

CANADIAN SOIL VAPOUR QUALITY GUIDELINES FOR THE PROTECTION OF HUMAN HEALTH

TABLE OF CONTENTS

LIST OF ABBREVIATIONS.....	I
DOCUMENT OVERVIEW.....	1
1.0 SUMMARY OF THE SOIL VAPOUR QUALITY GUIDELINE PROTOCOL	1
1.1 Chemicals of Concern.....	3
1.2 Environmental Fate and Behaviour in the Sub-surface	3
1.3 Guideline Derivation.....	4
1.3.1 Soil Vapour Quality Guidelines for Human Health.....	4
1.3.2 Non-Toxicity Considerations and Management Limits.....	5
1.4 Use of Canadian Soil Vapour Quality Guidelines	6
1.5 Final Soil Vapour Quality Guidelines.....	8
2.0 CANADIAN SOIL VAPOUR QUALITY GUIDELINES	8
3.0 REFERENCES	57
APPENDIX A: REVISION TO THE SOIL VAPOUR PROTOCOL	59

LIST OF FIGURES

Figure 1: Key receptors and exposure pathways for soil vapour quality guidelines.....	2
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LIST OF SOIL VAPOUR GUIDELINE TABLES

Aniline (CAS RN 62-53-3).....	9
Benzene (CAS RN- 71-43-2).....	11
Chlorinated Benzenes	
Monochlorobenzene (CAS RN 108-90-7).....	12
1,2-Dichlorobenzene (CAS RN 95-50-1).....	13
1,4-Dichlorobenzene (CAS RN 106-46-7).....	14
1,2,3-Trichlorobenzene (CAS RN 87-61-6).....	15
1,2,4-Trichlorobenzene (CAS RN 120-82-1).....	16
1,3,5-Trichlorobenzene (CAS RN 108-70-3).....	17
1,2,3,4-Tetrachlorobenzene (CAS RN 634-66-2).....	18
1,2,3,5-Tetrachlorobenzene (CAS RN 634-90-2).....	19
1,2,4,5-Tetrachlorobenzene (CAS RN 95-94-3).....	19
Pentachlorobenzene (CAS RN 608-93-5).....	21
Chlorinated Ethanes	
1,2-Dichloroethane (CAS RN 107-06-2).....	22
1,1,1-Trichloroethane (CAS RN 71-55-6).....	23
1,1,2,2-Tetrachloroethane (CAS RN 79-34-5).....	24
Chlorinated Ethenes	
Monochloroethene (Vinyl chloride) (CAS RN 75-01-4).....	25
1,1,2-Trichloroethene (TCE) (CAS RN 79-01-6).....	26
1,1,2,2-Tetrachloroethene (PCE) (CAS RN 127-18-4).....	27

39	Chlorinated Phenols	
40	2-Chlorophenol (CAS RN 95-57-8).....	28
41	2,4-Dichlorophenol (CAS RN 120-83-2).....	29
42	2,4,6-Trichlorophenol (CAS RN 88-06-2).....	29
43	2,3,4,6-Tetrachlorophenol (CAS RN 58-90-2).....	31
44	Ethylbenzene (CAS RN 100-41-4).....	32
45	Halogenated Methanes	
46	Dichloromethane (CAS RN 75-09-2).....	33
47	Trichloromethane (CAS RN 67-66-3).....	34
48	Tetrachloromethane (CAS RN 56-23-5).....	35
49	Bromodichloromethane (CAS RN 75-27-4).....	36
50	Dibromochloromethane (CAS RN 124-48-1).....	37
51	n-Hexane (CAS RN 110-54-3).....	38
52	Methanol (CAS RN 67-56-1).....	39
53	Methyl tertiary-butyl ether (MTBE) (CAS RN 1634-04-4).....	39
54	Petroleum Hydrocarbon Fractions	
55	Petroleum hydrocarbon fraction F1.....	41
56	Petroleum hydrocarbon fraction F2.....	43
57	Phenol (CAS RN 108-95-2).....	48
58	Polycyclic Aromatic Hydrocarbons	
59	Acenaphthene (CAS RN 83-32-9).....	49
60	Benzo(a)pyrene (CAS RN 50-27-8).....	49
61	Fluorene (CAS RN 86-73-7).....	51
62	2-Methylnaphthalene (CAS RN 91-57-6).....	52
63	Naphthalene (CAS RN 91-20-3).....	53
64	Styrene (CAS RN 100-42-5).....	54
65	Toluene (CAS RN 108-88-3).....	55
66	Xylenes.....	56

67 LIST OF ABBREVIATIONS

68	AF	allocation factor
69	AO	aesthetic objective
70	BAF	bioattenuation factor
71	BTEX	benzene, toluene, ethylbenzene and xylenes
72	CCME	Canadian Council of Ministers of the Environment
73	CGWQG	Canadian Groundwater Quality Guideline
74	CSoQG	Canadian Soil Quality Guideline
75	CSVQG	Canadian Soil Vapour Quality Guideline
76	HC	Health Canada
77	IUR	inhalation unit risk
78	K _{OC}	organic carbon-water partition coefficient
79	LEL	lower explosive limit
80	PAH	polycyclic aromatic hydrocarbon
81	PHC	petroleum hydrocarbons
82	PQL	practical quantitation limit
83	RSC	risk-specific concentration
84	RSD	risk-specific dose
85	SVQG	soil vapour quality guideline
86	SVQG _F	soil vapour quality guideline final
87	SVQG _{IAQ—basement}	soil vapour quality guideline for the protection of indoor air quality, building with basement
88		
89	SVQG _{IAQ—slab}	soil vapour quality guideline for the protection of indoor air quality, slab on grade building
90		
91	SVQG _M	soil vapour quality guideline for management considerations
92	SVQG _{OAQ}	soil vapour quality guideline for the protection of outdoor air quality
93	SVQG _{SS}	soil vapour quality guideline for sub-slab or shallow soil vapour (within 1 m of building foundation)
94		
95	TC	tolerable concentration
96	TDI	tolerable daily intake
97	TRV	toxicological reference value

98 DOCUMENT OVERVIEW

99 This document is divided into three sections: (1) a summary of the protocol used to derive the
100 Canadian Soil Vapour Quality Guidelines (CSVQGs), (2) separate guideline tables for 40 organic
101 compounds and the sub-fractions of petroleum hydrocarbon (PHC) fractions F1 and F2 as defined
102 by the Canadian Council of Ministers of the Environment (CCME) (2008) and (3) references. In
103 addition, Appendix A describes the revised approach to the use of dose-averaging for the indoor
104 air quality pathway. Substance-specific chemical property information used to derive the
105 guidelines is provided in the *Canadian Groundwater Guidelines for the Protection of*
106 *Environmental and Human Health*, Appendices C and D (CCME 2026). Detailed guiding
107 principles and guideline development processes are available in *A Protocol for the Derivation of*
108 *Environmental and Human Health Soil Quality Guidelines* (CCME 2006), referred to herein as the
109 soil protocol, and *A Protocol for the Development of Soil Vapour Quality Guidelines for Protection*
110 *of Human Exposures via Inhalation of Vapours* (CCME 2014), referred to herein as the soil vapour
111 protocol.

112 1.0 SUMMARY OF THE SOIL VAPOUR QUALITY GUIDELINE 113 PROTOCOL

114 CCME has established a framework for assessing and remediating contaminated sites in Canada
115 and has developed scientific tools to provide guidance and promote consistency across the country.
116 The CSVQGs are a part of the suite of Canadian Environmental Quality Guidelines (available at
117 <https://ccme.ca/en/resources/canadian-environmental-quality-guidelines>). These soil vapour
118 guidelines may be used at contaminated sites in conjunction with the Canadian Soil Quality
119 Guidelines (CSoQGs) and Canadian Groundwater Quality Guidelines (CGWQGs) and other
120 relevant CEQGs, as determined by the applicable jurisdictional regulatory framework.

121 The CSVQGs are intended to protect human health. Procedures for deriving SVQGs are
122 documented in the soil vapour protocol, which is based on the soil protocol. The soil vapour
123 protocol represents a separate and abbreviated version of the soil protocol, presenting key policy
124 and technical elements needed to derive soil vapour-specific guidelines.

125 SVQGs are developed to maintain indoor and outdoor air quality for the protection of human
126 health. At this time, methods for evaluating the potential exposures of ecological receptors (e.g.,
127 wildlife exposure to soil vapour in underground burrows) are not considered sufficiently developed
128 to allow for the derivation of SVQGs to protect environmental health.

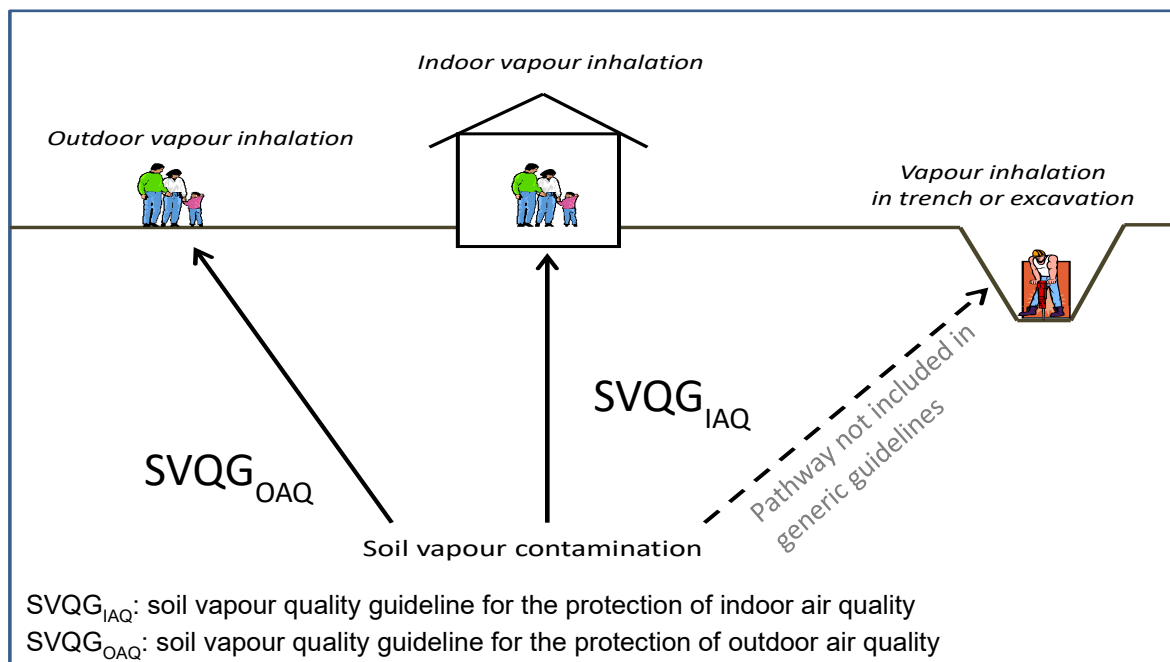
129 CSoQGs and CGWQGs are developed using the soil protocol and *A Protocol for the Derivation*
130 *of Groundwater Quality Guidelines for Use at Contaminated Sites* (CCME 2015; referred to herein
131 as the groundwater protocol), and include a consideration of the protection of indoor air for
132 chemicals that are sufficiently volatile to exceed an inhalation toxicity benchmark. However, the
133 derivations include the calculation of a soil vapour concentration as an intermediate step prior to
134 partitioning back to a soil or groundwater concentration. The partitioning calculation from soil
135 vapour to soil or groundwater includes significant assumptions that can result in the soil or
136 groundwater concentration being poorly representative at many sites. SVQGs have been developed

to allow for the direct screening of soil vapour data without the need for partitioning equations and their associated uncertainties. While this approach limits uncertainties related to partitioning, soil vapour samples are associated with a high degree of spatial and temporal variability and soil vapour intrusion assessments should take this into consideration, including through the use of multiple lines of evidence, as discussed in Section 1.4.

