East Gippsland Disaster Waste Management Plan

EAST GIPPSLAND
SHIRE COUNCIL

VERSION CONTROL

East Gippsland Disaster Waste Management Plan
(A sub-plan of the East Gippsland Municipal Emergency Management Plan)

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The East Gippsland Shire Council Disaster Waste Management Plan is a sub plan of the Municipal Emergency Management Plan. Major changes to the Disaster Waste Management Plan must be approved and authorised by the Municipal Emergency Management Planning Committee (MEMPC). This document will be reviewed annually or after an event. Any changes to the document will be forwarded to the MEMPC for adoption.

The record below is to be completed by the person making the amendment(s). Each new page will have a revision number and date of issue printed on it.

Version	Page Number	Date	Description	Amended by

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1. EXECUTIVE SUMMARY

Debris and waste generation are unavoidable by-products of natural disasters and emergency events. Waste management in the aftermath of major disasters is complicated by the primacy of life and property. Then comes the interrelated concerns associated with availability of disposal capacity, availability of treatment or recycling/reuse options, transport of wastes, access to waste management facilities, environmental hazards, financial responsibility, and ownership related legal and ethical issues.

This Disaster Waste Management Plan for East Gippsland sets out the rationale for waste management and provides information on how and where waste left over from a disaster can be disposed of promptly to minimise the adverse effects of waste disposal after or during an emergency event. Disaster waste management is an important process following a major catastrophe as it can determine how quickly a community recovers from the event.

This Plan is a sub-plan of the Municipal Emergency Management Plan (MEMP), which is to be read in conjunction with this Plan. The types of emergencies addressed in this Plan are:

- Bushfire
- Flood
- Biological Emergency
- Storm
- Tsunami
- Earthquake
- Hazmat/Chemical Spill.

The categories of waste accounted for in this plan include:

- Asbestos
- Contaminated soil
- Deceased Animals
- Electrical and electronic waste
- Hard waste
- Masonry
- Medical waste
- Metals
- Other hazardous wastes
- Putrescible waste
- Soil and sediment
- Vegetative waste
- Vehicle bodies
- White goods

2. INTRODUCTION

2.1 Purpose

The purpose of the East Gippsland Shire Disaster Waste Management Plan is to provide a guide to preparing for and responding to the need to dispose of waste after or during an emergency event, and includes the following information:

- How to dispose of a number of different types of waste generated from an event.

- A list of pre-approved sites for when landfill disposal is not possible, for example for carcass and hazardous waste disposal

- Key stakeholders roles and responsibilities

2.2 Why Have a Disaster Waste Management Plan

There is general consensus that an effective disaster waste management strategy should be implemented before the disaster strikes to ease impacts. Managing disaster waste is often complex due to the range of possible disasters which can strike, and their magnitude and impacts. This Plan was created as Council did not have a document in place for dealing with waste after an event. If an emergency was to occur, the response had to be hasty and ad hoc, with little consultation or discussion between key stakeholders. This creates a potential risk for inappropriate disposal occurring at various sites. There is also risk that key stakeholders will not know the procedures for disposing of waste during or after an emergency event, particularly if they are new to their position or filling in while someone is on leave. Having this formal document in place can alleviate these risks.

2.3 What is the aim of the Disaster Waste Management Plan

The aim of this Plan is to ensure that key stakeholders in East Gippsland can respond to the waste disposal needs of the community efficiently and effectively in the event of an emergency.

2.4 Objectives

- Ensure there are guidelines in place for waste disposal in the event of an emergency, so agencies can act quickly and relieve the burden on those who have been affected.

- Ensure adequate information is provided to the public about how and where to dispose of their waste and if any special circumstances occur (eg: vouchers etc)

3. KEY CONSIDERATIONS

3.1 Health and safety

Health and safety are extremely important to the success of disaster waste management. Requirements include:

- Ensuring that all personnel managing and overseeing disaster waste efforts are experienced and implement appropriate safety systems.

- Ensuring the greatest possible use of personal protective equipment (PPE), to prevent risk of injury for all staff handling waste. For example, wearing adapted footwear (hard boots to prevent spikes entering the sole and minimise the risk of harm from heavy materials dropping onto feet), hard hats, gloves, overalls and masks.

- PPE Equipment:

    - Safety boots
    - High visibility vests/shirts
    - Gloves
    - Overalls/shirts/pants
    - Wet weather gear and gum boots
    - Safety glasses
    - Dust mask
    - Hat
    - Torches
    - Sunscreen
    - Insect protection
    - Other as required

- At the waste handling site, ensure the lay out of the site takes health and safety into account. For example one way traffic systems and limited cross over between vehicles and people at the site.

- Waste contractors and volunteers should have access to proper and clean changing and washing facilities for use during and after waste handling and processing works

- Having adequate dust suppression where rubble is being crushed or waste is being processed. Facilities and equipment should be fitted with noise, vibration and harmful emission reduction mechanisms, as well as machinery guards to prevent accidents.

3.2 Risk Management

Council is committed to the management of risk and to providing and maintaining a safe and healthy environment for employees, contractors and the public. It is the responsibility of Council to treat risks as per sections 1.10.2 and 2.2 of the MEMP.

There are a number of possible risks should be taken into account when dealing with disaster waste management.

- Chemical risks

    - Direct skin contact with contaminants such as pesticides, oils and acids
    - Inhalation of hazardous chemicals or products like pesticides, dust, asbestos fibres.

- Ingestion of surface/groundwater contaminated by leachate from waste.
- Nuisance from odours arising from chemicals in the waste or decomposition of some waste types.

- Biological risks:

  - Skin contact/ingestion of biological waste
  - Direct exposure to healthcare waste
  - Disease vectors from animals that congregate on or near waste
  - Disease spread by animals or insects
  - Nuisance from insects, birds and rodents which are attracted to and feed on waste

- Physical risks:

  - Collapse of buildings and other constructions as well as waste piles, such as large piles of rubble that have been pushed to the side of a road
  - Cuts and abrasions from sharp objects in waste, for example where healthcare waste has been mixed with general household waste
  - Uncontrolled fires in piles of waste
  - Vehicle accidents from trucks picking up, transporting and dropping waste
  - Nuisance from smoke and/or wind or wave-blown litter

- Environmental risks:

  - Waste that contaminates soils, rendering it hazardous to humans and animals, and/or making it unsuitable for agriculture
  - Leachate from fluids passing through waste and contaminating water
  - Landfill gas from decomposing organic waste, which can pose risks to humans and animals
  - Infestation of rodents and insects feeding on waste
  - Windblown and wave transported litter which can impact an area

3.3 Stakeholder Management

- **Beneficiaries**

  The following beneficiary and target groups should be taken into account and involved from the early stages of disaster waste assessment, planning, programme design and management:

  - Disaster affected communities and populations requiring support in clearing their property of disaster wastes and removing waste generated by households.

- Private sector and non-government waste businesses that may have been affected by the disaster
- Hospitals that affected by the disaster
- The community in general

- **Local level administration**
  A number of agencies are involved in the response and recovery after an emergency event that should be involved in the removal of disaster waste. Agency roles for recovery are as per section 4 of the MEMP and section 5.18 the MEMP.

