SOIL HAZARD CATEGORISATION AND MANAGEMENT

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INTRODUCTION

Producers of contaminated soil must categorise their waste into one of four categories, Category A, B, C or clean fill.

This guideline applies only to soils (it is not suitable for rubble, concrete and other inert solid waste materials).

WHAT THIS MEANS FOR YOU

If you are a producer or treater of contaminated soils, you will be required to categorise the soil into Category A, B, C or clean fill to determine what management options are available for that material.

WASTE CHARACTERISATION

Waste characterisation involves an assessment of the soil, including site history, to identify which contaminants require analysis to determine the hazard category. The assessment must be for all chemical substances known and reasonably expected to be present in the waste.

If the waste contains a contaminant that is potentially poisonous (acute), toxic (delayed or chronic) and/or ecotoxic and the contaminant is not listed in Table 2, the waste generator must apply to EPA for a determination of hazard category.

Allowable contaminant levels for fill material are also specified in Table 2. EPA does not regulate the use of fill material. However, the Environment Protection Act 1970 places general obligations to prevent adverse impacts on the environment and human health. Where there is potential for adverse impacts from the deposit of fill material, advice should be sought from EPA.

SAMPLING AND ANALYSIS

Soil sampling should be conducted in accordance with the IWRG *Soil sampling*, whilst soil analysis should be performed in accordance with the IWRG *Sampling and analysis of waters, wastewaters, soils and wastes*.

EPA requires that leachability testing be undertaken in accordance with the Australian Standard Leaching Procedure (ASLP) (Australian Standards AS4439.2 and 44396.3) by a NATA accredited laboratory. For contaminated soil going to disposal or re-use, it is necessary to perform ASLP using the acetate buffer solution (pH of 2.9 or pH 5, dependant on the pre-testing step as outline in the Australian Standard).

There is no need to conduct leachability tests in cases where total concentration data indicates that all total concentration results are less than 20 times the relevant Category C leachable concentration upper limits. This reflects the effect of dilution resulting from the use of the Australian Standard Leaching Procedure.

RECOMMENDED METHODS

The recommended methods for contaminated soils are provided in the IWRG *Solid industrial waste sampling*. EPA has no plans to mandate methods for 'totals', but the method that is used must be appropriate to determine the 'total concentration' of the contaminants.

Further information on these methods can be found on the USEPA website Test Methods SW-846 www.epa.gov/epaoswer/hazwaste/test/main.htm and from the National Environment Protection (Assessment of Site Contamination) Measure 1999 Guideline on Laboratory Analysis of Potentially Contaminated Soils www.ephc.gov.au/sites/default/files/ASC_NEPMsch__03_Lab_Analysis_199912.pdf

SPECIFIC CONTAMINANTS

Many laboratories conduct Total Recoverable Hydrocarbon (TRH) analysis and report this for Total Petroleum Hydrocarbon (TPH). A number of people have raised concerns with using TRH result and reporting these as TPH due to the presence of other hydrocarbon substances, not related to petroleum hydrocarbons, that are included in a TRH test. Until

This guidance forms part of the Industrial Waste Resource Guidelines (IWRG), which offer guidance for wastes and resources regulated under the *Environment Protection (Industrial Waste Resource) Regulations 2009* (the Regulations). Publication IWRG621 – June 2009.

there is a routine test developed exclusively for TPH, it may be necessary to discuss with clients what options are available to remove non petroleum based hydrocarbons.

To provide consistency in the approach of summing grouped contaminants and interpreting results that are below the limit of reporting, EPA recommends all positive values for the individual components be summed together.

Soils with a pH value of 4 or less or a pH of 9 or more are considered to be Prescribed Industrial Wastes (PIWs). Table 1 provides further information on pH values that are applicable to Category A.

Results for total concentrations are to be reported on a dry weight basis.

WASTE CATEGORIES

To determine the hazard category, contaminated soil must first be considered and excluded from Category A, then considered and excluded from Category B, before it can be considered as Category C. Figure 1 shows a decision flowchart for classifying waste soils.