Figure 1 shows the receptors and exposure pathways considered for the development of the soil vapour quality guidelines. While the soil and groundwater protocols only include consideration of the indoor air pathway, the soil vapour protocol includes the migration of soil vapour into outdoor air as a potential exposure pathway to be considered in the development of the SVQGs. While there is a lack of validation for the outdoor air pathway model and the pathway does not drive any of the SVQGs, it is included in case the soil to indoor air pathway is removed in Tier 2 or as allowed by a jurisdiction. The soil to outdoor air pathway should not be managed without consideration of the preservation of ecological functioning.

The migration of soil vapours into trenches or excavations and inhalation by construction or utility workers is also considered to be an operative exposure pathway in the soil vapour protocol. However, due to the highly site-specific nature of this pathway, it is not included in the derivation of generic or Tier 1 guidelines. Soil vapours in trenches and excavations should be addressed in a Tier 2 or Tier 3 risk assessment.

Figure 1: Key receptors and exposure pathways for soil vapour quality guidelines



The lower of the SVQGs for the protection of indoor air quality (SVQG_{IAQ}) and for the protection of outdoor air quality (SVQG_{OAQ}) becomes the final generic soil vapour guideline (SVQG_F) unless a non-toxicity consideration or management limit is considered appropriate. These guidelines are considered generic or Tier 1 guidelines, as default or “generic” assumptions are used. The generic guidelines can be adjusted to account for a limited number of site-specific conditions to develop

179 Tier 2 objectives. Finally, if required, a site-specific risk assessment may be conducted to develop
180 Tier 3 site-specific objectives.

181 SVQGs for sub-slab or shallow soil vapour samples (i.e., vapour collected directly below or within
182 1 m of a building foundation) (SVQG_{SS}) are also provided in the guideline tables, but they are for
183 convenience only and are not included in the derivation of the final guideline.

184 One method of modifying guidelines at Tier 2 based on site-specific conditions is the elimination
185 of guidelines for exposure pathways that are not operative at or near a contaminated site. Individual
186 jurisdictions may specify requirements for the elimination of specific pathways. Tier 2 guidelines
187 may also be established by re-calculating guidelines with site-specific values substituted for certain
188 default model parameters. The derivation of Tier 2 guidelines could result in equivalent protection
189 provided by numerically higher guidelines. For more information on setting Tier 2 site-specific
190 objectives, see Section 1.1 of the soil protocol, suggestions presented in the soil vapour protocol,
191 and *Guidance Manual for Developing Site-Specific Soil Quality Remediation Objectives for*
192 *Contaminated Sites in Canada* (CCME 1996).

193 **1.1 Chemicals of Concern**

194 The chemical properties and human health benchmarks used to develop the CSVQGs are the same
195 as those used to develop the CGWQGs for the protection of indoor air (CCME 2026).

196 As detailed in the soil vapour protocol, the vapour inhalation pathway is considered for any
197 chemical for which vapour concentrations can exceed risk-based concentration limits after
198 accounting for a *de minimis* amount of attenuation from the subsurface to the breathing zone (as
199 described in Appendix D of CCME 2014). This definition accounts for the fact that some chemicals
200 with low vapour pressures and Henry's law constants are nevertheless capable of posing a potential
201 risk because of their high toxicity, while some highly volatile compounds are not capable of posing
202 a risk via inhalation because of their insufficient toxicity.

203 **1.2 Environmental Fate and Behaviour in the Sub-surface**

204 Chemicals will exhibit different fate and transport characteristics in the environment by virtue of
205 different physical and chemical properties. Four primary processes control the fate and behaviour
206 of a chemical in the sub-surface: (1) ability to form a dissolved phase into groundwater; (2)
207 adsorption to soil and sediment affecting chemical mobility; (3) volatilization into the gas phase,
208 coupled with diffusive and advective transport; and (4) biodegradation and chemical persistence.

209 The tendency to partition between water and air (represented by Henry's law constant) is
210 approximated as the ratio of a chemical's abundance in the gas phase (i.e., vapour pressure) to that
211 in the aqueous phase (i.e., solubility) at equilibrium. Henry's law constants provide an indicator
212 of a chemical's tendency to volatilize from water to air. Chemicals with a relatively higher Henry's
213 law constant are usually more volatile, such as n-hexane and benzene, toluene, ethylbenzene and
214 xylenes (BTEX) compared to polycyclic aromatic hydrocarbons (PAHs). As stated by

Environment Canada (EC) (2005), temperature significantly influences the partitioning of a chemical between the air and water phases. As the Henry's law constant increases with increasing temperature, the loss of dissolved-phase chemicals in groundwater to the vapour phase in soil through volatilization also increases. However, groundwater temperature does not fluctuate as much as ambient air temperature and therefore cold ambient air temperatures may not be an accurate indicator of subsurface conditions and the potential for subsurface vapour transport.

Chemicals with a high organic carbon partition coefficient (K_{OC}) tend to sorb strongly to soil organic matter and therefore can be less mobile in the environment relative to chemicals with a lower K_{OC} , given the same soil organic matter content. The reported K_{OC} values for soluble organic chemicals of concern span a few orders of magnitude. PAHs with greater than two rings are an example of high- K_{OC} , low-mobility compounds, while trihalomethanes and BTEX are examples of relatively high-mobility, low- K_{OC} compounds.

Certain contaminants may potentially degrade into chemicals which are more toxic or mobile than the parent compound. The rate and extent of degradation of the parent compound may be affected by site-specific factors, such as electron acceptor availability and redox conditions. Currently there is no formal method for adjusting SVQGs to reflect degradation to more toxic or mobile compounds. However, where data support doing so, accounting for degradation to more toxic compounds could be considered on a chemical-specific basis and jurisdictions could recommend additional assessment of the degradation products.

1.3 Guideline Derivation

The development of SVQGs is based on both scientific and management considerations that may impact potential risks to human receptors. Where appropriate, separate guidelines are developed for coarse- and fine-textured soils.¹ Detailed guideline development processes are discussed in the soil vapour protocol.

1.3.1 Soil Vapour Quality Guidelines for Human Health

SVQGs for the protection of human health are developed to ensure that contaminants present at the guideline concentration will result in no appreciable human health risk. For Tier 1 guideline development, CCME assumes a chronic exposure scenario at the guideline value (i.e., lifetime exposure). Human health guidelines for non-threshold carcinogenic chemicals are derived based on specified incremental risk above background exposure for vapour inhalation. Canadian jurisdictions generally employ a 10^{-5} or 10^{-6} incremental lifetime cancer risk as a *de minimis* risk level. For convenience, CCME provides guidelines for the protection of human health at both the 10^{-5} and 10^{-6} incremental risk levels. Individual jurisdictions may apply guidelines based on either one of these risk levels.

¹ Coarse-grained soil contains greater than 50% by mass particles greater than 75 μm mean diameter ($D_{50} > 75 \mu\text{m}$). Fine-grained soil contains greater than 50% by mass particles equal to or less than 75 μm mean diameter ($D_{50} \leq 75 \mu\text{m}$).

SVQG_{IAQ}s are calculated using a model developed by Johnson and Ettinger (1991) (the J&E model), which is based on a number of assumptions that, if not met, can invalidate the use of the model and, thus, the SVQG_{IAQ}. A list of limitations (or precluding conditions) that may invalidate model assumptions is presented in Section 1.4 as well as in the soil vapour protocol. Guideline users should assess whether limiting conditions are present at a site prior to using the SVQG_{IAQ}. If limitations are present, it may be possible to evaluate the indoor air pathway using the SVQG_{SS} values calculated using the default attenuation factors of 0.01 for a commercial building and 0.03 for a residential building, if appropriate (e.g., no earthen basement or preferential pathways or presence of gas under pressure). Sub-slab or shallow soil vapour guideline values are provided for convenience on the SVQG factsheets. However, some sites may require building specific human health risk assessment and/or alternative models to assess site conditions. Health Canada (HC) has published a vapour intrusion assessment guidance (HC 2023) to support site-specific evaluation of the vapour intrusion pathway.

SVQGs are derived separately for buildings with a basement and for buildings with a foundation built as a concrete slab directly on the ground surface with no basement (slab-on-grade). For commercial land uses, only slab-on-grade construction is considered (CCME 2014).

SVQGs are derived based on chemical-specific toxicological reference values (TRVs). If a threshold inhalation TRV is available, a tolerable concentration (TC) is used to evaluate chemical toxicity to humans; if a non-threshold inhalation TRV is available, a risk-specific concentration (RSC) is used. If a TC or RSC is not available, they can be extrapolated from a tolerable daily intake (TDI) or a risk-specific dose (RSD), respectively, if the mode of toxicity supports the extrapolation of an inhalation TRV from an oral TRV (CCME 2006, 2014). Human health TRVs developed or endorsed by HC or CCME are preferred for guideline derivation purposes, if available; however, when not available, TRVs from other reliable sources are used, such as the United States Environmental Protection Agency (US EPA). SVQGs are calculated separately for two land use scenarios: a combined agricultural/residential guideline reflecting an individual residing at the site full-time, and a combined commercial/industrial guideline reflecting a typical occupancy for these land uses, as described in the soil vapour protocol and as modified in the *Canadian Groundwater Quality Guidelines for the Protection of Environmental and Human Health* (CCME 2026). If toxicity is evaluated using a TC or RSC, receptor characteristics are unnecessary. If a TC or RSC is extrapolated from a TDI or RSD, characteristics for a toddler are used for all land uses. Some jurisdictions may allow the indoor air exposure pathway to be eliminated if there are no potential existing or future receptors within the vicinity of the contamination (CCME 2014).

1.3.2 Non-Toxicity Considerations and Management Limits

The development of soil vapour quality management considerations is required to reflect any additional concern associated with the chemical of concern beyond toxicity to human receptors. As discussed in the soil vapour protocol, for chemicals that are potentially explosive, the SVQG for management consideration (SVQG_M) should include a consideration of safety; 50% of the lower explosive limit (LEL) is recommended. Where available the 50% LEL is provided in the SVQG factsheets; however, final guideline values are not capped at the 50% LEL. Risk managers/site assessors should use their professional judgement and knowledge of the site to

assess whether the potential for fire and explosion hazards is present. In addition, some jurisdictions may use a different % LEL to define an explosive or hazardous condition (e.g., HC [2023] identifies 10% LEL). Where available, aesthetic objectives (AO) for odour could also be considered as management limits.

1.4 Use of Canadian Soil Vapour Quality Guidelines

The intended use of the CSVQGs is to assess in-place contaminants in soil vapour. They represent “clean down to” levels at contaminated sites and should not be interpreted as “pollute up to” levels for less contaminated sites. They are not intended to evaluate discharges to air or for application at the point of exposure (e.g., indoor air).

The guidelines should be used in combination with acceptable sampling and analytical methods. Guidance documents on sampling methods, site characterization, and analytical guidance have been published by CCME (CCME 2016a, 2016b, 2016c, 2016d).

Multiple lines of evidence are recommended to assess the soil vapour to indoor air pathway.

This means that sample results for various environmental media (e.g., groundwater, soil vapour, sub-slab or shallow soil vapour, indoor air and outdoor air) should be considered and analysed in conjunction with information regarding subsurface and building conditions. Guidance for completing soil vapour intrusion assessments using multiple lines of evidence is provided in CCME (2016a) and HC (2023).