- **Contractors**
  Waste collection in East Gippsland is executed by contractors. The contractors will need to be aware of the protocols in place for disaster waste disposal, and their role as per section 1.10.3 of the MEMP.

- **Donors**
  Offers of Financial assistance will be referred to the Gippsland Emergency Relief Fund. Donations can be made at any National Australia Bank in Gippsland as per section 5.7.5.1 of the MEMP.

- **Communication**
  Effective communication and coordination with stakeholders is essential for the effectiveness of the disaster waste management plan.
  Communication with the public regarding disaster waste management will be done as per section 6.9 of the MEMP.

4. VOLUNTEERISM

In large scale emergencies, offers of volunteer assistance may be made to Council. These offers will be directed to the Online Victoria Volunteers Portal www.volunteer.vic.gov.au.

Volunteers may be utilised to assist with sorting the waste into separate categories for collection including deconstructing larger items to recover metals.

5. WASTE STREAMS AND CHARACTERISTICS

The main types of waste generated by natural disasters and emergencies are:

- Building materials from damaged building structures, roads and other infrastructure. These structures can include masonry materials, steel and timber and can include asbestos containing materials.
- Building contents, including hard waste (such as carpets, timber, furniture, clothing, other personal items), whitegoods, electronic and electrical waste.

- Vegetative debris, such as fallen trees, and
- Soil and sediment.

Other wastes generated by disasters, but generally smaller in volume, include putrescible wastes, vehicle bodies, and other hazardous wastes (such as household chemicals, paint, farm and industry chemicals).

See the classifications of waste streams in table 1 below

Table 1: Classifications of Waste Streams, Key Agencies and Actions

Waste Stream Category	Waste Materials	Waste Sources	Agencies	Action
Asbestos	Asbestos containing waste	Damaged building structures containing asbestos (e.g. in roof sheeting and capping, guttering, gables, eaves/soffits water pipe and flues, wall sheeting, vinyl sheet flooring, carpet and tiles underlays, zelemite backing boards to the switchboards, flexible building boards, imitation brick cladding, fencing, carports and sheds, waterproof membrane, telecommunications pits, some window putty, expansion joints, packing under beams, concrete formwork (Australian Government Asbestos Safety and Eradication Agency).	East Gippsland Shire Council EPA Licensed EPA Hazardous Waste Removal Contractor	• If asbestos waste is less than 1 tonne, Council will accept it at Bairnsdale Landfill provided it has been wrapped in polythene sheeting and in parcels that can be easily lifted by the customer. • If there is over 1 tonne of asbestos waste, it will need to be disposed of at an alternative disposal site. • EPA provides transport certificate and transport permit to licensed asbestos removalists. • EPA provides licence to landfill and alternative disposal sites where asbestos will be disposed of.
Contaminated soil	Contaminated soil	Waste soil that has been contaminated with hazardous substances.	East Gippsland Shire Council Licensed EPA Hazardous Waste Removal Contractor	• Assess and remove. • Take to Dutson Downs or Bairnsdale Landfill for Disposal (only if Category

			Gippsland Water	3).
Deceased Animals	Deceased Animals	Natural disaster affecting a farm (bushfire, flood) where animals are unable to be evacuated. Mass wildlife and marine deaths.	East Gippsland Shire Council DELWP EPA	• Determine best site/method for disposal. • Facilitate disposal at Bairnsdale Landfill or alternative disposal site. • Livestock can be composted by owner. • Advise EPA and Incident Controller of actions taken.
Electrical and electronic waste	Electrical and electronic material (e.g. TVs, computers, appliances)	Damaged and/or displaced electrical and electronic goods from households and businesses.	East Gippsland Shire Council Waste Removal Contractor	• Separate recyclable items (computers and TVs) • Remove and transport to closest landfill or transfer station or alternate site for disposal or recycling.
Hard Waste	Mix of wastes - such as timber including copper chrome arsenate (CCA) treated timber, furnishings, carpet and textiles	Damaged and/or displaced furniture, personal belongings and other items. Timber from damaged building	East Gippsland Shire Council Waste Removal Contractor	• Separate recyclable materials (any steel or other metals) • Remove and transport to closest landfill or transfer station or alternate site or recycling. • CCA treated timber must be disposed of in landfill.

Masonry	Concrete, bricks, stone, asphalt, tiles and plasterboard	Damaged building structures, slabs, kerbing, roads.	East Gippsland Shire Council Waste Removal Contractor	• Remove and transport to closest landfill or transfer station or alternate site for disposal or recycling.
Medical waste	Pharmaceutical waste	Waste generated across hospitals from treatment of persons that were injured in the disaster.	East Gippsland Shire Council Medico	• Contact Medico and arrange for collection and disposal.
Metals	Ferrous (steel), aluminium and other non-ferrous, car, truck and other vehicle bodies, white goods (e.g. refrigerator, dishwasher)	Damaged fencing, sheds, windows and doors, reinforced concrete, electrical cable, copper pipe, damaged and/or displaced vehicle bodies, damaged and/or displaced whitegoods from households and businesses.	East Gippsland Shire Council Scrap Metal Merchant	• Contact scrap metal removalists and arrange for collection.
Other hazardous wastes* See 'What is hazardous waste' info from Department of the Environment and Energy in appendix.	Chemicals, batteries, fluorescent lighting, putrescible waste (Food waste, disposable nappies, liquid putrescible waste.)	Household hazardous wastes (e.g. fluorescent lighting, cleaning chemicals, batteries), farming waste (e.g. farming chemicals) and other industry wastes, Spoilt food from supermarkets, restaurants and households, and putrescible waste from	East Gippsland Shire Council EPA Waste Removal Contractor Victoria Police East Gippsland Water Gippsland Water	• Remove and transport to Bairnsdale Landfill for disposal. • Explosives, flares, firearms, ammunition must be removed by the Police. • Solid putrescible waste can be disposed of at the closest landfill. • Putrescible food waste in Mallacoota can be taken to the Composting

		post-disaster relief centres.		Facility. • Liquid putrescible waste can be transported to East Gippsland Water facilities in Bairnsdale, Cann River, Omeo, Metung and Mallacoota, though limited amounts can be accepted (approximately 2 tanker loads). • Other putrescible wastes can be accepted at Dutson Downs for composting, provided there is transport available.
Soil and sediment (Clean fill)	Clays, fines, rubble and soil	Clay, fines, rubble and soil that has been displaced.	East Gippsland Shire Council Waste Contractor	• Remove and transport to Bairnsdale, Lakes Entrance or Cann River Landfill for disposal as clean fill.
Vegetative waste	Green waste	Fallen and/or burnt trees, broken branches, leaves and other vegetative material.	East Gippsland Shire Council	• Remove and transport to closest landfill or transfer station or alternate site for mulching or controlled burn.

Table adapted from Office of Green Industries SA Disaster Waste Management Scoping Study p.29

For detailed actions on disposal of disaster waste, see *Disaster Waste Management Plan Standard Operations Procedures* Document.

APPENDIX A: CODES AND ACTS

The *East Gippsland Disaster Waste Management Plan* should be read in conjunction with relevant legislation and plans to identify any further strategies, arrangements and resources that could assist with animal welfare support following an emergency.