Contaminated soils that display any specific hazard characteristic listed in Table 1 are categorised as Category A PIW.

Table 2 contains the threshold limit values (upper limits) for each of the categories, including clean fill. Contaminated soils must be assessed against the total concentration (TC0, TC1 and TC2) and leachable concentration (ASLP1 and ASLP2) thresholds specified in Table 2

Contaminated soils with any contaminant level above the TC2 or ALSP2 thresholds are categorised as Category A. Contaminated soils with any contaminant level greater than TC1, but below TC2, or greater than ASLP1, but below ASLP2 are categorised as Category B. Soils with any contaminant level greater than TC0, but below the TC1 and ALSP1 thresholds are categorised as Category C. Soils with all contaminant levels below the TC0 threshold are categorised as clean fill.

If doubt exists as to which hazard category applies to a soil, seek advice from EPA.

Landfill operators will require analytical results to demonstrate that the contaminated soil meets the relevant criteria set out in their licence.

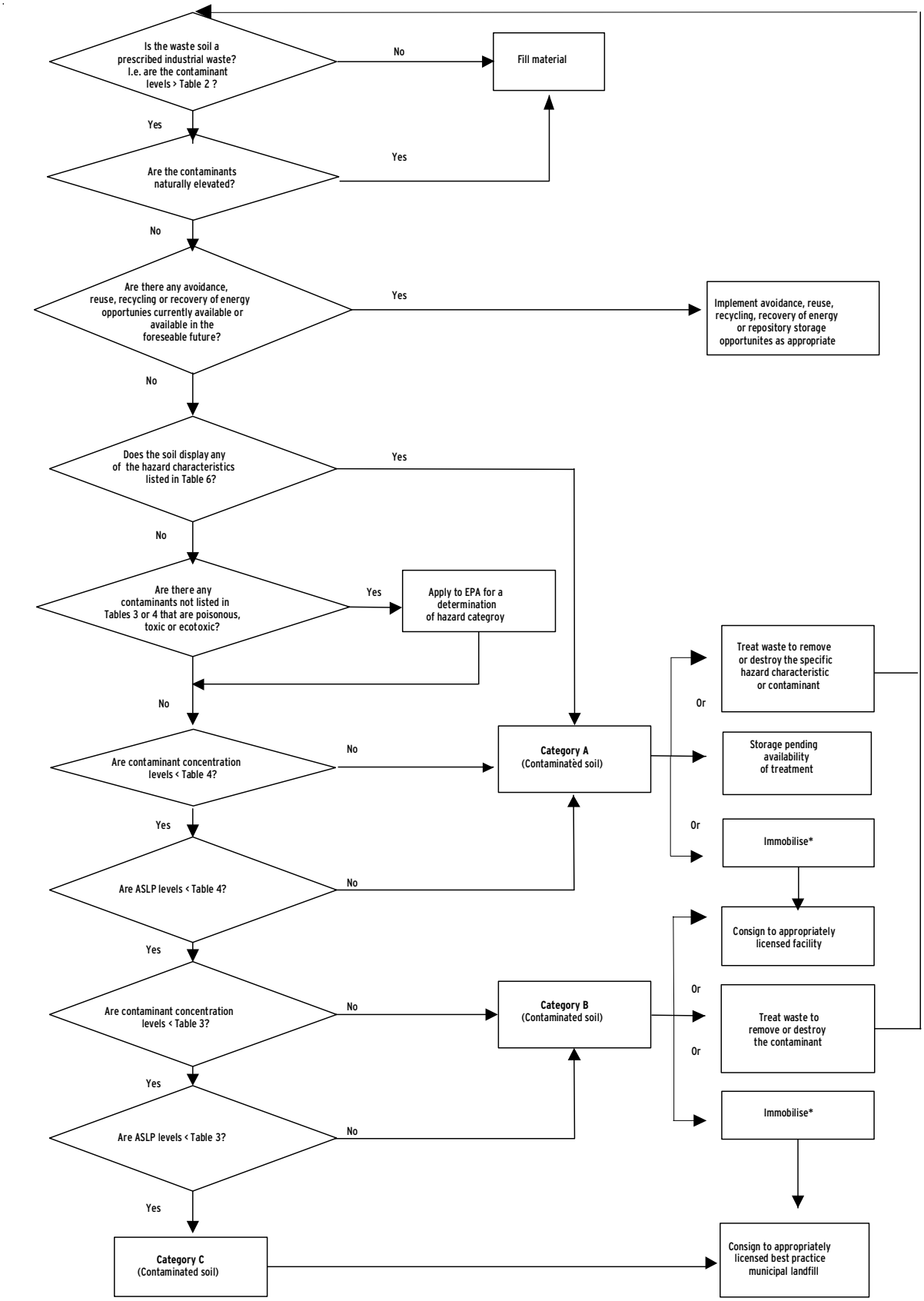

Figure 1: Decision flow chart for waste soil

Table 1: Specific hazard characteristics

Hazard characteristic	Definition1
Explosive wastes	An explosive waste is a solid waste (or mixture of wastes) which is in itself capable, by chemical reaction, of producing gas at such a temperature, pressure and speed, as to cause damage to the surroundings. Note: These are wastes classified as 'Class 1' under the provisions of the Road Transport (Dangerous Goods) Act 1995 and/or classified as 'Goods too dangerous to be transported' under the Australian Dangerous Goods Code.
Flammable2 solid wastes	Waste solids, other than those classified as explosives, which, under conditions encountered in transport or containment, are readily combustible, or may cause or contribute to fire through friction. Note: These are wastes classified as 'Class 4.1' under the provisions of the Road Transport (Dangerous Goods) Act 1995.
Wastes liable to spontaneous combustion	Wastes which are liable to spontaneous heating under normal conditions encountered in transport, or to heating up in contact with air, and liable to catch fire. Note: These are wastes classified as 'Class 4.2' under the provisions of the Road Transport (Dangerous Goods) Act 1995.