SVQGs are developed using a specific set of assumptions and models. In some cases, the assumptions used to derive these guidelines may not be protective for particularly sensitive sites. Any of the following conditions may invalidate some of the assumptions used to develop the SVQGs:

- The source-to-building separation distance (for indoor air) or source-to-ground surface separation distance (for outdoor air) is less than 1 m. For indoor air, soil vapour screening may be done through sub-slab or shallow soil vapour samples and compared to the SVQG_{SS} for sub-slab/shallow soil vapour values instead of the SVQG_F.
- Preferential pathways (e.g., wet basements, highly permeable and atypical utility conduits, fractured media immediately below the building, etc.) are present in the subsurface that provide a direct conduit from the vapour source to the inside of the building over and above that of a typical residential building.
- Building features, such as earthen floors or unusually low air exchange rates, that are not consistent with the assumptions of the model.
- Methanogenic conditions (or anaerobic conditions) are observed in close proximity to the building foundation (possible gas pressure-driven flow or explosion risk).

If limitations specific to the J&E model for the indoor air quality pathway are present, information regarding assumptions and what to do is available in Part C, section 3.2 of the groundwater protocol; Part A, section 3.3, Part C, section 3.1 and Appendices C and E of the soil vapour

protocol; Appendix E of the soil protocol, as well as HC (2023) and British Columbia Ministry of Environment and Climate Change Strategy (BC ENV) (2023).

There are additional limitations to consider for PHC fractions F1 and F2 (excluding aviation fuel), BTEX, naphthalene and hexane which utilize a bioattenuation factor (BAF). A BAF = 10 was selected for development of Tier 1 guidelines for these substances; however, the BAF is only applicable if soils beneath the building are unsaturated and biologically active (i.e., oxygen levels are >5% by volume and soil moisture content is >4% dry weight) (CCME 2014, HC 2023). If site conditions suggest low oxygen levels, data to demonstrate oxygen distribution is recommended. For example, size of the contaminant source should be considered as large sources may have a greater oxygen demand (HC 2023) which could result in lower biodegradation. Presence of an impermeable surface cover or cap might impact both oxygen levels and moisture content (BC ENV 2023, HC 2023). Furthermore, for F2, naphthalene and hexane for which there is greater uncertainty in their biodegradation compared to F1 and BTEX, jurisdictions may require additional supporting evidence. This could include soil vapour data from nested wells demonstrating attenuation along with indoor air data showing that indoor air concentrations are below what is predicted without consideration of biodegradation (HC 2023). Part C, section 3.1.1 and Appendix E of the soil vapour protocol and section 7.6 and 7.7 of HC (2023) provide further information on factors affecting biodegradation and the use of a BAF = 10 for these chemicals. Use of a higher BAF may be acceptable when deriving Tier 2 or Tier 3 guidelines if additional site-specific information is available, however the applicable jurisdiction should be consulted.

The SVQGs for PHC F1 and F2 are provided separately for each of the aromatic and aliphatic subfractions. It is recommended that analysis of soil vapour samples be completed for individual subfractions to better represent the composition of the petroleum product and environmental conditions at the site. Soil vapour analysis is discussed in CCME 2016a. However, when interpreting soil vapour data, results for PHC subfractions which rely on the same TRVs should be summed and compared to the SVQG. Due to differences in background indoor air concentrations, subfractions using the same TRV have minor variations in SVQG values. Therefore, to facilitate the recommended approach, the lowest SVQG for each of the subfractions using the same TRV is selected as the guideline for all subfractions using the TRV.

Similarly, the concentration of all PHC subfractions within each of PHC F1 and F2 should be summed prior to comparison to the 50% LEL, as it applies to the full fraction.

PHC F1 and PHC F2 do not include BTEX and naphthalene, respectively (CCME 2008). BTEX and naphthalene should be analyzed separately as target chemicals and results compared to their individual soil vapour guidelines. It is not mandatory to subtract these target chemicals from the results of their associated PHC subfraction results, but if the subtraction is completed it should be clearly documented by the laboratory in the certificate of analysis and in the assessment report.

Below are some deviations from the soil protocol associated with the development of SVQGs:

- SVQGs are not developed separately for the four land uses defined in the soil protocol. Instead, a single guideline is developed for land uses with the same exposure scenario and building characteristics (i.e., agricultural/residential and commercial/industrial). Jurisdictions may allow

for the exclusion of certain exposure pathways based on land use, potentially subject to offset distances to more sensitive land uses.

- The outdoor air pathway is not considered in the development of the SoQGs but is considered in the development of the SVQG.
- Certain input parameters for the fate and transport models were updated to reflect recent improvements in the science and research, as noted in the *Canada-wide Standard for Petroleum Hydrocarbons in Soil* (CCME 2008) and in the soil vapour protocol (e.g., fixed soil gas flow rate [Q_{soil}] values of 10 L/minute for coarse-textured soil and 1 L/minute for fine- and medium-textured soils are used instead of the perimeter crack model).
- The approach to dose-averaging of threshold TRVs for the commercial and industrial land use exposure scenario was updated to reflect the approach recommended by HC (2021) and as described in Appendix A and used in the CGWQGs (CCME 2026). This approach limits the use of dose averaging in certain situations.

1.5 Final Soil Vapour Quality Guidelines

The lower of the guidelines established for human health becomes the $SVQG_F$ for a given chemical. Professional judgement is used at the time of guideline development on whether to adjust the $SVQG_F$ based on a management limit.

Occasionally, a calculated guideline may be lower than background concentrations or practical quantitation limits (PQL). It is expected that for most volatile chemicals, background concentrations in soil vapour will not be available and the default soil vapour background concentration is assumed to be 0 mg/m^3 . If background soil vapour concentrations are available, jurisdictions have the option to set site-specific or regional guidelines that consider naturally occurring background concentrations. A candidate $SVQG_F$ should also be checked against the current PQL of available analytical methods achievable. Where the $SVQG_F$ is below the limit of practical quantitation available, jurisdictions will have to consider how to incorporate PQLs in their implementation of the guideline.

2.0 CANADIAN SOIL VAPOUR QUALITY GUIDELINES

CSVQGs for 40 chemicals of concern and for the sub-fractions of PHC fractions F1 and F2 (CCME 2008) are presented in the following tables. Each table presents the CSVQGs for an individual chemical or PHC subfraction for two sets of land use scenarios, one or two building types and two soil textures. In addition, human health guidelines for non-threshold carcinogenic chemicals are presented at both the 10^{-5} and 10^{-6} incremental risk levels.

The $SVQG_F$ is presented in the top row of each table. As noted previously, $SVQGs_{ss}$ are also noted in factsheets, but they are provided for convenience only and are not included in derivation of the $SVQG_F$. A final guideline may be labelled as provisional to reflect uncertainty in the guideline

development process, such as when the final guideline is based on an inhalation guideline developed using an oral TRV.

At a site, both indoor and outdoor pathways (represented as pathway-specific guidelines in the table) are considered applicable at Tier 1. It may be possible to exclude or modify certain pathways at Tier 2. Due to the mobility of soil vapour, particular care should be applied when excluding exposure pathways based on the location of existing buildings or on land use. Consult the jurisdiction for specific requirements for offset distances from more sensitive land uses and potential future buildings. The soil vapour protocol provides an introduction to potential Tier 2 adjustments. More detailed Tier 2 guidance can be found in the *Guidance Manual for Developing Site-Specific Soil Quality Remediation Objectives for Contaminated Sites in Canada* (CCME 1996).

CCME has not developed scientific criteria documents specifically for this large suite of SVQGs. Background information for many chemicals in this document may be found in the existing scientific criteria documents for various CSoQGs or Canadian water quality guidelines. This section and Appendices C and D of the CGWQGs (CCME 2026) contain the input parameters needed to derive the SVQGs. Readers may consult the equations in the soil vapour protocol to understand how these physical and chemical parameters contribute to the guideline calculation, or they may replicate the individual guideline values presented here. Additionally, the footnote section of individual guideline tables may contain information on specific features or decisions related to the chemicals. By documenting the most essential elements of guideline derivation, CCME has been able to produce a large suite of SVQGs. For more detailed information on derivation of the guidelines, including models and assumptions, refer to the soil and soil vapour protocols.

Additional information that is needed for guideline derivation but not presented above is as follows:

- Certain input parameters and methods unique to PHC fractions F1 and F2 can be found in the *Canada-wide Standard for Petroleum Hydrocarbons (PHC) in Soil: Scientific Rationale Supporting Technical Document* (CCME 2008) and Table C-10 of the *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (AEP 2019).
- Allocation Factor (AF) (unitless) = 0.5 for PHC F1 and F2 subfractions, consistent with the soil AF for F1 and F2 in the Canada-wide Standard for PHC in soil (CCME 2008). For all other chemicals, AF = 0.2, which is consistent with the default value in the soil vapour protocol.

The SVQGs are presented alphabetically, with some chemicals placed in groupings: chlorinated benzenes (10 chemicals), chlorinated ethanes (three chemicals), chlorinated ethenes (three chemicals), chlorinated phenols (four chemicals), halogenated methanes (five chemicals), subfractions of PHC fractions F1 and F2, and polycyclic aromatic hydrocarbons (five chemicals).

Soil Vapour Quality Guidelines for Aniline (CAS RN 62-53-3) (mg/m³)

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline: 10⁻⁵ incremental risk (provisional*)	0.13	0.95	0.39	2.8
Guideline: 10⁻⁶ incremental risk (provisional*)	0.13	0.95	0.39	2.8
Human health guidelines: 10 ⁻⁵ incremental risk				
Protection of indoor air quality (basement) ◇	0.13 ♦	0.95 ♦	--	--
Protection of indoor air quality (slab on grade) ◇	0.17 ♦	1 ♦	0.39 ♦ •	2.8 ♦ •
Protection of outdoor air quality ◇	31 ♦	39 ♦	31 ♦	39 ♦
Human health guidelines: 10 ⁻⁶ incremental risk				
Protection of indoor air quality (basement) ◇	0.13 ♦	0.95 ♦	--	--
Protection of indoor air quality (slab on grade) ◇	0.17 ♦	1 ♦	0.39 ♦ •	2.8 ♦ •
Protection of outdoor air quality ◇	31 ♦	39 ♦	31 ♦	39 ♦
Management considerations				
Lower explosive limit (50%) †		23,000		
Protection of indoor air quality (sub-slab/shallow)				
10 ⁻⁵ incremental risk ◇		0.007 ♦		0.020 ♦ •
10 ⁻⁶ incremental risk ◇		0.007 ♦		0.020 ♦ •

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

* Provisional guideline: A soil vapour quality guideline developed using an inhalation toxicological reference value (TRV) extrapolated from an oral TRV is considered provisional.

◇ Value represents the lowest of either carcinogenic or non-carcinogenic guidelines, if available.

♦ Presented value is based on the non-carcinogenic risk.

• A high-level screening was not completed as no air quality benchmark was available; therefore, dose averaging was not used (see [Appendix A](#)).

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

**Canadian Soil Vapour Quality Guidelines
for the Protection of Human Health**

Benzene

Soil Vapour Quality Guidelines for Benzene (CAS RN 71-43-2) (mg/m³)

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline: 10⁻⁵ incremental risk	4.1	30	12	90
Guideline: 10⁻⁶ incremental risk	0.41	3	1.2	9
Human health guidelines: 10 ⁻⁵ incremental risk				
Protection of indoor air quality (basement) ◇	4.1	30	--	--
Protection of indoor air quality (slab on grade) ◇	5.1	32	12	90
Protection of outdoor air quality ◇	910	1700	910	1700
Human health guidelines: 10 ⁻⁶ incremental risk				
Protection of indoor air quality (basement) ◇	0.41	3	--	--
Protection of indoor air quality (slab on grade) ◇	0.51	3.2	1.2	9
Protection of outdoor air quality ◇	91	170	91	170
Management considerations				
Lower explosive limit (50%) †		21,000		
Protection of indoor air quality (sub-slab/shallow)				
10 ⁻⁵ incremental risk ◇		0.021		0.063
10 ⁻⁶ incremental risk ◇		0.002		0.006

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- the pathway is not considered for the selected land use.

