



## **Appropriate measures for the biological treatment of waste**

**Consultation draft July 2020**

We are the Environment Agency. We protect and improve the environment.

We help people and wildlife adapt to climate change and reduce its impacts, including flooding, drought, sea level rise and coastal erosion.

We improve the quality of our water, land and air by tackling pollution. We work with businesses to help them comply with environmental regulations. A healthy and diverse environment enhances people's lives and contributes to economic growth.

We can't do this alone. We work as part of the Defra group (Department for Environment, Food & Rural Affairs), with the rest of government, local councils, businesses, civil society groups and local communities to create a better place for people and wildlife.

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## 1. Introduction

We have produced this guidance to help you understand which standards (appropriate measures) are relevant to regulated facilities with environmental permits to treat organic waste.

This guidance applies to aerobic and anaerobic processes and includes:

- composting in open-air and closed processes
- aerobic processing of organic fractions in mechanical and biological treatment (MBT) and mechanical heat treatment (MHT)
- Thermophilic aerobic digestion (TAD)
- Anaerobic digestion (AD) including the combustion or upgrading of the resulting biogas and treating the digestate, (anaerobic treatment can include wet, dry and dry-batch digestion)
- storing recovered material (compost and digestate)
- aerated lagoons and activated sludge (as a waste-water treatment)
- treating sewage sludge using any of the above biological processes

This guidance document replaces the following guidance notes:

- How to comply with your environmental permit: Additional guidance for anaerobic digestion. Reference LIT 8737, version 1, November 2013
- How to comply with your environmental permit: Additional guidance for composting and aerobic treatment sector. Reference LIT 8705, version 1, November 2013
- How to comply with your environmental permit: Additional technical guidance for mechanical biological treatment (MBT). Reference LIT 8707, version 1, August 2013
- Framework for assessing suitability of wastes going to anaerobic digestion, composting and biological treatment. Framework guidance note dated July 2013.

## 2. When appropriate measures apply

There is considerable overlap between best available techniques (BAT) for waste installations and necessary measures for waste operations, therefore we use the term 'appropriate measures' to cover both sets of requirements. The appropriate measures set out in this guidance apply to all waste received at permitted biological treatment facilities, including waste received from producers outside of England.

For installations there are additional standards that cover using energy and raw materials (including water) efficiently.

Appropriate measures are the standards that operators should meet to comply with their environmental permit requirements. This guidance sets out what you must consider when assessing the appropriate measures for your site. It is not definitive and does not replace your obligation to assess appropriate measures fully.

Some measures may not be suitable for, or relevant to your operation. Appropriate measures will depend on the:

- activities being carried out

- size and nature of the activities
- location of the site

Where a measure is not suitable or relevant, an operator can either:

- propose alternative measures, that must achieve the same level of environmental protection
- provide an explanation of why the measure is not relevant

In certain situations, a higher standard of environmental protection may be needed, for example:

- where there are local sensitive receptors - a place where people live or work, including undertaking recreational activities, for more than 6 hours at a time
- if there is a risk that an operator may exceed an Environmental Quality Standard (EQS)

Other technical guidance may also apply to facilities treating biodegradable and organic waste, including guidance on [emissions, odour and noise](#).

[Specific technical guidance](#) may also be relevant and an operator must refer to it to where appropriate. For example, operators of treatment processes that are connected to other activities such as intensive pig or poultry rearing.

If you are permitted to accept, store, handle, treat or transfer the following, you must also comply with the requirements in [sector guidance note S5.06: recovery and disposal of hazardous and non-hazardous waste](#):

- laboratory smalls or chemicals
- any hazardous wastes or wastes considered a 'mirror entry' (where waste may be allocated to a hazardous or to a non-hazardous entry according to the European List of Waste)

Combustion plant with a rated thermal input equal to or greater than 1 megawatt (but less than 50 megawatts) must have a permit and comply with the relevant requirements of the Medium Combustion Plant Directive (2015/2193). Specified generators which are used to generate electricity must also have a permit and comply with the relevant requirements of the specified generator regulations. [Additional guidance](#) is available from the Environment Agency.

Operators of exempt waste facilities must comply with the relevant objectives in Schedule 2, paragraph 4 of the [Environmental Permitting \(England and Wales\) Regulations 2016](#). Operators of exempt facilities that biologically treat waste should consider implementing the relevant measures in this guidance to help with their site's operational management. This guidance may also help operators meet the relevant objectives in [Article 13 of the 2008 Waste Framework Directive](#).

### **Implementing appropriate measures at new and existing facilities**

The appropriate measures in this guidance apply to both new and existing facilities that treat biodegradable and organic waste.

All new plants must implement the relevant appropriate measures, or equivalent. These must be in place before waste treatment operations start.

New installations (including new or replacement plant at existing facilities) must comply with any relevant Best Available Technique (BAT) Associated Emission Level (AEL) as set out in the published [Waste Treatment BAT Conclusions document](#). They must do this from the start of their operations, unless we approve a [derogation](#).

Existing installations must comply with the BAT-AELs by August 2022. Where operators are unlikely to comply with a BAT-AEL by 2022 they must apply for a derogation.

Where we have identified an operator needs to and can improve the facility, or there is significant environmental risk, we will vary permits to meet required standards. Some improvements can be delivered by operators reviewing and amending their Environmental Management System (EMS) and progressing a voluntary scheme of improvement.

Improvements at existing facilities are likely to fall into one of the following two categories:

#### **Standard 'good-practice' requirements**

For example, these could be:

- updated management systems
- waste pre-acceptance, acceptance and handling techniques
- waste, water and energy efficiency measures
- measures to prevent fugitive or accidental emissions
- appropriate monitoring
- equipment and infrastructure maintenance

Where these improvements are relatively low cost, operators must implement them as soon as reasonably possible. They must implement them no later than 12 months from publication of this guidance, in a timeframe agreed with us, or set in the site permit.

#### **Larger, more capital-intensive improvements**

For example, these could be:

- installing significant abatement equipment
- the significant redesign of facility layout, including, for example, the design and installation of new buildings or treatment plant
- installation of secondary containment

These improvements must be completed as soon as reasonably possible or within a timeframe set in the site permit. For installations where there are applicable BAT conclusions this is no later than August 2022.

Local environmental impacts (for example, having sensitive receptors or an air quality management area close by) may mean an operator has to take action more quickly than the indicated timescales.

### **3. Definition of biodegradable, organic waste and sewage sludge**

Organic matter is a collection of complex humic substances and other organic compounds generally of animal or vegetable origin.

We define biodegradable waste as material that can undergo biological anaerobic or aerobic degradation leading to the production of the following, depending on the environmental conditions of the process:

- carbon dioxide (CO<sub>2</sub>)
- water (H<sub>2</sub>O)
- methane (CH<sub>4</sub>)
- biomass and mineral salts.

The term 'biowaste' is often used to describe biodegradable, organic waste. Biowaste is defined in Article 3 of the Waste Framework Directive to mean, "biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises and comparable waste from food processing plants".

Sewage sludge means residual sludge from sewage plants treating domestic or urban wastewaters. It also includes sewage sludge from other sewage plants treating wastewaters that have a similar composition to domestic and urban wastewaters. Sewage sludges which have undergone treatment to make them suitable for use on land are sometimes referred to as biosolids.

Activated sludge treatment means treating sewage or industrial wastewaters using the biological oxidation of dissolved organic pollutants with oxygen, using the metabolism of microorganisms.

### **Definition of biological (organic) treatment**

We define biological treatment as the decomposition and stabilisation of biodegradable waste. This is done under controlled conditions resulting in stable, sanitised material that can be applied to land either for:

- the benefit of agriculture
- to improve the soil structure or nutrients in land

Biological treatment is done in the following two ways.

#### **1. Anaerobic digestion**

Anaerobic digestion converts the organic inputs to a methane-rich biogas and whole digestate. It does this in the absence of free oxygen and at temperatures suitable for mesophilic or thermophilic bacterial species.

#### **2. Aerobic treatment**

Aerobic treatment enables the development of thermophilic temperatures as a result of biologically produced heat in the presence of oxygen.

We define stable as the degree of processing and biodegradation needed to slow the rate of biological activity to an acceptably low and consistent level. Biological activity will not significantly increase under favourable, altered conditions.

### **Wastewater treatment works**

Using aeration and activated sludge treatment methods to treat wastewaters falls within the definition of biological treatment and therefore this guidance applies. This guidance does not apply to wastewater treatment at [Urban Waste Water Treatment Directive](#) (UWWTD) facilities because those processes are not regulated under the Waste Framework Directive.

### **Animal by-products (ABP)**

Biological treatment facilities may need to comply with The Animal By-Products (Enforcement) (England) Regulations 2013 (ABPR) for the acceptance and treatment of animal by-products. This is regulated by the [Animal and Plant Health Agency](#) (APHA). More information is available from the APHA on the definition and categorisation of animal by-products. Biological, organic treatment facilities can be authorised to accept category 3 ABP.

### **Energy crops**

AD plants which process purpose-grown energy crops, such as maize crop, do not need an environmental permit or exemption.



Any crop which is grown specifically for use as a fuel for heat, combined heat and power (CHP) or power generation is not a waste. If this crop is treated (in the absence of any waste inputs) in an AD plant to produce energy, the biogas produced by the plant will also be a non-waste.

Energy crops which are mixed with waste become waste. You must carry out any treatment of them, including AD, under an environmental permit or appropriate exemption.

Materials produced incidentally to the anaerobic digestion process, for example, clean down washwaters, are waste and must be disposed of following the legislation that applies, for example, [waste duty of care code of practice](#).

The duty of care code of practice sets out practical guidance on how to meet your waste duty of care requirements. This was issued under [section 34\(7\) of the Environmental Protection Act 1990](#) and covers the duty of care set out in Section 34(1) of that Act.

### **Bespoke wastes suitable for biological treatment**

Waste streams for biological organic recovery are generally well understood and are listed in either standard rules permits or quality protocols. The Environment Agency recognises the potential to use biological processes to treat other (bespoke) waste streams where the intended end market for the output is agricultural use.

Biological processes have the potential to ferment and degrade complex synthetic organic substances. The products resulting from these biological degradation processes may pose a greater threat to human health and the environment when a bespoke waste is introduced. It is therefore important to fully characterise and assess all bespoke wastes prior to introducing them into a biological treatment process. This also applies to tankered wastes received at a waste water treatment works where the sewage sludge then enters a regulated treatment process.

Additional guidance on the characterisation and assessment of bespoke wastes is included in the [waste pre-acceptance and acceptance section](#). General inhibitory values are provided in the section on [inhibition values for aerobic and anaerobic processes](#).

Your site must have a permit that allows you to receive the individually identified [List of Waste \(LoW\) code](#) and description. If you are permitted to accept a bespoke waste type, it typically applies to waste from a single producer. If you accept similar waste from a different producer it will require its own pre-acceptance assessment and you may need to apply for a permit variation.

## **4. Managing biodegradable, organic waste**

Correctly classifying and segregating biodegradable, organic waste at source makes sure that the right waste goes to the right place for appropriate treatment, complying with the waste hierarchy. The waste producer is responsible for correctly characterising, describing and classifying their waste. They must also make sure they comply with the waste duty of care code of practice.

You must implement waste pre-acceptance and acceptance procedures to make sure that you have satisfactory information about the waste's composition and confirm its characteristics. You must prevent inorganic materials such as non-compostable plastic and metal from entering the process. You must treat wastes containing physical contaminants to remove them to as low as reasonably practicable. You must have in place a system of tracking waste from receipt, handling on site and transfer off site.

To make sure that the outputs from the biological treatment facility are suitable for their expected end use, you must follow a quality, process and management system.

## Site design and suitability

### Site location

You must select an appropriate location for your facility. There must be sufficient space to both:

- manage wastes within the site
- make sure that you prevent or mitigate potential pollution impacts on nearby receptors

You must locate waste storage on site as far as technically and economically possible from sensitive receptors and watercourses, while minimising unnecessary handling.

### Site capacity and waste storage capacity

Environmental permits set limits on both the amount of waste you can:

- bring onto site on an annual basis
- store there at any one time

We may set other capacity limits within the permit. However, the available space at your facility may in practice be substantially less than your permit allows. Exceeding manageable quantities of materials on-site will significantly increase the risks of pollution.

You must determine the actual physical capacity to manage, treat and store the waste you accept and produce on site. You must work this out based on the available space and the space needed for your processes. You must include factors like seasonal changes in supplies of inputs and markets for outputs.

You must establish the maximum:

- waste storage capacity at any one time
- annual throughput
- residence time for waste

Good site design and process flow reduces the risk of cross-contamination between sanitised and stabilised materials. You must provide enough space on site to operate your plant and equipment safely and to allow easy and environmentally safe storage and treatment.

Waste segregation relies on both the:

- physical separation of waste
- procedures that identify when and where wastes are stored

You can find further information on determining treatment capacity in our regulatory guidance note [\(RGN\) 2 guidance](#). The treatment capacity of the site also determines if you are an installation or a waste operation.

All biological treatment facilities must be designed by a suitably qualified or experienced person to deliver full treatment and recovery of the waste. Waste quantities must not exceed designed storage and treatment capacities. Biological treatment facilities must be built to recognised industry standards. They must be tested, operated and maintained following operational requirements and design criteria.

For all anaerobic systems, designed digester capacity is directly related to all of the following:

- organic loading rate
- designed retention time
- operating temperature

- quantity and type of material processed.

Longer retention times within the reactor releases more biogas, provides a more stable digestate and reduces post digestion methane and odour release.

Recognised industry standards include, for example, Construction Industry and Research Information Association ([CIRIA 736](#)) and the design and construction of your plant must comply with this. A [risk assessment tool and guide](#) is available to determine the secondary containment provisions that must be in place at a site. The tool is based on the principles of CIRIA 736 and produced by the [Anaerobic Digestion and Bioresources Association](#) (ADBA).

A chartered civil or structural engineer must provide construction quality assurance (CQA) and validate the construction of all facilities. A chartered geotechnical engineer can be used for lagoon design and construction.

Operators of existing sites must use a chartered structural or civil engineer to undertake a detailed assessment to identify if additional infrastructure improvements are required to protect the environment.

### **Minimising emissions to air**

You must prevent, or where prevention is not possible, mitigate fugitive emissions to air. Where possible you must install plant and equipment that can be contained to collect and manage emissions. Where that is not practicable you must reduce fugitive emissions to air using techniques such as installing covers.

New facilities must consider at the design stage, the opportunity to cover storage areas and where possible contain and abate air using appropriately engineered plant. Existing facilities must review their activities to identify opportunities to cover equipment and processes and contain and abate emissions. The design specifications to contain emissions will differ depending on the risk.

A risk-based approach can be followed when determining the complexity of the control measure you need to apply. This approach must consider the:

1. Composition of emissions, for example dust, odour, organic compounds, litter.
2. Site location and proximity to sensitive receptors.
3. Likelihood of release, taking account of seasonal and process variation.

Some circumstances will require a minimum specification and these are set out in this document.

A cover can include using a simple organic barrier for example straw or wood-chip but in some circumstances you may need a more durable cover, such as a semi-permeable membrane, for example Gortex. All covers must help to reduce the transmission of fugitive emissions, reduce rainwater infiltration and be resistant to environmental effects.

Containment means to confine emissions within a space or area that can be managed and controlled to prevent release to the environment. This may include for example installing a suitably engineered building, a sealed tank or using localised air extraction equipment. Air collected from a contained source must be managed through appropriate abatement systems or a gas recovery system.

Your EMS and [odour management plan](#) must demonstrate how you will identify the need for and evaluate the effectiveness of covers, containment and abatement systems. For example, in a [leak detection and repair plan](#) (LDAR) or through a requirement to do site monitoring.

## 5. General management appropriate measures

### Environmental management system

1. You must have an up-to-date, written [environmental management system](#) (EMS)
2. To improve your overall environmental performance, you must put in place and follow an EMS that incorporates the following features.

You have management commitment, including from senior managers.

You have an environmental policy that is defined by senior managers and includes the continuous improvement of the facility's environmental performance.

You plan and establish the resources, procedures, objectives and targets needed for environmental performance alongside your financial planning and investment.

You implement your environmental performance procedures, paying particular attention to:

- staff structure and relevant responsibilities
- staff recruitment, training, awareness and competence
- communication (for example, of performance measures and targets)
- employee involvement
- documentation
- effective process control
- maintenance programmes
- emergency preparedness and response
- making sure you comply with environmental legislation

You check environmental performance and take corrective and preventative action, paying particular attention to:

- monitoring and measurement
- learning from incidents, near misses and mistakes including those of other organisations
- records maintenance
- independent (where practicable) internal or external auditing of the EMS to confirm it has been properly implemented and maintained

Senior managers review the EMS to check it is still suitable, adequate and effective.

You review the development of cleaner technologies and their applicability to site operations.

When designing new plant, you make sure that you assess the environmental impacts from the plant's operating life and eventual decommissioning.

You consider whether your operations could be affected by changing climate and have appropriate plans in place to assess and manage future risks.

You apply sectoral benchmarking on a regular basis by comparing site operations with relevant sector guidance and standards:

You carry out appropriate [waste stream management](#).

You have and maintain:

- an [inventory of waste water and waste gas streams](#)
- a [site condition report](#)

- a [residues management plan](#)
- an [accident management plan](#)
- a [site infrastructure plan](#)
- an [odour management plan](#)
- a [fire prevention plan](#), if required
- a [noise and vibration management plan](#), if required
- a [pest management plan](#), if required
- a [dust, mud and litter management plan \(emissions management plan\)](#), if required
- a [leak detection and repair plan](#), if required

By 'inventory' we mean a complete and detailed list of all wastewater and waste gases produced, handled and treated by your process or plant. Where possible, for example from channelled emissions points (point-sources), your inventory must quantify characteristics such as:

- substance concentration
- load value and variability of each wastewater and waste gas stream

You have a schedule of inspection and maintenance for all plant and equipment including the impermeable surfacing and drainage system. You inspect and maintain plant, equipment and infrastructure in accordance with your schedule and manufacturers guidelines (as a minimum). You hold a list of critical parts and chemicals and can procure and install spares without undue delay.

You have a programme of design improvements that considers future de-commissioning (for existing plants). These improvements need to make sure that you:

- avoid using underground tanks and pipework - if it is not economically possible to replace them, you must protect them by secondary containment or a suitable monitoring programme
- can drain and clean-out vessels and pipework before dismantling
- design new or replacement lagoons with a view to their eventual clean-up
- use insulation which you can dismantle easily without dust or hazard
- use recyclable materials, taking into account operational or other environmental objectives

You have inspection, maintenance and validation procedures for re-commissioning plant and equipment following periods of dormancy.

You identify potential risks that your plant could pose to off-site critical infrastructure should an incident occur (for example to roads, railways, pipelines, potable water supply, hospitals or schools).

You have a management of change procedure for plant, process and people that identifies the hazards that any changes may introduce. You identify a process to categorise the risks and demonstrate how you will systematically address them.

You have a document control procedure in place that clearly describes how and when you will periodically review documentation. Your procedure includes the steps you will take for maintaining version control.

### **Staff competence**

3. Your site must always be operated at all times by an adequate number of staff with the appropriate qualifications, training and [competence](#).

4. The design, installation and maintenance of infrastructure, plant and equipment must be carried out by competent people.
5. If you operate a 24-hour process, for example an in-vessel or anaerobic digestion facility you must have remote or telemetric systems in place to make sure an alarm would be raised in the event of an incident during unmanned hours. You must have appropriate personnel on call to deal with such incidents. You must adequately explain these procedures in your management system.
6. You must have appropriately qualified managers for your waste activity who are members of a government-approved [technical competence scheme](#).
7. For non-hazardous wastes, technical appraisals can be carried out by someone with enough training to determine if the waste is suitable for the site. This does not apply to wastes that are 'mirror entries' (where waste may be allocated to a hazardous entry or to a non-hazardous entry according to the European List of Waste).

If you are permitted to accept hazardous wastes, for example waste glycerol, the person carrying out the technical appraisal of a waste's suitability for receipt (at pre-acceptance) must have the minimum of an HNC in chemistry (or equivalent qualification). You must comply with sector guidance note S5.06 when receiving, handling, storing and treating hazardous waste.

8. At sites where the waste needs only a visual check, for example green waste, the person who receives the waste must have had enough training to be able to confirm its characteristics and manage any non-conformances in the load received.
9. You must make sure that any required sample is representative of the waste and has been taken by someone technically competent to do so.
10. Any required analysis of waste must be done by someone who has been appropriately trained or holds relevant qualifications.
11. Non-supervisory staff must be reliable and technically skilled. Their skills may be based on experience and relevant training.
12. You must keep records of the training, and qualifications or relevant experience of training providers.

