Health Conditions (respiratory, cardiovascular; partially able or homebound?)

Allergies _____ Other _____ (describe)

Part II - Building Characteristics

Building type: single-family residential / trailer or mobile / multi-family residential (duplex, row, apartment?) / office / strip mall / commercial / industrial

Describe building:

- 1) age
- 2) construction frame / masonry / steel / other;
- 3) type of insulation;
- 4) type of roof
- 5) general condition and air tightness
- 6) fireplace or chimney (serviced recently?)

Number of floors - below grade: _____ (full basement / crawl space / slab) at or above grade:

Number of rooms _____ Do windows open?

Basement size: _____ ft² Basement floor: concrete / dirt / floating / other (specify): _____

Foundation type: poured concrete / cinder blocks (hollow?) / stone / other (specify):

Type of ground cover around outside of building: grass / concrete / asphalt / other (specify):

If vegetation, does it appear stressed? _____ French drain? _____

Flooding experienced? _____

Floor drains present? _____ If yes, trap present? _____ Water in trap?

Connected to a: a) sanitary sewer b) storm sewer c) septic system

d) surface discharge

e) unknown

Basement sump present? *Yes / No*

Sump pump? *Yes / No*

Type of heating system (circle all that apply):

hot air circulation

hot air radiation

wood

steam radiation

kerosene heater

hot water radiation

electric baseboard

heat pump

other (specify): _____

solar/air

solar/glycol or other heat transfer fluid

solar/water

If air, when were filters changed last?

Type of ventilation system (circle all that apply):

central air conditioning

mechanical fans

bathroom ventilation fans

individual air conditioning units

kitchen

range hood fan

other (specify): _____

Type of fuel utilized (circle all that apply):

Natural gas / electric / fuel oil / wood-wood pellets / coal / solar / kerosene / waste oil/ outside (fresh) air intake

Septic system? *Yes / Yes (but not used) / No* Irrigation/private well?
Yes / Yes (but not used) / No

Public or private well *Yes / No* If public, name of company

Existing subsurface depressurization (radon) system in place? *Yes / No*
and running? *Yes / No*

Part III - Outside Contaminant Sources

DNREC DEN/Marplot/Brownfields lists (1000-ft. radius):

Previous land use in area:

Other stationary sources nearby:

Gas stations

Emission stacks

Refineries/chemical plants

Waste disposal facilities (LFS & WWTPs) Hot-mix plants Fuel
oil tanks
Dry cleaners Beauty shops Auto repair/body shops Road
or roof repair w/hot
tar

Wetlands nearby? (distance and direction)

Heavy vehicular traffic nearby (or other mobile sources):

Known groundwater or soil contamination within 1000 feet

Physical parameters of unsaturated zone (summarize or attach)

Sinkholes or Debris Pits

Part IV – Indoor Contaminant Sources

Identify all potential indoor sources found in the building (including attached garages), the location of the source (floor & room), and whether the item was removed from the building 48 hours prior to indoor air sampling event.

<i>Potential Sources</i>	Location(s)	Removed Prior to Sampling? (Yes / No / NA)
Gasoline storage cans		
Gas-powered equipment		

Kerosene storage cans		
Paints / thinners / strippers / glues / caulks		
Cleaning solvents		
Oven cleaners		
Carpet / upholstery cleaners		
Other house cleaning products/laundry products		
Moth balls		
Polishes / waxes		
Insecticides		
Furniture / floor polish		
Nail polish / polish remover		
Hairspray		
Cologne / perfume / after-shave, etc.		
Air fresheners		
Fuel tank (inside building) (outside)		NA
Wood stove or fireplace		NA
New furniture / upholstery		
New carpeting / flooring / paneling		NA
Recent painting in building? Roof repair?		NA
Hobbies - glues, paints, etc.		
Toilet or septic additives		
Dry drain traps, plugged drains, toilets won't flush		
Garbage/spoiled food		
Standing water/tire piles/recent flooding		
Sewage/septage		
Dead animals (including unusual numbers of insects)?		
Mold/mildew		
Wet sheetrock/paneling/flooring		
Neighbors making drugs/Explosives		
Mercury-containing switches or instruments		
Alcohol/bleach/disinfectants		
Recent concrete/masonry work		
Flowers		
Pets (specify); scented kitty litter		
Compost/manure		

Part V – Miscellaneous Items

Do any occupants of the building smoke? *Yes / No* How often? _____

Any chronic health problems? *Yes / No*

Has anyone smoked within the building within the last 48 hours? *Yes / No*

Does the building have an attached garage? *Yes / No*
If _____ yes, _____ does _____ garage _____ have _____ heat/ventilation?