- East Gippsland Municipal Emergency Management Plan
- Public Health and Wellbeing Act 2008
- Emergency Management Act 2013
- Environmental Protection Act 1970

APPENDIX B: CONTACTS

GOVERNMENT ORGANISATIONS

ORGANISATION	PHONE NUMBER	WEBSITE
East Gippsland Shire Council	(03) 5153 9500	http://www.eastgippsland.vic.gov.au
EPA Victoria	1300 372 842	http://www.epa.vic.gov.au/
State Emergency Service (SES)	132 500	http://www.ses.vic.gov.au/
Department of Environment Land Water and Planning (DELWP)	136 186	http://delwp.vic.gov.au/
East Gippsland Water	(03) 5150 4444	http://www.egwater.vic.gov.au/
Victoria Police (Bairnsdale Office)	(03) 5150 2600	http://www.police.vic.gov.au/content.asp?Document_ID=2
Gippsland Water	1800 050 500	https://www.gippswater.com.au/

NON HAZARDOUS WASTE CONTRACTOR CONTACTS

BUSINESS NAME	PHONE NUMBER	SERVICES	WEBSITE
Tambo Waste Pty Ltd (Lakes Entrance, Bairnsdale)	1300 131 807	Municipal solid waste removal, recycling	http://www.kwiktipbins.com.au/tambo-waste
Bairnsdale Waste (Bairnsdale)	(03) 5152 2116		-
EG Waste (Bairnsdale)	0467 892 444		-
East Gippsland Scrap Metal Recyclers & Bargain Centre (Bairnsdale)	(03) 5152 4100	Collection of all scrap metal (residential and commercial); copper, brass, aluminium, dross, stainless steel, batteries, aluminium cans, lead, electric motors, radiators, PVC copper wire, all steel etc. Industrial & farm clean ups, collection of farm machinery, all motorised appliances, electronic waste, whitegoods, pipes, roofing, wire, transformers, pumps.	-

ASBESTOS/HAZARDOUS WASTE CONTACTS

BUSINESS NAME	PHONE NUMBER	SERVICES	WEBSITE
Premier Safety and Environmental (Eagle Point)	0438 531 594	Asbestos building inspections for domestic, commercial and Industrial establishments, asbestos sampling, air monitoring and inspections.	http://www.premiersafety.com.au/
SSM Asbestos Removal and Demolition (Bairnsdale)	0405 083 197	A class removal, B class removal and transportation, and demolition.	http://www.ssm-asbestosremoval.com/default.html
Bigham Keith & Tracy (Sale)	(03) 5144 5440		
Maffra & District Asbestos Removal (Maffra)	(03) 5147 1658		
Mairin OHS & E Consulting Pty Ltd (Moe)	(03) 5127 2311	Asbestos sampling, monitoring, analysis and auditing services	http://mairin.net.au/asbestos/
A A H Contracting Pty Ltd (Warragul)	(03) 9887 4342	Removal and disposal of all types of friable and bonded asbestos materials from commercial, industrial and residential buildings. Asbestos clean ups of general contamination, spills, burst pipes, post natural disasters, contaminated soil removal, synthetic mineral fibre removal, polychlorinated biphenyls removal, contaminated adhesive removal.	http://www.aahcontracting.com.au/services/
Asclear Pty Ltd (Morwell)	(03) 5133 6200	Commercial, industrial and residential asbestos removal.	-
Medico (Sale)	1800 633 426	Collection and transport of Clinical & Related Waste, including sharps containers, Cytotoxic Substances, Pharmaceutical	http://www.medicoservices.com.au/

		substances. Supply sharps containers and related products. Supply appropriate clinical waste bins for individual needs of the client and the installation required. Sanitary Disposal Units, Nappy Disposal Units, Air Freshener Units, Urinal Deep Clean Services, General Urinal and Wc maintenance, sanitary/nappy/condom vending dispenser units, Antibacterial Toilet Seat Wipe Units.	

APPENDIX C: ALTERNATIVE WASTE DISPOSAL SITES

Site	Address	GPS Coordinates	Accepted waste types	Crown Land	EPA 30A approval
Bairnsdale	200 Johnstons Road, Forge Creek	X 554606 Y 5806699	All including asbestos	No	
Bendoc	Clarkeville Rd, Bendoc	X 667170 Y 5886581	Animals, Asbestos, Household	Yes	
Bonang	Mailing Rd, Bonang	X 653148 Y 5881277	Animals, Asbestos, Household	No	
Buchan	2337 Bruthen Buchan Rd, Buchan	X 602475 Y 5846299	Animals, Asbestos, Household	No	
Cann River	Old Coast Rd, Cann River	X 686148 Y 5838375	Animals, Household	Yes	
Eagle Point	1100 Forge Creek Rd, Eagle Point	X 557089 Y 5804701	Animals, Household	No	
Genoa	Gravel Pit Rd, Genoa	X 729865 Y 5851111	Animals, Asbestos, Household	Yes	
Goongerah	Bonang Rd, Goongerah	X 650432 Y 5867753	Animals, Asbestos, Household	No	
Lindenow	90 Snobbs Lane, Lindenow South	X 537453 Y 5814658	Animals, Household	No	
Newmerella	Corringle Rd, Newmerella	X 625951 Y 5819535	Animals, Household	Yes	
Noorinbee	Opposite 503 Monaro Highway, Noorinbee	X 691843 Y 5844696	Animals, Asbestos, Household	Yes	
Omeo	18 Margetts St, Omeo	X 553659 Y 5893748	Animals, Household	No	
Omeo Nightsoil depot	181 Depot Road, Omeo	X 554510 Y 5894064	Animals, Asbestos, Household	No	

Orbost	351 Bonang Road, Orbost	X 624655 Y 5833909	Animals, Asbestos, Household	Yes	
Swifts Creek	237 Cassilis Rd, Swifts Creek	X 561816 Y 5875018	Animals, Household	No	
Wairewa	Carl Smith Road, Wairewa	X 604878 Y 5827929	Animals, Asbestos, Household	Yes	
Wulgulmerang	Snowy River Rd, Wulgulmerang	X 613251 Y 5898905	Animals, Asbestos, Household	No	
Bairnsdale	200 Johnstons Road, Forge Creek	X 554606 Y 5806699	All including asbestos	No	

APPENDIX D: EGSC WASTE TYPES AND ACCEPTED LOCATIONS LIST

Waste Types and Accepted Locations in East Gippsland Shire Council

Please note: The sites listed are supervised transfer stations and landfills located at: Bairnsdale, Lakes Entrance, Cann River, Bruthen, Bemm River, Buchan, Lindenow, Mallacoota, Metung, Marlo, Omeo, Orbost, Swifts Creek and Wairewa. Local community access sites have not been included in this list as they only accept basic waste and recyclables.