### **Accident management plan (AMP)**

13. As part of your written management system you must have a plan for [dealing with any incidents or accidents](#) that could result in pollution.
14. The accident management plan must identify the hazards to the environment posed by the activities or processes. You must follow a methodology such as a Hazard and Operability Study (HAZOP) or a similar detailed risk assessment that identifies hazards through possible deviations from the design intention.
15. You must consider the risks from (though not limited to):
  - waste types (for example, the risk of emissions, litter, contaminants, compatibility, over-heating)
  - overfilling of vessels
  - transfer of substances and gases, for example filling or emptying of lagoons, vessels, biogas transfer

- failure of the plant or equipment, for example over-pressure of vessels and pipework, blocked drains
- failure of containment – air & liquids, for example failure of the bund or air ventilation systems or overflowing of drainage sumps
- failure to contain firefighting water
- failure of abatement systems
- making the wrong connections in drains or other systems
- preventing incompatible substances coming into contact
- unwanted reactions or runaway reactions, for example temperatures in large composting piles
- emission of an effluent before adequate checking of its composition has taken place
- vandalism and arson
- vehicle collisions
- failure of main services, for example power, steam or cooling water and interrupted gas to grid availability
- operator error
- accessibility of control equipment in emergency situations
- extreme weather conditions, for example flooding and very high winds
- controlling feedstocks during limited land bank or gas to grid availability for compost or digestate produced

16. You must assess the risk of accidents and their possible consequences (risk is the combination of the likelihood that a hazard will occur and the severity of the impact resulting from that hazard). Having identified the hazards, you can assess the risks by addressing seven basic questions:

- how likely is it that the accident will happen
- what may be emitted and how much
- where will the emission go
- what are the pathways and receptors
- what are the consequences (on the environment, plant and processes)
- what is the overall significance of the risk
- what can you do to prevent or reduce the risk

17. In particular, you must identify any fire risks that may be caused, for example by:

- arson or vandalism
- self-combustion, for example due to chemical oxidation such as during carbon filter maintenance or storage of oversize materials
- plant or equipment failure and other electrical faults
- naked lights and discarded smoking materials
- hot works, for example welding or cutting, industrial heaters and hot exhausts
- reactions between incompatible materials
- neighbouring site activities
- sparks from loading buckets and other mechanically generated sparks
- electrostatic discharge
- hot loads deposited at the site
- lightning strike



18. The depth and type of accident risk assessment you carry out will depend on the characteristics of the facility, type of plant and its location. The main factors to take into account are the:
- scale and nature of the accident hazard presented by the facility or plant and its activities
  - risks to areas of population and the environment (the receptors)
  - nature of the facility or plant and complexity of the activities and how difficult it is to decide and justify adequate risk control techniques
19. Through your accident management plan, you must also identify the roles and responsibilities of the staff involved in managing accidents. You must provide them with clear guidance on how to manage each accident scenario, for example, whether to use containment or dispersion to extinguish fires, or let them burn.
20. You must appoint one facility employee as an emergency coordinator who will take lead responsibility for implementing the plan.
21. You must train your employees so they can perform their duties effectively and safely and know how to respond to an emergency.
22. You must also:
- establish how you will communicate with relevant authorities, emergency services and neighbours, as appropriate both before, during and after an accident
  - put in place appropriate emergency procedures, including for safe plant shutdown and site evacuation, considering for example safe entry and exit points
  - put in place post-accident procedures that include assessing the harm that may have been caused by an accident and the remediation actions you will take, considering the impact of accidents on the function and integrity of plant and equipment
  - have contingency plans to relocate or remove waste from site or suspend incoming waste
23. Following a flooding event you must inspect and assess the integrity of effected plant and equipment, in particular infrastructure that may have been in contact with floodwater or groundwater. Inspection of tanks may need to include non-destructive testing methods to verify integrity.
24. All biological treatment process operators, in particular of anaerobic digestion plants where explosion hazards may be present, must identify and evaluate the hazards in a risk assessment. You must do this in accordance with the Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR).
25. You must use signage on-site to identify all potentially explosive atmospheres and confined spaces. A confined space is one which is both:
- substantially enclosed (though not always entirely)
  - where serious injury can occur from hazardous substances or conditions within the space or nearby (such as lack of oxygen)

Further information is available from the [HSE](#).

### **Accident prevention measures**

26. You must take the following measures, where appropriate, to prevent events that may lead to an accident:



### **Segregating wastes**

27. You must keep apart incompatible or segregated wastes and substances according to their properties.
28. You must segregate incompatible waste types into bays or store them in dedicated buildings. The minimum requirement is to use a kerbed perimeter and separate drainage collection. You must also have measures in place to prevent containers falling over into other storage areas.
29. You must have procedures in place for checking raw materials and wastes to make sure they are compatible with other substances they may accidentally come into contact with.

### **Preventing accidental emissions**

30. You must make sure that you contain the following and route them to a suitable drainage and containment system:
  - process waters
  - contaminated site drainage waters
  - emergency firefighting water
  - chemically contaminated waters
  - spillages of chemicals
31. You must have planned for how you will contain wastewaters, flood waters or surges and storm water flows. You must consider abnormal operating scenarios and incidents and provide enough buffer storage capacity to make sure that you can achieve this. You can define this capacity using a risk-based approach, for example, by taking into account the:
  - nature of the pollutants
  - effects of downstream wastewater treatment
  - sensitivity of the receiving environment
32. You must have appropriate measures in place to monitor, treat and re-use the water held in the buffer storage before discharging it. You must make sure you have authorisation within your permit to discharge wastewater from your site into the environment.
33. Where installed, you must make sure that storage and drainage lagoons without impermeable covers have adequate storage capacity to receive and hold excess water in the event of heavy rainfall. You must make sure their structural integrity is not compromised during extreme weather events.
34. You must put spill contingency procedures in place to minimise the risk of an accidental emission of raw materials, products and waste materials, and to prevent their entry into water.
35. Your emergency firefighting water collection system must take account of additional firefighting water flows or firefighting foams. You may need emergency storage lagoons to prevent contaminated firefighting water reaching a receiving water body.
36. You must consider, and if relevant to your process, plan for the possibility that you may need to contain or abate accidental emissions from:
  - vents
  - safety relief valves
  - bursting discs and seals
  - tank wall penetrations

If this is not advisable on safety grounds, you must focus attention on reducing the probability of the emission.

### Security measures

37. You must have security measures in place (including staff) to prevent:

- entry by vandals and intruders who could be exposed to harmful substances by contact with waste or gaseous emissions produced during biological decomposition
- damage to the equipment
- theft
- fly-tipping
- arson

38. Facilities must use a combination of the following measures:

- security guards
- total enclosure (usually with fences)
- controlled entry points
- adequate lighting
- warning signs
- 24-hour surveillance such as CCTV

### Fire and explosion prevention

39. You must have an approved [fire prevention plan](#) that meets the requirements of our guidance if you have a permit to carry out an activity involving non-hazardous combustible waste, including:

- the storage of oversize (tail ends) material from composting
- maturation of composted material
- storage of finished compost and green waste

You may also need to have a fire prevention plan if you operate a wet anaerobic digestion or TAD plant. In particular if:

- you carry out additional activities on site, for example, oversize storage and maturation following the composting of digestate fibre
- the Environment Agency notifies you that your activities could pose a fire risk

You must have a fire prevention plan if you operate a dry AD system.

40. For all biological treatment activities, you must:

- have appropriate systems in place for fire and explosion prevention, detection and suppression or extinction - you must document these in your accident management plan or fire prevention plan if you need one
- prevent uncontrolled decomposition and self-heating of stored waste by managing and monitoring temperatures
- implement written systems of work to prevent unsafe situations during site operations and maintenance.
- have a permit to work system in place for maintenance and repairs such as hot work on plant and equipment and where the risk of unsafe conditions could occur

41. For open and in-vessel composting plants, excluding TAD (unless relevant activities apply) you must:

- size your treatment and maturation pile sizes, for example open-composting windrows, to make sure that over-heating does not occur as this can lead to spontaneous combustion
- regularly monitor the temperature of all waste on site in treatment and storage, including oversize and screened material
- have adequate space between windrows to allow safe access so fire fighters can reach composting waste in windrows and vessels if there is a fire
- have sufficient water or liquor available on site to provide adequate moisture to your composting waste, and to deal with a fire or excessive thermal activity

42. For anaerobic digestion plants, you must have lightning conduction systems in place or demonstrate that you have adequately considered this in a risk assessment.

43. If a DSEAR risk assessment has identified potential explosion hazards on your site you must make sure the design and planning of your plant includes appropriate structural, technical and organisational fire protection measures. You must install protective measures on your site and implement procedures such as:

- a permit to work system
- using specialised personal protective equipment (PPE)
- safety and health protection signage
- using ATEX-rated equipment

All AD facilities must comply with DSEAR regulations.

Organisational protective measures also include regular maintenance of the plant, systems and components.

More information is available from the [HSE](#).

44. You must take account of national guidelines and standards regarding fire protection when designing and planning your site. For example, BS EN 62035 for lightning protection.

45. Your facility must have enough water supplies to extinguish fires and the capability to collect, contain and store firefighting water run-off.

46. You must isolate drainage systems from flammable waste storage areas to prevent fire being spread along the drainage system by solvents or other flammable hydrocarbons.

47. You must prevent the build-up of loose combustible material (including dust and waste) particularly around treatment plant, equipment and other potential sources of ignition.

48. You must consider if the [Control of Major Accident Hazard \(COMAH\) Regulations 2015](#) apply to your activities, for example, considering the quantity of flammable gas (biogas) stored.

49. You should share and communicate accident management and fire prevention plans with your local fire and rescue service.

#### **Other accident prevention measures**

50. You must maintain plant control in an emergency using one or a combination of the following measures:

- alarms
- process trips and interlocks
- automatic systems based on microprocessor control and valve control
- tank level readings such as ultrasonic gauges, high level warnings, process interlocks and process parameters
- using a flare to manage biogas in anaerobic digestion systems

51. You must:

- make sure that all the measurement and control devices you would need in an emergency are easy to access and operate in an emergency situation
- maintain plant in a good state through a preventive maintenance programme and a control and testing programme
- use techniques such as suitable barriers to prevent moving vehicles damaging equipment
- put procedures in place to avoid incidents due to poor communication between operating staff - during shift changes, periods of cover by temporary staff and following maintenance or other engineering work
- where relevant, use equipment and protective systems designed for use in potentially explosive atmospheres

52. You must be mindful of alarm fatigue and make sure all alarms are appropriately set and promptly responded to.

53. You must make sure that critical safety equipment, for example sprinklers, pressure relief valves and flares are maintained and kept in good working order.

54. Workers in enclosed and confined spaces must wear personal alarms to monitor for H<sub>2</sub>S and CO. You must also consider the risk of exposure to explosive gases, depleted oxygen environments and of personal exposure to bioaerosols. You must carry out all assessments in line with your facility's occupational exposure process and health and safety guidelines.

### **Records keeping and procedures**

55. You must:

- keep an up-to-date record of all accidents, incidents, near misses, changes to procedures, abnormal events, and the findings of maintenance inspections
- carry out investigations into accidents, incidents, near misses and abnormal events and record the steps taken to prevent their reoccurrence
- maintain an inventory of substances, which are present (or likely to be) and which could have environmental consequences if they escape; many apparently innocuous substances can damage the environment if they escape
- record and hold a critical plant and equipment asset register, including a register of equipment installed in explosive atmospheres (ATEX-rated equipment).

### **Notifications to the Environment Agency**

56. You must:

- provide the Environment Agency with written information about any actual or potential pollution incidents and breaches of emission limits – you must do this within 24 hours of the event

- notify the Environment Agency without delay if you detect any malfunction, breakdown or failure, accident or emission of a substance not controlled by an emission limit (and any breach of an emission limit) which has caused, is causing, or may cause significant pollution

## **Contingency plans, procedures and measures**

57. You must have and implement a contingency plan which makes sure that you:

- comply with all your permit conditions and operating procedures during maintenance or shutdown at your site or elsewhere
- do not exceed limits in your permit and you continue to apply appropriate measures for waste storage, handling and treatment
- stop accepting waste unless you have a clearly defined method of recovery or disposal, and enough permitted storage capacity when land-bank availability is limited
- stop accepting waste or reduce feeding rates unless you have a clearly defined method of gas management when gas to grid capacity is restricted

58. You must take account of any potential impacts on your ability to recover or dispose of the outputs you produce during exceptional weather events, for example prolonged rain or snowfall, deep frosts and severe drought.

59. You must have contingency procedures in place to make sure that, as far as possible, you know in advance about any restrictions in place affecting waste or material recovered to land for agricultural benefit, for example, Nitrate Vulnerable Zones (NVZ) closed periods.

60. You must consider every option available for managing each waste and material, including extended storage, other recovery or treatment options and disposal. You must have the following information in your contingency plan:

- a description of each waste and material and the correct List of Waste (EWC) code for each waste (outputs and inputs)
- companies or permitted waste facilities that could accept and manage your waste - you must obtain a copy of the site permit to make sure it can accept your waste type
- the capacity (volume) of each option and the length of time for which it would be available or needed
- potential environmental and health & safety risks and hazards of every option (for example, odour and emission generation or leachate production from longer-term storage)
- any legal restrictions or constraints for each option
- any additional costs you may incur from each option

You must identify every option available in the short term (1-2 weeks), medium term (4-6 weeks) and the long term (up to 6 months).

Your management procedures and contingency plan must also:

- identify known or predictable malfunctions associated with your technology and the procedures, spare parts, tools and expertise needed to deal with them
- make sure you have the spare parts, tools, and competent staff needed before you start maintenance
- record where you can get critical spare parts from and how long it would take to obtain them if you cannot hold them on site

- have a defined procedure to identify, review and prioritise items of plant which need a preventative regime
- include all equipment or plant whose failure could directly or indirectly lead to an impact on the environment or human health
- identify non-productive or redundant items such as tanks, pipework, retaining walls, bunds, reusable waste containers, ducts, filters and security systems

61. You must make your feedstock suppliers and customers aware of your contingency plan, and of the circumstances in which you would stop accepting waste from them.

62. You must consider whether the sites or companies you rely on in your contingency plan:

- can take the waste at short notice
- are authorised to do so in the quantities and types likely to be needed in addition to carrying out their existing activities - if in doubt contact your local Environment Agency office for advice

63. You must not include unauthorised capacity in your contingency plan. If your contingency plan includes using temporary storage for additional waste on your site, then you must make sure your site is authorised for this storage and the appropriate infrastructure is in place.

64. Your management system must include procedures for auditing your performance against all the contingency measures detailed above and for reporting the audit results to the site manager.

65. If you produce an end of waste material at your facility, your contingency planning must consider storage capacity for end of waste products and materials that fail the end-of-waste specification.

## **Plant commissioning, validation and decommissioning**

### **Commissioning and validation**

66. You must consider arrangements for commissioning your plant at the design stage. You must have a commissioning plan in place before commissioning to minimise the risks of pollution and harm to human health and the environment. The level of detail can be based on the complexity of and risks associated with the process. You must define the suite of indices you will use to determine and monitor process performance and efficiency. You must review and refine the relevant monitoring parameters during the facility's operation as part of an on-going process of system optimisation.

The term commissioning means to bring an item of plant or equipment into working condition.

67. You must test and validate all systems and components of your plant and building(s) against operational requirements identified at the design stage. This must include, for example, the air extraction and abatement system and containment structures. You must have completion certificates (for each commissioning phase) in place, signed by an appropriately qualified person.

68. Commissioning biological treatment plants must be carried out to relevant industry standards where they are available and in accordance with manufacturers' guidelines. As a minimum, the commissioning plan must include summaries of:

- commissioning phases (and sequences) including milestones and timeframes (for example pre, cold, hot commissioning)

- procedures and mechanical tests at each phase including relevant industry test standard (or otherwise), for example manufacturers' guidelines.

Mechanical tests could include, for example:

- tests for leaks
- pressure tests of piping and equipment
- purging or inerting requirements
- pressure and vacuum safety relief
- temperature
- flow and pressure control
- mixing
- air-flow ventilation
- extraction

Your commissioning plan must also include the:

- scope of performance tests, for example, acceptance criteria, measurement requirements, sampling requirements, reference to analytical procedures, chemical and biological analysis
- identification of potential releases to the environment of displaced and generated emissions
- scope of responsibilities of the person(s) related to the test procedures, including the sign-off process
- qualifications of the responsible person(s) involved
- process for dealing with failed tests and problems that you may encounter
- health and safety precautions and protective measures employed

69. When commissioning anaerobic digestion plants that have mixing systems installed, you must test the mixing system is effective, for example using a lithium tracer test.

70. You can only seed and commission anaerobic digestion plants using waste after the Environment Agency has issued your environmental permit. The permit must contain the relevant EWC code and description for the seeding material. Currently, using certified PAS110, quality protocol (QP) digestate for seeding anaerobic digestion plants is not permitted under the terms of the QP.

71. The biomass (inoculum) used in seeding a digester should be sourced to match the type of feedstock the facility is designed to process. This will provide a more stable substrate.

### **De-commissioning and moth-balling**

72. You must consider the decommissioning of your plant or ceasing activities (moth-balling) at the design stage and have plans to minimise risks during later decommissioning or moth-balling. This includes removing or replacing individual items of plant throughout the life of the facility.

Before you de-commission plant you must notify the Environment Agency and provide a copy of your decommissioning plan. Once de-commissioning is complete you must provide a written report to the Environment Agency verifying that you have carried out activities according to your plan.

73. If you bring plant back into service following a period of dormancy you must follow the commissioning requirements set out in this document or be directed by a suitably qualified person.

74. You must have a decommissioning plan to demonstrate:

- plant can be decommissioned without causing pollution
- the site will be returned to a satisfactory condition, for example in accordance with your site condition report

75. The decommissioning plan must include details on (not limited to):

- the removal or the flushing out of pipelines and vessels where appropriate and their complete emptying of any potentially harmful contents
- drawings showing all the underground pipes and vessels
- the method and resources necessary for clearing lagoons
- removing asbestos or other potentially harmful materials, unless you have agreed that it is reasonable to leave such liabilities to future owners
- methods of dismantling buildings and other structures in a way that protects surface water and groundwater at construction and demolition sites
- the soil testing needed to understand the degree of any pollution caused by the site activities, and information on what remediation is needed to return the site to a satisfactory state as defined by the initial site report
- the measures proposed, once activities have ceased, to avoid any pollution risk and to return the site to a satisfactory state (including, where appropriate, those covering the design and construction of the plant)
- clearing deposited residues, waste and any contamination resulting from the waste treatment activities

76. De-commissioning of some plant and equipment, for example those with potentially explosive atmospheres present, is a specialist activity. You must make sure you have written procedures in place to support the safe removal or closure of plant on site.

77. You must make sure that equipment taken out of use is decontaminated and removed from the site.

## **6. Waste pre-acceptance, acceptance and tracking appropriate measures**

### **Waste pre-acceptance and characterisation**

1. If you accept hazardous, 'mirror-entry' hazardous, bespoke, or waste streams not ordinarily directed to biological treatment you must follow the requirements of [sector guidance note S5.06 and Technical Guidance WM3 Waste Classification](#), in addition to this guidance.
2. You must implement waste pre-acceptance procedures so that you know enough about a waste (including its composition and age) before it arrives at your facility. You need to do this to assess and confirm the waste is technically and legally suitable for your facility. Your procedures must follow a risk-based approach, taking account of:
  - the source and nature of the waste, at the point of production
  - the full characteristics of the waste including the variability of each waste (for example, liquid effluents must be subject to individual assessment and testing)
  - its hazardous properties
  - potential risks to process safety, occupational safety and the environment



- effects on the biological treatment process including gas generation and quality of the final waste or product
- risks of contamination
- the effects the waste may have on the use of the outputs
- the effects of any potential carry-over of residual chemical components into the outputs

3. When you receive a customer query, and before the waste arrives at the facility, you must obtain the following in writing or in an electronic form:

- details of the waste producer including their organisation name, address and contact details
- the source of the waste (the process that gives rise to the waste)
- information on the nature and variability of the waste production process and the waste

You must also obtain (in writing or electronic form) details about the waste including:

- a description
- List of Waste code (EWC code)
- its physical form
- its composition (based on representative samples)
- any hazardous properties
- the odour potential
- the type of packaging
- an estimate of the quantity you expect to receive in each load and in a year
- the potential for self-heating, self-reactivity or reactivity to moisture or air
- the age of the waste

4. You must establish a list of unacceptable waste based on your facility's permit and on whether the waste poses specific risks to the site or process, for example:

- corrosion caused by strong acids
- a risk of uncontrolled reactions
- a risk of the evolution of unfavourable gases

5. The biological treatment process must be capable of fully treating the waste. For example, within the time-temperature conditions of your process, to enable biodegradation of packaging and full recovery of the material.

