Government of Western Australia
Department of Water and Environmental Regulation

Guideline

Better practice composting

Activities regulated under the:

Environmental Protection Act 1986

Environmental Protection Regulations 1987

May 2020

For external consultation

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Contents

Tables

1. Purpose

The purpose of this *Guideline*: *Better Practice Composting* (guideline) is to provide environmental performance objectives and minimum standards for the construction and operation of composting premises regulated under Pt V of the *Environmental Protection Act 1986* (EP Act). The guideline also defines 'better practice' for composting facilities in relation to the Waste Avoidance and Resource Recovery Strategy 2030 (Waste Strategy 2030).

2. Scope

Guidelines provide direction on how the Department of Water and Environmental Regulation (the department) interprets and applies the legislation it administers.

This guideline relates to all composting activities covered by Category 67A of Schedule 1 of the Environmental Protection Regulations 1987 (EP Regulations).

Table 1: Description of category 67A Compost manufacturing and soil blending

Description of category	**Production or Design Capacity***
Category 67A	
Compost manufacturing and soil blending: Premises on which organic material (excluding silage) or waste is stored pending processing, mixing, drying or composting to produce commercial quantities of compost or blended soils.	1,000 tonnes or more per year

*The production or design capacity is based on the amount of compost produced or that can potentially be produced at the premises per year.

Category 67A includes aerobic and anaerobic composting activities of organic material or waste and includes anaerobic digestion. It also relates to composting activities that may take place at other types of prescribed premises either under Category 67A or as a directly related activity (see Glossary). Activities typically associated with Category 67A composting facilities include:

- Category 25 – Alcoholic beverage manufacturing
- Category 61 – Liquid waste facility
- Category 61A – Solid waste facility
- Category 62 – Solid waste depot
- Category 64 or 89 – Putrescible landfill site
- Category 1 or 68 – Cattle feedlot
- Category 2 or 69 – Intensive piggery.

The guideline is not applicable to Category 67A soil blending premises where composting is not undertaken.

The guideline is not applicable to Category 62 solid waste depots/waste transfer stations, Category 61A solid waste facilities receiving and storing composting feedstocks or composting premises operating below the production and design capacity for Category 67A. However, some of the minimum standards in this guideline may be relevant to the activities undertaken at these premises, especially in relation to the transfer and management of high-risk feedstocks such as food organics and garden organics (FOGO). A separate better practice guideline is under development for Category 61A and 62 prescribed premises.

The definitions and acronyms used in this document are listed in the Glossary.

3. Context

The department's *Guideline: Industry Regulation Guide to Licensing* outlines the legal requirements for the occupier of prescribed premises under the EP Act and the general process and timeframes for assessments.

This guideline builds on that information by providing better-practice industry-specific guidance for composting premises. The department recommends using this guideline in conjunction with *Guideline: Industry Regulation Guide to Licensing*.

In February 2019, the Waste Authority published the *Waste Avoidance and Resource Recovery Strategy 2030* (Waste Strategy 2030). It outlines targets and strategies to achieve the objectives of waste avoidance, waste recovery and protection of the environment through responsible waste management.

Objective 3 of Waste Strategy 2030 relates to environmental protection and seeks that '*Western Australians protect the environment by managing waste responsibly'.*

Waste Strategy 2030 identifies that where waste cannot be avoided, the environment should be protected from the negative impacts of waste by recycling and disposal facilities adopting better practice.

A key target under Objective 3 is that waste is managed and disposed of to 'better practice' facilities by 2030. For this target to be achieved, new premises are expected to meet published better-practice requirements and existing premises are expected to improve their standards to align with better practice.

This guideline sets standards for the regulation of composting premises under Pt V of the EP Act and also sets the standard for better practice composting to fulfil the requirements of Waste Strategy 2030, which was developed in accordance with the *Waste Avoidance and Resource Recovery Act 2007* (WARR Act).

4. Legislation

The EP Act provides for the prevention, control and abatement of pollution and environmental harm in Western Australia, in accordance with (s.4A of the EP Act):

- the precautionary principle
- the polluter pays principle
- the principle of intergenerational equity
- the principle of the conservation of biological diversity and ecological integrity
- the principle of waste minimisation.

In accordance with the above-listed principles and s.51 of the EP Act, all reasonable and practicable measures should be taken to prevent or minimise emissions. Under s.51 of the EP Act, it is an offence for occupiers of prescribed premises not to take these measures.

Part V Division 3 of the EP Act provides the department with mechanisms for regulating emissions, by way of conditions on works approvals and licences applied to prescribed premises.

The primary objective of the WARR Act is to contribute to sustainability and to the protection of human health and the environment. It is also designed to help Western Australia to move towards a waste-free society by:

- promoting the most efficient use of resources, including resource recovery and waste avoidance
- reducing environmental harm, including pollution caused by waste
- consideration of resource management through avoidance of unnecessary resource consumption and disposal
- resource recovery which includes re-use, reprocessing, recycling and energy recovery.

The WARR Act also reflects the principles set out in the EP Act s.4.

5. Outcome

This guideline will:

- facilitate improved environmental management in the composting industry to minimise harm to the environment, human health and amenity from composting activities
- provide guidance to composting facilities to achieve the Waste Strategy 2030 target of operating to better practice by 2030
- increase the industry and community's confidence in the regulatory process

- support innovation and growth in the composting industry by providing a standard that applicants can use to inform the development of alternative environmental protection measures.

6. Implementation

This guideline will be implemented for new and existing composting premises to achieve the regulatory standards required under Pt V of the EP Act and to meet the relevant objectives of Waste Strategy 2030. The department will adopt a staged approach to the implementation of the guideline once published, meaning:

- any new application relating to a composting activity, whether for a new or existing premises, will be assessed using the guideline

- the department will have regard to the guideline when assessing any application relating to composting activities that was submitted and remains undetermined before the publication of the guideline

- the department will implement the guideline for existing premises over a period that takes into consideration the composting sector's recovery from the impacts of COVID-19. The implementation timeframe for existing premises will take into consideration input provided in the consultation process for this guideline.

Should existing premises wish to commence implementation of the guideline, once published, on their premises in advance of the department's implementation schedule, they may do so. In these circumstances, the department will work with the licence holder on the implementation process and relevant requirements at their premises.

To support the assessment process all new applications and existing premises will need to implement the following self-assessment process and:

1. identify each environmental performance objective relevant to the premises

2. confirm whether all relevant minimum standards, for each environmental performance objective, are or will be implemented

3. where minimum standards will not be implemented, detail the control measures on, or proposed at, the premises and confirm the types and quantities of emissions from the premises.

Additional information on the implementation of this guideline for new and existing facilities is provided in Appendix A. This includes requirements to demonstrate that deviation from the minimum standards may be acceptable.

7. Environmental performance objectives

The department has determined environmental performance objectives and minimum standards for the key aspects of composting activities which have the potential to cause impacts to the environment, human health and public amenity. Environmental performance objectives generally reflect the requirements of the EP Act and so provide a link between regulated premises and the governing legislation.

The key aspects for composting are considered to be environmental siting, feedstocks, emissions and compost product quality. The environmental performance objectives are set out in Table 2.

Composting premises within the scope of this guideline will be assessed and regulated against the environmental performance objectives set out in Table 2. Operators should therefore be able to satisfy themselves and the department that they meet these environmental performance objectives. The final two objectives, highlighted in grey, are industry-specific objectives.

Table 2: Environmental performance objectives

Aspect	**Environmental performance objective**
Air	Maintain air quality and minimise emissions so environmental values and human health are protected.
Dust	Maintain air quality and manage construction and operations to protect surrounding environmental values, human health and social surroundings from unacceptable dust impacts.
Environmental siting	Premises are sited in locations which minimise their potential to cause adverse impacts to environmental values, water resources, human health and social surroundings.
Fire prevention and management	Minimise the risk of fires occurring at the facility and be sufficiently prepared in the event of a fire.
Land	Prevent adverse impacts to the environmental values of terrestrial ecosystems and beneficial uses of soil.
Litter and debris	Maintain environmental values and human health by preventing the discharge of litter and debris beyond the premises boundary.
Noise	Maintain compliance with the assigned levels specified in the Environmental Protection (Noise) Regulations 1997 to protect surrounding environmental values, human health and social surroundings from unreasonable emissions of noise.

Aspect	Environmental performance objective
Odour	Maintain air quality and manage on-site operations to protect surrounding environmental values, human health and social surroundings from unreasonable emissions of odour.
Vectors	Prevent the attraction, refuge, growth and spread of vermin and pests to mitigate impacts to environmental values, human health and social surroundings.
Waters	Prevent adverse impacts to the environmental values and beneficial uses of marine, groundwater and surface waters.
Feedstocks for waste-derived products	Activity is undertaken using feedstocks that can be treated by the composting process to produce a fit-for-purpose waste-derived material.
Waste-derived material composition	Waste-derived materials are demonstrated to be fit for their intended purpose without their use presenting unacceptable risks to environmental values, water resources and human health.

The following sections (Section 8-18) set out the environmental performance objectives and minimum standards for composting premises. These sections also include additional guidance to support applicants' understanding of the environmental risks associated with each aspect of composting premises.

It should be noted that the term 'regular' is used in a number of the minimum standards in relation to the frequency of a specific action being required to be undertaken, for example the characterisation verification sampling and testing of incoming waste streams and inspections of infrastructure. Where the term 'regular' is used, it is considered that the frequency of the specific action required is dependent on a number of factors such as the scale and type of activities taking place on a premises, and the type of feedstocks accepted, all of which contribute to the overall risk presented by the premises.

Where the term 'regular' is used, applicants/operators will be required to specify the proposed frequency of undertaking that action at their premises and justify why it is considered acceptable given the assessed level of risk presented by the (proposed) operations on their premises. Frequencies of undertaking specific actions will be included in licences following a site-specific risk assessment by the department taking into account the applicant/operator's submission.

8. Air emissions – point source

8.1 Objective

Environmental performance objective: Maintain air quality and minimise emissions so that environmental values and human health are protected.

Air emissions can cause detriment to the local ambient air quality as well as cause health and amenity impacts to human receptors. This section addresses point source air emissions which may arise from composting facilities which include anaerobic digestion plants.

Further guidance on air emissions is provided in the department's *Guideline: Air Emissions* (see Related documents).

Non-point source air emissions (see Glossary) are not specifically addressed in this guideline as the department considers they are adequately controlled by minimum standards in this section, odour (Section 15), dust (Section 9) and fires (Section 11).

8.2 Typical sources

Point source air emissions are particularly relevant to composting facilities involving anaerobic digestion plants. Point source emissions arise from generator stacks and flares at these facilities. Generator stacks are used to emit waste gases produced during the combustion of biogas generated during anaerobic digestion for the purpose of electricity generation. Flares are used to burn off excess biogas which cannot be sent to the generator, for example during start up and shutdown sequences and when the generator is turned off.

Air emissions released during combustion of biogas in a generator or flare vary depending on multiple factors (e.g. type of feedstock, composition of the biogas, pre-combustion treatment processes and flare/generator parameters). Potential air pollutants which may be released from these sources include but are not limited to methane (CH_4), carbon dioxide (CO_2), carbon monoxide (CO), nitrous oxide (N_2O), sulfur dioxide (SO_2), nitrogen oxides (NO_x), VOCs (e.g. formaldehyde, benzene), dioxins/furans and particulate matter (PM) (Paolini et al. 2018; Kuo & Dow, 2017).

8.3 Minimum standards

The following minimum standards are required to meet the environmental-performance objective for point source air emissions.

8.3.1 Infrastructure and equipment

- Anaerobic digestion plants are designed, operated and maintained to contain, extract and combust all biogas in a generator or flare.
- Anaerobic digestion plants are fitted with a hydrogen sulfide scrubber to treat biogas before it enters power generators.

- Flares are enclosed and designed to:
  - provide a sufficient capacity which is compatible with the operational requirements of the premises
  - permit a homogeneous temperature distribution across the combustion chamber
  - include lining with refractory material on the interior
  - allow the flame to be contained
  - allow the flare to be maintained in an effective condition.
- The flare air supply is controlled to achieve a minimum temperature of 1,000ºC and minimum retention time of 0.3 seconds at this temperature.
- Air emission points are positioned and sized to minimise the impact to receptors.
- Emissions concentrations from biogas generator exhaust do not exceed the emissions standards specified in Table 3 or site-specific emission limits imposed on the premises licence.