◇ Value represents the lowest of either carcinogenic or non-carcinogenic guidelines, if available.

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

**Canadian Soil Vapour Quality Guidelines
for the Protection of Human Health**

Monochlorobenzene

Soil Vapour Quality Guidelines for Monochlorobenzene (CAS RN 108-90-7) (mg/m³)

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline	1.4	9.9	15	110
Human health guidelines				
Protection of indoor air quality (basement)	1.4	9.9	--	--
Protection of indoor air quality (slab on grade)	1.8	11	15 •	110 •
Protection of outdoor air quality	360	660	360	660
Management considerations				
Lower explosive limit (50%) †		NA		
Protection of indoor air quality (sub-slab/shallow)	0.066		0.72 •	

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

NA = not available.

• A high-level screening did not flag any concern with the use of dose averaging for this substance (see [Appendix A](#)). However, there is some uncertainty associated with the use of dose averaging as a full toxicological review was not conducted for each substance, therefore these values should be used with caution and other lines of evidence should also be employed to assess risks. Jurisdictional authorities should be consulted for further guidance.

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

**Canadian Soil Vapour Quality Guidelines
for the Protection of Human Health**

1,2-Dichlorobenzene

Soil Vapour Quality Guidelines for 1,2-Dichlorobenzene (CAS RN 95-50-1) (mg/m³)

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline (provisional*)	130	870	380	2,600
Human health guidelines				
Protection of indoor air quality (basement) #	130	870	--	--
Protection of indoor air quality (slab on grade) #	170	950	380 •	2,600 •
Protection of outdoor air quality #	39,000	73,000	39,000	73,000
Management considerations				
Lower explosive limit (50%) †		NA		
Protection of indoor air quality (sub-slab/shallow) #	5.7		17 •	

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

NA = not available.

* Provisional guideline: A soil vapour guideline developed using an inhalation toxicological reference value (TRV) extrapolated from an oral TRV is considered provisional.

Tolerable concentration (TC) extrapolated from tolerable daily intake (TDI).

• A high-level screening was not completed as only an acute air quality benchmark was available; therefore, no dose averaging was used (see [Appendix A](#)).

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

**Canadian Soil Vapour Quality Guidelines
for the Protection of Human Health**

1,4-Dichlorobenzene

Soil Vapour Quality Guidelines for 1,4-Dichlorobenzene (CAS RN 106-46-7) (mg/m³)

Guideline	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
	9.1	60	95	650
Human health guidelines II				
Protection of indoor air quality (basement)	9.1	60	--	--
Protection of indoor air quality (slab on grade)	12	66	95 •	650 •
Protection of outdoor air quality	2,800	5,100	2,800	5,100
Management considerations				
Lower explosive limit (50%) †		NA		
Protection of indoor air quality (sub-slab/shallow)		0.39		4.3 •

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

NA = not available

II There are no cancer toxicological reference values for this substance in HC (2021); therefore, this substance is classified as a non-carcinogen for the purposes of the Canadian Soil Vapour Quality Guidelines (CSVQGs). However, HC (2021) notes that it is a possible human carcinogen.

• A high-level screening did not flag any concern with the use of dose-averaging (see [Appendix A](#)). However, there is some uncertainty associated with the use of dose-averaging as a full toxicological review was not conducted for each substance; therefore, these values should be used with caution and other lines of evidence should be considered when assessing risks. Jurisdictional authorities should be consulted for further guidance.

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

529 **Soil Vapour Quality Guidelines for 1,2,3-Trichlorobenzene (CAS RN 87-61-6) (mg/m³)**

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline (provisional*)	0.54	3.2	1.5	9.4
Human health guidelines				
Protection of indoor air quality (basement) #	0.54	3.2	--	--
Protection of indoor air quality (slab on grade) #	0.75	3.6	1.5 •	9.4 •
Protection of outdoor air quality #	190	360	190	360
Management considerations				
Lower explosive limit (50%) †		NA		
Protection of indoor air quality (sub-slab/shallow) #	0.020		0.060 •	

532 **Notes:**

533 Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

534 -- = the pathway is not considered for the selected land use.

535 NA = not available.

536 * Provisional guideline: A soil vapour guideline developed using an inhalation toxicological reference value (TRV) extrapolated from
537 an oral TRV is considered provisional.

538 # Tolerable concentration (TC) extrapolated from tolerable daily intake (TDI).

539 • A high-level screening could not be completed as only an acute air quality benchmark was available; therefore, no dose averaging
540 was used ([Appendix A](#)).

541 † This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in
542 presence of an ignition source (arc, flame, heat).

**Canadian Soil Vapour Quality Guidelines
for the Protection of Human Health**

1,2,4-Trichlorobenzene

Soil Vapour Quality Guidelines for 1,2,4-Trichlorobenzene (CAS RN 120-82-1) (mg/m³)

Guideline	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
	1.2	7.3	3.5	22
Human health guidelines				
Protection of indoor air quality (basement)	1.2	7.3	--	--
Protection of indoor air quality (slab on grade)	1.7	8.3	3.5 •	22 •
Protection of outdoor air	450	830	450	830
Management considerations				
Lower explosive limit (50%) †		NA		
Protection of indoor air quality (sub-slab/shallow)	0.046		0.14 •	

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

NA = not available.

• A high-level screening was not completed as only an acute air quality benchmark was available; therefore, no dose averaging was used (see [Appendix A](#))

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

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Soil Vapour Quality Guidelines for 1,3,5-Trichlorobenzene (CAS RN 108-70-3) (mg/m³)				
Guideline	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
	0.65	3.8	1.8	11
Human health guidelines				
Protection of indoor air quality (basement)	0.65	3.8	--	--
Protection of indoor air quality (slab on grade)	0.91	4.3	1.8•	11•
Protection of outdoor air	230	440	230	440
Management considerations				
Lower explosive limit (50%) †		NA		
Protection of indoor air quality (sub-slab/shallow)	0.024		0.070•	

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Notes:
 Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).
 -- = the pathway is not considered for the selected land use.
 NA = not available.
 • A high-level screening was not completed as no air quality benchmark was available; therefore, no dose averaging was used (see [Appendix A](#)).
 † This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

571 **Soil Vapour Quality Guidelines for 1,2,3,4-Tetrachlorobenzene (CAS RN 634-66-2) (mg/m³)**

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline (provisional*)	1.4	7.5	3.9	22
Human health guidelines				
Protection of indoor air quality (basement) #	1.4	7.5	--	--
Protection of indoor air quality (slab on grade) #	2	8.7	3.9 [•]	22 [•]
Protection of outdoor air #	570	1,000	570	1,000
Management considerations				
Lower explosive limit (50%) †		NA		
Protection of indoor air quality (sub-slab/shallow) #	0.045		0.14 [•]	

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

NA = not available.

* Provisional guideline: A soil vapour guideline developed using an inhalation toxicological reference value (TRV) extrapolated from an oral TRV is considered provisional.

Tolerable concentration (TC) extrapolated from tolerable daily intake (TDI).

• A high-level screening was not completed as no air quality benchmark was available; therefore, no dose averaging was used (see [Appendix A](#)).

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

587 **Soil Vapour Quality Guidelines for 1,2,3,5-Tetrachlorobenzene (CAS RN 634-90-2) (mg/m³)**

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline (provisional*)	0.17	0.92	0.49	2.7
Human health guidelines				
Protection of indoor air quality (basement) #	0.17	0.92	--	--
Protection of indoor air quality (slab on grade) #	0.25	1.1	0.49 •	2.7 •
Protection of outdoor air #	71	130	71	130
Management considerations				
Lower explosive limit (50%) †		NA		
Protection of indoor air quality (sub-slab/shallow) #		0.0054		0.016 •

590 **Notes:**

591 Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

592 -- = the pathway is not considered for the selected land use.

593 NA = not available.

594 * Provisional guideline: A soil vapour guideline developed using an inhalation toxicological reference value (TRV) extrapolated from
595 an oral TRV is considered provisional.

596 # Tolerable concentration (TC) extrapolated from tolerable daily intake (TDI).

597 • A high-level screening was not completed as no air quality benchmark was available; therefore, no dose averaging was used (see
598 [Appendix A](#)).

599 † This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in
600 presence of an ignition source (arc, flame, heat).

**Canadian Soil Vapour Quality Guidelines
for the Protection of Human Health**

1,2,4,5-Tetrachlorobenzene

Soil Vapour Quality Guidelines for 1,2,4,5-Tetrachlorobenzene (CAS RN 95-94-3) (mg/m³)

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline (provisional*)	0.084	0.46	0.24	1.4
Human health guidelines				
Protection of indoor air quality (basement) #	0.084	0.46	--	--
Protection of indoor air quality (slab on grade) #	0.12	0.53	0.24 •	1.4 •
Protection of outdoor air #	34	62	34	62
Management considerations				
Lower explosive limit (50%) †	NA			
Protection of indoor air quality (sub-slab/shallow) #	0.0028		0.0083 •	

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

NA = not available.

* Provisional guideline: A soil vapour guideline developed using an inhalation toxicological reference value (TRV) extrapolated from an oral TRV is considered provisional.

Tolerable concentration (TC) extrapolated from tolerable daily intake (TDI).

• A high-level screening was not completed as no air quality benchmark was available; therefore, no dose averaging was used (see [Appendix A](#)).

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

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Soil Vapour Quality Guidelines for Pentachlorobenzene (CAS RN 608-93-5) (mg/m ³)				
Guideline (provisional*)	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
	0.42	2.2	1.2	6.6
Human health guidelines				
Protection of indoor air quality (basement) #	0.42	2.2	--	--
Protection of indoor air quality (slab on grade) #	0.61	2.6	1.2 [•]	6.6 [•]
Protection of outdoor air #	170	320	170	320
Management considerations				
Lower explosive limit (50%) †		NA		
Protection of indoor air quality (sub-slab/shallow) #	0.013		0.040 [•]	

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Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

NA = not available.

* Provisional guideline: A soil vapour guideline developed using an inhalation toxicological reference value (TRV) extrapolated from an oral TRV is considered provisional.

Tolerable concentration (TC) extrapolated from tolerable daily intake (TDI).

• A high-level screening was not completed as no air quality benchmark was available; therefore, no dose averaging was used (see [Appendix A](#)).

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

Soil Vapour Quality Guidelines for 1,2-Dichloroethane (CAS RN 107-06-2) (mg/m³)

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline: 10⁻⁵ incremental risk (provisional*)	8.5	63	25	190
Guideline: 10⁻⁶ incremental risk (provisional*)	0.85	6.3	2.5	19
Human health guidelines: 10 ⁻⁵ incremental risk				
Protection of indoor air quality (basement)	8.5	63	--	--
Protection of indoor air quality (slab on grade) # ◇	11	67	25	190
Protection of outdoor air # ◇	1,900	3,600	1,900	3,600
Human health guidelines: 10 ⁻⁶ incremental risk				
Protection of indoor air quality (basement) # ◇	0.85	6.3	--	--
Protection of indoor air quality (slab on grade) # ◇	1.1	6.7	2.5	19
Protection of outdoor air # ◇	190	360	190	360
Management considerations				
Lower explosive limit (50%) †		NA		
Protection of indoor air quality (sub-slab/shallow)				
10 ⁻⁵ incremental risk # ◇		0.43		1.3
10 ⁻⁶ incremental risk # ◇		0.043		0.13

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

NA = not available.