Type of Waste	Accepted Locations
General Household Waste	All sites
Commingled Household Recycling	All sites
Green Waste	Bairnsdale, Lakes Entrance, Cann River, Bruthen, Buchan, Mallacoota, Marlo, Metung, Omeo, Orbost, Swifts Creek
Scrap Metal	Bairnsdale, Lakes Entrance, Cann River, Bruthen, Buchan, Lindenow, Mallacoota, Marlo, Metung, Omeo, Orbost, Swifts Creek, Wairewa
Motor Oil	Bairnsdale, Lakes Entrance, Mallacoota, Omeo, Swifts Creek, Buchan, Bruthen, Metung, Orbost, Marlo, Lindenow
Batteries (Car)	All sites
Batteries (Household)	Bairnsdale (Free disposal at Bairnsdale)
Cardboard	Bairnsdale, Lakes Entrance, Mallacoota, Metung, Orbost, Swifts Creek, Cann River
Car Bodies	Bairnsdale, Lakes Entrance , Cann River, Mallacoota, Orbost
LED/Fluorescent Light globes	Bairnsdale (Free disposal at Bairnsdale)
Paint Tins (With Paint)	Bairnsdale (Free disposal at Bairnsdale)
Tyres	Bairnsdale, Lakes Entrance, Mallacoota, Orbost, Buchan
Asbestos	Bairnsdale (See http://www.eastgippsland.vic.gov.au/Planning_and_Building/Building_Process_and_Approvals/Residential_Housing_Information/Asbestos for requirements)
Clean Fill	Bairnsdale, Lakes Entrance (Free disposal at Lakes Entrance), Cann River
Low Level Contaminated Soil Category C	Bairnsdale
Commercial/Industrial/Building Waste	All sites
Concrete, Brick and Tile	Bairnsdale, Lakes Entrance, Mallacoota, Cann River
Televisions	All sites (Free disposal at Bairnsdale)
Computers	All Sites (Free disposal at Bairnsdale)
Dead Animals	Bairnsdale, Lakes Entrance, Cann River
Gas Bottles	All sites
Mattresses	All sites. Mattress recycling only at Bairnsdale Landfill. To avoid paying to dispose of your mattress, you can strip it (See 'How to do I dispose of mattresses? http://www.eastgippsland.vic.gov.au/Services/Waste/FAQs_and_Quick_Links)
White Goods	All sites

For further enquiries, please contact Council's Waste Unit on 03 5153 9500

APPENDIX E: EMERGENCY WASTE DISPOSAL VOUCHERS

Voucher no.

Event name: ....

Date: ....

Valid to: ....

Name: ....

Property Address: ....

....

Phone: ....

Volume (m³): ....

Issuing officer: ....

Emergency Waste Disposal Voucher

Voucher no.

Issued: ....

Valid to: ....

Issuing officer: ....

This voucher is valid for the disposal of

..........................cubic metres

Items not accepted under this voucher:

Asbestos

Hazardous items

Chemicals

Other hazardous waste

EAST GIPPSLAND SHIRE COUNCIL

APPENDIX F: SOLID INDUSTRIAL WASTE HAZARD CATEGORISATION AND MANAGEMENT – EPA

INDUSTRIAL WASTE RESOURCE GUIDELINES

SOLID INDUSTRIAL WASTE HAZARD CATEGORISATION AND MANAGEMENT

CONTENTS

INTRODUCTION

This guideline will assist waste generators and treaters in categorising their solid industrial waste based on the hazard posed by those wastes.

It provides guidance on determining the hazard category of prescribed industrial wastes (PIWs) that come from manufacturing sources, that are not contaminated soils and that are destined for disposal at a landfill.

WHAT THIS MEANS FOR YOU

If you are a generator or treater of manufacturing waste, you will be required to categorise the waste prior to disposal. There are four waste categories: A, B, C and industrial waste (IW). The category chosen will determine what management options are available for that material.

The waste generator will need to categorise wastes that are transported directly from their premises for disposal. If wastes are treated off-site, they will need to be categorised by the waste treater prior to disposal. Waste treaters will require information from the waste generator on the nature of the waste, so that it can be treated appropriately.

WASTE CHARACTERISATION

Waste characterisation will involve identification of contaminants likely to be present in the waste, as well as sampling and analysis for each of the contaminants. Documented evidence to support the categorisation must include the results of a sampling and analysis program.

The nature of the waste characterisation study will vary, depending on factors such as the process that generated the waste. For example, solid wastes from processes with variable inputs will require more regular testing than waste streams where the inputs and processes are consistent and repeatable results can be demonstrated. Each study must, therefore, be tailored specifically for the waste that is to be characterised.

The waste characterisation study may be integrated into existing environmental management systems or environment improvement plans (EIPs) implemented by waste generators and waste treaters.

Thorough characterisation of a waste stream may enable waste generators to identify opportunities to manage wastes higher up the waste management hierarchy. For example: by identifying cleaner production opportunities that would result in a reduction in the volume of waste generated.

Waste generators and waste treaters may seek to characterise a waste stream by undertaking an assessment of the process that generated the waste. By doing this, all contaminants, or waste components, that are likely to be present in the waste, can be identified in conjunction with a waste sampling and analysis program.

The following information may assist in undertaking a process assessment:

1. process flow diagrams or plans
2. determination of process inputs and outputs (including secondary chemical reactions and products)
3. physical state of the waste
4. quantity of the waste produced
5. process variations which may produce a different waste composition.

This guidance forms part of the Industrial Waste Resource Guidelines, which offer guidance for wastes and resources regulated under the *Environment Protection (Industrial Waste Resource) Regulations 2009*. Publication IWRG631 • June 2009.

Relevant information may also be obtained through literature reviews and/or industry associations. Material safety data sheets (MSDS) might provide additional information, however most MSDS do not contain information on all components found in a waste.

The process assessment must be accompanied by waste sampling and analysis results. A sampling and analysis program may include all or some of the following steps, depending on what is appropriate for the particular waste being characterised. A waste generator or waste treater may use alternative steps to characterise their waste, if appropriate. However, they should seek advice from EPA, if in doubt about the appropriateness of the waste characterisation study.

Broad screen: An analysis of a small number of samples for a wide screen of likely components in the waste. This screening process seeks to confirm that all components of the waste have been identified by the process assessment.

Specific sampling and analysis: A short term intensive sampling and analysis program that seeks to achieve repeatable results for each component of the waste that was identified in both the process assessment and the broad screen, and that is likely to influence the classification of the waste. This step allows the total and leachable concentration of waste contaminants to be determined and should include relevant statistical measures of uncertainty.

Ongoing sampling and analysis: Periodic sampling and analysis of the waste for the purposes of confirming that it remains within the range identified by the specific sampling and analysis step. This may also include periodic screening for a broader range of contaminants to confirm that no new contaminants are present.

Contingency planning: A plan developed to ensure the appropriate management of wastes in cases where the ongoing sampling and analysis program indicates changes to the waste characteristics that would result in the waste classification changing.

Review: The results of the waste characterisation study should be regularly reviewed to assess any changes in waste composition. Should the nature of the process generating the waste change, for example, through a change in raw materials or supplier, it may be necessary to conduct further sampling and analysis.

HAZARD CHARACTERISTICS

A hazard characteristic assessment is used to determine whether a waste displays any of the specific hazard characteristics listed in Table 1.

Any solid industrial waste which displays one or more of the hazard characteristics listed in the following table is a Category A.