6. You must make sure you manage and control nutrient balance, moisture and toxic compounds which may inhibit biological activity.

7. You must verify the pre-acceptance information by contacting or visiting the producer. Dealing with staff directly involved in waste production can help to fully characterise a waste.

8. You must obtain a representative sample or analysis, or analyse a representative sample of a waste, if:

- the chemical composition or variability of the waste is unclear from the information supplied by the customer
- there are doubts about whether the sample analysed is representative of the waste
- you will treat the waste at your facility (this will allow you to carry out tests to determine if the planned treatment will be safe and effective)

9. Where you rely on a customer sample you must record that you have done this and the reason why the customer sample is acceptable.
10. If the customer has a number of containers holding the same waste, you can apply 'the square root of (n+1)' rule to sampling those containers. If the waste is variable, a sample of each container will be required.
11. You may not need a sample analysis at the pre-acceptance stage where the waste is:
  - packaged food waste from food manufacturers or food retailers – however, you must have confirmation of its origin and sufficient information to understand how it will affect your biological treatment process
  - biodegradable agricultural waste direct from the agricultural premises - however, you must have confirmation of origin and sufficient information to understand how it will affect your biological treatment process
  - green waste
  - food waste and co-mingled green and food waste from local authority collections only
  - a pure product chemical or where the chemical composition and hazardous properties are available in a REACH-compliant safety data sheet, for example manufactured glycerol product
  - produced in an emergency - these wastes must remain quarantined until you have completed full characterisation and you must contact the Environment Agency
12. You must make sure that feedstock testing and frequency of testing reflects the nature of the material, how it arises and any potential variation within it, for example, taking account of seasonal variations.
13. For operators of anaerobic digestion plants you must characterise the feedstock in order to understand its effect on the biological treatment process. This includes understanding, for example:
  - particle size distribution and physical contaminants
  - total solids and volatile solids
  - biochemical methane potential
  - total organic carbon (TOC)
  - nutrient analysis
  - calorific value
  - fibre content
  - pH and alkalinity
  - volatile fatty acids (VFA)
  - ammonia and total nitrogen content - carbon to nitrogen (C to N) ratio
  - heavy metals and potentially toxic elements (PTEs)
  - carbohydrates and lipids
14. For operators of composting and aerobic treatment plants you must characterise the feedstock in order to understand its effect on the biological treatment process. This includes understanding, for example:
  - particle size distribution and physical contaminants
  - total moisture
  - total organic carbon (TOC)

- pH and alkalinity
- ammonia and nitrogen content
- heavy metals and potentially toxic elements (PTEs)

Many of these characteristics are also applicable to testing digestate or compost during the treatment process and in quality testing of the output.

15. You must understand whether the waste you receive may impact on the quality of your outputs and end use.
16. You must make sure that your facility can comply with other regulatory requirements, for example ABPR.
17. You must advise your customers that they must avoid contaminating waste because it can cause handling difficulties and inhibit the biological treatment process. You must tell them what wastes are likely to contaminate your process.
18. After fully characterising a waste, you must technically assess the waste's suitability for treatment and storage to make sure you can meet your permit conditions and any other regulatory requirements. You must make sure that the waste complies with the site's treatment capabilities and capacities. In the case of water-based liquid waste, you may perform laboratory-scale tests to predict the treatment's performance, for example on breaking of emulsion or biodegradability.
19. You must keep pre-acceptance records for at least 3 years (in a computerised waste tracking system) following receipt of the waste. If an enquiry does not lead to receipt of the waste, you do not need to keep records. You must reassess the information you had at pre-acceptance on an annual basis.
20. You must also reassess information required at pre-acceptance if the:
  - waste changes
  - process giving rise to the waste changes
  - waste received does not conform to the pre-acceptance information
21. Before you accept waste you must consider its potential odour and emission impact (description and intensity), for example:
  - mercaptans, ammonia or other volatile organic compounds (VOCs)
  - low molecular weight amines, for example, decaying fish, meat
  - other high-nitrogen and odorous materials or chemicals, for example from highly decomposed food waste or poultry manure

You can only accept these wastes using special handling and storage arrangements such as in adequately covered or air contained and abated areas.

22. You must keep separate the roles and responsibilities of sales staff and technical staff. If sales staff are involved in waste enquiries then technical staff must carry out a final assessment before approval. You must use this final technical check to make sure that you:
  - only accept wastes that are suitable for the site
  - avoid over accumulating waste
  - have enough storage and treatment capacity

23. When you agree that you will accept waste from a customer, you must decide and record what parameters you will check at the acceptance stage. The checks could be visual (for example colour, phase, fuming), physical (for example pumpability, temperature, form) and chemical (for example pH, metals content) parameters. You must also record the criteria for non-conformance or rejection.

24. Waste must not be transferred unnecessarily between waste facilities.

### **Assessing the suitability of bespoke wastes for biological treatment**

The treatment of non-standard or bespoke wastes must result in both:

- full mineralisation and stabilisation of the waste
- recovery of the waste or be beneficial to the process itself

Mineralisation refers to the advanced stage of decomposition that results in the complete breakdown of the organic matter into available nutrients, water (H<sub>2</sub>O) and carbon dioxide (CO<sub>2</sub>).

25. You must understand and demonstrate what happens to the substances present within the bespoke waste material when it undergoes the proposed method of biological treatment. You must demonstrate that these substances are capable of completely degrading within the treatment system.

26. You must obtain representative test data and undertake upstream auditing of the production process in accordance with this guidance to fully characterise the waste and identify the substances it contains. You must provide detailed information. You must not include wastes in the process solely for dilution.

27. For each bespoke waste type you must fully describe and demonstrate the:

- source and process that gives rise to the waste
- characteristics including chemical, physical and biological make-up of the waste
- variability potential considering source production methods
- biodegradability rate
- inhibition effects on the biological process
- residual by products
- substances within the
- waste are biodegradable and recoverable under the conditions of the biological treatment process

28. Using the information above you must prepare a sampling and testing plan to demonstrate how you will obtain chemical data that adequately describes the composition of the waste and any substances in it which may inhibit the biology of the treatment process.

Sampling plans must meet the requirements of BS EN 14899:2005. The testing plan must adequately reflect the source of the material and include:

- objectives of the testing
- detail of testing required
- test parameters
- background information on the process to be sampled
- predicted waste arising's that require treatment

- the sampling approach including population, number of sampling events, number of samples, sample weight and reliability of the outcome
  - sampling methodology
29. You must make sure testing is carried out by laboratories who are UKAS or MCERT accredited for the prescribed test, for example biodegradability.
30. You must identify the effects of seasonal variance on the waste's composition.
31. You must refer to guidance document S5.06 if the waste is hazardous. Producers must fully characterise the waste to include all chemical components so that you can adequately assess the waste for compatibility with biological treatment.
32. You must demonstrate that the proposed biological system will treat any hazardous properties of the waste, and provide details of any pre-treatment or additional control measures required.
33. You must demonstrate what additional measures will be implemented if the waste falls outside of the suggested inhibition values in the section, [inhibition values for aerobic and anaerobic processes](#).
34. You must provide an operational plan demonstrating how the process will accept and treat the bespoke waste where parameters or determinants fall outside the general inhibition values.
35. You must describe what additional measures you will apply if the characterisation data contains specific substances that may inhibit the process. This is to demonstrate the waste is capable of being treated and can be considered recovered.
36. You must demonstrate the waste is capable of safely biodegrading or mineralising through the treatment process under normal operating times and temperature conditions. All substances within the waste should be capable of at least 90% biodegradability within the process.
37. The residues or outputs from the process must not result in potential risks to human health or the environment in any further use or application.

## **Waste acceptance and tracking**

### **Acceptance and reception**

38. In addition to this guidance you must refer to guidance document S5.06 and implement its requirements if you accept hazardous, 'mirror-entry' hazardous, bespoke, or waste streams not ordinarily directed to biological treatment.
39. You must implement waste acceptance procedures to check the characteristics of the waste received matches the information you obtained during waste pre-acceptance. This is to confirm the waste is as expected and you can accept it, or that you must reject it.

Your procedures must follow a risk-based approach, considering:

- the source and nature of the waste
- the variability of a waste (for example, liquid effluents) - it must be subject to individual assessment and testing
- any hazardous properties of the waste
- potential risks, process safety, occupational safety and the environment (for example from odour and other emissions)
- knowledge about the previous waste holder(s) and the age of the waste
- the waste's potential for self-heating, self-reactivity or reactivity to moisture or air

40. Other than in an emergency (for example, taking waste from an emergency incident clean-up) you must only receive wastes onto site that have been pre-booked, adequately pre-accepted, and that are consistent with the pre-acceptance information.
41. If you accept waste in an emergency you must obtain all of the following information:
- the age of the waste
  - the source and process that produced the waste
  - description and EWC code – the waste must be listed on your site permit
  - correct documentation in accordance with duty of care legislation

Waste must be quarantined and assessed as suitable for the process prior to treatment.

You can accept occasional loads of green waste from landscaping activities that are not pre-booked. However these must be infrequent, free from contaminants and are subject to the same criteria as emergency waste.

42. You must visually check wastes and verify them against pre-acceptance information and transfer documentation before you accept them on site. The extent of the initial visual check is determined by the waste type and how it is packaged.
43. You must check and validate all transfer documentation and resolve discrepancies before you accept the waste. If you believe the incoming waste classification and description is incorrect or incomplete, then you must address this with the original waste producer during waste acceptance. You must record any non-conformances. If you have assessed it as acceptable for on-site storage or treatment, you must document this.
44. You must have clear and unambiguous criteria that you use to reject non-conforming wastes. You must also have a written procedure for recording, reporting and tracking non-conforming wastes, including notifying the relevant customer or waste producer and the Environment Agency.
45. You must weigh each load of waste on arrival to confirm the quantities against the accompanying paperwork, unless alternative reliable systems are available (for example, based upon density and volume). You must record the weight in the computerised waste tracking system.
46. The person carrying out waste acceptance checks must be trained to effectively identify and manage any non-conformances in the loads received, comply with this guidance and with permit conditions.
47. After you have carried out the initial visual inspection and confirmatory checks, you must offload waste into a dedicated reception or storage area to await detailed checks or sampling. You must not offload wastes if you do not have enough space and capacity to then treat the waste. Wastes that do not require further checking can go into the appropriate storage area.
48. If you need to offload feedstock deliveries for inspection or acceptance sampling prior to treatment, you must segregate the reception areas (typically into bays) and verify the waste as compliant as soon as possible. If you use a bay every day you must clean it at least weekly. You must clean it more frequently (depending on the waste) if there is a risk of encouraging vermin or causing fugitive emissions.
49. You must design reception areas according to the emission risk criteria of the waste input and site location. In the following cases you must make sure new reception areas are within an

enclosed building that is fitted with negative pressure air-lock controls and a suitably engineered air extraction and ventilation system:

- if the receipt, storage or pre-treatment (for example de-packaging) of the waste may lead to fugitive emissions, for example odorous food waste
- for all waste containing animal by-products

You must collect and treat all emissions in an appropriately engineered abatement system or air suction system close to the source. In in-vessel systems, you can use exhaust air to aerate composting piles before treatment and discharge.

50. If you accept food and putrescible wastes, you must fit existing reception buildings with fast-acting roller shutter doors to allow delivery and other vehicles to enter and leave. Additional measures to minimise fugitive emissions may be required, for example installing an airlock entry system.
51. You must design and maintain buildings used for feedstock reception and storage so they minimise fugitive emissions. (A building is a covered structure enclosed on all vertical sides that is designed to provide sheltered cover and contain emissions of noise, particulate matter, odour and litter.)
52. Design of the reception building must provide enough space to minimise the amount of time waste is held before treatment and to deliver first-in, first-out principles. You can achieve this by operating an alternate bay system or single bay all-in, all-out approach. All bays used to segregate wastes must have defined and visibly clear storage demarcation boundaries.
53. You must install a dust filter before releasing emissions where there is a likelihood you will generate bioaerosols and dust.
54. If you accept and store ammonia-rich feedstock for example poultry litter and manures, you must store it in a way that minimises the release of ammonia. This can be by covering it with a sheet or using organic media such as straw or compost to form a biofilter. You may need additional measures to reduce odour or ammonia in sensitive locations.
55. You must design reception areas to facilitate cleaning and include contained drainage so you can collect wash-water separately for disposal or re-use (where appropriate). If you accept animal by-products, you must keep liquors and leachate separate and provide wheel-wash facilities for disinfecting delivery vehicles on exit from the reception building. You may need additional cleaning methods, for example steam cleaning and you must carry this out in an enclosed area. You must characterise wash-down water containing cleaning chemicals, for example disinfectants, and dispose of them appropriately.
56. You must have impermeable surfacing and a contained drainage system in reception areas.
57. You must minimise the time you store waste in reception before treatment and hold it for no longer than 5 days. You must treat waste that is at risk of encouraging vermin or causing fugitive emissions such as odour, promptly and within 24 hours. You can store green waste and agricultural wastes for longer providing you follow all other appropriate measures.
58. Once offloaded, and as soon as possible and practicable to do so, you must assess the waste and verify it for acceptance in accordance with your procedures.
59. You must carry out a thorough visual check of all loads of waste received (for example, in carts or similar bulk containers, or on pallets) to identify any non-conforming items.

60. You must put non-conforming containers and wastes into quarantine and deal with them immediately. You must record all non-conformances.
61. Where pallets are used to hold containers, you must stack them no more than 1.8m high (including the height of the pallet) and secure them with clear or transparent shrink-wrap. The containers must not extend beyond (over-hang) the sides of the pallet. The shrink-wrap must be clear or transparent so that you can identify waste types, damaged containers, leaks or spillages and incorrectly stacked containers.
62. If you identify a non-conforming waste during a spot check, you must take measures to prevent a recurrence (including contacting the customer).
63. If you accept a waste load and you only identify non-conformance after the waste has been deposited, for example loose green waste with elevated levels of metal or plastic, you must remove and quarantine the contaminants. If possible, you should return non-conforming loads to the producer prior to deposit on site. You must address the non-conformance with the waste producer as part of your waste acceptance procedures and record these events.
64. If packaging such as paper, card and plastic is destined for treatment alongside its contents, it must be treatable within the conditions of the process. You must take measures to remove plastic that is not certified compostable before and during treatment to minimise the contamination of outputs.
65. You must only accept separated loads of plastic packaging if it is all certified compostable to BS EN 13432, for example from closed loop sources such as festivals, coffee shops or individual buildings.
66. You must receive packaged waste in a state which does not result in uncontrolled emissions.
67. You must minimise the manual handling of waste and where possible use mechanical unloading technologies where it is safe and practicable to do so.
68. If you are permitted to accept animal by-products you must segregate and manage the wastes in accordance with any additional regulatory requirements.
69. You must wherever possible keep wastes segregated in reception.
70. When designing your biological treatment plant you must consider the handling of waste between each step in the process from receipt through to treatment and storage. You must use all appropriate measures to minimise emissions during the transfer of waste from one step to another. For example, the transfer of feedstock from reception to a feed hopper. You must install covers, containment or enclosure where possible. You must also minimise handling, such as transporting waste in vehicles around the site, particularly if there is an increased risk of emissions when you handle the waste.

### **Quarantine**

71. Your facility must have a dedicated waste quarantine area. Where there is a risk of fugitive emissions from quarantined waste you must store it in closed or covered containers or within a building.
72. You must separate quarantine storage from all other storage and clearly mark it as a quarantine area.
73. Waste stored in quarantine must be held for a maximum of 5 working days. You must have written procedures in place for dealing with wastes held in quarantine, together with a



maximum storage volume. For some limited and specific cases you can extend quarantine storage time if the Environment Agency agrees. The maximum storage time must take account of the potential for odour generation, pest infestation and storage conditions such as temperature effects. If the waste is infested or odorous you must remove it as soon as possible and within 24 hours.

74. The waste offloading area, any sampling points and quarantine areas must have an impermeable surface with self-contained drainage. This is to prevent any spillage entering the storage systems or escaping off site. All surfaces must be of a type and quality that will allow effective cleaning.

#### **Acceptance of bulk loads, drums and Intermediate Bulk Containers (IBC's)**

75. You must only offload bulk loads (liquid, sludge or solid) after they have been fully verified. You must not accept a non-compliant bulk load for interim storage except in an emergency. Verification testing must include:

- checking consistency with the pre-acceptance information
- compatibility with the receiving vessel contents
- where appropriate, checking treatability by using laboratory-scale simulation

76. Deliveries in a bulk road tanker must be accompanied by a 'wash-out' certificate or a declaration of the previous load so that contamination by this route can be checked. Transfer procedures are provided in the section on [Waste storage, segregation, transfer and handling](#).

77. You must take representative samples when sampling from tankers. You must sample from each compartment if the tanker is divided into multiple compartments. If you have to take a sample from the back valve, you must avoid spillages.

78. For drummed waste, controls must be in place to make sure each drum is given a label to facilitate its on-site storage.

#### **Acceptance sampling**

79. You must representatively sample all wastes, bulk or containerised (including from every container). You do not need to do this if the waste you receive has been representatively sampled and characterised during the pre-acceptance stage and you have verified the information as correct. You must take representative samples at the acceptance stage and carry out verification and compliance testing. This does not apply to:

- green wastes
- food wastes and co-mingled food and green wastes from local authority collections only
- food slurry that has been pre-treated and pre-pasteurised at separately permitted premises
- biodegradable wastes of agricultural origin only
- sewage sludge and septic tank sludge

Where a sample is not required, you must still visually check the waste and carry out periodic audits of the waste against pre-acceptance and duty of care criteria. You must record the reason why you did not sample the waste in your computerised waste tracking system.

A representative sample is one that takes account of the full variation and any partitioning of the load so you can account for worst case scenarios.

80. You must make sure that all waste is free from visual contaminants as far as practicable and it conforms to the EWC code and description on the accompanying duty of care paperwork.
81. If sampling multiple containers, you can make a composite sample if each of the containers making up the composite holds the same waste and the waste is known not to be variable. You must obtain a representative sample by taking a core sample down to the base of the container. You must make sure that you replace lids, bungs and valves immediately after sampling.
82. On-site sampling must take place under the supervision of the site's qualified staff. Where a driver arrives at the site with a sample taken elsewhere, the sample:
- must be verified as representative, reliable and obtained by a person technically competent to take it
  - is only acceptable if it was taken for specific health or safety purposes only
83. Sampling must not increase the risk of incompatible substances coming into contact with one another, for example within a sump serving the sampling point, or because of contaminated sampling equipment.
84. You must have suitable absorbents and spill kit material available to deal with any spills.
85. You must keep a record of the sampling regime, process and justification in your computerised waste tracking system.
86. You must keep acceptance samples on site for at least 2 working days (or otherwise agreed with the Environment Agency) after you have:
- treated a waste and removed its treatment residues from the facility
  - transferred a waste from your site
87. You must have a sampling and analysis procedure. You must design it based on the risk factors for the waste, including:
- the type of waste (for example hazardous or non-hazardous)
  - knowledge of the customer (for example waste producer)
  - the impact of potential mixing or blending and the possibilities for subsequent treatment
88. You must customise sampling procedures for bulk liquids.
89. You must determine and record the following information:
- the sampling regime for each load, together with your justification for selecting each option
  - a suitable location for the sampling points
  - the capacity of the sampled vessel (for samples from drums, an additional parameter would be the total number of drums)
  - the number of samples and degree of consolidation
  - the operating conditions at the time of sampling
90. Wherever possible, you must sample waste in accordance with:
- EN 14899 Characterization of waste - Sampling of waste materials - Framework for the preparation and application of a Sampling Plan
  - CEN/TR 15310-1 Characterization of waste - Waste Collection - Part 1: Guide on the selection and application of criteria for sampling under various conditions

- CEN/TR 15310-2 Characterization of waste - Waste Collection - Part 2: Guide on sampling techniques
- CEN/TR 15310-3 Characterization of waste - Waste Collection - Part 3: Guide on procedures for sub-sampling in the field
- CEN/TR 15310-4 Characterization of waste - Waste Collection - Part 4: Guide to the packaging procedures for storage, conservation, transportation and delivery of samples
- CEN/TR 15310-5 Characterization of waste - Sampling of waste - Part 5: Guide on the process of developing a sampling plan

### Testing and analysis

91. Where you sample a waste, you must test the waste for acceptance according to the parameters decided at pre-acceptance. You must record the results of the tests in the computerised waste tracking system. You must note and investigate any discrepancies.
92. You must make sure all the waste analysis you carry out for regulatory compliance is done following the [Environment Agency's Monitoring Certification Scheme](#) (MCERTS), unless no certification exists for the required tests. You must demonstrate that any other approach you use is equivalent to MCERTS.