Table 3: Emissions standards for anaerobic digestion plants

Pollutant	**Biogas generator exhaust gas concentration[1]**
NO_x (as NO_2)	500 mg/m^3
CO	1400 mg/m^3
Total VOCs (as carbon)	1000 mg/m^3

Note 1: Biogas engine exhaust emissions standards are reported under the following conditions: temperature 0ºC (273 K), pressure 101.3 kPA, 5% oxygen and dry gas. Sourced from the United Kingdom Environment Agency *Guidance for monitoring landfill gas engine emissions* LFTGN08 V2 2010.

8.3.2 Management

- Biogas flare and electricity-generating equipment must be operated and maintained in accordance with the manufacturer's recommendations and in a proper and efficient manner.
- Emission points must be monitored at least annually for potential pollutants and other parameters (e.g. exit temperature and flow rate).
- Air emissions monitoring results must be reported to the department at least annually. Reports must include an interpretive summary and assessment of data including:
  - comparison to emissions standards and limits
  - comparison to previous results and identification of any trends.

9. Dust (including bioaerosols)

9.1 Objective

Environmental performance objective: Maintain air quality and manage construction and operations to protect surrounding environmental values, human health and social surroundings from unacceptable dust impacts.

Dust is particulate matter (PM) comprising very small solid particles of earth, organic matter, manufactured products or waste matter which may become airborne by natural forces (such as wind) and/or by mechanical processes (such as crushing, grinding and conveying). Bioaerosols are airborne particulates and/or water droplets that may contain bacteria, fungi and fungal spores, pathogens or other microorganisms.

Further guidance on dust emissions is provided in the department's *Guideline: Dust Emissions* (see Related documents).

9.2 Typical sources

The department considers the key sources of dust emissions (including bioaerosols) at composting premises to be:

- site preparation and construction of site infrastructure
- feedstock acceptance and handling, particularly from dry loads such as straw and sawdust
- dust lift-off from storage of feedstock, products and other materials such as soils
- dust lift-off from materials undergoing composting, especially during turning
- dust lift-off from roads and other surfaces including the generation of dust during vehicle movements
- feedstock processing (grinding and screening), especially when using dry materials
- bagging plants.

Some feedstocks present a higher risk of bioaerosol generation, such as biosolids, animal effluent and residues.

9.3 Minimum standards

The following minimum standards are required to meet the environmental performance objective for dust.

9.3.1 Infrastructure and equipment

- A water cart and sufficient water supply must be maintained on-site and used to suppress dust.
- All vehicle-moving areas are sealed to prevent the generation of dust. Where roads are not sealed, measures are implemented to reduce the generation of dust, including the use of water carts or chemical stabilisers and restrictions to vehicle speed.
- Vehicles leaving the premises must be free from mud, dirt and sediment to prevent the generation of dust on public roads.
- Outdoor dust-generating infrastructure (e.g. stockpiles and windrows) and equipment (e.g. grinders and screeners) are positioned in a part of the premises where their impact to sensitive receptors is minimised. This includes siting in a location furthest away from sensitive receptors and using topographical features or buildings to achieve shielding from the wind.
- Sprinkler/misting systems must be fitted on outdoor dust-generating equipment such as grinders, screeners and windrow turners. High-pressure misting systems, where situations allow, are preferable to sprinkler systems (or hosing). This is because smaller water droplets in the misting systems have a greater surface area and greater capacity to bind onto and settle dust particles.
- All truckloads transporting feedstock, un-bagged finished compost product and residual physical contaminants (see Glossary) into or out of the premises must be covered.

9.3.2 Process

- Stockpiles and windrows must be maintained in a damp state to prevent dust lift-off.
- Stockpile and windrow heights must be maintained at a height of 5 m or less.
- Stockpiles and windrows within 5 m of the perimeter fence or wall must be maintained below the top of the fence/wall line.
- Stockpiles and windrows must not be within 2 m of the perimeter fence/wall.
- Moisture content is maintained between 40 and 65 per cent in stockpiles/windrows of material during pasteurisation. Care should be taken to avoid over-wetting of the compost which may result in other emissions, including odours and leachate production.
- Moisture content is maintained at 25 per cent or higher in stockpiles of feedstock and finished compost product.
- Materials must be wetted down before processing in dust-generating equipment such as grinders, shredders and screeners.
- General housekeeping such as sweeping down roads and other areas prone to dust lift-off must be regularly undertaken on the premises.

- Composting facilities must be operated to ensure the whole mass of the compost product is subject to pasteurisation, thereby reducing the risk of pathogens in final products. Acceptable pasteurisation criteria are provided in Section 18.3.1.
- Proper material-handling and leachate-management measures are implemented to prevent recontamination of pasteurised material with unpasteurised materials.

9.3.3 Management

- Wind direction and strength are observed and dust-generating activities must be suspended or reduced on-site when winds are strong or in the direction of sensitive receptors.
- A complaints-management system must be implemented to ensure complaints are recorded and acted on promptly.

10. Environmental siting

10.1 Objective

Environmental performance objective: Composting premises are in locations which minimise their potential to cause adverse impacts to environmental values, water resources, human health and social surroundings.

Because of the emissions likely to be associated with composting facilities, it is recommended that they are sited away from sensitive receptors and specified ecosystems (see Glossary).

10.2 Minimum standards

The department's minimum standards to achieve the environmental performance objective for siting are presented in Table 4. Greater minimum separation distances than those specified in Table 4 may be necessary based on site-specific conditions.

Additional siting considerations are required for certain operating conditions, for example based on the composting method and feedstock types. Further siting requirements related to specific emissions are referenced in Sections 8-9 and 11-16.

Siting considerations outlined in this guideline will be applied during the assessment of applications for new facilities. Existing facilities will not be required to meet minimum separation distance requirements. The department will give consideration to the proximity of receptors when determining appropriate regulatory controls for new and existing premises.

Table 4: Siting standards for composting facilities

Receptor or environmental condition	**Standard**
Sensitive receptors	As detailed in *Guideline: Odour emissions*
Public Drinking Water Source Areas (PDWSA)	Water Quality Protection Note No. 25, *Land use compatibility tables for PDWSAs* indicates that composting facilities are an incompatible land use within Priority 1 and Priority 2 PDWSAs. Composting facilities in Priority 3 PDWSAs may also be an incompatible land use based on the feedstocks, activities and controls proposed by the applicant.
The following specified ecosystems listed in the *Guidance Statement: Environmental Siting*: • Parks and Wildlife-managed lands and waters • Bush Forever: Regional open space or proposed regional open space • Western swamp tortoise habitat • Rottnest Island Reserves nature reserve • Regional parks • Threatened and priority ecological communities	Composting facilities should not be within these specified ecosystems.
The following specified ecosystems listed in the *Guidance Statement: Environmental Siting*: • Peel Harvey Environmental Protection Policy • State Environment Policy Cockburn Sound Policy • Waterways Conservation Areas	Composting facilities sited within these specified ecosystems may require controls in addition to the minimum standards in this guideline and will need to demonstrate compliance with the relevant policy objectives and/or requirements.
The following wetlands which are listed as specified ecosystems in the *Guidance Statement: Environmental Siting:* • Ramsar sites • Important wetlands • South Coast Significant Wetlands • Geomorphic Wetlands (Conservation and Resource Enhancement categories)	Composting facilities should be at least 1000 m from a wetland of this type which is down hydraulic gradient of the premises.

Receptor or environmental condition	Standard
Surface water	Composting facilities should be at least 500 m from watercourses (see Glossary) or wetlands (see Glossary) which are down hydraulic gradient of the premises.
Groundwater	A minimum vertical separation distance of 3 m should be maintained between the base of any containment infrastructure and the maximum regional groundwater level (excluding seasonal perched aquifers).
Estuaries	Composting facilities should be at least 500 m from the high water mark of estuaries, which in relation to tidal waters means ordinary high water mark at spring tides.
Private water supply bore	Composting facilities should be at least 100 m and preferably down hydraulic gradient from these bores.
1 in 100 (1%) Annual exceedance probability (AEP) flood fringe	Composting facilities should not be within this area.

11. Fires

11.1 Objective

Environmental performance objective: Minimise the risk of fires occurring at the facility and be sufficiently prepared in the event of a fire.

Fire is not an emission itself but gives rise to emissions and has the potential to damage containment infrastructure, thereby leading to further emissions. Adverse impacts from fires can be mitigated by preventing fires through appropriate operational and management controls. Implementation of appropriate fire response procedures and firefighting equipment are also important controls to reduce the impact of any fires which do occur.

Emissions from fires include air emissions (particulates and noxious gases), odour and contaminated water (from contact with feedstock, products and other materials around the premises as well as firefighting waters).

Fires can cause impacts to air, water and land quality, including destruction of native vegetation, fauna and property. Fire events can also cause amenity impacts and severe consequences to human health.

11.2 Typical sources

The main activities at composting facilities which contribute to potential fire risk are:

- storage of combustible materials which may include feedstocks, materials undergoing composting, residual physical contaminants and finished compost product
- generation and storage of flammable biogas during anaerobic processes.

The main ignition sources of fires at composting facilities include:

- spontaneous combustion of windrows and stockpiles due to elevated internal temperatures
- contaminants in feedstocks such as lithium batteries
- arson and vandalism
- equipment and machinery such as conveyors and shredders
- acts of nature such as bushfires and lightning.

11.3 Minimum standards

The following minimum standards are required to meet the environmental performance objective for fire.

11.3.1 Planning

- Preparation and submission of a Fire and Emergency Management Plan (FEMP) which as a minimum includes:
  - assessment of fire safety risk including identification of areas where a fire might occur and conditions which might lead to a fire
  - fire prevention measures. This should include the range of infrastructure/equipment, process and management controls used to reduce the risk of fires at the premises. Examples include the windrow/stockpile turning schedule which will be implemented to prevent overheating and security measures which will be used to mitigate the risk of arson
  - fire control and response measures. This should include the range of infrastructure/equipment, process and management measures. Examples include firefighting equipment, water supply planning and personnel responsibilities and procedures
- The premises layout must be designed to allow firefighting trucks to enter and access all areas of the premises.

11.3.2 Infrastructure and equipment

- Appropriate firefighting equipment and water supplies, as specified in the FEMP, must be maintained on the premises.
- Machinery present onsite capable of breaking apart, separating and dividing stockpiles/windrows to arrest the spread of fire.
- Sufficient cleared area onsite to enable stockpiles/windrows to be relocated and broken apart during a fire.

- Outdoor stockpiles/windrows of combustible materials must be managed to achieve:
  - maximum dimensions of 50 m long, 10 m wide and 5 m high
  - individual stockpiles/windrows must be separated with at least 6 m of clear ground or a physical barrier constructed of non-combustible materials (i.e. masonry walls)
  - stockpiles/windrows must be separated from the premises boundary by at least 6 m of clear ground or a physical barrier constructed of non-combustible materials (i.e. masonry walls).
- Indoor stockpiles/windrows of combustible materials must be maintained at a size appropriate to the building size and layout, compartmentation, installed safety systems, process equipment and plant.
- Physical barriers between indoor and outdoor stockpiles must extend at least 1 m above the stockpile height and 2 m beyond the outermost stockpile edge.
- Warning devices/alarms or pressure-detection systems must be installed and maintained on critical process infrastructure such as anaerobic digestion tanks.
- The premises is secured by a fence at least 1.8 m high made of non-combustible materials and gates which are locked when the premises is unattended.

11.3.3 Process and management

- Combustible solid materials must be stored away from:
  - powerlines and other ignition sources
  - fuels and flammable solvents used for operational purposes
  - flammable or combustible liquid waste feedstocks.
- Regular monitoring of moisture content and temperature within composting windrows must be undertaken to ensure moisture content is maintained between 40 and 65 per cent and temperature does not exceed 70ºC.
- Moisture content must be maintained at 25 per cent or higher in stockpiles of feedstock and finished compost product.
- Stored combustible materials must be inspected regularly to identify any smouldering areas or smoke, especially during extreme weather conditions and total fire bans.
- Mandatory notification and reporting of fire events to the department.

12. Land and Water

12.1 Objective

Environmental performance objectives: Prevent adverse impacts to the environmental values of terrestrial ecosystems and beneficial uses of soil.
Prevent adverse impacts to the environmental values and beneficial uses of marine, groundwater and surface water.

The term leachate in this guideline refers to liquid that been generated by the decomposition of waste material and stormwater that has interacted with feedstocks, composting material or final compost products. This section also addresses risks to soil, groundwater and surface water from liquid wastes as the containment and control requirements for these feedstocks are generally consistent with those for leachate.