Wastes which, in contact with water, emit flammable gases	Wastes which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities. Note: These are wastes classified as 'Class 4.3' under the provisions of the Road Transport (Dangerous Goods) Act 1995.
Oxidising wastes	Wastes which, while in themselves not necessarily combustible, may, generally by yielding oxygen, cause or contribute to the combustion of other materials. Note: These are wastes classified as 'Class 5.1' under the provisions of the Road Transport (Dangerous Goods) Act 1995.
Organic peroxide wastes	Organic wastes which contain the bivalent-O-O-structure and which are thermally unstable and may undergo exothermic self-accelerating decomposition. Note: These are wastes classified as 'Class 5.2' under the provisions of the Road Transport (Dangerous Goods) Act 1995.
Infectious wastes	Wastes containing viable microorganisms or their toxins which are known or suspected to cause disease in animals or humans. Note: These include clinical and related wastes as prescribed in the Environment Protection (Prescribed Waste) Regulations 1998 and is waste classified as 'Class 6.2' under the provisions of the Road Transport (Dangerous Goods) Act 1995.
Corrosive wastes	Wastes which, by chemical action, will cause severe damage when in contact with living tissue, or in the case of leakage, will materially damage, or even destroy, other goods or the means of transport or containment. They may also cause other hazards. Where corrosivity testing data is not available, pH may be used to determine if the material is Category A. • pH value of 2 or less • pH value of 12.5 or more Note: This includes wastes classified as 'Class 8' under the provisions of the Road Transport (Dangerous Goods) Act 1995.
Wastes that liberate toxic gases in contact with air or water	Wastes which, by liberation with air or water, are liable to give off toxic gases in dangerous quantities. Note: These are wastes liable to give off toxic gases that are classified as 'Class 2.3' under the provisions of the Road Transport (Dangerous Goods) Act 1995.