### Waste tracking

93. You must use a computerised tracking system to hold up to date information about the available capacity of the waste quarantine, reception, general and bulk storage areas of your facility. Your information must include treatment residues and end of waste product materials.
94. Your tracking system must hold all the information generated during:
- pre-acceptance
  - acceptance
  - non-conformance or rejection
  - storage
  - repackaging
  - treatment
  - removal off-site

This information must be readily accessible.

95. You must create records and update them to reflect deliveries, on-site treatment and despatches. Your tracking system will operate as a waste inventory and stock control system. It must include this information as a minimum:
- the date the waste arrived on-site
  - the original producer's details
  - all previous holders
  - a unique reference number
  - the pre-acceptance and acceptance analysis results
  - the package type and size
  - the intended treatment or disposal route
  - accurate records of the nature and quantity of wastes held on site, including all hazards - identifying the primary hazards
  - where the waste is physically located on site
  - where the waste is in the designated disposal route

- identifying the staff who have taken any decisions about accepting or rejecting waste streams and who have decided on recovery or disposal options
- linking each waste container accepted to its consignment or transfer note
- non-conformances and rejections

96. The tracking system must be able to report:

- the total quantity of waste present on site at any one time
- the total quantity of end of waste product materials on site at any one time, where applicable
- a breakdown of the waste quantities you are storing pending on-site treatment or awaiting onward transfer
- a breakdown of the waste quantities by hazardous property
- an indication of where a batch or load of waste is located based on a site plan
- the quantity of waste on site compared with the limits authorised by your permit
- the length of time a waste has been on site

97. You must store back-up copies of computer records off-site. Records must be easily accessed in an emergency.

98. You must hold acceptance records for a minimum of 2 years after you have treated the waste or removed it off site. You may have to keep some records for longer if they are required for other purposes, for example hazardous waste consignment notes.

## **7. Waste storage, segregation, transfer and handling**

### **Waste storage, segregation and handling**

1. Your facility must have enough physical and permitted capacity for the wastes, raw materials and end of waste materials that you store on site. You must comply with the limits set in your environmental permit and with any additional regulatory requirements that may apply, for example:
  - The Animal By-Products (Enforcement) (England) Regulations 2013
  - COMAH regulations
2. You must store waste in locations that minimise the handling of waste and have handling procedures in place. Waste handling must be carried out by competent staff using appropriate equipment.
3. Where possible, you must locate storage areas away from watercourses and sensitive perimeters (for example those close to public rights of way, housing or schools). You must store all waste within the security protected area of your facility to prevent unauthorised access and vandalism.
4. You must clearly document the maximum storage capacity of the site and the designated storage areas. You must not exceed these maximum capacities. You must define capacity in terms of, for example, maximum tank or vessel capacities, tonnage or numbers of pallets or containers. You must regularly monitor the quantity of stored waste on the site and in designated areas to check against the allowed maximum storage capacities.
5. For biological treatment plants such as in-vessel composting and anaerobic digestion, available storage capacity and throughput will be influenced by the period of time that the waste is in the treatment vessels. You must make sure you have sufficient capacity to store

waste inputs and outputs taking account of the loading rate and capacity for treatment. Information on determining capacity is available in our [Regulatory Guidance Note 2](#) (RGN 2).

6. You must clearly mark all waste storage areas and provide signs indicating the quantity and type of waste stored there.
7. You must locate all above ground tanks used for storing and treating the following on an impermeable surface with contained drainage:
  - liquid-based waste
  - digestate, composting liquors and any other sludges, slurries or liquids whose release could be harmful to the environment

The tanks must also have secondary containment constructed to CIRIA 736 standard and you must fit the tanks with alarms and cut-out systems to detect and prevent leakage.

8. All below ground tanks (including those partially and fully submerged) used for storing and treating the following must be constructed with secondary containment and an engineered leak detection system that is constructed in accordance with CIRIA 736 where relevant, or alternative recognised standard:
  - liquid-based waste
  - digestate, composting liquors and any other sludges, slurries or liquids whose release could be harmful to the environment

You must fit the tanks with alarms and cut-out systems to prevent and detect leakage.

9. You must cover all existing and new storage structures, for example lagoons, tanks and outdoor bays.
10. You must cover lagoons and tanks used to store dirty water, digestate, slurries and other liquids and sludges. The covers must be designed to prevent odour, emissions such as ammonia and rainwater ingress. More information on how to control emissions specifically from slurry stores is available in the [intensive farming environmental permitting guidance](#).
11. For existing sites, floating covers such as clay balls may be acceptable on lagoons used to store digestates and on existing storage vessels. Coverage must be sufficient to minimise fugitive emissions and using them must not compromise the integrity of plant and equipment.
12. New lagoons used for the storage of digestate must be covered with an engineered impermeable rigid or flexible cover provided with gas collection and extraction to abatement or gas recovery system. A risk-based approach can be applied for the design of covers for digestate stores from agricultural wastes only.
13. All new lagoons must be constructed in accordance with CIRIA 736. Existing lagoons must be appropriately risk-assessed by a suitably qualified engineer. You must maintain the structural integrity of the lagoon and carry out any improvements identified during the assessment.
14. All new storage tanks that require additional management, including agitation, active gas collection or aeration must be contained with the air collected and appropriately abated or recovered.
15. You must store highly putrescible wastes including odorous and ammonia-rich wastes and wastes containing ABP in a contained environment. For solid and semi solid wastes this would be a building fitted with an appropriately engineered extraction and ventilation system with the air collected and directed to a suitable abatement system. You can use localised

point source air extraction installed within buildings to minimise an area source emission. For liquid wastes this would be:

- a sealed tank fitted with an air control system which may include air circulation or
- directing air to a gas recovery plant or engineered abatement system.

You can use a risk-based approach when designing air containment for the storage of agricultural wastes.

16. You must make sure lagoons used for storing composting liquors and digestates have enough capacity for at least 6 months storage to account for closed land-spreading periods.
17. You must monitor substrate levels in all storage tanks, vessels and lagoons used to hold liquids, sludges and digestate. Storage vessels used for liquids, sludges and digestate must have a freeboard as recommended by the plant manufacturer. Lagoons must have a freeboard of at least 750mm at all times.
18. Storage vessels, surfacing for the siting of storage vessels and secondary containment infrastructure must have sealed construction joints.
19. Your storage areas must be large enough to manage foreseeable changes in feedstock supply and your ability to despatch outputs without causing pollution. For example, during:
  - public holidays
  - periods of adverse weather
  - the acceptance of seasonal peak volumes of waste
20. You must not over accumulate wastes. You must treat wastes, or remove them from the site as soon as possible. You must prioritise the treatment or off-site transfer of waste based on:
  - its type
  - its age on arrival
  - date of arrival and
  - duration of storage on site
21. You must store waste for the minimum amount of time possible before and after treatment. See [waste acceptance](#) for storage times in reception.
22. The surfaces of storage areas used for putrescible waste must be of a type and quality suitable for effective disinfection with a broad spectrum agent. You must put procedures in place and use them to make sure that surfaces are regularly cleaned and disinfected.
23. Your storage facilities and procedures must be designed to make sure no cross-contamination occurs between inputs and outputs of the process, and, where applicable, during the treatment cycle. For example, during the sanitisation and stabilisation of composting waste.
24. To minimise carry-over of contaminants and damaging plant and equipment, you must regularly carry out the safe cleaning of storage vessels.
25. You must store all waste on an impermeable surface with contained drainage that meets the recommendations of CIRIA 736.
26. Storage area drainage infrastructure must:
  - contain all possible contaminated run-off

- prevent incompatible wastes coming into contact with each other
  - make sure that fire cannot spread
  - be designed to allow access for inspection and cleaning
27. For waste in storage you must follow the first-in, first-out principle and also identify and prioritise dealing with wastes with a higher risk of causing odour, litter or pest problems. This can be achieved by filling and emptying bays alternately or operating an all-in, all-out approach.
28. Your on-site waste inventory must be readily available.
29. Where possible you must keep clean rainwater separate from wastes and wastewaters.
30. There must be safe pedestrian or vehicular access (for example, for forklifts) at all times to storage areas so that you can retrieve waste safely. Bunkers, bays and pits must be designed so that waste and debris does not build-up in inaccessible areas such as corners and you must be able to access the waste safely.

**Storage in containers (not including bulk containment), IBCs and drums**

31. You must store all waste containers, for example drums and IBCs in a way that allows easy inspection. You must maintain safe access between rows of bulk containers or palletised wastes.
32. Where practicable you must store containerised waste under cover. Covered areas must have good ventilation. This applies to any container held in storage, reception storage (pending acceptance) or quarantine.
33. You must empty, re-package or otherwise manage containerised waste under cover. If this activity could give rise to emissions you must carry it out within an enclosed building with suitable air extraction, abatement and drainage.

Under cover storage provides better protection for containers than open air storage and minimises the generation of contaminated water. Covered storage also:

- lowers temperature fluctuations that can cause a pressure build-up in containers
  - reduces the degradation of containers through weathering
34. Where wastes are known to be sensitive to heat, light, air and water you must make sure that they are protected from such ambient conditions. These storage provisions apply to any container held in any storage area, or which is being emptied, sorted, repackaged or otherwise managed.
35. All waste containers must be fit for purpose, that is:
- in sound condition
  - undamaged
  - not corroded, if metal
  - have well-fitting lids
  - suitable for the contents
  - with caps, valves and bungs in place and secure
  - within the manufacturers use-by date, particularly for plastic containers (this does not apply to certified compostable packaging destined for treatment)

36. You must check any containers (and pallets they may be stored on) daily and record non-conformances. Non-compliant containers and pallets must be made safe. You must immediately and appropriately manage any unsound, poorly labelled or unlabelled containers (for example, by re-labelling, over-drumming and transferring the container's contents). You must not use containers, tanks and vessels beyond their specified design life. You must only use them for the purpose, or substances, they were designed for.
37. To minimise emissions and reduce spills, you must maintain the integrity of waste packaging at all times, until it enters the treatment process, if and when applicable. You must design and operate your facility in a way that minimises waste handling. You must never throw, walk on or handle wastes in a way that might damage the integrity of the packaging.
38. All containers must have a lid, and the lid must be closed except when the container is being sampled, loaded or unloaded.
39. You must not stack skips containing waste.
40. You must inspect storage areas, containers and infrastructure daily. You must deal with any issues immediately. You must keep written records of the inspections. You must rectify and log any spillages of waste.
41. You must use contained drainage systems to prevent leaks and spillages contaminating other wastes.
42. You must only move wastes between different locations on-site (or load for removal off-site) following written procedures. You must then amend your waste tracking system to record these changes where necessary.
43. You must train forklift drivers in the handling of palletised goods, to minimise forklift truck damage to the integrity of containers.
44. All containers must remain labelled during storage in the way it was labelled at acceptance. You must handle and store containers so that the label is readily visible and continues to be legible.
45. You must not carry out activities that represent a clear fire risk within any storage area. Examples include:
  - grinding
  - welding or brazing of metalwork
  - smoking
  - parking of normal road vehicles except while unloading
  - recharging forklift truck batteries

If you need to carry out maintenance which may involve for example, grinding and welding, you must first remove all flammable materials and carry out a detailed risk assessment following safe systems of work.

### **Bulk storage**

46. You must use tanks and associated equipment that are suitably designed, constructed and maintained. You must carry out a risk assessment to validate the design and operation of bulk storage systems. As part of the commissioning process, and before new tanks and equipment are put into service you must verify they are functioning in accordance with their design.



47. You must cover all bulk storage tanks. Where possible you must contain and vent tanks and vessels through suitable abatement or direct emissions to a gas recovery system.
48. Bulk storage systems must conform to the following CIRIA guidance:
- C535 Above-ground proprietary prefabricated oil storage tank systems (where relevant)
  - C736 Containment systems for the prevention of pollution
49. You must locate bulk storage vessels on an impermeable surface which is resistant to the material being stored. The surface must have self-contained drainage to prevent any spillage entering the storage systems or escaping off site. Impermeable surfaces must have sealed construction joints.
50. You must provide secondary containment (bunds) for all tanks containing liquids whose spillage could be harmful to the environment. Bunds must:
- be impermeable, stable and resistant to the stored materials
  - have no outlet (that is, no drains or taps) and drain to a blind collection point
  - have pipework routed within bunded areas with no penetration of contained surfaces
  - be designed to catch leaks from tanks or fittings
  - have a capacity calculated following the relevant CIRIA guidance
  - have regular visual inspections - any contents must be pumped out or otherwise removed under manual control after checking for contamination
  - be fitted with a high-level probe and an alarm (as appropriate) if not frequently inspected
  - have tanker connection points within the bund (where possible), and if not possible you must provide adequate containment for spillages or leakage
  - have programmed engineering inspections (extending to water testing if structural integrity is in doubt)
  - be emptied of rainwater regularly to maintain the containment capacity
51. You must schedule to remove sediment from storage tanks and lagoons at appropriate intervals which will be determined by a written programme of inspection. You must do this more frequently if operational conditions identify it is needed. Grits and sediments removed from tanks and grit traps will be a waste when discarded and therefore subject to waste regulatory control. You must not deposit them into lagoons.
52. You must equip all liquid-based storage tanks with an automatic level monitoring system and an associated alarm and cut-out out system to protect against over-filling. These systems must be sufficiently robust (for example, be able to work if sludge and foam are present) and regularly maintained.
53. You must be able to close all connections to vessels, tanks and secondary containment via suitable valves. You must fit a valve close to the tank if you have bottom outlets and have at least 2 isolation points in case of valve failure.
54. You must direct overflow pipes to a contained drainage system (for example the relevant secondary containment) or to another vessel where suitable control measures are in place.
55. Tanks, pipework and fittings must be inspected by a competent person, following a written programme of inspection. The scope and frequency of inspection must be determined by a competent person. You must determine the intervals between internal inspections using a risk assessment approach based on:
- design, specified design life and intended use of tank, pipework or fitting

- age, maintenance and service history
- known and potential damage mechanisms and their rates of attack
- operational and thermal stresses
- influence of cyclic and pressure loadings
- bio-chemical influence of substrate carried
- non-destructive testing and frequency of inspection

You must also determine the intervals for external inspection such as using non-destructive testing (NDT) methods. You must schedule external visual inspections. You must act on the results of all inspections and carry out any necessary repairs to make sure the tanks remain fit for service. You must keep records of the results of inspection and any repairs.

56. You must have systems in place to make sure that loading, unloading and storage are safe, considering any associated risks. This can include:
- having piping and instrumentation diagrams
  - using ticketing systems
  - using key-locked coupling systems
  - having colour coded points, fittings and hoses
  - using specific coupling or hose sizes for certain waste transfers
57. New facilities must not use open-topped tanks, vessels or lagoons to store or treat hazardous or liquid wastes. Older storage facilities may use floating covers as long as these are applied in line with manufacturers' recommendations and re-applied as necessary. There must be no exposed surface in the storage tank or lagoon. You must contain and manage emissions produced from the storage of liquid wastes to minimise fugitive emissions to air.
58. All pipes, hoses, connections, couplings and transfer lines must be fit for purpose and resistant to the wastes being stored. You must use a suitable pipework coding system (for example RAL European standard colour coding). You must monitor the transfer of liquids and sludges between tanks and this must be linked to an alarm or cut-out system.
59. Site staff must supervise loading and unloading activities, either directly or via CCTV.

**Transfer of waste into and from sealed tankers (including liquid effluents, digestate and slurries)**

60. You must make sure that transfers from tankers only take place after you have completed waste acceptance checks and then only with the approval of a responsible person. You must record:
- which batch or load of material is to be transferred
  - the receiving storage vessel
  - the equipment required, including spillage control and recovery equipment
  - any special provisions relevant to that batch or load including minimising fugitive emissions
61. You must have in place systems to prevent 'tanker drive off' (a vehicle pulling away whilst still coupled).
62. You must make sure that the transfer of waste from tankers is only carried out by competent staff and with an appropriate amount of time so they are not under pressure to work more quickly than is acceptable.

63. You must have measures in place to make sure that couplings are a correct fit. This will prevent couplings from loosening or becoming detached. You must provide, maintain and clean your own couplings to guarantee their integrity and fitness. You must also:
- make sure you take special care so that a coupling is able to withstand the maximum shut valve pressure of the transfer pump
  - maintain a sound coupling at each end of the transfer hose, even when a gravity feed system is in place, and protect the transfer hose
  - control potential leaks from coupling devices by using fairly simple systems such as drip trays
  - You must carry out all tanker loadings and discharge either in a building or if you do this outdoors, you must safely manage the displaced air from tankers and direct it to an abatement system. To capture worst-case leaks and spills you must locate all connection points either:
    - on an area of impermeable surfacing with contained drainage
    - within a building with contained drainage
    - in an area where leaks and spillages can be readily contained and managed

You must not allow unsupervised discharges or transfers.

64. You must unload or discharge all tankers of waste containing ABP via a sealed pipe. You must do this within a building fitted with an appropriately designed and engineered air collection and abatement system.
65. You must carry out routine maintenance to prevent failure of the plant or equipment causing an acute accident. This may include the failure of a pump seal or the blockage of a filter pot commonly used at transfer points.
66. You must have emergency storage for leaking vehicles to minimise any acute incidents caused by a seal on a road tanker failing.
67. You must have measures in place to make sure that the correct waste is discharged and from the correct tank and road tanker. For example, you could use a lockable isolating valve fitted to the loading connection. This is kept locked during periods when the unloading points are not supervised.
68. If you use a delivery tanker to collect and transport digestate (from AD or TAD), you must clean out the tanker before refilling it where there is a risk of cross-contamination, for example following the delivery of manures and slurries.
69. You must have in place systems and procedures to make sure that wastes due to be transferred comply with the Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (CDG) when they are packaged and transported.
70. You must make sure that the transfer from a tanker to a drum or vice versa is done in a dedicated area and uses a minimum of two people to check the pipes and valves at all times. Dip pipes must be fitted with a shut-off valve to control the dispensing into containers and prevent overfilling.
71. You must continue the waste tracking system that began at the pre-acceptance stage, throughout the duration waste is kept at the site.
72. You must make a record of any spillages. You must retain spillages within the contained areas and collect those promptly using pumps or absorbents.

73. You must make sure that bulking into tankers only takes place once you have carried out suitable verification and compatibility testing.
74. You must take operational and design precautions when mixing or blending wastes, depending on the composition and consistency of the wastes to be mixed or blended.
75. If you use rotary-type pumps, they must be equipped with a pressure control system and safety valve.
76. You must pump liquids and sludges instead of using open movement.

### **Repackaging**

77. Repackaging is the removal of waste from one container into another and this may involve mixing it with other wastes of the same type from other containers. You must have a specific permit for repackaging activities (which are coded D14 and R12). Placing containers together with other waste containers of the same type for storage purposes, without emptying the contents from the container, is sorting (which is coded D15 and R13) and not repackaging.
78. Repackaging must only take place in a dedicated area or store which is equipped with the plant and equipment needed to deal with the specific risks of that process. You must have a risk assessment and carry out appropriate compatibility testing to make sure that no reaction occurs between the bulked repackaged wastes.
79. You must label containers of bulked wastes so that their contents and origin can be identified through the tracking system. After repackaging, you must move the bulked materials and containers to an appropriate segregated storage area.

### **Mixing wastes (by bulking, blending or repackaging)**

80. Mixing must have a clear and defined benefit to the process (for example, adjusting moisture content or solid fraction). You must only mix wastes together under controlled and safe conditions. You may need air handling and extraction. You must assess the compatibility of wastes in the mixing process and you must not allow dangerous reactions to take place, for example those caused by:
  - polymerisation
  - gas evolution
  - exothermic reaction
  - decomposition
  - crystallisation
  - precipitation
81. Mixing hazardous waste with non-hazardous waste or non-waste creates a larger amount of material that must be treated as a hazardous waste. Unless you have a permit that specifically allows this, and the mixing is for a specific beneficial purpose, you must not mix hazardous waste with non-hazardous waste or non-waste. You must avoid mixing or blending wastes to deliberately dilute contaminants.
82. Compatibility effects must be understood before:
  - combining waste batches
  - discharging from a tanker to bulk storage
  - tank-to-tank transfer
  - transfer from a container to a bulk tank

- bulking into drums or intermediate bulk containers (IBCs)
- bulking solid waste into drums or skips

Where compatibility effects are not clearly understood, you must undertake testing.