Table 1: Specific hazard characteristics

Hazard characteristic	Definition[1]
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 - This includes 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.
Flammable 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 - This includes 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 - This includes 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 - This includes 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 - This includes 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 - This includes 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 - This includes clinical and related wastes as prescribed in the Environment Protection (Prescribed Waste) Regulations 1998, and further defined in Addendum for Victoria Only, Additional Operational Guidance, 4th Edition, ANZCWMIG, Code of Practice for the Management of Clinical and Related Wastes, Version 1 2004 as amended from time to time, and includes wastes 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 - This includes 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.
Wastes capable of yielding another material which possesses any of the characteristics above	Wastes capable, by any means, after containment, of yielding another material, for example, leachate, which possesses any of the characteristics listed above and/or is a flammable liquid.

Notes:

1. Definitions are adopted from the Industrial Waste Management Policy (Movement of Controlled Wastes between States and Territories) 2001.
2. In this table 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 degrees Celsius, closed-cup test, or not more than 65.6 degrees Celsius, open-cup test. Note - The definition of flammable liquid wastes includes wastes classified as 'Class 3' under the provisions of the Road Transport (Dangerous Goods) Act 1995.

SAMPLING AND ANALYSIS

The following procedures must be used to sample and analyse the waste stream:

1. wastes must be sampled, collected, preserved and analysed as specified in IWRG *Sampling and Analysis of Waters, Wastewater, Soils and Waste*.
2. sampling must be representative of the waste and account for variability in the waste composition (see IWRG Waste Sampling for Solid Prescribed Industrial Waste).
3. samples must be submitted to an analytical laboratory accredited by the National Association of Testing Authorities (NATA) to undertake the analyses

When determining the leachate concentrations for waste, two buffer solutions must be used (as outlined in Australian Standards AS 4439.2 and 4439.9 using class 3b leaching fluids).

It is recommended that a two-step analytical process be followed when determining the hazard category of waste.

- Initially total concentrations should be determined and if, and only if, the total concentration (TC) is less than twenty times the ASLP1 value, leachable testing is not necessary for Category C (this is due to the twenty times dilution factor involved in the ASLP leaching test method).
- In all other situations ASLP must be determined.
- Leachability testing is required to determine if the waste is Industrial Waste.

RECOMMENDED METHODS

The recommended methods for solid industrial waste are provided in the EPA Victoria recommended NATA-accredited methods for the analysis of total contaminant levels in solid waste, which can be found in IWRG *Sampling and Analysis of Waters, Wastewater, Soils and Waste*. EPA have 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 http://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 http://www.ephc.gov.au/pdf/cs/cs_03_lab_analysis.pdf

SPECIFIC CONTAMINANTS

For the contaminant formaldehyde, it will only be necessary to determine leachable concentrations. This is due to the lack of an effective method to determine the total concentration of formaldehyde.

For the contaminant boron, it will only be necessary to determine leachable concentrations using the acetate buffer.

Many laboratories conduct Total Recoverable Hydrocarbon (TRH) analysis and report this as Total Petroleum Hydrocarbon (TPH). A number of people have raised concerns with using the TRH result and reporting these as TPH due to the presence of other hydrocarbon substances, not related to petroleum hydrocarbons, being included in the TRH test. Until there is a routine test developed exclusive for TPH, it may be necessary to discuss with clients what options are available to remove non petroleum based hydrocarbons prior to analysis.

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.

Acids in solid form with a pH value of 4 or less and alkaline solids with a pH of 9 or more are considered to be PIW. 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

A hazard category of either A, B, C or IW must be applied to all solid industrial wastes. The hazard category determines the type of facility able to accept such wastes. Management options for each of the hazard categories are summarised in Table 3 of this document.

The hazard categorisation framework (Figure 1) outlines the process for attributing a hazard category to solid PIWs. The framework specifies the following requirements:

1. Solid industrial wastes that display any specific hazard characteristic listed in Table 1 are Category A PIW.
2. Solid industrial wastes must be assessed against the total concentration (TC0, TC1 and TC2) and leachable concentration (ASLP0, ASLP1 and ASLP2) thresholds specified in Table 2
3. PIWs with any contaminant level above the TC2 or ALSP2 thresholds are categorised as Category A. PIW with any contaminant level greater than TC1 but below TC2, or greater than ASLP1 but below ASLP2 are categorised as Category B. Wastes

with any contaminant level greater than ASLP0 but below the TC1 and ALSP1 thresholds are categorised as Category C. Solid industrial wastes with all contaminant levels below both the TC0 and ASLP0 thresholds are categorised as IW.

4. If a component of the waste is, in its pure form, poisonous (acute), toxic (delayed or chronic) and/or ecotoxic and is not listed in Table 2, or if, after containment the waste is capable (by any means) of yielding another material, for example leachate, which is poisonous (acute), toxic (delayed or chronic) and/or ecotoxic and is not listed in Table 2, the waste generator must apply to EPA for a determination of hazard category.
5. Assessment must be for all chemical substances known and reasonably expected to be present in the waste. Contact EPA for further guidance on contaminants not listed in Table 2.

