Module 2:

Hazardous Waste Guidelines

Landfill Waste Acceptance Criteria and Landfill Classification

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Appendices

1. Introduction

Module 2 of the Hazardous Waste Guidelines outlines a nationally consistent approach to the disposal of waste to landfills. This module provides:

- waste acceptance criteria for two classes of landfills (Class A and Class B), including concentration limits covering a greater range of contaminants than those currently specified in the US EPA Toxicity Characteristic Leaching Procedure (TCLP) list
- a landfill classification system
- a definition of liquid waste
- a list of prohibited wastes
- flowcharts clearly outlining the waste acceptance and landfill classification process
- model resource consent conditions for Class A and Class B landfills.

The following sections provide a context for the proposed waste acceptance criteria and landfill classification guidelines, and the background to the development of the approach adopted.

Why do we need to control the disposal of wastes?

Landfills without effective containment increase the likelihood of the discharge of hazardous contaminants to the environment. There are many inconsistencies in the design and management of landfills throughout New Zealand, and many operate with vague, subjective or ineffective controls on hazardous waste disposal. Current New Zealand approaches to the landfill disposal of hazardous wastes are out of alignment with international best practice.

The Ministry for the Environment believes that policy instruments for controlling hazardous waste disposal should be adopted at a *national* level (as opposed to being developed locally). The following factors result in inconsistency and increased risk to the environment.

- Many landfills operate with inappropriate or ineffective waste acceptance criteria.
- A variety of approaches have been used for setting waste acceptance criteria.
- Hazardous wastes are easily transported across regional boundaries.
- In some cases New Zealand waste acceptance criteria in landfill resource consent conditions are inconsistent with international best practice.
- Policy set nationally by central government can provide waste generators and the waste management industry with both certainty and a level playing field.

How does the landfill classification system work?

This module outlines a method for classifying landfills based on the level of natural and engineered containment. The relevant sections are:

- Section 4: Landfill Classification
- Appendix D: Landfill Classification – Class A Requirements
- Appendix E: Assessing Alternative Solutions for Class A Landfills.

The Ministry proposes that the 'class' of a landfill be assessed through the existing resource consent process (including review) in order to identify the appropriate waste disposal controls to put in place through consent conditions.

Development of this guideline

The Waste Acceptance Criteria and Landfill Classification system has been developed following:

- general consultation through an issues and options report (Landfill Acceptance Criteria for Wastes with Hazardous Properties: Issues and Options)
- an examination of international approaches to waste acceptance criteria, including a study tour to Australia and consideration of approaches adopted in Europe and the USA
- ongoing consultation with key stakeholders, including regulators, landfill operators and waste producers
- development of an approach to landfill classification for New Zealand (Basis for Landfill Classification System, URS New Zealand Limited, 2001)
- development of waste acceptance criteria for Class A landfills (Waste Acceptance Criteria for Class A Landfills, URS New Zealand Limited, 2003).

In addition to the waste acceptance criteria work programme, several other documents have provided the technical basis for the development of the guideline:

- The 2002 Landfill Review and Audit, Ministry for the Environment, 2003
- The Landfill Guidelines, Centre for Advanced Engineering, 2000
- *Waste Acceptance Criteria at Landfills*, SCS-Wetherill Environmental, 1999
- *Review of Overseas Approaches to the Management and Landfilling of Hazardous Waste*, Environment and Business Group, 1997
- *Towards a New Zealand Definition of Hazardous Waste*, Ministry for the Environment, 1999
- *Guidelines for the Management of Hazardous Waste – Module 1: Identification and Record-keeping*, Ministry for the Environment, 2002.

2. The Waste Acceptance Criteria and Landfill Classification System

These guidelines provide a method for determining if wastes are acceptable for disposal to landfill. Under these guidelines, landfills with a higher standard of environmental protection (Class A landfills) will be able to accept wastes subject to less stringent criteria than those applicable to lower-standard (or Class B) landfills. This will result in hazardous wastes only being able to be accepted after they have been treated or stabilised to minimise hazards and then disposed of at landfills that offer an appropriately high standard of environmental protection.

This Waste Acceptance Criteria and Landfill Classification system provides a consistent and integrated approach for determining whether a waste is acceptable for disposal at a specific landfill. The system provides:

- waste acceptance criteria for the two landfill classes (Section 3: Landfill waste acceptance criteria, Section 5: Liquid waste definition, Section 6: Prohibited wastes and Appendix A: Total Concentration and Leachability Limits for Class A and Class B Landfills)
- a method for classifying landfills based on the level of natural and engineered containment. (Section 4: Landfill classification, Appendix D: Landfill Classification – Class A Requirements and Appendix E: Assessing Alternative Solutions for Class A Landfills).

Appendix F presents worked examples for landfill waste acceptance and landfill classification.

3. Landfill Waste Acceptance Criteria

Background

Appendix A presents landfill waste acceptance criteria for Class A and Class B landfills for a range of contaminants. These criteria will be included as individual landfill consent conditions imposed by the appropriate regulatory authority. It is the responsibility of the consent holder for each individual landfill to ensure that these conditions are complied with.

The waste acceptance criteria presented in Appendix A have been developed to protect the most sensitive receptor (either drinking water supplies or aquatic ecosystems). There may be other issues of concern for specific wastes, including effects on leachate treatability and the health and safety of waste transporters and landfill operations staff.

Leachate treatability may be assessed by reference to the limit criteria in the New Zealand Standard Trade Waste By-Law (Standards New Zealand, 1999) where leachate is discharged to a municipal wastewater treatment system. Where leachate is treated on-site, site- and process-specific factors will need to be taken into account (Centre for Advanced Engineering, 2000).

The health and safety of waste transporters and landfill operations staff can largely be managed through operational procedures (e.g. controlling dust, the appropriate use of personal protective equipment). Volatile contaminant concentrations should be limited to ensure that Occupational Safety and Health Workplace Exposure Standards (OSH-WES) are not exceeded.

The underlying philosophy is that landfills offering a lower level of environmental protection should be more restricted in the range of wastes they can accept. The process to determine what wastes are acceptable for disposal in each of the differing classes is summarised in Figure 1.

Waste acceptance criteria for Class A landfills

It is recommended that any non-municipal waste streams be checked against the NZ Waste List. Non liquid wastes marked as not hazardous (i.e. non-asterisked) are suitable for disposal to Class A landfills.

Wastes that are marked on the NZ Waste List as being hazardous may be appropriate for disposal at Class A landfills, but only after the landfill operator is confident the waste will not result in leachate from the wastes exceeding the leachate concentrations specified in Appendix A for Class A landfills. Normally this will be assessed using the US EPA TCLP test.

Appendix A provides ‘screening limits’ for Class A landfills based on the analysis of samples of the waste rather than the TCLP extract. These levels are derived by multiplying the TCLP criteria by 20, based on the assumption that all the contaminant present in the waste is transferred to leachate (which is diluted 20-fold in the TCLP methodology). Where the concentration of the contaminant in the waste is below the screening level, there is no need to

test for TCLP. Where the concentration of the contaminant in the waste exceeds the screening level, a TCLP test may show that the contaminant is sufficiently immobilised in the waste matrix to still meet the TCLP criteria.

Some contaminants have low solubility in water but may still pose a risk via leachate discharge where they are present as a separate phase in leachate. Non-volatile hydrocarbons are an example of this.