Leachate emissions from compositing facilities have the potential to contain nutrients, metals, salts and other soluble or suspended components and decomposition products of the waste. Leachate also generally has a high biochemical oxygen demand. Higher-risk feedstocks (e.g. biosolids and liquid wastes) have the potential to contribute additional contaminants to leachate such as pathogens, hydrocarbons, pesticides, per- and poly-fluoroalkyl substances (PFAS) and volatile organic acids (VOCs).

Without effective containment measures, composting leachate and liquid wastes have the potential to infiltrate to soil and groundwater or flow into surface water bodies. This may lead to adverse environmental impacts or affect the beneficial use of these resources. Beneficial use means a use of the environment, or of any portion thereof, which is conducive to public benefit, public amenity, public safety, public health or aesthetic enjoyment and which requires protection.

12.2 Typical sources

The department considers the key sources of leachate generation at composting facilities to be:

- decomposition and breakdown of waste during:
  - feedstock acceptance, decontamination, handling and storage
  - feedstock processing (grinding and screening)
  - composting in windrows or in-vessel systems.
- addition of water, leachate and liquid wastes, if not managed appropriately, may generate leachate during:
  - feedstock acceptance, handling and storage
  - composting in windrows or in-vessel systems.

- interaction between rainwater/stormwater and waste may contribute to leachate generation during:
  - feedstock acceptance, handling and storage
  - composting in windrows or in-vessel systems
  - storage of final products.

Leachate generated through the mechanisms above has the potential to be released as an emission via pathways, which are:

- seepage and infiltration of leachate when feedstocks, compost materials and finished products are stored on non-hardstand surfaces
- seepage and infiltration of leachate through hardstand surfaces (i.e. in processing and storage areas). This may be because of the hardstand permeability not being low enough or the hardstand becoming compromised because cracks or holes
- leachate and liquid waste may infiltrate from storage ponds where the permeability of the liner of the pond base is not low enough, the liner integrity has been compromised, no liner is present or the pond has been inadequately constructed to contain the leachate
- leachate and liquid waste may be released from storage ponds or tanks because of overtopping during a storm event, wave action, when excess water (i.e. leachate, process water, bore water, runoff) enters a pond or tank, or because of damage to or failure of the containment infrastructure
- inappropriate use of leachate or liquid waste (e.g. for dust suppression on roads) can cause leachate and liquid waste to be spread outside of the containment systems on the premises
- spills of liquid waste or leachate.

12.3 Minimum standards

The following minimum standards are required to meet the environmental performance objective for leachate.

12.3.1 Infrastructure

12.3.1.1 Overall design

- The premises must be designed and constructed to separate uncontaminated stormwater from the area defined by the leachate containment system. This may be achieved through the use of surface-grade changes, bunds, interceptor drains, piping and other drainage systems.
- Stormwater which has come into contact with feedstock, materials undergoing composting, final compost product or residual physical contaminants must be collected in the leachate containment system.

- Design and construction of the leachate containment system must be informed by a quantitative water balance which accounts for leachate inputs and outputs and stormwater. The water balance must be designed to account for monthly inputs and outputs to demonstrate that the system will be able to operate in a satisfactory manner throughout the year. Cumulative leachate storage over multiple years of operation (at least two consecutive years) should also be factored in. Aspects to consider in the preparation of water balances are provided in Table 5. An example water balance conceptual diagram and calculation is presented in Appendix C.

Table 5: Leachate containment infrastructure water balance considerations

	Process	**Description**	**Relevant considerations/variables**
Inputs	Composting	Leachate generated during composting. This includes liquids generated during the decomposition of waste or from the addition of liquids to the composting process (i.e. water, re-use leachate and liquid waste feedstocks).	• Feedstock – moisture content on receipt and expected leachate generation potential. • Process conditions – expected rate of liquid addition (re-use leachate, potable water, liquid waste etc) during composting and type of composting method (e.g. covered/uncovered, enclosed/outdoors).
	Precipitation	Leachate generated from rainwater/ stormwater entering the leachate containment system (i.e. direct rainfall or runoff into ponds and onto hardstand surfaces).	• Surface area of leachate containment system (i.e. hardstand surfaces and open ponds/tanks). • Local rainfall rates sourced from the Bureau of Meteorology (BOM) or Scientific Information for Land Owners (SILO) database for specified scenarios as follows: o 90th percentile wet year (see Glossary): Monthly rainfall rates based on either a 90th percentile wet year or adjusted 90th percentile monthly rainfall data. o Storm event: 1 in 20 (5 per cent) annual exceedance probability (AEP), 24-hour rainfall event. An appropriate rainfall rate for this event should be determined for the premises location based on the most recent BOM Design Rainfall Data System.

	Process	Description	Relevant considerations/variables
			Amount of rainfall from hardstand areas converted into runoff. A runoff coefficient (see Glossary) of 1 provides a conservative approach to water balance calculations. Applicants using a runoff coefficient less than 1 should provide justification for the proposed value.

	Process	Description	Relevant considerations/variables
Outputs	Extraction	Leachate extracted from ponds for application in the composting process.	• Expected rate of leachate extraction for re-use.
	Evaporation	Evaporative loss from storage ponds.	• Surface area of ponds. • Local pan evaporation rates as sourced from BOM or SILO. • Pan factor (see *Glossary)*, calculated on a site-specific basis or using a default value of 0.7.

12.3.1.2 Hardstand surfaces

- Hardstand surfaces used for the receipt, storage and processing of feedstocks, materials undergoing composting, products and residual physical contaminants must be:
  - designed and constructed to support, without sustained damage, the load of the material on it and any machinery to be used on the surface
  - designed and constructed to prevent pooling of leachate and provide sufficient fall towards the leachate storage infrastructure. The department recommends that a grading of 2-4 per cent is used to achieve this outcome
  - bunded by low-permeability materials such as compacted clay, asphalt or concrete which are constructed in a manner which prevents leachate runoff from the hardstand surface and stormwater from entering the hardstand surface. The interface between bunds and hardstand materials must be effectively sealed to prevent leakage
  - constructed of low-permeability material such as compacted clay, asphalt or concrete to provide a leachate barrier which minimises infiltration of leachate to soil, surface water and groundwater. Acceptable leachate barrier designs are presented in Table 6.

12.3.1.3 Storage infrastructure (ponds and tanks)

- Leachate must be collected and stored in a pond or an above-ground tank.
- Liquid waste which requires storage before mixing with other feedstocks must be stored in a pond or an above-ground tank.
- Above-ground storage tanks for leachate or liquid waste must be surrounded by a bund with capacity of 110 per cent or greater than that of the tanks within the bund. Any pipe connections associated with the tank should checked on a regular basis.
- Leachate storage infrastructure must have a sufficient capacity to:

– contain the runoff from the leachate containment system which would result from a 1 in 20 (5 per cent) AEP, 24-hour rainfall event[1]

– be maintained with a minimum top of embankment freeboard of 500 mm during operation.

The department may specify alternative leachate storage capacity specifications to those above for premises in high rainfall regions. This will be considered on a case-by-case basis and the department's assessment will take into account the risks associated with feedstocks processed at the premises and the proximity to relevant receptors.

- Leachate ponds must be designed and constructed to provide a leachate liner which minimises infiltration of leachate to soil, surface water and groundwater. Acceptable leachate liner designs are presented in Table 7.
- Leachate ponds or tanks have monitoring equipment installed (e.g. high-level alarms) or the licence holder must implement management practices to ensure that they cannot be overfilled.

12.3.1.4 Drainage infrastructure (pipes and drains)

- Drainage infrastructure must be designed and constructed to provide a leachate liner which minimises infiltration of leachate to soil, surface water and groundwater. Acceptable leachate liner designs are presented in Table 7. Concrete pipework is also an acceptable form of drainage infrastructure.
- Drainage infrastructure must be designed and constructed to convey the runoff from the leachate containment system which would result from a 1 in 20 (5 per cent) AEP, 24-hour rainfall event.

[1] The rainfall rate for a 5 per cent AEP, 24-hour rainfall event should be determined for the premises location based on the most recent BOM Design Rainfall Data System (see Glossary).

Table 6: Minimum design standards for hardstand surfaces

Leachate barrier type	**Barrier specifications**	**Protective layer**
Clay	Clay or modified soil installed: • at least 300 mm thick with a permeability of $1x10^{-9}$ m/s or less and minimum compaction of 95 per cent, or • at least 600 mm thick with a permeability of $1x10^{-8}$ m/s or less and minimum compaction of 95 per cent. Such clay liners are installed in successive layers up to 300 mm uncompacted thickness. Each underlying layer is scoured to prevent excessive permeability because of lamination. Permeability and compaction requirements are to be demonstrated by geotechnical testing conducted by a suitably qualified person (see Glossary*)* and in accordance with Australian Standard 1289 Methods of testing soils for engineering purposes series (AS 1289).	Suitable protective layer at least 150 mm thick overlying the leachate barrier to prevent damage and desiccation.
Natural geological barrier	A natural geological barrier that is proven to provide a secure barrier equivalent to the clay or modified soil liner described above. This type of leachate barrier is to be supported by geotechnical investigations conducted by a suitably qualified person (see Glossary*)*. Permeability and compaction requirements are to be demonstrated by geotechnical testing undertaken in accordance with AS 1289.	
Concrete or asphalt	A concrete or asphalt cement pad of a thickness of at least 100 mm with a permeability of $1x10^{-9}$ m/s or less.	Not required

Table 7: Minimum standards for leachate liners in ponds or drainage infrastructure

Leachate liner type	Specifications
Compacted clay	Clay or modified soil installed to be at least 600 mm thick with a permeability of $1x10^{-9}$ m/s or less and minimum compaction of 95 per cent. Such clay liners are installed in successive layers up to 300 mm uncompacted thickness. Each underlying layer is scoured to prevent excessive permeability because of lamination. Permeability and compaction requirements are to be demonstrated by geotechnical testing conducted by a suitably qualified person (see Glossary) and in accordance with AS 1289.
Geosynthetic clay liner	At least 7 mm thick with a permeability of $1x10^{-9}$ m/s or less
High-density polyethylene (HDPE) geomembrane	At least 1 mm thick. An appropriate HDPE specification (i.e. thickness, permeability) must be determined by a suitably qualified person (see Glossary) based on the leachate characteristics, meteorological conditions and warranty considerations.

12.3.2 Process

- Moisture content of windrows must be maintained below 65 per cent to reduce the potential for oversaturation and leachate generation.
- Direct application of liquids onto windrows including leachate, liquid waste feedstocks and water must be managed appropriately (i.e. with spraying, mixing and suitable liquid-to-solid ratios) to avoid excessive leachate generation.
- A minimum freeboard of 500 mm is maintained on all leachate ponds to prevent overtopping.

12.3.3 Management

- The leachate containment system must be monitored in accordance with the following requirements:
  - Regular inspections of the entire leachate containment system including but not limited to hardstand surfaces, bunding, drains, ponds and tanks must be undertaken.
  - Regular integrity testing of infrastructure used for the storage of high-risk feedstocks (i.e. hardstand surfaces, bunding, ponds) must be undertaken.
- Where inspections and integrity testing identify damage or deterioration which may affect containment performance, it must be investigated and repaired as soon as practicable.

- Leachate may be re-used by addition to the composting process but is not to be re-used for dust-suppression purposes outside of the leachate-containment system.
- Groundwater monitoring of at least three monitoring bores, comprising one up-gradient and two down-gradient bores, is undertaken at the premises. The monitoring network should be designed to detect groundwater contamination associated with key containment infrastructure, such as hardstands and ponds. Large, complex or higher-risk premises may require a more extensive monitoring bore network.
- Groundwater is monitored at least every six months while the premises is operational for potential contaminants associated with the feedstocks received and processed at the premises. Applicants may propose a sampling frequency and parameter suite. The department will consider this information as part of its assessment process and determine an appropriate monitoring program for the premises.
- Groundwater monitoring results are reported to the department at least annually. Reports must include an interpretive summary and assessment of data including:
  - comparison to specific consequence criteria (see Glossary*),* selected based on the environmental and sensitive receptors within the vicinity of the premises
  - comparison to previous results and identification of any trends
  - identification and discussion of differences in groundwater quality between up-gradient and down-gradient monitoring bores which may be caused by activities on the premises.

13. Litter and debris

13.1 Objective

Environmental performance objective: Maintain environmental values and human health by preventing the discharge of litter and debris beyond the premises boundary.

Litter and debris have the potential to impact on the visual amenity of the environment as well as potentially causing impacts to air, land and water quality, and pose risks to the health and welfare of native fauna and human receptors. Litter prevention is regulated under the *Litter Act 1979*, while preventing harm to the environment or human health from litter and debris is considered under the EP Act.

