



Environment Protection Authority

NSW Organics Processing Facility Guidelines

DRAFT FOR CONSULTATION



A vertical strip of decorative Aboriginal artwork on the left side of the page. It features a variety of traditional patterns including concentric circles, wavy lines, and geometric shapes in shades of blue and white.

Acknowledgement of Country

The NSW Environment Protection Authority acknowledges the Traditional Custodians of the land on which we live and work, honours the ancestors and the Elders both past and present and extends that respect to all Aboriginal people.

We recognise Aboriginal peoples' spiritual and cultural connection and inherent right to protect the land, waters, skies and natural resources of NSW. This connection goes deep and has since the Dreaming.

We also acknowledge our Aboriginal and Torres Strait Islander employees who are an integral part of our diverse workforce and recognise the knowledge embedded forever in Aboriginal and Torres Strait Islander custodianship of Country and culture.

Aboriginal artwork by Worimi artist Gerard Black

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1 Purpose

1.1 Introduction

The processing of organic waste provides significant environmental advantages and contributes to a circular economy. The diversion of organic waste from landfill reduces greenhouse gas (GHG) emissions and facilitates the recovery of valuable nutrients.

An organics processing facility may generate outputs that can improve soil health, reduce reliance on synthetic fertilisers, increase water retention and boost crop yields. Other beneficial outputs can include recovered energy and animal feed. The operation of a facility requires effective management and control of environmental and amenity impacts. If a facility is mismanaged, serious environmental impacts may be created, such as odour, water and soil contamination and human health risks.

1.2 Aim

The aim of the *NSW Organics Processing Facility Guidelines* (the Guidelines; this document) is to provide guidance for the planning, design and operation of organics processing facilities to minimise the risk of harm to the environment and human health. These Guidelines are intended to provide technical and regulatory guidance only. They do not create legal obligations.

The Guidelines are relevant to:

- facilities that receive and process organic waste from external off-site sources and require an Environment Protection Licence (EPL) to operate
- facilities that undertake biological processing of organics on a larger than domestic scale but do not require an EPL, such as modular on-site processing
- entities planning new facilities or modifications to existing facilities, including changes to feedstock or other key operating criteria
- professionals engaged in the design, development or modification of an organics processing facility
- existing or intended users of the outputs from these facilities
- NSW regulatory and consent authorities e.g. local councils, the NSW Environment Protection Authority (EPA), NSW Health, the Department of Primary Industries and Regional Development (DPIRD), and the Department of Planning, Housing and Infrastructure (DPHI).

The Guidelines:

- outline the regulatory framework that governs the development, approval and operation of organics processing facilities
- define the common environmental considerations that affect the design, operation and management of organics processing facilities
- identify best practice and performance measures for managing each key environmental consideration

- provide guidance on design and operation, based on a risk assessment framework
- identify the benchmarks that can be used for measuring and monitoring performance for each key environmental consideration.

The EPA may refer to the Guidelines when it considers and/or provides input into planning approvals and reviews EPL applications for new or modified organic waste processing facilities. The Guidelines set out the standards the EPA may refer to when assessing whether a proposal adequately addresses environmental risks associated with air emissions, land and water impacts, noise, fire and litter.

The Guidelines focus on the planning, design and operational phases of organic waste processing facilities, and are not intended to cover impacts arising during construction.

1.3 Scope

In the context of the Guidelines, organics processing is defined as:

Any controlled method used to break down organic waste into useful outputs. Processing includes size reduction, biological digestion and conversion of organics into outputs such as compost, mulches, soil conditioners, fertilisers, protein and biogas.

The definition of organics is detailed in section 2.2.

The Guidelines cover the following technologies suitable for processing organic material:

- composting (including passive aeration and forced aeration systems)
- anaerobic digestion (including wet and dry digestion)
- dehydration
- insect bioconversion
- vermicomposting
- mulching.

Additional information on the organic processing technologies can be found in section 4.3 and Appendix A through to Appendix G.

Note that the Guidelines do not cover thermal treatment technologies captured by the Energy From Waste Framework, such as the processing of wastes via combustion, thermal oxidation, thermal or plasma gasification, pyrolysis and torrefaction.

1.4 How to use these Guidelines

These Guidelines are structured to allow users to easily reference topics relevant to the planning, design, approval and operation of an organic waste processing facility. The main body of the document sets out common considerations applicable across all types of organic processing facilities, focusing on the management of environmental risks associated with air, land, water, noise, fire and litter.

1.4.1 Document summary

- **Section 2**

Legislative and Policy Context outlines the planning approval and environment protection licensing framework in NSW and identifies relevant legislation, policies and supporting guidance that may apply depending on the scale, location and nature of the facility.

- **Section 3**

Risk Assessment describes a risk assessment framework to be applied during the planning, design and operation of facilities to identify, assess and manage site-specific environmental risks.

- **Section 4**

Facility Planning and Design sets out key site-selection, planning and design considerations to support appropriate technology and feedstock selection.

- **Section 5**

Environmental Management establishes an overarching approach to environmental management. For each key environmental consideration, it outlines the objective/s, identification and assessment of risk, typical design controls, and monitoring and performance expectations.

- **Section 6**

Facility Operation focuses on operational practices that underpin good environmental performance and regulatory compliance, and supports operators, regulators and consent authorities in understanding day-to-day operational controls.

- **Section 7**

Facility Closure outlines requirements and considerations for facility closure, including closure planning where required, to ensure sites are appropriately decommissioned.

The appendices provide supporting technical guidance. Appendix A addresses feedstock characteristics and suitability, while Appendix B to Appendix G provide technology-specific information, including process descriptions, design and operational considerations, and typical outputs for each organic processing technology.

2 Legislative and policy context

2.1 Overview of legislation

2.1.1 Protection of the Environment Operations Act

The primary environment protection legislation in NSW that regulates waste, resource recovery, water, air and noise pollution is the *Protection of the Environment Operations Act 1997* (POEO Act) and its subordinate regulations, including the Protection of the Environment Operations (Waste) Regulation 2014 (Waste Regulation). Both the POEO Act and Waste Regulation contain provisions for the management, storage, transport, processing, recovery and disposal of waste.

The EPA is responsible for administering the POEO Act and its Regulations, with other government authorities, such as local councils, being responsible for some functions.

2.1.2 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) sets out the structure for the planning system in NSW and provides the regulatory framework for planning decisions, including the assessment of development applications.

The Environmental Planning and Assessment Regulation 2021 (EP&A Regulation) determines the approved form for planning applications, assessment timeframes, determination notifications and requirements for modifications. Schedule 3 of the EP&A Regulation provides definitions for designated development based on environmental impact or throughput thresholds.

2.1.3 Assessment and licensing

The POEO Act, the EP&A Act and their associated regulations are enforced through a set of assessment and licensing frameworks that influence the design and operational requirements of an organics processing facility. These frameworks are detailed further in section 2.4.

2.2 Defining organics

The POEO Act defines organics and other specific organic material streams that fall under the organics category. The Guidelines are aligned with the definitions specified in the POEO Act; refer to the POEO Act for all official definitions pertaining to waste.¹ The key terms used in this document are:

- animal waste
- biosolids
- food organics waste and garden organics waste (FOGO)²
- food waste

¹ POEO Act Schedule 1 Part 3 Definitions

² POEO Act Section 170A

- garden waste
- grease-trap waste
- manure
- natural organic fibrous materials
- organics (putrescible /non-putrescible)
- wood waste

2.3 Defining outputs

Outputs from organics processing facilities include all materials generated during processing. The definition of outputs used in the Guidelines, and common examples, are provided in Table 1.

Table 1 Summary of output definitions and types

Output type	Definition	Examples
Primary outputs	Materials that the processor intends to produce and supply for beneficial reuse.	• Compost • Mulch • Digestate (solid and liquid) • Biogas • Proteins • Dehydrated food waste • Liquid or solid fertilisers • Vermicast
Secondary outputs	Other materials generated during the process. Depending on their characteristics and regulatory requirements, these materials may be reused, further treated, or managed separately.	• Oversize material from screening of composted organics • Wastewater • Leachate • Frass • Vermiliquid
Rejects	Materials that are removed prior to, during, or after processing (such as contaminants) to meet relevant feedstock acceptance or output quality requirements.	• Plastic • Glass • Engineered timbers • Metal

2.4 Planning and licensing overview

There are regulatory approval pathways in place to determine:

- whether a facility can be built
- whether it can operate
- the technical standards it must meet.

This section of the Guidelines is intended to help facility operators, local councils, consultants and technology suppliers understand the planning and licensing processes as they apply to organics processing facilities.

This section provides information on typical planning and licensing processes only. There are many specific circumstances under NSW planning and licensing frameworks that do not follow these typical process flows. These include, but are not limited to

- circumstances where regulatory authorities, other than NSW DPHI, NSW EPA or local councils, are involved in the regulation of facility development or operation
- the application of licensing exemptions under specific circumstances
- the issuing of licences for carrying out non-scheduled activities for the purposes of regulating water pollution from those activities.

Figure 1 shows regulatory approval pathways and steps that apply to planning and operating a new facility or modifying an existing one.

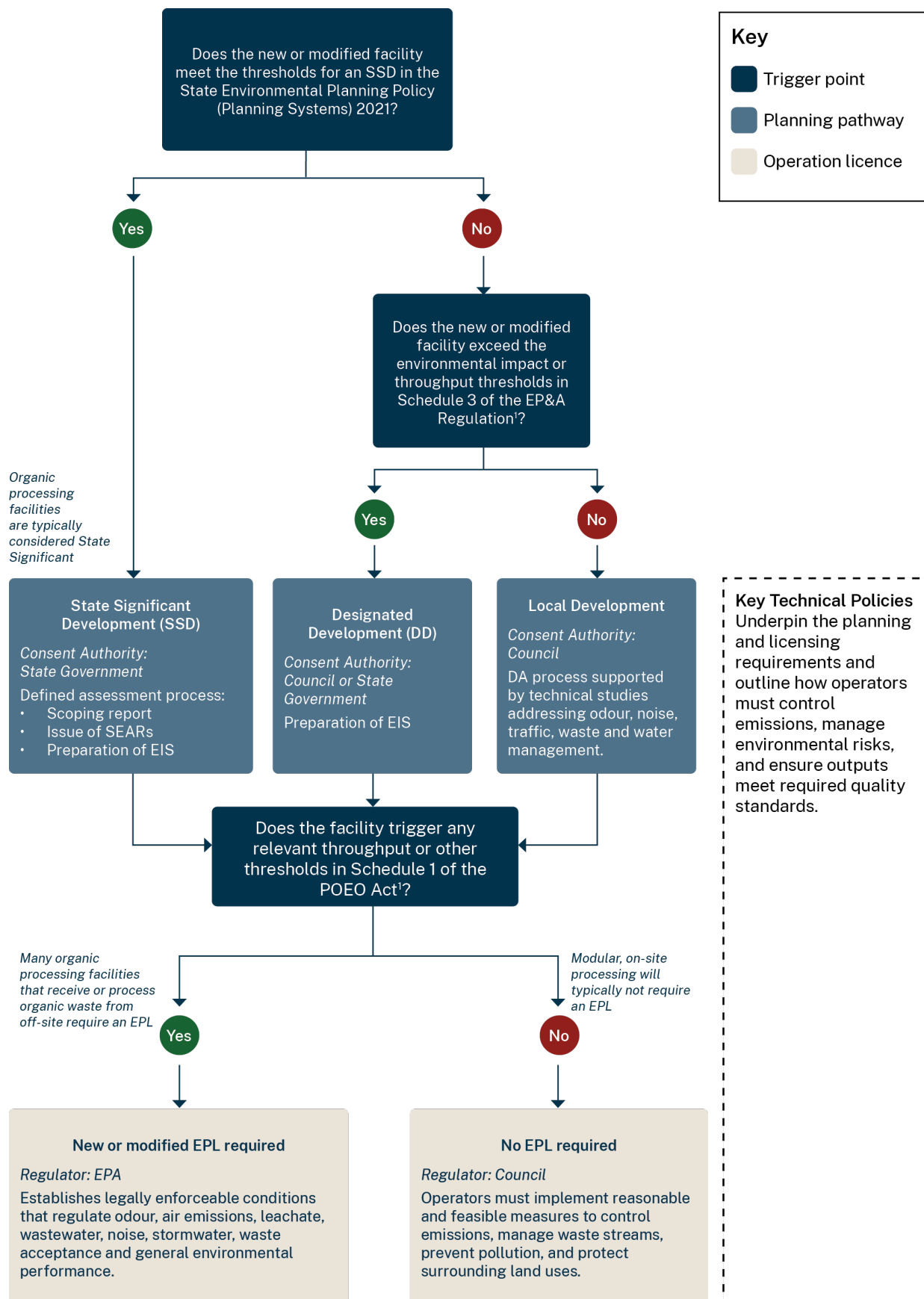


Figure 1 Decision tree for new or expanding facilities

Notes

SEARs: Secretary's Environmental Assessment Requirements

EIS: Environmental Impact Statement

DA: Development Application

2.4.1 Planning approvals

Obtaining planning approval is the first step in establishing or modifying an organics processing facility in NSW. It determines whether an activity is permissible on a given site or parcel of land and identifies the environmental impacts that must be assessed and managed before development can begin.

Development approval (DA) is required for both:

- new facilities
- when an existing facility proposes to expand or change its operations in relation to
 - the feedstocks it accepts
 - increased throughput
 - new processing technologies
 - any other change to its operation that may alter emissions, amenity impacts or environmental risks.

The type of planning pathway a facility is assessed under depends on the:

- Scale of operations
- Nature of the waste feedstock and treatment process
- Sensitivity of the surrounding environment
- Location of the site

Regulatory authorities will provide environmental assessment requirements that must be met by the proponent of the activity or development.

State Environmental Planning Policies (SEPPs) may also restrict the location of specific activities or developments or require more robust modelling, assessment, mitigation or control measures to determine whether the site is suitable for the activity or development being proposed. This is an important factor to consider as areas frequently impacted by natural disasters (e.g. flood-prone land) may not be appropriate for an organics processing facility.

Outputs of the planning process typically include development consent or approval with conditions that must be met during both the development and operation of a facility. These conditions may address issues such as site layout, waste storage requirements, fire control measures, buffer distances, stormwater and leachate controls, odour and noise mitigation, maximum throughput quantities, operating conditions, permitted feedstock types, operating hours and monitoring requirements.

It is important to note that inadequate investigations, assessments or proposed mitigation measures provided as part of an application may lead to additional assessments being required and delays to approval.

More information on the NSW planning system and approvals can be found on the [NSW Planning website](#).

2.4.2 Environment protection licences

An organics processing facility must have an environment protection licence (EPL) if it carries out a scheduled activity above the thresholds specified in Schedule 1 of the POEO Act.

- An EPL can only be issued after development consent has been granted.
- The EPL framework ensures that larger or higher-risk processing activities operate and are regulated proportionately to their risk.
- The proponent is responsible for determining whether an EPL is required for the proposed activity at a premises.

For more information on EPLs, see the EPA's *Guide to Licensing*.

What an environment protection licence regulates

When the EPA issues an EPL, it contains legally enforceable conditions that relate to the unique context of the site. Depending on the identified risks, EPL conditions may regulate:

- odour
- air emissions
- leachate
- wastewater
- stormwater
- noise
- waste acceptance
- waste storage
- contamination management and control
- general environmental performance.

EPL conditions may also require monitoring, reporting and auditing to ensure that the facility:

- operates within acceptable limits
- produces outputs that comply with relevant standards or resource recovery orders
- does not cause environmental harm.

Typical facilities requiring an environment protection licence

Many commercial-scale organics processing facilities, such as FOGO composting operations and anaerobic digestion plants, typically operate at volumes that exceed the EPL thresholds in Schedule 1 of the POEO Act. They are thus likely to require an EPL.

Facilities below EPL thresholds

Facilities that do not meet EPL thresholds, such as small modular systems, on-site processing units or lower-volume operations, are not exempt from environmental responsibility. These facilities are typically regulated by local councils under DA conditions of approval. In these cases, operators can use the guidance provided in these Guidelines to implement measures to control emissions, manage waste streams, prevent pollution and protect surrounding land uses.

2.4.3 Resource recovery orders and exemptions

Resource recovery orders (RROs) and resource recovery exemptions (RREs) are regulatory instruments issued under section 286A of POEO Act and Part 9 of the Waste Regulation.

The resource recovery order and exemption (RRO/E) framework permits the use of waste or waste-derived materials in land application, and use as fuel or in thermal processes, where it can be demonstrated that the reuse is genuine, fit for purpose or beneficial, and will not cause harm to the environment and human health.

This framework facilitates the lawful off-site use of these types of waste by exempting them from certain parts of the regulatory framework for waste management and disposal, including the requirement to hold an EPL and pay the waste levy.

Table 2 gives an overview of resource recovery orders and exemptions.

Table 2 Overview of resource recovery orders and exemptions

Resource recovery orders (RROs)	Resource recovery exemptions (RREs)
Issued under section 286A of the POEO Act. Applies to the generator, processor or supplier of the material and lists the permitted inputs, sets requirements relating to material quality, contaminant thresholds, sampling, testing and record keeping/reporting requirements. Waste-derived materials that meet the conditions of a RRO can be supplied as a recovered resource.	Issued under Clause 91 and 92 of the Waste Regulation. Applies to the receiver or user of the waste and outlines how and where the waste may be lawfully used, including any site restrictions, permitted uses or notification obligations and record-keeping/reporting requirements. Waste that meets the conditions of a RRE is exempt from certain licensing, waste transport and levy requirements for that use.

In the context of an organic waste processing facility, the RRO/E framework permits the lawful supply and reuse of recovered organic outputs, such as compost, pasteurised garden organics and mulch.

One of the key controls used in RRO/Es to manage contaminant and quality risks is specifying what waste can be used as inputs or feedstocks to produce a resource recovery waste.

This is important for the development and operation of organic waste processing facilities. Resource recovery orders and exemptions establish a list of materials that can be received for processing (and by exception, those that cannot) if the facility output is to meet RRO/E requirements and be lawfully used in land application. So, when identifying and targeting feedstock materials, it is important to understand whether the facility outputs will be covered by existing RRO/Es (ones that are currently published by the EPA), or whether the proponent will need to apply to the EPA for specific RRO/Es to cover the proposed process and facility outputs.

A full list of currently published RRO/Es can be found on the EPA website at [current orders and exemptions](#). Where there is no current order and exemption for your planned re-use of a waste, you can apply to the EPA by submitting an application online via the eConnect EPA Portal.

2.4.4 Relevant guidance and policies

EPA technical policies and guidance documents provide the performance standards, assessment methods and design expectations that underpin both planning approval and EPL conditions. These technical policies and guidance documents should be read in conjunction with the Guidelines as required. They function as the practical toolkit through which regulatory requirements are interpreted and applied. Table 3 provides a summary of EPA technical guidance documents that may be relevant to the development of an organics processing facility.

Table 3 Summary of EPA technical guidance documents

Technical guidance	Description
NSW Organics Processing Facility Guidelines (this document)	Defines the main environmental issues impacting the design and management of organics processing facilities, sets out best-practice measures and guidance for managing these issues and provides guidance on performance measures and benchmarks for monitoring and continuous improvement.
Waste Classification Guidelines (EPA, 2014)	Defines the process for classification of waste into groups that pose similar risks to the environment and human health to facilitate appropriate disposal pathways for process rejects.
Technical Framework: Assessment and Management of Odour from Stationary Sources in NSW (DEC, 2006)	Defines odour impact criteria, assessment methods and mitigation approaches to prevent and minimise odour for industry activities.
Technical Notes: Assessment and Management of Odour from Stationary Sources in NSW (DEC, 2006)	Provides technical guidance and detailed odour assessment procedures to support the technical framework, which aims to manage offensive odour impacts from industry.
Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA, 2022)	Sets the technical requirements for air quality impact assessment, including dispersion modelling methods and criteria.
Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (EPA, 2022)	Lists the methods that must be used when sampling and analysing air pollutants (including odour) in NSW for statutory purposes.
Guide to Conducting Field Odour Surveys (EPA, 2021)	Provides resources to be used for ensuring that a consistent approach is applied when investigating odour-related complaints.
NSW Guide for Large Emitters: Guidance on how to prepare a greenhouse gas assessment as part of NSW environment planning processes (EPA, 2025)	Sets out requirements for when and what should be included in the planning process with respect to assessing climate change impacts and mitigation.
Noise Policy for Industry (EPA, 2017)	Sets the technical requirements for a noise impact assessment, including assessment methods, criteria and the management of noise emissions from industrial and commercial developments.
Noise Guide for Local Government (EPA, 2023)	Provides practical advice for council officers on planning, assessing, managing and preventing local noise problems.
Approved methods for the measurement and analysis of environmental noise in NSW (EPA, 2022)	Sets the technical requirements for measurement and analysis of environmental noise.
Assessing Vibration – A Technical Guideline (EPA, 2006)	Sets technical requirements for vibration evaluations and for assessing human responses to vibration. It proposes recommendations for measurement and evaluation techniques.
NSW Road Noise Policy (DECCW, 2011)	Identifies the strategies that address the issue of road traffic noise from existing roads, new road projects, road redevelopment projects and new traffic-generating developments. Additionally, defines the criteria to be used in assessing the impact of road noise.
Approved methods for sampling and analysis of water pollutants in NSW (EPA, 2022)	Sets technical requirements for water quality monitoring and analysis.
Environmental Guidelines: Use and Disposal of Biosolids Products (EPA, 2000)	Establishes requirements for the beneficial use and disposal of biosolids products to land in NSW.

Technical guidance	Description
Fire safety in waste facilities (FRNSW, 2020)	Provides guidance on fire safety in waste facilities that receive combustible waste material, including adequate provision for fire safety, and facilitates safe fire brigade intervention to protect life, property and the environment.
Access for fire brigade vehicles and firefighters (FRNSW, 2020)	Provides guidance on safe, efficient and effective access for fire brigade vehicles to any premises, to support the rapid intervention of firefighters when fire or other emergency incidents occur.

2.4.5 Supporting regulatory considerations

There are further broader environmental obligations that may require additional permits, licences and secondary approvals depending on the site's location, environmental sensitivity, scale of development and potential risks. Not all facilities will trigger these requirements and consultation with a planning consultant or suitably qualified person is recommended. The process of undertaking adequate investigations and assessments during the application for development consent will identify these requirements for a specific project, in addition to consultation with relevant government agencies.

A non-exhaustive list of Commonwealth and State legislation that may be relevant to the development of an organics processing facility is outlined in Table 4.

Table 4 Summary of relevant Commonwealth and State legislation

Jurisdiction	Planning legislation	Description
Commonwealth (Cth)	Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Establishes a national framework to protect matters of national environmental significance by promoting ecologically sustainable development, conserving biodiversity, strengthening cooperative environmental management across governments and communities, recognising and supporting Indigenous knowledge and participation, and ensuring efficient, coordinated environmental assessment and approval processes.
	National Greenhouse and Energy Reporting Act 2007 (NGER Act)	Establishes a national framework for consistent reporting of greenhouse gas emissions, energy production and consumption to inform policy, meet international obligations, support government programs, and reduce duplication, while ensuring emissions from large facilities do not exceed prescribed baselines.
State (NSW)	Biodiversity Conservation Act 2016	The legislation that provides a risk-based, scientific framework for conserving biodiversity in NSW by protecting ecosystems and species, managing and offsetting development impacts, supporting climate resilience and Aboriginal ecological knowledge, and enabling strategic, market-based investment in biodiversity conservation.
	Biosecurity Act 2015	This legislation provides a risk-based framework to prevent, eliminate and minimise biosecurity risks by managing pests, diseases, contaminants and other biosecurity threats, promoting shared responsibility across government, industry and communities, protecting the environment, public health, infrastructure and primary production, and supporting intergovernmental obligations and market access.
	Biosecurity Regulation 2017	This regulation supports the Biosecurity Act 2015 (NSW) by establishing a list of declared pests and prohibited matter, and includes mandatory measures and definitions to prevent, eliminate or minimise biosecurity risks.

Jurisdiction	Planning legislation	Description
	Contaminated Land Management Act 1997 (CLM Act)	The CLM Act allows the EPA to respond to contamination that it has reason to believe is significant enough to warrant regulation.
	Environmental Planning and Assessment Act 1979 (EP&A Act)	The primary legislation governing land use planning, development assessment, and environmental impact assessment within NSW.
	Environmental Planning and Assessment Regulation (EP&A Regulation)	This regulation supports the EP&A Act by prescribing the procedural and administrative requirements for environmental planning and development assessment in NSW.
	Local Government Act 1993	The primary legislation that establishes the legal framework for local government in NSW, defining the powers, functions, and responsibilities of councils and councillors, and supporting democratic, accountable, and sustainable local governance with community participation.
	Planning for Bush Fire Protection 2019	This planning guidance establishes a framework to manage bush fire risk to human life and property, while balancing development potential, site-specific characteristics and environmental considerations.
	Protection of the Environment Operations Act 1997 (POEO Act)	The primary environment protection legislation in NSW that regulates waste, resource recovery, water, air and noise pollution.
	Protection of the Environment Operations (Clean Air) Regulation 2022 (Clean Air Regulation)	This regulation establishes regulatory standards to minimise air pollution from domestic solid fuel heating, controlled burning, motor vehicles, industrial activities and plant, and emissions of volatile organic liquids from fuel storage tanks, loading facilities and petrol.
	Protection of the Environment Operations (Waste) Regulation 2014 (Waste Regulation)	This regulation supports the POEO Act by setting detailed requirements for waste management in NSW, including waste classification, transport, tracking, disposal, and the application of the NSW waste levy to protect the environment and human health.
	Public Health Act 2010	The legislation in NSW that provides a framework for protecting community health by managing public health risks and infectious diseases, recognising the role of local government, and prioritising public health and safety.
	Rural Fires Act 1997	This legislation provides a framework for the coordinated prevention and management of bush and other fires, protecting people, property, infrastructure, and environmental, cultural and community assets, while ensuring fire management activities are undertaken in accordance with ecologically sustainable development principles.
	State Environmental Planning Policy No 3 – Exempt and Complying Development Codes	This policy establishes a streamlined, statewide framework for exempt and complying development, enabling low-impact development to proceed without consent or be approved through complying development certificates, with flexibility for future expansion and transitional arrangements.
	State Environmental Planning Policy (Resilience and Hazards) 2021	This policy acts as a planning instrument that provides a coordinated framework for managing natural hazards, coastal risks, hazardous and offensive development, and land remediation and contamination in NSW.

Jurisdiction	Planning legislation	Description
	State Environmental Planning Policy (Precincts – Regional) 2021	This policy provides the planning framework for designated regional precincts in NSW, consolidating provisions for state significant precincts, activation precincts, and certain special regions. It guides land use, development standards, and assessment pathways to support coordinated regional growth and infrastructure delivery.
	The Work Health and Safety Act 2011 (WHS Act)	This legislation establishes a nationally consistent framework to protect workers and others by eliminating or minimising work health and safety risks, ensuring effective consultation and representation, promoting education and continuous improvement and enforcing compliance.
	The Work Health and Safety Regulation 2025 (WHS Regulation)	This regulation supports the WHS Act by setting out detailed requirements for managing health and safety risks in workplaces. It defines responsibilities for businesses, addresses risk management, hazardous work and substances, plant and equipment, worker consultation, and sets forth enforcement provisions.
	Water Management Act 2000	The legislation that sets a framework for the sustainable and integrated management of NSW water resources by applying ecologically sustainable development principles, protecting water ecosystems and quality, recognising social, economic, cultural and Aboriginal benefits, promoting community involvement, ensuring equitable water sharing, integrating water and land management, and encouraging shared responsibility and best-practice water use.