* Provisional guideline: A soil vapour guideline developed using an inhalation toxicological reference value (TRV) extrapolated from an oral TRV is considered provisional.

Risk-specific concentration (RSC) extrapolated from risk-specific dose (RSD).

◇ Value represents the lowest of either carcinogenic or non-carcinogenic guidelines, if available.

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

650 **Soil Vapour Quality Guidelines for 1,1,1-Trichloroethane (CAS RN 71-55-6) (mg/m³)**

Guideline	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
	720	5,000	2,100	15,000
Human health guidelines				
Protection of indoor air quality (basement)	720	5,000	--	--
Protection of indoor air quality (slab on grade)	950	5,400	2,100 [•]	15,000 [•]
Protection of outdoor air	200,000	370,000	200,000	370,000
Management considerations				
Lower explosive limit (50%) †		NA		
Protection of indoor air quality (sub-slab/shallow)	33		100 [•]	

653 **Notes:**

654 Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

655 -- = the pathway is not considered for the selected land use.

656 NA = not available.

657 • A high-level screening was not completed as only an acute air quality benchmark was available; therefore, no dose averaging was
658 used (see [Appendix A](#)).

659 † This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in
660 presence of an ignition source (arc, flame, heat).

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Soil Vapour Quality Guidelines for 1,1,2,2-Tetrachloroethane (CAS RN 79-34-5) (mg/m³)

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline: 10⁻⁵ incremental risk (provisional*)	0.17	1.1	0.5	3.3
Guideline: 10⁻⁶ incremental risk (provisional*)	0.017	0.11	0.05	0.33
Human health guidelines: 10 ⁻⁵ incremental risk				
Protection of indoor air quality (basement) # ◇	0.17	1.1	--	--
Protection of indoor air quality (slab on grade) # ◇	0.24	1.2	0.5	3.3
Protection of outdoor air # ◇	56	100	56	100
Human health guidelines: 10 ⁻⁶ incremental risk				
Protection of indoor air quality (basement) # ◇	0.017	0.11	--	--
Protection of indoor air quality (slab on grade) # ◇	0.024	0.12	0.05	0.33
Protection of outdoor air # ◇	5.6	10	5.6	10
Management considerations				
Lower explosive limit (50%) †	NA			
Protection of indoor air quality (sub-slab/shallow)				
10 ⁻⁵ incremental risk # ◇	0.0071		0.021	
10 ⁻⁶ incremental risk # ◇	0.00071		0.0021	

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Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

NA = not available.

* Provisional guideline: A soil vapour guideline developed using an inhalation toxicological reference value (TRV) extrapolated from an oral TRV is considered provisional.

Risk-specific concentration (RSC) extrapolated from risk-specific dose (RSD).

◇ Value represents the lowest of either carcinogenic or non-carcinogenic guidelines, if available.

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

**Canadian Soil Vapour Quality Guidelines
for the Protection of Human Health**

Monochloroethene (Vinyl chloride)

Soil Vapour Quality Guidelines for Monochloroethene (CAS RN 75-01-4) (mg/m³)

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline: 10⁻⁵ incremental risk	0.7	5.5	2	16
Guideline: 10⁻⁶ incremental risk	0.07	0.55	0.2	1.6
Human health guidelines: 10 ⁻⁵ incremental risk				
Protection of indoor air quality (basement) ◇	0.7	5.5	--	--
Protection of indoor air quality (slab on grade) ◇	0.85	5.7	2	16
Protection of outdoor air ◇	140	250	140	250
Human health guidelines: 10 ⁻⁶ incremental risk				
Protection of indoor air quality (basement) ◇	0.07	0.55	--	--
Protection of indoor air quality (slab on grade) ◇	0.085	0.57	0.2	1.6
Protection of outdoor air ◇	14	25	14	25
Management considerations				
Lower explosive limit (50%) †		46,000		
Protection of indoor air quality (sub-slab/shallow)				
10 ⁻⁵ incremental risk ◇		0.038		0.11
10 ⁻⁶ incremental risk ◇		0.0038		0.011

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

Vinyl chloride is a synonym for monochloroethene.

◇ Value represents the lowest of either carcinogenic or non-carcinogenic guidelines, if available.

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

**Canadian Soil Vapour Quality Guidelines
for the Protection of Human Health**

1,1,2-Trichloroethene (TCE)

Soil Vapour Quality Guidelines for 1,1,2-Trichloroethene (TCE) (CAS RN 79-01-6) (mg/m³)

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline: 10⁻⁵ incremental risk	0.081	0.59	0.24	1.7
Guideline: 10⁻⁶ incremental risk	0.081	0.59	0.24	1.7
Human health guidelines: 10 ⁻⁵ incremental risk				
Protection of indoor air quality (basement) ◇	0.081 ♦	0.59 ♦	--	--
Protection of indoor air quality (slab on grade) ◇	0.1 ♦	0.63 ♦	0.24 ♦ •	1.7 ♦ •
Protection of outdoor air ◇	20 ♦	36 ♦	20 ♦	36 ♦
Human health guidelines: 10 ⁻⁶ incremental risk				
Protection of indoor air quality (basement) ◇	0.081 ♦	0.59 ♦	--	--
Protection of indoor air quality (slab on grade) ◇	0.1 ♦	0.63 ♦	0.24 ♦ •	1.7 ♦ •
Protection of outdoor air ◇	20 ♦	36 ♦	20 ♦	36 ♦
Management considerations				
Lower explosive limit (50%) †		320,000		
Protection of indoor air quality (sub-slab/shallow)				
10 ⁻⁵ incremental risk ◇	0.0040 ♦		0.012 ♦ •	
10 ⁻⁶ incremental risk ◇	0.0040 ♦		0.012 ♦ •	

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

TCE = trichloroethene (or trichloroethylene).

◇ Value represents the lowest of either carcinogenic or non-carcinogenic guidelines, if available.

♦ Presented value is based on the non-carcinogenic risk.

• The inhalation toxicological reference value (TRV) for 1,1,2-trichloroethene is based on adverse effects that suggest reproductive or development toxicity; therefore, no dose averaging was used (see [Appendix A](#))

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

Soil Vapour Quality Guidelines for 1,1,2,2-Tetrachloroethene (PCE) (CAS RN 127-18-4) (mg/m³)

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline: 10⁻⁵ incremental risk	5.8	37	17	110
Guideline: 10⁻⁶ incremental risk	3.1	20	8.9	59
Human health guidelines: 10 ⁻⁵ incremental risk				
Protection of indoor air quality (basement) ◇	5.8 ◆	37 ◆	--	--
Protection of indoor air quality (slab on grade) ◇	7.9 ◆	41 ◆	17 ◆ ●	110 ◆ ●
Protection of outdoor air ◇	1,900 ◆	3,400 ◆	1,900 ◆	3,400 ◆
Human health guidelines: 10 ⁻⁶ incremental risk				
Protection of indoor air quality (basement) ◇	3.1	20	--	--
Protection of indoor air quality (slab on grade) ◇	4.2	22	8.9	59
Protection of outdoor air ◇	980	1,800	980	1,800
Management considerations				
Lower explosive limit (50%) †	NA			
Protection of indoor air quality (sub-slab/shallow)				
10 ⁻⁵ incremental risk ◇	0.24 ◆		0.73 ◆ ●	
10 ⁻⁶ incremental risk ◇	0.13		0.38	

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

NA = not available.

PCE = perchloroethylene, a synonym for 1,1,2,2-tetrachloroethene.

◇ Value represents the lowest of either carcinogenic or non-carcinogenic guidelines, if available.

♦ Presented value is based on the non-carcinogenic risk.

• A high-level screening was not completed as no air quality benchmark was available; therefore, no dose averaging was used (see [Appendix A](#)).

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

**Canadian Soil Vapour Quality Guidelines
for the Protection of Human Health**

2-Chlorophenol

Soil Vapour Quality Guidelines for 2-Chlorophenol (CAS RN 95-57-8) (mg/m³)

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline (provisional*)	1.4	9.8	4.1	29
Human health guidelines				
Protection of indoor air quality (basement) #	1.4	9.8	--	--
Protection of indoor air quality (slab on grade) #	1.9	11	4.1•	29•
Protection of outdoor air #	390	660	390	660
Management considerations				
Lower explosive limit (50%) †		NA		
Protection of indoor air quality (sub-slab/shallow) #	0.066		0.20•	

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

NA = not available.

* Provisional guideline: A soil vapour guideline developed using an inhalation toxicological reference value (TRV) extrapolated from an oral TRV is considered provisional.

Tolerable concentration (TC) extrapolated from tolerable daily intake (TDI).

• A high-level screening was not completed as no air quality benchmark was available; therefore, no dose averaging was used (see [Appendix A](#)).

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

**Canadian Soil Vapour Quality Guidelines
for the Protection of Human Health**

2,4-Dichlorophenol

Soil Vapour Quality Guidelines for 2,4-Dichlorophenol (CAS RN 120-83-2) (mg/m³)

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline (provisional*)	32	200	93	590
Human health guidelines				
Protection of indoor air quality (basement) #	32	200	--	--
Protection of indoor air quality (slab on grade) #	44	220	93 [•]	590 [•]
Protection of outdoor air #	10,000	15,000	10,000	15,000
Management considerations				
Lower explosive limit (50%) †		NA		
Protection of indoor air quality (sub-slab/shallow) #	1.3		4.0 [•]	

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

NA = not available.

* Provisional guideline. A soil vapour guideline developed using an inhalation toxicological reference value (TRV) extrapolated from an oral TRV is considered provisional.

Tolerable concentration (TC) extrapolated from tolerable daily intake (TDI).

• A high-level screening was not completed as no air quality benchmark was available; therefore, no dose averaging was used (see [Appendix A](#)).

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

Soil Vapour Quality Guidelines for 2,4,6-Trichlorophenol (CAS RN 88-06-2) (mg/m³)

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline: 10⁻⁵ incremental risk (provisional*)	3.9	20	11	58
Guideline: 10⁻⁶ incremental risk (provisional*)	0.39	2	1.1	5.8
Human health guidelines: 10 ⁻⁵ incremental risk				
Protection of indoor air quality (basement) # ◇	3.9	20	--	--
Protection of indoor air quality (slab on grade) # ◇	5.7	21	11	58
Protection of outdoor air # ◇	1,600	1,600	1,600	1,600
Human health guidelines: 10 ⁻⁶ incremental risk				
Protection of indoor air quality (basement) # ◇	0.39	2	--	--
Protection of indoor air quality (slab on grade) # ◇	0.57	2.1	1.1	5.8
Protection of outdoor air # ◇	160	160	160	160
Management considerations				
Lower explosive limit (50%) †		NA		
Protection of indoor air quality (sub-slab/shallow) #				
10 ⁻⁵ incremental risk ◇		0.13		0.39
10 ⁻⁶ incremental risk ◇		0.013		0.039

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

NA = not available.

* Provisional guideline. A soil vapour guideline developed using an inhalation toxicological reference value (TRV) extrapolated from an oral TRV is considered provisional.

Risk-specific concentration (RSC) extrapolated from risk-specific dose (RSD).

◇ Value represents the lowest of either carcinogenic or non-carcinogenic guidelines, if available.

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

Soil Vapour Quality Guidelines for 2,3,4,6-Tetrachlorophenol (CAS RN 58-90-2) (mg/m³)

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline (provisional*)	3.2	20	9.2	59
Human health guidelines				
Protection of indoor air quality (basement) #	3.2	20	--	--
Protection of indoor air quality (slab on grade) #	4.3	22	9.2 [•]	59 [•]
Protection of outdoor air #	1,000	1,500	1,000	1,500
Management considerations				
Lower explosive limit (50%) †		NA		
Protection of indoor air quality (sub-slab/shallow) #		0.13		0.40 [•]

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

NA = not available.