13.2 Typical sources

The department considers that litter and debris emissions may arise from the following sources of waste becoming windblown or moved by animals:

- Contamination in feedstocks, for example from FOGO feedstocks which commonly contain contamination such as food packaging and household waste. Contaminants may be present on-site mixed in with feedstock materials or in separate stockpiles of residual physical contaminants which have been screened out of feedstocks.
- Food wastes in FOGO feedstocks.
- Packaging of feedstocks and products.
- Open waste bins.

13.3 Minimum standards

The following minimum standards are required to meet the environmental performance objective.

13.3.1 Infrastructure and equipment

- Fencing suitable to contain windblown litter must be erected on the premises boundary or surrounding operational areas where waste is accepted, stored and processed.
- All truckloads transporting feedstock, un-bagged finished compost product and residual physical contaminants into or out of the premises must be covered.
- General waste bins on-site must be kept covered at all times.

13.3.2 Process and management

- At least weekly inspections of the fence line must be conducted to collect and dispose of any accumulated litter.
- Residual physical contaminants must be frequently removed from the composting area for on-site or off-site disposal as appropriate based on the prescribed activities licensed at the premises.
- Feedstock storage and composting areas must be regularly cleaned and maintained with good housekeeping practices.

14. Noise

14.1 Objective

Environmental performance objective: Maintain compliance with the assigned levels specified in the Environmental Protection (Noise) Regulations 1997 (Noise Regulations) to protect surrounding environmental values, human health and social surroundings from unreasonable emissions of noise.

The Noise Regulations operate as a prescribed standard under the EP Act and set limits on noise emissions. They deal with noise emitted on a premises or public space and received on another premises.

The assigned levels in the Noise Regulations take into consideration different variables which affect noise sensitivity, including:

- types of receptors present surrounding the premises, for example noise-sensitive, commercial and industrial and utility premises
- times of day and days of the week
- specified policy areas, for example the Kwinana Policy Area
- influencing factors which account for background noise levels from surrounding land uses and transport. Influencing factors are only relevant to highly sensitive areas on noise-sensitive premises.

Further guidance on noise emissions is provided in the department's *Guideline: Assessment of Environmental Noise* (see Related documents).

14.2 Typical sources

The department considers the key sources of noise emissions at composting premises to be:

- vehicle movements during general site operations, deliveries and removal of products and waste materials off-site. Vehicle noise includes that from engines and reversing alarms
- feedstock processing and associated plant including grinders, shredders and screeners
- formation of windrows and associated plant including turners and front-end loaders
- power generators and turbines
- air and odour extraction systems
- bagging plants.

14.3 Minimum standards

The following minimum standards are required to meet the environmental performance objective for noise.

14.3.1 Infrastructure and equipment

- Mufflers and low-tonal reversing beepers (croakers) must be installed on all vehicles and machinery.
- Noise-generating equipment is operated within enclosed buildings where practicable. If this cannot be achieved, equipment should be positioned in a part of the premises where its impact to receptors is minimised. This includes siting in a location furthest away from sensitive receptors and using topographical features or buildings to achieve shielding.

- Installation of noise bunds/screens around the premises or around specific noise-generating equipment where required, for example where the premises is sited close to sensitive receptors.

14.3.2 Management

- Noise-mitigating equipment and machinery is kept in good working order.
- Hours of operation are limited to daytime (7am to 7pm, Monday to Saturday) when noises are afforded a higher assigned level under the Noise Regulations. Where it is not feasible to restrict whole-of-premises operating hours, higher noise-generating sources (e.g. screening and shredding) may be limited to daytime hours.
- Where there are multiple sources of noise-generating activities occurring on-site, consideration should be given to staggering operations of higher noise-generating emissions so that only one of these activities occurs at any one time, reducing the potential impacts from cumulative emissions.

15. Odour

15.1 Objective

Environmental performance objective: Maintain air quality and manage on-site operations to protect surrounding environmental values, human health and social surroundings from unreasonable emissions of odour.

Odour emissions can cause impacts to the health and amenity of human receptors. Individual responses to odour may vary depending on a person's sensitivity to odours, age, health status and previous exposure patterns to odour.

Further guidance on odour emissions is provided in the department's *Guideline: Odour Emissions* (see Related documents).

15.2 Typical source

Odour emissions do not typically occur during the construction phase of a facility.

Odour emissions may occur during the environmental commissioning phase if the acceptance of feedstocks has been authorised. The greatest likelihood of odour emission generation occurs during the operational phase.

The department has identified the key sources of odour emissions during the environmental commissioning and operational phases at a composting facility to be as follows:

- Feedstock acceptance and handling. Different types of feedstocks pose varying risks regarding odour emissions. The risk categories of the different feedstock types are presented in Section 17.2. Some feedstocks such as

FOGO may be very odorous at acceptance because of anaerobic conditions in bins/trucks before collection and during transport.

- Storage of feedstock and product. Some feedstock types have the potential to generate odour emissions if stored inappropriately or for extended periods before composting. For example, food wastes such as fruit and vegetables may not initially generate an unreasonable odour; however, the longer they are stored on-site before being composted, the more likely it is that degradation and putrefaction of the feedstock will occur which may result in the generation of unreasonable odours.
- Odour-treatment systems (e.g. biofilters) treating odorous air extracted from receipt and decontamination halls.
- Compost windrows. If not appropriately managed (i.e. through turning or forced aeration), windrows may become anaerobic causing an increase in the generation of offensive odours. Windrows may also become anaerobic from over-wetting or the addition of excessive liquid waste.
- In-vessel aerobic composting or anaerobic digestion. Closed-loop systems are generally able to contain most odour emissions. Feeding and emptying systems can result in emissions of odours.
- Leachate containment system including hardstands, drains, tanks and ponds. Nutrient-rich leachate has the potential to generate odours, particularly when the leachate water has become anaerobic. Leachate from the early composting phase presents the highest risk of odour generation.
- Bagging plants where manures, composts or other odorous materials are packaged can generate odours if not appropriately managed.
- Digestate produced at anaerobic digestion plants is a highly odorous material and can generate odour if used on a premises.
- Uncovered storage of residual physical contamination.
- Leachate pond desludging.

15.3 Minimum standards

The following minimum standards are required to meet the environmental performance objective for odour.

15.3.1 Infrastructure and equipment

- Composting (excluding maturation) of high-risk feedstocks (as specified in Section 17.2) within 1 km of sensitive receptors must be undertaken in an enclosed structure.
- Storage and pre-composting screening/picking of high-risk feedstocks within 1 km of sensitive receptors must be undertaken in an enclosed structure.
- Enclosed structures in which composting activities are undertaken must be:

  - fitted with air-extraction systems which capture odorous air and direct it to an odour-treatment system. Odour-treatment systems are designed and selected based on the specific feedstocks and processes at the premises, with the rationale for selection included in the supporting information to the application
  - operated under negative pressure at all times
  - fitted with fast-action doors which minimise the release of fugitive odour emissions from the enclosed area. Operational procedures should minimise door-open periods.
- Leachate ponds must be effectively managed to maintain aerobic conditions to avoid the generation of offensive odours. Achieving this outcome will require measures to manage the aeration, sediment load and biochemical oxygen demand of leachate ponds. These measures may include:
  - special management of leachate from the early composting phase which has a high biochemical oxygen demand. If early phase leachate is not appropriately diluted with water from other sources it may lead to leachate ponds becoming anaerobic
  - screening of stormwater and leachate entering leachate ponds to prevent the build of sediments or sludge within the ponds
  - deployment of aeration devices within leachate ponds.
- Leachate hardstand surfaces must be designed, constructed and maintained to prevent pooling of leachate. Pooling increases the surface area from which odours can be generated and may also generate anaerobic conditions and provide an additional source of odour.
- Outdoor odour-generating infrastructure (e.g. stockpiles, windrows and leachate ponds) are positioned in a part of the premises where their impact to sensitive receptors is minimised. This includes siting in a location furthest away and downwind (based on the prevailing wind direction) from sensitive receptors, and using topographical features or buildings to achieve shielding from the wind.
- Anaerobic digestion plants must be designed, operated and maintained to contain, extract and combust all biogas in a generator or flare.

15.3.2 Process

- High-risk feedstocks (as specified in Section 17.2) must be added to the composting process on the same day they are received at the premises.
- Materials undergoing aerobic composting must be maintained in an aerobic state through implementation of the following controls:
  - Stockpiles or windrows are regularly turned or otherwise aerated (such as forced aeration).
  - Moisture content of compost windrows is maintained between 40 and 65 per cent during the pasteurisation phase to achieve optimal composting conditions and prevent material becoming saturated and anaerobic.

  - Carbon dioxide and/or oxygen content are monitored to inform management practices and maintain aerobic conditions. Optimal aerobic composting conditions occur at an oxygen content of 10 per cent or higher.

- Addition of feedstocks to the composting process is designed to achieve a nutrient-input balance (carbon to nitrogen ratio) of 25:1 to 35:1.

15.3.3 Management

- Wind direction and strength are observed and high odour-generating activities, such as windrow turning and bagging of manures, must be suspended or reduced on-site when winds are in the direction of sensitive receptors.
- Odour-treatment systems must be tested, maintained and serviced in accordance with manufacturer requirements.
- A complaints-management system must be implemented to ensure complaints are recorded and acted on promptly.

16. Vectors

16.1 Objective

Environmental performance objective: Prevent the attraction, refuge, growth and spread of vermin and pests to mitigate impacts to environmental values, human health and social surroundings.

Vermin, pests and disease vectors can affect health and amenity in surrounding communities and disrupt surrounding ecological communities.

16.2 Typical sources

The department considers the key sources of vectors to be:

- storage of feedstocks, products and residual physical contaminants, particularly putrescible materials
- ponds, drainage channels and sumps (mosquitoes)
- pooling and ponding of leachate in composting process areas (mosquitoes).

16.3 Minimum standards

The following minimum standards are required to meet the environmental performance objective for vectors.

- Feedstocks must be regularly turned and mixed during storage before addition to the composting process.
- Feedstock storage and composting areas, stormwater and leachate infrastructure must be regularly cleaned and maintained with good housekeeping practices.

- Residual physical contaminants must be frequently removed from the composting area for on-site or off-site disposal as appropriate based on the prescribed activities licensed at the premises.
- Measures must be implemented to prevent pooling and stagnation of water (e.g. deployment of aerators in ponds and grading of surfaces to achieve effective drainage).

17. Feedstocks

17.1 Objective

Environmental performance objective: Composting is undertaken using feedstocks that will produce a fit-for-purpose compost product that can be used without presenting an unacceptable risk to environmental values, water resources and human health.

Different feedstocks pose different risks in terms of emissions (leachate and odour), environmental harm (disease and vectors) and compost product contamination. The department will apply regulatory controls in proportion to the level of risk posed by the type of compost feedstock. Stricter regulatory controls will be applied to premises accepting higher-risk feedstocks.

17.2 Typical feedstocks

Table 8 below identifies typical feedstocks and the risks associated with them. The risk category is determined based on the expected consequence and likelihood of emissions arising from each feedstock, with particular focus on odour and leachate emissions. The potential for feedstocks to contaminate compost products with physical, chemical or biological contaminants is also considered.

Table 8: Feedstock risk categories

Risk	Waste types	Examples
Low	Green waste derived from controlled collections and landscaping sources	Grass, leaves, plants, branches, tree trunks and stumps. This category is applicable to green waste streams with very low levels of contamination.
	Untreated timber	Sawdust, shavings, timber offcuts, crates, pallets and wood packaging.
	Natural fibrous organics	Peat, seed hulls/husks, straw, bagasse and other natural organic fibrous organics.
	Processed fibrous organics	Paper, cardboard, paper-processing sludge and non-synthetic textiles.