3 Risk assessment

3.1 Risk assessment methodology

The risk assessment methodology provides a structured and practical framework to help proponents identify, assess and manage environmental risks, supporting informed planning, design, technology selection and operational decision-making without prescribing a one-size-fits-all approach.

A detailed understanding of risks to human health and the environment is particularly important during applications for development consent and EPLs, where proponents must clearly communicate potential impacts and demonstrate that appropriate design and operational controls are in place to manage those risks so far as is reasonably practicable.

Once risks are identified, controls can be implemented to manage the risk and meet the required human health and environmental objectives. If environmental risk is not managed, it can lead to various issues such as, but not limited to, the following:

- air quality impacts such as odour and air emissions (e.g. bioaerosols, volatile organic compounds (VOCs))
- leachate and groundwater contamination
- noise impacts
- surface water run-off
- water and soil pollution
- loss of amenity
- potential hazards such as fire and explosions
- contaminated or poor-quality outputs

Poor management of environmental risks either in design or operation can result in unacceptable impacts on the environment. The EPA may take regulatory action including clean-up and/or prevention notices that require improvement projects, and issue penalties. Further failure to comply may result in the revocation or suspension of an EPL.

A risk assessment consistent with *AS ISO 31000 Risk Management – Guidelines* and *ISO 31010 Risk management – Risk assessment techniques* should be undertaken. This applies to all key risks, including environmental, health, safety, operational, social and regulatory risks. Risk identification, assessment, control, monitoring and review must be integrated into facility design and operation for the full project life cycle.

The following risk assessment process has been applied to environmental risks associated with organic waste facilities in the Guidelines:

- **Identify**
Identify environmental considerations specific to organic waste management facilities.
- **Assess**
Assess risk to environment, compliance and community.

- **Control**

Eliminate risk where possible and apply adequate controls to meet EPA environmental objectives.

- **Monitor and review**

Understand performance requirements, monitor, audit and continually improve.

3.2 Assessing and controlling risk

The level of detail in a risk assessment should be proportionate to the complexity of the proposed operations. For organics processing facilities, some of the key areas of focus that may require risk assessment include, but are not limited to, the following:

- **Feedstock**

Factors to review may include odour controls, contamination, logistics and handling, storage, impact on process, final product quality, quantity and consistency, sampling etc.

- **Proposed processing technology and equipment**

Factors include suitability and flexibility to feedstock, maintenance, availability of critical spare parts, system redundancies, control systems, safety etc.

- **Proximity to sensitive receivers**

A key factor relating to the risk of odour, particulate matter, groundwater, surface water, noise and other impacts relating closely to meteorology, topography, and buffers.

More information about key considerations in facility planning and design is detailed in section 4, however each site will have different and specific risks that should be managed. Section 5 lists the key environmental considerations that should be reviewed in a risk assessment process.

It is important that a formal process is followed and documented in the development of an organics processing facility.

An organics processing facility requires multiple, layered risk assessments, not a single study. AS ISO 31000 is the overarching framework which discusses risk assessments and tools including hazard identification (HAZID), Environmental Risk Assessment (ERA), Hazard and Operability Study (HAZOP), Construction Hazard Assessment Implication Review (CHAIR) studies, and odour/fire/biological risk assessments.

The outcome of these studies may trigger the need for more site-specific or process specific risk assessments.

Once risks are identified and assessed, appropriate controls for environmental management can be applied. There is a hierarchy of controls for managing identified risks:

1. **Elimination**

Often preferable to mitigating or controlling an identified risk, although this may not always be possible. Some risks can be reduced or eliminated by choosing the appropriate site location and site layout (Refer to section 4.2).

2. **Substitution**

Some risk can be managed by choosing appropriate feedstocks (section 4.4 and Appendix A) or can be appropriately managed through technology selection (section 4.3).

3. Control

Other risks are inherent and cannot be eliminated. In such cases, a variety of controls or mitigations may be identified to reduce those risks to an acceptable level.

Adequately meeting the environmental objectives requires a whole-of-facility approach, as specific risks can require an array of design and operational control measures. It is also essential to consider the potential for cumulative issues such as odour, emissions or encroachment by residential or other developments for which contemporary higher-level controls may be required by the EPA.

3.3 Environmental monitoring and performance review

Environmental control performance must be monitored and reviewed consistently to ensure ongoing achievement of environmental management objectives and to implement improvements when required. Section 5 outlines monitoring and performance guidance for each environmental consideration.

4 Facility planning and design

4.1 Overview

This section outlines key considerations for selecting the site of an organics processing facility and planning and designing it, to ensure appropriate technology is chosen and impacts to human health, amenity and the environment are effectively mitigated. Appropriate site selection can:

- **reduce traffic and transport distances** for feedstock, outputs and transport logistics
- **facilitate synergies between businesses** where one business uses outputs from another and vice versa
- **manage specific environmental impacts** such as odour, fire risk, noise, pollution of water, soil and land through consideration of topography, weather patterns and distance to sensitive receptors
- **reduce approval delays** by avoiding problematic site-selection concerns
- **impact economic viability** through availability of feedstock, transport costs, secondary treatment, distance to market, vehicle turnaround times
- **minimise cost** by minimising complexity of environmental controls and ongoing management
- **avoid significant establishment and operational costs** by reducing the environmental controls needed.

4.2 Key factors for planning and design

Consideration of the factors provided in Table 5 is recommended to inform site and processing technology selection. Technology specific considerations are outlined in Appendix A to Appendix G.

Table 5 Key factors to consider during planning and design

Factor	Considerations
Incoming feedstock	Are there available and appropriate feedstocks? Consider: • Quantity and composition of feedstock and a clear understanding of seasonal changes. • Suitability as input for chosen technology, C:N ratio, moisture content and sizing. • Impact of feedstock characteristics (including water sources) such as density and moisture, on mass and water balances. • Potential type and quantity of contamination (physical, chemical and biological), and impact on mass balance and output logistics. • Odour profile and consideration of controls. • Biosecurity risks. • Cost considerations such as feedstock gate fee. • Consideration of regulatory framework for outputs e.g. RRO/Es (refer to section 2.4.3).

Factor	Considerations
Site selection and site characteristics	Is the site suitable for the type and scale of organics processing activities? How do the site characteristics impact the viability and processing technology selection? Consider the following. • Permissibility – Identify whether zoning permits the proposed use and other constraints imposed by applicable planning instruments (e.g. Local Environment Plan (LEP), Development Control Plan (DCP), State Environmental Planning Policy). • Surrounding land use – Identify surrounding land uses that may buffer or constrain the facility and any planned changes (such as residential development) that could affect ongoing operation. • Distance from feedstock source – Determine feedstock transport costs, including connectivity to transport corridors. • Proximity to environmental or ecological sensitive receivers – Understand the source of emission(s), sensitive receiver(s) and emission pathway(s) for the site. Unsuitable locations may include: – sites with environmental or conservation value as identified under relevant legislation – sites that are close to sensitive receivers such as residential properties – sites that have unfavourable topography. • Meteorological conditions including seasonal weather, inversions, extreme or unexpected weather events, and prevailing winds in relation to sensitive receivers and potential litter movement. • Size of site – Whether the site can accommodate feedstock volumes, input and output storage and feedstock blending and future expansion requirements. • Topography considerations such as: – groundwater and surface water locations – ground stability and soil composition – slope and orientation – impact of surrounding topography under different meteorological conditions affecting the potential movement of odour. • Co-location or alignment with synergistic industries, feedstock sources, product markets, and proximity to infrastructure needed to manage contamination and other processing outputs. An early understanding of these factors is important to drive positive technoeconomic and environmental performance outcomes. • Connection to utilities and infrastructure such as water, sewerage (trade waste), telecommunications and energy needs • Proximity to fire or flooding zones • Contingency planning for extreme or unexpected weather events
Primary outputs	What is the market demand for primary outputs and required quality standards? Consider the following. • Need for blending to meet market needs • Compliance with relevant RRO and RRE or other relevant regulatory instruments • Compliance with relevant standards such as <i>AS 4454: Compost, soil conditioners and mulches</i> • Compliance with market requirements e.g. anaerobic digestion gas quality or vermiculture and insect bioconversion outputs

Factor	Considerations
Management of secondary outputs and rejects	Is there an understanding of the mass balance and the cost and challenges of managing secondary process outputs and rejects? Consider the following. • Treatment requirements for secondary outputs. For example, solid and liquid digestate from anaerobic digestion may undergo additional pasteurisation if required by the receiving facility and planned end use • Trade-waste capacity and discharge limits, or availability and cost of secondary water treatment • Management of contamination that has been removed from the feedstock during pre-treatment • Management of oversize material such as from final screening of composts. This includes sufficient space for storage as well as disposal. A clear understanding is required of the process mass balance and sensitivity of the mass balance to the volume of oversize material. • Mass balance to inform space, storage buffer capacity and logistics requirements for outputs • Water balance and sizing of process infrastructure to manage process requirements as well as any excess liquids

4.3 Technology overview

Processing technology selection is a critical component of facility planning and design, and technologies must be selected based on site constraints, feedstock characteristics and intended outputs. Technologies differ in terms of feedstock suitability, size, sensitivity to contamination, outputs and environmental management requirements.

Table 6 provides an overview of the key organic waste processing technologies. Detailed technology specific considerations, including common feedstocks, advantages, limitations, and recommended design and operational controls, are provided in Appendix A to Appendix G.

Table 6 Summary of organic waste processing technologies

Technology	Description
Composting	The breakdown of organic material in the presence of oxygen. Microorganisms use oxygen to decompose waste, generating heat, carbon dioxide (CO ₂) and stable end products. Aerobic processing technologies include windrows, aerated and non-aerated piles, and in-vessel systems. Composting includes pasteurisation as a managed process to significantly reduce the numbers of plant and animal pathogens and plant propagules, followed by maturation to achieve biological stability.
Anaerobic digestion	The breakdown of organic material in the absence of oxygen. Anaerobic bacteria digest the organic material in a controlled processing environment, producing biogas (mainly methane and CO ₂) and a nutrient-rich digestate. Variants can include both wet and dry anaerobic digestion suited to different feedstocks.
Insect bioconversion	Insect bioconversion uses insects (typically black soldier fly larvae) to rapidly consume and transform organic waste into outputs such as protein meal, oils and nutrient-rich frass, for the purposes of waste reduction, animal feed production and to process high-moisture food waste.
Dehydration	The controlled removal of moisture from organic material (usually food) using heat, mechanical processing or both, to stabilise the material, reduce odours, slow microbial activity and reduce the mass that needs to be transported or processed further.

Technology	Description
Vermicomposting	A process of bioconversion using worms to break down organic waste. Worms consume the material and produce vermicast (worm excreta) which can be used as a soil amendment. Vermicomposting relates to the broader process; vermiculture focuses on worm cultivation itself.
Mulching	Plant material shredded and/or screened to a preferred particle size and grading for particular applications.

4.4 Feedstock

Feedstocks must be identified and assessed during planning and design, as their characteristics determine technology suitability, processing requirements, environmental risk and output quality. Feedstocks must be compatible with the selected technology, either directly or through blending, as incompatibility can result in odour impacts, poor performance, reduced output quality, non-compliant outputs. Facility design must therefore reflect the expected feedstock mix over the facility life, including seasonal variation.

Once suitability is confirmed, feedstock-related risks must be identified and assessed, considering impacts on the process, outputs, human health, amenity and the environment, in proportion to the scale and complexity of the facility.

Examples of risks that should be considered during facility planning and design include environmental risks such as:

- odour and air emissions from odorous feedstocks or processing conditions
- leachate generation (e.g. resulting from wet and putrescible feedstocks)
- fire (e.g. resulting from dry or stockpiled feedstocks)
- noise and litter (e.g. resulting from feedstock handling and transport).

These examples are not exhaustive and may not be relevant to all facilities. The nature and significance of feedstock-related risks will vary depending on site-specific circumstances (e.g. distance to sensitive receivers, refer to section 4.2 (Table 5) for more information), feedstock sources and processing technology type.

Appropriate controls must be implemented to manage identified risks. For contamination, some example controls might include clear feedstock acceptance processes, robust supplier agreements and appropriate sampling and testing procedures.

Monitoring and performance requirements for feedstocks should be proportionate to the level of risk. They may include routine inspection, and sampling and testing to ensure that the incoming materials remain consistent with the facility's approved feedstock types, contamination assumptions and processing capacity. Performance is demonstrated by consistent acceptance of compliant feedstocks, low incidence of rejected material and an absence of environmental, operational, or output quality issues.

More detailed guidance on feedstock planning, risk and controls is provided in Appendix A.

4.5 Outputs

Facilities should be designed and operated with the principal objective of consistently producing high-quality processed organic primary outputs, such as composts or soil conditioners. To support

this objective, primary output production should be informed by anticipated feedstock volumes and should account for seasonal variations in the availability and composition of organic materials.

Suitable waste inputs should be selected to support defined output quality outcomes. Facilities that generate poor-quality or unsuitable primary outputs are inherently unsustainable, as they undermine market confidence and the long-term viability of organics processing. They also have the potential to disperse contaminants in the environment. The implementation of robust quality assurance and maintenance of consistent output quality are essential to sustaining and growing demand for primary outputs from organic processing facilities.

Key considerations for outputs during design and operation include:

Regulatory requirements

Facilities must be designed to produce outputs that comply with all applicable regulatory requirements. Outputs from organics processing facilities must meet the requirements of RROs issued by the EPA, while RREs define the conditions under which processed organics may be lawfully reused (see section 2.4.3). Where outputs are intended for specific end uses, additional regulatory requirements may apply. For example, outputs proposed for land application must meet relevant biosecurity requirements, including those specified in the Biosecurity Regulation 2017.

Voluntary output standards

Facilities should also meet recognised voluntary standards (where relevant) to demonstrate output quality and consistency. These may include Australian Standards, such as AS 4454: Compost, soil conditioners and mulches, as well as industry or customer specifications for digestate or liquid fertiliser outputs, and applicable standards or specifications for animal feed outputs. It should be noted that these standards do not replace the requirement to meet RRO/Es.

Risks to human health and biosecurity

Outputs can present risks to human health, agricultural biosecurity, and the receiving environment if not appropriately stabilised, stored, handled and managed. Where animal-derived materials (also referred to as restricted animal materials (RAM)) or biosolids are present in feedstock, the resultant outputs are subject to additional restrictions before land application (Appendix A.3.2). To manage these risks, facilities should consider the management of contaminants, including pathogens, physical and chemical contaminants and plant propagules. In particular, to address the risk posed to human health from pathogens present in incoming feedstocks, facilities are required to expose relevant process streams to sufficient temperature over an extended period of time to achieve pasteurisation, or alternatively demonstrate that another method of pathogen reduction achieves the same outcomes as the pasteurisation method defined in the Compost Order 2016.

Failed batches

Where outputs do not meet regulatory or quality requirements (failed batches), they must be managed through reprocessing, further treatment, or lawful disposal at a facility authorised to receive the material. Rejects and failed batches present specific environmental and operational risks and must be appropriately segregated, contained and stored to prevent environmental impacts.

Adequate storage

Adequate storage space for all outputs should be appropriately designed with regard to the expected material volumes and the management of environmental risks such as water contamination and odour emissions. This includes consideration of whether output storage areas require cover to minimise odours and leachate generation from stormwater exposure. Facility design should also consider how outputs will be stored before and during transport, including whether materials are typically bagged, bulked for sale, or pumped into tankers.

Loading

Suitable infrastructure should be provided to support safe and efficient loading, along with appropriate labelling for outputs to support quality control and traceability, where applicable. Environmental impacts and design controls for organics processing facilities are discussed further in section 5.

Output-related risks should be identified and addressed through the facility risk assessment. Further guidance on output and rejects management is provided in section 6.6 and technology specific information from Appendix B through to Appendix G.

5 Environmental management

5.1 Environmental considerations

Effective environmental management is essential to ensure organic waste processing facilities operate safely and minimise impacts such as odour, emissions, soil and water contamination, and risks to human health and amenity.

This section identifies the key environmental considerations relevant to organic waste processing facilities. It addresses the primary risks associated with facility operation and is not intended to be exhaustive or to replace site-specific environmental assessment.

Environmental management measures are based on the risk assessment framework outlined in section 3.

For each environmental consideration, this section specifies:

- an **overarching objective**
- an overview of the process to **identify and assess** the risks specific to the environmental consideration
- **standard design controls**
- **monitoring and performance** requirements to demonstrate effective management.

Table 7 summarises the key environmental considerations and objectives for organic waste processing facilities.

These environmental considerations are common to all sizes and scale of organics processing facilities and should be reviewed through a risk assessment process. The selected design and operational controls and any associated monitoring requirements are then typically documented in an Environmental Management Plan (EMP) and/or Operational Environmental Management Plan (OEMP). These plans are generally required as part of development consent and environmental licensing processes (refer to section 2.4).

Please note that the design controls in this section are provided as guidance only and not meant to be exhaustive. Site-specific risks should be assessed to inform the types and extent of controls needed.

Table 7 Summary of environmental considerations and objectives for organic waste processing facilities

Consideration	Objective
Air emissions	Controls for emissions to air from the facility are designed such that the assessment criteria set out in the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA, 2022) and the Clean Air Regulation are met. Section 129 of the POEO Act, which prohibits the emission of offensive odour from licensed premises, is complied with. All controls identified during design and assessment are implemented. Risks to public health are minimised.
Land and water	Prevention of pollution to land and water, including soil, groundwater and surface waters.
Noise	To design and implement the measures necessary to meet the noise criteria derived for the premises as set out in the Noise Policy for Industry (EPA, 2017).

Consideration	Objective
Fire	Ensure that the existing or proposed fire prevention, detection, protection and firefighting measures are appropriate for the specific fire hazard and adequate to meet the extent of potential fires.
Litter	The local amenity must not be degraded by litter emanating from the organics processing facility.

5.2 Air

5.2.1 Overview

Organic waste processing facilities have the potential to emit odour, particulate matter, and bioaerosols during receipt, handling, storage and processing. Additional air emissions may be generated through odour control systems and the combustion of biogas.

Emission sources will vary by operation and should be controlled to protect amenity, human health, the environment (including climate) and safety.

This section sets out the objectives, assessment approach, controls and monitoring requirements to minimise off-site impacts to the environment and community from air emissions.

5.2.2 Objective

- Controls for emissions to air from the facility are designed such that the assessment criteria set out in the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (EPA, 2022) and the Protection of the Environment Operations (Clean Air) Regulations 2022 (Clean Air Regulation) are met.
- Section 129 of the POEO Act, which prohibits the emission of offensive odour from licensed premises, is complied with.
- All controls identified during design and assessment are implemented.
- Risks to public health are minimised.

5.2.3 Identify and assess

Potential emissions to air should be identified and assessed during the planning and design of an organic waste processing facility and reviewed where material changes to operations are proposed. Assessment is required to inform site selection, facility layout, technology selection, emission controls and monitoring requirements.

Air emissions assessments should be proportionate to the scale, risk and proximity of sensitive receivers. Assessment outcomes should be used to define design controls, operational limits, mitigation/management measures and monitoring requirements to be documented in an air quality impact assessment (AQIA) and air quality management plan (AQMP). Air emissions assessments should be supported where relevant by an odour impact assessment and an odour management plan. The assessment should identify:

- all emission sources and emission scenarios
- pollutants of concern, such as odour, particulate matter, methane and biogas, nitrogen oxides, sulfur oxides and non-methane volatile organic compounds
- emission pathways and dispersion characteristics

- off-site sensitive receivers
- cumulative impacts.

Potential sources of odour for consideration include:

- odorous feedstock received, stored, blended and processed at facility
- compost or feedstock pile turning (where relevant)
- output management (for example liquid and solid digestate from AD, insect larvae and frass from insect processing, process water)
- odour treatment equipment (such as chemical scrubbers and biofilters)
- exhaust air from building.

Air quality and odour assessment/modelling must be undertaken in accordance with the:

- *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (EPA, 2022)
- *Technical Framework of Assessment and Management of Odour from Stationary Sources in NSW* (DEC, 2006)
- *Technical Notes of Assessment and Management of Odour from Stationary Sources in NSW* (DEC, 2006), including the application of relevant impact assessment criteria and modelling techniques
- Odour source monitoring must be undertaken in accordance with the *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW* (EPA, 2022).
- Odour field surveys should be undertaken in accordance with *Guide to Conducting Field Odour Survey* (EPA, 2021) or any project-specific adaptation of internationally recognised methodologies such as German Standard VDI 3940 and European Standard EN 16841 (where appropriate and in consultation with EPA or the authorising agency).

The risk of bioaerosols should also be considered. A microbial risk assessment may be required if the organic processing involves generation of bioaerosols and a complete source-pathway receptor exists between the bioaerosol emissions from the site and off-site human populations.

5.2.4 Design controls

Emissions controls should be selected based on site-specific considerations, processing technology, feedstock characteristics and proximity to sensitive receivers. Controls should be applied in line with the risk mitigation hierarchy. Emissions should be avoided where possible; if this cannot be achieved, risks should be minimised through source control, containment and treatment, with operational measures used only as a last resort.

Process design and layout should allow for future augmentation or retrofitting of controls to address facility expansion, changes in feedstock, or residential encroachment. Some typical controls for different emission types are summarised in Table 8.

Table 8 Emissions design controls

Risk/hazard	Goal	Design controls
Odour	Design of facility so that offensive odours do not create amenity impacts upon sensitive receivers.	• Maintain adequate buffer distance: Implement adequate buffer distances between a facility and sensitive receivers to reduce public exposure. • Containment of odour sources: Enclosure of receipt, processing and storage areas as far as is reasonably practical to contain odour. • Containment of highly odorous materials: Storing rapidly biodegradable or highly odorous material such as food, dairy waste, fish waste in contained areas or vessels with odour extraction. • Refer to section 6.3 and section 6.4 for additional operation controls to support odour management. • Odour treatment systems: Odour treatment such as biofilters (with or without chemical scrubber). If ammonia levels are expected to be high due to feedstock types, they can reduce the effectiveness of a biofilter and may need to be treated using chemicals prior to biofiltration. • Leachate system design: Ensuring that leachate drains and storage ponds are designed and managed appropriately to mitigate risk of odour generation due to anaerobic conditions forming. This includes ensuring that no leachate pooling occurs through both design and operational measures. Refer to section 5.3 for additional detail. • Contingencies for prolonged wet weather events or other failures causing odours: Facility design should consider effective odour containment and treatment during prolonged wet weather events and abnormal operating conditions. Design controls could include surge capacity for incoming feedstock (e.g. covered bunkers), weather proofing and containment of receipt and processing areas, odour control systems sized for peak and upset loads, the ability to augment odour controls where required and forced aeration systems sized for wet and dense material (for composting). • Internal odour control and ventilation: Building ventilation and odour controls should protect operator amenity and occupational health and safety (refer to section 6.7.3) and may also reduce ambient odour through source control.
Particulate matter	Design facility to effectively manage airborne particulate matter and nuisance dust from feedstock and output handling, process and transfer.	• Maintain adequate buffer distance: Implement adequate buffer distances between a facility and sensitive receivers to reduce public exposure. • Sealed surfaces: Constructing sealed or gravel surfaces on site will reduce the generation of entrained dust. This issue can also be managed operationally by spraying water or surface sealants on these surfaces for dust suppression. • Dust capture at process points: Bulk organic material automated processing, handling and transfer operations may generate nuisance dust levels that may require means of capture

Risk/hazard	Goal	Design controls
		(hoods), extraction (fans) and filtration (dust collectors), to ensure environmental emissions are within EPA guidelines. • Protection of stormwater systems: Protect stormwater systems from settling airborne particulate matter by employing vegetated swales, interceptors and/or retention ponds.
Bioaerosols	Design facility to minimise emission of bioaerosols and minimise risk to public health.	• Maintain adequate buffer distance: Implement adequate buffer distances between a facility and sensitive receivers to reduce public exposure. • Air filtration and ventilation: Ensure indoor facilities have high air-change rates and utilise air filtration systems.
Other air pollutants (such as nitrogen oxides, sulfur oxides and non-methane organic compounds)	Design facility to minimise emissions to air.	• Combustion equipment emission controls: Engines and boilers using biogas as fuel should have emission controls. These may include pre-treatment of biogas (e.g. removing high hydrogen sulfides and moisture levels to prevent damage to engines), engine specifications (e.g. low nitrogen oxides burner) and exhaust treatment. Provisions specified in the Clean Air Regulation should be followed where relevant. • Flare design: Gas flares should be provided and sized appropriately where used to manage excess gas, bypass gas engine when off-specification conditions occur or when engines are undergoing maintenance. Flares should be located at ground level, shrouded, provided with automatic combustion air control, an automatic shut-off gas valve and an automatic restart system. • Flare performance: Biogas enclosed flares should be designed to achieve a destruction efficiency of greater than 98% for non-methane organic compounds, residence time of more than 0.6 seconds and temperature greater than 760°C, as per Clause 68 of the Clean Air Regulation.

5.2.5 Monitoring and performance

Performance is influenced both by good design and operational management. Monitoring of emissions should be proportionate to risk, which will be informed by impact assessments and defined in regulatory and licence conditions. Where monitoring is required during operation, sampling and analysis must be undertaken using the Approved Methods for the Sampling and Analysis of Air Pollutants (EPA, 2022), as specified by development consent or EPL conditions.

Monitoring and performance considerations for different types of emissions are provided in Table 9.

Table 9 Monitoring and performance considerations for emissions management

Emission type	Monitoring	Performance indicators
Odour	- The frequency, location and type of odour monitoring is informed by the odour risk, based on the odour impact assessment. - Monitoring may be conducted at source, at the site boundary and/or at the receivers (as appropriate to the risk).	- A clear understanding of the odour intensity generated by site operations, odour emission pathways, and the implementation of effective management measures to control those odours. - The facility demonstrates that emissions, when modelled under typical and worst-case conditions (including meteorological), will not impact sensitive receivers. - Demonstrate good performance by an absence of verified odour complaints, and compliance with section 129 POEO Act and relevant EPL conditions. - All odour control equipment is to be appropriately designed to site conditions and operated as per vendor specifications. Regular monitoring of critical parameters of equipment operations is to take place to demonstrate/ensure performance. - All other odour controls (design and operational procedures) are to be appropriately designed, monitored and recorded to demonstrate/ensure performance.
Particulate matter	The frequency, location and type of particulate matter monitoring is informed by the relevant risk assessment and identification of source and receiver.	- A clear understanding of the particulate matter generated by site operations and their emission pathways and the implementation of effective management measures to control particulate matter. - The facility manages particulate matter emissions, as informed by the AQIA for the site. - The facility is designed and operated in line with the EPL conditions to ensure that the performance objective is met. - All particulate matter control equipment is to be appropriately designed to site conditions and operated as per vendor specifications. Regular monitoring of critical parameters of equipment operations is to take place to demonstrate/ensure performance.

		All other particulate matter controls (design and operational procedures) are to be appropriately designed, monitored and recorded to demonstrate/ensure performance.
Bioaerosols	- The frequency, location and type of bioaerosol monitoring is informed by the microbial risk assessment (if required). - Monitoring for bioaerosols involves collecting airborne microorganisms (bacteria, fungi, viruses) or their by-products using active (sampling pumps) or passive (settle plates) methods, followed by identification.	- Regular monitoring of bioaerosols may be required to ensure bioaerosol loads (colony forming units (CFUs) or similar) do not cause a risk to worker health or public health as a performance indicator. - All bioaerosol controls (design and operational procedures where required) are to be appropriately designed, monitored and recorded to demonstrate/ensure performance.
Other air pollutants (such as nitrogen oxides, sulfur oxides and non-methane organic compounds)	- Biogas generation rate. - Operating parameters/frequency of flaring and/or internal combustion engines through Supervisory Control and Data Acquisition (SCADA) system.	- Combustion equipment utilising/controlling biogas is to be designed and operated with the expected rate of biogas generation, in line with that assessed in the AQIA. - All critical operation parameters of the combustion equipment are to be monitored and recorded to demonstrate/ensure performance (do not exceed design parameters).