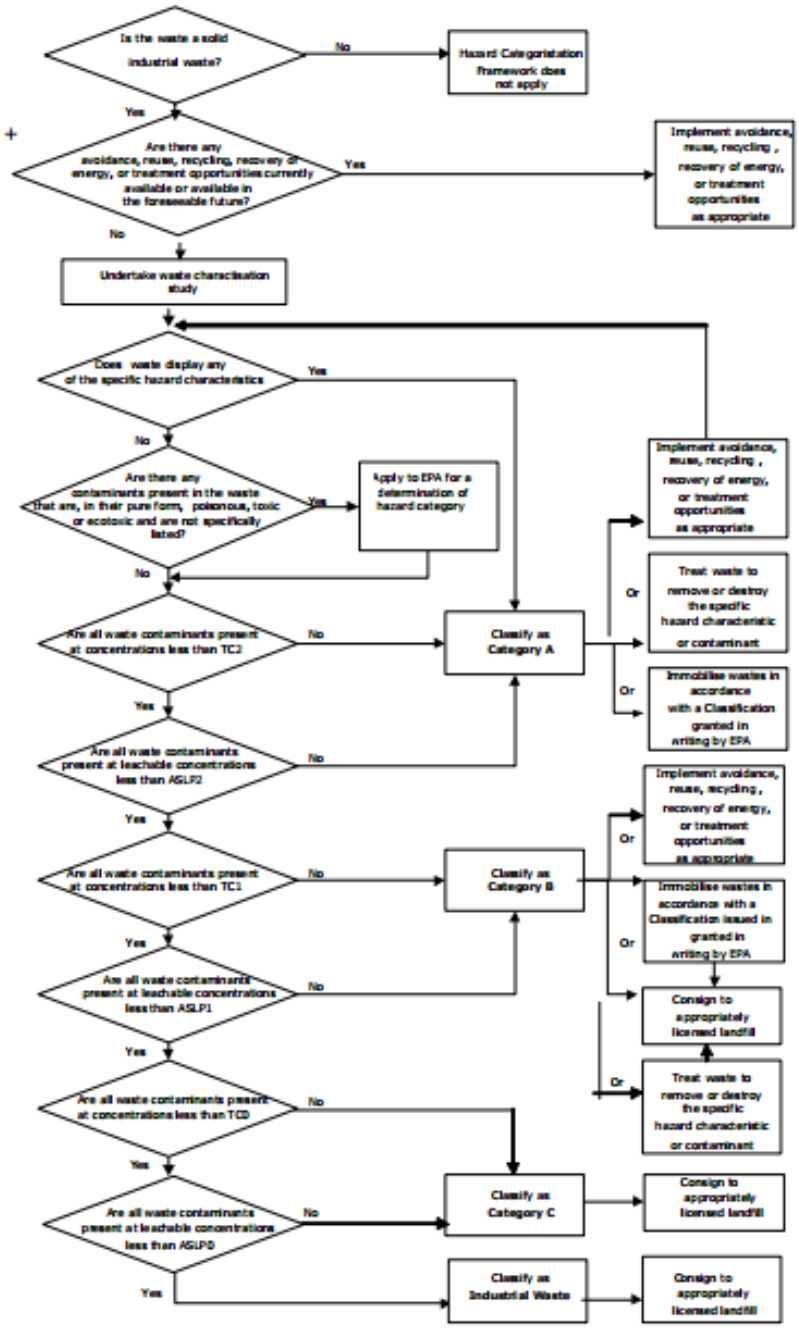

Figure 1: Hazard categorisation framework

Table 2: Solid industrial waste hazard categorisation thresholds

Category	Industrial waste upper limits		Category C upper limits		Category B upper limits		
Contaminant concentration thresholds (dry weight)	ASLP0	TC0	ASLP1[1]	TC1[2]	ASLP2	TC2	
Units	(mg/L)	(mg/kg)	(mg/L)	(mg/kg)	(mg/L)	(mg/kg)	
Inorganic species	**Inorganic species**		**Inorganic species**		**Inorganic species**		
Antimony[3,8]	1	75	2	75	8	300	
Arsenic	0.35	500	0.7	500	2.8	2,000	
Barium[3]	35	6,250	70	6,250	280	25,000	
Beryllium[5]	0.5	100	1	100	4	400	
Boron	15	15,000	30	15,000	120	60,000	
Cadmium	0.1	100	0.2	100	0.8	400	
Chromium (VI)	2.5	500	5	500	20	2,000	
Copper	100	5,000	200	5,000	800	20,000	
Lead	0.5	1,500	1	1,500	4	6,000	
Mercury	0.05	75	0.1	75	0.4	300	
Molybdenum[6]	2.5	1,000	5	1,000	20	4,000	
Nickel	1	3,000	2	3,000	8	12,000	
Selenium[6]	0.5	50	1	50	4	200	
Silver[6]	5	180	10	180	40	720	
Tributyltin oxide[3]	0.05	2.5	0.1	2.5	0.4	10	
Zinc	150	35,000	300	35,000	1,200	140,000	
Anions	**Anions**		**Anions**		**Anions**		
Chloride	12,500	N/A	25,000	N/A	N/A	N/A	
Cyanide (amenable)[5]	1.75	1,250	3.5	1,250	14	5,000	
Cyanide (total)	4	2,500	8	2,500	32	10,000	
Fluoride[6]	75	10,000	150	10,000	600	40,000	
Iodide	5	N/A	10	N/A	40	N/A	
Nitrate	2,500	N/A	5,000	N/A	20,000	N/A	
Nitrite	150	N/A	300	N/A	1,200	N/A	
Organic species	**Organic species**		**Organic species**		**Organic species**		
Benzene	0.05	4	0.1	4	0.4	16	
Benzo(a)pyrene[7]	0.0005	5	0.001	5	0.004	20	
C6-C9 petroleum hydrocarbons[6]	N/A	325	N/A	650	N/A	2,600	
C10-C36 petroleum hydrocarbons[6]	N/A	5,000	N/A	10,000	N/A	40,000	
Carbon tetrachloride	0.15	12	0.3	12	1.2	48	

INDUSTRIAL WASTE | CATEGORY C PRESCRIBED INDUSTRIAL WASTE | CATEGORY B PRESCRIBED INDUSTRIAL WASTE | CATEGORY A PRESCRIBED INDUSTRIAL WASTE

Category	Industrial waste upper limits		Category C upper limits		Category B upper limits		
Contaminant concentration thresholds (dry weight)	ASLP0	TC0	ASLP1[1]	TC1[2]	ASLP2	TC2	
Units	(mg/L)	(mg/kg)	(mg/L)	(mg/kg)	(mg/L)	(mg/kg)	
Chlorobenzene	15	1,200	30	1,200	120	4,800	
Chloroform[5]	3	240	6	240	24	960	
2 Chlorophenol	15	1,200	30	1,200	120	4,800	
Cresol (total)[5]	100	8,000	200	8,000	800	32,000	
Di (2 ethylhexyl) phthalate	0.5	40	1	40	4	160	
1,2-Dichlorobenzene	75	6,000	150	6,000	600	24,000	
1,4-Dichlorobenzene	2	160	4	160	16	640	
1,2-Dichloroethane	0.15	12	0.3	12	1.2	48	
1,1-Dichloroethene	1.5	120	3	120	12	480	
1-2-Dichloroethene	3	240	6	240	24	960	
Dichloromethane (methylene chloride)	0.2	16	0.4	16	1.6	64	
2,4-Dichlorophenol	10	800	20	800	80	3,200	
2,4-Dinitrotoluene[5]	0.065	5.2	0.13	5.2	0.52	21	
Ethylbenzene	15	1,200	30	1,200	120	4,800	
Ethylene diamine tetra acetic acid (EDTA)	12.5	1,000	25	1,000	100	4,000	
Formaldehyde	25	2,000	50	2,000	200	8,000	
Hexachlorobutadiene	0.035	2.8	0.07	2.8	0.28	11	
Methyl ethyl ketone[5]	100	8,000	200	8,000	800	32,000	
Nitrobenzene[5]	1	80	2	80	8	320	
PAHs (total)[7,10]	N/A	50	N/A	100	N/A	400	
Phenols (total, non-halogenated)[5,11]	7	560	14	560	56	2,200	
Polychlorinated biphenyls[4]	N/A	2	see note 4		see note 4		
Styrene	1.5	120	3	120	12	480	
1,1,1,2-Tetrachloroethane[5]	5	400	10	400	40	1,600	
1,1,2,2-Tetrachloroethane[5]	0.65	52	1.3	52	5.2	210	
Tetrachloroethene	2.5	200	5	200	20	800	
Toluene	40	3,200	80	3,200	320	12,800	
Trichlorobenzene (total)	1.5	120	3	120	12	480	
1,1,1-Trichloroethane[5]	15	1,200	30	1,200	120	4,800	
1,1,2-Trichloroethane[5]	0.6	48	1.2	48	4.8	190	
Trichloroethene[5]	0.25	20	0.5	20	2	80	
2,4,5-Trichlorophenol[5]	200	16,000	400	16,000	1600	64,000	