Risk	Waste types	Examples
	Neutralised acid sulfate soils	Acid sulfate soils which have undergone neutralisation in accordance with the department's *Identification and investigation of acid sulfate soils and acidic landscapes* (2015) and *Treatment and management of soil and water in acid sulfate soil landscapes* (2015). This waste type is only considered low risk if it is sourced from a non-contaminated site.
Moderate	Municipal source-separated kerbside garden waste	Grass, leaves, plants, branches, tree trunks and stumps. This category is applicable to green waste streams which are uncontrolled and expected to contain contamination, such as garden organics only green-top bins.
	Aged manure	Aged manure that has a dry matter greater than 35 per cent.
	Other natural or processed vegetable organics	Vegetables, fruits and seeds and processing wastes, solid winery, brewery and distillery wastes.
High	Grease interceptor trap wastes	Grease trap waste.
	Treated septage	Waste from septic tanks which has undergone treatment to a level to significantly reduce pathogens and microorganisms.
	Biosolids (see Glossary)	Sewage sludge from a wastewater treatment plant which has undergone further treatment to significantly reduce disease-causing pathogens and volatile organic matter, e.g. by liming or anaerobic digestion and then dewatering.
	Dewatered sewage sludge	Dewatered untreated sewage sludge from a wastewater treatment plant.
	Fresh manures	Fresh animal manure and mixtures of animal manure and animal bedding organics.
	Mixed-source separated kerbside food organics and garden organics (FOGO)	Food, kitchen and garden putrescible wastes disposed from domestic and commercial sources. Grass, leaves, plants, branches, tree trunks and stumps, vegetables, fruit and other food scraps.
	Meat, fish and fatty foods	Animal mortalities, parts of carcasses, bone, fish and fatty processing or food and abattoir waste.
	Contaminated Solid Waste (see Glossary)	Contaminated soil.

Risk	Waste types	Examples
	Liquid wastes	Putrescible and organic wastes including animal effluent and residues (e.g. blood and paunch), liquid grease trap waste, food and beverage processing wastes. Oils including waste mixtures/emulsions of oils and water or hydrocarbons and water, oil interceptor wastes and oil sludges.

17.3 Minimum standards

The following minimum standards are required to meet the environmental performance objective for feedstocks.

All feedstocks must achieve one of the following positive outcomes:

- Add beneficial ingredients to the compost thereby increasing the quality of the final compost product.
- Be effectively bioremediated and/or beneficially treated during composting.

Acceptance of waste in the composting process as a means of disposal through absorption and dilution of contaminants does not achieve a positive outcome.

17.3.1 Liquid wastes

- Characterisation of each liquid waste stream proposed for acceptance is conducted, including:
  - identification of the source and process which produced the liquid waste stream
  - determination of the contaminants and contaminant concentration ranges in the liquid waste stream by laboratory analysis of substances known or reasonably expected to be present in the waste. The minimum analytical suites for some organic liquid waste streams commonly accepted for composting are provided in Appendix B
  - assessment of how and to what extent the liquid waste stream contributes to the biological composting process.
  - for all liquid waste streams which contain contaminants that do not contribute to the biological composting process, identification of:
    i) the contaminants that are treated by the biological composting process and their treatment pathway
    ii) the contaminants that are not treated by the biological composting process.
- Incoming liquid wastes are:
  - regularly sampled and tested on receipt at the premises for all substances (including contaminants) known or reasonably expected to be present in the waste. Laboratory certificates of analysis must be retained in accordance with recordkeeping requirements specified in the licence

  - assessed for conformance against their characterisation.

- Liquid feedstocks which are not suitable for composting and must not be accepted at composting facilities are:
  - waste streams which present a higher risk of PFAS contamination
  - quarantine waste (see Glossary*)*
  - clinical and related waste (see Glossary*)*
  - liquid waste derived from diseased animals containing pathogens which may constitute a health or environmental risk and will not be rendered harmless by the composting process
  - any other waste stream which does not add beneficial ingredients to the compost thereby increasing the quality of the final compost product; and is not effectively bioremediated or treated during the composting process.
- The storage, transport and disposal of liquid wastes are subject to the provisions of the Environmental Protection (Controlled Waste) Regulations 2004 (Controlled Waste Regulations). It is the applicant's responsibility to ensure that all necessary approvals are in place when dealing with liquid wastes. Further information on controlled waste requirements is available on the department's website (see Related documents).
- Premises which accept more than one type of liquid waste feedstock are required to implement appropriate procedures to segregate non-compatible wastes and avoid adverse chemical reactions. This will require technical oversight from a suitably qualified person (see Glossary).

17.3.2 Solid wastes

- Feedstocks which are not suitable for composting and must not be accepted at composting facilities are:
  - wood and wood-derived wastes impregnated with preservatives, pesticides, painted, or with any non-biodegradable layer
  - quarantine waste (see Glossary)
  - waste which includes asbestos and asbestos cement products – Special Waste Type 1 (see Glossary*)*
  - clinical and related waste including those classified as Special Waste Type 2 or Hazardous Waste (see Glossary*)*
  - soils and other solid wastes impacted by PFAS – Special Waste Type 3 (see Glossary*)*
  - other waste streams which present a higher risk of PFAS contamination
  - solid waste derived from diseased animals containing pathogens which may constitute a health or environmental risk and will not be rendered harmless by the composting process

- untreated sewage sludge and biosolids derived from wastewater treatment plants which receive trade waste because of the likely presence of higher-risk contaminants
- any other waste stream which does not add beneficial ingredients to the compost, thereby increasing the quality of the final compost product; and is not effectively bioremediated or treated during the composting process.

18. Product quality

18.1 Objective

Environmental performance objective: Compost products are demonstrated to be fit for their intended purpose without their use presenting unacceptable risks to environmental values, water resources and human health.

Category 67A licence holders are responsible for ensuring all compost products are fit-for-purpose based on the proposed end use.

The minimum standards for compost product quality in this section are based on mitigating environmental and human health risks from compost products. These specifications relate to physical, chemical and biological contamination.

The minimum standards in this section do not address maturation or beneficial qualities of compost products (e.g. nutrient content, carbon content and particle size). Compost producers are responsible for ensuring that the maturity level and beneficial qualities of compost products are suitable for their intended end use. These considerations are outside the scope of the guideline.

18.2 Regulatory context

Existing standards and guidance for the product specifications of compost produced in Western Australia include:

- Standards Australia, *Australian Standard AS 4454-2012: Compost, soil conditioners and mulches* (AS 4454-2012)
- The department's *Western Australian Guidelines for biosolids management* (Biosolids Guidelines).

Composting facilities produce a wide range of compost products for a variety of different end-use purposes. The department acknowledges that compost products may be fit-for-purpose for a specific end use without meeting the specifications in AS 4454-2012 or the Biosolids Guidelines.

If compost produced on a premises has not been pasteurised and does not meet a suitable end-use standard, it may still be considered a waste and additional regulatory controls may apply to its transport, storage and application to land.

Category 67A licence holders are responsible for determining whether their compost product is a waste or not. The department's *Factsheet – Assessing whether material is waste* (see Related documents) sets out key factors that should be considered in this determination. Licence holders who consider that their compost product has

ceased to be waste should satisfy themselves that they have sufficient recorded evidence to document and support this determination.

18.3 Minimum standards

The following minimum standards are required to meet the environmental performance objective for compost products.

18.3.1 Pasteurisation

Pasteurisation is an important part of the active composting phase during which the number of plant and animal pathogens (organisms responsible for diseases) and plant pests and propagules (viable regenerative plant materials or seeds) are significantly reduced.

The following minimum standards are required in relation to pasteurisation:

- Compost facilities must be designed and operated to ensure that the whole mass of the compost product is subject to pasteurisation. Acceptable pasteurisation process criteria are outlined in Table 9.
- Management measures must be implemented to prevent recontamination of pasteurised material. As a minimum, this requires that re-use leachate is not applied to material that has already been pasteurised. Additional controls to prevent recontamination may include separation of feedstock and product-handling equipment, vehicles and areas and washing of machinery between use for untreated feedstock and compost product.

Table 9: Time/temperature ratio for pasteurisation

Process type	**Feedstock risk (Section 17.2)**	**Time/temperature ratio**
Windrow composting	Low	Appropriate turning of outer material to the inside of the windrow so the whole mass is subjected to a minimum of three turns with the internal temperature reaching a minimum of 55ºC for three consecutive days before each turn.
	Moderate to high	The core of the compost mass shall be maintained at 55ºC or higher for 15 days or longer, during which the windrow shall be turned a minimum of five times.
In-vessel composting	All feedstocks	The whole mass should be maintained at 55ºC or higher for a minimum of three consecutive days. (To meet this, the material will need to be in the enclosed vessel for longer to ensure it gets to and maintains temperature.)

18.3.2 Product specification

Composters must demonstrate that compost products do not present an unacceptable risk to the environment and human health when used for their intended purpose. This can be achieved by following one of the two approaches outlined below:

1. Compliance with AS 4454-2012 and Biosolids Guidelines

Licence holders producing compost products which comply with AS 4454-2012 are required to classify their products according to the physical and chemical requirements set out in the standard. The department expects that most compost products produced from low- to moderate-risk feedstocks will meet the physical, chemical and biological contaminant requirements set out in AS 4454-2012.

Compost products which are partially derived from biosolids need to comply with the P1C1 unrestricted use requirements specified in the Biosolids Guidelines.

2. Development and maintenance of a fit-for-purpose assessment report

This approach is required where:

- compost products do not comply with the physical, chemical and/or biological contaminant requirements in AS 4454-2012
- compost products do not comply with the P1C1 unrestricted use requirements in the Biosolids Guidelines, or
- compost products contain chemical contaminants which do not have upper limits specified in Table 3.1(C) of AS 4454-2012. This includes but is not limited to all compost products which are partially derived from liquid wastes.

A fit-for-purpose assessment report is required to include:

- identification of all potential contaminants associated with the feedstocks used to produce the compost product. This step is informed by knowledge of the process that generated the feedstocks and the composting process. Laboratory analysis is required to characterise liquid waste feedstocks (see Section 17.3.1 and Appendix B) and may also be required for other high-risk feedstocks
- a description of the intended end use of the product
- a fit-for-purpose product specification that sets out the maximum concentration limits for all identified potential contaminants which either do not meet or are not specified in AS 4454-2012 or the Biosolids Guidelines
- an assessment of the potential risks to human health and the environment which may arise from the compost product being used (with reference to the product specification). Licence holders should make reference to relevant guidance documents[2] in undertaking this assessment

[2] *Investigation into the impacts of contaminants in mineral fertilisers, fertiliser ingredients and industrial residues and the derivation of guidelines for contaminants* (Sorvari et al., 2009) and the *Environmental risk assessment guidance manual for agricultural and veterinary chemicals* (Environment Protection and Heritage Council, 2009).

- a quality-assurance sampling and testing plan which will be implemented to ensure ongoing compliance with the product specification. This plan is required to address the full range of contaminants known or reasonably expected to be present in the proposed feedstocks. See minimum standards for sampling and testing (Section 18.3.3).

18.3.3 Sampling and testing

Quality sampling and testing are required to provide ongoing assurance that compost products meet the product specification and are fit-for-purpose. The department requires the following minimum standards for sampling and testing:

- Each batch of compost product is sampled and prepared in accordance with the sampling protocol in Appendix D of this guideline. Further guidance on sample size, preservation, transport and preparation for analysis at the laboratory is provided in AS 4454-2012 Appendix A Methods for sampling, sample handling and preparation prior to analysis.
- Compost products are to remain on the premises until the results of sampling and testing have been finalised and reported by the laboratory and the batch is demonstrated to meet the relevant product specification.
- Each sample of compost product is tested by a NATA-accredited laboratory to assess compliance with:
  a) chemical contaminant concentrations in Table 10
  b) physical contaminant concentrations in Table 11
  c) for compost products partially or wholly derived from moderate to high-risk feedstocks, pathogen concentrations in Table 12
  d) for compost products partially or wholly derived from biosolids, maximum pathogen levels for Grade P1 in the Biosolids Guidelines
  e) for compost products with a fit-for-purpose product specification (see Section 18.3.2), the maximum contaminant concentrations in that document.

Table 10: Maximum chemical contaminant concentrations

Contaminant	**Maximum concentration[1] dry weight basis (mg/kg)**	**Contaminant**	**Maximum concentration[1] dry weight basis (mg/kg)**
Arsenic	20	DDT/DDD/DDE	0.5
Cadmium	1	Aldrin	0.02
Boron	100	Dieldrin	0.02
Chromium	100	Chlordane	0.02

Contaminant	Maximum concentration[1] dry weight basis (mg/kg)	Contaminant	Maximum concentration[1] dry weight basis (mg/kg)
Copper	150	Heptachlor	0.02
Lead	150	HCB	0.02
Mercury	1	Lindane	0.02
Nickel	60	BHC	0.02
Selenium	5	PCBs	Not detectable (detection limit of 0.2 mg/kg)
Zinc	300		

Note 1: Appendix D in AS 4454-2012 outlines the method to determine concentrations of chemical contaminants

Table 11: Maximum physical contaminant concentrations

Contaminant	Maximum concentration[1] (% w/w dry matter)
Glass, metal and rigid plastics	0.5
Plastics – light, flexible or film	0.05

Note 1: Appendix I in AS 4454-2012 outlines the method to determine the level of visible contamination

Table 12: Maximum pathogen indicator requirements

Contaminant	Maximum concentration[1] (dry weight equivalent)
Salmonella spp	Absent in 50 g
Faecal coliforms	1000 Most Probable Number (MPN)/g

Note 1: Appendix D in AS 4454-2012 outlines the method to determine pathogen indicators

18.3.4 Record keeping and reporting

Licence holders are required to implement appropriate recordkeeping and reporting to provide evidence that compost products meet the product specification and are fit-for-purpose. The department requires the following minimum standards for recordkeeping and reporting of compost product quality:

- Records must be kept to demonstrate that each batch of compost product has undergone pasteurisation in accordance with the criteria in Section 18.3.1. This includes records of in-field temperature monitoring and time periods for which the pasteurisation temperature was sustained. The department may

request access to pasteurisation records within the scope of annual reporting requirements or during compliance inspections.