5.3 Land and water

5.3.1 Overview

Organics processing facilities generate and handle multiple water streams that, if not properly controlled, have the potential to cause pollution to land, groundwater and surface water. The pollutants associated with organics processing facilities originate primarily from the organic waste materials themselves, where nutrients, metals, pathogens and other contaminants present in the feedstocks are mobilised and transferred into liquids as water moves through, contacts or drains from stored and processed organics.

Typical sources of water that need to be managed and controlled for organic waste processing facilities include stormwater run-off, leachate, floodwater (where relevant), dust suppression water, firefighting water and wash water from cleaning equipment or machinery. Effective water management controls are therefore required to protect the environment, meet regulatory requirements, maintain facility performance and minimise impacts on community health and amenity.

5.3.2 Objective

Prevention of pollution to land and water, including groundwater, surface water and soils.

5.3.3 Identify and assess

There may be potential for pollution of groundwater, surface water and/or soils depending on the proposed operations.

If pollution of water or soils is an identified risk for the facility, a site water balance and water quality impact assessment will be required during site assessment, planning and design. These assessments will identify potential interactions with surface water, groundwater and soils, assess pollution risks and determine the need for further detailed assessment. An important function of the assessment is to understand the background characteristics of the groundwater and surface water bodies that may be at risk, with this information forming the basis for ongoing management. Site hydrology, sensitive receivers, and potential pollution sources and pathways should be considered.

A surface water and groundwater impact assessment may be prepared during design to confirm risks and define the design controls needed to prevent land and water pollution. The assessment must be informed by a site water balance and updated when there are material changes to design capacity, feedstock risk profile, operations, or monitoring outcomes. A surface water and groundwater impact assessment would typically consider:

- source, pathway and receiver linkages (including surface water, groundwater, drainage lines and off-site receivers)
- site conditions affecting risk (e.g. topography, drainage, soil permeability, groundwater depth, flood exposure)
- water balance including the expected stormwater run-off and leachate volumes under normal and wet-weather conditions
- contaminant risks (e.g. nutrients, metals, organics, suspended solids, pathogens and emerging contaminants)
- required containment, treatment, reuse and lawful disposal pathways.

5.3.4 Design controls

The site should be engineered to ensure that water and liquids in contact with organic materials, storage or processing areas (including stormwater from these areas) are not discharged to the environment. Stormwater outside of these areas is not considered to be contaminated and can be diverted to normal stormwater discharge points.

To support design and operational parameters, a water balance should be established, considering:

- (e.g. rainfall, feedstock moisture, process/cleaning water, fire management water)
- outputs (e.g. evaporation, moisture in outputs, leachate generation, run-off)
- on-site storage (e.g. tanks and ponds).

Maintaining an accurate water balance is essential for site management, guiding leachate and stormwater infrastructure design, preventing water, groundwater and soil pollution, ensuring compliance, and helping operators manage seasonal changes, extreme weather and operational risks for safe, sustainable facility operation.

Water management controls should be selected based on the specific risks identified in the surface water and groundwater impact assessment with the objective of clean and contaminated water segregation. Table 10 outlines some typical engineering controls to prevent pollution to land and water.

Table 10 Land and water pollution design controls

Risk/hazard	Goal	Design controls
Surface water contamination	Design site to minimise surface water and groundwater contamination and provide effective stormwater management.	All water that makes contact with waste should be handled and treated in the same way as leachate. Therefore, design controls to prevent surface water from interacting with incoming organics, primary and secondary outputs, rejects and any contaminated materials should be implemented. Surface water collected from waste-free open areas should go through appropriate stormwater treatment to prevent pollution of waters, according to the environmental sensitivity of receiving waters. Examples of on-site retention and treatments include: • grass-lined swales • bioretention swales • bioretention basins • sedimentation basins • gross pollutant traps • stormwater filtration devices • rainwater harvesting • permeable pavements. Surface water treatment must meet local government area stormwater management requirements, including pollutant reduction targets and on-site detention requirements.
Uncontrolled release of contaminated water	Design to prevent contaminated water from leaving the site or leaching into the environment.	To prevent contaminated water leaving the site, the water management system should consider: • the full water balance for the site including provisions for managing water streams such as cleaning/wash water and fire management water. For example, drainage and tanks for wash down water and recirculation. To prevent contaminated water leaving the site, any working areas where organic waste is managed (from feedstock receipt and processing of outputs and final storage, in and out of buildings) require: • construction using low-permeability materials such as concrete, clay, geomembranes or other low-permeability materials • drainage for working surfaces to include drains/falls and other engineering controls to reduce standing water and hydraulic gradient • appropriate design life and maintenance of all working surfaces to prevent cracking, chemical attack (organic acids, sulfides and ammonia) or deterioration of surfaces • close attention to redundancy of systems

Risk/hazard	Goal	Design controls
		• bunding of areas for chemical truck delivery areas, chemical storage tanks, chemical scrubbers, leachate storage tanks and liquid waste storage tanks. Concrete collection sumps, pits and basin for leachate and liquid waste processing areas • firewater containment strategy (i.e. separation of firewater drainage/swales from stormwater and firewater retention ponds).
Leachate collection and management	Prevent leachate from impacting subsoil, groundwater and surface water bodies. Ensure leachate is collected efficiently at the facility for further management.	• Low-permeability working surfaces and adequate leachate drainage systems designed to prevent pollution of water or land by leachate. Construction of drainage barrier systems may include: — Low-permeability mineral liners such as clay with protective surfaces. — mineral/geosynthetic composites. — concrete pad with blended chemical sulfate resisting cement (Type SR) and resin based concrete coating systems. • Processing stages designed such that leachate drainage is adequately managed in terms of operational serviceability. • Leachate systems designed to be able to clear blockages effectively (rod points/cleaning access). • Design informed by a comprehensive appreciation of the site water balance and concrete durability assessment.
Storage of leachate	Effectively store leachate and prevent contamination of surface water and groundwater.	• Leachate storage volume to be determined by water balance assessment. • Storage of leachate in either lined open dams or above-ground storage tanks. • Above-ground storage tanks surrounded by a bund with capacity of 110% containment of the largest tank or 25% of the total stored volume whichever is the greater. • Bunding designed correctly to hold the type and volume of liquids stored. Lined with impermeable barriers and maintained, leak-free. • Bunding provided as needed for unloading and loading of any containers or trucks needed for operation such as chemical scrubbers and other imported process chemicals. • Leachate storage dam to have freeboard to accept rainfall directly on the dam from a 24-hour rainfall event with a minimum 2% annual exceedance probability (AEP) rainfall event before overflowing. • Facility design should appropriately consider flood risk. Key items for consideration include site selection outside of floodplains, flood-resilient layouts to keep high-risk areas out of flood zones, bunding and containment designed based on flood risk, freeboard above certain AEP event levels, consideration of scouring, uplift etc. • Open leachate dams constructed with combinations of the following elements: — Liner system: i. compacted clay layer or geosynthetic clay liner

Risk/hazard	Goal	Design controls
		ii. flexible membrane liner such as HDPE, fully welded and tested. The membrane should achieve a performance equivalent to or better than that of a clay liner with an in-situ hydraulic conductivity of $\leq 1 \times 10^{-9}$ m/s — Coverage: Extends across the base and side walls of the pond and is securely terminated in anchor trenches to prevent leakage and liner slippage. — Design life and capacity: Sized to accommodate operational leachate volumes, storm events and contingency storage, informed by a site-specific water balance. — Construction quality assurance (CQA): Installed under a construction quality assurance program, with testing and certification by a suitably qualified engineer. — Risk-based flexibility: Alternative liner designs where proponents can demonstrate that they provide equivalent or better environmental protection. • Sufficient leachate treatment and disposal capacity should be identified and used to prevent the build-up of leachate and an increase in the risks of water pollution and offensive odours. Options include: — on-site leachate treatment plant — discharge to sewer under a discharge agreement with the local water authority — off-site transport to a licensed treatment facility — evaporation — irrigation such as onto compost material to aid in composting, subject to any treatment that may be required and consideration of pasteurisation controls etc. — off-site discharge to surface water subject to discharge consent limits. • Untreated leachate should not be disposed of to off-site water or land, or used for dust suppression. Depending on the characteristics of the leachate, it may be used to supply the water needs at the front end of a process if there is no risk of recontamination of an output: for example, leachate could be used to inoculate compost.

5.3.5 Monitoring and performance

Monitoring for design performance may include, but not be limited by, the following considerations:

- testing and quality assurance of systems constructed for containment and hardstand integrity e.g. concrete durability and drainage systems
- leachate and contact water storage capacity i.e. addressing water balance and incorporating adequate factors of safety, regular desludging or desilting to maximise storage as required
- liner and barrier system performance construction quality assurance where required
- flood protection measures
- chemical and fuel storage containment design compliance
- emergency and backup system design.

A facility may be required to establish and maintain a water management plan (WMP) informed by the surface water and groundwater impact assessment and updated when there are material changes to operations, design capacity, incoming organics risk profile, or monitoring outcomes.

Monitoring and analysis must be conducted in accordance with *Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales* (EPA, 2022), and where licensed, monitoring design and reporting must be consistent with EPL conditions (where applicable).

Performance is achieved when monitoring shows:

- no material deterioration in groundwater, surface water or soil quality attributable to the facility's activities
- effective containment and management of leachate and separation of stormwater within engineered and operational controls
- monitoring, reporting and incident response are conducted in accordance with EPL conditions (where licensed) and relevant EPA requirements.

5.4 Noise

5.4.1 Overview

Noise is a key consideration in the planning, design and operation of organics processing facilities. Facilities must be designed and operated to minimise noise impacts on surrounding land uses, particularly sensitive receivers.

5.4.2 Objective

To design and implement the measures necessary to meet the noise criteria derived for the facility as set out in the *Noise Policy for Industry* (EPA, 2017).

5.4.3 Identify and assess

A noise impact assessment should be undertaken to:

- characterise existing background and ambient noise levels at relevant sensitive receivers. Noise impacts must be assessed in accordance with the *Noise Policy for Industry* (EPA, 2017), which defines the noise criteria (project noise trigger levels), above which adverse impacts on the

community may result. More stringent criteria may exist in local government regulations and should be addressed where required

- predict operational noise impacts generated by the facility, which may include:
 - external noise emitting operational equipment, such as process fans and blowers, exhaust fans, compressors, process plant (e.g. shredders, mixers, blenders), backup diesel generators, flares, mobile plant (e.g. front-end loaders) and large vehicles
 - activities including loading/unloading, materials handling, processing and mixing, and deliveries
- identify measures to minimise and manage noise impacts from operation of the facility where appropriate.

5.4.4 Design controls

Noise impacts should be managed through a combination of site planning, facility design and appropriate operational practices. Noise mitigation measures should be considered early in the design process and refined as part of the noise impact assessment.

Some examples of acceptable noise control measures are summarised in Table 11.

Table 11 Noise design controls

Risk/hazard	Goal	Design controls
Unacceptable noise	To design and implement the measures necessary to meet the relevant noise criteria.	• Incorporating separation distances and buffers between noise sources and receivers. • Keeping noise-generating equipment within the building. • Installing acoustic barriers, enclosures, silencers or screens. • Selecting low-noise plant and equipment and applying acoustic treatment where required. • Designing site infrastructure (such as speed humps, vibration grids and traffic surfaces) to minimise impulsive or tonal noise.

The selection of controls must demonstrate that feasible and reasonable mitigation measures have been implemented to achieve compliance with the applicable noise criteria. Where exceedances persist, a study into the nature of residual exceedances is required.

5.4.5 Monitoring and performance

The project noise trigger levels established in accordance with the Noise Policy for Industry provide the primary performance benchmark for operational noise, provided more stringent criteria, such as Local Government requirements, do not apply.

Facilities must be designed and operated to comply with the applicable noise criteria under representative operating and meteorological conditions. Where required by development consent or regulatory instruments, noise monitoring must be undertaken in accordance with the *Approved Methods for the Measurement and Analysis of Environmental Noise in NSW* (EPA, 2022).

Performance is demonstrated by:

- compliance with the applicable limit set out in a consent or an EPL when assessed using appropriate methods

- the absence of substantiated noise complaints attributable to the facility
 - an absence of verified noise complaints, together with demonstrated compliance with relevant noise criteria, indicates that the noise management objective is being met.
-

5.5 Fire

5.5.1 Overview

Organic waste processing facilities inherently carry fire risk, as such potential sources of fire need to be identified and assessed. Fires can damage infrastructure, threaten worker and community safety, degrade local amenity (smoke/odour), and lead to polluted run-off from firefighting water and impacted materials. Facilities must adopt a structured, site-specific approach to prevent fires, minimise their impact in the event of an incident, ensure occupant safety and facilitate firefighting.

5.5.2 Objective

Ensure that the existing or proposed fire prevention, detection, protection and firefighting measures are suitable for the specific fire hazard and able to meet the extent of potential fires.

5.5.3 Identify and assess

A fire safety management plan should be developed to identify, assess and control fire risks to support the selection of appropriate design controls. This may be undertaken through Fire Hazard Identification which may include:

- inventory of flammable and combustible materials
- hazardous area classification
- identification of ignition sources and potential fire or explosion scenarios
- bushfire-prone area overlay.

In some situations, a fire hazard analysis may also be required. This can include:

- simulation of thermal radiation and explosion overpressure
- consequence analysis of radiant heat flux vs distance
- investigation of impact zones for people, property and the environment
- propagation of an explosion through the ducting system.

The Fire and Rescue NSW (FRNSW) *Fire Safety Guidelines: Fire safety in waste facilities* (FRNSW, 2020) and *Access for fire brigade vehicles and firefighters* (FRNSW, 2020) may be helpful in informing the fire safety management plan.

5.5.4 Design controls

The hierarchy of controls should be applied in fire risk management. Where feasible, the risk should be eliminated through design. If the risk cannot be eliminated, appropriate controls should be applied to minimise the remaining risk. Examples of controls for managing fire risk are shown in Table 12.

Table 12 Design controls for fire risk management

Risk/hazard	Goal	Description
Fire	Early fire detection and adequate fire protection.	Provision of fire detection and protection requirements such as: - for enclosed buildings, an appropriate fire detection and warning system (e.g. smoke, heat, spark, flame detectors, thermal cameras) - active protection (e.g. sprinklers, hydrants, foam systems) - passive protection (e.g. fire-rated walls, barriers) - explosion protection (e.g. explosion vent panels, containment and isolation). Provision of first-aid fire protection such as: - portable extinguishers, hose reels and fire blankets suitable for identified fire classes - accessibility and signage.
Inadequate water supply and uncontrolled release of firefighting water	Adequate firefighting water supply and containment.	Understand demand for adequate firefighting water supply by: - calculation of required firewater flow rates and pressures - assessment of water supply capacity, storage and reliability. Design for redundancy and backup systems. Design suitable containment of contaminated firewater through bunding, drainage and contaminated fire water retention systems.

5.5.5 Monitoring and performance

The management objective is met by managing fire risks through a fire safety management plan. Fire scenario planning should be part of the emergency management plan. The fire safety management plan should be adhered to at all times. Staff must be informed of this plan and have ready access to it, so appropriately trained personnel are present whenever the facility is staffed.

The fire safety management plan should be part of an emergency management plan, and include:

- identification and assessment of potential fire risks
- details of design and operational controls to address identified risks
- details of signage and locations of firefighting equipment
- maintenance schedules for firefighting equipment and facilities
- evidence of maintenance
- requirements for staff training

An emergency management plan should include:

- information, training and instructions to relevant workers about the emergency procedures and how to effectively respond to an emergency
- evacuation procedures
- notifying emergency services quickly
- medical treatment and help
- protocols for communication between the emergency response coordinator and all people at the workplace
- when and how to do emergency procedure testing.

The occupier must implement monitoring and record keeping that demonstrates the fire safety management plan is being maintained and remains effective, including:

- maintenance and testing of essential services to *AS 1851: Routine service of fire protection systems and equipment*
- routine checks that equipment signage is clear and access is unobstructed
- inspection and maintenance of firebreaks as specified in the fire safety management plan
- training records demonstrating staff competency and refresher training in accordance with the fire safety management plan.

5.6 Litter and tracking of material off-site

5.6.1 Overview

Organics processing facilities can affect local amenity if litter or site materials are allowed to leave the premises. The facility should be designed and operated so that litter is controlled at source, contained within operational areas, prevented from leaving the site boundary and promptly collected when it occurs.

5.6.2 Objective

The local amenity and environment must not be degraded by litter emanating from the organics processing facility.

5.6.3 Identify and assess

Potential sources of litter should be identified. Litter may be introduced with incoming organics (for example, packaging and other contaminants) and may also be generated or mobilised during receipt, handling, processing, screening, storage and transport activities. Wind, vehicle movements and poor housekeeping can contribute to litter being spread within the site or beyond the boundary. Mud and litter on vehicle wheels leaving the premises can also affect local amenity and the quality of surface water run-off. The risk of litter should be assessed and suitable controls implemented.

5.6.4 Design controls

The design of the facility must control litter and site materials so that local amenity and environment is not degraded. Table 13 shows design controls for managing litter.

Table 13 Design controls for litter management

Risk/hazard	Goal	Description
Litter leaving the site	The local amenity and environment must not be degraded by litter emanating from the facility.	• Careful management of incoming feedstock in open areas. • Careful management of processed material prior to screening. • Wheel washing or wheel cleaning facility for use by vehicles as required, with the method selected to suit site traffic and local conditions. • Provision of truck body and tray cleaning and disinfecting facilities for open-bodied vehicles (if used). • Where litter risk is elevated (for example, contaminated incoming loads or exposed handling areas), additional measures should be implemented, such as installing and maintaining litter fences and ensuring they are effective and cleared regularly.

5.6.5 Monitoring and performance

To demonstrate effective litter control, the occupier should monitor performance through:

- checks that wheel washing/cleaning facilities are available and used as intended, to prevent tracking of mud and litter beyond the premises
- routine inspection of receipt, processing, storage and traffic areas and the site boundary, including fences and gates, to confirm that litter is being controlled and removed promptly
- inspection of adjacent roads and nearby areas to confirm that effective steps are being taken to prevent litter leaving the site and to retrieve it if it does.

Compliance with the objective is measured by:

- the absence of litter and site material emanating beyond the boundary of the premises
- the absence of mud and other types of dirt, organics, wastes and litter being carried by vehicles from the facility and deposited on roads outside the facility and nearby streets
- inspections confirming the facility and nearby areas are kept free of wind-blown litter and site materials, no more than one working day after windy weather.

6 Facility operation

6.1 Introduction

Robust operational management is essential for organics processing facilities to achieve their intended environmental, human health and resource recovery outcomes. The most significant impacts associated with organics processing facilities (such as odour incidents, water pollution, fire events, contamination of recovered outputs and community complaints) are most often caused by day-to-day operational practices, rather than technology choice alone.

Effective operation of organics processing facilities relies on anticipating risks, maintaining discipline in daily practices, and continually adapting operations to protect human health, the environment and community amenity. This requires a risk-based, whole-of-facility approach, supported by competent staff, and fit-for-purpose infrastructure and procedures across all stages of operation. Operational controls must be proportionate to the scale, complexity, feedstocks, and location of the facility, and must be capable of adapting over time as conditions change.

This chapter outlines the key operational consideration and is intended to support operators, regulators, and consent authorities in understanding the operational elements that underpin good environmental performance and regulatory compliance.

6.2 Operational risk-management framework

Operational activities should be informed by a structured risk-management process that identifies hazards, assesses risks, and implements controls to eliminate or minimise the likelihood of harm. Organics processing requires operators to proactively manage foreseeable risks rather than respond reactively to incidents.

Key principles

- Identifying hazards associated with feedstocks, processing activities and primary or secondary outputs
- Assessing risks to human health, the environment and amenity
- Implementing preventative and mitigative controls
- Monitoring performance and reviewing controls over time

Operational risk management should be embedded in routine decision-making, staff training, maintenance planning and continuous improvement processes.

6.3 Receiving and acceptance of feedstocks

6.3.1 Feedstock acceptance controls

The receiving stage is one of the highest risk operational phases for organics processing facilities. Poor control of incoming materials is a primary cause of downstream environmental and output quality issues.

Operational considerations include:

- clearly defined feedstock acceptance criteria aligned with approvals, licences, and regulatory requirements for outputs according to relevant RRO/Es
- documented inspection procedures at receipt
- processes for identifying, isolating and rejecting non-conforming loads
- contractual and commercial mechanisms to manage contamination at source.

Facilities should ensure that staff responsible for receipt are trained and empowered to refuse non-compliant material.

More detail on feedstock acceptance controls is provided in Appendix A.

6.3.2 Managing contamination

Contamination (physical, chemical, or biological) poses risks to equipment, workers, end users and receiving environments. Contamination may compromise compliance with RRO/Es or result in unlawful disposal.

Operational measures may include:

- pre-sorting, de-packaging, or screening systems
- segregation of higher-risk feedstocks
- monitoring contamination trends over time
- continuous engagement with suppliers to improve feedstock quality.

More detail on the management of contamination is provided in Appendix A.

6.3.3 Managing compostable caddy liners

The provision of compostable kitchen caddy liners may be used to make it easier for residents to collect and transport food scraps, increasing participation rates. These may include:

- compostable plastic kitchen caddy liners that comply with AS 4736 for commercial composting
- fibre-based kitchen caddy liners (e.g. paper or newspaper).

Operators can find it hard to distinguish compostable liners from non-compostable liners during the decontamination process. Processors may therefore need to consider:

- how certified and non-certified compostable liners will be identified
- whether the facility can appropriately process the compostable liners
- whether the compostable liners will need to be removed and, if so, how will they be removed and disposed of.

6.4 Storage and handling of organic materials

6.4.1 Storage of incoming feedstocks

Storage of organic materials must be actively managed to prevent odour generation, leachate formation, vector attraction, and fire risk. Storage duration and pile configuration is one of the critical operational factors influencing risk.

Feedstocks that are wet or high in nitrogen, sulfur, protein or fat decompose rapidly and can generate odorous gases. Odour risks increase with long storage times, warm weather, and activities such as turning piles or unloading trucks. Anaerobic zones can form within stockpiles, further elevating emissions. These risk factors need to be carefully controlled and managed.

Operational considerations include:

- minimising residence time of putrescible materials
- appropriate pile sizing and geometry
- separation of incompatible materials
- protection from rainfall where necessary.

6.4.2 Internal material movement

Material handling activities, such as loading, turning, mixing and transfer can trigger emissions, noise, litter and safety risks. Facilities should manage traffic flows, operating hours and equipment use to minimise off-site impacts and amenity protection.

6.5 Process operation and control

6.5.1 Process monitoring

Effective process control is fundamental to achieving stabilisation, pathogen reduction, and emission control objectives. Failure to maintain appropriate operating conditions is a common contributor to odour and output quality issues.

Operational controls may include:

- Stockpile identification and tracking.
- Regular monitoring.
- Use of SCADA (Supervisory Control and Data Acquisition)-type systems where relevant (larger more complex plants).
- Routine monitoring and recording of temperature, moisture, oxygen and other relevant parameters linked to batch or stockpile ID
- Documented operational set points and response actions
- Clear accountability for process adjustments.

6.5.2 Managing upsets and abnormal conditions

Facilities should anticipate and plan for process upsets arising from feedstock variability, equipment failure, weather events, or power outages. It is important to have pre-defined response procedures to prevent minor issues escalating into environmental incidents.

6.6 Management of outputs and rejects

6.6.1 Output quality and compliance

Recovered organic outputs must meet applicable regulatory, technical and market requirements. Output compliance is thus inseparable from operational control of inputs and processing conditions. Facility operators must be able to demonstrate through accurate and adequate monitoring and recording that the products have undergone the appropriate processing and treatment to meet these requirements e.g. pasteurisation.

Operational considerations include:

- segregation of compliant and non-compliant material
- quality assurance and testing regimes
- traceability of outputs to feedstocks and batches
- procedures for managing material that doesn't meet pre-defined quality standards or specifications (off-spec material).

6.6.2 Rejects

Rejects such as screenings, oversize fractions and contaminated outputs must be managed lawfully and safely, and only stored for reasonable periods of time prior to disposal. Poor management of rejects can undermine the environmental benefits of organics processing and create secondary pollution risks.

6.7 Water, odour, noise and emissions management in operation

6.7.1 Water and leachate management

A water management plan may be required as per section 5.3 and should document the compliance framework, strategies and risks for the management of water resources at a facility. Operational water management must ensure that leachate, process water and contaminated stormwater is segregated, contained, collected and treated appropriately. Leachate escape is a key compliance risk.

Operational measures include monitoring equipment such as high-level alarms, or management practices should be applied to ensure overflows are prevented.

6.7.2 Noise

Noise is a key consideration in the planning, design and operation of organics processing facilities. Noise must be actively managed to minimise impacts on surrounding land uses, particularly sensitive receivers. During operation, noise is primarily controlled through careful management of operating hours and operational practices, especially during sensitive periods.

Operational controls can include:

- restricting operating hours to avoid early morning, evening and night-time periods

- scheduling higher-noise activities during less sensitive daytime hours
- staggering or limiting simultaneous operation of noisy equipment
- implementing standard operating procedures that promote low-noise work practices
- regularly maintaining equipment to prevent excessive noise generation.

6.7.3 Odour and air emissions

Management of odour and air emissions is a key consideration for organics processing operations, and the use of effective operational management techniques can minimise off-site impacts to sensitive receivers.

Operational measures include:

- timely processing of odorous materials
- maintaining aerobic conditions where required
- managing turning and handling activities
- maintaining odour control infrastructure
- maintaining a balanced feedstock recipe appropriate to the processing technology to reduce risk of odour. See section 4.4 and Appendix A for additional details on feedstocks
- keeping comprehensive records of odour-related complaints, correlating and accurately recording weather conditions using calibrated equipment, pile turning activity and management of feedstock delivery times
- in open composting applications, regularly turning windrows can ensure adequate moisture content throughout, anaerobic pockets are avoided reducing the likelihood of particulate matter becoming airborne
- in a composting context, avoiding uncontrolled emissions of biogas in aerobic processes by keeping material adequately aerated and ensuring that each entire batch is subjected to stabilisation conditions
- avoid large stockpiling of waste, minimising drop heights when waste is being moved or processed and restricting the movement of waste outdoors during high winds to reduce exposure.

6.7.4 Greenhouse gas emissions

Organic waste processing facilities manage organic material in a controlled environment that significantly reduces greenhouse gas (GHG) emissions compared with landfill disposal or uncontrolled decomposition. While this represents an overall emissions benefit, facilities may still generate greenhouse gases during operation. The principal greenhouse gases associated with organic waste processing are methane (CH₄) and nitrous oxide (N₂O). These are considered air emissions and should be managed through appropriate facility design (refer to section 4) and operational controls.

Operators should be aware of legislation, policies and targets relating to GHG emissions at both the NSW and Commonwealth levels. Although organic waste processing facilities are generally unlikely to be classified as large GHG emitters, regulatory obligations may still apply depending on facility scale, configuration and emissions profile. These obligations may arise through national GHG

reporting frameworks, NSW climate policy settings, or conditions of development consent and environmental licensing.