1 Definitions are adopted from the *Industrial Waste Management Policy (Movement of Controlled Wastes between States and Territories) 2001.*

2 In this document the word 'flammable' has the same meaning as 'inflammable'. Flammable liquid wastes are waste liquids, or mixtures of liquids, or liquids containing solids in solution or suspension (for example, paints, varnishes, lacquers, etc.) which give off flammable vapour at temperatures of not more than 60.5 °C (closed-cup test), or not more than 65.6 °C (open-cup test). Note: The definition of flammable liquid wastes are those wastes classified as 'Class 3' under the provisions of the Road Transport (Dangerous Goods) Act 1995.

Table 2: Soil hazard categorisation thresholds

Category	Fill Material upper limits		Category C upper limits		Category B upper limits		
Contaminant concentration thresholds (dry weight)		TC0	ASLP1[1]	TC1	ASLP2[1]	TC2	
Units		(mg/kg)	(mg/L)	(mg/kg)	(mg/L)	(mg/kg)	
Inorganic species	**Inorganic species**		**Inorganic species**		**Inorganic species**		
Arsenic		20	0.7	500	2.8	2,000	
Cadmium		3	0.2	100	0.8	400	
Chromium (VI)		1	5	500	20	2,000	
Copper		100	200	5,000	800	20,000	
Lead		300	1	1,500	4	6,000	
Mercury		1	0.1	75	0.4	300	
Molybdenum		40	5	1,000	20	4,000	
Nickel		60	2	3,000	8	12,000	
Tin		50	-	500	-	-	
Selenium		10	1	50	4	200	
Silver		10	10	180	40	720	
Zinc		200	300	35,000	1,200	140,000	
Anions	**Anions**		**Anions**		**Anions**		
Cyanide		50	8	2,500	32	10,000	
Fluoride		450	150	10,000	600	40,000	
Organic species	**Organic species**		**Organic species**		**Organic species**		
Phenols (halogenated)[2]		1	2	10	8	320	
Phenols (non-halogenated)[3]		60	14	560	56	2,200	
Monocyclic aromatic hydrocarbons[4]		7	-	70	-	240	
Benzene		1	0.1	4	0.4	16	
Polycyclic aromatic hydrocarbons[5]		20	-	100	-	400	
Benzo(a)pyrene		1	0.001	5	0.004	20	
C6-C9 petroleum hydrocarbons		100	-	650	-	2,600	
C10-C36 petroleum hydrocarbons		1,000	-	10,000	-	40,000	
Polychlorinated biphenyls[6]		2	see note 6		see note 6		
Chlorinated hydrocarbons[7]		1					
Hexachlorobutadiene			0.07	2.8	0.28	11	
Vinyl chloride			0.03	1.2	0.12	4.8	
Other chlorinated hydrocarbons[8]			-	10	-	50	
Pesticides	**Pesticides**		**Pesticides**		**Pesticides**		
Organochlorine pesticides[9]		1					
Aldrin + dieldrin			0.03	1.2	0.12	4.8	
DDT + DDD + DDE			2	50	-	50	
Chlordane			0.1	4	0.4	16	
Heptachlor			0.03	1.2	0.12	4.8	
Other organochlorine pesticides[10]			-	10	-	50	