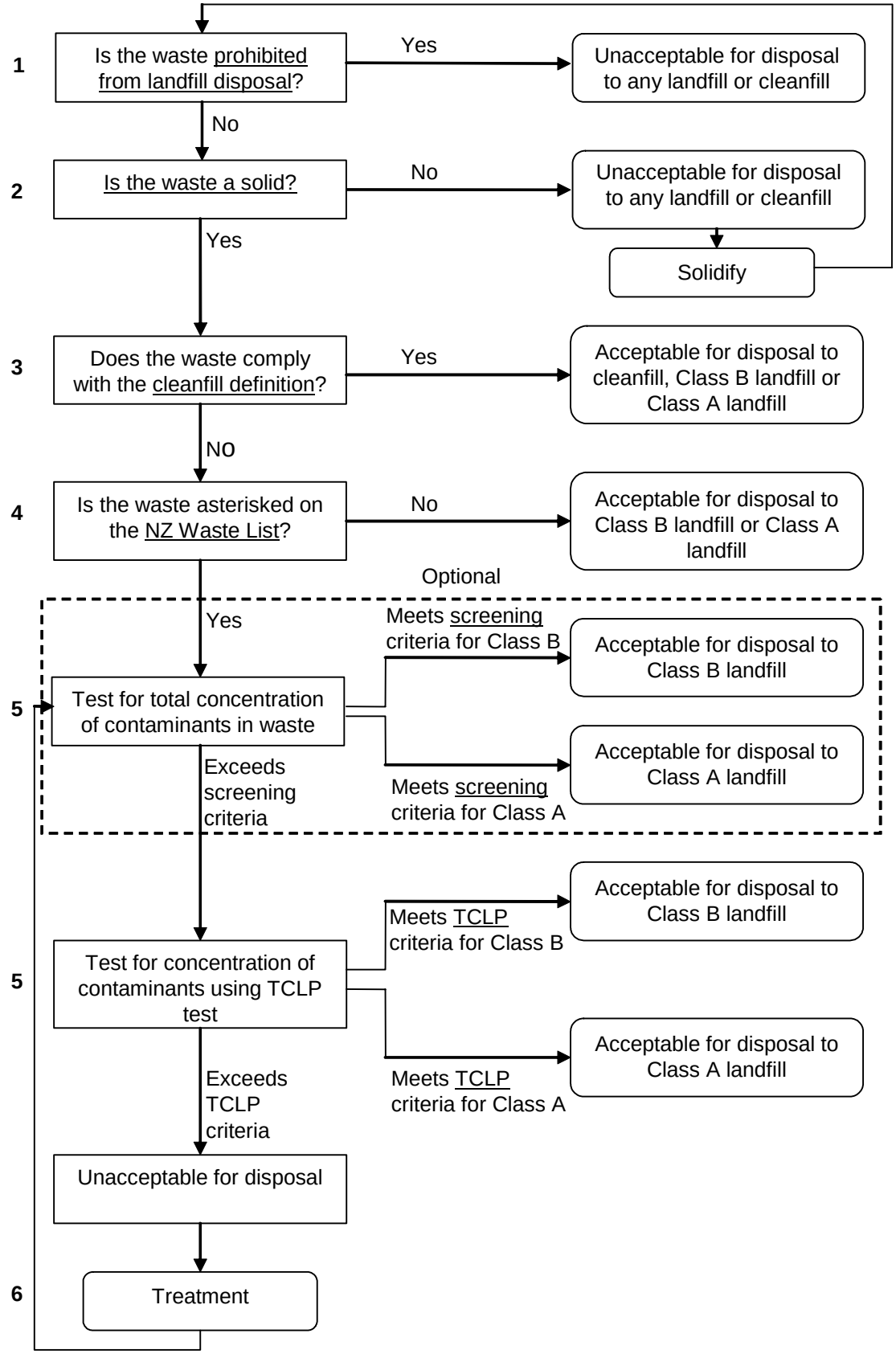
Waste acceptance criteria for Class B landfills

Wastes marked on the NZ Waste List as being hazardous may be appropriate for disposal at Class B Landfills, but only after the landfill operator is confident the waste will not result in leachate from the wastes exceeding the leachate concentrations specified in Appendix A for Class B landfills. Normally this will be assessed using the US EPA TCLP test.

Appendix A provides 'screening limits' for Class B landfills based on the analysis of samples of the waste rather than the TCLP extract. These levels are derived by multiplying the TCLP criteria by 20, based on the assumption that all the contaminant present in the waste is transferred to leachate (which is diluted 20-fold in the TCLP methodology). Where the concentration of the contaminant in the waste is below the screening level, there is no need to test for TCLP. Where the concentration of the contaminant in the waste exceeds the screening level, a TCLP test may show that the contaminant is sufficiently immobilised in the waste matrix to still meet the TCLP criteria.

Note: cleanfill sites are only able to accept solid wastes that meet the cleanfill definition in the Guide to Managing Cleanfills.

Figure 1: Waste acceptance decision process



The steps illustrated in Figure 1 are explained below.

Step 1. Is the waste prohibited from landfill disposal?

Is the waste included in the list of prohibited wastes?

Step 2. Is the waste a solid?

Does the waste pass the Paint Filter Test? If the waste is a liquid it cannot be disposed to landfill. Alternatives to direct landfill disposal include:

- solidifying the waste, possibly including treatment to immobilise contaminants, prior to disposal
- disposing of the waste to sewer in accordance with the relevant tradewaste controls, possibly including pre-treatment prior to disposal.

Step 3. Does the waste comply with the cleanfill definition?

Is the waste acceptable for disposal to cleanfill? To establish this, check using the cleanfill definition.

Step 4. Is the waste asterisked on the NZ Waste List?

Check the waste stream against the NZ Waste List. If the waste is not marked with an asterisk then it is acceptable for disposal at a Class A or Class B landfill. Waste streams identified on the NZ Waste List as being potentially hazardous are not acceptable for disposal to a cleanfill site, even if they have been treated.

Step 5. Test for total concentration of contaminants in waste *and/or* Test for concentration of contaminants using TCLP test

If the waste is marked with an asterisk on the NZ Waste List it may still be able to be disposed to a Class A or B landfill without pre-treatment, but only if a total concentration and/or TCLP test shows that the waste meets the relevant disposal criteria specified in Appendix A for Class A and Class B landfills.

The screening criteria are provided as an optional tool for assessing wastes with TCLP criteria, or where contaminant concentration data is already available. If the contaminant concentration is below the screening criteria then no TCLP test is required. Where the contaminant concentration exceeds the screening criteria the waste may still meet the relevant TCLP criteria due to immobilisation of the contaminant in the waste matrix. For contaminants with low solubility, total concentration criteria provide the only waste acceptance criteria.

For wastes with well-defined characteristics, testing may not be required for every load. This is subject to the resource consent conditions for the specific landfill operation and the landfill management plan.

Step 6. Treatment

If the waste is shown by testing to be unacceptable, some form of treatment or immobilisation may be possible to reduce the leachable concentrations to acceptable levels (dilution is not acceptable) for disposal to a Class A or Class B landfill. Cleanfills can not accept treated wastes.

4. Landfill Classification

The landfill classification system divides landfills into two classes, with different levels of environmental protection and minimum requirements for each class, covering siting, design and operational characteristics. The two classes are as follows.

- **Class A landfills** meet, or are consistent with, the site selection and design standards outlined in the Centre for Advanced Engineering's *Landfill Guidelines* (2000). These landfills are sited in areas that reduce the potential for adverse environmental effects, have engineered systems designed to provide a degree of redundancy for leachate containment, and collect landfill leachate and landfill gas. See Appendix D: Landfill Classification –Class A Requirements and Appendix E: Assessing Alternative Solutions for Class A Landfills for help in determining whether a specific landfill can be considered a Class A landfill.