Monitoring and management of GHG emissions should be proportionate to the materiality of emissions from the facility. Where required, emissions management may be informed by a GHG assessment undertaken during the planning and approvals process, regulatory reporting requirements (such as under the National Greenhouse and Energy Reporting Act 2007), and/or licence or consent conditions, including preparation of a GHG mitigation plan as part of an Environmental Management Plan. Recognised guidance and methodologies, including the NSW Guide for Large Emitters and the GHG Protocol Corporate Accounting and Reporting Standard, may also be used where applicable.

Potential sources of GHG emissions associated with organic waste processing facilities may include:

- transport of organic feedstocks to the facility
- on-site plant, machinery and energy use, depending on fuel type and power sources
- unintended generation of methane during processing
- transport of processed outputs off site
- generation of nitrous oxide during composting and biofilter operation.

In composting systems based on aerobic biological processes, facilities should be operated to minimise any anaerobic conditions developing in the materials. This is typically achieved through appropriate feedstock management, pile geometry, moisture control and aeration. Operators may also consider the use of alternative or low emissions energy sources to support further reductions in GHG emissions associated with facility operations.

6.8 Fire safety and emergency preparedness

As detailed in section 5.5, a fire safety management plan and an emergency response plan (ERP) are required as an inherent part of minimising fire safety risks. Operational requirements in these plans must always be followed.

Table 14 summarises key considerations during operation.

Table 14 Operational controls to manage fire risk

Operational control	Description
Fire prevention strategies and measures	• Stockpile management control. • Administrative controls (e.g. hot work permits, training). • Design features to reduce ignition likelihood.
Maintenance schedules for firefighting equipment and facilities	At a minimum this includes essential fire safety measures to be maintained to AS1851, facilities to be visually checked regularly as part of good housekeeping and equipment to be checked for damage.
Firefighting equipment	Appropriate provision of fire aid firefighting equipment such as portable fire extinguishers and fire hose reels for use by occupants. Location to be shown on site plans. Appropriate provision of firefighting equipment, depending on fire risk and, for enclosed facilities, the National Construction Code, for use by fire brigades. Locations to be shown on block plans.
Signage and access to firefighting equipment	Signage to be clear and visible, access must be maintained at all times.

Operational control	Description
Staff training	Training requirements for facility staff in emergency procedures, to the extent appropriate.
Restricting ignition sources	Restricting ignition sources (e.g. hot works controls, smoking controls) given reported common causes such as cigarettes and welding sparks. Management of ignition sources near gas handling infrastructure.
Good housekeeping	Material management including managing build-up of combustible particulate matter near engines/exhaust systems, exit routes kept clear, general equipment inspections.
Site security measures	To restrict unauthorised access which can increase the risk of injury and damage, including arson risk.

6.9 Litter management

Organics processing facilities can affect local amenity and the environment if litter or site materials leave the premises. The facility should be operated in such a way that litter is controlled at the source, contained within operational areas and promptly collected when it occurs.

Key requirements

- Implement procedures to prevent the unnecessary proliferation of litter and to ensure any litter that leaves the site is retrieved.
- Conduct regular inspections and immediately clean up any litter found.
- Following periods of windy weather, carry out clean-up activities on and near the facility as soon as practicable, preferably within one working day.
- Keep fences and gates clear of litter on a daily basis or as required.
- Ensure vehicles leaving the facility do not track or distribute mud, sediment, litter or site materials beyond the site boundary.
- Install signage advising drivers of their responsibility to
 - secure loads (for example, covering loads to prevent wind-blown litter)
 - remove material from vehicle undersides or wheels, to prevent littering of public roads.
- Retrieve litter that leaves the site, daily.
- Maintain access roads to ensure they remain free of dirt and litter generated by customers and site users.

6.10 Staffing, training and operational competence

Operational competence is central to achieving good environmental outcomes at organics processing facilities. Good performance comes about when staffing and competence arrangements lead to controls being consistently implemented, and there are no recurring operator-related failures.

This section sets out the objectives, key considerations and best-practice controls for staffing and training arrangements that are proportionate to facility risk and complexity and support consistent compliance and performance.

6.10.1 Key objectives

Facility staff must be able to:

- implement operational and environmental controls consistently
- prevent pollution and minimise amenity impacts
- manage foreseeable upsets and emergencies
- meet applicable approval, licence and other regulatory obligations (where relevant).

To be able to do this, the staff must be:

- sufficient in number
- adequately supervised
- demonstrably competent.

Staffing to accord with site-specific risks

The facility operator should identify the staffing and competence needs required to manage the site-specific risks. This should be proportionate to the facility's:

- scale of operations and storage volumes
- technology type and process complexity
- feedstock characteristics and contamination profile
- proximity to sensitive receivers and environmental sensitivity
- operating hours (including periods of reduced staffing).

Staffing to meet critical functions

The facility operator should also identify critical functions that must be covered at all times (by staff or competent contractors), including:

- operational decision-making and supervision
- receipt inspection and contamination management
- plant/equipment operation and maintenance readiness
- implementation of environmental controls and monitoring/record keeping
- emergency response initiation and incident escalation.

Smaller facilities may have one or two roles to cover multiple functions, provided the person(s) are competent, procedures are clear and escalation/backup arrangements are defined.

6.10.2 Controls

Staffing, training and competence controls should be implemented as a whole-of-facility system. Examples are detailed below.

6.10.3 Staffing and supervision

Staffing levels must be sufficient to:

- undertake routine controls (e.g. receipt inspection, housekeeping, leachate/containment checks)
- manage peak periods
- respond to foreseeable upsets.

Supervision should be based on task risk and worker experience, including during weekends/after-hours operations where applicable.

There must be clear accountability for environmental performance (including complaint response, incident escalation and corrective actions), even where the facility is small and roles are shared.

6.10.4 Competence management (training systems)

Facilities should maintain a practical competence framework that defines:

- what training/competence is required for each role and task
- who is authorised to perform critical tasks
- how competence is verified and maintained (including refresher training).

Use a staged approach:

1. site induction for all workers (including contractors)
2. task-specific training for each task performed
3. supervision and ongoing training to confirm competence is sustained.

Competence verification should extend beyond attendance and may include practical sign-off, observed task performance and scenario/drill participation.

6.10.5 Minimum training topics (tailored to site risk)

Training should be tailored to facility technologies and risk profile, and should typically cover:

- receipt and feedstock acceptance (inspection procedures, rejection/isolation of unacceptable materials, contamination awareness)
- process control and environmental protection tasks (timely processing, housekeeping, containment, leachate/stormwater controls, odour prevention measures where relevant)
- monitoring procedures and record keeping (routine inspections, complaints logging, escalation triggers and corrective actions)
- plant and traffic safety relevant to the facility (mobile plant operation, exclusion zones, pre-start checks, isolation procedures where applicable)
- licensed operators of mobile plant (i.e. forklifts, front-end loaders, telehandlers)
- emergency preparedness (site emergency procedures, fire/overheating response, chemical spills, spill/leachate escape response, communications and escalation).

6.10.6 Contractor and shared site controls

Where contractors are used (common at smaller facilities), the operator should ensure contractors:

- receive site safety induction, safe operating procedures and task training
- are licensed operators when in control of mobile plant

- are competent for assigned tasks
- follow site procedures (including environmental controls and emergency procedures).

6.10.7 Monitoring and performance

Monitoring and performance measures may include:

- a current training matrix showing required training, authorisations and refreshers for each role (staff and key contractors)
 - completion rates for induction, task training and refresher training
 - supervision/competency checks (e.g. periodic observations of tasks, and verification of critical procedures)
 - tracking and review of incidents, near misses, complaints and corrective actions to identify competence gaps and update training accordingly
 - emergency drill participation and debrief outcomes, with improvements actioned. Drills should be appropriate for site risk
 - internal audits or periodic management reviews to confirm that roles, training and documentation remain fit for purpose as feedstocks, technologies or operating conditions change.
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6.11 Health and safety risks in operation

Managing workplace operational health and safety (OHS) risks is an integral part of the safe operation of processing facilities, and must be considered carefully. It lies outside the scope of these Guidelines; however, this section gives a brief overview of the issues, to help operators understand their obligations.

All workplaces employing operational staff (full-time, part-time, casual or contracted workers), are required to comply with the *Work Health and Safety Act 2011*. This Act is supported by the Work Health and Safety Regulation 2017, which sets out detailed requirements for identifying, managing and monitoring workplace health and safety risks.

OHS risks at organic waste processing facilities will vary depending on processing technology, scale of operations, workforce size, machinery, chemicals and materials handled on site. Given this variation, operators must identify hazards specific to their facility and implement appropriate mitigation and monitoring measures. Risks must be managed and reduced so far as is reasonably practicable, consistent with the WHS risk management hierarchy.

Examples of OHS hazards at organic waste processing facilities

- Machinery and equipment (e.g. conveyors, shredders, screens)
- Physical activities that can lead to injury or fatality (e.g. manual labour; operating heavy machinery)
- Biological or airborne hazards (e.g. exposure to bioaerosols, particulate matter, odour, pathogens and decomposing organic material)
- Chemical hazards (e.g. biogas produced on site, chemicals stored on site)
- Psychosocial hazards (e.g. high workload and long working hours; working conditions)

Examples of mitigation measures

- Negative pressure extraction and controlled ventilation in enclosed processing areas to address operator amenity and manage odour/bioaerosols within the building. (A minimum of four air changes per hour is recommended.)
- Using machinery (such as front-end loaders) with a cab and an air filtration system
- Using personal protective equipment (PPE), such as respirators, as required
- Minimising personnel exposure by using enclosed or automated machinery for turning/screening, and using local exhaust ventilation (LEV) in enclosed composting areas

7 Facility closure

7.1 Introduction

When an organics processing facility is closed, the site should be appropriately decommissioned in such a way that it does not pose ongoing harm to the environment, local amenity and human health and safety.

For facilities requiring an EPL, a closure plan must be prepared for EPA approval. Post-closure requirements are set out in section 76 of the POEO Act.

7.1.1 What a closure plan covers

The POEO Act section 76(2) states that the closure plan must:

- specify the steps taken (or to be taken) in closing, stabilising or rehabilitating the premises and the timeframe for doing so
- provide for a post-closure monitoring and maintenance program
- identify any proposed future uses of the premises
- comply with any other specified requirements relating to the plan.

7.1.2 Site remediation requirements (not exhaustive)

During site closure, site remediation requirements may include:

- Feedstock, outputs, amendments, contaminated outputs, process residues or chemicals must not remain on the premises.
- All equipment must be emptied, cleaned and disinfected.
- All equipment must be removed from the premises, unless it can be demonstrated that the equipment that remains will not have the potential to cause environmental impacts and is needed for subsequent uses of the site.
- The facility must be revegetated or otherwise made stable and suitable for the proposed future land use of the site. The revegetation of any exposed working areas must be started within 30 days of operations ceasing and the final revegetation layer must be of a depth and type sufficient to support the revegetation scheme proposed.
- The final surfaces prepared on the site must control surface erosion and protect local amenity.
- Groundwater monitoring and monitoring of surface water bodies must be continued until it demonstrates the absence of any pollution that would pose a threat to the quality of groundwater, surface waters or surface water bodies.
- Depending upon the history of the site and feedstock processed on site, the site may have become contaminated for the purposes of s 60 of the CLM Act. If the site is contaminated, the owner or person who carried on the activities may have a duty to notify the EPA in accordance with s 60 of the CLM Act.

The EPA may approve the submitted closure plan or vary it before approval. If the closure plan cannot be approved, the EPA may not accept surrender of the environment protection licence.

7.2 Financial assurance

The licensee may need to demonstrate that they can cover the cost of site remediation that may be needed when processing eventually ceases. Under Part 9.4 of the POEO Act, the EPA can require a financial assurance to secure or guarantee funding for remediation or pollution reduction programs from the occupier of a licensed premises. If the EPA requires a financial assurance, it will liaise with the applicant to establish the amount and form of the financial assurance.

8 Glossary

Term	Definitions
Active aeration	Also known as forced aeration, is the intentional supply of air to organic materials using mechanical systems such as fans or blowers.
Aerobic	Referring to processes that require oxygen, where microorganisms break down organic matter in the presence of air.
Amenity	The current existence of healthy, pleasant and agreeable community surroundings.
Anaerobic	Describes biological processes that occur in the absence of oxygen.
Batch process	An operational processing method where organic material is treated in discrete loads for a defined period, with no new material added until the batch cycle is complete.
Bedding	Refers to bedding usually made of straw and wood shavings used in animal housing. Also can be used to describe a deep layer of mature vermicast that provides habitat and helps regulate moisture and temperature.
Bioaerosols	Organisms or biological agents that can be dispersed through the air and that have the potential to affect human health.
Biodegradable	Capable of being degraded by biological activity.
Biogas	Gaseous emission from the anaerobic decomposition of organics, usually a mixture of methane, carbon dioxide and other byproduct gases.
BMP	Biochemical methane potential, a laboratory-based measure of the potential for organic material to generate methane during anaerobic conditions.
BOD	Biochemical oxygen demand, a measure of the oxygen required by microorganisms to decompose organic matter in water.
Buffer	Refers to a buffer distance or buffer zone which is established to provide separation between an activity and a receiver, thereby reducing the potential impact of the activity on the receiver.
Buffer distance	The distance between the reception, storage and processing areas of a composting and related organics processing site and a segment of the environment to be protected.
Bulk density	The mass of the particles in a material divided by the total volume inclusive of the space between particles.
Bulking agent	A material added to organic feedstocks to improve structure and porosity, manage moisture content and improve airflow to support aerobic composting.
C:N ratio	Carbon-to-nitrogen ratio, by mass, of carbon atoms to nitrogen atoms present in the organics.
CFU	Colony forming units: a unit of quantification of bioaerosol loads or microorganisms.
Clean Air Regulation	Protection of the Environment Operations (Clean Air) Regulations 2022
Closure plan	A plan that describes how a facility will be decommissioned and rehabilitated to manage environmental risks and achieve a stable end use following cessation of operations.
CNG	Compressed natural gas
Co-digestion	The practice of using a combination of multiple organic feedstocks for processing in the same digester.
Compost	Stabilised organic materials produced by aerobic composting and suitable for beneficial use, where compliant with applicable EPA requirements. Refer to Appendix C.
Continuous process	An operational method in which materials are processed continuously, with feedstock input into and output generation from the process occurring simultaneously.

Term	Definitions
Cth	Commonwealth
DCA	The New South Wales Development Coordination Authority
Digestate	A water-rich material generated during anaerobic digestion, containing residual organic matter, nutrients (notably nitrogen, phosphorus, and potassium), and microbial biomass.
DPHI	The New South Wales Department of Planning, Housing and Infrastructure.
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i> , refer to Table 4 for definition.
EP&A Regulation	<i>Environmental Planning and Assessment Regulation 2021</i> , refer to Table 4 for definition.
EPA	The NSW Environment Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> , refer to Table 4 for definition.
EPL	Environment Protection Licence, a legally enforceable document that authorises certain industrial, agricultural, or commercial activities that have the potential to impact the environment. It regulates how these activities manage pollution related to air, water, noise, waste, and land.
Feedstock	Organic material accepted as an input to an organic treatment process.
Flaring	The controlled burning of waste gases to manage flammable emissions from a process.
FOGO	Food Organics Garden Organics; refer to the POEO Act Section 170A for definition.
Frass	A secondary output of the insect bioconversion process producing a mixture of insect excreta, exoskeletons, and residual feedstock.
GHG	Greenhouse gases, such as methane and carbon dioxide, that are implicated in the greenhouse effect, which in turn is thought to cause global warming.
GO	Garden organics
Groundwater	Water that is located below the ground surface
Guidelines	Refers to this document, the NSW Organics Processing Facility Guidelines
HRT	Hydraulic retention time: the typical length of time that a volume of liquid remains inside a process unit.
Larvae	Refers to the distinct immature, juvenile form of animals, particularly insects in the context of the Guidelines.
Leachate	Liquid that has percolated through or drained from waste and that has extracted from it dissolved and/or suspended materials
LEP	Local Environmental Plan. LEPs set out the land use zoning for a Local Government Area. LEPs outline the permitted and prohibited uses of each zone as well as setting standards for certain aspects of land use.
Local development	Local development is the most common type of development in NSW and includes projects such as home extensions and small-to-medium commercial or industrial developments. It requires development consent under a Local Environmental Plan (LEP) or State Environmental Planning Policy (SEPP) and is not classified as State or Regionally Significant Development. It is unlikely an organics processing facility will be considered a local development.
Maceration	A mechanical process which breaks down solids into smaller particles or slurry.
Maturation	The stage of composting after the primary composting and pasteurisation phases, where the composted material continues to stabilise and cure.
Mature compost	Compost that exhibits lower levels of phytotoxicity and a higher degree of biological stability as defined in AS 4454. Refer to Appendix C.
Mesophilic	For AD, describes microorganisms or biological activity that operate within 30–40°C (UK Anaerobic Digestion and Bioresources Association, 2017).

Term	Definitions
Microplastics	Small plastic particles typically less than 5 mm in size, originating from the breakdown of larger plastic items or from intentionally manufactured sources.
Moisture content	Quantity of water present in a material expressed as a percentage of the material's total mass.
NGER Act	<i>National Greenhouse and Energy Reporting Act 2007</i> , refer to Table 4 for definition.
OHS	Operational health and safety
Oversized material	Materials that are too large and removed during pre-treatment screening or post treatment during organics processing.
Particle size	Refers to the physical dimensions of individual material fragments within an organics mixture.
Passive aeration	A method of air supply to an organics process which relies on natural forces to exchange air between the interior of the material being processed and the surrounding environment.
Pasteurisation	A treatment involving the application of sufficient heat for a sufficient period of time to a material to reduce the levels of human, animal and plant pathogens, and to inactivate weed seeds and propagable shoots.
PFAS	Per- and polyfluoroalkyl substances, a persistent organic pollutant.
pH	The negative logarithm of the hydrogen ion concentration of an aqueous solution. This provides a measure of whether a solution is acid or alkaline.
POEO Act	<i>Protection of the Environment Operations Act 1997</i> . Refer to Table 4 for definition.
Pollution	Any direct or indirect alteration of the physical, chemical, thermal, biological or radioactive properties of any part of the environment by discharging, emitting or depositing wastes or substances that adversely affect beneficial use, or that cause a condition that is hazardous or potentially hazardous to public health, safety or welfare or the condition of flora and fauna.
Porosity	A metric used to describe the proportion of the total volume of a material that consists of void spaces occupied by air and water, rather than solid particles.
Primary composting	Active phase of composting where pasteurisation occurs.
Primary outputs	Materials produced from an organics process that the processor intends to produce and supply for beneficial reuse.
Protein	Protein refers to a secondary output from organics processing, often from insect bioconversion. This protein may be used as a feed to produce subsequent products including animal feed, oils and biofuels.
Putrescible	Containing organic matter that is liable to putrefaction, that is, rapid degradation by micro-organisms. Examples are materials containing food, offal and animals.
RAM	Restricted animal materials. Any materials derived from a vertebrate including food waste, animal manures and rendered products such as blood and bone, abattoir waste, grease-trap waste, and pet food are considered as RAM and specific biosecurity legislation thus applies to this material. Refer to Appendix A.3.
RDF	Refuse-derived fuel: a solid fuel made from waste that would otherwise go to landfill.
Rejects	Materials that are removed from the output streams as contaminants, in order to meet relevant feedstock acceptance or output quality requirements.
RNG	Renewable natural gas
RRE	Resource recovery exemption: refer to section 2.4.3.
RRO	Resource recovery order: refer to section 2.4.3.
RRO/E	Used to refer to both RROs and RREs or the RRO/E framework.

Term	Definitions
SCADA	Supervisory control and data acquisition: automated systems used at processing facilities to remotely monitor and control a process.
Screening	The process of separating materials based on size, typically carried out with specialised equipment such as rotary trommels or star screens.
SEARS	Secretary's Environmental Assessment Requirements, a tailored set of requirements issued by DPHI that outline the information required for an EIS (environmental impact statement) or SSD (State Significant Development).
Secondary outputs	Materials that may be generated alongside primary outputs during organics processing that may be reused, further treated or managed separately, depending on their characteristics and regulatory requirements.
Sensitive receiver	Refers to an area that has an elevated environmental risk to pollution, noise and discharges from a facility. These may include proximity to certain ecosystems, groundwater sources, potable water sources or places where people live, work or congregate for extended periods.
SEPP	State Environmental Planning Policy.
SSD	State Significant Development. A project that is declared significant due to its scale, economic value, environmental sensitivity or strategic location, and is listed in Schedules 1 or 2 of the State Environmental Planning Policy (Planning Systems) 2021 or is called in by the Minister for Planning. An organics processing facility is typically considered an SSD.
Stockpile	Temporary accumulation of material stored on site prior to processing or disposal. It may be feedstock or output.
Stormwater	Excess water that is generated by rainfall and is often routed into drain systems to prevent flooding.
Surface water	Includes all natural and built waterways or channels, whether flow is intermittent or not; all lakes and impoundments (except lined dams) associated with landfilling activities; and other marshes, lagoons and swamps.
Thermophilic	For anaerobic digestion, describes microorganisms or biological activity that operate within 50–60°C (UK Anaerobic Digestion and Bioresources Association, 2017).
Trace elements	Small quantities of essential minerals in a material such as iron, cobalt, nickel, tungsten, manganese, etc.
TS	Total solids, used to describe the fraction of solids in a mixture.
Vermicast	Nutrient-rich, odourless worm excreta produced from vermicomposting, which can be applied as soil amendment.
Vermiliquid	Nutrient-rich liquid produced as water passes through worm beds, picking up soluble nutrients and microorganisms.
VOC	Volatile organic compounds: organic compounds that are readily vaporisable at a relatively low temperature.
Volatile solids	Refers to the organic portion of total solids in a mixture that can be volatised.
w/w%	Weight-by-weight %: describes the mass composition of a mixture by mass.
Waste Regulation	<i>Protection of the Environment Operations (Waste) Regulation 2014</i> : refer to Table 4 for definition.
WHS Regulation	<i>Work Health and Safety Regulation 2025</i> : refer to Table 4 for definition.
Windrow	A long, narrow pile of organic material formed for composting, arranged in rows and periodically turned or mixed to maintain aeration, control temperature, and promote uniform aerobic decomposition.

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Appendix A: Feedstock

A.1 Introduction

Feedstock quality and management is a critical factor in underpinning output quality, operational performance and risk outcomes. This Appendix provides supporting information to guide the planning, design and operation of organics processing facilities by describing the key considerations associated with feedstocks. It outlines the types and characteristics of common organic feedstocks, and provides guidance on management of contamination, feedstock variability and relevant environmental risks.

Further detail on feedstock suitability for different technologies is provided in Appendix B through to Appendix G.

A.2 Feedstock characteristics

During facility planning and design, it is important to consider the proposed feedstocks and their characteristics in relation to the processing technology. Feedstock characteristics that inform design may include:

- moisture content
- particle size
- porosity
- bulk density
- total solids (TS) and volatile solids
- pH
- carbon content and nitrogen content
- biogas potential (BMP)
- biochemical oxygen demand (BOD)
- pathogen load and biological contaminants
- physical and chemical contaminants.

Feedstocks that do not suit the processing technology or vice versa can cause operational problems, reduce output quality and increase environmental and safety risks. Feedstock suitability needs to be clearly assessed in the design and planning stages, through to operational management. Table A1 provides examples of feedstock characteristics suited to specific processing technologies to provide guidance for feedstock selection.

Table A1 Typical feedstock characteristics for different technologies

Processing technology	Typical feedstock characteristics	Typical feedstocks ³
Composting	- Moisture content of 50–60% by weight - C:N ratio of 25:1 to 40:1 - Variable feedstock particle size - Neutral pH - Bulk density of 400 – 600 kg/m³	Animal waste ⁴ Biosolids ⁵ Food waste Food waste and garden waste Garden waste Manure Natural organic fibrous materials Wood waste
Dehydration	Food waste with high moisture content	Food waste
Dry AD	- High TS content of 20–40% - Neutral pH - Moderate moisture content - C:N ratio of 20:1 to 30:1 - High BMP (measure for biogas production)	Animal waste Biosolids Food waste Food waste and garden waste Garden waste Manure Natural organic fibrous materials
Wet AD	- Low TS content of <10–20% - Neutral pH - High moisture content - In the form of liquid or slurry, easily pumpable - High BMP (measure for biogas production)	Animal waste Biosolids Food waste Grease-trap waste Manure
Insect processing	- Small particle size or slurry-like consistency (suitable for small mouthparts) - Neutral pH - High moisture content - Nutrient profile suitable for desired outputs (i.e. higher fat) - Balanced C:N ratio	Food waste Food waste and garden waste Manure Natural organic fibrous materials
Vermicomposting	- Small particle size (suitable for small mouth parts) - Neutral pH - Moderate moisture content - Balanced C:N ratio - Loose, aerated structure	Food waste Food waste and garden waste

³ The feedstocks are defined in the POEO Act Schedule 1 Part 3 Definitions, and the reader should refer to the Act for all official definitions pertaining to waste.

⁴ Wastes, such as animal waste and biosolids, may require specific approvals for reuse. Regulatory conditions may change over time and processors must be aware of the requirements for specific feedstocks under the relevant up-to-date regulations.

⁵ See above, footnote 4.

Processing technology	Typical feedstock characteristics	Typical feedstocks ³
Mulching	• Low moisture content • High carbon content • High lignocellulosic content, containing materials such as woody branches, leaves, and other fibrous plant matter	Garden waste Wood waste

Facilities can also blend feedstocks to develop mixes or ‘recipes’ based on material characteristics such as the carbon-to-nitrogen (C:N) ratio, pH, moisture content and bulk density, to assist in meeting process requirements.

A.3 New feedstocks

The introduction of new feedstocks to an existing facility can potentially impact the current feedstock composition, influence the process and the final outputs. As such, where a new feedstock is proposed at an existing facility, the processor should assess the suitability of the existing operating conditions and infrastructure. The processor should identify, assess and implement necessary modifications to the process to maintain output quality or add additional controls to manage any new risks introduced (e.g. new contaminants). In addition, the processor may need to review permitting conditions and apply to amend these appropriately (e.g. planning consents, EPLs).

A.4 Contamination

Contamination can pose a risk to both human health and the environment. Contaminated outputs can impact land, groundwater or surface water and when applied to agricultural land, it has the potential to affect crops, livestock and can enter the food chain. Contamination also has the potential to cause serious health and safety impacts for staff, damage processing equipment, impact the facility economics and reduce broader community confidence in recycled outputs from organic processing plants.

A.4.1 Types of contamination

Contamination in organic feedstocks can be broadly categorised into physical, chemical and biological contamination. Further detail on these types of contamination is provided in Table A2.

Table A2 Types of contamination

Types of contamination	Description	Examples	Impact
Physical contaminants	Physical contaminants are non-organic materials that are visually or mechanically distinguishable from the expected feedstock.	Some examples include plastics (rigid and film), glass, metals, stones, packaging, and hazardous materials (i.e. flammable or explosive items, needles, asbestos).	Visible contaminants in output can undermine market acceptance and breach conditions of RRO/Es and industry output standards (i.e. AS 4454). Sharp and abrasive contaminants such as glass and stones can damage equipment (e.g. wear or failure in shredders, grinders and digesters) and/or pose work, health and safety issues.

Chemical contaminants	Chemical contaminants are chemical substances that pose a risk of harm to human health or the environment due to toxic, or other harmful properties.	Some examples include heavy metals, pesticides, industrial chemicals, leachates from packaging and consumer products, and persistent organic pollutants (POPs) such as PFAS, triclosan, and galaxolide.	These contaminants can resist degradation during processing and remain in the output, inhibit microbial activity, contaminate water and soil, and breach conditions of RRO/Es and output standards. If contaminated outputs are applied to land, leachates from this material can migrate into soils, groundwater and surface water.
Biological contaminants	Biological contaminants are living organisms, or their by-products, that may pose risks to human health or biosecurity.	Some examples include human pathogens (e.g. viruses, bacteria, fungi and mould spores), weed seeds and propagules, invasive species, and genetic material conferring anti-microbial resistance (otherwise known as antibiotic resistance genes (ARGs)).	These contaminants can remain in output material if not adequately processed and may multiply further in the final processed material posing potential risks to the health of facility staff and end users, and the environment receiving contaminated output materials.