INDUSTRIAL WASTE

CATEGORY C PRESCRIBED INDUSTRIAL WASTE

CATEGORY B PRESCRIBED INDUSTRIAL WASTE

CATEGORY A PRESCRIBED INDUSTRIAL WASTE

Category	Industrial waste upper limits		Category C upper limits		Category B upper limits	
Contaminant concentration thresholds (dry weight)	ASLP0	TC0	ASLP1[1]	TC1[2]	ASLP2	TC2
Units	(mg/L)	(mg/kg)	(mg/L)	(mg/kg)	(mg/L)	(mg/kg)
2,4,6-Trichlorophenol	1	80	2	80	8	320
Vinyl chloride	0.015	1.2	0.03	1.2	0.12	4.8
Xylenes (total)	30	2,400	60	2,400	240	9,600
Pesticides	**Pesticides**		**Pesticides**		**Pesticides**	
Aldrin + dieldrin	0.015	1.2	0.03	1.2	0.12	4.8
DDT + DDD + DDE[9]	1	50	2	50	N/A	50
2,4-D	1.5	120	3	120	12	480
Chlordane	0.05	4	0.1	4	0.4	16
Heptachlor	0.015	1.2	0.03	1.2	0.12	4.8

Notes

1. Where not otherwise specified, ASLP1 criteria are derived from the *NHMRC Australian Drinking Water Guidelines (1996) Guideline Health Values*, multiplied by 100.
2. Where not otherwise specified, TC1 criteria for 'Inorganic species' and 'Anions' has been adopted as the *National Environment Protection Measure on the Assessment of Site Contamination 1999, Health Investigation Level for Commercial/Industrial land.*
3. TC1 adopted from the Risk-based *Assessment of Soil and Groundwater Quality in the Netherlands, Intervention Values for soil.*
4. Waste 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.
5. ASLP1 adopted from $TCLP_2$ value specified in Department of Environment and Climate Change NSW, *Waste Classification Guidelines Part 1: Classifying Waste*, 2008.
6. TC1 adopted from SCC_2 value specified in Department of Environment and Climate Change NSW, *Waste Classification Guidelines Part 1: Classifying Waste*, 2008.
7. TC1 value adopted from the *National Environment Protection Measure on the Assessment of Site Contamination 1999, Health Investigation level for Commercial/ Industrial Land.*
8. ASLP1 adopted from *World Health Organisation (WHO), Antimony in drinking water. Background document for development of WHO guidelines for Drinking-water quality* 2003, multiplied by 100.
9. TC1 and TC2 values adopted from the *ANZECC Organochlorine Pesticides Waste Management Plan* 1999.
10. 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.
11. 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.

Table 3: Management options for each hazard category

Category	Management option
A	Prescribed industrial wastes which require a very high level of control and ongoing management to protect human health and the environment. Wastes in this category cannot be accepted at a disposal facility without prior treatment to reduce or control the hazard.
B	Prescribed industrial wastes which require a high level of control and ongoing management to protect human health and the environment. Solid prescribed industrial wastes in this category can be accepted at a facility licenced by EPA to receive this category of waste.
C	Prescribed industrial wastes which pose a low hazard, but require control and/or ongoing management to protect human health and the environment. Solid prescribed industrial wastes in this category are able to be accepted at best practice municipal landfills licensed by EPA to accept such waste.
Industrial waste	Industrial wastes are not regulated as prescribed industrial wastes, but when disposed of to landfill, continue to be controlled by EPA. These wastes can be accepted at solid inert landfills (non-putrescible) or municipal solid waste landfills (putrescible) licenced by EPA to accept this type of waste.

MANAGEMENT OPTIONS

Table 3 provides a summary of the disposal options available for each category of waste.

Generators of prescribed industrial waste 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 the waste. For example, a contaminant that is intrinsically immobile may display a low hazard because of the 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 IWRG Classifications – for Disposal provides further information on the requirements for a classification.

DEFINITIONS

The following definitions apply for the purposes of this guideline:

ASLP: Australian Standard Leaching Procedure as specified in Australian Standards 4439.2 and 4439.3

Ecotoxic wastes: wastes that, if released, may present immediate or delayed adverse impacts to the environment by means of bioaccumulation and/or toxic effects upon biotic systems. They include wastes classified as displaying aquatic toxicity (including Acute Category 1, 2 and 3 and Chronic Category 1,2,3 and 4) under the Harmonised Integrated Classification System for Human Health and Environmental Hazards of Chemical Substances or Mixtures (OECD, 2001).

Immobilisation: a process whereby the solubility, leachability, availability or reactivity of a waste and its components is reduced by chemical reaction and/or physical encapsulation in a solid matrix.

Poisonous (acute) wastes: wastes liable either to cause death or serious injury or harm to human health if swallowed, inhaled or absorbed via skin contact. They include substances or wastes classified as Class 6.1 under the provisions of the *Road Transport (Dangerous Goods) Act 1995*.

TC – Total concentration.

Toxic (delayed or chronic) wastes - wastes which, if they are inhaled or ingested or if they penetrate the skin, may involve delayed or chronic effects, including carcinogenicity. They include substances or wastes classified as any of the following hazard categories under the Harmonised Integrated Classification System for Human Health and Environmental Hazards of Chemical Substances or Mixtures (OECD, 2001):

- germ cell mutagenicity (including Category 1, 1A, 1B or 2)
- carcinogenicity (including Category 1, 1A, 1B or 2)
- reproductive toxicity (including Category 1, 1A, 1B, 2 or additional category)
- specific target organ systemic toxicity (including single exposure Category 1 and 2 and repeated exposure Category 1 and 2).

Treatment: a process whereby the specific hazard characteristic is removed or destroyed, or the contaminant total concentration reduced (ie. the contaminant is removed from the waste).

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

APPENDIX G: EPA COMPOSTING OF DAIRY CATTLE MORTALITIES FACT SHEET

DEPARTMENT OF
PRIMARY INDUSTRIES

On-Farm Composting of Dairy Cattle Mortalities

Why Consider Composting?

As knackery and rendering services have declined in many parts of Victoria over the last five or so years, the question of what to do with dead stock has become increasingly problematic for some dairy farmers. There are stringent guidelines for the burial of dead stock (see EPA Victoria Publication 660, www.epa.vic.gov.au). Unfortunately, a few desperate farmers have been known to leave their animals in the 'back paddock' or even dump them in waterways (Fig 1). Dumping of farm animals in this manner is a biosecurity and environmental hazard - it is also illegal and EPA Victoria has prosecuted those responsible for it in the past.

Composting of dead farm animals is a relatively simple and effective process for the routine disposal of dead stock of all sizes (i.e. from poultry to mature cattle). Some farmers have been composting for a long time. The resulting compost can be applied to cultivated land, as top dressing on pastures, or on non-grazed farm areas such as shelterbelts. Compost is a soil conditioner that is able to improve a range of different soil properties, e.g. organic matter content, and provide slow release nutrients

Figure 1: Illegal dumping of stock is a biosecurity and environmental hazard

What is mortality composting?

Composting is a biological process in which naturally occurring microorganisms and soil animals convert organic materials into a soil-like material called compost. More specifically, mortality composting can be described as the above-ground burial of dead stock in a mound of sawdust, shavings or similar supplemental carbon material. Sufficient supplemental carbon is required around the carcass to absorb bodily fluids and to prevent odours from escaping from the pile.

Mortality composting is generally conducted in 3 stages. In the first stage of composting, the pile is left undisturbed as soft tissue decomposes and bones partially soften. The compost is usually then moved, turned or mixed to begin the second stage, during which time the remaining materials (mainly bones) break down further. Following completion of the second stage, the composting process is completed during a curing or storage phase.