FILL MATERIAL | CATEGORY C CONTAMINATED SOIL | CATEGORY B CONTAMINATED SOIL | CATEGORY A CONTAMINATED SOIL

Notes

1. Australian Standard Leaching Procedure (acetate buffer) as specified in Australian Standards 4439.2 and 4439.3.
2. Total sum of 4-chloro-3-methylphenol, 2-chlorophenol, 2,4-dichlorophenol, 2,6-dichlorophenol, pentachlorophenol, 2,3,4,5-tetrachlorophenol, 2,3,4,6-tetrachlorophenol, 2,3,5,6-tetrachlorophenol, 2,4,5-trichlorophenol, and 2,4,6-trichlorophenol.
3. Total sum of phenol, 2-methylphenol (o-cresol), 3-methylphenol (m-cresol), 4-methylphenol (p-cresol), 2,4-dimethylphenol, 2.4-dinitrophenol, 2-methyl-4,6-dinitrophenol, 2-nitrophenol, 4-nitrophenol, 2-cyclohexyl-4,6-dinitrophenol and dinoseb.
4. Total sum of benzene, toluene, ethyl benzene, xylenes (includes ortho, para and meta xylenes) and styrene.
5. Total sum of naphthalene, acenaphthylene, acenaphthene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluorene, fluoranthene, indeno(1,2,3-c,d)pyrene, phenanthrene and pyrene.
6. Soil containing polychlorinated biphenyls (PCBs) must be managed in accordance with the *Notifiable Chemical Order for Polychlorinated Biphenyls*. Industrial Waste Guidelines section *Polychlorinated Biphenyls (PCBs)* provides further information.
7. Total sum of carbon tetrachloride, chlorobenzene, chloroform, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,2-dichloroethane, 1,1-dichloroethene, 1,2-dichloroethene, dichloromethane (methylene chloride), 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, 1,2,4-trichlorobenzene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, trichloroethene, tetrachloroethene, vinyl chloride and hexachlorobutadiene.
8. Total sum of carbon tetrachloride, chlorobenzene, chloroform, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,2-dichloroethane, 1,1-dichloroethene, 1,2-dichloroethene, dichloromethane (methylene chloride), 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, 1,2,4-trichlorobenzene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, trichloroethene and tetrachloroethene.
9. Total sum of aldrin, hexachlorobenzene, alpha BHC, beta BHC, gamma BHC (lindane), delta BHC, chlordane, DDT, DDD, DDE, dieldrin, endrin, endrin aldehyde, heptachlor, heptachlor epoxide, methoxychlor and endosulfan (includes endosulfan I, endosulfan II and endosulfan sulphate).
10. Total sum of hexachlorobenzene(HCB), alpha BHC, beta BHC, gamma BHC (lindane), delta BHC, chlordane, endrin, endrin aldehyde, heptachlor, heptachlor epoxide, methoxychlor and endosulfan (includes endosulfan I, endosulfan II and endosulfan sulphate).

MANAGEMENT OPTIONS

Waste generators must classify contaminated soil by hazard category in order to determine which facility is licensed to accept the soil. If the soil does not meet the acceptance criteria, further treatment or stabilisation will be required.

Category C and Category B Contaminated soil can be accepted at a landfill or facility licensed by EPA to accept such waste.

Category A Contaminated soil will require treatment to reduce or control the hazard before meeting acceptance criteria for disposal at an appropriate EPA-licensed facility.

Table 3: Contaminated soil management options

Category A contaminated soil	• On-site remediation • Off-site remediation • Storage pending availability of treatment	No disposal to landfill. • EPA transport certificates must be used. • Vehicles must hold EPA permit (unless exemption issued).
Category B contaminated soil	• On-site remediation • Off-site remediation • Licensed facility	Disposal to licensed facility. • EPA Transport certificate system must be used. • Vehicles must hold EPA permit (unless exemption issued).
Category C contaminated soil	• On-site remediation • Off-site remediation • Licensed landfill	Disposal to licensed landfill. • EPA Transport certificate system must be used. • Vehicles must hold EPA permit (unless exemption issued).

Generators of contaminated soils may wish to submit a classification application to EPA for approval, where it can be demonstrated that a different category from that outlined above is appropriate for a particular contaminant or group of contaminants in soil. For example, a contaminant that is intrinsically immobilised (without treatment) may display a low hazard because of the very low leachable concentration, despite a relatively high total concentration. Applications will need to provide justification as to why the proposed management will achieve the best environmental outcome. Further analytical testing may also be required. The Industrial Waste Resource Guidelines (IWRG) Classifications - for Disposal provides further information on the requirements for a classification.

FURTHER INFORMATION

- Australian Standard 4439.2 – 1997, *Wastes, sediments and contaminated soils*. Part 2: Preparation of leachates – Zero headspace procedure
- Australian Standard 4439.3 – 1997, *Wastes, sediments and contaminated soils*. Part 3: Preparation of leachates –Bottle leaching procedure
- Australian Standard 4482.1 – 2005, *Guide to sampling and investigation of potentially contaminated soil*. Part 1: Non-volatile and semi-volatile compounds