* Provisional guideline. A soil vapour guideline developed using an inhalation toxicological reference value (TRV) extrapolated from an oral TRV is considered provisional.

Tolerable concentration (TC) extrapolated from tolerable daily intake (TDI).

• A high-level screening was not completed as no air quality benchmark was available; therefore, no dose averaging was used (see [Appendix A](#)).

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

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Soil Vapour Quality Guidelines for Ethylbenzene (CAS RN 100-41-4) (mg/m ³)				
Guideline	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
	2,700	20,000	7,900	58,000
Human health guidelines				
Protection of indoor air quality (basement)	2,700	20,000	--	--
Protection of indoor air quality (slab on grade)	3,500	21,000	7,900 [•]	58,000 [•]
Protection of outdoor air	680,000	1,300,000	680,000	1,300,000
Management considerations				
Lower explosive limit (50%) †		22,000		
Protection of indoor air quality (sub-slab/shallow)		13		40 [•]

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Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

• A high-level screening flagged potential concern with dose averaging; therefore, no dose-averaging was used (see [Appendix A](#)).

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

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Soil Vapour Quality Guidelines for Dichloromethane (CAS RN 75-09-2) (mg/m³)

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline: 10⁻⁵ incremental risk	74	570	220	1,700
Guideline: 10⁻⁶ incremental risk	63	480	180	1,400
Human health guidelines: 10 ⁻⁵ incremental risk				
Protection of indoor air quality (basement) ◇	74 ♦	570 ♦	--	--
Protection of indoor air quality (slab on grade) ◇	91 ♦	600 ♦	220 ♦●	1,700 ♦●
Protection of outdoor air ◇	15,000 ♦	28,000 ♦	15,000 ♦	28,000 ♦
Human health guidelines: 10 ⁻⁶ incremental risk				
Protection of indoor air quality (basement) ◇	63	480	--	--
Protection of indoor air quality (slab on grade) ◇	77	510	180	1,400
Protection of outdoor air ◇	13,000	24,000	13,000	24,000
Management considerations				
Lower explosive limit (50%) †		NA		
Protection of indoor air quality (sub-slab/shallow)				
10 ⁻⁵ incremental risk ◇		3.9 ♦		12 ♦●
10 ⁻⁶ incremental risk ◇		3.3		10

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- Notes:**

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

NA = not available.

◇ Value represents the lowest of either carcinogenic or non-carcinogenic guidelines, if available.

♦ Presented value is based on the non-carcinogenic risk.

● A high-level screening flagged potential concern with dose-averaging; therefore, dose-averaging was not used (see [Appendix A](#)).

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

Soil Vapour Quality Guidelines for Trichloromethane (CAS RN 67-66-3) (mg/m³)

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline: 10⁻⁵ incremental risk	0.3	2.1	0.86	6.3
Guideline: 10⁻⁶ incremental risk	0.03	0.21	0.086	0.63
Human health guidelines: 10 ⁻⁵ incremental risk				
Protection of indoor air quality (basement) ◇	0.3	2.1	--	--
Protection of indoor air quality (slab on grade) ◇	0.38	2.3	0.86	6.3
Protection of outdoor air ◇	73	140	73	140
Human health guidelines: 10 ⁻⁶ incremental risk				
Protection of indoor air quality (basement) ◇	0.03	0.21	--	--
Protection of indoor air quality (slab on grade) ◇	0.038	0.23	0.086	0.63
Protection of outdoor air ◇	7.3	14	7.3	14
Management considerations				
Lower explosive limit (50%) †	NA			
Protection of indoor air quality (sub-slab/shallow)				
10 ⁻⁵ incremental risk ◇	0.014		0.043	
10 ⁻⁶ incremental risk ◇	0.0014		0.0043	

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

NA = not available.

◇ Value represents the lowest of either carcinogenic or non-carcinogenic guidelines, if available.

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

Soil Vapour Quality Guidelines for Tetrachloromethane (CAS RN 56-23-5) (mg/m³)

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline: 10 ⁻⁵ incremental risk	0.095	0.63	0.99	6.8
Guideline: 10 ⁻⁶ incremental risk	0.095	0.63	0.37	2.5
Human health guidelines: 10 ⁻⁵ incremental risk				
Protection of indoor air quality (basement) ◇ #	0.095 ◇	0.63 ◇	--	--
Protection of indoor air quality (slab on grade) ◇ #	0.13 ◇	0.69 ◇	0.99 ◇ ●	6.8 ◇ ●
Protection of outdoor air ◇ #	28 ◇	52 ◇	28 ◇	52 ◇
Human health guidelines: 10 ⁻⁶ incremental risk				
Protection of indoor air quality (basement) ◇ #	0.095 ◇	0.63 ◇	--	--
Protection of indoor air quality (slab on grade) ◇ #	0.13 ◇	0.69 ◇	0.37	2.5
Protection of outdoor air ◇ #	28 ◇	52 ◇	28 ◇	52 ◇
Management considerations				
Lower explosive limit (50%) †	NA			
Protection of indoor air quality (sub-slab/shallow)				
10 ⁻⁵ incremental risk ◇ #	0.0042 ◇		0.045 ◇ ●	
10 ⁻⁶ incremental risk ◇ #	0.0042 ◇		0.017	

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

NA = not available.

◇ Value represents the lowest of either carcinogenic or non-carcinogenic guidelines, if available.

Tolerable concentration (TC) extrapolated from tolerable daily intake (TDI).

◆ Presented value is based on the non-carcinogenic risk.

• A high-level screening did not flag concern with the use of dose averaging (see [Appendix A](#)). However, there is some uncertainty associated with the use of dose-averaging as a full toxicological review was not conducted for each substance; therefore, these values should be used with caution and other lines of evidence should be considered when assessing risks. Jurisdictional authorities should be consulted for further guidance.

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

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Soil Vapour Quality Guidelines for Bromodichloromethane (CAS RN 75-27-4) (mg/m³)

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline: 10⁻⁵ incremental risk (provisional*)	0.53	3.5	1.5	10
Guideline: 10⁻⁶ incremental risk (provisional*)	0.053	0.35	0.15	1
Human health guidelines: 10 ⁻⁵ incremental risk				
Protection of indoor air quality (basement) # ◇	0.53	3.5	--	--
Protection of indoor air quality (slab on grade) # ◇	0.7	3.8	1.5	10
Protection of outdoor air # ◇	160	290	160	290
Human health guidelines: 10 ⁻⁶ incremental risk				
Protection of indoor air quality (basement) # ◇	0.053	0.35	--	--
Protection of indoor air quality (slab on grade) # ◇	0.07	0.38	0.15	1.0
Protection of outdoor air # ◇	16	29	16	29
Management considerations				
Lower explosive limit (50%) †	NA			
Protection of indoor air quality (sub-slab/shallow)				
10 ⁻⁵ incremental risk # ◇	0.023		0.069	
10 ⁻⁶ incremental risk # ◇	0.0023		0.0069	

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Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

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-- = the pathway is not considered for the selected land use.

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NA = not available.

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* Provisional guideline. A soil vapour guideline developed using an inhalation toxicological reference value (TRV) extrapolated from an oral TRV is considered provisional.

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Risk-specific concentration (RSC) extrapolated from risk-specific dose (RSD).

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◇ Value represents the lowest of either carcinogenic or non-carcinogenic guidelines, if available.

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† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

855 **Soil Vapour Quality Guidelines for Dibromochloromethane (CAS RN 124-48-1) (mg/m³)**

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline (provisional*)	7.4	43	21	130
Human health guidelines				
Protection of indoor air quality (basement) #	7.4	43	--	--
Protection of indoor air quality (slab on grade) #	10	48	21 •	130 •
Protection of outdoor air #	2,800	5,100	2,800	5,100
Management considerations				
Lower explosive limit (50%) †		NA		
Protection of indoor air quality (sub-slab/shallow) #	0.026		0.79 •	

858 **Notes:**

859 Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

860 -- = the pathway is not considered for the selected land use.

861 NA = not available.

862 * Provisional guideline: A soil vapour guideline developed using an inhalation toxicological reference value (TRV) extrapolated from
863 an oral TRV is considered provisional.

864 # Tolerable concentration (TC) extrapolated from tolerable daily intake (TDI).

865 • A high-level screening was not completed as no air quality benchmark was available; therefore, no dose-averaging was used (see
866 [Appendix A](#)).

867 † This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in
868 presence of an ignition source (arc, flame, heat).

**Canadian Soil Vapour Quality Guidelines
for the Protection of Human Health**

n-Hexane

Soil Vapour Quality Guidelines for n-Hexane (CAS RN 110-54-3) (mg/m³)

Guideline	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
	750	6,300	8,100	61,000
Human health guidelines				
Protection of indoor air quality (basement)	750	6,300	--	--
Protection of indoor air quality (slab on grade)	850	6,500	8,100 •	61,000 •
Protection of outdoor air	90,000	170,000	90,000	170,000
Management considerations				
Lower explosive limit (50%) †		21,000		
Protection of indoor air quality (sub-slab/shallow)		4.7		51 •

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

• A high-level screening did not flag any concern with the use of dose-averaging (see [Appendix A](#)). However, there is some uncertainty associated with the use of dose-averaging as a full toxicological review was not conducted for each substance; therefore, these values should be used with caution and other lines of evidence should be considered when assessing risks. Jurisdictional authorities should be consulted.

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

884 **Canadian Soil Vapour Quality Guidelines** **Methanol**
885 **for the Protection of Human Health**

886 **Soil Vapour Quality Guidelines for Methanol (CAS RN 67-56-1) (mg/m³)**

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Guideline	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
	2,300	19,000	6,700	52,000
Human health guidelines				
Protection of indoor air quality (basement)	2,300	19,000	--	--
Protection of indoor air quality (slab on grade)	2,600	19,000	6,700 [•]	52,000 [•]
Protection of outdoor air	340,000	560,000	340,000	560,000
Management considerations				
Lower explosive limit (50%) †		44,000		
Protection of indoor air quality (sub-slab/shallow)		130		400 [•]

889 **Notes:**

890 Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

891 -- = the pathway is not considered for the selected land use.

892 • The inhalation toxicological reference value (TRV) for methanol is based on adverse effects that suggest reproductive or
893 developmental toxicity; therefore, dose averaging was not used (see [Appendix A](#)).

894 † This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in
895 presence of an ignition source (arc, flame, heat).

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Soil Vapour Quality Guidelines for Methyl tertiary-butyl ether (MTBE) (CAS RN 1634-04-4) (mg/m³)				
Guideline	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
	5.1	36	54	390
Human health guidelines				
Protection of indoor air quality (basement)	5.1	36	--	--
Protection of indoor air quality (slab on grade)	6.5	39	54 [•]	390 [•]
Protection of outdoor air	1,300	2,300	1,300	2,300
Management considerations				
Lower explosive limit (50%) †		NA		
Protection of indoor air quality (sub-slab/shallow)		0.25		2.7 [•]

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Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

NA = not available.

• A high-level screening did not flag concern with the use of dose-averaging (see [Appendix A](#)). However, there is some uncertainty associated with the use of dose-averaging as a full toxicological review was not conducted for each substance; therefore, these values should be used with caution and other lines of evidence should be considered when assessing risks. Jurisdictional authorities should be consulted for further guidance.