The first (and sometimes second) stage of composting is characterised by high temperatures (>55°C); these conditions result in the elimination of nuisance odours and destruction of pathogens (disease-causing organisms) and weed seeds.

Warning!
If there is suspicion that the animal may have died from a notifiable or exotic disease, the carcass must not be composted but disposed of under the direction of the Victorian Department of Primary Industries. If in doubt, a vet should be contacted.

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National Landcare Program

Selecting the Site for Composting

The site should be located in an elevated area with soils that have low permeability. It may be possible to use an existing hardstand area or a disused concrete pad for composting dead farm animals. If neither is available, a hardstand area that provides all-weather access may need to be established. Instructions for constructing a hardstand are available on the Internet (e.g. www.epa.sa.gov.au/pdfs/cattle.pdf).

Additional requirements include the following:

- The watertable at the site must be at least 1-2 m below the surface;
- The site must not be within 100 m of surface waters (e.g. streams, lakes, wells etc);
- The site should have an adequate slope (1-3%) to allow proper drainage and prevent pooling of water following a rain event;
- Run-off from the composting facility (e.g. during a heavy rainfall event) should be directed to an effluent pond or a vegetative filter strip / infiltration area;
- The site should have all-weather access and have minimum interference from other traffic;
- Consideration should be given to prevailing winds and the location and proximity of the site in relation to the farm house and neighbours in order to prevent potential odour problems;
- Fence off the site to help eliminate scavenging animals and other livestock accessing the piles.

Figure 2: Establish 45-60 cm base layer of carbon material

Figure 3: Place the carcass in the centre of the base

Figure 4: Cover the carcass with 60 cm carbon material

How is Composting Done?

These instructions are for composting dairy cattle using the open pile method, which is likely to be the method of choice for most farmers.

Constructing the Pile

The construction of the pile requires considerable quantities of carbon material; about 10 - 12m^3 is needed to establish a composting pile for a 450-kg carcass. Up to 50% of carbon material can be comprised of finished compost from previous composting piles.

Follow this process for constructing a mortality composting pile:

Step 1. Establish a base layer of relatively dry carbon material at the composting hardstand area (Fig. 2). The depth of the base layer should range between approximately 45 cm for small carcasses and 60 cm for large carcasses. The dimensions of this base layer must be large enough to accommodate the carcasses with >60 cm space around the edges.

Step 2. Place the carcass in the centre of the base layer (Fig. 3).

Step 3. Cover the carcass with carbon material to a depth of about 60 cm (Fig. 4). The material used to cover the animal should be damp to enhance the composting process. The material must feel moist but not be too wet. Composting material is too wet when water can be squeezed from it (droplets appear between fingers).

Step 4. Leave the pile undisturbed for at least 4 months. Provided that the animal is covered well enough, scavengers should not be attracted to the pile.

Step 5. When the soft tissue has completely decomposed after 4-6 months the pile can be turned and watered (Fig. 5) to complete the composting process.

Step 6. When the pile starts to cool down, leave it to cure for at least another 4 weeks before using the compost. It is not necessary to turn the pile during the curing stage.

Although the composting process is complete, large bones of adult cattle such as the skull, the spine, shoulder blades or leg bones may still be present. However, they are usually 'clean' (free of soft tissue) and have become brittle, starting to disintegrate (Fig 6).

Figure 5: Watering the compost at turning

Figure 6: Bones remaining after 4 months composting

Monitoring the Composting Process

1. Monitor compost pile temperatures (> 60 cm depth) weekly for the first four weeks after establishing the pile and after turning (Fig. 7). Subsequently, fortnightly measurements should be sufficient. Take temperature readings (three are suggested) from several points in the pile and record them down for future reference.
2. After establishing the pile, visit the pile daily for the first week, to ensure there is no odour or liquid running from the base of the pile, and no dogs or foxes have dug into the pile to get access to the carcass. Add more carbon material if needed to cover the animal or to mop up seeping fluids.
3. From about 4 months (less for younger, smaller animals), periodically check for signs of remaining soft tissue. If none remains, the pile can be turned and watered as described above.

Figure 7: Monitoring temperature during composting

Biosecurity

Composting is known to control nearly all pathogens - viruses, bacteria, fungi, protozoa (including cysts) and helminth ova to acceptably low levels. Exceptions to this are some spore-forming bacteria (e.g. *Bacillus anthracis*, 'anthrax') and prions like BSE (bovine spongiform encepalopathy). Prions are highly resistant to both physical and chemical means of inactivating pathogens and for this reason it is assumed that composting will be ineffective in reducing infectivity of prion-infected carcasses.

Pathogens are killed during composting by multiple means, such as high temperatures, the direct and indirect effects of other microorganisms and the presence of organic acids and ammonia in the compost. Not only is temperature considered to be the most important factor in killing pathogens, it is also relatively easy to measure during composting.

The heat required for the inactivation of pathogens is a function of both temperature and length (time) of exposure. Exposure to an average temperature during composting of 55 to 60°C for a couple of days is usually sufficient to kill the vast majority of pathogens.

Figure 8: Temperature variation within a typical pile

To achieve efficient pathogen kill, all materials in a compost pile must be exposed to high temperatures for prolonged periods. In piles, there is great variation in the temperature profile from the cool outside layers to the hot central mass (Fig. 8). As a result, piles are usually turned periodically to expose the outer layers of the pile to high temperature composting. In mortality composting, piles are turned after the soft tissue has decomposed (stage 2).

Risk Management

Proficient design and operation of mortality composting systems is very important to ensure that all material achieves adequate temperatures for long enough to kill pathogens. This is achieved for mortality composting piles provided that temperature is monitored.

The current state of knowledge suggests that taking the following factors into consideration will reduce the potential biosecurity risk associated with mortality composting:

- Attention to site design and layout to minimise scavenging and contamination of ground and surface water with pathogens;
- Using a minimum two-stage composting system followed by the use of a curing phase to properly complete the composting process;
- Where possible, fully encapsulating mortalities in 'clean' carbon source; use sufficient carbon source to absorb liquids and odorous gasses produced during composting;
- Monitor and manage the composting process to maximise progress towards the full completion of composting (e.g. temperature, monitoring, watering and turning);
- Attention to basic standards of hygiene (e.g. minimising pooling of water at the site, regular sanitising of equipment and keeping it separate from production facilities, use of personal safety equipment by compost operators).

Health and Safety

A compost pile contains living microorganisms including moulds, bacteria, fungi and protozoa. These microorganisms can cause adverse reactions, particularly in people with a weakened immune system, asthma or a punctured ear-drum, or if somebody takes antibiotics or adrenal cortical hormones. Dust particles or bioaerosols released from the pile during handling of the compost on rare occasions may cause skin irritations, eye infection or respiratory illness.

The following precautions should always be followed when handling dead stock or compost materials:

- Wear gloves;
- Wash hands after handling dead stock or compost;
- Avoid breathing dusts or mists;
- Wear particulate mask;
- Wear dust resistant eye protection;
- Wash work clothing regularly;
- Prevent injury when operating machinery.

Further information

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Detailed instructions for mortality composting available on the Dairying for Tomorrow website (www.dairyingfortomorrow.com)

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