  Minimum requirements: Centre for Advanced Engineering, *Landfill Guidelines* (2000).

- **Class B landfills** are existing landfills that do not meet the site selection and design standards outlined in the Centre for Advanced Engineering's *Landfill Guidelines* (2000) and are consented to accept general domestic and commercial waste. These landfills have limited or no engineered systems designed to collect landfill leachate or gases, and may be in areas that pose a risk to the environment (e.g. sited over highly permeable sands and/or gravels, active faults, or floodplains).

  Minimum requirements: existing resource consent to accept general domestic and commercial waste.

The landfill classification system allows some level of flexibility. For instance, there may not be sufficient low-permeability clay regionally available to allow the cost-effective design of a landfill that is clearly equivalent to the suggested landfill designs outlined in the CAE Landfill Guidelines. However, it may be possible to design the landfill in such a way that it provides a level of containment equivalent to those designs.

Landfills that do not clearly meet the requirements outlined in the CAE Landfill Guidelines have the option of showing that the selected combination of siting and design provide an equivalent level of containment. In all cases, Class A landfills must meet a number of minimum design and siting requirements. These are the criteria in Appendix A where no alternative solutions are provided for.

The decision process for waste acceptance is outlined in Figure 2, but the following points should be noted.

- The landfill classification system applies to municipal waste landfills – it does not include industrial monofills. Waste acceptance criteria for industrial monofills should be determined through the resource consent process under the Resource Management Act 1991.
- Cleanfill sites are covered by the Guide to the Management of Cleanfills and can accept wastes meeting the Ministry's cleanfill definition. Cleanfills should have an existing resource consent to accept cleanfill material, or meet the conditions of a relevant permitted activity rule in a regional plan.
- The majority of existing landfills do not meet the Class A standard, although the majority of refuse in New Zealand is disposed to sites that are likely to meet Class A. The

inclusion of Class B acknowledges the existence of older-style tips or landfills and the need to control waste disposal at these sites. It is unlikely that new landfills would be consented unless they meet the Class A landfill standard.

- It is recognised that there is an increasing demand for sites that accept construction and demolition wastes. The acceptable standard for these sites depends on the range of wastes being accepted at the site. In practice this varies widely, and it is recommended that the acceptable standard be developed on a site-by-site basis.

Figure 2: Landfill classification

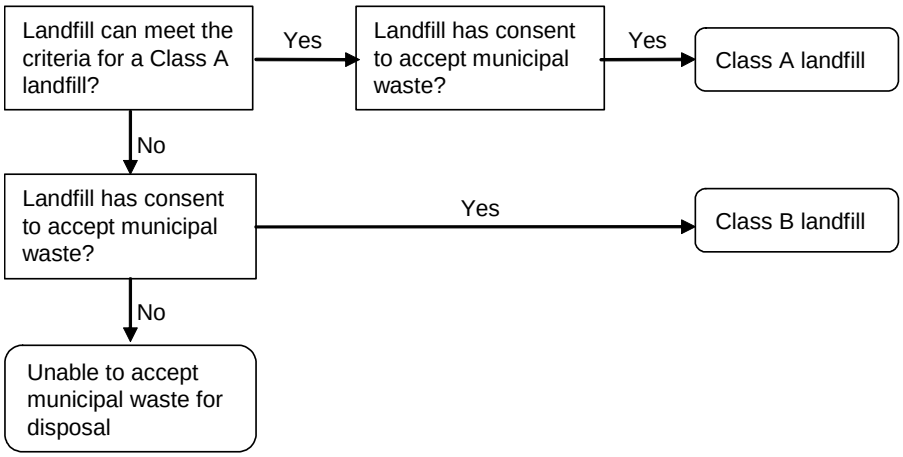


Figure 2 shows that if a landfill can meet the criteria for Class A landfills *and* has a consent to accept municipal waste, then it is a Class A landfill. If a landfill cannot meet the criteria for Class A landfills but has a consent to accept municipal waste, then it is a Class B landfill.

5. Liquid Waste Definition

Bulk liquids are not suitable for disposal to any class of landfill because they:

- increase the volume of leachate generated and requiring treatment and/or disposal
- can result in increased odour nuisance
- can reduce the stability of the refuse mass under certain conditions.

The prohibition of liquid waste requires an appropriate definition and practical test to enable clear, consistent and unequivocal determination of whether or not a waste is suitable for disposal. The following definition of liquid waste is recommended, as it provides a consistent means of determining whether or not a waste is non-liquid and therefore whether it is acceptable for landfill disposal.

For waste to be considered non-liquid it must meet the following requirements:

- a solids content of at least 20% *and* liberate no free liquids when transported; *or*
- no free liquids when tested in accordance with the US EPA Paint Filter Liquids Test (US EPA Method 9095A 1996) *and* liberate no free liquids when transported.

6. Prohibited Wastes

There are a number of waste streams that due to their inherent nature or characteristics can adversely affect the operation of a landfill site and therefore should be prohibited from landfill disposal. The following are recommended as not being suitable for disposal to *any* type of landfill (Class A, Class B or cleanfill):

- bulk liquids (see previous section for definition of liquid waste)
- radioactive wastes[1]
- lead acid batteries[2]
- used oil
- explosive, flammable, oxidising or corrosive substances – as defined under the HSNO Act
- refrigerators or freezers, unless they have been degassed[3]
- PCB wastes.

[1] Unless meeting the disposal requirements specified by Section 14 of the Radiation Protection Regulations 1982.

[2] Lead acid batteries can be recycled in New Zealand.

[3] Phone 0800 NOLOSS for details of a local contractor who can undertake refrigerant recovery.

7. Model Resource Consent Conditions

The following are recommended resource consent conditions for Class A landfills and Class B landfills.

Model resource consent conditions for Class A landfills

Operational conditions

1. No liquid wastes shall be accepted for disposal. For waste to be considered non-liquid it must meet one of the following requirements:
   - a solids content of at least 20% *and* liberate no free liquids when transported; *or*
   - no free liquids when tested in accordance with the US EPA Paint Filter Liquids Test (US EPA Method 9095A 1996) and liberate no free liquids when transported.

2. Medical wastes shall only be accepted in accordance with NZS 4304:2002 "Healthcare Waste Management", or subsequent amendments.

3. Asbestos waste shall be accepted only in accordance with the Asbestos Regulations 1998, or subsequent amendments.

4. The following wastes are not acceptable for disposal at the landfill:

   (i) waste marked with an asterisk on the NZ Waste List (L Code), with the following exceptions:

   - solid wastes which, following testing using the US EPA Toxicity Characteristic Leaching Procedure (TCLP), result in leachable concentrations of contaminants less than the leachable concentration values listed in Table 1; or
   - solid wastes which, following testing for total concentration, result in total concentration values less than the screening criteria listed in Table 1; or
   - any asterisked waste stream from the waste list identified as containing asbestos – if they are labelled, packaged and disposed in accordance with the requirements laid out in the Asbestos Regulations 1998; or
   - small quantities of waste products containing potentially hazardous components that are not likely to have adverse effects on the environment, such as can reasonably be expected to be contained in the municipal waste stream

(ii) any liquid wastes as defined by condition 1 of this consent, with the exception of landfill leachate; and

(iii) wastes or substances classified as explosive, flammable, oxidising or corrosive under the Hazardous Substances and New Organisms Act 1996.