It should be noted that contaminants in feedstocks may also be altered as they move through the processing system. For example, plastics contained in feedstock can undergo polymer degradation and fragmentation and can be transformed into microplastics (<5mm) and remain in the output material. During processing, plastics and microplastics may be subjected to high temperatures which can cause chemicals (such as phthalates and flame retardants) to leach out and contaminate the output material.

Table A3 presents the types of contamination that are likely to be found in different organic feedstock types and can be used to support an initial review of likely feedstock contaminants.

The feedstock types listed in Table A3 are aligned with the definitions specified in the POEO Act. Further information to note regarding specific feedstock types is provided below.

Table A3 Potential contaminants in different feedstocks

Type	Contaminant	Animal waste and manure	Biosolids	Food waste	Food waste and garden waste	Garden waste	Grease-trap waste	Natural organic fibrous material	Wood waste
Physical	Plastics and microplastics ⁶	●	●	●	●	●	●	-	-
	Glass	-	-	●	●	●	-	-	-
	Metals	-	-	●	●	●	-	-	-
	Grit and stones	●	●	-		●	-	●	●
	Packaging	-	-	●	●	-	-	●	-
	Hard organic residues (i.e. fruit pits)	-	-	●	●	-	-	●	-
Chemical	Heavy metals	●	●	●	●	●	●	●	●
	Pesticides	●	-	-	●	●	●	●	●
	Industrial chemicals	-	●	-		-	●	●	-
	Leachates from packaging and consumer products	-	-	●	●	-	-	-	-
	Persistent organic pollutants (POPs)	●	●	●	●	●	●	●	-
Biological	Human pathogens	●	●	●	●	-	●	●	-
	Bioaerosols	●	●	●	●	●	●	●	●
	Weed seeds and propagules	-	-	-	●	●	-	●	●
	Invasive species and animal diseases	●	●	●	●	●	-	●	●
	Antibiotic resistance genes (ARGs) ⁷	●	●	●	●	-	-	-	-

⁶ Conventional plastics and bioplastics may fragment during processing, creating microplastics (plastic particles <5mm in size).

⁷ Waste feedstocks such as animal mortalities and manure may contain antimicrobial resistant bacteria (ARB) and antimicrobial resistance genes (ARG) which may contribute to the spread of antimicrobial resistance (AMR) if not managed appropriately. Treatment processes such as composting, in particular during the thermophilic phase, can help to reduce ARB and ARG. Operators should implement thorough process controls and testing, manage run-off and wind dispersal, and apply withholding periods to reduce the risk of AMR entering the food chain and minimise human health risks.

Biosolids

Biosolids are organic solids generated after sewage sludge has been treated and stabilised to meet classification criteria enabling its beneficial reuse on land as required under the *Environmental Guidelines: Use and Disposal of Biosolids Products* (EPA, 2000) (Biosolids Guidelines). Biosolids can be applied directly to land (subject to the relevant RRO/E approvals for reuse) or be further processed into new outputs or energy using methods such as aerobic and anaerobic digestion, composting and thermal treatment. Generators, processors and users of biosolids must comply with relevant guidelines for biosolids management, which includes applicable general or specific RRO/Es or other related guidance documentation as amended from time to time.

Restricted animal material (RAM)

Any materials derived from a vertebrate including food waste, animal manures and rendered products such as blood and bone, abattoir waste, grease-trap waste and pet food are considered restricted animal material (RAM) and specific biosecurity legislation applies to this material. In NSW, it is prohibited to feed RAM to ruminants (i.e. cattle, sheep, goats, deer and camelids) due to concerns regarding bovine spongiform encephalopathy (BSE) or 'Mad Cow Disease'. Feeding includes allowing the ruminant to have access to the material. Organics processors receiving RAM must ensure that they are aware of and are meeting their responsibilities under the *Biosecurity Act 2015* and *Biosecurity Regulation 2017* (clauses 37 and 38). This includes understanding any restrictions this creates on the feeding of RAM to ruminants, the production of animal feed, and the storage or application of RAM to land where ruminants can access this material (e.g. fenced feedstock receipt and processing areas, meeting any specified withholding requirements, sanitisation of equipment). The RAM classification cannot be removed by any of the organics processing methods outlined in this document. Compost, digestate, frass and any other output generated from RAM feedstock will still be considered as RAM and must be managed accordingly.

A.4.2 Feedstock acceptance controls

Feedstock acceptance controls should focus on preventing contamination at the source where possible, detecting problems early, and keeping contaminants out of the biological treatment step. Table A4 provides examples of controls for managing the acceptance of feedstocks at processing facilities.

Table A4 Example feedstock acceptance controls

Controls	Description
Clear feedstock acceptance processes	Establish procedures for acceptance, inspection, sampling and testing, and rejection of feedstock. This should include the handling and management of hazardous material, including but not limited to, asbestos, needles and sharps.
Robust supplier agreements	Setting out contamination limits, acceptance and rejection criteria, inspection processes, non-compliant delivery procedures, financial compensation and record-keeping requirements in supplier agreements. Contamination of all kinds should be kept to an absolute minimum. A limit of less than 2% w/w physical contamination in source-separated organics, with management and contractual processes in place to reduce this to 1% w/w over time, is considered good practice (AORA, 2024) (Frontier Ag & Environment, 2024). A contamination level of <1% w/w for FOGO is considered best practice in some international jurisdictions noting that high contamination levels make it difficult and costly to consistently meet compost standards.

Controls	Description
Sampling and testing	The level of testing should be proportionate to the feedstock risk profile and in accordance with the relevant RRO/E. Higher risk of contamination may require more frequent and rigorous testing. Operators should be aware of contaminants of known or emerging concern which may change over time. Feedstocks that present a high risk of PFAS or microplastic contamination may require testing before being accepted.

In addition to these acceptance controls, effective education is key to reducing contaminants received at facilities from certain sources, such as FOGO or GO that is presented by the general public in residential waste collection. Often this is not the responsibility of organic processors, but the effectiveness of education defines processing viability and final quality of output. Education is thus a critical first step to prevent excessive contamination at the processing facility, drive better segregation outcomes, and has a direct impact on output quality and use (i.e. application to land). The responsibilities for output quality are therefore shared between producers (e.g. councils, residents and other feedstock suppliers) and processors.

A.4.3 Contamination removal

If feedstocks are significantly contaminated, the same contaminants are likely to be retained in the final outputs from a process. Contaminants can be hard to remove at a facility even with comprehensive pre-processing or manual picking. When physical contaminants are processed along with the organic material, they can leach, degrade and may be disseminated into the compost, digestate, frass or protein material, making them difficult or impossible to remove economically. Chemical contaminants in incoming feedstock should be closely monitored and feedstock supply managed accordingly.

It is acknowledged that contamination can occur from various sources, even with source-separated material, and the degree of contamination in incoming feedstocks will dictate the need for pre-treatment or decontamination. As above, physical contamination should be kept below 2% w/w initially, with processes in place to reduce this further, and no hazardous materials should be accepted (AORA, 2024) (Frontier Ag & Environment, 2024).

Physical contamination can be removed using appropriate pre-treatment processes or equipment, such as manual/automatic picking, screens, de-packaging units and trommel screens. It is important that physical contamination is removed before the biological processing step begins. This is to limit the impact of various chemicals of concern, or microplastics being transferred into the outputs.

Post-treatment techniques, such as screening final outputs, can remove some of the remaining contaminants, however, should not be relied upon as the primary decontamination process. Every effort should be made to remove contaminants prior to processing to avoid incorporation into the final output (i.e. compost, digestate, protein, frass etc). Post-treatment alone is not recommended by the EPA, as contaminants may be altered during treatment processes and become more challenging to remove afterwards (e.g. plastics shredded into microplastics, leaching of chemicals).

A.5 Feedstock variability

Feedstock variability can arise due to seasonal fluctuations (i.e. increased green organics in spring and summer, higher contamination rates during holiday periods), changes in collection and recovery practices over time (i.e. introduction of FOGO services), and evolving community behaviours. When this risk is managed improperly, it can affect operational stability and output quality.

In addition to this, facilities should also be prepared for unplanned disruptions to feedstock supply, such as supplier and transport interruptions, extreme weather events and power outages. The commencement or expiry of supply agreements can also contribute to shifts in feedstock type, volume or quality. Sudden changes in end-product markets, such as shifts in demand for electricity, compost, or digestate, can also lead to changes in the types of feedstocks to be processed.

Examples of mitigation measures for addressing feedstock variability

- Ensuring there is flexibility to adjust feedstock recipes to respond to changing inputs
 - Planning an adequate buffer for processing capacity and storage spaces to accommodate fluctuations in feedstock supply
 - Communicating regularly with suppliers to anticipate changes in feedstock availability
 - Ensuring there is flexibility of processing technology and/or system to accommodate changing inputs
 - Conducting periodic market assessments, and analysis of feedstock volume and composition trends
-

A.6 Environmental risks

Environmental issues can arise during feedstock receipt, acceptance, storage and handling, such as odour generation, leachate formation, vector attraction and fire risk. Specific environmental risks and associated controls are detailed in sections 5, 6.3 and 6.4.

Appendix B: Anaerobic digestion

B.1 Introduction

Anaerobic digestion is a tightly controlled biochemical process that uses anaerobic microorganisms (anaerobes) to break down organic matter in the absence of oxygen. This process produces biogas (mainly methane and carbon dioxide) and digestate. The ability to produce energy (biogas) as well as soil conditioners or fertiliser (digestate) can give anaerobic digestion an advantage over other organic waste processing techniques. However, overall project viability depends on recovering and using the biogas and digestate effectively.

B.1.1 Uses of anaerobic digestion

Anaerobic digestion is an established technology and considered a standard process for stabilising sewage sludge and agricultural manures. From the late 20th century, anaerobic digestion expanded beyond wastewater treatment into energy recovery from agricultural, industrial and municipal organic wastes, particularly in Europe. In Australia, anaerobic digestion has historically been used in wastewater treatment to stabilise sewage sludge and reduce solids volumes, with biogas commonly flared or used on-site for heat and electricity generation.

B.1.2 Facility size

Currently, in the Australian context, anaerobic digestion facilities are commonly designed to operate at larger throughputs to take advantage of economies of scale, with typical processing capacities in the order of approximately 20,000–70,000 tonnes per annum.

B.1.3 Facility cost structure

Anaerobic digestion facilities can have a complex cost structure needing careful consideration of all input and output volumes and characteristics. The financial viability of an anaerobic digestion facility is dependent on several factors, including:

- feedstock type, which dictates gate fee income
- contamination of different feedstocks
- revenue opportunities from biogas generation
- cost of managing digestate outputs, including treatment of solid digestate and liquid waste streams.

B.1.4 Drivers for the adoption of anaerobic digestion

Key drivers for the adoption of anaerobic digestion typically include:

gas and power generation	where there are cost benefits to using energy on site (e.g. at a wastewater treatment facility) or supplying energy to a co-located or nearby user
decarbonisation targets	where anaerobic digestion supports emissions reduction commitments by displacing fossil fuels with renewable biogas and contributing to corporate or government decarbonisation targets

landfill diversion targets	where regulatory or policy drivers require the diversion of organic waste from landfill, reducing methane emissions and extending landfill life
markets for digestate	where stable end-use markets exist for digestate as a soil conditioner or fertiliser, enabling recovery of nutrients and additional revenue or avoided disposal costs.

B.2 Feedstock suitability

The anaerobic digester vessel provides a controlled environment for the microbial population, while the feedstock supplies the energy and nutrients required for methane production. Biogas production is driven by feedstock characteristics and the operator's role is to maintain a stable, healthy microbial population with a consistent and appropriate supply of feed material.

Anaerobic digestion facilities may process a single feedstock but mixed feedstocks are more commonly used, to optimise process performance. Where two or more feedstock types are treated together, such as animal manures combined with industrial food wastes, the process is referred to as co-digestion. Co-digestion may require additional pre-processing, mixing equipment or pre-treatment to ensure stable and effective operation.

Feedstock is a key factor determining the effectiveness and economic viability of an anaerobic digestion plant, and its composition will have significant implications on the plant design and the quality and quantity of biogas and digestate produced. The impacts of feedstock on the anaerobic digestion process are summarised in Table B1 below.

Table B1 Process considerations and their impact on the anaerobic digestion process

Factor	Impact
Biogas quantity	Feedstock type influences the biochemical methane potential (BMP), which affects the quantity of biogas produced.
Biogas quality	Consistent quality and specification of feedstock required to avoid fluctuations.
Bacteria health	Maintaining the right C:N ratio helps to prevent toxic conditions in the digester. Biological activities may be affected and reduce biogas generation.
pH in the digester	Acidosis or alkalosis in the digester inhibits methanogenic activity and reduces biogas production. If not corrected, significant time may be required to re-establish optimal conditions or the digester may fail.
Physical contamination	Physical contaminants can cause equipment blockage and can affect the hydraulic retention time of the digester.
Chemical contamination	- Chemicals may inhibit methanogenic activity and reduce biogas production. - Chemical contamination may inhibit the application of digestate outputs to land.
Pre-treatment	Feedstock type and risk determine the pre-treatment steps required.
Quality of primary outputs	Consistent quality and specification for digestate required to be practical for compost or liquid fertiliser applications.
Digester startup and shutdown	Significant time is required to re-establish the biological activity within the digester to achieve optimal performance. This can result in extended downtime, reduced throughput and feedstock accumulation at the facility.

Understanding the properties of individual and blended feedstocks, including their biochemical methane potential (BMP; also called biological methane potential), is essential for predicting digester performance. Feedstock acceptance and management should be based on a risk-based approach, recognising that some feedstocks present higher operational and environmental risks.

The potential for physical and chemical contamination should be assessed, and pre-treatment systems should be designed and operated to effectively manage these risks.

Table B2 summarises common feedstocks for anaerobic digestion, key considerations and typical contaminants.

Table B2 Common anaerobic digestion feedstocks and considerations

Feedstock	Key considerations	Typical physical contamination	Typical chemical contamination
Food waste from residential, commercial and industrial sources	- Feedstock variability, contamination control and pre-treatment systems are critical to manage potential blockages and maintain stable digester performance - Biodegradability and BMP	- Packaging materials (plastic, paper, metal) - Materials unsuitable for anaerobic digestion (e.g. fragments of shells, glass, bones) - Foreign objects (e.g. cutlery, nappies) - Microplastics	- Cleaning agents or disinfectants - Food additives (e.g. salt, allicin, capsaicin, allyl isothiocyanate, monosodium glutamate, and non-nutritive sweeteners)
Food waste and garden waste	- Pre-treatment required to remove contaminants and reduce particle size - Woody fractions that may limit biogas yield - Unsuitable for some anaerobic digestion processes (i.e. generally suitable for 'dry' or high-solids processes only)	As for food waste, plus woody material with high cellulose, hemicellulose, or lignin content that cannot be digested easily by anaerobic bacteria	As for food waste, but may include pesticides and herbicides
Manure	- Digestion characteristics that may result in relatively low methane yield per tonne - Co-digestion with higher-energy feedstocks may be required to improve performance	- Bedding material (e.g. straw, wood shavings) - Soil and stones - Foreign objects (e.g. wire, plastic)	- Antibiotics and hormones - Disinfectants - Heavy metals (e.g. from animal feed additives)
Animal waste	Feedstock characteristics, biosecurity risks and specific regulatory requirements	As for manure, plus - Bone fragments - Packaging and containment materials	As for manure, plus High lipid concentrations
Natural organic fibrous material Includes agricultural slurries, energy crops and crop residues	- High lignin content (e.g. straw and fibrous crop residues): lignin is less readily biodegradable and can reduce gas yields or require longer retention times - Materials may need to be reduced in size, diluted or blended prior to digestion - Essential plant nutrients are not destroyed or lost through digestion process	- Soil and stones - Sand - Plastic debris (from silage wrap) - Metal fragments (from machinery) - Woody material with high cellulose/hemicellulose/lignin that cannot be digested easily by anaerobic bacteria	- Pesticides and herbicides - Fertiliser residues

Feedstock	Key considerations	Typical physical contamination	Typical chemical contamination
Biosolids	- Consistency of performance with moderate biogas yields - Chemical contamination levels	- Grit and sand - Plastic and other non-biodegradable materials - Hair and fibres	- PFAS - Heavy metals - Chemicals (e.g. polymers used for thickening biosolids) - Other emerging contaminants as per Biosolids Guidelines
Grease-trap waste	- Highly energy-rich and positive impact on methane production when co-digested in controlled quantities - Pre-treatment and controlled dosing - Chemical contamination levels	- Plastics (e.g. food packaging) - Paper and fibrous materials (e.g. paper towels) - Grit and sediments - Metal objects (e.g. bottle caps)	- Long-chain fatty acids (LCFAs), produced from the breakdown of fats and oils - Cleaning chemicals and detergents - High salt concentrations - Heavy metals - Siloxanes

B.3 Technology description

Anaerobic digestion relies on different groups of microorganisms, each responsible for breaking down different components of organic material. Stable operation depends on maintaining balance between these microbial populations and the chemical conditions within the digester, as the different biological phases occur simultaneously but at varying rates. Anaerobic digestion systems can therefore be configured in a range of ways to support process stability and performance. The key design parameters are outlined in Table B3. These characteristics form the basis for choosing an anaerobic digestion technology and facility design.

Table B3 Key characteristics of anaerobic digestion

Design parameter	Options
Operating temperature ⁸	Mesophilic (30–40°C) or thermophilic (50–60°C)
Feeding type	Batch or continuous
Feedstock moisture	Wet (<15% total solids) or dry (15–40% total solids)

B.3.1 Operating temperature

Different microbial communities operate at different temperature ranges. Whether a system is mesophilic (30–40°C) or thermophilic (50–60°C) has a significant impact on the digestion process, including hydraulic retention time. The key variables and benefits of mesophilic and thermophilic systems are summarised in Table B4.

Table B4 Benefits of mesophilic and thermophilic systems

Variable	Mesophilic	Thermophilic
Operating temperature	30–40°C	50–60°C
HRT	20–25 days	15–20 days
Benefits	• More stable process due to higher diversity of the methanogenic bacteria • Lower energy requirements therefore more favourable energy balance • Reduction in water vapour and CO₂ in the biogas • More favourable energy balance because less energy is required to heat the substrate • Digestate requires additional treatment to remove pathogens	• Faster liquefaction, higher bacterial activity and therefore reduced retention time, typically resulting in a smaller digester footprint • Higher operating temperatures will increase energy demand, which should be considered in the overall energy balance and cost of the facility • Higher biogas production at the same retention time • Volume reduction of the solid digestate • Greater pathogen reduction potential than mesophilic anaerobic digestion • More flexible maintenance of the anaerobic conditions due to the higher solubility of the gases at higher temperatures • Less stable process due to bacterial sensitivity to temperature

⁸ At temperatures between these ranges, a mixed population of mesophilic and thermophilic microorganisms is expected. This intermediate temperature zone is regarded as biologically unstable.

B.3.2 Feeding type

The digester feeding type directly impacts feedstock receipt, storage and handling requirements. It will also influence site logistics, delivery scheduling, staffing and operational management, and drives the selection and sizing of key equipment such as tanks, mixing systems and plug flow or batch reactor configurations.

Continuous-fed systems

Continuous-fed systems require receipt infrastructure that supports frequent, controlled feeding. Such feeding can include:

- buffer storage and equalisation
- pre-treatment to produce a homogeneous, pumpable feedstock
- metered dosing systems
- enclosed receiving areas sized for a continuously fed system with adequate internal ventilation to control odour.

Batch-fed systems

Batch-fed systems are designed to accommodate intermittent, high-volume loading and therefore require:

- larger receipt and storage areas
- solid handling equipment such as loaders and conveyors
- controls to manage short-term odour and bioaerosol emissions during loading events.

B.3.3 Feedstock moisture content

Anaerobic digestion systems are commonly classified as wet or dry, based on the total solids (TS) content of the feedstock. The choice between a wet or dry system will typically inform:

- the feeding type (e.g. batch or continuous)
- the receiving system (e.g. a wet system will utilise a tank system)
- pre-treatment method
- mass balance (e.g. energy requirements, liquid and solid fractions).

Wet anaerobic digestion

Wet anaerobic digestion operates at low solids content (generally less than 15% total solids) and treats organic material in a pumpable liquid. It is widely applied to high-strength liquid wastes and to the co-digestion of organic solids with wastewater sludge or manure. Where solid organic wastes are treated, hydraulic pre-treatment is typically required to remove contaminants such as plastics and heavy inert material prior to digestion.

Wet anaerobic digestion systems rely on tanks, pumps, mixing and controlled dosing, and are well suited to continuous or semi-continuous operation where consistent feed characteristics can be maintained.

Dry anaerobic digestion

Dry anaerobic digestion operates at higher solids content (typically 15–40% total solids) and is used to treat solid organic materials such as food waste and green waste, either alone or co-digested. Feedstock is generally pre-processed through shredding and decontamination.

Dry anaerobic digestion systems are commonly fed and operated continuously, with buffer storage used to manage seasonal variations in feedstock.

B.4 Process design

Anaerobic digestion systems vary in complexity, but all systems will generally follow the same core process steps. These are outlined below.

1 Feedstock receipt

Feedstocks are received within a dedicated reception area. Receipt and storage systems should be sized for peak-flow conditions, not average throughput. Sufficient buffer capacity is required to manage delivery variability and maintain a consistent feed to the digestion process.

A facility needs adequate space and appropriate equipment to allow feedstocks to be unloaded, inspected for contamination and stored without creating bottlenecks or environmental risks. Receipt infrastructure should take into account the way the feedstock is delivered – for example, whether loose solid material is delivered by tipper truck, palletised or drummed materials are delivered by non-tipper truck, or liquid feedstock is delivered by tanker. Facilities may also need tipping areas for solids and enclosed pits or tanks for liquid discharges.

2 Pre-treatment

Pre-treatment is used to prepare feedstocks for digestion, protect equipment and maintain stable digester performance. The level of pre-treatment required depends on feedstock variability, contamination risk, process sensitivity and the intended use of the digestate. Solid feedstocks are typically mechanically pre-treated to produce a pumpable or uniform material. This may include removing packaging materials, screening, size reduction, maceration and mixing.

Removing contaminants

Pre-treatment may include mechanical and chemical processes to remove or control contaminants that could affect digester operation or output quality.

Physical contaminants (such as grit) must be removed before digestion to prevent equipment damage, protect the microbial process, improve efficiency and support digestate quality.

Chemical contaminants should also be identified and managed as early as possible to protect digester performance and downstream biogas recovery systems. Contaminants that contribute to biogas impurities, such as siloxanes, should be controlled prior to digestion to protect process integrity and allow the digestate to be used as intended.

3 Digestion

Prepared feedstock is transferred into an enclosed digester vessel, where organic material is biologically degraded by anaerobic microorganisms in the absence of oxygen. Digestion occurs in a controlled environment designed to support stable biological activity and prevent uncontrolled emissions. Digesters may operate as wet or dry systems and may be configured as batch or

continuous processes, depending on feedstock characteristics and technology selection. The digestion process converts biodegradable organic matter into biogas and digestate over a defined residence period. Digesters and associated infrastructure should be designed to prevent air ingress, leakage of liquids and uncontrolled release of biogas, and to allow for ongoing monitoring and access for maintenance.

4 Biogas collection and management

Biogas generated during digestion is collected from the digester and conveyed via a sealed gas handling system. Raw biogas typically contains methane and carbon dioxide, along with trace contaminants such as water vapour and hydrogen sulfide.

Anaerobic digestion systems can be designed to produce:

- electricity (via a generator)
- heat (via boiler or other type of heat generating equipment)
- natural gas/biomethane
- compressed natural gas (CNG) (with appropriate compression and cleaning equipment)
- a combination of the above.

Gas treatment

The gas may have to be treated to support its intended use or to reduce maintenance requirements for downstream equipment. Gas treatment systems add capital costs and ongoing operating costs, and these should be assessed against the benefits and expected returns from using the gas. Reinjecting gas into the gas grid, for example, requires a high level of gas cleaning to meet strict network quality standards, and the cost of this level of treatment may outweigh the returns from selling the gas.

Flaring capacity is typically provided to manage excess gas and to allow safe operation during start-up, shutdown and abnormal operating conditions. The biogas system should incorporate appropriate safety controls to manage fire, explosion and emission risks.

5 Digestate processing and management

Digestate is the residual material produced following anaerobic digestion. It may be managed as a liquid digestate or separated into solid and liquid fractions. Digestate management depends on the characteristics of the material and the proposed reuse or disposal pathways. A clear understanding of the intended digestate pathway is critical, as inappropriate management can result in significant disposal costs.

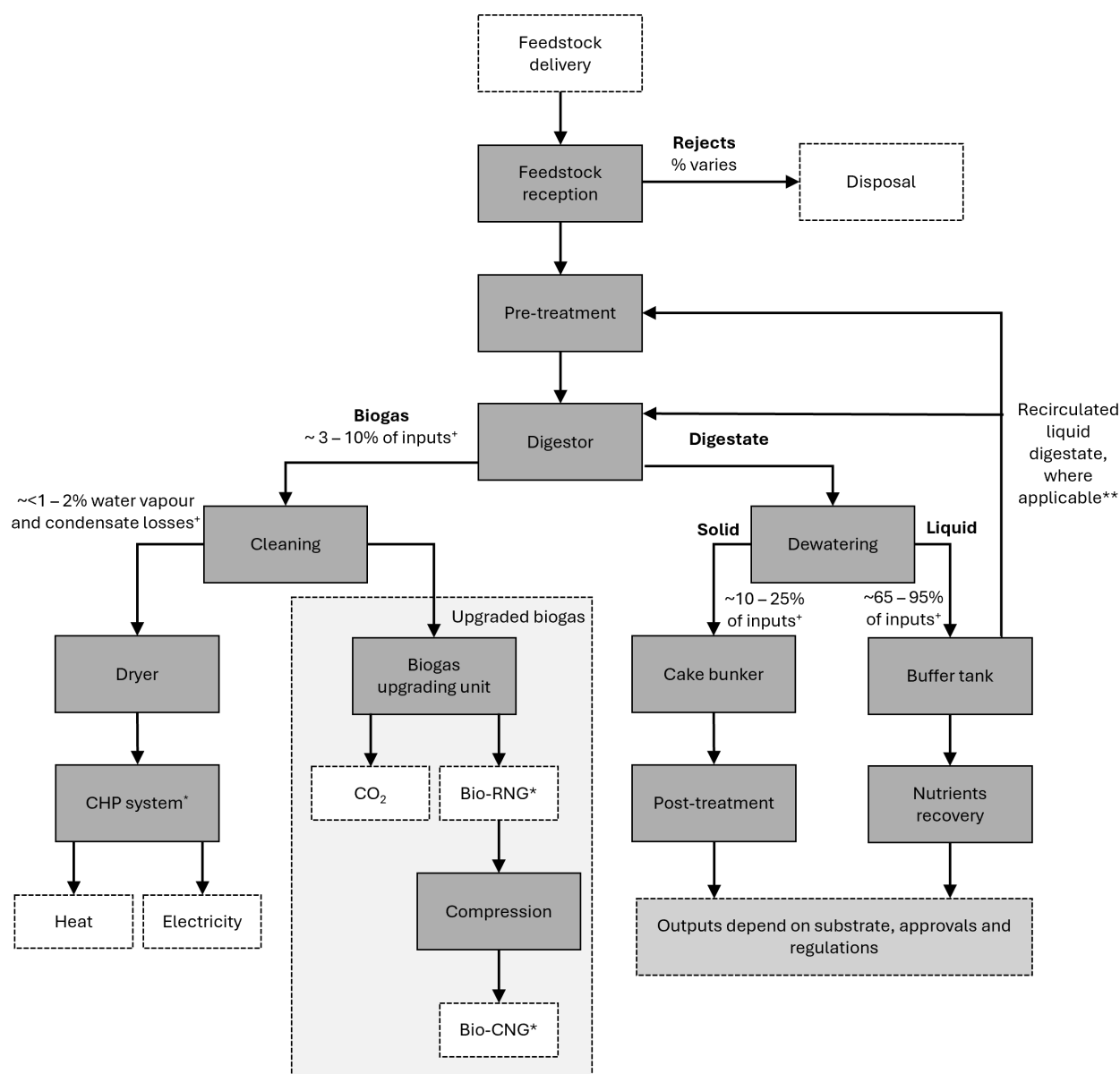
Digestate may require further processing, such as dewatering, stabilisation or pasteurisation, before it is reused or transferred off site. Dewatering to separate the liquid and solid fractions is commonly required to support beneficial reuse of digestate.