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

911 **Canadian Soil Vapour Quality Guidelines** **PHC F1 subfraction Aliphatics C-6-C8**
912 **for the Protection of Human Health**

913 **Soil Vapour Quality Guidelines for PHC F1 subfraction Aliphatics C-6-C8 (mg/m³)**

Guideline	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
	74,000	470,000	210,000	1,400,000
Human health guidelines				
Protection of indoor air quality (basement)	74,000	470,000	--	--
Protection of indoor air quality (slab on grade)	100,000	520,000	210,000 [•]	1,400,000 [•]
Protection of outdoor air	24,000,000	44,000,000	24,000,000	44,000,000
Management considerations				
Lower explosive limit (50%) †		27,000		
Protection of indoor air quality (sub-slab/shallow)		300		920 [•]

916 **Notes:**

917 Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

918 -- = the pathway is not considered for the selected land use.

919 • A high-level screening was not completed as no air quality benchmark was available; therefore, no dose averaging was used (see
920 [Appendix A](#)).

921 † This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in
922 presence of an ignition source (arc, flame, heat). The concentrations of petroleum hydrocarbon (PHC) F1 subfractions should be
923 summed for comparison to the 50% lower explosive limit (LEL).

926 **Soil Vapour Quality Guidelines for PHC F1 subfraction Aliphatics C>8-C10 (mg/m³)**

Guideline	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
	3,900	25,000	11,000	73,000
Human health guidelines				
Protection of indoor air quality (basement)	3,900	25,000	--	--
Protection of indoor air quality (slab on grade)	5,200	27,000	11,000 [•]	73,000 [•]
Protection of outdoor air	1,200,000	2,300,000	1,200,000	2,300,000
Management considerations				
Lower explosive limit (50%) †		27,000		
Protection of indoor air quality (sub-slab/shallow)	16		48 [•]	

929 **Notes:**

930 Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

931 Petroleum hydrocarbon (PHC) aliphatic subfractions C>8-10, C>10-12, and C>12-16 rely on the same inhalation toxicological
932 reference value (TRV) and, therefore, should be summed and compared to the soil vapour quality guideline (SVQG). To facilitate this,
933 the lower of the SVQGs for the subfractions (i.e., C>8-10) is shown.

934 -- = the pathway is not considered for the selected land use.

935 • A high-level screening was not completed as no air quality benchmark was available; therefore, no dose averaging was used (see
936 [Appendix A](#)).

937 † This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in
938 presence of an ignition source (arc, flame, heat). The concentrations of PHC F1 subfractions should be summed for comparison to
939 the 50% lower explosive limit (LEL).

**Canadian Soil Vapour Quality Guidelines
for the Protection of Human Health**

PHC F1 subfraction Aromatics C>8-C10

Soil Vapour Quality Guidelines for PHC F1_{||} subfraction Aromatics C>8-C10 (mg/m³)

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline*	660	4,200	1,900	12,000
Human health guidelines				
Protection of indoor air quality (basement)	660	4,200	--	--
Protection of indoor air quality (slab on grade)	890	4,600	1,900 [•]	12,000 [•]
Protection of outdoor air	210,000	390,000	210,000	390,000
Management considerations				
Lower explosive limit (50%) †		27,000		
Protection of indoor air quality (sub-slab/shallow)	2.7		8.1 [•]	

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

Petroleum hydrocarbon (PHC) aromatic subfractions C>8-10, C>10-12, and C>12-16 rely on the same inhalation toxicological reference value (TRV) and, therefore, should be summed and compared to the soil vapour quality guideline (SVQG). To facilitate this, the lower of the SVQGs for the subfractions (i.e., C>8-10) is shown.

_{||} Petroleum hydrocarbon fraction F1 does not include benzene, toluene, ethylbenzene or xylenes (BTEX) (see CCME 2008 for further information). These chemicals should be analyzed separately and compared to their individual soil vapour guidelines.

-- = the pathway is not considered for the selected land use.

• A high-level screening was not completed as no air quality benchmark was available; therefore, no dose averaging was used (see [Appendix A](#)).

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat). The concentrations of PHC F1 subfractions should be summed for comparison to the 50% lower explosive limit (LEL).

**Canadian Soil Vapour Quality Guidelines
for the Protection of Human Health**

PHC F2 subfraction Aliphatics C>10-C12

Soil Vapour Quality Guidelines for PHC F2 subfraction Aliphatics C>10-C12 (mg/m³)

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline*	3,900	25,000	11,000	73,000
Human health guidelines				
Protection of indoor air quality (basement)	3,900	25,000	--	--
Protection of indoor air quality (slab on grade)	5,200	27,000	11,000 [•]	73,000 [•]
Protection of outdoor air	1,200,000	2,300,000	1,200,000	2,300,000
Management considerations				
Lower explosive limit (50%) †		21,000		
Protection of indoor air quality (sub-slab/shallow)		16		48 [•]

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

Petroleum hydrocarbon (PHC) aliphatic subfractions C>8-10, C>10-12, and C>12-16 rely on the same inhalation toxicological reference value (TRV) and, therefore, should be summed and compared to the soil vapour quality guideline (SVQG). To facilitate this, the lower of the SVQGs for the subfractions (i.e., C>8-10) is shown. Also, use of a bioattenuation factor (BAF) = 10 does not apply to this pathway when F2 is aviation fuel (see Section 1.4). If aviation fuel is present, divide the SVQG by 10 for a guideline value based on a BAF = 1.

-- = the pathway is not considered for the selected land use.

• A high-level screening was not completed as no air quality benchmark was available; therefore, no dose averaging was used (see [Appendix A](#)).

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat). The concentrations of PHC F2 subfractions should be summed for comparison to the 50% lower explosive limit (LEL).

**Canadian Soil Vapour Quality Guidelines
for the Protection of Human Health**

PHC F2 subfraction Aliphatics C>12-C16

Soil Vapour Quality Guidelines for PHC F2 subfraction Aliphatics C>12-C16 (mg/m³)

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline*	3,900	25,000	11,000	73,000
Human health guidelines				
Protection of indoor air quality (basement)	3,900	25,000	--	--
Protection of indoor air quality (slab on grade)	5,200	27,000	11,000 [•]	73,000 [•]
Protection of outdoor air	1,200,000	2,300,000	1,200,000	2,300,000
Management considerations				
Lower explosive limit (50%) †		21,000		
Protection of indoor air quality (sub-slab/shallow)		16		48 [•]

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

Petroleum hydrocarbon (PHC) aliphatic subfractions C>8-10, C>10-12, and C>12-16 rely on the same inhalation toxicological reference value (TRV) and, therefore, should be summed and compared to the soil vapour quality guideline (SVQG). To facilitate this, the lower of the SVQGs for the subfractions (i.e., C>8-10) is shown. Also, use of a bioattenuation factor (BAF)=10 does not apply to this pathway when F2 is aviation fuel (see Section 1.4). If aviation fuel is present, divide the SVQG by 10 for a guideline value based on a BAF=1.

-- = the pathway is not considered for the selected land use.

• A high-level screening was not completed as no air quality benchmark was available; therefore, no dose averaging was used (see [Appendix A](#)).

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat). The concentrations of PHC F2 subfractions should be summed for comparison to the 50% lower explosive limit (LEL).

**Canadian Soil Vapour Quality Guidelines
for the Protection of Human Health**

PHC F2 subfraction Aromatics C>10-C12

Soil Vapour Quality Guidelines for PHC F2_{II} subfraction Aromatics C>10-C12 (mg/m³)

Guideline*	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline*	660	4,200	1,900	12,000
Human health guidelines				
Protection of indoor air quality (basement)	660	4,200	--	--
Protection of indoor air quality (slab on grade)	890	4,600	21,900 [•]	12,000 [•]
Protection of outdoor air	210,000	390,000	210,000	390,000
Management considerations				
Lower explosive limit (50%) †		21,000		
Protection of indoor air quality (sub-slab/shallow)		2.7		8.1 [•]

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

Petroleum hydrocarbons (PHC) aromatic subfractions C>8-10, C>10-12, and C>12-16 rely on the same inhalation toxicological reference value (TRV) and, therefore, should be summed and compared to the soil vapour quality guideline (SVQG). To facilitate this, the lower of the SVQGs for the subfractions (i.e., C>8-10) is shown. Also, use of a bioattenuation factor (BAF)=10 does not apply to this pathway when F2 is aviation fuel (see Section 1.4). If aviation fuel is present, divide the SVQG by 10 for a guideline value based on a BAF=1.

II Petroleum hydrocarbon fraction F2 does not include naphthalene (see CCME 2008 for further information). Naphthalene should be analyzed separately and compared to its individual soil vapour guideline.

-- = the pathway is not considered for the selected land use.

• A high-level screening was not completed as no air quality benchmark was available; therefore, no dose averaging was used (see [Appendix A](#)).

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat). The concentrations of PHC F2 subfractions should be summed for comparison to the 50% lower explosive limit (LEL).

**Canadian Soil Vapour Quality Guidelines
for the Protection of Human Health**

PHC F2 subfraction Aromatics C>12-C16

Soil Vapour Quality Guidelines for PHC F2 subfraction C>12-C16 (mg/m³)

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline*	660	4,200	1900	12,000
Human health guidelines				
Protection of indoor air quality (basement)	660	4,200	--	--
Protection of indoor air quality (slab on grade)	890	4,600	1,900 [•]	12,000 [•]
Protection of outdoor air	210,000	390,000	210,000	390,000
Management considerations				
Lower explosive limit (50%) †		21,000		
Protection of indoor air quality (sub-slab/shallow)	2.7		8.1 [•]	

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

Petroleum hydrocarbons (PHC) aromatic subfractions C>8-10, C>10-12, and C>12-16 rely on the same inhalation toxicological reference value (TRV) and, therefore, should be summed and compared to the soil vapour quality guideline (SVQG). To facilitate this, the lower of the SVQGs for the subfractions (i.e., C>8-10) is shown. Also, use of a bioattenuation factor (BAF)=10 does not apply to this pathway when F2 is aviation fuel (see Section 1.4). If aviation fuel is present, divide the SVQG by 10 for a guideline value based on a BAF=1.

-- = the pathway is not considered for the selected land use.

• A high-level screening was not completed as no air quality benchmark was available; therefore, no dose averaging was used (see [Appendix A](#)).

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat). The concentrations of PHC F2 subfractions should be summed for comparison to the 50% lower explosive limit (LEL).

1045 **Canadian Soil Vapour Quality Guidelines** **Phenol**
1046 **for the Protection of Human Health**

1047 **Soil Vapour Quality Guidelines for Phenol (CAS RN 108-95-2) (mg/m³)**

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline (provisional*)	16	110	45	330
Human health guidelines				
Protection of indoor air quality (basement) #	16	110	--	--
Protection of indoor air quality (slab on grade) #	20	110	45 [•]	330 [•]
Protection of outdoor air #	3,500	2,000	3,500	2,000
Management considerations				
Lower explosive limit (50%) †		NA		
Protection of indoor air quality (sub-slab/shallow) #	0.80		2.4 [•]	

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

NA = not available.

* Provisional guideline. A soil vapour quality guideline (SVQG) developed using an inhalation toxicological reference value (TRV) extrapolated from an oral TRV is considered provisional.

Tolerable concentration (TC) extrapolated from tolerable daily intake (TDI).

• A high-level screening flagged potential concerns with dose averaging; therefore, no dose averaging was used (see [Appendix A](#)).

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

1060 **Canadian Soil Vapour Quality Guidelines** **Acenaphthene**
1061 **for the Protection of Human Health**

1062 **Soil Vapour Quality Guidelines for Acenaphthene (CAS RN 83-32-9) (mg/m³)**

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline (provisional*)	21	130	59	370
Human health guidelines				
Protection of indoor air quality (basement) #	21	130	--	--
Protection of indoor air quality (slab on grade) #	29	140	59 [•]	370 [•]
Protection of outdoor air #	7,300	13,000	7,300	13,000
Management considerations				
Lower explosive limit (50%) †		NA		
Protection of indoor air quality (sub-slab/shallow) #	0.80		2.4 [•]	

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

NA = not available.