5. To minimise the potential for hazardous waste to be disposed of at the landfill the following measures shall be taken:

- notice shall be clearly positioned at the landfill entrance to identify the hazardous wastes that are unacceptable at the landfill; and
- random inspections of incoming loads for the presence of hazardous waste shall be undertaken; inspections should be undertaken on a minimum of 1 in 50 loads.

Monitoring and reporting conditions

6. The consent holder shall maintain to the satisfaction of the _____ Regional Council a record of the quantities and types of waste accepted at the landfill.

   A copy of this record shall be forwarded to the _____ Regional Council by 1 August each year, unless otherwise agreed in writing by the _____ Regional Council.

7. The consent holder shall immediately notify the _____ Regional Council if any vehicle(s) is/are turned away from the landfill with waste that does not comply with the waste acceptance criteria detailed in conditions 1, 2, 3 and 4. This notification shall include the vehicle registration number and source of the waste (if known).

Review conditions

8. The _____ Regional Council, after consultation with the consent holder, may commence a review of conditions 1, 2, 3 and 4 of this consent within six months of the release of any national guidelines or national environmental standard covering the definition of hazardous waste or landfill disposal controls.

   Costs relating to the above review shall be borne by the consent holder.

Table 1: Leachability limits and screening concentrations

	CAS no.[1]	Class A landfills	
		Screening criteria[2] (mg/kg)	Concentration in leachate (mg/L)
Inorganic contaminants			
Aluminium	7429-90-5	800	40[5]
Antimony	7440-36-0	12	0.6[4]
Arsenic	7440-38-2	100	5[3]
Barium	7440-39-3	2,000	100[3]
Beryllium	7440-41-7	200	10[4,6]
Boron	7440-42-8	400	20[6]
Cadmium	7440-43-9	20	1[3,6]
Chromium (VI)	18540-29-9	100	5[3]
Copper	7440-50-8	100	5[5]
Fluoride	16984-48-8	4,000	200[5,6]
Lead	7439-92-1	100	5[3]
Lithium	7439-93-2	400	20[4]
Mercury	7439-97-6	4	0.2[3,6]
Molybdenum	7439-98-7	200	10[5]
Nickel	7440-02-0	200	10[5,6]
Selenium	7782-49-2	200	1[3,6]
Silver	7440-22-4	200	5[3]
Tin	7440-31-5	20,000	1000[4,6]
Vanadium	7440-62-2	40	2[5]
Zinc	7440-66-6	200	10[5]
Aromatic hydrocarbons			
Aniline	62-53-3	4	0.2[5]
Styrene	100-42-5	120	6[5,6]
Polynuclear aromatic hydrocarbons			
Naphthalene	91-20-3	200	10[5,6]
Other halogenated aromatic hydrocarbons			
1,2 Dichlorobenzene	95-50-1	4	0.2[5,6]
1,3 Dichlorobenzene	541-73-1	1000	50[5,6]
1,2,3 Trichlorobenzene	87-61-6	1000	50[5,6]
1,2,4 Trichlorobenzene	120-82-1	800	40[5,6]
BTEX			
Benzene	71-43-2	10	0.5[3]
Toluene	108-88-3	2000	100[5,6]
Ethyl benzene	100-41-4	1000	50[4,6]
Xylene (m,o,p)	1330-20-7	2000	100[4,6]
Chlorinated aliphatic hydrocarbons			
Vinyl chloride	75-01-4	4	0.2[3]
1,2 Dichloroethene	540-59-0	200	10[4,6]
1,3 Dichloropropene	542-75-6	40	2[4,6]
Dichloromethane	75-09-2	40	2[4,6]
1,1,1, Trichloroethane	71-55-6	4,000	200[4,6]
1,1,2 Trichloroethane	79-00-5	10,000	500[5,6]
1,1,2,2 Tetrachloroethane	79-34-5	1,000	50[5,6]
1,2 Dibromo-3-chloropropane	96-12-8	40	0.2[4]
1,2 Dichloropropane	78-87-5	20	1[4]

	CAS no.[1]	Class A landfills	
		Screening criteria[2] (mg/kg)	Concentration in leachate (mg/L)
Other halogenated aliphatic hydrocarbons			
Bromodichloromethane	75-27-4	20	1[4]
Bromoform	75-25-2	200	10[4]
Dibromochloromethane	124-48-1	200	10[4]
Phenols			
2,4,6 Trichlorophenol	88-06-2	2	0.1[4,6]
2 Chlorophenol	95-57-8	0.1	0.05[4,6]
2,4 Dichlorophenol	120-83-2	0.1	0.05[4,6]
Phenol	108-95-2	800	40[5]
Pesticides			
2,4 Dichlorophenoxyacetic acid (2,4 D)	94-75-7	200	10[3,6]
Aldrin	309-00-2	0.00016	0.00008[5]
Dieldrin	60-57-1	8	0.4[5,6]
Endosulfan	115-29-7	6	0.3[5,6]
Phthalates			
Diethylphthalate	84-66-2	2,000	100[5]
Dimethylphthalate	131-11-3	8,000	400[5]
Di-n-butylphthlate	84-74-2	6,000	300[5]
Other organics			
Carbon disulphide	75-15-0	60	3[5]
Organometallics			
Tributyltin oxide (TBTO)	56-35-9	60	3[4]

1. Chemical Abstracts Service Registry Number – a unique identifier that tells you, for example, that acetone and dimethyl ketone are the same substance.
2. Screening criterion = 20 x TCLP criteria; where contaminant concentration is below the screening criteria, no TCLP test is necessary.
3. Adopted from the US EPA TCLP numbers.
4. Derived using a constituent specific dilution attenuation factor and the *Drinking-water Standards for New Zealand* (Ministry of Health, 1995).
5. Derived using a constituent specific dilution attenuation factor and the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC and ARMCANZ, 2000).
6. Concentration exceeds the limit in the New Zealand Standard Trade Waste By-law (NZS 9201).

Model resource consent condition for Class B landfills

The recommended resource consent conditions for Class B landfills are more restrictive.

Operational conditions

1. No liquid wastes shall be accepted for disposal. For waste to be considered non-liquid it must meet one of the following requirements:
   - a solids content of at least 20% *and* liberate no free liquids when transported; *or*
   - no free liquids when tested in accordance with the US EPA Paint Filter Liquids Test (US EPA Method 9095A 1996) and liberate no free liquids when transported.

2. Medical wastes shall only be accepted in accordance with NZS 4304:2002 "Healthcare Waste Management", or subsequent amendments.

3. Asbestos waste shall be accepted only in accordance with the Asbestos Regulations 1998 or subsequent amendments.

4. The following wastes are not acceptable for disposal at the landfill:
   (i) waste marked with an asterisk on the NZ Waste List (L Code), with the following exceptions:
      - solid wastes which, following testing using the US EPA Toxicity Characteristic Leaching Procedure (TCLP), result in leachable concentrations of contaminants less than the leachable concentration values listed in Table 1; or
      - solid wastes which, following testing for total concentration, result in total concentration values less than the screening criteria listed in Table 2; or
      - any asterisked waste stream from the waste list identified as containing asbestos – assuming they are labelled, packaged and disposed in accordance with the requirements laid out in the Asbestos Regulations 1998; or
      - small quantities of waste products containing potentially hazardous components that are not likely to have adverse effects on the environment, such as can reasonably be expected to be contained in the municipal waste stream

   (ii) any liquid wastes as defined by condition 1 of this consent, with the exception of landfill leachate; and

   (iii) wastes on the NZ Waste List described as liquids, oils, solvents, acids, alkalis; and

   (iv) wastes or substances defined as explosive, flammable, oxidising or corrosive under the Hazardous Substances and New Organisms Act 1996.