Liquid digestate may be reused within the anaerobic digestion process, treated, or managed through approved reuse or disposal pathways, subject to regulatory controls. Any water treatment system required to support digestate management should be designed and sized based on the proposed use of the water, such as process recirculation or discharge to sewer.

Solid digestate may be further treated, for example through composting, to improve its stability and suitability for land application, subject to compliance with relevant RRO/E requirements (see section 2.4.3).

Digestate processing and storage areas should be designed to prevent odour generation, leachate escape and uncontrolled emissions, and to provide sufficient storage capacity to accommodate fluctuations in production, seasonal constraints and market demand.

Figure B1 presents a general anaerobic digestion process flow which summarises the main process steps and includes typical points where digestate or process liquid is recirculated.



* CHP – combined heat and power (refers to the combustion chamber used to generate heat and electricity from cleaned biogas), RNG – renewable natural gas, CNG – compressed natural gas

* The % mass of inputs will vary depending on the composition of the feedstock, contamination levels, and the AD technology selected (e.g. wet or dry AD). The ranges presented are indicative only and have been summarised from a review of various technical references. A detailed assessment of the selected technology is required to establish a project-specific mass balance for AD processing.

** The quantity and points of input for recirculated liquid digestate will vary depending on the selected AD technology and process configuration.

Figure B1 Flow chart of the main process steps of anaerobic digestion

B.5 Process operations

Anaerobic digestion is a complex and process sensitive technology requiring tight control of feedstock quality and operating conditions. This section outlines the key process parameters and operational practices that support effective anaerobic digestion.

Key process parameters

1. **pH:** between 6 and 7.5
2. **C:N ratio:** optimal ratio is 20–35:1
3. **organic loading rate:** input rate of organic material per unit volume of the digester
4. **hydraulic retention time (HRT):** depends on digest volume and substrate input flow rate
5. **trace elements:** small quantities of essential minerals needed for the process such as iron, cobalt, nickel, tungsten, manganese, etc.
6. **temperature:** mesophilic (30–40°C) or thermophilic (50–60°C)

Together, these parameters affect not only biogas yield and quality, but also process resilience, odour and emission risks, digestate management requirements and overall operational performance.

How key process parameters affect the process

1. pH directly affects microbial activity and process stability, with deviations increasing the risk of microbe inhibition or process upset.
2. C:N ratio influences nutrient balance and ammonia levels, which can affect both biogas production and digestate quality.
3. Organic loading rate determines the rate at which material is fed to the digester and should be controlled to avoid overloading, acidification and odour generation.
4. Hydraulic retention time influences the extent of digestion and conversion efficiency and affects digester sizing, stability and residual organics in the digestate.
5. Trace elements are required in small amounts to support microbial function, with deficiencies leading to reduced performance (i.e. reduced biogas production and higher hydraulic retention time).
6. Temperature directly affects microbial activity and process stability, with deviations increasing the risk of microbe inhibition or process upset.

Managing key parameters for efficient operations

The key process parameters directly affect digester performance and stability. The operational practices below provide examples of how these parameters can be actively managed to support efficient operations.

- **Defined start-up and commissioning procedures:** Start-up should include inoculation strategies, staged loading and enhanced monitoring to allow microbial populations to establish and stabilise.
- **Feedstock sampling and testing:** Sampling and testing should be undertaken at appropriate points within the pre-treatment system to confirm feedstock suitability and manage risks to the

digestion process. Sampling is commonly undertaken at reception areas or interim buffer tanks where representative samples can be obtained. The frequency and scope of sampling should be proportionate to feedstock variability and the potential risk posed to digester performance and digestate quality. Further guidance on feedstock inspection is provided in Appendix A.

- **Controlled loading and feed management:** Feedstock should be supplied to the digester at a controlled and consistent rate to maintain stable operating conditions. Buffer systems (e.g. feed hoppers or intermediate storage tanks) should be used to decouple feedstock reception from digester feeding and allow controlled delivery based on digester capacity. Defined feeding schedules and ramp-up procedures should be implemented following start-up, shutdowns or feedstock changes to manage variable supply and avoid overloading, shock loading, acidification, foaming or microbial inhibition.
- **Management of feedstock changes and co-digestion ratios:** Changes in feedstock type or co-digestion proportions should be implemented gradually and supported by enhanced monitoring to manage impacts on microbial balance, ammonia levels and biogas quality.
- **Volatile fatty acid (VFA) and buffering capacity management:** Operational monitoring should include indicators of process imbalance (e.g. VFA accumulation or declining buffering capacity), with procedures in place to respond through load reduction, dilution, alkalinity addition or feedstock adjustment, as appropriate.
- **Trace element and nutrient supplementation:** Where required, trace element dosing should be actively managed to support microbial function, particularly for feedstocks that are deficient in key micronutrients, recognising that deficiencies can reduce biogas production and process resilience.
- **Digester mixing and stratification control:** Mixing systems should be operated to prevent solids settling, crust formation or dead zones, while avoiding excessive shear that may disrupt microbial communities or increase foaming risk.
- **Process monitoring and control:** The key operating parameters should be monitored to assess digester health and performance. Monitoring systems should allow operators to readily assess material balance and process trends at any given time. Instrumentation such as pH probes, temperature sensors and flow meters can be integrated into an active monitoring system, commonly supported by a SCADA platform that provides a visual interface for plant operation and data management. Monitoring frequency and control requirements should reflect feedstock risk, process sensitivity and system complexity.
- **Foaming and scum management:** Operational controls should be in place to manage foaming and scum formation associated with feedstock composition, surfactants or process imbalance, recognising that foaming can rapidly compromise digester capacity and gas handling systems.
- **Biogas quality monitoring and treatment:** Biogas composition should be routinely monitored (e.g. methane content, hydrogen sulfide, moisture and trace contaminants) to inform operation of gas cleaning systems and protect downstream energy utilisation or upgrading infrastructure.
- **Biogas system balancing and pressure control:** Gas storage and handling systems should be actively managed to prevent over-pressure, under-pressure or uncontrolled venting, particularly during process upsets or maintenance activities.
- **Biogas and fire safety management:** Biogas systems should be operated and maintained to manage fire, explosion and emission risks. Appropriate safety controls, monitoring and

maintenance procedures should be in place to ensure safe handling, storage and use of biogas. Refer to section 5.5 and section 6.8 for more information on fire safety management.

- **Digestate and output storage:** Digestate storage systems should be designed and operated to avoid prolonged storage where practicable, as extended storage can lead to degradation and increased odour generation. Storage capacity should align with downstream reuse or disposal pathways and allow for operational variability.
 - **Digestate residual gas and biological stability management:** Digestate handling and storage systems should account for ongoing biological activity and residual biogas production, including appropriate degassing, covered storage or post-treatment where required to manage odour, safety and emission risks.
 - **Digestate storage aligned with reuse pathways:** Digestate storage capacity and management should align with downstream reuse, further treatment or disposal pathways to minimise prolonged storage and secondary emissions.
 - **Process upset response and recovery planning:** Contingency procedures should address AD-specific failure modes (e.g. acidosis, ammonia inhibition, foaming or biogas quality deterioration), recognising that biological recovery may be prolonged and require active intervention.
 - **Contingency planning:** Contingency measures should be in place to manage process disruptions, equipment failures or abnormal operating conditions. This may include provisions for reduced loading, temporary storage, alternative pathways for digestate or other outputs and controlled shutdown, as appropriate to the facility design and risk profile.
-

B.6 Outputs

Anaerobic digestion facilities produce a number of different outputs, which in the context of these Guidelines, have been categorised as primary outputs, secondary outputs, and rejects.

- **Primary outputs** include biogas, solid digestate, and liquid digestate.
- **Secondary outputs** include process water, liquid digestate not utilised for internal recirculation, biogas emissions, and oversized materials removed during screening.
- **Rejects** refer to materials unsuitable for processing within the anaerobic digestion system (e.g. physical contaminants).

Any output designated for land application is subject to an RRO/E on a case-by-case basis (refer to section 2.4.3).

Outputs transported off-site for further processing or treatment must comply with the licensing requirements that apply to feedstock at the receiving facility.

B.6.1 Primary outputs

Biogas

Biogas represents most of the recoverable energy from the anaerobic digestion process. Biogas is classified as a primary output and is regarded as a usable energy output. Regulatory compliance focuses on air emissions limits established by the facility licence and applicable NSW guidelines (see section 5.2).

Depending on plant configuration and end-use strategy, biogas may be:

- combusted on-site to generate electricity and useful heat in either combined heat and power systems, or combined cooling, heat and power systems
- or
- converted to upgraded biogas for injection into a gas grid or use as a transport fuel.

Biogas emissions generated during startup, shutdown, abnormal operations, or released in an uncontrolled manner, are not considered primary outputs. Such emissions are categorised as a secondary output.

Digestates

Digestate constitutes the largest mass output from an anaerobic digestion system. It is a water-rich material containing residual organic matter, nutrients (notably nitrogen, phosphorus, and potassium), and microbial biomass. Digestate is typically produced as a single bulk stream and may subsequently be separated into liquid and solid fractions.

Liquid digestate

Separated liquid digestate represents the largest fraction of digestate by volume and mass and is characterised by a high-water content with dissolved and fine-suspended nutrients. In wet anaerobic digestion systems, this fraction typically dominates the overall digestate output. A proportion of liquid digestate is often recirculated internally to support feedstock preparation, dilution and process stability. Any liquid digestates not required for internal reuse form a net secondary output from the anaerobic digestion system; this is discussed in Appendix B.6.2.1.

Solid digestate

Solid digestate is the separated fibrous fraction of digestate and contains most of the remaining structural organic material that resists further anaerobic degradation. Digestate may need additional pasteurisation before application to land, subject to the material meeting RRO/E requirements. This output can be pasteurised on site or transported to a composting facility subject to material complying with the EPL and relevant RRO/Es of the downstream receiving facility. Solid digestate can also be dried and pelletised to become a refuse-derived fuel (RDF) or a soil amendment for application to land. It is important to note that any form of digestate that is applied to land will require a general or site-specific RRO/E regardless of any processing.

B.6.2 Secondary outputs

Non-recirculated liquid digestates

This portion of liquid digestate may be applied to land subject to general or site-specific RRO/E requirements for land application or transported to a liquid waste treatment facility for additional processing. This secondary output may also require treatment before it is discharged to sewer, to ensure that all applicable discharge limits and conditions are met. Due to the nutrient concentration and mobility of liquid digestate, it must be managed carefully to protect the environment; special attention must be paid to run-off, leaching, odour control and storage capacity. Section 5 details environmental management considerations and design measures for organic processing facilities.

Biogas emissions

Biogas emissions that are not captured for the primary uses outlined in Appendix B.6.1.1 constitute a secondary output of the process. They encompass emissions occurring during start-up, shutdown, abnormal operating conditions (such as maintenance), or any instance where biogas is released in an uncontrolled manner.

Capturing and using biogas in line with the facility's licence is vital to the facility's environmental performance, because uncontrolled releases may compromise the greenhouse-gas mitigation benefits associated with the anaerobic digestion. Accordingly, the potential for uncontrolled biogas release should be identified and assessed when facilities are being planned and designed. Emissions can be managed through risk-based design and operational controls, including:

- ensuring biogas capture and treatment is conducted efficiently with appropriately sized boilers and engines that maximise combustion efficiency
- providing gas flares to manage excess gas, bypassing gas engines when off-spec conditions occur or when engines are undergoing maintenance
- ensuring engine and boiler equipment are designed to meet AS 3814 (AG501) for industrial gas fired appliances and AS 1375 for industrial fuel fired appliances.

Additional air pollutant management and control measures are detailed in section 5.2.

Oversized materials

Large materials that are removed by pre-treatment screening can be mechanically broken down and reintroduced to the process once their particle size is small enough for consistent feedstock. If the particle size cannot be reduced, these materials are considered rejects to the process.

B.6.3 Rejects

Contaminants separated before or after anaerobic digestion processing, such as plastics, are classified as rejects. Unlike oversized materials, these rejects are unsuitable for anaerobic digestion processing and could compromise output quality. They are typically separated out and sent to an appropriate facility for further treatment or disposal.

Appendix C: Composting

C.1 Introduction

Composting is a controlled aerobic process in which microorganisms break down organic materials in the presence of oxygen. It produces a humus-like material (compost), plus secondary outputs such as heat, water vapour and carbon dioxide. Composting is a well-established organics processing method that supports the diversion of organic waste from landfill, helping to avoid methane generation and recovering valuable nutrients for beneficial reuse.

Composting systems vary widely in scale and complexity, from small backyard setups and simple open-air windrows to enclosed, fully engineered, in-vessel systems. Each system has a different level of process control, space requirements, capital costs and operating needs.

Final compost can be screened into different sizes or blended with other materials to meet specific market requirements. It is commonly used in horticulture, agriculture, landscaping, land rehabilitation and erosion control. When applied correctly, compost improves soil structure, increases water-holding capacity and supports soil health.

Processors are responsible for ensuring that compost meets applicable quality, contaminant and pasteurisation requirements prior to supply.

C.2 Feedstock suitability

Many types of plant and food materials can be composted. However, materials that break down poorly or that are heavily contaminated can reduce the quality of the final output and should be avoided or removed at the start of the process: examples are treated wood, engineered wood products, garden material contaminated with pesticides and herbicides. Table C1 below summarises common composting feedstocks and considerations. This list is guidance only and is not exhaustive.

Table C1 Common composting feedstocks and considerations

Feedstock type	Suitability and considerations for composting
Food waste	Food waste breaks down easily and contains valuable nutrients, making it well-suited to composting. It is typically high in nitrogen and should be blended with carbon-rich materials to maintain an appropriate carbon-to-nitrogen (C:N) ratio. This also helps manage odour, moisture and leachate. Contamination control is essential to maintain output quality. It can, however, have a high salt content.
Garden waste	Garden waste, such as leaves and grass clippings, is suitable for composting and contribute carbon to feedstock blends. It helps to improve the structure and aeration of compost piles, although it may decompose more slowly when woody or too coarse. Shredding and careful moisture management are often required to support effective processing. A large amount of woody material in the feedstock will lead to a high volume of oversized components in the compost (prior to screening).
Food waste and garden waste	Combined food waste and garden waste – also known as food organics and garden organics (FOGO) – is commonly supplied from domestic council kerbside collections. It typically contains a high proportion of garden organics and a smaller amount of food organics. This blend provides both nitrogen and carbon, supporting good composting conditions when other parameters are managed well.

Feedstock type	Suitability and considerations for composting
Wood waste	Untreated wood waste is suitable as a carbon-rich bulking agent rather than a primary feedstock. It improves porosity and airflow but decomposes slowly (as does woody material in green waste) and should be blended with more nitrogen-rich materials. Treated wood is unsuitable because it contains chemicals that contaminate the finished product.
Natural organic fibrous materials	Natural organic fibrous materials, such as agricultural residues (e.g. straw and crop waste) are suitable for composting and are commonly used for composting on farms. These materials are typically carbon-rich and require blending with nitrogen-rich feedstocks to achieve ideal composting conditions.
Animal waste and manure⁹	Animal waste and manure can be composted under controlled conditions and are commonly managed in agricultural settings in accordance with relevant regulations. These feedstocks are high in nitrogen and moisture and require careful blending, containment and temperature control to manage odour and biosecurity risks, and reduce pathogens. Relevant controls appropriate to the level of risk are particularly important. Refer to Appendix A for specific guidance on processing and managing animal carcasses and manure.

C.2.1 Ideal feedstock characteristics

To support efficient composting, individual feedstocks are commonly blended to achieve characteristics more suitable for the composting process. Blending is used to adjust key physical and chemical characteristics such as moisture content, carbon-to-nitrogen (C:N) ratio, particle size, pH and bulk density.

Blending can be undertaken using fixed mixing equipment (such as auger-based systems) or mobile plants (such as loaders or excavators). The approach used will depend on the scale of the facility, site layout and the composting method selected.

The ideal ranges for feedstock characteristics provided in Table C2 should be used when managing feedstock blends. Composting can still occur outside ideal conditions; however, this may result in slower processing times or lower-quality output. It can also increase operational risks: for example, some parameters such as moisture content are particularly important for managing odour, because wet feedstocks can restrict airflow, leading to development of anaerobic conditions. Further detail on feedstock selection and associated risks is provided in Table C2.

Table C2 Ideal ranges for feedstocks

Characteristic	Range	Recommended (Ideal)
Moisture content	40–65% by weight	50–60% by weight
C:N ratio of combined feedstocks	20:1–60:1	25:1–40:1
Feedstock particle size	<5 cm	Variable
Bulk density	<700 kg/m ³	400–600 kg/m ³
pH	5.5–9.0	6.5–8.0

⁹ Animal waste is currently not an allowable input under the Compost Order 2016 (EPA, 2016) and an application for a specific RRO/E is required at present. Regulatory conditions may change over time. Processors must ensure they comply with the requirements of any new or updated RRO/Es or other relevant documentation.

C.3 Technology description

There are many different composting methods, from simple open-air systems to fully enclosed and engineered processes. Systems vary in their level of process control, infrastructure requirements, capital cost and operating complexity. When selecting a composting system, operators should carefully consider several factors, including what materials are being processed, how much space is available, where the system can be located, and what the facility needs the system to do.

C.3.1 Open composting systems

Open composting systems, such as turned windrows and passively aerated static piles, are relatively simple and typically require lower capital investment. These systems are generally suitable where lower-risk feedstocks are used, and sites have sufficient separation from sensitive receivers.

As processing volumes increase, or where the facility accepts higher-risk feedstocks (such as food waste, animal by-products or biosolids), additional controls are usually required. This may include longer processing or holding times, forced aeration, leachate and stormwater management systems, process monitoring, and odour mitigation measures.

C.3.2 Enclosed composting systems

Enclosed composting systems provide a higher level of containment and control, and may allow odour and emissions to be better managed.

C.3.3 Base system choice on risk

The choice of composting system depends on several factors, including the type and amount of feedstock being received, site constraints, and how close the facility is to sensitive receivers. Facilities should be designed and operated using a risk-based approach, with higher levels of containment, monitoring and management where there is a greater risk of off-site impacts and/or higher-risk feedstocks are used. The selected technology or method should be based on an assessment of these risks and the controls needed to manage them effectively.

Examples of common composting systems are provided in Table C3 below.

Table C3 Common types of composting systems

System	Technology	Description
Open passively aerated composting	Turned windrows	Feedstocks are placed in long rows, commonly called piles or windrows. These rows are regularly turned using mobile equipment to mix the material and introduce air. Aeration relies on the turning process and natural airflow through the pile.
	Passively aerated static piles	Feedstocks are placed in piles and left to decompose without mechanical aeration. Air moves through the pile naturally. Because there is limited control over airflow, processing times can be long.
Open forced aeration composting	Aerated static piles	Feedstocks are placed over a system of perforated pipes and air is forced or drawn through the pile using blowers. This controlled airflow improves oxygen supply, helps manage temperatures, and removes excess moisture, carbon dioxide and ammonia when the system is well operated.
Enclosed composting	In-vessel composting (IVC)	Feedstocks are processed inside enclosed vessels, tunnels or containers. Key process conditions such as airflow, moisture and temperature are actively controlled, typically using automated systems. This allows a high level of process control and containment.

System	Technology	Description
	Agitated bays/beds	Feedstocks are placed in a turning machine and are turned regularly and automatically. Such systems often include forced aeration.
	Vertical silos	Feedstocks are loaded into the top of a vertical vessel or reactor and materials move downward as compost is removed from the base. These systems often include forced aeration, with air being supplied from below.
	Rotating drums	Feedstocks are placed in horizontally oriented cylinders, which are rotated slowly to mix and aerate the material. Feedstocks are typically added to one end of the drum, with compost removed at the opposite end. This treatment is primarily used for pre-composting.
	Synthetic covers	Compost piles are covered with specialised breathable membranes. These covers are often used with aerated static piles to improve containment and reduce emissions, while still allowing airflow through the material.

C.4 Process design

While composting systems differ in configuration, the core process steps (listed below) are generally similar.

C.4.1 Feedstock receipt and pre-treatment

Feedstocks are delivered to the facility, unloaded and inspected in accordance with the site's feedstock acceptance procedure. Pre-treatment may include decontamination, de-packaging, shredding and blending, depending on feedstock type and contamination risk.

C.4.2 Primary composting (active phase)

Pre-treated feedstock is transferred into the primary composting system, such as windrows, static piles, tunnels or vessels. During this phase, microorganisms rapidly break down organic material, generating heat and consuming oxygen and moisture. Aeration is required to maintain aerobic conditions and vent accumulated gases. Aeration can be provided through turning or forced airflow (via floors or pipes).

Pasteurisation occurs during this phase, whereby temperatures rise and are maintained for a sufficient period of time to reduce pathogens and weed seeds. Pasteurisation is validated through a combination of both time-temperature records and microbiological testing according to the compost resource recovery order. For example, typical practice for compost piles containing higher-risk material involves maintaining the core temperature of the pile above 55°C for three consecutive days prior to each of five turnings, as shown in Figure C1 (Freshcare, EPA, AHR, & MRA Consulting, 2023).

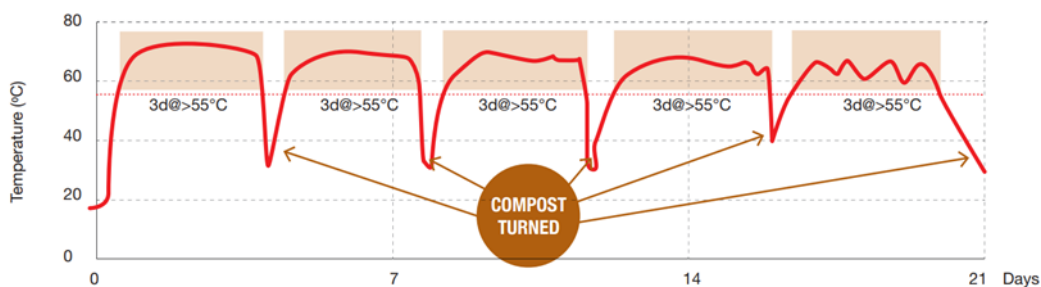


Figure C1 Example of time-temperature relationship during turning of high-risk compost

In enclosed systems, the time–temperature relationship during pasteurisation is recorded and controlled automatically. Simpler composting systems may rely on manual temperature measurements during this phase.

C.4.3 Maturation

Maturation generally occurs in a separate area away from the active pasteurisation stage, and plant and equipment used for managing pasteurisation should be kept separate to avoid recontamination of the compost with pathogens and plant propagules. Maturation will vary in duration and the level achieved, depending on the type of output required by the end user.

The maturation phase occurs after the primary composting phase and generally begins once the windrow or pile no longer reheats after turning. With forced aeration, it generally begins after the pile temperature shows a steady decrease and approaches mesophilic levels (~40°C). Aeration can be applied during maturation and may decrease the time needed in this stage somewhat, but aeration is no longer required for cooling. This stage allows for further decomposition of resistant compounds, organic acids and large particles. Less mature composts may be unsuitable for specific horticultural or agricultural applications, as they may damage or ‘burn’ plants.

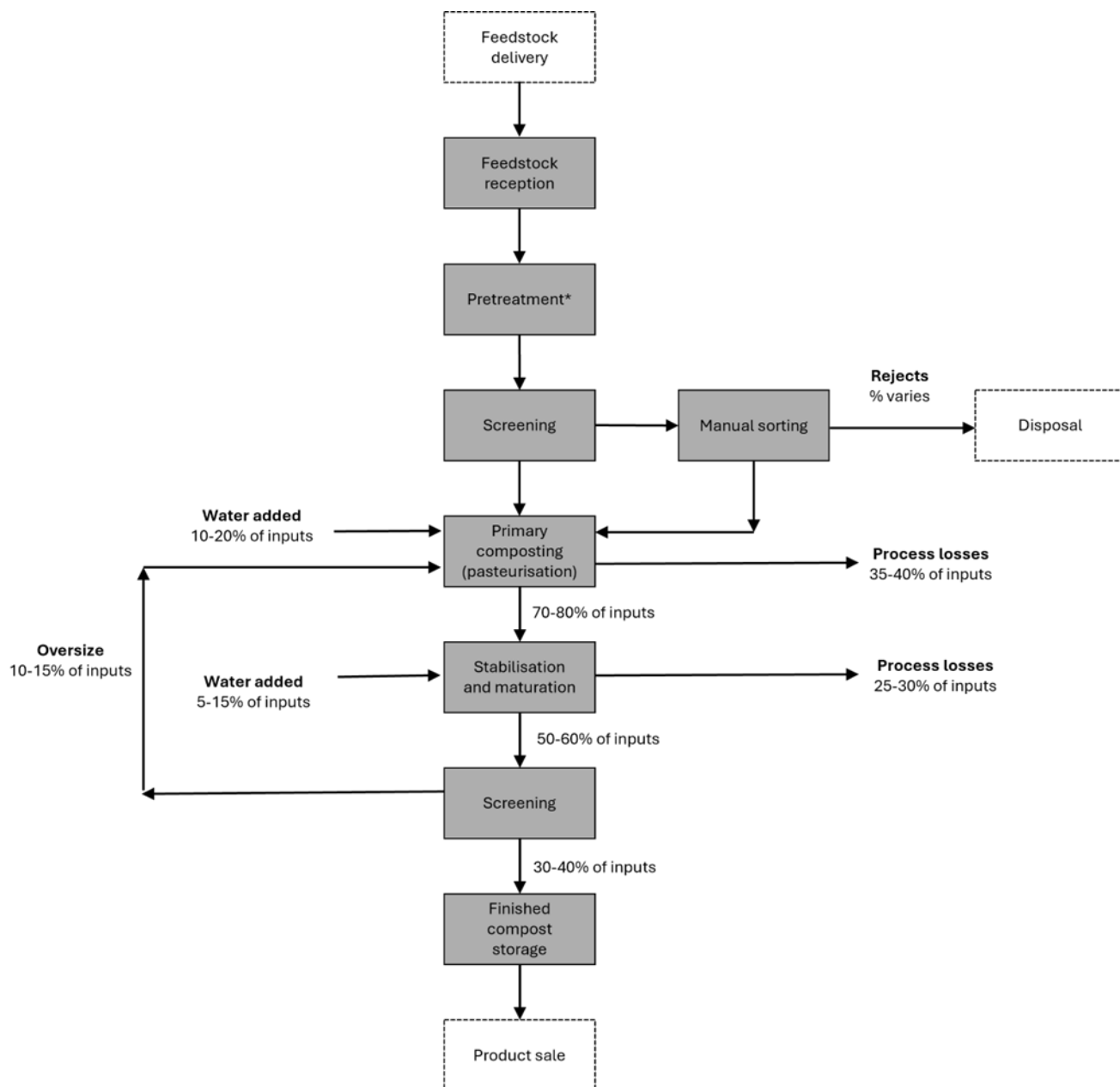
C.4.4 Screening, finishing and storage

The mature compost is usually screened to produce sizes or grades of output suited to the intended application. Smaller screen sizes will create higher-grade output as less contamination is likely to pass through the screen; larger screen sizes will generally produce a lower-grade output.