- Records must be kept to demonstrate that each batch of compost product complies with the product specification in Section 18.3.2.
- Product specification testing results must be reported to the department at least annually. Reporting is required to include:
  - a tabulated summary of data
  - the range of recorded concentrations for each parameter required to be tested (see Section 18.3.3)
  - comparison of data to the maximum chemical, physical and biological contaminant concentrations specified in Section 18.3.3
  - identification of test results which did not comply with the product specification and description of how the relevant batch of compost product was remediated to achieve compliance or otherwise managed
  - assessments on the status of each product as a waste (see Section 18.2).

19. Record keeping and reporting

Composting facilities should maintain records relating to site activities that are capable of being audited for the purpose of demonstrating compliance with all relevant regulatory controls and legislative requirements.

Each licence outlines the specific record keeping and reporting requirements for a premises. In addition to the record keeping and reporting requirements outlined in Sections 811 to 18 above, general information which will be required for periodic reporting to the department includes:

- monitoring data of incoming feedstocks and outgoing products/wastes. The annual compost production will be required to be reported annually as part of the annual fee process
- summary of complaints including the name and contact details of complainant (if provided), time and date, nature of any concerns or issues raised and the action taken to investigate or respond to the complaint
- environmental incidents such as fires or failure/malfunction of pollution control equipment
- discharges of waste required to be reported to the department under section 72 of the EP Act. This includes discharges which have caused or are likely to cause pollution, material environmental harm or serious environmental harm. Failure to notify the department of these discharges as soon as practicable after they occur is an offence.

20. Additional approvals

An applicant may be required to obtain additional approvals outside the Pt V Division 3 EP Act requirements.

The most common additional approvals associated with composting facilities are:

- clearing approvals under Part V, Division 2 of the EP Act – obtained from the department
- licences to take groundwater under the *Rights in Water and Irrigation Act 1914* – obtained from the department
- controlled waste carrier licences under *the Environmental Protection (Controlled Waste) Regulations 2004* – obtained from the department
- development and planning approvals from the relevant Local Government Authority
- approvals from the Department of Health, particularly regarding the use of biosolids and other sewage treatment-derived wastes
- approvals from the Department of Primary Industries and Regional Development.

Any approvals granted under Pt V Division 3 of the EP Act do not limit legal obligations under any other legislation. It is the responsibility of the applicant/licence holder to ensure that all applicable approvals are valid and that all relevant legislative requirements are complied with.

Document implementation

This guideline comes into effect on the day it is published. Applications received after publication will be assessed in accordance with the information contained herein.

This guideline will be implemented as detailed in Section 6 Implementation and Appendix A Implementation additional information.

Related documents

Department documents/tools	
Application form for works approvals, licences and amendments	*Application form*
Department Regulatory Framework	*Guideline: Industry Regulation Guide to Licensing*
	Guideline: Air Emissions
	Guideline: Dust Emissions
	Guideline: Assessment of Environmental Noise
	Guideline: Odour Emissions
	Guidance Statement: Environmental Siting
	Guidance Statement: Environment Standards
	Guidance Statement: Decision Making
	Guidance Statement: Risk Assessments
	Guidance Statement: Setting Conditions
Other publications	*A guideline for managing the impacts of dust and associated contaminants from land development sites remediation and other related activities*
	Air Quality and Air Pollution Modelling Guidance Notes
	Assessing whether material is waste
	Assessment and management of contaminated sites
	Controlled Waste
	Identification and investigation of acid sulfate soils and acidic landscapes
	Landfill Waste Classification and Waste Definitions 1996
	Treatment and management of soil and water in acid sulfate soil landscapes
	Water quality protection note no. 25: Land use compatibility tables for public drinking water source areas
Databases/tools	*Contaminated Sites*
	Floodplain Mapping Tool
	Perth Groundwater Map
	Water Information Reporting
	Water Register

Legislation
Contaminated Sites Act 2003
Environmental Protection Act 1986
Environmental Protection Regulation 1987
Environmental Protection (Controlled Waste) Regulations 2004
Country Areas Water Supply Act 1947
Environmental Protection (Kwinana) (Atmospheric Wastes) Policy 1999
Environmental Protection (Noise Regulations) 1997
Environmental Protection (Unauthorised Discharges) Regulations 2004
Freedom of Information Act 1992
Litter Act 1979
Metropolitan Water Supply, Sewerage, and Drainage Act 1909
Rights in Water and Irrigation Act 1914
Waste Avoidance and Resource Recovery Act 2007

Non-department documents	
Author	Title
Bureau of Meteorology	*Climate Data Online*
National Environment Protection Council	*National Environment Protection (Ambient Air Quality) Measure*
	National Environment Protection (Assessment of Site Contamination) Measure
Queensland Government	*SILO Database*
Waste Authority	*Waste Avoidance and Resource Recovery Strategy 2030*

Custodian and review

The currency of this document will be continuously evaluated, and reviewed no later than three years from the date of issue or sooner as required.

Document details	
Lead group (custodian)	Regulatory Services (Environment) Industry Regulation (Waste Industries)
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Appendices

Appendix A: Implementation additional information

New facilities

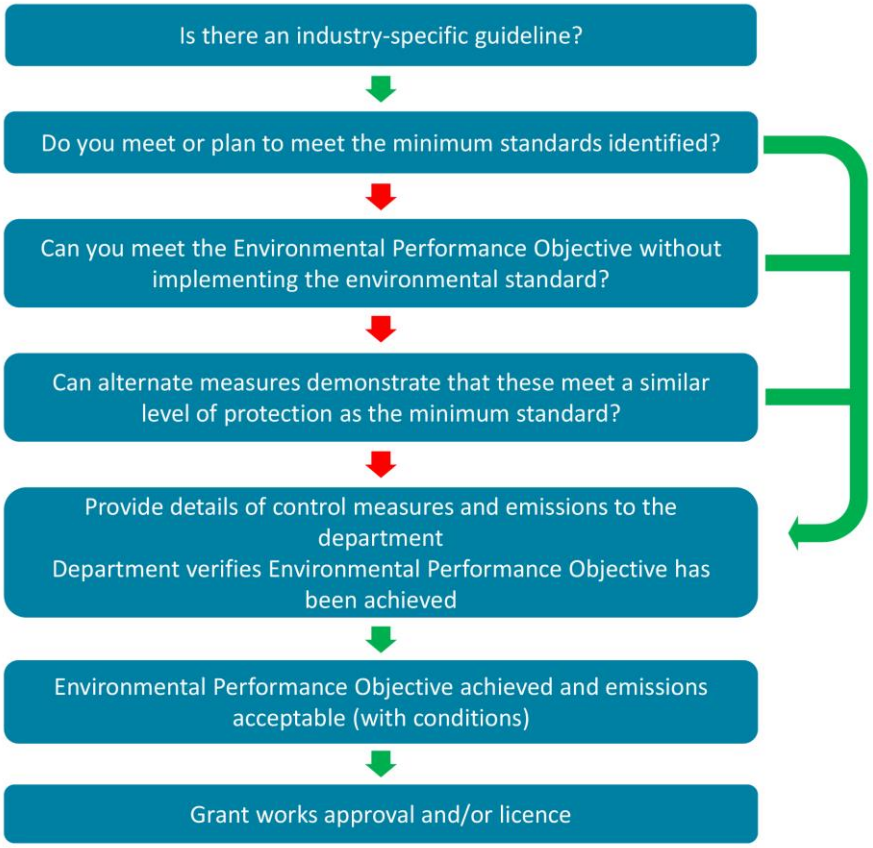
All applications for new facilities will be assessed using this guideline. Applications should implement the self-assessment process set out in Section 6 of this guideline. The department will use this information to undertake a risk assessment to validate that the relevant environmental performance objectives will be achieved.

Where an applicant does not intend to implement all relevant minimum standards relating to an environmental performance objective, they must either:

1. detail the alternative measures that will be implemented and demonstrate that these are sufficient to achieve the environmental performance objective, or
2. demonstrate that the minimum standards are not required to achieve the relevant environmental performance objective.

Figure A.1 illustrates the implementation process for industry-specific guidelines for new facilities.

Figure A.1 Implementation process for the guideline at new facilities.



Existing facilities

Occupiers of existing facilities will be required to assess their facilities against the environmental performance objectives and minimum standards contained in the guideline and submit their assessment to the department by a specified date. The requirement for this review will generally be imposed through a department-initiated amendment to existing licences.

Similar to the process for new premises, licence holders will be required to implement the self-assessment process set out in Section 6 of this guideline.

Once the submission is received, the department will use the information to undertake a risk assessment to validate that the relevant environmental performance objectives are being achieved.

Where licence holders identify that their facility does not meet the minimum standards for any environmental performance objective, their submission to the department will be required to either:

1. identify what upgrades and improvements will be undertaken on the premises to achieve the minimum standards
2. detail the alternative measures that are or will be implemented and demonstrate that these are sufficient to achieve the environmental performance objective, or
3. demonstrate that the minimum standards are not required to achieve the relevant environmental performance objective.

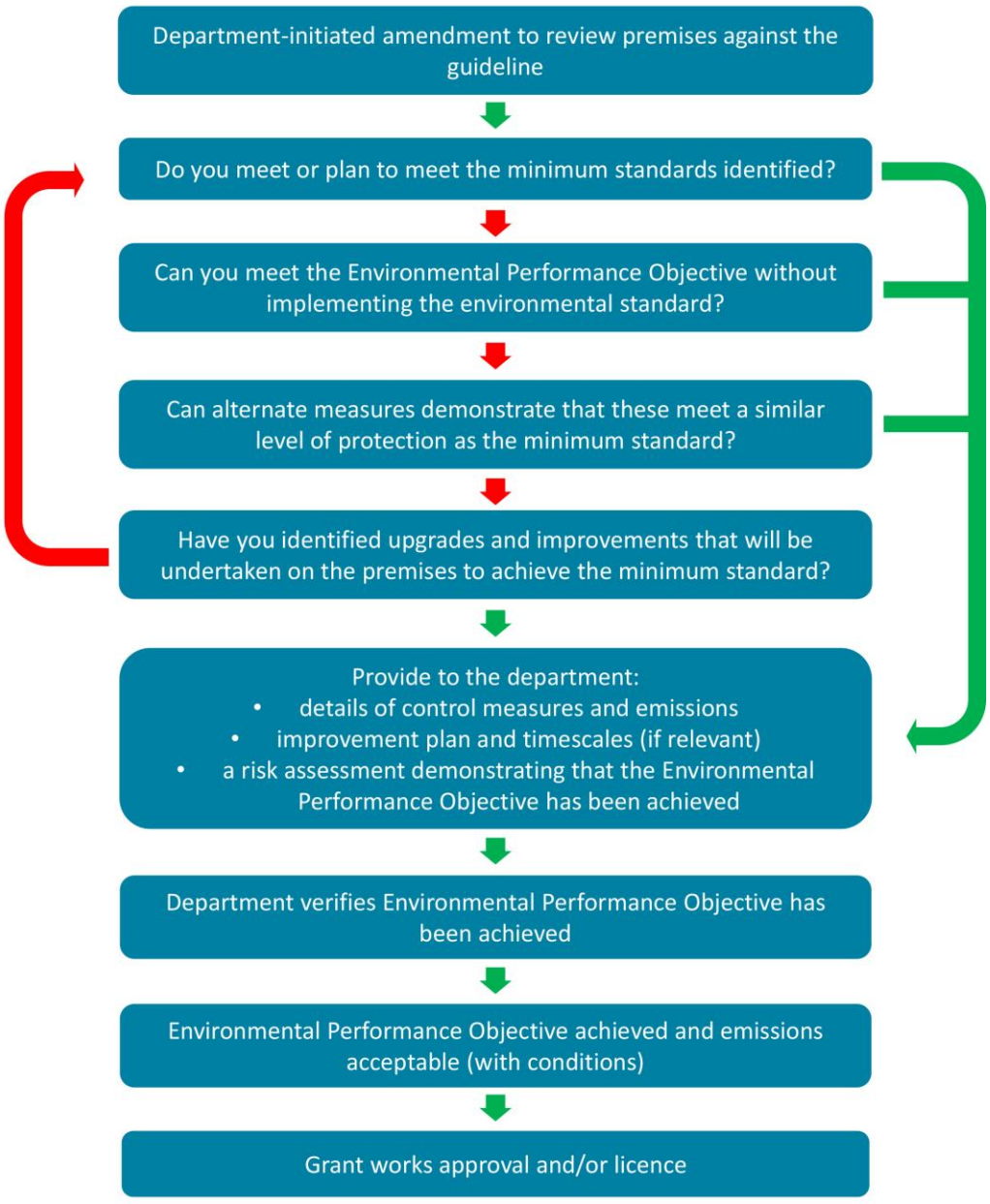
Where any upgrades or improvements are required, the submission to the department must include a timeframe to undertake the upgrades and improvements.