5. To minimise the potential for hazardous waste to be disposed of at the landfill the following measures shall be taken:

   - notice shall be clearly positioned at the landfill entrance to identify the hazardous wastes that are unacceptable at the landfill; and
   - random inspections of incoming loads for the presence of hazardous waste shall be undertaken; inspections should be undertaken on a minimum of 1 in 50 loads.

Monitoring and reporting conditions

6. The consent holder shall maintain to the satisfaction of the _____ Regional Council a record of the quantities and types of waste accepted at the landfill.

   A copy of this record shall be forwarded to the _____ Regional Council by 1 August each year, unless otherwise agreed in writing by the _____ Regional Council.

7. The consent holder shall immediately notify the _____ Regional Council if any vehicle(s) is/are turned away from the landfill with waste that does not comply with the waste acceptance criteria detailed in conditions 1, 2, 3 and 4. This notification shall include the vehicle registration number and source of the waste (if known).

Review conditions

8. The _____ Regional Council, after consultation with the consent holder, may commence a review of conditions 1, 2, 3 and 4 of this consent within six months of the release of any national guidelines or National Environmental Standard covering the definition of hazardous waste or disposal controls.

   Costs relating to the above review shall be borne by the consent holder.

Table 2: Leachability limits and screening concentrations

	CAS no.[1]	Class B landfills	
		Screening criteria[2] (mg/kg)	Concentration in leachate (mg/L)
Inorganic contaminants			
Aluminium	7429-90-5	80	4
Antimony	7440-36-0	1.2	0.06
Arsenic	7440-38-2	10	0.5
Barium	7440-39-3	200	10
Beryllium	7440-41-7	20	1
Boron	7440-42-8	40	2
Cadmium	7440-43-9	2	0.1
Chromium (VI)	18540-29-9	10	0.5
Copper	7440-50-8	10	0.5
Fluoride	16984-48-8	400	20
Lead	7439-92-1	10	0.5
Lithium	7439-93-2	40	2
Mercury	7439-97-6	0.4	0.02
Molybdenum	7439-98-7	20	1
Nickel	7440-02-0	20	1
Selenium	7782-49-2	20	0.11
Silver	7440-22-4	20	0.5
Tin	7440-31-5	2,000	100
Vanadium	7440-62-2	4	0.2
Zinc	7440-66-6	20	1
Aromatic hydrocarbons			
Aniline	62-53-3	0.4	0.02
Styrene	100-42-5	12	0.6
Polynuclear aromatic hydrocarbons			
Naphthalene	91-20-3	20	1
Other halogenated aromatic hydrocarbons			
1,2 Dichlorobenzene	95-50-1	0.4	0.02
1,3 Dichlorobenzene	541-73-1	100	5
1,2,3 Trichlorobenzene	87-61-6	100	5
1,2,4 Trichlorobenzene	120-82-1	80	4
BTEX			
Benzene	71-43-2	1	0.05
Toluene	108-88-3	200	10
Ethyl benzene	100-41-4	100	5
Xylene (m,o,p)	1330-20-7	200	10
Chlorinated aliphatic hydrocarbons			
Vinyl chloride	75-01-4	0.4	0.02
1,2 Dichloroethene	540-59-0	20	1
1,3 Dichloropropene	542-75-6	4	0.2
Dichloromethane	75-09-2	4	0.2
1,1,1, Trichloroethane	71-55-6	400	20
1,1,2 Trichloroethane	79-00-5	1,000	50
1,1,2,2 Tetrachloroethane	79-34-5	100	5
1,2 Dibromo-3-chloropropane	96-12-8	0.4	0.02
1,2 Dichloropropane	78-87-5	2	0.1

	CAS no.[1]	Class B landfills	
		Screening criteria[2] (mg/kg)	Concentration in leachate (mg/L)
Other halogenated aliphatic hydrocarbons			
Bromodichloromethane	75-27-4	0.2	0.01
Bromoform	75-25-2	20	1
Dibromochloromethane	124-48-1	20	1
Phenols			
2,4,6 Trichlorophenol	88-06-2	0.2	0.01
2 Chlorophenol	95-57-8	0.01	0.005
2,4 Dichlorophenol	120-83-2	0.01	0.005
Phenol	108-95-2	80	4
Pesticides			
2,4 Dichlorophenoxyacetic acid (2,4 D)	94-75-7	20	1
Aldrin	309-00-2	0.000016	0.000008
Dieldrin	60-57-1	0.8	0.04
Endosulfan	115-29-7	0.6	0.03
Phthalates			
Diethylphthalate	84-66-2	200	10
Dimethylphthalate	131-11-3	800	40
Di-n-butylphthlate	84-74-2	600	30
Other organics			
Carbon disulphide	75-15-0	6	0.3
Organometallics			
Tributyltin oxide (TBTO)	56-35-9	6	0.3

1. Chemical Abstracts Service Registry Number – a unique identifier that tells you, for example, that acetone and dimethyl ketone are the same substance.
2. Screening criterion = 20 x TCLP criteria; where contaminant concentration is below the screening criteria, no TCLP test is necessary.

References

ANZECC. 1992. *Australian Water Quality Guidelines for Fresh and Marine Waters*. Australia and New Zealand Environment and Conservation Council. Department of the Environment and Heritage, Canberra, Australia.

ANZECC, ARMCANZ. 2000. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Environment and Conservation Council and the Agriculture and Resource Management Council of Australia and New Zealand Environment. Department of the Environment and Heritage, Canberra, Australia.

Centre for Advanced Engineering. 2000. *Landfill Guidelines: Toward Sustainable Waste Management in New Zealand.* University of Canterbury, Christchurch, New Zealand.

Environment and Business Group. 1997. *Review of Overseas Approaches to the Management and Landfilling of Hazardous Waste*. Environment and Business Group, Auckland, New Zealand.

Ministry for the Environment. 1999. *Guidelines for assessing and managing petroleum hydrocarbon contaminated sites in New Zealand.* Ministry for the Environment, Wellington, New Zealand.

Ministry for the Environment. 2000. *Acceptance Criteria for Wastes with Hazardous Properties: Issues and Options*. Ministry for the Environment, Wellington, New Zealand.

Ministry for the Environment, 2003. *The 2002 Landfill Review and Audit*. Ministry for the Environment, Wellington, New Zealand.

Ministry for the Environment and Ministry of Health. 1997. *Health and Environmental Guidelines for Selected Timber Treatment Chemicals.* Ministry for the Environment / Ministry of Health, Wellington, New Zealand.

Ministry of Health. 1995. *Drinking-water Standards for New Zealand*. Ministry of Health, Wellington, New Zealand.

SCS-Wetherill Environmental. 1999. *Waste Acceptance Criteria at Landfills*. Ministry for the Environment, Wellington, New Zealand.

Standards New Zealand. 1999. *Model General By-Laws. Part 23 – Trade Waste*. NZS 9201: Part 23:1999.

Standards New Zealand. 2002. *Management of Healthcare Waste*. NZS4304:2002

US EPA. 1999. Identification and Listing of Hazardous Waste – Toxicity Characteristic. *The Code of Federal Regulations*, Title 40, Volume 18, Parts 261.24 (40CFR261.24).

URS New Zealand Limited. 2001. *Basis for Landfill Classification System*, http://www.mfe.govt.nz

URS New Zealand Limited. 2003. *Waste Acceptance Criteria for Class A Landfills*, http://www.mfe.govt.nz.