83. Compatibility tests are risk-based considering, for example:

- the hazardous properties of the waste
- the risks posed by the waste in terms of process safety
- occupational safety and environmental impact
- the knowledge of the previous waste holder(s)

84. You must prevent the mixing of substances that react strongly with each other (causing heat, fire or gas formation). Mixing must not lead to increased risks to human health or the environment, either during the mixing operation itself or during the subsequent treatment process. Before wastes are combined, you must assess whether this combination can take place safely.

85. You must guarantee the traceability of wastes when mixing wastes.

86. You must only mix or blend waste in a dedicated area.

87. Mixing wastes must lead to the best possible level of waste management. For example, you must not mix:

- a waste which could be recovered with other wastes, meaning that the waste must now be sent for disposal or a lower form of recovery
- liquid wastes with other wastes for the purpose of landfilling
- waste to deliberately dilute it

88. When mixing wastes you must follow the joint Environment Agency and HSE Compatibility Testing Guidance for Bulking Operations in the Waste Treatment Industry.

89. For liquid, paste-like and pumpable wastes, you may use the following to mix waste:

- agitators, primarily to produce an optimal mixture of liquid or paste-like wastes - this technology can sometimes also avoid separation
- tanks (with agitators if necessary), to homogenise liquid or paste-like wastes and prepare them for feeding into a plant - tanks also help combine many small batches into larger transportation units
- pumps, to transport liquid or paste-like wastes, for instance to empty collection tanks in refuse trucks - different types of liquid may also be mixed in the process

## **8. Waste treatment**

### **General waste treatment**

1. Waste treatment must have a clear and defined benefit. You must fully understand, monitor and optimise the waste treatment process to make sure that you treat waste effectively and efficiently. The treated output must meet your expectations and be suitable for its intended disposal or recovery route. You must identify and characterise emissions from the process, and take appropriate measures to control them at source.

2. Selecting and configuring technologies must be based on the combination of waste types to be treated. These may include a combination of processes, for example:

- mechanical techniques for waste preparation
- material separation and refinement
- aerobic treatments and anaerobic digestion

You must treat your waste using the most effective technology or combination of technologies.

3. You must make sure that your environmental permit allows the specific treatment processes you wish to carry out at your facility.

4. You must provide written process descriptions of your treatment activities and the equipment you use. This must include:

- characteristics of the waste to be treated and the waste treatment processes
- diagrams of the main plant items where they have environmental relevance, for example, storage, tanks, treatment and abatement plant design
- descriptions of process-integrated techniques and wastewater or waste gas treatment at source including their performances
- an equipment inventory, detailing plant type and design parameters, for example, time, temperature, pressure
- waste types to be subjected to the process
- the control system philosophy and how the control system incorporates environmental monitoring information
- process flow diagrams (schematics) for waste, water and air and gas flow
- simplified process flowsheets that show the origin of emissions
- operating and maintenance procedures
- process instrumentation diagrams
- details of chemical reactions and the rate of reaction and energy balance
- venting and emergency relief provisions

5. You must provide a written description of the protection provided during abnormal operating conditions to make sure you continue to comply with permit conditions. Abnormal operating conditions include:

- unexpected releases
- start-up
- momentary stoppages
- shutdown

6. You must use material flow analysis to identify potential contaminants in waste inputs, outputs and emissions; in particular where you accept bespoke waste streams. You must apply your knowledge of the fate of the contaminants to make sure that you correctly minimise, remove and recover them from the process stream. You must use robust pre-acceptance and acceptance procedures in the first instance to minimise the risk. You may need pre-treatment methods to further minimise the carry-over of contaminants through to the treatment process. Undesired materials must not be diluted into the recycling or product cycle.

7. You can apply a risk-based approach when using material flow. You must consider:

- the hazardous properties of the waste
- the risks posed by the waste in terms of process safety and biological inhibition

- occupational safety and environmental impact
  - knowledge of the previous waste holder(s)
8. You must not proceed with the treatment if your material flow analysis indicates that losses from a process will cause:
- the breach of an environmental quality standard
  - the breach of a benchmark
  - a significant environmental impact
9. You must clearly define the objectives and reaction (chemical, physical or biological) steps for each treatment process. You must define the end point to the process so that you can monitor and control the reaction. You must define the suitable inputs to the process, and the design must take into account the likely variables expected within the waste stream. You must sample and analyse the waste to check that an adequate end point has been reached.
10. You must manage all biological treatment activities in a way which minimises the risk of pollution from odour, bioaerosols, dusts and other emissions.
11. For all stages of the process, you must minimise the risk of over-heating, re-heating, foaming, uncontrolled biological activity and leachate breakout.
12. You must fit sensors on tanks used for the treatment of feedstocks that will detect foaming, for example from high protein feedstocks and oils and fats.
13. You must monitor and record meteorological conditions including wind speed, air temperature and wind direction. You must locate monitoring stations appropriately on your site. You must calibrate meteorological monitoring equipment every 4 months unless agreed otherwise with the Environment Agency. You must follow manufacturers' recommendations.
14. For a relevant waste to be considered suitable for biological treatment, your treatment process must be designed to:
- treat the types of wastes on your environmental permit
  - manage variability in feedstock and optimise process conditions
  - make sure storage areas prevent emissions and uncontrolled releases
  - make sure there is sufficient capacity for waste to be treated within the retention time of the process

You must also:

- apply the correct technology to pre-treat the waste to provide optimal substrate characteristics
- provide the correct conditions for biological activity
- retain the correct biological conditions to biodegrade the feedstock into an output that meets expectations and is suitable for its intended end use
- comply with additional regulatory requirements for example animal by-products regulations

You can only treat waste containing animal by-products at facilities that have been validated in accordance with the regulations and approved by the [Animal and Plant Health Agency](#) (APHA).

15. You must provide impermeable surfacing with contained drainage for all areas where waste is to be treated. You must segregate your drainage systems to provide separate collection for

dirty and clean areas. You must collect dirty water, for example composting liquor run-off, in an engineered system for disposal or re-use on site where appropriate to do so.

16. You must install and operate a manual or automatic monitoring system that provides for effective operational management and minimises operational difficulties. For example by displaying (visually and audibly) early warning signals to prevent system failures.
17. You must monitor your process in accordance with animal by-products regulations where required to do so.
18. You must periodically validate your monitoring methods, for example by drying if you typically rely on squeeze tests. You must keep records of your validation tests.
19. You must provide a maintenance and inspection programme for all items of plant and equipment used in the treatment, storage, handling and utilisation of biodegradable organic waste. You must minimise unscheduled shut downs or any other event where equipment or process failure could lead to an impact on the environment.
20. You must calibrate monitoring equipment and maintain your plant and equipment in accordance with manufacturers' recommendations and your maintenance and inspection programme. This includes for example doing daily and weekly inspection checks and holding records of completion.
21. You must carry out a risk assessment, for example Hazard Analysis and Critical Control Point (HACCP) or HAZOP or similar risk assessment. To guarantee operational control you must assess the requirements for process monitoring, alarms, interlocking and any critical control measures. You must identify opportunities to improve operational and safety control systems and document these in your EMS.
22. You must demonstrate that all process equipment is made of materials suitable for each unit's operation and you will use it according to its design capability for the life of the plant or the manufacturers stated design life. This includes vessels, ancillary pipe work, valves and other mechanical and electrical items. A qualified and competent person must justify and verify the use of operating plant and equipment beyond its design life, to demonstrate no additional risk of failure.
23. You must have an up to date piping and instrumentation (including control devices) diagram (P&ID) if you operate piping and process equipment on your site.
24. You must equip vessels and tanks used for liquid-based waste treatment, for example anaerobic and TAD digesters, with continuous temperature and substrate height monitoring capability. You must also install pressure monitoring if there is a risk of pressurisation in the vessel. You must link all monitoring to an alarm system that can be remotely monitored and that provides you with audible and remote alarm notification in the event of over or under-heating and over-filling.
25. You must install mixing systems to all liquid-based treatment vessels, these may include one or a combination of:
  - mechanical stirrers by means of agitators
  - hydraulic mixing by means of pumps that recirculate the substrate
  - pneumatic mixing by recirculation (for example biogas in AD digesters)
26. Mixing or stirring mechanisms must be appropriate for the type of vessel and waste to be processed. This is to make sure there is:



- efficient mixing
- adequate oxygenation (where applicable)
- uniform heat transfer
- sedimentation prevention

27. You must determine mixing efficiency and sediment loading in your vessels. In some systems this can be by continuously monitoring the agitation ampere of your mixing system. You must make sure sediment is not impeding mixers which may lead to pressurisation or plant failure. You must periodically carry out lithium tracing or heat conduction thermal imaging (at least yearly or in accordance with the design specification requirements).
28. The design of vessels must allow for sludge draw-off, debris and grit removal.
29. You must have a maintenance schedule to de-grit treatment vessels where sediment can build up. You must de-grit your vessels at intervals pre-determined by your written programme of inspection or more frequently as established by operational conditions.
30. You must prevent the emergence of foams in digesters. If you use foam suppressants for example anti-foaming chemicals you must have procedures in place to support their deployment.
31. You must install [pressure and vacuum relief valves](#) (PVRV) on all vessels where there is a risk of pressurisation. You must record the date, time and duration of pressure relief events. (SCADA systems must identify release events).
32. All tanks used for the treatment of liquid-based waste must be sealed. You must contain, collect and treat air from within the tanks in a suitably designed and engineered abatement system or gas recovery system.
33. All in-vessel systems used to treat solid and semi-solid waste must be adequately contained. You must collect and contain and treat air from within the treatment vessels in a suitably designed and engineered abatement system or gas recovery system.
34. Treatment plant and abatement technology must be specifically designed, commissioned and operated to be fit for purpose. The designs need to consider chemical and biological process hazards and a hazard assessment of the chemical and biological reactions. They also need to consider prevention and protective measures and process management, such as:
- working instructions
  - staff training
  - plant maintenance
  - checks
  - audits
  - emergency procedures
35. In order to track and control the process of change, you must have a written procedure for proposing, considering and approving changes to technical developments, or to procedural or quality changes.
36. You must consider provision for on-site laboratory facilities in order to regularly analyse samples and inform your treatment process. If an on-site laboratory is not available, alternative off-site arrangements must be in place.

## Pre-treatment

37. Pre-treatment of waste may include one or more of the following:

- hand-sorting
- de-packaging
- removal of contaminants, for example using screening, separation, sifting, pressing or floatation
- mixing and blending - to obtain correct C to N or substrate characteristic ratios
- screening and thickening, for example the addition of polymers
- use of additives, for example trace elements
- optimising particle size, for example using shredding or maceration

Whether you need to remove physical contaminants from feedstocks, and the type of pre-treatment required, depends on the feedstock material and the type of biological treatment process you operate. You must remove or reduce all non-compostable plastic to levels that are as low as reasonably practicable. You must remove all other contaminants from the feedstock as far as is reasonably possible. You must consider your pre-treatment requirements at the design stage. Pre-treatment methods must provide the flexibility needed to process the types of feedstock you anticipate accepting at the facility.

38. You must make sure you carry out particle size reduction where this is required:

- by animal by-products regulations for sanitisation or pasteurisation
- to optimise substrate characteristics for effective and efficient processing

As far as is reasonably practicable, you must make sure that particle size reduction does not simply result in smaller contaminants entering the biological treatment process.

39. You must make sure that where animal by-products and non-animal by-products are treated and stored at your facility, you segregate the wastes to prevent cross-contamination either by staff or equipment where appropriate to do so.

40. Where practicable and possible to do so, you must carry out the pre-treatment of waste using plant and equipment that can be contained to minimise fugitive emissions. You must carry out the pre-treatment of highly putrescible wastes including odorous wastes, ammonia-rich wastes and wastes containing ABP within a suitably designed building fitted with an air ventilation and extraction system. This must be connected to an appropriately engineered air abatement system or gas recovery plant. You can apply a risk-based approach when designing air containment for the pre-treatment of agricultural wastes only.

41. If you operate MBT plants you must segregate and condition the waste inputs before biological treatment. This may include:

- using shredders for the opening of bags
- using metal separators to extract undesirable components that might obstruct the subsequent process
- using sieves or shredders to optimise particle size and segregate biodegradable fractions
- using air separation to segregate high calorific materials such as textiles, plastics and paper
- homogenising materials

- sterilising waste in an autoclave - before mechanical treatment
42. If you use chemical, thermal, ultrasonic or biological pre-treatment you must have appropriate controls and procedures in place for their storage, handling and use. For example if you use these treatments:
- using oxidative chemicals
  - adding acids or alkalis
  - using high-temperature heating
  - paper enzyme addition
43. You must avoid decanting sacks or drums of chemicals directly into treatment tanks or vessels. You must monitor any reactions and make sure control mechanisms are in place to manage such reactions.
44. Pre-treating waste feedstocks is sometimes done off-site from a treatment facility. For example de-packaging, blending or pasteurising waste before transporting it to one or more treatment facilities. The objectives and requirements for pre-treatment at a third party facility are equivalent to an on-site facility. The pre-treatment facility will require a separate environmental permit and biowaste material must be transported to and from sites in accordance with [Duty of Care legislation](#). You must apply pre-acceptance and acceptance procedures. You must comply with animal by-products regulations. This has been referred to as the [Hub and Pod](#) concept for AD. The process risk is controlled by HACCP assessment.

## **Treatment and process control**

### **Aerobic treatment**

45. An aerobic treatment of waste facility may include the following processes (or combination of processes):
- in-vessel composting (including rotating drum systems, containers and vertical towers)
  - open-air windrow composting (animal by-products excluded)
  - hall (housed) composting
  - static aeration
  - biodrying and biostabilisation (MBT)
  - thermophilic aerobic digestion (TAD)
  - aerated lagoons and activated sludge (for wastewater treatment)
46. You must equip vessels used for batch processing of solid waste, for example in-vessel composting or biostabilisation for MBT, with the capability to carry out continuous, representative temperature monitoring during sanitisation. You must link monitoring to an alarm system that you can monitor remotely and that provides you with remote alarm notification.
47. In order to reduce emissions to air and to improve environmental performance, you must monitor and control the key waste and process parameters, including:
- waste input characteristics (for example, C to N ratio, particle size, pH, porosity)
  - temperature and moisture content (at different points if in a windrow)
  - aeration (for example, via windrow turning frequency, O<sub>2</sub> and CO<sub>2</sub> concentrations, temperature of air streams in the case of forced aeration)
  - for windrow composting: height and width of composting piles

- visual and olfactory assessment of the material, to detect actinomycetes, fly infestation, odours

You can monitor the moisture content for enclosed processes before loading the waste into the enclosed composting stage. You can adjust it when the waste exits the enclosed composting stage, or when you move it from stage 1 to 2 to meet the requirements of the animal by-products regulations.

48. For the following parameters you must maintain your aerobic treatment process within the ranges below. If you operate outside these ranges you must justify the reasons for this and demonstrate there is no adverse impact on the treatment process or the environment as a result:
- pH 5.5 – 8.0
  - particle size 10mm to 50mm
  - temperature 55°C to 70°C (reducing after sanitisation and during stabilisation and maturation)
  - moisture 60% - 65% (start of the process), 30% - 65% (during the process)
  - C to N ratio 20:1 - 40:1
49. You must keep a record of your moisture assessments, watering date and the origin of water used, for example composting liquor or roof water.
50. You must make sure that moisture and temperature are monitored during both treatment and storage and that you adjust the moisture in dry periods to prevent dusty conditions. You must keep records of monitoring data.
51. As a minimum you must monitor the temperature of composting waste daily during sanitisation and stabilisation. This can reduce to weekly during maturation. You must install continuous monitoring where it is required in your permit or under the ABPR.
52. You must control moisture by means of visual control and using one of the following methods:
- a squeeze or fist test (when carried out by an experienced operator)
  - a moisture monitoring device with read-out or connectivity to a data capture system
  - an accurate oven-drying method
53. You must locate your monitoring points so as to provide you with representative data. If you insert monitoring probes into windrows and static piles you must work out the length of the probe needed to obtain representative data based on the size of the waste pile. You must obtain data from within the core of the pile. For example, a 4m stack will need a probe over 2m in length to make sure you take a representative sample of the core temperature.
54. If you use portable aeration and monitoring pipework you must clean it after each treatment batch.
- You must assess all the monitoring data you collect to continually make sure you:
- have an effective and stabilising process
  - can make safe and informed processing adjustments where needed
  - can minimise operational difficulties
  - prevent creating anaerobic conditions
55. You must minimise oxygen deficiency and avoid anaerobic conditions occurring during the composting process.

This includes making sure you take measures against water surplus. For example, to:

- reduce water input by adding input materials with high C to N ratio
- increase water-release by, for example balancing the mix of materials and maximising porosity

This also includes taking measures to improve structure, for example, by adding bulking materials and effectively blending wastes. You must make sure waste piles are appropriately structured.

56. You must clearly segregate composting batches undergoing sanitisation and stabilisation or maturation. You must clearly label batches to allow traceability from the receipt of the waste to its dispatch from site.

57. You must not combine multiple stabilising or maturing waste piles or windrows into single larger piles that could result in:

- you being unable to carry out representative monitoring and safe handling
- increased fugitive emissions, odour or over-heating
- the development of anaerobic conditions

Block composting or deep clamp systems are not considered compliant with appropriate measures because they do not allow adequate and reactive monitoring.

58. You must make sure that you avoid composting liquors pooling at the base of waste piles. You can do this by:

- installing sloping ground infrastructure and appropriate drainage
- regular cleaning
- taking measures to minimise over-watering

### **Open-air composting**

59. To minimise fugitive emissions to air of dust, odour and bioaerosols from open-air composting processes, you must make sure that:

- material is actively managed to prevent anaerobic conditions developing and
- you prevent overheating

60. You must work out the appropriate dimensions of your windrows taking account of:

- waste type
- heat generation and loss
- space availability
- effective retention time
- aeration requirements
- monitoring capability
- seasonal variation

61. You must provide enough space between composting windrows so that there is sufficient passive aeration and plant and equipment can get access without compacting the waste or causing cross-contamination.

62. You must adapt operations to meteorological conditions. For example by:

- avoiding turning waste, screening or shredding during adverse weather conditions

- orientating windrows so that the smallest possible area of composting mass is exposed to the prevailing wind
- locating windrows and piles at the lowest elevation within the overall site layout

63. You must also use one or a combination of the following techniques:

- cover actively composting windrows using semi-permeable membranes (particularly if there is an increased risk to receptors) - using alternative targeted containment may be acceptable
- use purpose-made windrow turners
- use dust and bioaerosol suppressants during turning, shredding and screening, for example back actor water sprayers or aprons on plant
- dampen roadways and working areas
- install static aeration with an aeration system that is the correct size to deliver enough air to the waste to prevent anaerobic conditions developing

### **Static-pile aeration**

64. To minimise fugitive emissions to air of dust, odour and bioaerosols from static (forced) aerated waste you must install an aeration system that is the right size to deliver enough air to the waste to prevent anaerobic conditions developing and to maintain microbial efficacy. You must design your aeration system to cope with differences in feedstock and the demands of the treatment process.

65. You must collect and direct exhaust air from all negatively aerated piles and in-vessel (enclosed) aeration systems to an appropriately designed and engineered air abatement system. This must be designed to treat the maximum air flow and the full range of chemical contaminants and bioaerosols it may contain. (Negative aeration means drawing air down through the waste into the floor).

66. Batch operated treatment vessels must have localised air extraction systems. In an in-vessel batch system, you must, where possible, incorporate air extraction above the loading and unloading door(s) of the vessels. This is so you can collect any residual emissions released when the doors are opened following treatment and direct them to appropriate abatement.

67. You must regularly inspect and maintain your aeration and exhaust system to make sure it remains fit for purpose, this means it is:

- free from debris and
- functioning correctly at all times in accordance with designed performance specifications

You must re-mix statically aerated composting waste if preferential pathways develop. You must have procedures in place to minimise emissions during this activity. Re-mixing static piles must not be routine operation.

### **Drainage**

68. You must inspect on a weekly basis all drainage channels, aeration channels and collection sumps to identify blockages caused by debris and condensate. You must remove debris and clean the channels and sumps to prevent odour, pest infestations and maximise drainage and air-flow through aeration channels.