The department will amend licences in accordance with normal statutory process to require upgrades and improvements using a risk-based approach so that priority is given to premises posing a greater risk to the environment, human health or public amenity.

The department will provide reasonable timeframes for improvements based on the potential risks posed by the premises and having regard to timescales proposed by the licence holder.

Figure A.2 illustrates the implementation process for industry-specific guidelines for existing facilities.

Figure A.2: Implementation process for the guideline at existing facilities.



Deviating from minimum standards

The department supports applicants and existing licence holders to develop and propose alternative controls to the minimum standards outlined in this guideline. This approach allows for growth and innovation within industry and encourages practical site-specific solutions suited to local conditions.

The responsibility lies with the applicant to clearly demonstrate how they will meet the relevant environmental performance objective when alternative controls are proposed. The department acknowledges that in some circumstances certain minimum standards may not be required to meet the environmental performance objectives. For example, a premises without nearby sensitive receptors may be able to meet the environmental performance objective for odour without implementing some of the minimum standards for odour emissions.

Any deviation from the minimum standards set out in this guideline must be supported by a risk assessment, undertaken in accordance with the *Guidance Statement: Risk Assessments* and the relevant Emissions Guidelines (where published, see Glossary) to demonstrate that the relevant objective has been met and the risk to the environment, human health and social surroundings is acceptable.

In these circumstances, it is important that applicants provide relevant technical details of the proposed control, such as maps, product specifications or management procedures. Applicants must also demonstrate that the control is practicable, meaning it is both possible and likely to be carried out in practice. Specialist technical data may be used to demonstrate how a proposed alternative control will achieve the environmental performance objective. The department uses the scientific precautionary principle in its assessments and will take a conservative approach where the outcome of an action is uncertain.

Appendix B: Liquid waste feedstock analysis

Table B.1 lists the minimum analytical suites required to achieve characterisation of two liquid waste feedstocks which may be accepted for composting/biological treatment in the composting process. Characterisation of other liquid waste types not listed in Table B.1 will require detailed chemical analysis of all substances known or reasonably expected to be present in the waste (see Section 17.3.1).

Table B.1: Minimum analytical suites for common organic liquid waste feedstocks

Waste category	**Parameters for analysis**
Oil interceptor waste (controlled waste code J130)	Benzene, toluene, ethylbenzene and xylenes (BTEX)
	Metals – arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc
	Polycyclic aromatic hydrocarbons (PAHs)
	Semi-volatile organic compounds (SVOCs)
	Total recoverable hydrocarbons (TRHs)
	Volatile organic compounds (VOCs)
Oil sludge (controlled waste code J180)	BTEX
	Metals – arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc
	PAHs
	SVOCs
	TRHs
	VOCs

Appendix C: Example water balance

The minimum standards for leachate infrastructure presented in Section 12.3.1 include a requirement that the design and construction of the leachate containment system is informed by a quantitative water balance. The water balance is required to account for leachate inputs and outputs and be carried out on at least a monthly basis to demonstrate that the system will be able to operate in a satisfactory manner throughout the year.

The following diagram, Figure C.1, presents a simple conceptual water balance for a leachate pond at a composting premises. Additional inputs and outputs to those presented may be relevant at some composting premises. Table C.1 presents an example of a monthly quantitative water balance for a leachate pond at a composting premises.

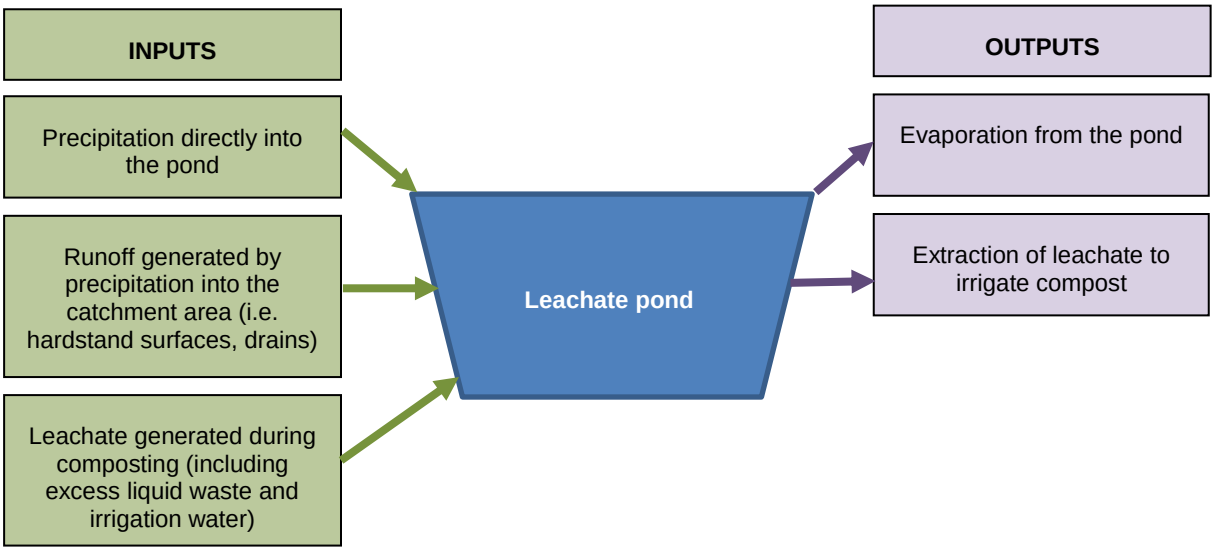


Figure C.1: Example conceptual water balance for a leachate pond at a composting premises

Table C.1: Example water balance calculation

Infrastructure				**Notes:**
Catchment area (i.e. hardstand and drainage)	(A_1)	10,000	m^2	# Monthly rainfall rates from a 90th percentile wet year (see Glossary)
Leachate pond area	(A_2)	3600	m^2	* Monthly composting leachate input volumes estimated based on feedstock types and process conditions
				Assumptions in this water balance include that 100% of precipitation to the catchment area is converted to runoff into the leachate pond (i.e. runoff coefficient of 1) and negligible seepage occurs from the leachate pond.

Parameter	**Symbol**	**Formula**	**Units**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**TOTAL**
Days in month	(D)	-	days	31	28	31	30	31	30	31	31	30	31	30	31	365
Precipitation rate#	(P_1)	-	mm/month	45	30	24	50	71	88	173	152	77	42	5	41	797
Pan evaporation rate	(E_1)	-	mm/month	316	269	239	150	93	66	65	81	111	167	228	282	2067
Pan factor	(K)	-	(-)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	-
Inputs																
Precipitation	(P_2)	(A_1+A_2) x P_1 / 1000	m^3/month	617	408	321	680	963	1197	2347	2062	1053	571	65	552	10836
Composting process*	(C)	-	m^3/month	2	2	2	2	3	4	4	4	3	2	2	2	32
Total inputs	-	P_2 + C	m^3/month	619	410	323	682	966	1201	2351	2066	1056	573	67	554	10868
Outputs																
Evaporation	(E_2)	E_1 x K x A_2 / 1000	m^3/month	797	677	602	378	234	166	164	203	280	422	575	711	5209
Extraction	(L)	-	m^3/month	30	30	30	25	20	20	20	20	30	30	30	30	315
Total outputs	-	E_2 + L	m^3/month	827	707	632	403	254	186	184	223	310	452	605	741	5524
Balance																
Storage	(S)	(P_2 + C) - (E_2 + L)	m^3/month	-207	-297	-309	279	712	1014	2167	1843	746	121	-537	-187	-
Cumulative storage year 1	(M_1)	-	m^3	0	0	0	279	991	2005	4172	6015	6761	**6882**	6345	6158	-
Cumulative storage year 2	(M_2)	-	m^3	5951	5653	5345	5624	6335	7350	9517	11360	12106	**12227**	11690	11503	-
Maximum storage during first two years	(V)	Highest M_2	m^3	**12227**												

Appendix D: Product sampling protocol

This section outlines the sampling protocol required to assess compost product quality. The purpose of this sampling protocol is to achieve consistent and representative sampling of compost product to ensure that the physical, chemical and biological contaminant levels meet the product specification.

This appendix does not address requirements for sample size, preservation, transportation or preparation for analysis at the laboratory. Licence holders should refer to AS 4454-2012 and the NATA-accredited laboratory engaged for analysis for further guidance. This appendix does not address sampling procedures to assess the maturity or beneficial qualities of compost as these characteristics are outside of the scope of this guideline.

Licence holders are required to follow the sampling protocol outlined below. The department may approve a reduced product sampling rate for compost products derived from low-risk feedstocks (as specified in Section 17.2). This would only be approved where there is a consistent feedstock and composting process in use and licence holders are able to demonstrate that their product consistently met product specification requirements during an initial validation phase.

Sampling protocol:

1. Calculate the number of samples and subsamples required.

Samples from each batch of compost product must be submitted for testing. A batch refers to each distinct quantity of compost which has undergone the same processes and is produced at one time.

The number of samples required is dependent on the size of the batch being represented. At a minimum, one sample is to be submitted for testing per 500 tonnes of compost product produced.

Each sample is to be made up of 12 subsamples.

2. Take subsamples from the stockpile/windrow.

Using a spade or trowel, the subsamples must be taken from random positions throughout the stockpile or windrow using one of the following methods:

(a) Subsampling Method 1

Arrange for the windrow or stockpile to be turned, screened or otherwise completely homogenised in a manner that breaks up and distributes any clumps using a front-end loader, windrow turner and/or screening equipment, on the same day as the sampling occurs. Once the pile has been so homogenised, subsamples can be taken from random positions over the exterior length and height of the pile. Ensure that each subsample taken is of approximately the same size.

(b) Subsampling Method 2

For a windrow or stockpile that has not been turned or otherwise completely homogenised within 24 hours, use the front-end loader to dig or back-blade halfway into the pile to expose a near-vertical cross-section face. Take three to five subsamples scattered over the width and height of the cross-section. Repeat until 12 subsamples have been collected for each sample, ensuring an approximately equal number of cross-sections from each side of the windrow or from opposite faces of a pile.

3. Prepare specimen for test.

Using a plastic bucket, convey the subsamples to a flat area of clean concrete; or using a plastic film or tarpaulin make a conical pile out of the combined subsamples. Using a riffle box, sample splitter or by mixing, coning and quartering, blend the composited subsamples into an appropriate specimen for test. The specimen for test is the component of the sample submitted to the laboratory for analysis.

Glossary

90th percentile wet year rainfall	This may be calculated using one of two approaches: i) The 90th percentile of the annual rainfall dataset (YR^{90}). ii) The total of the adjusted 90th percentile monthly rainfall values ($\sum MR^{90}_{adj}$). The 90th percentile monthly rainfall (MR^{90}) is determined for each calendar month and totalled ($\sum MR^{90}$). As the total of individual 90th percentile months is much larger than YR^{90}, the 90th percentile monthly rainfall is then adjusted so that $\sum MR^{90}_{adj}$ equals YR^{90} as follows: $$MR^{90}_{adj} = \frac{YR^{90}}{\sum MR^{90}} \times MR^{90}$$
Aerobic	In the presence of oxygen.
Aerobic composting	The process whereby organic materials are microbiologically transformed under controlled aerobic conditions to achieve pasteurisation and a specified level of maturity.
Anaerobic	In the absence of oxygen.
Anaerobic digestion	The process whereby organic materials are microbiologically transformed under anaerobic conditions into high-energy compounds such as methane, organic acids and alcohols and a solid residue digestate. Also, pasteurised, yielding compost or soil amendments
Annual exceedance probability (AEP)	In relation to rainfall, the probability that a given rainfall total accumulated over a given duration will be exceeded in any one year. In relation to flooding, the probability that a flood of a given size will occur in any one year.
Applicant	An individual, company, body corporate or public authority applying to the department for a works approval, licence or amendment under Pt V Division 3 of the EP Act.