Appendix A: Total concentration and leachability limits for Class A and Class B landfills

Leachability limits

	CAS no.[1]	Class A landfills		Class B landfills	
		Screening criteria[2] (mg/kg)	Concentration in leachate (mg/L)	Screening criteria[2] (mg/kg)	Concentration in leachate (mg/L)
Inorganic contaminants					
Aluminium	7429-90-5	800	40[5]	80	4
Antimony	7440-36-0	12	0.6[4]	1.2	0.06
Arsenic	7440-38-2	100	5[3]	10	0.5
Barium	7440-39-3	2,000	100[3]	200	10
Beryllium	7440-41-7	200	10[4,6]	20	1
Boron	7440-42-8	400	20[6]	40	2
Cadmium	7440-43-9	20	1[3,6]	2	0.1
Chromium (VI)	18540-29-9	100	5[3]	10	0.5
Copper	7440-50-8	100	5[5]	10	0.5
Fluoride	16984-48-8	4,000	200[5,6]	400	20
Lead	7439-92-1	100	5[3]	10	0.5
Lithium	7439-93-2	400	20[4]	40	2
Mercury	7439-97-6	4	0.2[3,6]	0.4	0.02
Molybdenum	7439-98-7	200	10[5]	20	1
Nickel	7440-02-0	200	10[5,6]	20	1
Selenium	7782-49-2	200	1[3,6]	20	0.11
Silver	7440-22-4	200	5[3]	20	0.5
Tin	7440-31-5	20,000	1000[4,6]	2,000	100
Vanadium	7440-62-2	40	2[5]	4	0.2
Zinc	7440-66-6	200	10[5]	20	1
Aromatic hydrocarbons					
Aniline	62-53-3	4	0.2[5]	0.4	0.02
Styrene	100-42-5	120	6[5,6]	12	0.6
Polynuclear aromatic hydrocarbons					
Naphthalene	91-20-3	200	10[5,6]	20	1
Other halogenated aromatic hydrocarbons					
1,2 Dichlorobenzene	95-50-1	4	0.2[5,6]	0.4	0.02
1,3 Dichlorobenzene	541-73-1	1000	50[5,6]	100	5
1,2,3 Trichlorobenzene	87-61-6	1000	50[5,6]	100	5
1,2,4 Trichlorobenzene	120-82-1	800	40[5,6]	80	4
BTEX					
Benzene	71-43-2	10	0.5[3]	1	0.05
Toluene	108-88-3	2000	100[5,6]	200	10
Ethyl benzene	100-41-4	1000	50[4,6]	100	5
Xylene (m,o,p)	1330-20-7	2000	100[4,6]	200	10

	CAS no.[1]	Class A landfills		Class B landfills	
		Screening criteria[2] (mg/kg)	Concentration in leachate (mg/L)	Screening criteria[2] (mg/kg)	Concentration in leachate (mg/L)
Chlorinated aliphatic hydrocarbons					
Vinyl chloride	75-01-4	4	0.2[3]	0.4	0.02
1,2 Dichloroethene	540-59-0	200	10[4,6]	20	1
1,3 Dichloropropene	542-75-6	40	2[4,6]	4	0.2
Dichloromethane	75-09-2	40	2[4,6]	4	0.2
1,1,1, Trichloroethane	71-55-6	4,000	200[4,6]	400	20
1,1,2 Trichloroethane	79-00-5	10,000	500[5,6]	1,000	50
1,1,2,2 Tetrachloroethane	79-34-5	1,000	50[5,6]	100	5
1,2 Dibromo-3-chloropropane	96-12-8	40	0.2[4]	0.4	0.02
1,2 Dichloropropane	78-87-5	20	1[4]	2	0.1
Other halogenated aliphatic hydrocarbons					
Bromodichloromethane	75-27-4	20	1[4]	0.2	0.01
Bromoform	75-25-2	200	10[4]	20	1
Dibromochloromethane	124-48-1	200	10[4]	20	1
Phenols					
2,4,6 Trichlorophenol	88-06-2	2	0.1[4,6]	0.2	0.01
2 Chlorophenol	95-57-8	0.1	0.05[4,6]	0.01	0.005
2,4 Dichlorophenol	120-83-2	0.1	0.05[4,6]	0.01	0.005
Phenol	108-95-2	800	40[5]	80	4
Pesticides					
2,4 Dichlorophenoxyacetic acid (2,4 D)	94-75-7	200	10[3,6]	20	1
Aldrin	309-00-2	0.00016	0.00008[5]	0.000016	0.000008
Dieldrin	60-57-1	8	0.4[5,6]	0.8	0.04
Endosulfan	115-29-7	6	0.3[5,6]	0.6	0.03
Phthalates					
Diethylphthalate	84-66-2	2,000	100[5]	200	10
Dimethylphthalate	131-11-3	8,000	400[5]	800	40
Di-n-butylphthlate	84-74-2	6,000	300[5]	600	30
Other organics					
Carbon disulphide	75-15-0	60	3[5]	6	0.3
Organometallics					
Tributyltin oxide (TBTO)	56-35-9	60	3[4]	6	0.3

1. Chemical Abstracts Service Registry Number – a unique identifier that tells you, for example, that acetone and dimethyl ketone are the same substance.
2. Screening criterion = 20 x TCLP criteria; where contaminant concentration is below the screening criteria, no TCLP test is necessary.
3. Adopted from the US EPA TCLP numbers.
4. Derived using a constituent specific dilution attenuation factor and the *Drinking-water Standards for New Zealand* (Ministry of Health, 1995).
5. Derived using a constituent specific dilution attenuation factor and the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC and ARMCANZ, 2000).
6. Concentration exceeds the limit in the New Zealand Standard Trade Waste By-law (NZS 9201).

Total concentration limits

	Cas no.[1]	Class A landfills total concentration (mg/kg)	Class B landfills total concentration (mg/kg)
Organic contaminants			
Benzo(a)pyrene	50-32-8	300[2]	30
Carcinogenic PAHs as Benzo(a)pyrene equivalent	NA	300[2]	30
Heptachlor epoxide	1024-57-3	1,500[2]	150
DDE	3547-04-4	500[2]	50
DDT	50-29-3	500[2]	50

1. Chemical Abstracts Service Registry Number – a unique identifier that tells you, for example, that acetone and dimethyl ketone are actually the same substance.
2. Derived from the concentration at which free product will be present in leachate.

Appendix B: Materials not covered by this guideline

Bromine	Not recommended for inclusion because of its presence, due to natural factors, which would make it impractical to set a limit.
Cobalt	Not recommended for inclusion because the most potentially harmful aspects relate to the radioactivity of Cobalt 60, which is covered by the Radiation Protection Regulations 1982.
Dioxins	Testing for dioxins is not undertaken routinely and is expensive. It is more appropriate to consider the management of waste materials in which dioxin contamination may be suspected on an event-specific basis.
Formaldehyde	Not recommended as it commonly used in processed wood products, and is therefore present in any wastes that contain manufactured wood products. There are issues associated with the handling of some manufactured wood wastes (e.g. dust from sawdust), but these relate more to site management procedures. The groundwater pathway is not the limiting factor in this case.
Iron	Not recommended for inclusion because it may be present naturally at concentrations that may exceed limits as a result of its mobility in reducing environments.
Manganese	Not recommended for inclusion because it may be present naturally at concentrations that may exceed limits as a result of its mobility in reducing environments.
Polyaromatic Hydrocarbons (PAHs) (non-carcinogenic)	Napthalene, which has the lowest log Koc (is the most mobile), is considered to be the risk driver for non-carcinogenic PAHs. When considering material contaminated by PAHs for landfill disposal, TCLP/screening criteria for naphthalene and total concentration criteria for benzo(a)pyrene should be used to determine suitability for disposal, because these are likely to be the limiting contaminants for non-carcinogenic and carcinogenic PAHs respectively.
PCB	Waste materials containing PCB should not be disposed of to landfill in New Zealand.
Sodium	Not recommended for inclusion because of its presence, due to natural factors, in a high number of wastes and high leachate concentrations, which would make it impractical to set a limit.
Thallium	Not recommended for inclusion because it is not used widely enough to warrant inclusion. In addition, there is insufficient data for thallium.
Total Petroleum Hydrocarbons (TPH)	Where waste contains elevated levels of TPH (assessed with reference to the Ministry for the Environment's *Oil Guidelines*, MfE 1999), suitability for disposal should be assessed using BTEX and/or PAH analysis (covered by specific analysis or Volatile Organic Carbon (VOC)/Semi-volatile Organic Carbon (SVOC) analysis respectively). See note regarding PAH analysis.
Uranium	Not recommended for inclusion as it is not used widely enough to warrant inclusion and the most potentially harmful aspects relate to radioactivity. Covered by the Radiation Protection Regulations 1982.

