

Assessing Petroleum Hydrocarbon Contamination

Contamination with petroleum hydrocarbons is commonly encountered.

The complex mixture of compounds comprising petroleum hydrocarbon products present human health concerns predominantly through inhalation of vapours and by direct contact with affected soils and groundwater.

Site assessments will require consideration of HSLs, ESLs and petroleum management limits in order to protect human health and the environment. Depending on the nature of the contamination, consideration of HILs, EILs and GILs may also be required.

Hydrocarbon Fractions

HSLs and ESLs use petroleum hydrocarbon fraction ranges based on specified ranges of equivalent carbon number (ECN) and total recoverable hydrocarbon (TRH) analysis. The divisions are based on consideration of analytical factors, physical and chemical properties and the availability of toxicity data.

Specific aromatic carbon compounds are managed separately and should therefore be subtracted from the analytical result for each fraction before comparing with the HSLs. This applies to benzene, toluene, ethylbenzene and xylenes (BTEX) and naphthalene.

Methods to determine TRH in soil are provided in [Schedule B3](#).

Health Screening Levels (HSLs)

HSLs for TPH compounds apply to exposure through the predominant vapour exposure pathway. TPH compounds >C16 are non-volatile and therefore are not of concern for vapour intrusion.

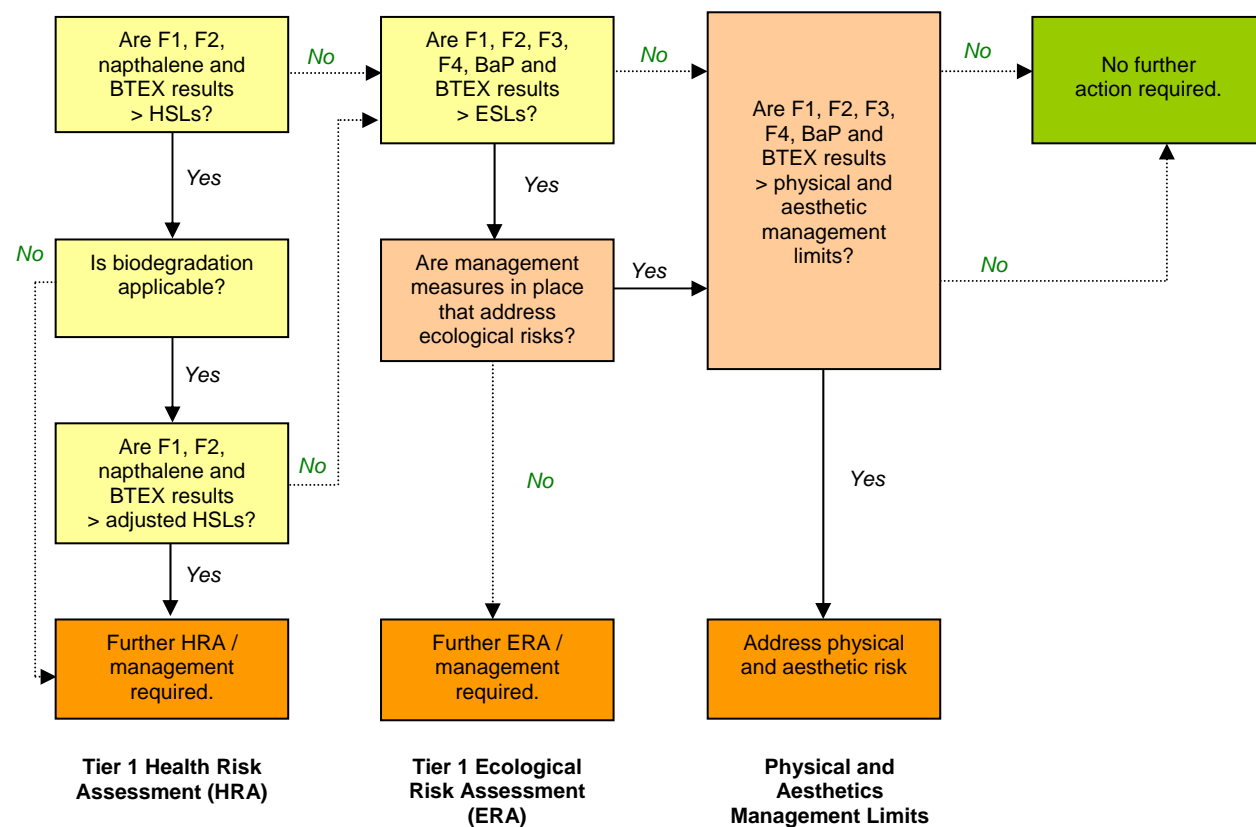
There are many site-specific, soil-specific and building-specific variables that affect the level of the HSL and these factors must be considered in risk assessment.