69. To minimise the risk of cross contamination, you must keep the run-off of composting liquors separate from sanitising and stabilising waste if you want to re-use liquor on stabilising waste. You must not use liquor drained from waste in sanitisation and reception areas on stabilising or maturing waste.
70. You must provide enough space for surface water and composting liquors to drain away and prevent cross-contamination.
71. You must appropriately characterise composting liquors sent for off-site recovery or disposal in accordance with [WM3](#). The use of '99' codes is discouraged. The Environment Agency advises this waste is either 16 10 01\* or 16 10 02.

## Outputs

72. Material stored after composting and screening must not cause pollution and you must demonstrate it is stable.
73. You must use the correct EWC code and description for the waste outputs you produce. You must only describe your waste compost as 'off-specification' using EWC 19 05 03 if it has completed the composting cycle and 1 or more of the following criteria apply, it:
- does not meet a market specification such as Publicly Available Standard (PAS) 100 standards
  - is composed from waste other than those listed in the Compost Quality Protocol
  - is composed from waste other than those considered typically suitable for biological treatment, for example from the listed waste types within relevant standard rules permits
  - has failed a PAS 100 test parameter
  - is not certified compliant with the PAS 100 scheme

Waste that has only undergone sanitisation (and not stabilisation) is not considered 'off-specification' compost.

74. You must correctly characterise and describe partially treated (sanitised) waste that is to be transferred off-site to complete the composting process elsewhere. The Environment Agency advises this waste is either 19 05 01 or 19 05 02. It does not recognise the use of EWC 19 05 03 for the classification of only partially treated composting waste.

## Mechanical and biological treatment (MBT)

75. If you operate an MBT or MHT facility, to minimise emissions to air you must use both of the techniques below.
1. You must segregate waste gas streams by splitting the total waste gas stream into waste gas streams with a high pollutant content and waste gas streams with a low pollutant content, as identified in your gas stream inventory, and
  2. You must recirculate waste gas with a low pollutant content in the biological process and follow this by a waste gas treatment adapted to the concentration of pollutants. Using waste gas in the biological process may be limited by the waste gas temperature or the pollutant content. You may need to condense the water vapour contained in the waste gas before reuse. In this case, cooling is necessary, and the condensed water is recirculated when possible or treated before discharge.

## Anaerobic treatment

76. The anaerobic treatment of waste may include a combination of activities:

- Mechanical or physical pre-treatment for example de-packaging, size reduction, blending
- chemical, thermal and biological pre-treatment, for example the addition of acids or alkalis, hydrolysis, nutrient addition
- pasteurisation, for example to meet animal by-products regulations
- continuous flow and batch treatment (single and multi-stage systems of varying retention and temperature)
- wet, dry and liquid feedstock digestion
- digestate treatment for example, screening, pressing, thickening, separation, drying, composting
- digestate storage in lagoons
- biogas treatment for example, drying, burning of biogas in gas engines, use of gas turbines, boilers, gas upgrading for direct biomethane injection to the gas grid, gas compression
- carbon capture
- vehicle fuelling
- use of flares and emergency pressure and vacuum relief systems
- emissions control and abatement for example, biofilters, chemical scrubbing, thermal oxidation

77. You must equip vessels used for batch processing in solid-waste systems, for example dry AD, with the capability to carry out continuous temperature monitoring. You must also install pressure monitoring if there is a risk of pressurisation in the vessel. You must link all monitoring to an alarm system that can be remotely monitored and can provide you with remote alarm notification.

78. In order to reduce emissions to air and to improve the overall environmental performance, you must monitor manually or automatically to:

- make sure digesters are stable
- minimise operational difficulties, such as foaming which may lead to odour emissions
- provide sufficient early warning of system failures which may lead to a loss of containment and explosions

79. In order to demonstrate digester stability you must monitor and control key waste and process parameters, including:

- pH and alkalinity of the digester feed
- digester operating temperature
- hydraulic and organic loading rates of the digester feed
- concentration of volatile fatty acids (VFA) and ammonia within the digester and digestate
- biogas quantity, composition and pressure
- liquid and foam levels in the digester

80. You must continuously monitor digester temperature and gas pressure. You must identify and define all operational parameters and limits within your management system.

81. You must define the optimum operating temperature depending on the ecology deployed and system design. The digester must be held within plus or minus 2 degrees Celsius of your defined operating temperature.

82. You must understand the parameters and make changes in the feedstock and micro-nutrient dosing to:



- maintain the digester to optimum performance
  - be able to demonstrate maximised efficiencies for volatile solids reduction or chemical oxygen demand (COD) reduction in the substrate
83. You must install an alarm mechanism that is interlocked so that reactor feeding automatically stops when a gas pressure alarm condition is evident.
84. You must incorporate the use of Supervisory Control and Data Acquisition Equipment (SCADA) to monitor, record and display data for continuously monitored parameters.
85. You must insulate your digesters in order to achieve and maintain a constant process temperature and to compensate for eventual heat losses and over-heating in extreme weather. (This may not be necessary in all cases, for example where secondary digesters are used post-pasteurisation). You must consider heat recovery options during the plant design stage.
86. You must feed your digesters regularly to avoid depleting the biomass as a result of starvation. Any upstream tank must therefore have sufficient residence time to account for weekends, public holidays and when there is limited feedstock supply.
87. You must not receive waste if there is not enough capacity to store and treat it in accordance with your design criteria.
88. You must minimise the potential for hazardous gases occurring in the immediate proximity of feeding areas. You must prevent the escape of gas from filling systems. You must equip feeding systems installed inside buildings with a hazardous gas warning system. These areas must be considered as part of your HAZOP and DSEAR risk assessment.
89. You must carry out a daily visible inspection of your digesters using inspection ports.

#### **Biogas treatment and storage**

90. You must minimise emissions of unburnt biogas. Release to the environment is only allowed in an emergency to protect the integrity of your plant or the health and safety of staff.
91. You must identify the intended end use of the biogas in order to determine the appropriate treatment method. You must consider the following factors:
- dewatering
  - removing hydrogen sulphide due to corrosive nature which may damage gas engines
  - removing oxygen and nitrogen (where present)
  - removing ammonia
  - removing siloxanes (if treating sewage sludge)
  - removing particulates
  - removing carbon dioxide (for upgrading to biomethane)
  - adding propane to improve calorific value for biomethane grid injection
92. You must assess hydrogen sulphide levels in the biogas to determine the efficiency of the removal methods applied. This can be done by monitoring both before and after gas cleaning equipment.
93. You must continuously monitor biogas flow, quality and composition. Monitoring systems must be interlocked where possible and provided with remote alarm capability.
94. You must remove water (condensate) from the biogas in order to protect the collection system, energy recovery plant and auxiliary flare. Condensate must be discharged into a

contained drainage system or recirculated back into a digester. Condensate storage must not give rise to odorous emissions.

95. You must collect biogas from all digesters and all other treatment and storage vessels where methane is actively generated at your facility.
96. Your biogas storage facilities must be gas tight, pressure-resistant and resistant to ultraviolet (UV) light, fluctuations in temperature and must be weather-proof.
97. You must not allow biogas and air to mix because explosions may result. You must build explosion protection into your facility, and provide an emergency flare.
98. If you use oxygen for the desulphurisation of biogas you must automatically monitor oxygen levels and provide high-level alarms that are set to automatically stop air addition before the lower explosive limit is reached.
99. You must inspect, maintain and routinely test all gas storage and treatment plant and equipment in accordance with manufacturers' recommendations.
100. If you use carbon filters, for example for gas cleaning prior to combustion, you must implement procedures to minimise the risk of [exothermic reactions](#) occurring during their maintenance, for example, by purging with nitrogen.

### **Using biogas**

101. You must manage gas production volumes within the processing constraints of the facility. You must appropriately manage any excess gas produced, and when there is limited gas to grid availability during low demand periods. You must make sure there is adequate gas storage capacity and combustion contingency available at all times. You must implement measures such as decreasing loading rate and diverting feedstocks if these are compromised.
102. When determining gas storage capacity, you must consider how changes in climatic conditions, such as high temperatures in the summer, affect the volume of gas to be stored.
103. You must protect your biogas upgrading and energy recovery plant with flame arrestors and slam shut valves.
104. You must install a permanent back-up generator to power critical plant and equipment in the event of power failure including for example, lighting, maintaining the integrity of gas storage systems and flare use. Or you can obtain a back-up generator if you can do this quickly and only where a delay will not impact on the environment, cause further plant failure or increase health and safety risks.
105. You must make sure there is no persistent emission of dark smoke as defined in section 3(1) of the Clean Air Act 1993.
106. You must make sure gas combustion stacks are vertical and unimpeded by cowls or caps. Stacks for the release of point source emissions must have an 'effective stack height' unless otherwise prescribed in your permit, for example if you operate under standard rules. [Guidance on monitoring of stack emissions](#) (formerly M2) is available.
107. You must notify the Environment Agency in writing, as soon as practicable, of any change of new combustion plant at the site.
108. You must monitor your gas utilisation plant following your permit requirements.

109. You must inspect and maintain all gas utilisation plant and equipment, as a minimum in accordance with manufacturers' recommendations. You must record all routine and non-routine inspection and maintenance.
110. You can follow the [Quality Protocol for Waste-Derived Methane](#) to achieve non-waste status for the use of biogas in specified markets. This sets out the current gas quality requirements for injection into the gas grid.
111. You must implement a leak detection programme that identifies and controls methane slippage through gas combustion units and biogas upgrading plants.
112. You must implement procedures for the safe handling of propane and odorants, for example mercaptans.

### **Pressure and vacuum control (PVRV)**

113. You must make sure your pressure relief valves and gas pipe-work are designed by appropriately qualified engineers and can cope with the anticipated maximum gas production volumes.
114. You must design and monitor gas production rates and organic loading so that excess pressure does not occur in tanks and vessels.
115. Biogas storage vessels must be provided with correctly designed and tested over and under pressure relief valves. Isolating valves must be incorporated to enable inspection and maintenance. The design and installation of PVRVs must be in accordance with recognised standards where possible, for example BS EN [ISO 28300:2008](#).

Under the highest gas-flow scenario, back-pressure on tanks containing biogas must be less than the maximum allowable operating pressure (and more than the minimum operating vacuum). When determining pressure set points you must consider:

- pipework dimensions
  - impact on gas production from changes in process conditions, for example temperature
  - impact on gas volume from sudden changes in atmospheric conditions
  - safety requirements. The system should allow for an acceptable margin of safety between the operating and design pressure of the tank.
116. Valves must be correctly installed to withstand variance in pressure and so that they do not routinely start to vent when gas production fluctuates below the safety set point. In some cases designing the system for higher pressures may be required to avoid uncontrolled emissions. You must correctly calculate and review the safety set point when there are changes to the operating process. You must then carry out any required adjustments.
  117. Each PVRV must be correctly fitted by a competent person and have a certificate of performance. You must document the tests that have been carried out to validate that the PVRVs meet their performance criteria. Revalidation must be carried out if damage to the PVRVs is possible or evident, for example if:
    - routine maintenance identifies corrosion or signs of corrosion
    - residues build-up
    - a foaming incident has occurred

118. You must fit pressure sensors to your digestion tanks and gas storage vessels. You must maintain safe operating pressure by managing gas production and directing biogas to gas storage, treatment, utilisation plant or flare.
119. You must specify a maximum pressure for each digester above which there is no further feed to the digesters. In a situation of excess gas pressure build-up in these tanks, due to pipe damage or blockage for example, an alarm signal must be triggered with immediate venting systems instigated.
120. All PVRVs must be correctly maintained in accordance with manufacturers' recommendations and inspected daily (visual or remote monitoring) to make sure there are no defects and they are correctly seated and re-seated after release. Safe systems of work must be in place for their inspection and maintenance. Ideally, you should locate pressure relief and vacuum devices independently from gas off-take lines and install stand-by valves to allow for down-time during maintenance.
121. You must inspect and protect PVRVs against environmental and climatic conditions, for example by providing frost protection and barriers to deter wildlife.
122. Data logging on SCADA must be in place to record release events. Date, time and duration of release must be recorded. (The installation of a temperature sensor within the release pipe can be used to identify releases).
123. You must detect leaks from your PVRVs under normal operating conditions in accordance with methods and intervals prescribed in a [Leak Detection and Repair Plan](#).
124. You must restrict using pressure relief valves so they activate in emergency situations only.

### **Gas Flaring**

125. You must install a gas flare and it must be available for use at all times. You must optimise your flare to make sure the combustion of gases is efficient.
126. You must install gas flares of an enclosed (ground) design which are capable of achieving a minimum of 1,000°C with 0.3 seconds retention time at this temperature. Using an open flare is not considered best practice. Where open flares are in operation on existing plants they must be replaced with an enclosed flare as soon as possible and no later than at the end of their operational life.
127. As your flare is exposed to all weather conditions, you must make sure that the finish on the exterior of the flare is weatherproof as well as heat-resistant. The structure of the flare must be designed to withstand wind stresses. You must protect ancillary items such as control and instrumentation equipment, including cabling. Providing housing makes maintenance tasks easier, but you must consider any explosion hazards.
128. Flares can be a source of noise from vents, the combustion process and smoke suppressant injection. You must design new flares to minimise noise emissions. Noise avoidance may for example include the following measures:
  - reducing or attenuating the high-frequency steam jet noise by using multi-port steam injectors. (Designing the orifice to cope with potential coke formation is essential)
  - installing the injectors in a way that allows the jet stream to interact and reduce the mixing noise
  - increasing the efficiency of the suppressant with better and more responsive forms of control

- restricting the steam pressure to <0.7MPa gauge
- using a silencer around the steam injector as an acoustic shield for the injectors
- using enclosed ground flares

129. You must minimise the operation of the flare and use it only for emergencies and during maintenance to protect the integrity of the plant (for example, start-ups or shutdowns). You must not use flares routinely.

You must specify measures in your procedures to minimise flare use during routine maintenance. This includes, for example:

- reducing feeding rates to reduce gas production
- increasing the safe storage of gas where capacity is available and
- installing stand-by gas utilisation plant

130. You must monitor and record the use of your flare. Your records must include the date, duration and number of flaring events. You must continuously monitor gas flow to the flare. You must be able to quantify emissions if required and identify the potential prevention of future flaring events. Your permit may require you to measure other parameters, for example:

- composition of gas flow
- gas temperature
- heat content
- ratio of assistance
- velocity
- purge gas flow rate

Your permit may also require you to measure pollutant emissions, for example:

- oxides of nitrogen (NO<sub>x</sub>),
- carbon monoxide (CO),
- VOCs

Monitoring and interlocking must be linked to your SCADA system.

131. Flares must be automatically activated when the quantity of biogas exceeds a set maximum limit and before venting of biogas occurs. Further information about flare design and use is in the Environment Agency's [Guidance on landfill gas flaring](#).

### **Medium combustion plant (MCP) and specified generators**

132. If you operate [medium combustion plant](#) or [specified generators](#) you must monitor your emissions in accordance with the Environment Agency guidance on [monitoring of stack gas emissions from medium combustion plants and specified generators \(M5\)](#) and maintain a record of the type and quantity of fuel used in the plant.

133. If you have a generator that utilises natural gas, for example in a boiler, you must comply with the Specified Generator regulations.

134. You must keep periods of start-up and shut-down for medium combustion plant and specified generators to a minimum. You must notify the Environment Agency of newly installed combustion units prior to start-up.

135. You must notify the Environment Agency at least 14 days in advance of any planned changes to the medium combustion plant or generator which could affect compliance with applicable emission limits, including any significant upgrades.

### **The Control of Major Accident Hazard Regulations 2015 (COMAH)**

136. You must determine if the COMAH regulations 2015 apply to your activities. This will depend on the quantity of dangerous substances you store on site. Raw biogas is classified as a category 1 flammable gas (extremely flammable), which has a lower tier COMAH limit of 10 tonnes. If your site stores less than 10 tonnes, you must apply the aggregation rule. Biogas is aggregated with other flammable gases or liquids, such as Liquid Petroleum Gas (LPG) (Propane or butane), or diesel. These have individual lower tier COMAH limits of 50 tonnes and 2500 tonnes respectively. If the aggregation is greater than 1 then COMAH applies. Here are 2 examples.

#### **Example 1: injecting gas to grid**

AD sites which inject biogas to the national gas grid would need to consider the quantity of both:

- biogas in the headspaces and storage facilities on site
- liquefied flammable gases stored

Example:

8 tonnes of raw biogas (lower tier limit is 10)

25 tonnes of LPG (lower tier limit of 50)

Aggregation for COMAH assessment is:

$$8 \div 10 = 0.8$$

$$25 \div 50 = 0.5$$

$0.8 + 0.5 = 1.3$  therefore above 1 and COMAH regulations applies

#### **Example 2: biogas burnt onsite to generate electricity**

AD sites which use gas to generate electricity, with a store of diesel for back up would need to consider the quantity of both:

- biogas in the headspaces and storage facilities on site
- diesel stored.

Example:

9.4 tonnes raw biogas (lower tier limit is 10)

600 tonnes diesel (lower tier limit of 2500)

Aggregation for COMAH assessment:

$$9.4 \div 10 = 0.94$$

$$600 \div 2500 = 0.24$$

$0.24 + 0.94 = 1.18$  therefore above 1 and COMAH regulations applies

Operators should contact the HSE for more information on [COMAH](#).

### **Digestate storage and treatment**

137. You must take all appropriate measures to minimise fugitive emissions from all digestate storage and treatment processes.

138. The design requirements for digestate storage lagoons and tanks are in the section [Waste storage, segregation and handling](#). You must design digestate storage to minimise the release of liquid and gaseous emissions at all times.
139. You must include all tanks and lagoons used for the on-site storage of digestate, whether waste or non-waste, within your permitted boundary and follow the guidance in this document.
140. You must make sure you operate your anaerobic digestion process in order to manage the biodegradation of your feedstocks into a stable digestate. The stability of digestate will depend on the type of feedstock, the pre-treatment and digestion process and how you manage your organic load and residence time.
141. You must test your digestate to confirm that the process is achieving the required level of treatment and it is suitable for its intended end use.

You must take measures to remove contaminants before digestion, for example plastic. If you use post-digestion treatment methods, for example strain presses, you must make sure they are maintained. You must be able to demonstrate how effective they are at removing contaminants. You must not solely rely on post-treatment technology to remove known contaminants.

142. You must make sure contingency measures are in place to manage any untreated or unscreened digestate in the event of technology failure. You must consider potential hazards, for example the release of residual biogas emissions and ammonia, and manage these in accordance with appropriate measures.
143. You must consider the design, process flow and intended use of digestate treatment technology during the planning and design stage of your plant. You must match the design of the technology to the properties of the digestate being separated and to the qualities of the separated products required. For example, a screw press may be more suitable for fibrous material.
144. You must carry out the separation of digestate either within an enclosed:
- building served by an appropriate air ventilation and extraction system that directs exhaust air to an abatement system or for recovery
  - system designed to effectively contain emissions

The abatement system must be capable of treating the type of emissions produced. The design and engineering of the containment and abatement must be determined by the emissions risk profile of the waste. This is to make sure it removes or minimises the impact of emissions on receptors.

145. You must effectively minimise fugitive emissions from dewatered digestate fibre and digested sewage sludge cake. You must store it under a suitable cover or in an enclosed building fitted with an air ventilation and extraction system.
146. If you compost digestate fibre, you must compost it following the requirements for the [aerobic treatment of waste](#). You must compost digestate fibre to promote aerobic conditions either in:
- an enclosed building fitted with a suitably designed ventilation, extraction and air abatement system
  - the open - with negative aeration connected to an appropriate air extraction system with abatement or suitable covered system



We will not permit open processes where there are sensitive human receptors within 250m unless you can adequately control the risk of bioaerosols.

147. If you dry the digestate, you must carry this out in a system designed for the throughput to be processed. You must contain, collect, extract and treat all emissions during the drying process.

Burning dried digestate as a fuel, for example, using dried digestate pellets, is considered a waste recovery activity which will require additional authorisation.

148. All extraction and abatement systems must be appropriately engineered, sized and designed to a relevant industry standard to treat the emissions produced. These may include for example, ammonia, residual biogas, odorous chemicals, particulates and bioaerosols.

149. You must consider within your risk assessments any health and safety hazards associated with all your digestate treatment and storage areas. For example biogas release from processing digestate and the potential creation of confined spaces within bunds and buildings.

150. You must separate and process digestate on an impermeable surface with a contained drainage system that meets CIRIA 736.