Appendix C: Development of total concentration and leachability limits for Class A and Class B landfills

Our approach

The full details of the development of leachability and total concentration limits for Class A landfills is provided in the report *Waste Acceptance Criteria for Class A Landfills* (URS New Zealand Limited, 2003).

In general, leachability criteria are derived using a target concentration in the receiving environment (drinking water, aquatic ecosystems) and a factor (dilution attenuation factor, or DAF) to account for dilution and attenuation between the landfill and receptor. The criteria adopted for this guideline are as follows.

1. Where the US EPA has developed criteria, these have been adopted:
   Target concentration: US Primary Drinking Water Standards
   DAF: 100 for all contaminants.

   Additional contaminants to be included were selected based on common analytical suites (VOC, SVOC, metals) and the availability of appropriate guideline criteria to be used as target concentrations.

2. Where additional contaminants were considered to be soluble in landfill leachate:
   Target concentration: The lower of the NZ Drinking-water Standard or ANZECC freshwater quality criteria
   DAF: Constituent-specific DAF based on a 'standard' Class A landfill.

Where contaminants were considered to be insoluble in landfill leachate, leachability criteria are inappropriate and total concentration criteria were developed. These were based on the concentration at which free product would be present in the waste (and therefore likely to be present in the leachate).

Alternative approaches to waste acceptance criteria

Jurisdiction	Leachability Target concentration	DAF[4]	Screening	Total concentration	
				Target concentration	DAF
This guideline	USDWS/NZDWS/ANZECC	Cont specific	20 x leach	Solubility	None
USEPA	USDWS[5]	100	NA	NA	NA
NSW EPA	USEPA/Aus DWS[6]	100	20 x leach	Various	None
WA EPA	Aus DWS	100	20 x leach	NEPM[7]	None
South Africa	NA	NA	NA	LC50[8]	Site specific
Hydrocarbons[9]	NZDWS/ANZECC	Site specific	NA	Total mass	1–2% of total waste
Timber treatment[10]	NZDWS/ANZECC	Site Specific	NA	Timber treatment	Site specific

4 DAF = Dilution Attenuation Factor.

5 US Drinking Water Standards (National Primary Drinking Water Standards).

6 Australian Drinking Water Standard.

7 National Environmental Protection (Assessment of Site contamination) Measure, NEPC 1999. Industrial/ commercial land use.

8 LC50 = Lethal Concentration 50, the concentration of a chemical which kills 50% of a sample population.

9 *Landfill Classification and WAC for Hydrocarbon Contaminated Soil*, Report for SMF Project 4153 (unpublished), March 2001.

10 *Health and Environmental Guidelines for Selected timber Treatment Chemicals*, Ministry for the Environment and Ministry of Health, 1997.

Appendix D: Landfill classification – Class A requirements

	Performance objective	Screening criteria	Alternative options
1	Minimise the potential for instability, waste breakout or leachate breakout due to inundation by floodwaters or scouring from floodwaters	Siting – landfill not sited in 1 in 100-year or less floodplain	Design – landfill designed to remove the risks of waste breakout, leachate breakout or instability associated with flooding or inundation
2	Minimise the potential for failure of basal liner and leachate collection system	Siting – landfill not sited in an inter-tidal zone	None
3	Minimise the potential for failure of basal liner and leachate collection system	Siting – over 1 m separation between underside of landfill basal liner and maximum expected groundwater level	Design – landfill designed to remove the risk of failure of the basal liner or leachate collection system from groundwater pressure under the liner system
4	Minimise the potential for failure of basal liner and leachate collection system	Siting – landfill not within a geothermally active area	Design – landfill designed to remove the risk of failure of the basal liner or leachate collection system from geothermal activity
5	Minimise risks to landfill stability (including effects on liner integrity and leachate collection system)	Siting – landfill not sited over compressible or unstable foundation materials	Design – landfill designed to remove risks from compressible or unstable foundation materials to liner integrity, landfill stability and leachate system operation
6	Avoid contamination of adjacent surface water bodies with leachate or contaminated stormwater	Siting – no direct pathway from landfill to a significant surface water body	Design – stormwater, groundwater and leachate management systems designed to mitigate risks to surface water bodies
7	To protect the coastal marine area from adverse environmental impacts associated with the landfill	Siting – landfill not sited in coastal marine area	None
8	Avoid contamination of a viable groundwater supply	Siting – landfill not sited over permeable material	Only site over highly permeable *in-situ* materials such as sands or gravels (perm > $1x10^{-5}$ m/s) if the landfill does not overlie a viable groundwater supply Siting – landfill not sited over viable groundwater supply Design – higher standard of engineered containment that accounts for the minimal natural containment available *and* includes a base and side composite liner 1.5 mm HDPE overlying 600 mm clay (10^{-9} m/s) (or the equivalent)
9	Avoid contamination of a viable groundwater supply	Siting – landfill not sited over a viable groundwater supply	Siting/design – only site over viable groundwater supply if the combination of engineered and natural containment results in negligible risk of contamination of the groundwater supply Siting – Aquitard between base of landfill and viable groundwater supply Design – high standard of engineered containment including a base and side composite liner 1.5 mm HDPE overlying 600 mm clay (10^{-9} m/s)

	Performance objective	Screening criteria	Alternative options
10	Remove the risks from active faults on the containment system	Siting – landfill not sited in an area subject to seismic instability	Design – designed to remove risks from seismic activity to liner integrity, landfill stability and leachate system operation
11	Effective containment of waste, leachate and landfill gas	Design – landfill has a base and side composite liner 1.5 mm HDPE overlying 600 mm clay (max permeability 10^{-9} m/s)	Design – alternative landfill liner design that provides equivalent level of risk mitigation, considered with reference to resistance to chemical degradation, hydraulic containment, physical strength and deformation characteristics, general installation procedures and expected service life (see Appendix E)
12	Effective containment of waste, leachate and landfill gas	Design – leachate collection system designed to ensure the maximum leachate head over liner is < 300 mm	None
13	Effective containment of waste, leachate and landfill gas	Design/operation – for sites with a total design capacity over 1,000,000 m^3, a landfill gas flaring system	Design/operation – alternative landfill gas treatment system or use that provides equivalent level of risk mitigation
14	Effective containment of waste, leachate and landfill gas, and control of water infiltration into landfill	Operation – effective use of daily and intermediate cover	None
15	Prevention of landfill fires	Operations – management plan includes measures to prevent landfill fires	None
16	Minimise the risks associated with inappropriate waste disposal	Operations – management plan requires documentation and record keeping of waste volumes, types and source	None
17	Minimise the risks associated with inappropriate waste disposal	Operations – management plan requires a licensing system for all non-municipal waste generators. The licensing system shall require adequate information to ensure that the landfill operator is satisfied that the waste meets the Landfill Waste Acceptance Criteria	None
18	Minimise the risks associated with inappropriate waste disposal	Operations – management plan defines waste acceptance criteria monitoring procedures – a minimum of 1 in 50 commercial/industrial loads inspected	None
19	Minimise the potential for instability, waste breakout or leachate breakout due to inundation by floodwaters or scouring from floodwaters	Operations – management plan ensures adequate maintenance of surface water control system	None
20	Avoid contamination of adjacent surface water bodies with leachate or contaminated stormwater	Operation – landfill management plan ensures adequate control of surface water	None