Beneficial use	As defined under s.3(1) of the EP Act means a use of the environment, or of any portion thereof, which is: a) conducive to public benefit, public amenity, public safety, public health or aesthetic enjoyment and which requires protection from the effects of emissions or of activities referred to in paragraph (a) or (b) of the definition of environmental harm in s.3A(2) of the EP Act, or b) identified and declared under s.35(2) of the EP Act to be a beneficial use to be protected under an approved policy.
Biochemical oxygen demand (BOD)	The quantity of oxygen used in the biochemical oxidation of organic matter in a specified time, at a specified temperature, and under specified conditions. Normally five days at 20ºC unless otherwise stated.
Bioaerosol	Airborne particulates and/or water droplets that may contain bacteria, fungi and fungal spores, pathogens or other micro-organisms.
Biogas	Gas produced during the decomposition of organic material in anaerobic conditions. Biogas is primarily composed of methane and carbon dioxide, with other minor components including nitrogen gas, hydrogen sulphide, water vapour and other gases.
Bioremediation	Bioremediation means an accelerated process using microorganisms (indigenous or introduced) and other processes to degrade and detoxify organic substances to less toxic compounds, such as carbon dioxide and water, in a controlled environment.
Biosolids	Sludge from a wastewater treatment plant that has undergone further treatment to reduce disease-causing pathogens and volatile organic matter significantly, resulting in a stabilised material suitable for beneficial use. Does not include industrial and food processing sludges.
BOM Design Rainfall Data System	Design rainfalls are based on the statistical analysis of historical rainfall data to determine the design rainfall depth (mm) or design intensity (mm/hr) corresponding to selected durations and frequencies. The BOM Design Rainfall Data System presents design rainfalls for different intensity-frequency-duration events (IFDs) across different locations in Australia.

BTEX	Benzene, toluene, ethylbenzene and xylenes
Clinical and related waste	Has the same meaning given to that term in the Department of Health *Operational Directive 0651/16: Clinical and related waste management policy*.
Compost	An organic material that has undergone controlled aerobic and thermophilic biological transformation through the composting process to achieve pasteurisation and reduce phytotoxic compounds, and achieved a specified level of maturity for compost.
Composting	For the purpose of this guideline means the production of composts, soil conditioners, mulches and other products such as mushroom growing substrate by processes including aerobic composting, anaerobic digestion and vermiculture. Composting does not include shredding, grinding, cutting and milling activities.
Construction phase	A period of time where the proposed infrastructure is constructed, where emissions and discharges are linked to the construction and not operation of the plant.
Contaminated solid waste	Waste which meets the definition of solid as specified in the *Landfill Waste Classification and Waste Definitions 1996* and has a substance in it at above-background concentrations that presents, or has the potential to present, a risk of harm to human health, the environment or any environmental value.
Contamination	Contaminants in the context of compost include physical and non-biodegradable materials (e.g. metals, glass, plastic etc), chemical substances (e.g. metals, pesticides, VOCs etc) and/or biological agents (e.g. bacteria) that can have a detrimental impact on the quality of compost products.
Digestate	Decomposed feedstock generated as a product of anaerobic digestion comprising slow degradable, stable organic components such as lignin, nitrogen and phosphorus in various forms, inorganic salts containing phosphate, ammonium, potassium and other minerals. Digestate may be separated into its liquid and solid components.

Directly related activity	Activities on a prescribed premises which do not fall within the description of the category in Schedule 1 of the EP Regulations but are activities related to the prescribed premises that occur on the same premises and may give rise to emissions and discharges.
Discharge	Has the same meaning given to that term in the EP Act
DWER	Department of Water and Environmental Regulation (the department)
Emission	Has the same meaning given to that term in the EP Act
Emissions guidelines	A guideline published by the department that addresses a particular emission type (e.g. *Guideline: Odour emissions*)
Environment	As defined under s.3(1) of the EP Act and subject to subsection (2), means living things, their physical, biological and social surroundings, and interactions between all of these.
Environmental commissioning phase	A period of time allowing for stabilisation and optimisation of the process following input of raw materials under operating conditions (including emissions) to confirm that emissions meet predicted levels before ongoing operation.
Environmental harm	As defined under s.3A(2) of the EP Act and means direct or indirect: a) harm to the environment involving removal or destruction of, or damage to native vegetation; or the habitat of native vegetation or indigenous aquatic or terrestrial animals b) alteration of the environment to its detriment or degradation or potential detriment or degradation c) alteration of the environment to the detriment or potential detriment of an environmental values, or d) alteration of the environment of a prescribed kind.
Environmental value	As defined under s.3(1) of the EP Act means: a) a beneficial use, or b) an ecosystem health condition
EP Act	*Environmental Protection Act 1986* (WA)

Fire and Emergency Management Plan (FEMP)	A Fire and Emergency Management Plan identifies the fire and emergency risks at a premises and the measures to be implemented by a licence holder to prevent, control and respond to fire and emergency incidents.
Fit-for-purpose product specification	A report prepared by an applicant to demonstrate that a specific compost product is fit for its intended end use and will not present an unacceptable risk to human health and the environment when used.
FOGO	Food organics and garden organics waste collected from kerbside municipal collections.
Fugitive emissions	Pollutants emitted to the air that are not caught by a capture system and do not originate from a stack, chimney, vent or other functionally equivalent opening designed specifically for the release of emissions. These also include small releases from leaks in plant equipment such as valves, flanges, pump seals and buildings. Emissions from surfaces such as ponds are also considered to be fugitive emissions.
Hazardous Waste	Has the same meaning given to that term in the *Landfill Waste Classification and Waste Definitions 1996.*
HDPE	High-density polyethylene.
Leachate	Liquid that has percolated through and/or been generated by the decomposition of waste material including water that has interacted with feedstocks, composting material or final compost products.
Leachate containment system	Infrastructure on the premises which is designed to contain, convey or store leachate. The leachate containment system includes but is not limited to hardstand surfaces, tanks, vessels, ponds, bunding and leachate drainage infrastructure.
Licence	A licence granted and in force under Pt V Division 3 of the EP Act.
Liquid waste	Means a waste that does not meet the definition of solid as specified in the *Landfill Waste Classification and Waste Definitions 1996.*

Maturation	The final stage of composting where the temperature is shown to decline and stabilise to an extent that it can be safely used on land and to come into direct contact with plants without negative effects.
Mulch	Any organic product (excluding polymers that do not degrade, such as plastics, rubber and coatings) that is suitable for placing on soil surfaces. Refer to AS 4454-2012 for different mulch classifications.
NATA-accredited laboratory	A laboratory which is accredited by the National Association of Testing Authorities for a specific analytical method.
Non-point source	A source from which emissions emanate from a non-specific location. Examples include area, volume, diffuse and fugitive sources.
Occupier	Has the same meaning given to that term in the EP Act.
P1C1	Classification for biosolids which are suitable for unrestricted use because they meet the P1 pathogen grade and C1 contaminant grade as outlined in the Biosolids Guidelines.
PAHs	Polycyclic aromatic hydrocarbons
Pan factor	Conversion factor used to estimate the rate of evaporation from a surface water body based on measured pan evaporation rates. The pan factor accounts for differences in the characteristics of a pan and actual evaporating surface, such as a leachate pond.
Pasteurisation	A process whereby organic materials are heat-treated to significantly reduce the numbers of plant and animal pathogens and plant propagules.
PFAS	Perfluoroalkyl and polyfluoroalkyl substances.
PM_{10}	Particulate matter with an equivalent aerodynamic diameter of 10 micrometres or less.
Point source	A source from which emissions emanate from a specific opening such as a stack or vent.

Public Drinking Water Source Area (PDWSA)	Surface water catchments and groundwater areas that provide drinking water to cities, towns and communities and are proclaimed under the *Metropolitan Water Supply, Sewerage, and Drainage Act 1909* or the *Country Areas Water Supply Act 1947.*
Prescribed premises	A site where an activity listed in Schedule 1 of the *Environmental Protection Regulations 1987* is carried out at, or above, the specified production or design capacity.
Quarantine waste	Means material from a foreign region or country that is capable of being host to insects, helminths or other parasites, diseases, weeds or any other organisms that are not existent or prevalent in Australia and pose a potential threat to local ecosystems, people or local plant or animal industries. Quarantine waste may include: • material used to pack and stabilise imported goods • galley food and any other waste from overseas vessels • human, animal or plant waste bought into Australia • refuse or sweepings from a hold of an overseas vessel • any other waste or other material, which comes into contact with quarantine waste • contents of airport amnesty bins • articles seized by quarantine inspectors and/or not collected by clients.
Residual physical contaminants	Physical contaminants such as plastics, glass and metals which have been screened or otherwise removed from composting feedstocks.
Runoff coefficient	Dimensionless coefficient relating the amount of runoff to the amount of precipitation received. It is larger for areas with low infiltration, low absorption and high runoff.

Sensitive receptors/ sensitive land uses	Places where people live or regularly spend time, and which are therefore sensitive to emissions from industry with implications for human health or amenity. They include, but are not limited to, residences, healthcare establishments, places of accommodation, places of study, childcare facilities, shopping centres, places of recreation, and some public buildings. Commercial, industrial and institutional land uses that require high levels of amenity, or are sensitive to particular emissions, may also be considered sensitive land uses.
Soil conditioner	Any composted or pasteurised organic product, including vermicast, manure and mushroom substrate, that is suitable for adding to soils (excluding polymers that do not degrade, such as plastics, rubber and coatings).
Special Waste Type 1	Has the same meaning given to that term in the *Landfill Waste Classification and Waste Definitions 1996.*
Special Waste Type 2	Has the same meaning given to that term in the *Landfill Waste Classification and Waste Definitions 1996.*
Special Waste Type 3	Has the same meaning given to that term in the *Landfill Waste Classification and Waste Definitions 1996*.
Specific consequence criteria	Specific criteria for consequences to the environment or public health, determined by the department in accordance with the *Guidance Statement: Risk assessments* (see Related documents).
Specified ecosystems	Ecosystems and their biological and physical components which are listed in the *Guidance Statement: Environmental Siting.* Specified ecosystems have special significance and may be impacted as a result of activities upon or emissions and discharges from prescribed premises.
Specimen for test	The blended or composited series of subsamples that is then reduced in size to an appropriate amount for delivery to the testing laboratory.
Subsample	An individual sample or incremental sample taken from the bulk mass of product being sampled and composted or blended with other such subsamples or increments to form the specimen for test.

Suitably qualified person	Means a person who: a) has appropriate accreditation in the relevant area of expertise b) demonstrates competency in the relevant area of expertise c) has appropriate experience working in the relevant area of expertise. Specific prerequisites for a suitably qualified person to demonstrate competency and experience in the relevant area of expertise will be determined by the department within the works approval or licence on a premises specific basis. The specific prerequisites will be informed by the assessed level of risk from the composting premises. A suitably qualified person may provide technical expertise during construction, commissioning or operation phases through validation or verification testing and reporting.
SVOCs	Semi-volatile organic compounds
Trade waste	Any wastewater discharged from a business other than waste from office facilities or staff amenities.
TRHs	Total recoverable hydrocarbons
Vermiculture	A composting process that uses worms and microorganisms to convert organics into nutrient-rich humus.
VOCs	Means volatile organic compounds.
Watercourse	Means: a) any river, creek, stream or brook in which water flows b) any collection of water (including a reservoir) into, through or out of which any thing coming within paragraph (a) flows c) any place where water flows that is prescribed by local by-laws to be a watercourse and includes the bed and banks of any thing referred to in paragraph (a), (b) or (c).

Wetlands	A natural collection of water whether permanent or temporary, on the surface of any land and includes: a) any lake, lagoon, swamp or marsh b) a natural collection of water that has been artificially altered but it does not include a watercourse.
Works approval	An approval required under s.52 and 53 of the EP Act to change a premises to become a prescribed premises or make changes to a licensed premises.

References

References which are listed in *Related documents* are not duplicated in the reference list below.

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Environmental Protection Authority South Australia 2019, *Composting guideline,* Adelaide.

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