Screening also allows oversize material, such as twigs or contaminants, to be removed from the output. Oversize material can be reused and recirculated in the composting process for use as a bulking agent or used for other purposes such as mulch or fuel; however, recirculation through the process will reduce throughput capacity to some extent.

The compost can be blended with other materials, such as soil or sand, to meet specific customer or market needs. Finished output can then be removed from site or transferred to a storage area before it is sold or distributed. Storage areas should be designed and clearly labelled to prevent the compost becoming re-contaminated, taking up excessive moisture or generating run-off. The processing facility needs to be designed with adequate storage to allow for fluctuations in compost production/seasonality or market supply.

A general process flow of composting is shown in Figure C2.



*Pretreatment steps can include steps such as decontamination, depackaging, shredding, and blending, dependent on the facility design.

Note: Process steps and values quoted are indicative only and are dependent on the facility design. Percentages are provided on a by weight basis.

Figure C2 Flow chart of the main process steps for composting

C.5 Process operations

This section outlines the key operational practices that support effective, compliant composting. While composting systems vary in scale and technology, all facilities should operate in a way that maintains aerobic conditions, achieves pasteurisation, protects output quality, and minimises risks to human health, the environment and surrounding communities. Table C4 below summarise the main operational areas and gives some short explanatory notes for additional detail and context.

Table C4 Operational areas in composting

Operational area	Key considerations
Process monitoring	Monitor temperature, moisture and odour to confirm aerobic conditions and achievement of pasteurisation. Monitoring frequency and method should reflect feedstock risk and system complexity.
Record keeping	Maintain records of feedstock receipt, batch formation, temperature logs, turning or aeration events, and movement between process stages. Records may be manual or automated.
Batch management	Manage compost in defined batches or piles to enable traceability and confirmation of residence times and pasteurisation requirements.
Pasteurisation control	Prevent cross-contamination between untreated feedstocks and pasteurised or finished material through site layout, traffic flow and equipment management.
Fire management	Manage risks of surface fires, equipment fires and spontaneous combustion through pile sizing, moisture control, aeration, equipment maintenance and emergency procedures.
Finished compost storage	Design and manage storage areas to prevent recontamination, odour, anaerobic conditions and excessive moisture uptake. Avoid compacting stockpiles.
Testing and sampling	Undertake appropriate testing based on feedstock risk, output type and end use, and in accordance with the relevant RRO/E. Use on-site testing where suitable and accredited laboratories where required.
Environmental risk management	Minimise odour, leachate, stormwater run-off, dust and noise through timely processing, aerobic operation, stockpile controls and seasonal adjustments.

Process monitoring

- Regular monitoring is essential to confirm the composting process is working as intended.
- Monitoring helps demonstrate that pasteurisation requirements have been met, allows process issues to be identified early, and supports timely operational adjustments.
- Monitoring may be manual or automated, depending on facility scale and complexity.
- Recommended monitoring parameters are outlined in Table C5.

Record keeping

- Facilities should keep clear and accurate records to demonstrate compliance with the requirements of any applicable licence, approval, resource recovery order and regulations.
- Typical records include:
 - starting volume (m³) or mass (tonnes)
 - feedstock receipt dates
 - batch or pile formation dates
 - temperature monitoring results
 - turning or aeration events
 - movement or addition of material between process stages.
- Larger facilities may use automated systems (such as Supervisory Control and Data Acquisition (SCADA)) while smaller facilities may rely on logbooks or spreadsheets.

Batch management and traceability

- Composting operations should be managed in defined batches or piles to allow material to be traced from feedstock receipt through to finished output.
- Batches should be clearly identifiable and tracked throughout the process to confirm that minimum residence times and pasteurisation requirements have been achieved.

Pasteurisation control

- Facilities should manage composting operations to minimise the risk of re-contamination of pasteurised material – that is, pasteurised compost, mature material and finished output – by non-pasteurised material. This is typically achieved by keeping material that is at different stages of the composting process in separate, clearly defined areas of the site.
- Windrow or stockpile height and shape are important for effective pasteurisation, process control and the ability to shed rain in high-rainfall areas. Factors to consider include:

Length, width, height and form of the windrows and/or stockpiles	These should be selected to ensure effective pasteurisation and allow for proper turning and handling so that all material receives the required time–temperature exposure.
Constraints of turning or rehandling equipment	This influences feasible windrow size, shape and spacing, and should be compatible with the intended stockpile configuration.
Monitoring of temperature in stockpiles	Daily temperature readings should be taken to show target temperatures have been achieved. Larger stockpiles may require additional temperature monitoring across the piles to adequately track temperature variations through the material. Processors should be aware of the potential for overheating and spontaneous combustion in larger stockpiles where temperature can build due to the insulation effect of large amounts of material. More regular turning or monitoring may be required depending on risk.
Managing material in discrete windrows or batches	This may support more effective treatment, monitoring and risk management.

- Site layout, traffic flow and operating procedures should be designed to support this separation and reduce the likelihood of cross-contamination.
- Mobile plant, such as front-end loaders, should be managed in a way that avoids transferring untreated material into areas containing pasteurised or finished compost.
- Where equipment is used across multiple process stages, appropriate cleaning or other controls should be implemented before handling pasteurised material.
- Clear isolation zones or designated areas can help maintain effective separation between process stages.
- Maturation and finished compost stockpiles should, where practicable, be located and oriented up-slope from receipt and primary composting areas to reduce the risk of contamination from run-off.

Fire management

- Composting facilities should identify and manage fire risks associated with organic material handling, processing and storage.

- Fire risks may include surface fires, equipment fires and spontaneous combustion within biologically active compost material.
- Equipment fires may occur due to the build-up of dust or dry organic material around engines, exhausts or moving parts. Regular equipment cleaning and maintenance can reduce this risk.
- Measures to reduce fire risk include appropriate pile sizing, moisture control, aeration practices, and avoiding excessive compaction of compost material.
- Spontaneous combustion can occur where heat generated within composting material accumulates faster than it can dissipate, particularly in large, compacted or poorly aerated stockpiles.
- Facilities should have procedures in place for identifying and responding to elevated temperatures or hot spots within compost piles.
- Where spontaneous combustion occurs, it is typically managed by breaking down the affected pile to allow heat to dissipate and extinguishing hot material, not just applying water to the pile's surface.
- Operators are encouraged to liaise with local fire authorities to ensure fire risks are understood and that emergency response procedures are appropriate for the site.
- Broader fire management considerations, including emergency planning and response, refer to section 5.5 and section 6.8 for more information on fire safety management.

Finished compost (storage and stockpiling)

- Finished compost often needs to be stored for a period of time due to seasonal demand, market conditions or logistical constraints.
- Storage areas should be designed and managed to maintain output quality and minimise the risk of re-contamination, odour generation or anaerobic conditions.
- Where finished compost is considered RAM (restricted animal materials), biosecurity measures need to be applied to ensure that compost is not easily accessible to ruminants (e.g. appropriate fencing).
- Although finished compost is generally stable, it may still generate odour or become anaerobic if stockpiles are too large, overly compacted, poorly aerated or subject to excessive rainfall.
- Stockpile height, shape and configuration should be managed to maintain free air space within the material.
- Driving or operating mobile plant on finished compost stockpiles should be avoided where practicable, as compaction can restrict airflow and increase the risk of odour or heating.
- Adequate space should be allowed at the design stage to accommodate fluctuations in production volumes, seasonal variations and temporary market disruptions.
- The space required for oversize material should be carefully considered. For certain feedstocks it can be significant and must be adequately allowed for in the design.

Testing and sampling

- Facilities should consider the level of testing and sampling appropriate to their operations, considering feedstock risk, output type, intended end use and any regulatory requirements (e.g. conditions of RRO/Es).

- Testing supports verification of output quality, compliance with relevant regulatory requirements, and suitability for beneficial reuse.
- Some basic parameters, such as moisture content, pH, salinity and compost maturity, may be assessed on site using simple field methods or test kits.
- More detailed or regulatory testing may be undertaken by accredited laboratories where required.
- The frequency and scope of testing should reflect the variability of incoming feedstocks, the level of process control and the sensitivity of end uses.

Environmental risk management

- Composting operations should be managed to minimise potential environmental impacts to surrounding land, water, air quality and community amenity.
- Odour risks can be reduced through timely processing of odorous feedstocks, maintaining aerobic conditions and appropriate management of stockpiles.
- Leachate and stormwater should be managed to prevent uncontrolled discharge to land or water, particularly during wet weather.
- Dust and noise impacts should be managed through appropriate operational controls, equipment maintenance and consideration of seasonal conditions.

Screening and contamination management

- Compost is usually screened to improve output consistency and remove physical contaminants.
- Screening can reduce visible physical contaminants in the final output (e.g. plastic), supporting output quality and market acceptance.
- Screening processes may concentrate plastics and other contaminants in the oversize fraction, which can limit the reuse of oversize material as a bulking agent.
- Facilities should consider how they manage oversize material containing concentrated contaminants (which should be assessed at the start of their process), including whether it is suitable for reuse or reprocessing, or must be removed from the composting process.
- Some facilities use additional separation technologies, such as air-separation systems, to further reduce plastic contamination in screened material.
- Screening and separation steps should be placed strategically within the composting process. Some feedstocks may require multiple contamination control barriers.
- Worker safety influences the design of screening systems: for example, manual raking or hand removal of large contaminants may be safer for managing sharps upstream in the process before mechanical screening or picking lines.
- Overall, the system should be designed to remain flexible, allowing operators to adjust or add contamination control measures as feedstocks or operational risks change.

Monitoring is an important part of demonstrating that the composting process is operating effectively and that key risks are being managed. Table C5 below summarises common process parameters that may be monitored at composting facilities, along with considerations relevant to their use.

Table C5 Monitoring parameters for composting

Process parameter	Monitoring considerations
Temperature	Temperatures should be measured regularly – daily during the active phase (pasteurisation) – at several locations within a batch, to be representative of the stockpile length and height. They must be recorded to confirm pasteurisation requirements and track composting progress. Sustained low temperatures may indicate insufficient aeration or moisture, while excessively high temperatures (>70°C) may reduce microbial activity and increase fire risk.
Moisture content	Composting must be maintained within an appropriate moisture range to support aerobic biological activity. Material that is too dry will slow or stop biological activity, whereas material that is too wet can become anaerobic and odorous. Moisture is commonly assessed using simple field methods, such as the hand squeeze test (material should feel moist and hold together briefly without releasing free water) and by visual inspection. Water should be added using hoses, sprinklers or water trucks as required. Leachate can only be introduced at the start of the pasteurisation stage (where potable water is not available) as this can re-introduce pathogens, and only when it does not create odour, moisture, or contamination risk.
Odour	Odour should be monitored through routine site inspections both near and downwind of the odour source. Putrid, septic or rotten-egg odours are usually a sign of anaerobic conditions and indicate a need for process adjustment, such as turning, improving aeration, adjusting moisture, or revising feedstock blends. Odour monitoring may need to be amended to account for the receipt and processing of highly odorous feedstocks. Refer to section 5.2 for more details on emissions.
Other	Some facilities also monitor oxygen, carbon dioxide or pH. Monitoring these parameters may help to confirm that aerobic conditions are being maintained and support troubleshooting of process issues.

C.6 Outputs

Composting facilities produce several different outputs. They can be grouped into three main categories:

- **Primary outputs** are compost outputs for supply to the market for soil conditioning.
- **Secondary outputs** are other materials generated during the composting process. Depending on their characteristics and regulatory requirements, these materials may be reused, further treated, or managed separately.
- **Rejects** are materials that are removed from the output streams, such as contaminants, to meet relevant feedstock acceptance or output quality requirements.

Guidance on how rejects, such as contaminants, should be managed is provided in Appendix A.

C.6.1 Primary outputs

The primary output of composting is compost, which may be screened into different grades or particle sizes, or directly used as a soil amendment in accordance with any relevant RRO/Es.

Facilities should allow adequate space and infrastructure for screening, blending, and other process steps required to meet regulatory and market requirements. Compost may be supplied either in bulk or as a bagged product. Bagged compost can be sold at a higher unit price than bulk compost but typically requires additional handling effort and equipment.

Maturity level of compost

Product specifications are influenced by various factors, including the intended end use, customer requirements and applicable regulatory requirements and/or industry standards.

AS 4454 recognises three levels of compost maturity:

- **Pasteurised:** An organic product that has undergone pasteurisation but is relatively immature and lacking in biological stability.
- **Compost:** An organic product that has undergone controlled aerobic and thermophilic biological transformation through the composting process to achieve pasteurisation and reduce phytotoxic compounds, and has achieved a specified level of maturity required for compost.
- **Mature compost:** Compost that exhibits lower levels of phytotoxicity and a higher degree of biological stability.

Different applications of compost require different levels of maturity. For example, compost may be suitable for use in established gardens, while mature compost is generally preferred for sensitive applications that cannot withstand short-term nitrogen immobilisation, such as turf establishment and potting mixes.

However, it should be noted that even if outputs meet industry product quality specifications (e.g. the requirements of AS 4454), compost outputs intended for land application in NSW must comply with regulatory requirements, such as relevant RRO/Es. These regulatory instruments define state-specific criteria around the lawful operation of the facility and its outputs, such as approved feedstocks, output contaminant thresholds and record-keeping requirements. Refer to section 2.4.3 for further information.

Failed batches of compost should be identified promptly and managed through reprocessing, extended maturation, blending or alternative lawful pathways, as appropriate. If outputs from a composting process are taken to another facility for further processing, the output may be required to comply with the conditions of the destination facility's environment protection licence.

C.6.2 Secondary outputs

Secondary outputs generated during composting operations may include oversize material removed from screening. This material may be returned to the front of the process for use as a bulking agent, used for further composting or processed for other uses.

Process water may be generated from feedstock moisture, rainfall, or water addition during operations. It should be managed to prevent uncontrolled discharge. Water management and prevention of recontamination of compost is further covered in section 5.3.

Appendix D: Dehydration

D.1 Introduction

Dehydration is a processing technology that removes moisture from organic material (typically food) using heat, mechanical processing or both. Dehydration systems generally operate at a small scale and are typically supplied as packaged units, processing between 20 kg and 1,000 kg per day.

Dehydrators are typically used to process organic waste at the point of generation and are installed in the back-of-house waste storage areas in commercial developments (e.g. shopping centres, supermarkets, universities and hospitals).

Dehydrators are commonly used in developments where one or more of the following conditions applies:

- Significant quantities of food waste are generated, and stabilising organic material will reduce odour, deter vermin and minimise potential impacts on amenity.
- There is limited space on site for storing organic waste.
- Reducing waste volumes will reduce frequency of waste collection and minimise waste vehicle movements.
- Reducing the volume and weight of organic waste will make it easier to transport the waste.

The output from a dehydrator is intended to be a dry, low-odour, stabilised residue. Its nutritional value will depend on the feedstock composition. The product is essentially a dried version of the input material and does not constitute a composted product, which has gone through pasteurisation, stabilisation and maturation. Re-wetting this material will restart the decomposition process and can produce offensive odours, attract vermin or encourage the regrowth of harmful microorganisms. For the dehydrated output to be applied to land, it will need to be either regulated under a specific RRO/E or be further processed at a suitable facility (such as a composting facility).

D.2 Feedstock suitability

Dehydrators are generally designed to process source-separated food waste. Acceptable inputs are technology-specific, and suppliers can place restrictions on certain materials, including cooking oils, packaging, large bones and oyster shells. Contamination risks should be assessed and managed appropriately, as the presence of contaminants may lead to system malfunction or the generation of outputs that do not comply with an RRO/E or other regulatory requirements.

D.3 Process design

Dehydrators are typically supplied as package plants and operational parameters are not standardised. Design and operational specifics tend to be proprietary and depend on the manufacturer or technology provider. The following is a general description of the dehydrator process:

- Food waste is inserted into a processing chamber.

- Within the chamber, mechanical paddles or agitators may be used to mix and fragment the waste.
- Heat may be applied at this stage to elevate the internal temperature and drive off moisture contained within the organic material.
- Heated air is circulated through the chamber to transport evaporated moisture away from the dehydrated waste.
- Dehydrated output is discharged into a receptacle.

Key design considerations for dehydrators include:

- **Feed configuration:** Selection of feed rate, timing and management of the dehydrator system, as this influences the required size of feedstock and output storage areas.
- **Services and utilities:** Provision of an appropriate electrical power supply and for some, connection to sewer for discharge of process water.
- **Equipment location and space requirements:** The dehydrator storage area should be appropriately sized and designed to allow for:
 - safe access for operation, inspection and maintenance
 - adequate storage capacity for feedstock and outputs, taking into account receptacle sizes, peak food-waste generation and the proposed collection frequency of the output.
- **Ventilation and refrigeration:** Design of the feedstock storage area should consider the need for refrigeration and appropriate ventilation to manage odour and minimise amenity impacts prior to processing.

D.4 Outputs

The primary output is dried organic material which may – subject to relevant regulatory controls and coverage by an appropriate RRO/E – be applied to land as a soil conditioner.

Under current RROs/RREs granted by the EPA, outputs from food waste dehydrators have not been permitted for direct land application at high-public-contact sites, such as childcare centres and children’s playgrounds. This is to avoid hand-to-mouth contact with soil in which dehydrated food waste has been applied, especially for children and other vulnerable members of the community. The risks identified are that re-wetting the output material can encourage the growth of potentially harmful microorganisms, including from bacterial spores that may be formed during the dehydration processes.

A dehydrator does not produce compost. Composting takes time (weeks to months) to breakdown and stabilise a waste to varying degrees of maturation. It requires the activity of a variety of different microorganisms such as bacteria and fungi over an extended period.

Secondary outputs may include wastewater, which may or may not require discharge to sewer, depending on system design and local requirements. Some systems may also require venting to atmosphere or connection to an existing air extraction system.

If outputs are taken to another facility for further processing, the output may be required to comply with the conditions of the destination facility’s environment protection licence.

Appendix E: Insect bioconversion

E.1 Introduction

Insect bioconversion involves the breakdown of organic materials by insects, such as black soldier fly larvae, and can be established as modular, containerised units that are scalable. Common feedstocks for insect bioconversion may include food waste, agricultural residues and animal waste. Suitability of organic materials is determined by physical and chemical characteristics, as well as specific contamination risk.

Insect bioconversion can be carried out with several different types of organisms, such as species of:

- fly (e.g. black soldier fly, house fly, or flesh fly)
- mealworm (e.g. yellow mealworm)
- cricket (e.g. house cricket).

The principal outputs of insect bioconversion are larvae and frass (excreta from the digestive tract of larvae and residual feedstock material). Generally, the process is optimised to maximise output of larval biomass as it is rich in protein and can have a high economic value.

Both outputs require additional processing before use, such as inactivation and drying (for larval biomass) or further composting (for frass).

One of the main drivers for the adoption of insect bioconversion is market demand for high-protein products (i.e. larval biomass). Outputs can be used for a variety of purposes, such as animal feed.

E.2 Feedstock suitability

Feedstocks for insect bioconversion processes are varied; however, they should be readily biodegradable and free of physical and chemical contamination that may impact the organisms and other outputs. It is essential to manage contamination appropriately to ensure the process remains optimised and stable. Feedstocks typically processed by insect bioconversion include food organics and animal waste. Examples of feedstocks that can be processed by insect bioconversion is shown in Table E1.

Table E1 Typical feedstocks for insect bioconversion

Feedstock type	Suitability and considerations for insect bioconversion
Food waste	Suitable for insect bioconversion with high biodegradability and nutrient content. Generally well-balanced and moist, which aligns well with the requirements of insect bioconversion processes.
Natural organic fibrous materials	Suitability depends on specific characteristics. Feedstocks with high fibre or lignocellulose content are difficult for insect larvae to digest. Nutrient accessibility is often improved via pre-treatment such as grinding or moistening (Larisa, 2025).
Animal waste and manure	Needs to be blended adequately with other feedstocks to balance nutrient content. Animal manure is suitable for insect bioconversion as it is generally moist and nitrogen-rich, promoting rapid larval growth.

Other feedstocks, such as garden organics, are generally unsuitable because they are not easily digestible by insect larvae. These materials generally contain high amounts of lignin and cellulose (Peguero, Gold, Vandeweyer, Zurbrügg & Mathys, 2022).

Feedstocks such as sewage sludge and grease-trap waste may contain heavy metals and pathogens, which can accumulate in larval biomass. This bioaccumulation impacts the suitability of larval biomass for animal feed (Ungureanu & Vlăduț, 2026). Feedstock blends with high C:N ratios may lead to higher carbon dioxide emissions, and reduced carbon and nitrogen recycling into larval biomass (Pang et al., 2020).

E.3 Process design

E.3.1 Technology description

Insect bioconversion practices are directly linked to the life cycle of the relevant organisms. For most insect species, the larval stage (between hatching and prepupal) is the period in which the organisms rapidly consume biological material. Following the larval stage, insects enter the prepupal and pupal stages. These may occur either at the same facility or at a separate location.

E.3.2 Process description

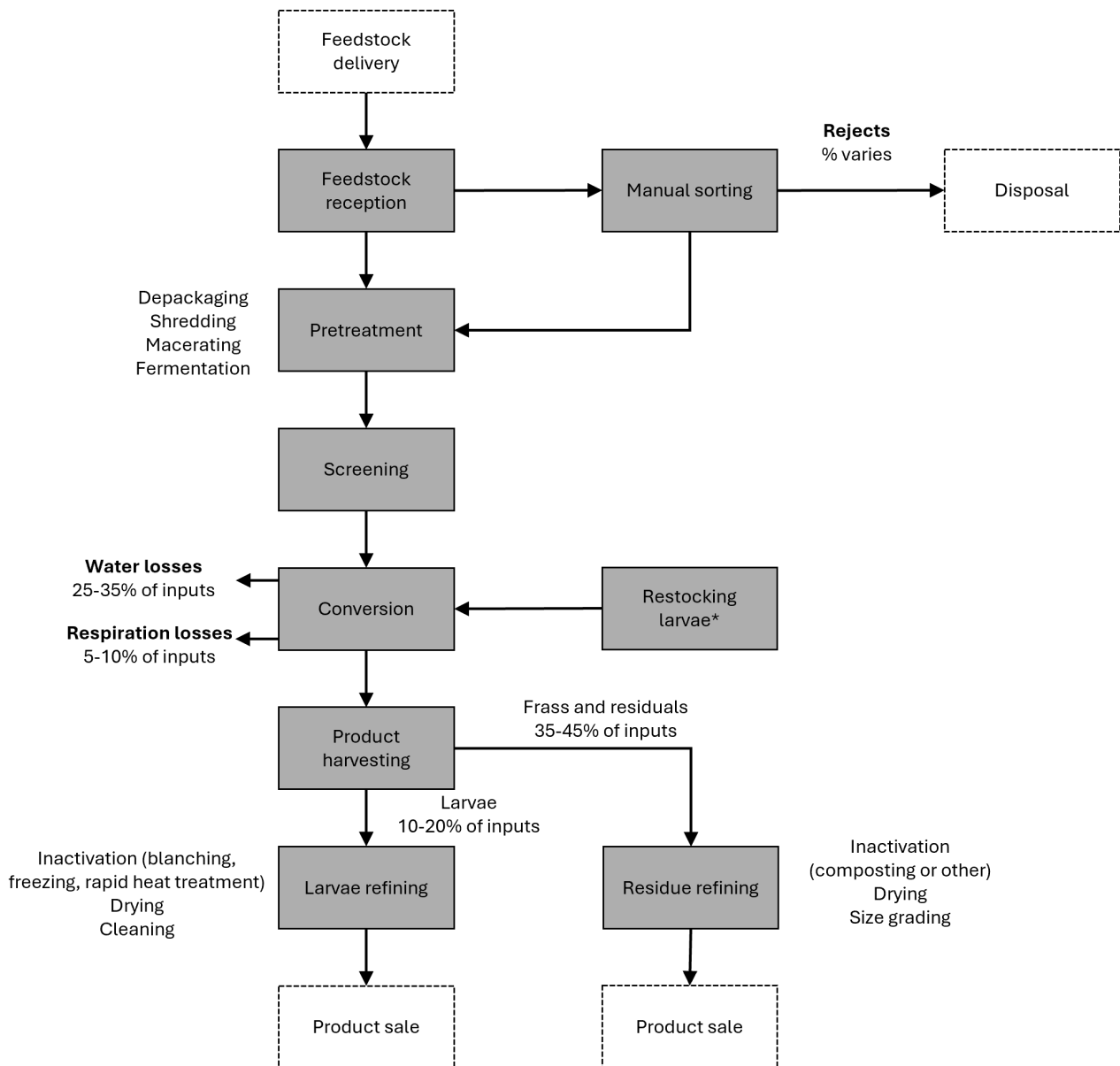
Insect bioconversion typically has five key steps.

1. **Feedstock preparation:** Maintaining a steady and reliable incoming feedstock stream is important for ensuring organism health and process efficiency. Reconditioning of feedstock materials is critical to ensure they are readily degradable and digestible by insects. Pre-treatment processes may include:
 - **sorting:** screening to remove physical contaminants.
 - **de-packaging:** removal of packaging materials (contamination) from packaged organic products using a dedicated de-packaging machine
 - **particle size reduction:** reducing the particle size of the feedstock materials, usually by maceration or shredding, to produce a small particle feedstock stream that is readily processed by insect larvae
 - **moisture content adjustment:** if necessary, water is added during feedstock preparation to reach the ideal moisture content level.
2. **Bioconversion:** The prepared substrate is fed to insects in a controlled environment. This can be done either manually or with automated feeding systems.
3. **Restocking of larvae:** The life cycle of the larvae is short so larvae have to be restocked regularly to maintain an adequate insect population. Restocking frequency depends on the species (e.g. black soldier fly larvae may require restocking every 10 to 12 days).
4. **Refining:** Refining is a necessary step for both the larval and frass streams to ensure they meet offtake requirements and are suitable for market.

Refining steps for insect larvae may include:

Harvesting and primary separation	Sieving and density separation to split larvae from frass and residual substrate
Inactivation	This is an important step for meeting biosecurity requirements for the use of insect larvae in products. Common inactivation methods for larvae include thermal (via hot water or blanching), cold stunning or freezing, or rapid heat treatment prior to drying.
Drying	Drying reduces biological activity and helps stabilise organic material. This step is designed to extend the shelf life of products and prevent spoilage, and is commonly done through hot air drying, belt or batch drying, or low temperature drying. Drying also reduces the volume and mass of materials, which can reduce on-site storage requirements and improve transport efficiencies.
Size grading and cleaning	To ensure product consistency and market acceptance, grading and cleaning may be required. Common approaches include screening of fines, sieving, and homogenisation to produce a consistent nutrient profile.
Transformation	As defined by end use. Following refining stages, various approaches are taken to convert larvae and frass into end-use products such as those described in Appendix E.5. Frass should be further processed or composted if to be used for further beneficial use, subject to regulatory and quality assurance requirements (such as those detailed in relevant RRO/E requirements). The use of frass as a suitable input to a composting process will depend on the presence of contaminants such as physical and chemical contaminants that may be derived from packaging.
Reproduction	Regeneration of insect populations via a separate breeding process for introduction or restocking of the process.