The Johnson and Ettinger vapour intrusion model, with parameter inputs appropriate to Australian conditions, has been used in the derivation of the HSLs. There are inherent limitations in deriving soil and groundwater criteria using this approach, hence the assessment approach has been widened to include soil gas.

A multiple lines of evidence approach to assessing vapour inhalation risk should be adopted wherever possible; further information can be found in [Schedule B2](#).

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To demonstrate the investigation and screening levels for petroleum hydrocarbons, the HSLs, ESL and Management Limits for coarse soil applicable to a low density residential setting are summarised below.



HSLs Soil (mg/kg)

Chemical/TPH fraction	HSL-A (low density residential)			
	0m to <1m	1m to <2m	2m to <4m	4m+
Toluene	190	260	370	NL
Ethylbenzene	NL	NL	NL	NL
Xylenes	45	70	110	200
Naphthalene	3	NL	NL	NL
Benzene	0.6	0.6	0.6	0.6
C6-C10	50	85	130	230
>C10-C16	130	280	520	NL

HSLs Groundwater (mg/L)

Chemical/TPH fraction	HSL A (low density residential)		
	2 to <4m	4m to <8m	8m+
Toluene	NL	NL	NL
Ethylbenzene	NL	NL	NL
Xylenes	NL	NL	NL
Naphthalene	NL	NL	NL
Benzene	0.9	1	1
C6-C10	1	1	1
>C10-C16	1	1	1

HSLs Soil gas (mg/m³)

Chemical/TPH fraction	HSL A (low density residential)				
	0 to <1m	1m to <2m	2m to <4m	4m to <8m	8m+
Toluene	1,500	4,400	8,600	17,000	34,000
Ethylbenzene	390	1,300	2,500	5,100	10,000
Xylenes	260	880	1,800	3,600	7,200
Naphthalene	0.9	4	7	15	30
Benzene	1	3	7	15	25
C6-C10	210	750	1,500	3,100	6,300
>C10-C16	160	650	1,400	2,800	NL

NL indicates that the screening level is not limiting for the assessment as the derived number is greater than is physically possible for that substance. A multiplication factor of 10 or 100 may be applied to account for biodegradation depending on depth to vapour source and confirmation of the presence of oxygen.

ESLs

Chemical/TPH fraction	ESLs (mg/kg) Coarse Soil	
	Urban residential and public open space	
Toluene	85	
Ethylbenzene	70	
Xylenes	105	
Benzene	50	
F1 C ₆ -C ₁₀	180	
F2 >C ₁₀ -C ₁₆	120	
F3 >C ₁₆ -C ₃₄	300	
F4 >C ₃₄	2800	

Management limits

TPH fraction	Management Limits (mg/kg) Coarse Soil	
	Residential, parkland and public open space	
F1 C ₆ -C ₁₀	700	
F2 >C ₁₀ -C ₁₆	1,000	
F3 >C ₁₆ -C ₃₄	2,500	
F4 >C ₃₄	10,000	

Refer to Schedule B1 for the full tables and guidance on the correct application of these numbers.