Appendix E: Assessing alternative solutions for Class A landfills

All deviations from the screening criteria in Appendix D should be assessed considering the level of chemical and hydrogeological containment provided by the combination of engineered systems and hydrogeology. The combination of siting and design should result in a level of containment equivalent or superior to a landfill that meets the screening criteria in Appendix D. All Class A landfills must be appropriately sited (see criteria in Appendix D) and have a leachate collection system that is capable of conveying leachate generated in the landfill. Leachate capture should be established through comparison of theoretical leachate generation (including any groundwater ingress) and measured leachate flow.

Equivalence of the liner and natural containment should be considered with reference to:

- resistance to chemical degradation
- hydraulic containment
- chemical containment
- physical strength and deformation characteristics
- general installation procedures
- expected service life.

For the purposes of determining equivalence with the Class A Landfill Screening Criteria, the following assumptions should be made.

1. Contaminants are present in leachate at the TCLP criteria concentration (e.g. benzene is present in leachate at 0.5 mg/L).

2. Where appropriate, leachate flow through the liner should be assessed using the US EPA's HELP model or equivalent and appropriate weather parameters.

3. Model transport to the closest receptor or to 100 m directly downgradient of the landfill boundary.

4. The concentration of contaminants in groundwater at the receptor should be at or below the New Zealand Drinking Water Standard or ANZECC Water Quality Criteria as appropriate[11].

[11] Appendix A specifies through footnotes the target concentration (NZ DWS or ANZECC 2000) used to derive the TCLP Criteria for Class A Landfills.

Appendix F: Worked examples

Landfill waste acceptance

Case study 1: contaminated soil

Soil has been excavated from a former timber treatment site, which is being redeveloped for low-density residential. The contaminant concentrations exceed the residential soil criteria in the timber treatment guidelines (Ministry for the Environment and Ministry of Health, 1997).

Step 1: Is the waste prohibited from landfill disposal? No

Step 2: Is the waste a solid? Yes

Step 3: Does the waste comply with the cleanfill definition? No

Step 4: Is the waste asterisked on the NZ Waste List? Yes: 17 05 03* soil and stones containing hazardous substances

Step 5: Total concentration *and/or* TCLP test

Existing contaminant concentrations from site investigation report:

Contaminant	Contaminant concentration mg/kg	Timber treatment residential criteria mg/kg	Screening concentration mg/kg
Copper	53.6	80	100
Chromium	45.2	9	100
Arsenic	15.4	30	100
Boron	259.7	3	400

The waste material meets the screening concentration for Class A landfills. No TCLP test is required prior to disposal at a Class A landfill.

Case study 2: waste treatment sludge

Wastewater treatment sludge has been obtained from a liquid and hazardous waste treatment operation. The operation accepts a variety of waste streams for treatment prior to disposal/re-use and treats all liquid residues on-site prior to discharge to trade waste and/or landfill.

Step 1: Is the waste prohibited from landfill disposal? No

Step 2: Is the waste a solid? Yes: the sludge is approximately 17 % solids *but* passes the US EPA Paint Filter test and liberates no free liquids on transport.

Step 3: Does the waste comply with the cleanfill definition? No

Step 4: Is the waste asterisked on the NZ Waste List? Yes: 19 08 13* sludges containing hazardous substances from other treatment of industrial waste water.

Step 5: Total concentration *and/or* TCLP test

Existing contaminant concentrations from waste treatment operational monitoring:

Contaminant	Contaminant concentration mg/kg	Screening concentration mg/kg	
TPH	500	NA	~
Naphthalene	263	200	✖
Phenol	26.5	800	✓
Styrene	59.8	120	✓
Benzo(a)pyrene	12.5	300	✓

TPH analysis indicates an elevated level of hydrocarbons (with reference to relevant contaminated site guideline criteria). Further analysis is required to determine suitability for disposal, including consideration of PAH (naphthalene and benzo(a)pyrene) and volatile organics, depending on the source of waste. Naphthalene exceeds screening criteria for Class A landfills, but a TCLP test may indicate that the naphthalene is immobilised in the sludge matrix. Consideration of the TPH results indicates that the hydrocarbons are in the semi-volatile range (i.e. BTEX is unlikely to be an issue).

Contaminant	TCLP result mg/L	TCLP criteria mg/L	
Naphthalene	5	10	✓

The TCLP result for naphthalene is below the TCLP criteria for Class A landfills.

Landfill classification

Case study 1: historical landfill

ABC Grove Landfill was developed in the mid-1980s and has a design life of 50 years (80–100,000 tonnes per annum). The site was granted resource consent (discharge to air, land and water, divert ...) in 1995 for 25 years' operation. Existing waste acceptance criteria are set out in the consent conditions.

	Design feature	Meets Class A criteria
Siting	Overlies silty clay (10 m, 10^{-6} m/s) and siltstone (> 25 m, 10^{-7} m/s)	✓
	100 m to XYZ River, above floodplain	✓
	Groundwater 1 m below base of refuse	✓
	1 km to nearest groundwater user (irrigation, siltstone aquifer)	✓
Design	No engineered liner	×
	Leachate cut-off drain (retrofit)	✓
	Surface/stormwater divert (retrofit)	✓
	Landfill gas management system (flaring/generation)	✓
Operation	Staged filling, daily and intermediate cover	✓
	Final cover on completed cells 1 m clay (10^{-7} m/s)	✓
	Documented waste acceptance system incl. manifest	✓
	Licensing and random inspections	×
	Monitoring of leachate, groundwater and stormwater	✓

The site meets the criteria for a Class B landfill (existing resource consent) but does not meet the screening criteria for a Class A landfill (no engineered liner, no licensing system, no random inspections).

Determining equivalence with the Class A Landfill Screening Criteria (Appendix D):

1. Use benzene and arsenic in leachate at TCLP criteria concentrations.

2. No liner so modelling of leachate flow through liner not required.

3. 100 m to adjoining river, receptor considered groundwater at 100 m downgradient of landfill boundary.

Contaminant parameters:

Parameter	Benzene	Arsenic
Half-life	732 days	NA
Log K_{oc}	1.7	NA
K_d (in silty clay)	NA	1.3
Density/effective porosity	NA	6

Model results:

Parameter	ABC Grove
Benzene in leachate	0.62 mg/l
Benzene at receptor	0.05 mg/l
Arsenic in leachate	3.1 mg/l
Arsenic at receptor	0.013 mg/l

Note: leachate concentrations derived using MfE Model, US EPA TCLP criteria adopted for benzene and arsenic

Conclusion: Since benzene and arsenic concentrations exceed the criteria for Class A landfills at the receptor, ABC Grove Landfill should use landfill waste acceptance criteria for Class B landfills.