### **Record keeping for treatment residues**

151. You must record in the computerised waste tracking system:

- that a waste has been treated
- what the treatment residues are and their weight
- what end of waste products have been made and their weight

152. You must keep records of non-waste materials leaving the site, including:

- the type of material
- batch number
- date of export off-site
- tonnage exported off-site

## **9. Emissions Control appropriate measures**

1. You must identify, characterise and control all emissions from your activities that may cause pollution.

2. You must establish and maintain an inventory of your wastewater and waste gas emissions. This must be part of your management system and incorporate the information about the characteristics of the waste emission such as:

- average and maximum values and variability of flow and temperature
- average and maximum concentration and load values of relevant substances and their variability (for example, speciated organic compounds and ammonia)
- flammability, lower and higher explosive limits, reactivity
- the presence of other substances that may affect the waste gas treatment system or plant safety (for example, oxygen, nitrogen, water vapour, dust)

The scope (for example, level of detail) and nature of the inventory will generally be related to both the:



- nature, scale and complexity of the facility
- range of environmental impacts it may have (determined also by the type and amount of wastes processed)

### **Point source emissions to air (channelled emissions – including open-topped biofilters)**

3. You must where possible contain, collect, extract and direct all emissions to air from plant, equipment and processes (for example shredding). You must use a suitably designed and engineered abatement system or gas recovery system for treatment before release.
4. You must make an assessment of the fate and impact of the substances emitted to air, following the Environment Agency's air emissions risk assessment methodology.
5. To reduce point source emissions to air (for example ammonia, dust, organic compounds and odorous compounds) from your biological treatment process, you must use one or a combination of the relevant abatement techniques:
  - biofiltration, biotrickling or bioscrubbing
  - scrubbing (for example wet or chemical)
  - adsorption, for example activated carbon
  - thermal oxidation
  - fabric filter – in the case of mechanical biological treatment to remove dust
6. You must adequately disperse emissions from stacks and vents using appropriate designs, locations and heights. You must use dispersion modelling where possible to demonstrate the emissions do not impact on sensitive receptors.
7. You must install a suitable monitoring point on stacks and vents with appropriate safe access. You must monitor emissions in accordance with [Environment Agency guidance on monitoring stack emissions](#).

### **Emissions abatement**

8. You must choose the type of abatement system you require for your facility, considering the following:
  - waste feedstock and intended purpose
  - chemical composition of the waste gas stream, considering for example variations in composition from individual processes
  - available space on site for locating the equipment, for example biofilters may require a large footprint depending on the volume of gas requiring treatment
  - pre-treatment requirements such as humidifying, gas cooling, pre-scrubbing, particulate removal
  - sizing and residence time for effective odour or chemical reduction
  - activity giving rise to the gas – aerobic or anaerobic
  - ability to monitor visually (where appropriate) and using data monitoring
  - ability to monitor flow, temperature, compaction, back-pressure, moisture, redox potential
  - ability to monitor pollutant removal efficiency
  - infrastructure requirements, drainage and emissions control
  - inspection, maintenance, regeneration of media and contingency planning

You may need to use a combination of abatement steps to make sure that emissions are treated effectively.

9. In order to make sure the abatement system is effective in treating odorous and chemical emissions you must monitor and maintain your abatement to achieve continual optimum conditions. To demonstrate effective control, monitoring and assessment may include the following parameters (depending upon the abatement system used):

- gas flow or loading rate
- bacterial viability (applicable to bio-oxidisation treatment systems)
- pH
- acid growth (indicated by pH)
- gas temperature
- pollutant removal efficiency rate
- chemical injection (redox potential - applicable for chemical scrubbing and bio-oxidisation systems)
- spent solutions (for waste recovery or disposal)
- humidity or moisture content
- back-pressure
- thatching and compaction of media (thatching is the formation of a natural barrier to the ingress of additional water to the surface layer)
- channelling (preferential pathways for gas flow) and vegetation growth
- ammonia, hydrogen sulphide and odour concentrations (in both input and exhaust gas streams)
- energy requirements for providing adequate and continuous airflow

In all cases you must trend monitoring results to allow observation of changes over time, which could indicate that additional maintenance is required.

10. You must have procedures in place to make sure that you correctly operate, monitor and maintain abatement equipment and address the following:

- the effect of a loss of abatement due to the introduction of toxic compounds
- a program of filter media replacement informed by performance and condition (for biofilters and carbon filters)
- the replenishment of reagents (for chemical scrubbers)
- commissioning and re-commissioning new filter media or abatement and a contingency for the treatment of gases during down-time

11. You must consider the flow and fate of materials through the biological treatment process when designing containment and abatement systems for controlling emissions. For example, the re-circulation of waste back through the process via a reception building may increase the potential emission loading on the system.

12. You must do a detailed, periodic (at least annually) efficiency assessment of your abatement system.

#### **Biofilters (open and closed fixed bed systems)**

13. You must use a filter medium that is suitable for maintaining bacterial communities that will degrade the identified contaminants and provide an efficient and effective system. In determining an appropriate filter bed material, you must consider water retention capacity, bulk density, porosity, structural integrity, surface area, nutrient viability and particle size.

14. The biofilter must be connected to a suitable ventilation and air circulation system to make sure a uniform air distribution through the bed and a sufficient residence time of the waste gas inside the bed.
15. Pre-treatment of the waste gas before the biofilter (for example, with a water or acid or alkaline scrubber) may be necessary. You must make sure gas is pre-treated where required to minimise the risk of carry-over of pollutant gases.
16. You must consider designing biofilters on a modular basis so that some parts of the abatement system can be kept in operation during staged refurbishment. The installation of your biofilter must be designed so that any liquid which accumulates in the base can be drained to an appropriate leachate collection or treatment system.
17. All ductwork conveying the inlet air to the biofilter must be made from corrosion resistant materials and must incorporate low points to prevent the build-up of condensed liquid within the ducts, as this can lead to corrosion and a drop in the systems overall efficiency.
18. You must monitor your biofilter to make sure it is effective in controlling odorous air emissions. As a minimum you must monitor the following parameters:
  - gas inlet temperature (inlet and outlet on closed systems)
  - gas inlet flow rate (inlet and outlet on closed systems)
  - filter media moisture
  - thatching and compaction using back-pressure measurement
  - pH (this should be monitored from the biofilter drainage effluent)

Advisable additional monitoring includes:

- gas inlet humidity
- gas inlet and outlet concentrations for ammonia, hydrogen sulphide and odour
- bacterial viability

You must visually monitor your biofilter where it is possible and safe to do so. This includes assessing the:

- absence of vegetation, moss and fungus – the media must be in good condition and clear of vegetation. You can use a photographic record of the media bed to determine how the bed changes over time
  - media depth to identify decomposition and compaction over time – you can do this using vertical rulers located in the biofilter bed
  - surface condition – to identify any channelling, gaps or signs of shrinkage of the biofilter bed
  - irrigation – to identify wet and dry spots and the uniformity of sprinkler systems where installed
19. You must assess the efficiency of your biofilter to make sure the microbial culture is vigorous and healthy and the system operating parameters are being maintained at optimum designed values. This includes a review of:
    - media health (for example bacterial viability, particle size distribution and depth)
    - volumetric air-flow or surface air-flow distribution (in open biofilters)
    - emission removal efficiency, for example odour removal

Removal efficiency is typically calculated using the concentrations sampled from the biofilter inlet and outlet. You must carry out sampling in accordance with recognised standards, for example BS EN 13725 for determining odour concentration.

20. Further information on biofilters and assessing their effectiveness is available in the reports titled [Biofilter Performance and Operation as Related to Commercial Composting](#) and [Understanding Biofilter Performance and Determining Emission Concentrations Under Operational Conditions](#).

[Understanding Biofilter Performance and Determining Emission Concentrations under Operational Conditions](#) outlines some of the key parameters that you could use for the routine monitoring and control of biofilters. You can directly measure a number of the parameters. Some parameters will require more complex testing periodically using accredited methodology.

21. Biofilter media must be re-mixed or replaced when required. This could either be following your planned routine maintenance schedule or more frequently if your monitoring assessment identifies it is needed.

### **Wet and chemical scrubbers**

22. You must select the most appropriate aqueous absorbing solutions for treating the pollutants in the air stream. Where a mix of pollutant gases are identified you may require a multi-stage process using a combination of solutions or technologies.
23. You must make sure flow rates allow for sufficient residence time and to prevent excess carry-over of scrubbing solution into the air stream.
24. You must monitor your abatement scrubber to make sure it is effective in controlling odorous air emissions. As a minimum you must monitor the following parameters:
- gas temperature and flow rate (inlet and outlet)
  - moisture content or humidity (inlet and outlet for dry scrubbers only or outlet if used before other abatement systems)
  - back-pressure (for packing scrubbers only)
  - pH of scrubber solution
  - chemical injection rate (redox potential) where possible to do so

Advisable additional monitoring includes gas inlet and outlet concentrations for ammonia, hydrogen sulphide and odour.

25. You must continuously monitor the flow rate, temperature and pH of the scrubber solution before and after abatement.
26. You must manage spent or recovered solutions, for example ammonium sulphate, as waste.

### **Activated carbon**

27. You must monitor your activated carbon filter to make sure it is effective in controlling odorous air emissions. As a minimum you must monitor the following parameters:
- inlet and outlet gas temperature and flow rate
  - inlet moisture content or humidity
  - back-pressure
  - carbon bed temperature where possible to do so

Advisable additional monitoring includes gas inlet and outlet concentrations for ammonia, hydrogen sulphide and odour.

28. You must continuously monitor the flow rate and temperature at the inlet and outlet.
29. You must make sure that carbon is either replaced or regenerated prior to saturation to prevent reduced performance.
30. You must make sure the concentrations of volatile organic compounds within the gas stream are below their lower explosive limit (LEL) to avoid explosion and combustion.
31. You must not exceed the activated carbon manufacturers' recommended maximum operating temperature unless a cooling system is installed and effective.
32. You must make sure impurities such as particulates are removed before gases pass through the carbon filter.
33. You must not allow exothermic reactions to occur during the maintenance of activated carbon filters.
34. You must store activated carbon safely to prevent spontaneous combustion. You must store it following supplier or manufacturers' recommendations.

#### **Masking agents, neutralising agents and topical barriers**

35. You must not substitute effective process monitoring and management to prevent emissions by using masking agents (for example deodorisers) or topical barriers.
36. You must only use chemical treatments (for example neutralising agents) to destroy or to reduce the formation of odorous compounds as part of a more comprehensive emissions treatment plan and in an environment where their benefit is clearly understood and demonstrable and it is safe to use. Using chemical treatments must not affect the quality of the compost or digestate.
37. You must review your water-efficiency measures when considering the use of neutralising agents and topical barriers.
38. You must only use topical barriers, for example the localised application of water during composting, where the following conditions can be achieved:
  - there is sufficient water available to dissolve the chemicals
  - the solubility of the chemicals is optimised for the odours present
  - there is an active biological community established to help break down the chemicals once they are dissolved

#### **Fugitive (Diffuse) emissions to air**

39. You must use appropriate measures to prevent emissions of odour, ammonia, [dust and particulates, mud and litter](#).
40. Where a [dust management plan](#) is required, you must develop and implement it following our guidance.
41. You must design, operate and maintain plant in a way that prevents and minimises fugitive emissions to air, for example by limiting drop height, using wind barriers, favouring gravity transfer rather than pumps or misting devices. This includes associated equipment such as:
  - screeners

- shredders
- conveyors
- skips or containers
- building fabric, including doors and windows
- pipework and ducting

42. To reduce fugitive emissions you must use high integrity components (for example seals or gaskets). You must minimise releases where possible. You must where possible contain, collect, extract and direct emissions from plant, equipment and processes to a suitably designed and engineered abatement system or gas recovery system.
43. You must use your waste pre-acceptance, waste acceptance and site inspection checks and procedures to identify and manage wastes that could cause, or are causing, fugitive emissions to air (for example of odour or dust). When you identify any such wastes you must:
- take appropriate risk assessed, measures to prevent and control emissions
  - prioritise their treatment or transfer
44. If you need to prevent fugitive emissions to air from the storage and handling of such waste, you must use a combination of the following measures:
- keep enclosed buildings or equipment under adequate negative pressure with an appropriate ventilation and abated air circulation or extraction system, where possible, locating air extraction points close to potential emissions sources
  - use fast-acting or 'airlock' doors that default closed
  - store and handle the waste within an enclosed building
  - use fully enclosed material transfer and storage systems and equipment (for example conveyors, hoppers, containers, tanks and skips)
  - keep building doors and windows shut to provide containment (except when you need access for loading or unloading, or if doing so could create unsafe environments, or if you need to open them as part of a designed air ventilation strategy)
  - use suitable covers which can include textile sheeting, synthetic membranes and organic materials such as straw and wood-chip. The choice of cover depends on the risk to receptors.
45. You must design and engineer containment infrastructure (for example a building or covered system) to make sure it is capable of containing emissions. This must include identifying opportunities to install localised containment to minimise area source releases.
46. You must design building containment following relevant ventilation standards such as BS EN 13779:2007 or guidance in the [HSE Exhaust Ventilation Guide](#). You must use suitably qualified engineers to design and install complex systems and make sure relevant standards are applied. The HSE provides [guidance](#) on selecting, using and maintaining local exhaust ventilation (LEV) correctly.
47. You must review the effectiveness of building containment following its installation and periodically thereafter, in particular where changes to plant, process or feedstock occur. You must carry out assessments to recognised standards, for example BS EN ISO 9972:2015. A smoke test can be a simple technique to identify emission leaks from buildings. This may indicate where improvements are needed before you carry out a more thorough survey.
48. You must periodically review the effectiveness of all covers and contained air systems to make sure they are beneficial in minimising or preventing fugitive emissions to air.

49. You must regularly inspect and clean all waste storage and treatment areas and equipment (including conveyor belts). You must identify the frequency of inspection and cleaning in your management system.
50. Your maintenance and cleaning schedules must make sure that tanks and plant are regularly cleaned where possible, to avoid large scale decontamination activities.
51. You must take measures to prevent the corrosion of plant and equipment (for example, conveyors or pipes). This includes selecting and using appropriate construction materials, lining or coating equipment with corrosion inhibitors and regularly inspecting and maintaining plant.
52. You must have a programme of work that covers the maintenance of all plant and equipment. This must also include protective equipment such as curtains and fast-action doors used to prevent and contain fugitive releases. You must identify the frequency of maintenance in your management system and follow manufacturers' recommendations as a minimum.
53. If you carry out container washing activities, you must design and operate the washing process and associated equipment in a way that prevents fugitive emissions to air (for example, carrying out this activity in a contained or enclosed system).
54. You must use contained or fully enclosed material transfer and storage systems and equipment (conveyors, hoppers and skips) where possible.
55. You must consider dampening potential sources of fugitive dust emissions with water or fog, for example during turning of open windrows and on areas of moving traffic.
56. You must proactively reduce the risk of litter emissions from your facility. You must reject feedstocks that are heavily contaminated and could give rise to wind-blown litter. Where loads have a minor level of contamination you must take appropriate measures to remove the contaminants before processing in order to reduce the risk.
57. You must stop outdoor processing activities, for example shredding and turning when weather conditions may either:
  - increase the risk of impact on local receptors
  - give rise to wind-blown litter, dust, odour or bioaerosols
58. You must have robust housekeeping measures in place to reduce airborne emissions and install litter screens where necessary.

**Leak detection and repair (LDAR) - (generally applicable to AD, MBT and TAD)**

59. To mitigate fugitive emissions to air such as methane from treatment plant and associated infrastructure (for example, pipework, conveyors, lagoons or tanks), you must set up a leak detection and repair plan. You must use it to promptly identify and carry out repairs or replacement of plant and equipment. A risk-based approach can be applied depending on the:
  - biological treatment activity
  - design of the plant
  - amount and nature of the organic compounds concerned

You must have a LDAR plan that includes:

- a map of the site processes that identifies all known locations (point and area sources) for potential emissions, for example seals, flanges, valves, pumps, connections, pipework, tanks, open post-composting windrows, building fabric and lagoons
- methods for locating unknown emission sources
- estimates of the type and volume of the potential emission at each leak location
- prioritised locations (from highest risk to lowest risk) based on potential quantity of release and environmental impact
- a risk-based LDAR programme of work for monitoring and controlling emissions
- identification of monitoring methods and frequency of monitoring to quantify significant emissions where possible
- possible mitigation measures

60. You must identify and reduce emissions of volatile organic compounds and other substances to air. If you monitor emissions, you must do this using recognised industry standards and techniques. The methodology must be appropriate to the characteristics of the emission source. Methods for identifying leaks include, for example:

- sniffing using organic compound analysers and bag sampling (carried out to EN15446 standards)
- optical gas imaging (OGI) using hand-held cameras to enable visualisation of gas leaks

To screen and quantify emissions you can use the following methods:

- solar occultation flux (SOF)
- differential absorption light detection and ranging (LIDAR)

61. You must consider all potential sources of leakage within your LDAR Plan, for example:

- double membrane roofs (air blower vent)
- roof and cover fixings
- pressure relief valves and vents
- feeding and digestate separation units
- gas pipes
- conveyors and presses
- compressor
- combined heat and power plant (methane slippage)
- gas upgrading plant
- reception storage
- digestate storage
- pits and sumps, for example condensate pits
- building containment

Further information on LDAR is available from the [United States Environmental Protection Agency \(EPA\)](#). Information on methane leakage from anaerobic digestion plants is available from the [Department of Business Energy and Industrial Strategy \(BEIS\)](#) and the [International Energy Agency](#).

### **Emissions of odour**

62. You must develop and implement an [odour management plan](#) following our guidance.



63. You must use pre-acceptance screening and waste acceptance checks to identify and manage the receipt of odorous wastes. If you receive waste that is odorous or at risk of becoming odorous, you must prioritise their treatment or transfer.
64. You must put in place and use procedures to minimise the amount of time odorous wastes spend in your storage and handling systems (for example, pipes, conveyors, hoppers, tanks). In particular, you must have provisions in place to manage waste during periods of peak volume.
65. You must have measures in place to prevent, contain, collect and treat odorous emissions where possible. This includes for example:
- using contained buildings with appropriate air ventilation, extraction and abatement
  - using plant or equipment with enclosure capability
  - adapting operations to minimise odour release, for example considering weather conditions and efficient waste flow
  - minimal storage and handling of feedstock
  - regular cleaning of handling and storage areas
66. You must monitor abatement systems to make sure they function to their designed performance specification, for example, ensuring that scrubber liquors are maintained at the correct pH and replenished or replaced at an appropriate frequency.
67. Contaminated wastewaters have the potential for odours and you must store them in covered or enclosed tanks, lagoons or containers. Storing this must not result in the build-up of unsafe environments.
68. Where you expect an odour pollution at sensitive receptors, or it has been substantiated, you must monitor odour emissions using EN standards, for example either:
- dynamic olfactometry according to EN 13725 in order to determine the odour concentration
  - EN 16841-1 or -2 in order to determine the odour exposure
69. If you are using alternative methods for which no EN standards are available (for example, estimating odour impact), you must use ISO, national or other international standards to make sure you use data of an equivalent scientific quality. You must set out the monitoring frequency in the odour management plan.
70. Where you expect an odour pollution at sensitive receptors, or it has been substantiated, you must set up, implement and regularly review an odour management plan as part of your environmental management system. It must include all of the following elements:
- actions and timelines to address any issues identified
  - procedure for conducting odour monitoring (as set out above)
  - procedure for response to identified odour incidents, for example, complaints
  - an odour prevention and reduction programme designed to identify the source(s), to characterise the contributions of the sources and to implement prevention and reduction measures

## **Pests**

71. You must manage waste in a way that prevents an infestation of pests and vermin.

72. You must have specific measures in place to deal with wastes that are identified as causing pests or vermin. Where you are required to follow a [pest and vermin management plan](#) this must be part of your environmental management system and must include procedures for:

- the inspection and control of pests and vermin
- rejecting loads of infested waste
- treating pest and vermin infestations promptly
- the storage, handling and use of approved pest and vermin control products

Information on the use of pest control chemicals at work is available from the [HSE](#)

73. You must consider whether waste heat from your process can be passed through fresh input waste to such a temperature that fly larvae cannot survive. Guidance on [fly management](#) is available.

### **Emissions of noise and vibration**

74. You must design the layout of the facility to make sure that, where possible, you locate potential sources of noise (including building exits and entrances) away from sensitive receptors and boundaries. You must locate buildings, walls, and embankments so they act as noise screens.