* Provisional guideline. A soil vapour guideline developed using an inhalation toxicological reference value (TRV) extrapolated from an oral TRV is considered provisional.

Tolerable concentration (TC) extrapolated from tolerable daily intake (TDI).

• A high-level screening was not completed as no air quality benchmark was available; therefore, no dose averaging was used (see [Appendix A](#)).

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

1078 **Soil Vapour Quality Guidelines for Benzo(a)pyrene (CAS RN 50-27-8) (mg/m³)**

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	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline: 10⁻⁵ incremental risk	0.00033	0.0019	0.00096	0.0055
Guideline: 10⁻⁶ incremental risk	0.00033	0.0019	0.00096	0.0055
Human health guidelines: 10 ⁻⁵ incremental risk				
Protection of indoor air quality (basement) ◇	0.00033 ◆	0.0019 ◆	--	--
Protection of indoor air quality (slab on grade) ◇	0.00046 ◆	0.0019 ◆	0.00096 ◆ ●	0.0055 ◆ ●
Protection of outdoor air # ◇	0.11 ◆	0.041 ◆	0.11 ◆	0.041 ◆
Human health guidelines: 10 ⁻⁶ incremental risk				
Protection of indoor air quality (basement) ◇	0.00033 ◆	0.0019 ◆	--	--
Protection of indoor air quality (slab on grade) ◇	0.00046 ◆	0.0019 ◆	0.00096 ◆ ●	0.0055 ◆ ●
Protection of outdoor air ◇	0.11 ◆	0.041 ◆	0.11 ◆	0.041 ◆
Management considerations				
Lower explosive limit (50%) †	NA			
Protection of indoor air quality (sub-slab/shallow)				
10 ⁻⁵ incremental risk ◇	0.000013 ◆		0.00004 ◆ ●	
10 ⁻⁶ incremental risk ◇	0.000013 ◆		0.00004 ◆ ●	

1081 **Notes:**

1082 Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

1083 -- = the pathway is not considered for the selected land use.

1084 NA = not available.

1085 ◇ Value represents the lowest of either carcinogenic or non-carcinogenic guidelines, if available.

1086 ♦ Presented value is based on the non-carcinogenic risk.

1087 • The toxicological reference value (TRV) for benzo(a)pyrene is based on adverse effects that suggest reproductive or developmental toxicity; therefore, no dose averaging is applied (see [Appendix A](#)).

1088 † This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

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1092 **Canadian Soil Vapour Quality Guidelines** **Fluorene**
1093 **for the Protection of Human Health**

1094 **Soil Vapour Quality Guidelines for Fluorene (CAS RN 86-73-7) (mg/m³)**

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline (provisional*)	15	86	43	250
Human health guidelines				
Protection of indoor air quality (basement) #	15	86	--	--
Protection of indoor air quality (slab on grade) #	21	97	43 [•]	250 [•]
Protection of outdoor air #	5,700	10,000	5,700	10,000
Management considerations				
Lower explosive limit (50%) †		NA		
Protection of indoor air quality (sub-slab/shallow) #	0.53		1.6 [•]	

1097 **Notes:**

1098 Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

1099 -- = the pathway is not considered for the selected land use.

1100 NA = not available.

1101 * Provisional guideline. A soil vapour guideline developed using an inhalation toxicological reference value (TRV) extrapolated from
1102 an oral TRV is considered provisional.

1103 # Tolerable concentration (TC) extrapolated from tolerable daily intake (TDI).

1104 • A high-level screening was not completed as no air quality benchmark was available; therefore, dose averaging was not used (see
1105 [Appendix A](#)).

1106 † This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in
1107 presence of an ignition source (arc, flame, heat).

1110 **Soil Vapour Quality Guidelines for 2-Methylnaphthalene (CAS RN 91-57-6) (mg/m³)**

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline (provisional*)	1.3	8.2	3.6	24
Human health guidelines				
Protection of indoor air quality (basement) #	1.3	8.2	--	--
Protection of indoor air quality (slab on grade) #	1.7	9	3.6 [•]	24 [•]
Protection of outdoor air #	390	720	390	720
Management considerations				
Lower explosive limit (50%) †		23,000		
Protection of indoor air quality (sub-slab/shallow) #	0.053		0.16 [•]	

1113 **Notes:**

1114 Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

1115 -- = the pathway is not considered for the selected land use.

1116 * Provisional guideline. A soil vapour guideline developed using an inhalation toxicological reference value (TRV) extrapolated from an oral TRV is considered provisional.

1117 # Tolerable concentration (TC) extrapolated from tolerable daily intake (TDI).

1118 • A high-level screening was not completed as no air quality benchmark was available; therefore, no dose averaging was used (see Appendix A).

1121 † This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

1123 **Canadian Soil Vapour Quality Guidelines** **Naphthalene**
 1124 **for the Protection of Human Health**

1125 **Soil Vapour Quality Guidelines for Naphthalene (CAS RN 91-20-3) (mg/m³)**

Guideline	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
	12	78	120	840
Human health guidelines				
Protection of indoor air quality (basement)	12	78	--	--
Protection of indoor air quality (slab on grade)	15	85	120 [•]	840 [•]
Protection of outdoor air	3,400	6,300	3,400	6,300
Management considerations				
Lower explosive limit (50%) †		23,000		
Protection of indoor air quality (sub-slab/shallow)		0.052		0.56 [•]

1128 **Notes:**

1129 Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

1130 -- = the pathway is not considered for the selected land use.

1131 • A high-level screening did not flag concern with the use of dose averaging. However, there is some uncertainty associated with the
 1132 use of dose averaging as a full toxicological review was not conducted for each substance; therefore, these values should be used
 1133 with caution and other lines of evidence should be considered when assessing risks. Jurisdictional authorities should be consulted for
 1134 further guidance.

1135 † This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in
 1136 presence of an ignition source (arc, flame, heat).

1139 **Soil Vapour Quality Guidelines for Styrene (CAS RN 100-42-5) (mg/m³)**

	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
Guideline	120	840	340	2,500
Human health guidelines				
Protection of indoor air quality (basement)	120	840	--	--
Protection of indoor air quality (slab on grade)	150	910	340 [•]	2500 [•]
Protection of outdoor air	31,000	57,000	31,000	57,000
Management considerations				
Lower explosive limit (50%) †		23,000		
Protection of indoor air quality (sub-slab/shallow)		5.7		17 [•]

1142 **Notes:**

1143 Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

1144 -- = the pathway is not considered for the selected land use.

1145 • A high-level screening flagged potential concern with dose-averaging; therefore, no dose averaging was used (see [Appendix A](#)).

1146 † This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in
1147 presence of an ignition source (arc, flame, heat).

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Soil Vapour Quality Guidelines for Toluene (CAS RN 108-88-3) (mg/m ³)				
Guideline	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
	3,000	22,000	8,600	65,000
Human health guidelines				
Protection of indoor air quality (basement)	3,000	22,000	--	--
Protection of indoor air quality (slab on grade)	3,700	23,000	8,600 [•]	65,000 [•]
Protection of outdoor air	670,000	1,200,000	670,000	1,200,000
Management considerations				
Lower explosive limit (50%) †		23,000		
Protection of indoor air quality (sub-slab/shallow)		15		45 [•]

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Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

• A high-level screening flagged potential concern with dose averaging; therefore, no dose averaging was used (see [Appendix A](#)).

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

1159 **Canadian Soil Vapour Quality Guidelines** **Xylenes**
 1160 **for the Protection of Human Health**

1161 **Soil Vapour Quality Guidelines for Xylenes (mg/m³)**

Guideline	Land use and soil texture			
	Agricultural/Residential		Commercial/Industrial	
	Coarse	Fine	Coarse	Fine
	110	800	1,200	8,700
Human health guidelines				
Protection of indoor air quality (basement)	110	800	--	--
Protection of indoor air quality (slab on grade)	140	860	1,200 [•]	8,700 [•]
Protection of outdoor air	27,000	50,000	27,000	50,000
Management considerations				
Lower explosive limit (50%) †		22,000		
Protection of indoor air quality (sub-slab/shallow)	0.55		6.0 [•]	

Notes:

Multiple lines of evidence are recommended to assess the vapour intrusion pathway (see Section 1.4).

-- = the pathway is not considered for the selected land use.

• A high-level screening did not flag any concern with the use of dose-averaging (see [Appendix A](#)). However, there is some uncertainty associated with the use of dose-averaging as a full toxicological review was not conducted for each substance; therefore, these values should be used with caution and other lines of evidence should be considered when assessing risks. Jurisdictional authorities should be consulted for further guidance.

† This management limit is an alert to the lowest concentration (percentage) of vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).

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APPENDIX A: REVISION TO THE SOIL VAPOUR PROTOCOL

Revised Approach to the Use of Dose-Averaging for the Indoor Air Quality Pathway

The exposure assumptions presented in the soil vapour protocol (CCME 2014) for the indoor air quality pathway follow those used by the soil protocol (CCME 2006). This is 24 hours/day, 365 days/year (i.e., an exposure term [ET] = 1) for threshold TRVs for agricultural and residential land uses, as well as for non-threshold (carcinogenic) TRVs for all land uses. For threshold TRVs, 10 hours/day, 5 days/week, 48 weeks/year (i.e., dose-averaging with an ET = 0.27) was used for commercial and industrial land uses. Dose-averaging results in a less conservative value for the calculated indoor air concentration of substances for the industrial and commercial land uses. However, since the publication of the soil vapour protocol, HC (2021) published guidance that recommends a precautionary approach with no dose-averaging (ET = 1) in human health risk assessments unless a scientific review of the TRVs supports the use of dose-averaging.

As a scientific review of TRVs for all chemicals addressed in this document would cause a significant delay in the publication of these soil vapour guidelines, a high-level screening approach was taken to address the discrepancy in the recommended ET that balances uncertainty and the need for protective guidelines that are not overly conservative. This aligns with the soil protocol which states: “While acknowledging the need for toxicity and exposure data of the highest quality, it is considered to be better to establish a guideline based on incomplete data than to not establish a risk-based guideline”.

A targeted, high-level screening of the soil vapour guidelines for the indoor air quality pathway was conducted to identify substances for which dose-averaging may result in values that exceed human health-based benchmarks from select jurisdictions. First, for chemicals that had guidelines driven by threshold TRVs, the basis for the TRV used in guideline derivation (CCME 2014, Appendix D) was considered and an ET = 1 was used as a precautionary approach if the TRV was based on adverse effects that suggest reproductive or developmental toxicity. Next, for chemicals with TRVs that did not suggest reproductive or developmental toxicity, target indoor air concentrations² for the commercial/industrial indoor air quality pathway using an ET = 0.27 were compared to the lowest of available acute or chronic air quality benchmarks from California (Reference Exposure Levels [RELs]) (California Office of Environmental Health Hazard Assessment [OEHHA] 2023) or Ontario (Ambient Air Quality Criteria [AAQCs]) (OMECF 2020)³. If the target indoor air concentration was above any of the available benchmarks, then as a precautionary measure an ET = 1 (i.e., no dose-averaging) was used. If the target indoor air concentration was below all available benchmarks, dose-averaging (i.e., ET = 0.27) was used. If no or only an acute air quality benchmark was available, a precautionary approach using an ET = 1 as recommended in HC (2021) was followed.

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² the predicted concentration of the chemical in indoor air based on the TRV and an ET = 0.27; see Appendix D calculation for non-carcinogenic target air concentration, CCME 2014.

³ The California chronic Reference Exposure Levels (California OEHHA 2023) and Ontario Ministry of the Environment, Conservation and Parks Ambient Air Quality Criteria (OMECF 2020) were chosen for this high-level screening due to the large number of chemicals for which values were available.

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