Figure E1 below shows the main process steps involved in insect bioconversion.



* Frequency of restocking is dependent on the species (e.g. black soldier fly larvae may require restocking every 10 to 12 days)
 Note: Process steps and values are indicative only and are dependent on the facility design. Percentages are provided on a by weight basis.

Figure E1 Flow chart of main process steps for insect bioconversion

E.3.3 Other design considerations

- Processing configurations may be modular and decentralised, with reproduction and bioconversion processes occurring at separate facilities.
- Facility design should consider future expansion, including allowances for additional equipment, utilities and storage requirements.
- Feedstock storage should be sized to ensure consistent supply over time, enabling buffering against short-term supply disruptions and variability in incoming loads.
- Output storage capacity should be sized to manage material build-up if offtake is temporarily disrupted. Different output streams have different handling, storage and treatment requirements.
- Sufficient areas should be provided for managing reject or residual materials.

- Timing and logistics should be well designed because the value chain can be sensitive to time delays.
- Redundancy should be provided for power systems and key utilities in case of disruption, including backup power supply.

E.4 Process operations

Process and facility management should be aimed at maintaining stable and optimal environmental conditions for insects. Insect bioconversion is sensitive to fluctuations in nutrient and moisture content. Table E2 below gives some ideal operating conditions for insect bioconversion.

Table E2 Typical operational conditions for insect bioconversion

Condition	Ideal
Moisture content	60–70%
Temperature	25–30°C (Ribeiro, Costa, & Amexia, 2022)
C:N ratio of combined feedstocks	18:1–14:1 (Lu, et al., 2021)
Air humidity	60–80%
pH	6–8 (neutral)

Favourable conditions can be achieved through the following:

- Managing contaminants through visual inspection or chemical testing of incoming loads. Note that toxic compounds, antibiotics or heavy metals can inhibit larval development and compromise final output quality (Lalander, Diener, Zurbrügg, & Vinnerås, 2019).
- Monitoring key process parameters, such as moisture content, temperature, oxygen levels and light exposure. Treatment units should be located out of direct sunlight. Conditions outside acceptable ranges may stress or kill larvae.
- Maintain a buffering volume in organic material stockpiles. It is important to ensure that the insects can be fed even if supply is disrupted, and that peaks in incoming loads can be accepted.
- Maintain a buffering volume in output storage so that material build-up is managed if offtake is disrupted.
- Address biosecurity risks, including containing insects within processing areas and preventing them being unintentionally released to the environment.
- Balance the stocking density of larvae against available feed. If density is too high, insects compete for food, which slows growth and increases mortality. If density is too low, system productivity is slowed. The optimal stocking density depends on insect species and feedstock composition.

E.5 Outputs

Insect bioconversion facilities generate a range of outputs, which can be grouped into primary outputs, secondary outputs and rejects. Primary outputs are materials that the processor intends to produce and supply to the market for beneficial reuse. These typically comprise high-value protein material for use in products such as animal feed, or in cosmetics manufacturing.

Secondary outputs are those that are generated as part of the bioconversion process and may be further treated for beneficial reuse, depending on their characteristics. Rejects are contaminating materials that are removed at various steps in the process.

E.5.1 Primary outputs

Larvae products from insect bioconversion generally consist of:

- live larvae
- dried larvae
- frozen larvae
- ground meal
- oil extracted from larvae.

The protein material produced in the insect bioconversion can be processed into high-value products. Following inactivation and drying, processing into protein meal or animal feed is common. However, this output is classified as a RAM and is not permitted for feed to ruminant animals. (See Appendix A.3.1 for more information on RAM.) For all reuse options, relevant specifications such as animal feed standards and biosecurity requirements must be met.

Given the broad range of uses for insect bioconversion products, the suitability of the outputs should be assessed to understand the specific risks associated with transfer of pathogens or other contaminants to animals when used as feed, or other end uses. Feedstock composition can also affect ammonia generation, which will need to be managed.

E.5.2 Secondary outputs

Frass, defined as a mixture of insect excreta, exoskeletons and residual feedstock, is considered a secondary output of the insect bioconversion process.

Frass can have beneficial uses but may need to be further treated to remove contaminants (e.g. fine plastics) or require further processing at a suitable facility to meet relevant specifications for beneficial reuse. For example, if frass is to be used as an input to a composting process to produce a compost product for land application, it will need to be transported to a facility that is authorised to receive frass (usually under conditions of the facility EPL) and meet the requirements and conditions of any RRO/E that applies to the reuse of that compost product.

Wastewater generated by the process should be managed using appropriate treatment either on site or at an approved facility licensed to receive and manage the water.

E.5.3 Rejects

Contaminants removed during pre-treatment or screening stages are considered rejects. Undigested materials removed during the bioconversion process are classified as rejects, and these can include indigestible parts of animal waste, packaging or other indigestible materials. Facility design should include a pathway for handling these materials.

Any reject waste materials leaving the facility will need to be appropriately classified under the EPA's waste classification guidelines to ensure they are taken to a lawful disposal facility that is authorised to receive them.

Appendix F: Mulching

F.1 Introduction

Mulching is a mechanical size-reduction process that produces coarse organic material for application to land. When appropriately produced and applied, mulch supports soil protection, plant health, moisture retention and broader environmental management outcomes.

Organic mulches, such as wood chips and processed green waste, gradually break down when applied to land. As they decompose, they contribute organic matter to soil, improving soil structure, water-holding capacity and biological activity. These benefits support plant growth and overall soil health.

Mulching operations can also present environmental and operational risks if not properly managed. These risks may include spread of weeds and diseases, dust and noise from processing activities, fire hazards associated with dry stockpiles, and polluted stormwater run-off or leachate from stored materials. Appropriate controls are therefore required to ensure mulching is carried out safely and responsibly.

F.2 Feedstock suitability

Mulch can be produced from a range of organic materials. Common feedstocks used for mulching include:

- **green waste**, such as garden and landscape materials including tree prunings, branches, leaves, grass clippings and shrubs
- **wood and timber materials**, including untreated timber offcuts, pallets, timber packaging and forestry residues such as bark, logs and wood chips. Only clean, untreated timber is suitable for mulch intended for landscaping or environmental applications
- **forestry and land management residues**, such as thinning residues, plantation harvest waste and land-clearing vegetation where permitted. These materials are often chipped or shredded to produce coarse mulches
- **agricultural residues**, including straw, stubble, husks and other crop residues, typically used in agricultural or horticultural settings.

Contamination risks must be carefully managed. Treated or painted timber, engineered wood products and construction and demolition materials, including asbestos-containing materials, are not suitable for mulching and must be excluded or removed. Mechanical processing (such as grinding and shredding) can spread weeds and other contaminants throughout the product if controls are not in place, increasing risks to product quality, the environment and human health.

F.3 Process design and operations

Mulching facilities are generally low-complexity operations and may use either fixed or mobile plant. The primary function of mulching is particle size reduction and size classification.

Mulching operations typically include:

- feedstock receipt and inspection to identify and remove visible contamination
- size reduction through grinding, shredding or chipping
- screening to control final particle size
- stockpiling of finished mulch
- blending of materials, where required, to achieve desired product characteristics.

A flow chart of the typical process steps is presented in Figure F1.

Process and facility management should focus on producing safe, clean mulch products. A risk-based approach should be used to identify potential sources of unsuitable materials and determine appropriate sorting, screening and exclusion controls.

The risk management process should include as a minimum the following core areas:

- **Preventing contamination**

Mulch must not contain asbestos, engineered wood, treated/coated timber, plastics, metals, glass, or polystyrene.

- **Ensuring suitability for land application**

Mulch must be 'ready for land application', meaning it must be processed, screened and free of unacceptable contaminants.

- **Preventing biological risks**

Mulch containing weeds, pests, or diseases must not be supplied for use in environmentally sensitive areas.

- **Implementing a documented risk-management protocol**

The processor must have systems in place to identify, assess and control contamination risks before mulch is supplied.

The following key risk-management measures should be incorporated into processing protocols:

- **Source-control measures**

- Verify the origin of plant material.
- Avoid high-risk sources (e.g. kerbside collections, demolition waste).
- Maintain supplier declarations and acceptance criteria.

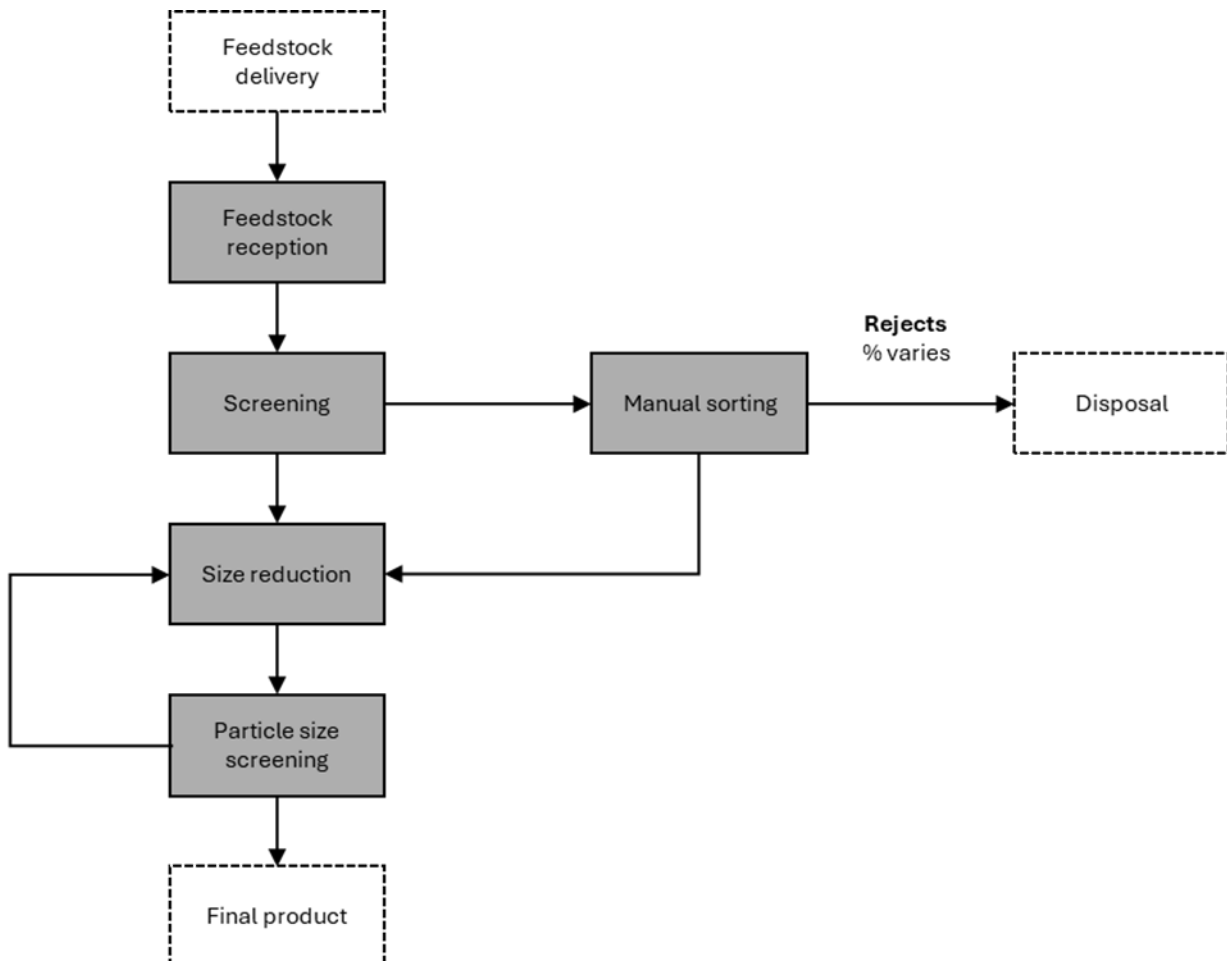
- **Inspection and screening controls**

- Visually inspect incoming loads.
- Remove contaminants before shredding or screening.
- Use multiple barriers (e.g. pre-screening, post-screening, manual picking) depending on feedstock risk.

- **Process controls**

- Ensure shredding, screening and handling processes do not introduce contaminants.
- Maintain separation between clean feedstocks and other waste streams.
- Implement site layout controls to prevent cross-contamination.

- Ensure record-keeping and traceability.
- Maintain records of feedstock sources, inspections, contamination incidents and corrective actions.
- Provide information to consumers as required by the RROs.
- **Staff training and WHS considerations**
 - Train staff to identify contaminants (e.g. asbestos, treated timber, plastics, metals).
 - Use safe manual-handling practices where needed (e.g. manual removal of sharps or large contaminants).
- **Environmental protection controls**
 - Prevent contaminated mulch from being supplied.
 - Manage stockpiles to avoid contamination from stormwater, soil or other materials.
 - Ensure clear and lawful pathways are in place for the removal and disposal of any contamination recovered during processing.



Note: Process steps are indicative only and are dependent on the facility design.

Figure F1 Flow chart of main process steps for mulching

F.4 Environmental risks and controls

Mulching operations may present several environmental risks that should be identified and managed, including:

- weeds, diseases and pest assessment and management
- dust generated during shredding, screening and stockpile handling
- noise from mobile plant and processing equipment
- fire risk associated with large stockpiles of dry mulch
- stormwater run-off and leachate, particularly where mulch is stored on unsealed surfaces.

These risks should be managed through appropriate site design, operational controls, equipment maintenance and, where relevant, buffer distances to sensitive receptors.

F.5 Outputs

Mulching operations generate a range of outputs depending on the feedstocks received and the level of processing undertaken. Application of mulch to land must be carried out in accordance with relevant regulatory requirements. The main outputs typically produced by mulching operations are as follows:

- **Primary output – mulch**

The main output is mulch, which may be supplied in different grades, such as coarse, medium, or fine, depending on processing and screening. Mulch is typically used for landscaping, moisture control, soil protection, weed suppression, and environmental applications. Mulch applied to land or public spaces should meet relevant regulatory requirements, including relevant RRO/Es.

- **Secondary output – fines**

Fines are smaller particles such as wood fibres, soil and leaf matter that pass through screens. Depending on quality, fines may be reused as soil conditioners or used in rehabilitation and erosion-control works.

- **Oversize material**

Oversize material that does not meet product specifications may be produced during screening. This material is usually reprocessed (through the mulcher or shredder) until it meets the required size specifications or diverted to alternative reuse pathways where appropriate.

- **Recovered contaminants**

Contaminants such as plastics, metals, stones and treated timber, should be separated during processing and recycled or disposed of via appropriate lawful pathways.

- **Residual waste**

A small amount of residual waste may be generated that cannot be reused or recycled and should be managed or disposed of in accordance with regulatory requirements.

Any outputs from mulching taken to another processing facility for further processing, will be subject to the relevant licence conditions of the destination facility (usually under conditions of the facility EPL).

Appendix G: Vermicomposting

G.1 Introduction

Vermicomposting is a controlled biological process involving the stabilisation of organic materials by the action of specific earthworm species. In this process, worms convert organic materials into a range of outputs such as solid vermicast, vermiliquid (worm tea) and worm biomass (the worms themselves).

The solid vermicast is a brown solid-like material generally high in nutrients and commonly used as a soil conditioner, and vermiliquid is the liquid produced as water passes through worm beds, picking up soluble nutrients and microorganisms.

Worm biomass may also be recovered and sold as a product, subject to markets and regulatory specifications. Vermicomposting outputs typically contain high levels of nutrients that are readily available to plants.

G.2 Feedstock suitability

Vermicomposting needs biodegradable feedstocks, at a particle size and moisture content suitable for consumption by earthworms. When selecting a feedstock or feedstock blend, the use of a bulking agent should be considered to provide porosity and regulate moisture content. Table G1 summarises the suitability of some common feedstocks.

Table G1 Suitability of feedstocks for vermicomposting

Feedstock type	Suitability and considerations for vermicomposting
Food waste	Suitable in controlled proportions, with contamination control essential.
Garden waste	Garden waste is suitable for vermicomposting provided it is non-woody and in a form that makes it digestible by the worms.
Food waste and garden waste	Mixed food and garden waste – also known as food organics and garden organics (FOGO) – is suitable for use in vermicomposting, provided contamination is controlled.
Wood waste	Wood waste is generally unsuitable as a primary feedstock, although woody materials may be used as a bulking agent to improve physical structure.
Natural organic fibrous materials	Suitability depends on fibre content, and pre-treatment may be required to convert to a digestible form.
Animal waste and manure	Animal manure is commonly suitable in controlled proportions. This feedstock is generally high in nutrients, so appropriate blending should be in place to ensure nutrient balance remains suitable. Manure produced by cows, pigs, horses, goats, llamas, alpacas, sheep and rabbits is suitable for vermicomposting. Chicken manure is generally unsuitable due to its high ammonia. Animal carcasses are generally unsuitable.

Materials that are very high in nutrients, such as seafood and dairy products, are less suitable for vermiculture because they can promote the development of anaerobic conditions, which can kill the worms.

G.3 Process design

G.3.1 Technology description

Vermicomposting is a series of biological processes. When organic materials are added to a vermiculture unit, bacteria, fungi and other microorganisms begin breaking down the material, releasing simpler compounds such as sugars and proteins. Worms then consume both the decomposing organic matter and the microorganisms, further stabilising the material as it passes through their digestive systems.

For the process to function effectively, conditions must support both worms and microbes, including adequate oxygen, suitable moisture levels and moderate temperatures. Poor control of these conditions can lead to anaerobic zones, odour generation, and worm stress or death, reducing processing efficiency.

There are four main components of a vermiculture unit:

- **Container**
Houses the worms and bedding, protects them from weather and predators, and excludes pests. The worms may be contained in a discrete unit or on the ground in a windrow system.
- **Worm population**
Converts compostable organic materials into vermicast.
- **Bedding**
Typically, a deep layer of mature vermicast that provides habitat and helps regulate moisture and temperature.
- **Source of food and moisture**
Compostable organic material applied to the surface of the bedding to feed the worms.

G.3.2 Process description

Vermicomposting is generally done in six main stages.

- **Feedstock receipt and pre-treatment:** Non-compostable materials (e.g. plastics, glass, metals) are removed to protect system performance and product quality.
- **Screening and particle size reduction:** Grading by particle size to ensure all incoming material is readily available for earthworms to consume. Organic materials are chopped or shredded to increase surface area and improve biological processing efficiency.
- **Mixing:** Materials are thoroughly mixed and moisture adjusted to create a suitable feedstock for worms and microorganisms. Bulking agents are typically added at this stage to improve porosity, regulate moisture content and achieve a suitable C:N ratio. Paper/cardboard used as bulking agents or bedding can be a direct PFAS source, especially if sourced from:
 - takeaway packaging
 - recycled cardboard
 - printed or coated paper
 - paperboard with grease-resistant linings.

- The C:N ratio is important for vermicomposting, but it matters in a different way than it does for composting. The C:N ratio affects:
 - microbial activity (which pre-processes food for worms)
 - odour generation
 - ammonia toxicity
 - worm health, growth, and reproduction.

If the balance is wrong, worms become stressed or die. An ideal C:N ratio of a feedstock for vermiculture processing is 20:1–30:1.

- **Vermicomposting:** Vermicomposting methods can be selected based on scale, labour intensity and intended application. Examples are:

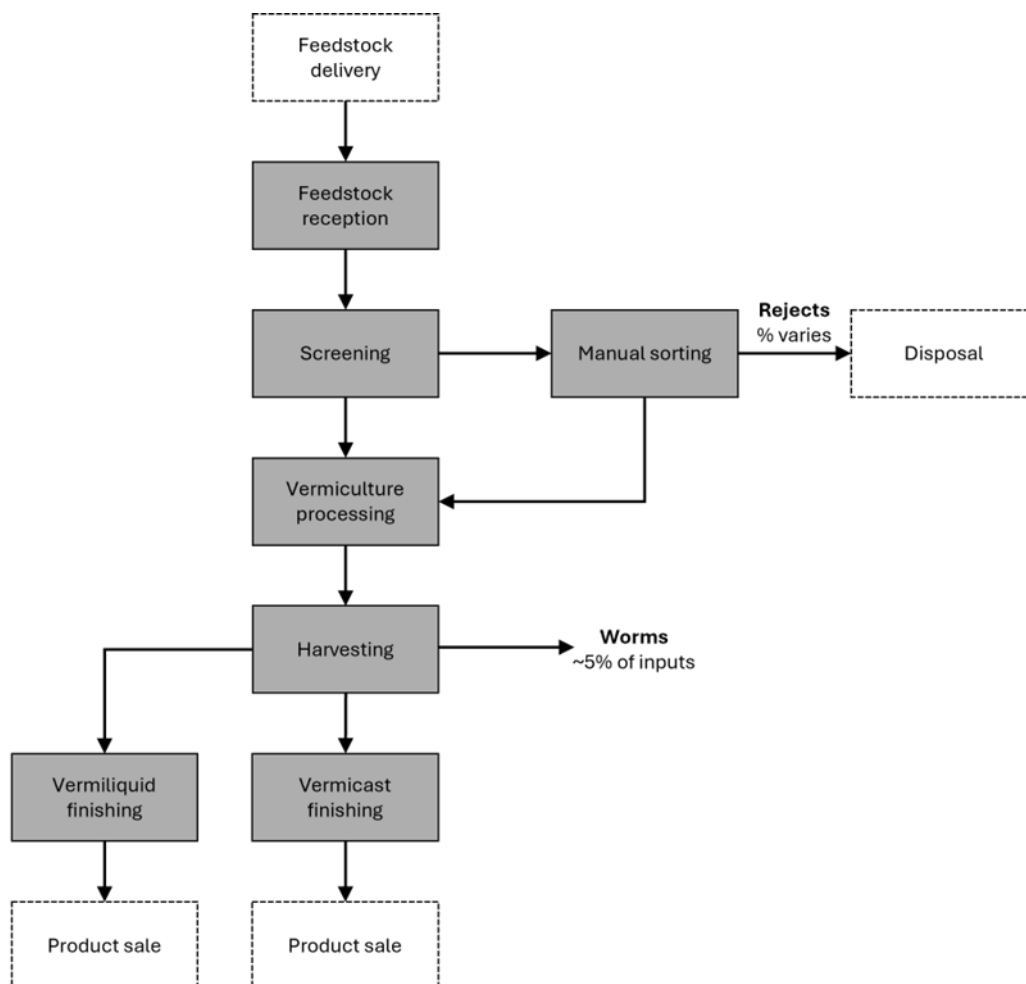
Continuous flow units	Raised containers where feedstock is applied to the surface and finished vermicast is harvested from the base, allowing continuous operation. These are the most efficient and least labour-intensive option and are best suited to on-site, mid-scale commercial and institutional applications.
Tray or stacking units	Consist of stacked trays filled sequentially with bedding and feedstock, with each tray harvested as a batch once full. They are suitable for mid-scale applications but require more labour during harvesting than continuous flow systems.
Batching or box units	Simple container systems where all material is processed in one vessel and harvested manually. These systems are low-cost and labour-intensive, making them most appropriate for small-scale or domestic use, not mid-scale commercial systems.
Windrow systems	Long beds of organic material placed directly on the ground and processed over extended periods. These systems are low-technology, land-intensive and slow. They are suited to large-scale agricultural or rural applications rather than urban on-site processing.

- **Harvesting and screening:** Vermicast is separated from the earthworms. There are various approaches for harvesting, which include:

Light harvesting	Using light exposure to encourage earthworms to burrow downward, allowing vermicast to be collected from the surface.
Migration feeding	Adding feedstocks in a way that attracts worms out of finished vermicast. Approaches include sideways or upwards feeding.
Mechanical separation	Physically separating out the vermicast by manual sorting or screening.

- **Finishing and storage:** Drying may be required following harvesting to reduce volume and mass and prevent anaerobic conditions from forming in products.

Figure G1 below summarises the main process steps for vermicomposting.



Note: Process steps and values are indicative only and are dependent on the facility design. Percentages are provided on a by weight basis.

Figure G1 Flow chart of main process steps for vermicomposting

G.4 Process operations

Process and facility management should be aimed at maintaining stable and optimal environmental conditions for worms. Table G2 sets out ideal operating conditions for vermicomposting.

Table G2 Typical operating conditions for vermicomposting

Condition	Ideal
Moisture content	60–90%
Temperature	20–25°
C:N ratio of combined feedstocks	20:1–25:1
Oxygen	>10%
pH	5–7.5

Operational considerations to achieve this include:

- Managing contaminants through visual inspection or chemical testing of incoming loads. Note that contaminants such as heavy metals, plastics, or industrial chemicals can impact worm health and compromise final output quality.

- Monitoring key process parameters, such as moisture content, temperature, oxygen levels, and light exposure. Conditions outside acceptable ranges may induce stress and mortality in worm populations. Temperatures above 35°C for prolonged periods may lead to poor worm health or death. Temperature is managed by controlling depth of windrows and adding feedstocks gradually as they are consumed.
 - Adding bulking agents to achieve appropriate moisture content and porosity.
 - Visual inspection of worm activity. Worms attempting to escape a vermiculture unit, or an accumulation of feedstock without digestion, can suggest that conditions are unsuitable.
-

G.5 Outputs

Vermicomposting facilities generate a range of outputs, which can be grouped into primary outputs, secondary outputs, and rejects. The primary output is vermicast; in some applications, a nutrient-rich liquid extract called vermiliquid is also produced. The liquid extract is generally considered a secondary output of the vermicomposting process. Other secondary outputs include worm biomass and excess bedding materials or bulking materials, which may be recycled through the process. Rejects from the vermicomposting process include non-putrescible or generally unsuitable materials, removed at any stage, that cannot be recycled through the process.

G.5.1 Primary outputs

The primary output of vermicomposting is vermicast, a stabilised organic material commonly used as soil conditioner. Vermicomposting typically occurs under mesophilic conditions, without relying on a thermophilic phase for pathogen reduction, and may therefore require additional treatment measures to meet pasteurisation requirements. These may include:

- **Pre-treatment**

Composting organic materials before feeding them to the worms ensures that pasteurisation is achieved prior to feeding to worms. For details on applicable composting practices, refer to Appendix C.

- **Post-treatment**

Typical post-treatments aimed at pathogen reduction include composting of vermicast or thermal treatment. The specifications of this treatment step should ensure that regulatory requirements are met based on intended end use.

G.5.2 Secondary outputs

Secondary outputs from vermicomposting may include:

- **Worm biomass**

In some systems, worm biomass may be recovered for sale, depending on production rate and available offtakes.

- **Vermiliquid**

Liquid extracts or leachates from vermicomposting are not inherently pasteurised and may not be suitable for direct land application. Treatment and dilution may be required. Product quality and suitability for use in land application depends on feedstock quality and level of process

control. Alternatively, liquid extracts may be recycled through the process depending on their nature or sent off-site as wastewater.

- **Excess bedding or bulking materials that have been removed during maintenance**

Organic materials removed during sorting or maintenance can potentially be recycled through the process, depending on physical and chemical properties. Otherwise, these materials require separate handling.

G.5.3 Rejects

Rejects may include:

- contaminants removed during feedstock receipt or screening
- oversize or poorly processed material removed during final screening or finishing.

Reject materials may be reprocessed if suitable. If not suitable for reprocessing, such as non-putrescible or hazardous wastes, and they are taken to another facility for further processing or disposal, the output may be required to comply with the licence requirements of the destination facility (usually under conditions of the facility EPL).



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