Connected to house or separate? _____ Windows? *Yes / No*

If so, is a car usually parked in the garage? *Yes / No*

Do the occupants of the building have their clothes dry-cleaned? *Yes / No*
If _____ yes, _____ name _____ of _____ dry _____ cleaner

When were dry-cleaned clothes last brought into the building?

Have the occupants ever noticed any unusual odors in the building? *Yes / No*

Describe (with location): Date _____ Amount

Any known spills of a chemical, fuel or sewage immediately outside or inside the building?

Yes / No Fires? *Yes / No*

Describe _____ (with location): _____

Have any pesticides/herbicides been applied around the building foundation or in the yard/gardens? *Yes / No*

Have any pesticides been applied regionally, e.g. by Mosquito Control or DSWC? *Yes / No*

If so, when and which chemicals?

Are odors more noticeable under certain weather conditions? Describe (wind direction/speed/precipitation/temperature/humidity):

Part VI – Sampling Information

Sample Technician: _____ Phone number: () _____ -

Sampler Type: Tedlar / Sorbent / Canister
Analytical Method: TO-15 / TO-17 / other:

Laboratory: _____ NJ Certified Lab? Yes /
No

Sample #	Floor	Room	Canister / Tube #	Pump ID # (if applicable)	Sample Start Date / Time	Sample End Date / Time

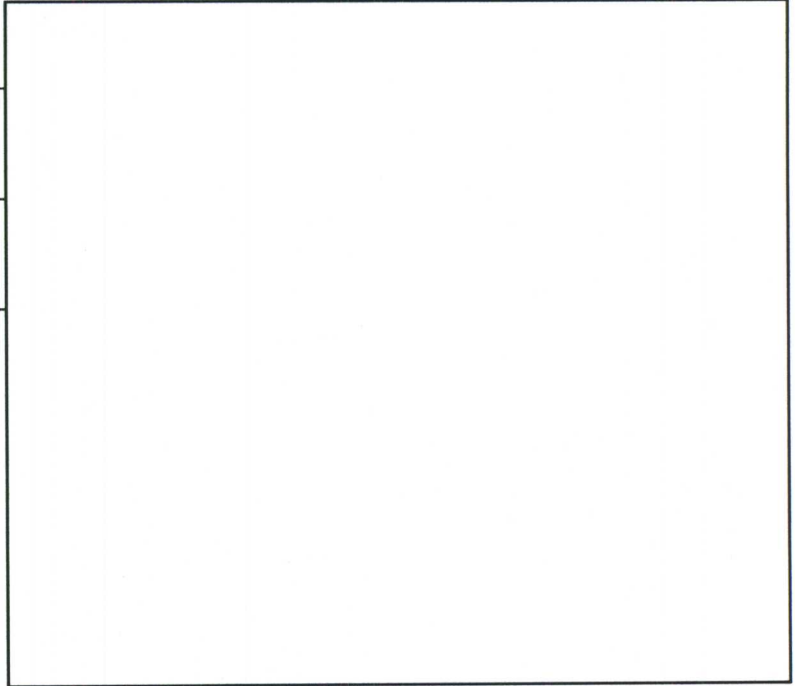
Sample location(s):
Location(s) in Building

Provide Drawing of Sample

Sample # _____ - _____

Sample # _____ - _____

Sample # _____ - _____



Did the occupants **not** follow any of the “Instructions for Residents” directions? *Yes / No*

If so, describe modifications: _____

Part VII - Weather Conditions

Outside temperature at time of sampling: _____ °F

Expected high temperature: _____ °F Expected low temperature: _____ °F

Humidity: _____ Barometric pressure: _____ Ozone:
Red/Orange alert?

Was there significant precipitation within 12 hours of (or during) the sampling event?
Yes / No

Wind direction and speed

Describe the general weather conditions:

Fill out and attach DNREC SIRB Vapor Intrusion Guidance Document Field Sampling Form 1 to this form.

Part VIII – General Observations

Provide any information that may be pertinent to the sampling event and may assist in the data interpretation process.