75. You must employ basic good practice measures to control noise, for example including:

- adequately maintaining plant or equipment parts which may become more noisy as they deteriorate (for example, bearings, air handling plant, the building fabric, and specific noise attenuation kit associated with plant or machinery)
- closing doors and windows of enclosed areas and buildings
- avoiding noisy activities at night or early in the morning
- minimising drop heights and the movement of waste and containers.
- using white noise reversing alarms and enforcing the on-site speed limit
- using low-noise equipment (for example, drive motors, fans, compressors, pumps)
- adequately training and supervising staff
- where possible, providing additional noise and vibration control equipment for specific noise sources (for example, noise reducers or attenuators, insulation, or sound-proof enclosures)

76. If you expect noise or vibration pollution at sensitive receptors, or if it has been substantiated, you must create, use and regularly review a [noise and vibration management plan](#). This must be part of the environmental management system, and must include:

- actions and timelines to address any issues identified
- a procedure for conducting noise and vibration monitoring
- a procedure for responding to identified noise and vibration events, for example, complaints

77. The noise and vibration management plan must also include a noise and vibration reduction programme designed to:

- identify the source(s) of noise and vibration
- measure or estimate noise and vibration exposure
- characterise the contributions of the sources
- implement prevention and reduction measures

78. Where a noise and vibration management plan is required, you must develop and implement it following our guidance.

### **Point source emissions to land and water (including sewer)**

79. You must identify the main chemical constituents of the site's point source emissions to water and sewer as part of the site's inventory of emissions to land, water and sewer.

80. You must assess the fate and impact of the substances emitted to water and sewer following the Environment Agency's [risk assessment guidance](#).

81. Discharges to water or sewer must comply with the conditions of an environmental permit or trade effluent consent. Relevant sources of waste water include:

- process water or condensate collected from treatment process
- waste compactor runoff
- vehicle washing
- vehicle oil and fuel leaks
- washing of containers, tanks and vessels
- spills and leaks in waste storage areas
- loading and unloading areas

82. In order to reduce emissions to water, if you need to treat wastewater before discharge or disposal, you must use an appropriate combination of these techniques:

- preliminary or primary treatment – for example, equalisation, neutralisation or physical separation
- physico-chemical treatment – for example, adsorption, distillation or rectification, precipitation, chemical oxidation or reduction, evaporation, ion exchange, or stripping
- biological treatment – for example, activated sludge process or membrane bioreactor
- nitrogen removal – for example, nitrification and denitrification
- solids removal – for example, coagulation and flocculation, sedimentation, filtration or flotation

83. You must direct wash waters from cleaning vessels to foul sewer or a contained drainage system for off-site disposal or re-circulation. You may need to pre-treat the waters in order to meet any limits on the effluent discharge consent. The degree of recirculation will be limited by the water balance of your plant, the content of impurities or characteristics of the water streams, for example nutrients. Discharges to surface water or storm drains are not acceptable.

84. Where applicable to your process, in order to reduce the generation of wastewater and to reduce water usage you must use all of the following techniques:

- segregating leachate seeping from compost piles and windrows from surface water
- re-circulating process water streams, for example from de-watering of liquid digestate or using other water streams such as surface water run-off as much as possible
- optimising the moisture content of the waste in order to minimise the generation of leachate

### **Fugitive emissions to land and water**

85. You must use appropriate measures to [control potential fugitive emissions](#) and make sure that they do not cause pollution.

86. You must have the following measures in place in operational areas:

- an impermeable surface
- spill containment kerbs
- sealed construction joints
- connection to a contained drainage system

87. You must have measures in place to prevent overflows and failures from tanks and vessels, including where relevant:

- overflow detectors and alarms
- directing over-flow pipes to contained drainage system
- locating tanks and packaged liquids in suitable secondary containment (bunds)
- providing isolation mechanisms (for example, closing valves) for tanks, vessels and secondary containment

88. You must collect and treat separately each water stream generated at the facility, for example, surface run-off water or process water. Separation must be based on pollutant content and treatment required. In particular you must make sure that you segregate uncontaminated water streams from those that require treatment.

89. You must use suitable drainage infrastructure to collect surface drainage from areas of the facility where you store, handle and treat waste. You must also collect washing water and occasional spillages. Depending on the pollutant content, you must either recirculate what you have collected or send it for further treatment.

90. You must have design and maintenance provisions in place to detect and repair leaks. These must include regularly monitoring, inspecting and repairing equipment and infrastructure and minimising underground equipment.

91. You must take measures to prevent emissions from washing and cleaning activities, including:

- directing liquid effluent and wash-waters to foul sewer or collecting them in a contained system for off-site disposal – you must not discharge them to surface or storm drains
- where possible, using biodegradable and non-corrosive washing and cleaning products
- storing all detergents, emulsifiers and other cleaning agents in suitable bunded or containment facilities, within a locked storage area, or in a building away from any surface water drains
- preparing working strength cleaning or disinfection solutions in contained areas of the site and never in areas that drain to the surface water system

92. You must have measures to prevent pollution from the on-site storage, handling and use of oil and fuel.

93. You must produce and implement a spillage response plan and train staff to follow it and test it.

94. You must have procedures and associated training in place to make sure that you deal with spillages immediately.

95. You must keep spill kits at locations close to areas where spillage could occur and make sure relevant staff know how to use them. You must make sure kits are replenished after use.

96. You must stop spillages from entering drains, channels, gullies, watercourses and unmade ground. You must make available proprietary sorbent materials, sand, booms and/or drain mats for use when required.
97. You must make sure your spillage response plan includes information about how to recover, handle and correctly dispose of all waste produced from a spillage.
98. Container washing equipment must be purpose-built, contained and located in a designated area of the facility provided with self-contained drainage. The container wash must be designed to collect and contain all wash waters, including any spray. It must be operated by trained staff and inspected and maintained regularly.
99. For subsurface structures, you must:
- establish and record the routing of all site drains and subsurface pipework
  - identify all sub-surface sumps and storage vessels
  - engineer systems to minimise leakages from pipes and make sure they can be detected quickly if they do occur, particularly where hazardous substances are involved
  - provide secondary containment and leakage detection for sub-surface pipework, sumps and storage vessels
  - establish an inspection and maintenance programme for all subsurface structures, for example, pressure tests, leak tests, material thickness checks or CCTV
100. For surfacing, you must design appropriate surfacing and containment or drainage facilities for all operational areas, taking into account:
- collection capacities
  - surface thicknesses
  - strength and reinforcement
  - falls
  - materials of construction
  - permeability
  - resistance to chemical attack
  - inspection and maintenance procedures
  - available relevant standards of construction
101. You must have an inspection and maintenance programme to review the integrity of impermeable surfaces and water containment facilities. This must take account of the plant and equipment manufacturers' recommended maintenance practices.

## **10. Emissions monitoring and limits appropriate measures**

We may set emission limits and monitoring requirements in your permit, based upon your emissions inventory and [environmental risk assessment](#). We may set additional limits and monitoring requirements for certain processes, for example dust and total volatile organic compounds (TVOCs).

1. Where you are required to monitor emissions to comply with the requirements of your environmental permit you must follow our [monitoring guidance](#).
2. You must create and maintain an inventory (emissions inventory) of point source emissions to air and water (including emissions to sewer) for your facility.

3. If you treat water-based liquid waste, for example drying of liquid digestate, you must identify the main chemical constituents of the point source emissions to air and water from the process in your emissions inventory.

### **Emissions to air**

4. Your facility's emissions inventory must include information about the relevant characteristics of emissions to air, such as the:
  - average values and variability of flow and temperature
  - average concentration and load values of relevant substances and their variability
  - flammability, lower and higher explosive limits and reactivity
  - presence of other substances that may affect the waste gas treatment system or plant safety (for example, oxygen, nitrogen, water vapour, dust)
5. Except for turned, open-windrow composting processes, sites that treat biodegradable, organic waste must reduce emissions of organic compounds to air using one or a combination of abatement techniques:
  - adsorption
  - biofiltration
  - thermal oxidation
  - wet scrubber
  - fabric filters (in the case of MBT processes)

### **Bioaerosols**

6. You must take measures to minimise the release of bioaerosols from your process.

You must document potential bioaerosol emission sources and identify measures to minimise their release. Measures include, for example:

- processing waste promptly and monitoring it according to defined processing conditions
  - taking corrective measures to address unfavourable conditions
  - using slow-speed shredders in sensitive locations with misting devices fitted where safe to do so, or carrying out these activities in covered areas
  - taking into account meteorological conditions when managing activities
  - avoiding activities such as turning and shredding in unfavourable meteorological conditions
  - stopping activities when the wind is blowing in the direction of sensitive receptors
  - dampening of haul roads and processing areas and stopping activities when the wind is blowing in the direction of sensitive receptors
  - using static aeration, and covering piles where possible and practicable
7. If your facility is within 250 metres of a sensitive receptor, you will be required to:
    - write and implement a site specific bioaerosol risk assessment
    - monitor bioaerosols to make sure that the control methods you have stated are effective

You must implement the control measures identified in your risk assessment. You must also consider the exposure of staff and visitors, and take measures to avoid or reduce prolonged exposure to bioaerosols.

We will not permit open processes where there are sensitive human receptors within 250m unless you can adequately control the risk of bioaerosols.

### **Emissions to water or sewer (discharge consents)**

8. Your facility's emissions inventory must include information about the relevant characteristics of point source emissions to water or sewer, such as:
  - average values and variability of flow, pH, temperature, and conductivity
  - average concentration and load values of relevant substances and their variability - for example, COD and TOC, nitrogen species, phosphorus, metals, priority substances or micro-pollutants
  - data on bio-eliminability - for example, BOD, BOD to COD ratio, Zahn-Wellens test, biological inhibition potential (for example, inhibition of activated sludge)
9. For relevant emissions to water or sewer identified by the emissions inventory, you must monitor key process parameters (for example, waste water flow, pH, temperature, conductivity, or BOD) at key locations. For example, these could either be at the:
  - inlet or outlet (or both) of the pre-treatment
  - inlet to the final treatment
  - point where the emission leaves the facility boundary
10. We may apply emission limits and monitoring requirements in your permit, based on your waste water stream inventory. Sites that treat biodegradable, organic waste must reduce emissions to water using an appropriate combination of techniques, for example:
  - neutralisation
  - adsorption
  - stripping
  - flotation
  - filtration

All BAT AEL's for emissions to water apply at the point where the emission leaves the facility.

### **11. Process efficiency appropriate measures**

1. You must monitor and review the annual consumption of water, energy and raw materials as well as the annual generation of residues and waste water for your facility at least once a year. Residues includes the generation of waste and non-waste classified composts and digestates.

#### **Energy efficiency (installations only)**

2. You must create and implement an energy efficiency plan at your facility. This must:
  - define and calculate the specific energy consumption of the activity (or activities) you carry out and waste stream(s) you treat
  - set annual key performance indicators - for example, specific energy consumption (expressed in kWh/tonne of waste processed)
  - plan periodic improvement targets and related actions
3. You must regularly review and update your energy efficiency plan as part of your facility's EMS.
4. You must have an energy balance record in place. This must provide a breakdown of your energy consumption and generation (including any exportation of energy or heat) by the type of source (electricity, gas, conventional liquid fuels, conventional solid fuels, and waste).
5. The record must include:

- information on energy consumption in terms of delivered energy
  - information on energy exported from the facility
  - energy flow information (for example, Sankey diagrams or energy balances) showing how the energy is used throughout the process
6. You must regularly review and update your energy balance record as part of your facility's EMS, alongside the energy efficiency plan.
7. You must have operating, maintenance and housekeeping measures in place for example:
- air conditioning, process refrigeration and cooling systems (leaks, seals, temperature control, evaporator/condenser maintenance)
  - operation of motors and drives
  - compressed gas systems (leaks, procedures for use)
  - steam distribution systems (leaks, traps, insulation)
  - space heating and hot-water systems
  - lubrication to avoid high-friction losses
  - boiler operation and maintenance, for example, optimising excess air
  - other maintenance relevant to the activities within the facility
8. You must have basic low-cost physical techniques in place to avoid gross energy inefficiencies. These may include for example:
- insulation
  - containment methods (such as seals and self-closing doors)
  - avoiding unnecessary discharge of heated water or air (for example, by fitting simple control systems such as timers and sensors)
9. Additional [energy efficiency measures](#) must be implemented at the facility as appropriate in accordance with our guidance.

### **Raw Materials (Installations only)**

10. You must maintain a list of the raw materials used at your facility and their properties (including auxiliary materials and other substances that could have an environmental impact).
11. You must have procedures for regularly reviewing new developments in raw materials and using any suitable ones with an improved environmental profile. This must include, where possible, substituting raw materials with waste.
12. You must justify the continued use of any substance for which there is a beneficial alternative.
13. You must have quality-assurance procedures in place to control the content of raw materials.

### **Water use (installations only)**

14. You must take measures to make sure you optimise water consumption in order to:
- reduce the volume of waste water generated
  - prevent or, where that is not practicable, to reduce emissions to soil and water
15. Measures you must take include:
- implementing a water saving plan (involving establishing water efficiency objectives, flow diagrams and water mass balances)



- optimising the use of washing water (for example, dry cleaning instead of hosing down, using trigger control on all washing equipment)
- recirculating and reusing water streams within the plant or facility, if necessary after treatment
- where relevant, reducing the use of water for vacuum generation (for example, using liquid ring pumps with high boiling point liquids)

16. You must carry out a review of water use (water efficiency audit) at least every 4 years.

17. You must also:

- produce flow diagrams and water mass balances for your activities
- establish water-efficiency objectives and identify constraints on reducing water use beyond a certain level (usually this will be site specific)
- use water pinch techniques in more complex situations such as chemical plant, to identify the opportunities for maximising re-use and minimising use of water
- have a time-tabled improvement plan for implementing additional water reduction measures

18. To reduce emissions to water, you must apply these general principles in sequence:

- use water-efficient techniques at source where possible
- re-use water within the process, by treating it first if necessary - or if not practicable, use it in another part of the process or facility that has a lower water-quality requirement
- if you cannot use uncontaminated roof and surface water in the process, you must keep it separate from other discharge streams - at least until after you have treated the contaminated streams in an effluent treatment system and have carried out final monitoring

19. You must establish the water-quality requirements associated with each activity and identify whether you can substitute water from recycled sources and where you can, include it in your improvement plan.

20. Where there is scope for re-use (possibly after some form of treatment) you must keep less contaminated water streams, such as cooling waters, separate from more contaminated streams.

21. You must minimise the volume of water you use for cleaning and washing down by:

- vacuuming, scraping or mopping in preference to hosing down
- reusing wash water (or recycled water) where practicable
- using trigger controls on all hoses, hand lances and washing equipment

22. You must directly measure fresh water consumption and record it regularly at every significant usage point - ideally on a daily basis.

### **Waste minimisation, recovery and disposal**

23. You must create and implement a residues management plan that:

- minimises the generation of residues arising from the treatment of waste
- optimises the reuse, regeneration, recycling or energy recovery of residues including packaging
- ensures the proper disposal of residues where recovery is technically or economically impractical

- 24. Where you must dispose of waste, you must carry out a detailed assessment identifying the best environmental options for waste disposal.
- 25. You must review on a regular basis options for recovering and disposing of waste produced at the facility. You must do this as part of the EMS to make sure that you are still using the best environmental options and promoting the recovery of waste where technically and economically viable.

## 12. Inhibition values for aerobic and anaerobic processes

**Table A - general inhibitors for anaerobic processes**

Determinant	Threshold
pH hydrolysis and fermentation acido and aceto genesis	Optimal pH 5-7
methanogenesis	Optimal pH 7-8, Operational 6.5-8.5
Temperature - below optimum. (mesophilic optimum Temperature 37 °C, Thermophilic optimum temperature 55°C)	The rate of activity will drop by approximately 50% for every 10 degrees below the respective optimum temperature (Caine, 1990).
Temperature above optimum (mesophilic optimum Temperature 37 °C)	Where the temperature is raised gradually above the mesophilic optimum, the cultures will adapt and thermophiles will become established. During this period performance will be reduced. Where temperature is raised suddenly by 10°C performance may reduce significantly.
Temperature above optimum (thermophilic optimum temperature 55°C )	Performance of thermophiles will drop if temperature is raised above the optimum values but will survive extreme increase up to 100 °C
Ammonium inhibition	Ammonium build up may inhibit the anaerobic process.

**Table B - general inhibitors for aerobic processes**

Determinant	Threshold
Moisture Content	Optimal range of 50-70%
pH	Optimal range of 6-8
C/N	Optimal range of 25:1-40:1

**Table C – specific inhibitors aerobic treatment**

The following table contains the inhibitive concentrations for a range of substances for aerobic treatment processes. Blanks indicate that there has been no data found within literature. The first column of data for aerobic treatment is based on the inhibition of respirometric activity, the second is based on the inhibition of nitrification.

**This table does not list every substance which may prove inhibitory to aerobic or anaerobic organisms. You must also consider the potential inhibitory effect of other substances.**

Parameter	Aerobic Treatment threshold mg/L Activated sludge	Aerobic Treatment threshold mg/L Nitrification	Comments/ Test methodology/Reference
	Anthracene ug/l	500	
Arsenic (As)	0.1	1.5	
Cadmium (Cd)	1-10	5.2	
Chloride mg/kg	-	180	
Chromium (Cr) III	10-50	-	3.5 - 68 (trickling filter; EPA)
Chromium (Cr) total	1-100	0.25-1.9	1-100 (nitrification trickling filter EPA)
Chromium (Cr) VI	1	1-10*	*as chromate
Copper (Cu)	1	0.05-0.48	
Cyanide	0.1-5	0.34-0.5	30 (Trickling filter; EPA)
Iodine (I)	10	-	
Lead (Pb)	1-5 or 10-100	0.5	
Mercury (Hg)	0.1-1; 2.5 as Hg(II)	-	
Naphthalene	500 (EPA); 29-670	-	IC50 (mg/L) for Nitrosomonas and aerobic heterotrphs respectively
Nickel (Ni)	1.0-2.5; 5	0.25-0.5; 5	

Parameter	Aerobic Treatment threshold mg/L	Aerobic Treatment threshold mg/L	Comments/ Test methodology/Reference
	Activated sludge	Nitrification	
Phenanthrene ug/l	500	-	
Sulphide	25-30	-	
Total ammonia nitrogen	480	-	
Zinc (Zn)	0.3-5; 5-10	0.08-0.5	

**Table D – specific inhibitors anaerobic treatment**

The following table contains the inhibitive concentrations for a range of substances for anaerobic treatment processes. Blanks indicate that there has been no data found within literature.

**This table does not list every substance which may prove inhibitory to aerobic or anaerobic organisms. You must also consider the potential inhibitory effect of other substances.**

Parameter	Anaerobic Treatment threshold g/L	Comments/ Test methodology/Reference
Acrylates	62 - 150 mg/l	Ref Blum and Speece
Alcohols	22-43000 mg/l	Short chain alcohols generally being less toxic than long chain alcohols (Blum and Speece)
Alkylbenzenes	160 - 580 mg/l	versus 1200 for benzene itself (Blum and Speece)
Aluminium (Al)	1	2% inhibition of methane production after 59 days. [150 mg/gTS not toxic (Mu et al., Chen)
Amines	13000 1-methylpyrrolidine mg/l	Ref Blum and Speece
Arsenic (As)	0.0016	"inhibitory concentration" EPA
Cadmium (Cd)	0.15-0.33	refs in Li and Fang
Calcium (Ca)	2.5-4	levels that can be tolerated; 8 g/L is strongly inhibitory (Chen)
Chlorinated aliphatics	0.5 - 600 mg/l	Depending on number and position of halo substituents (Blum and Speece)

Parameter		
Chromium (Cr) total	0.2	Methanogenesis (Li and Fang)
Copper (Cu)	0.009	acidogenesis is even more sensitive (by a factor of 10; Lin and Shiu) (Kerri et al)_
Fluoride (F)	0.018	Ref. Ochoa-Herrera
Halobenzenes	20-750 mg/l	depending on number and position of chloro substituents (Blum and Speece)
Halogenated alcohols	0.3 - 630 mg/l	Depending on the structure (Blum and Speece)
Halogenated carboxylic acids	< 0.001 to 0.01 mg/l	trichloroacetic acid is extremely toxic (Blum and Speece)
Halogenated phenols	2-300 for mono,-di and trichloros; 0.04 and 0.13 for penta and tetra mg/l	Ref Blum and Speece
Ketones	6000 - 50000 mg/l	Ref Blum and Speece
Lead (Pb)	3.2-8	refs in Li and Fang
Magnesium (Mg)	12	concentration tolerated by adapted methanogens (Chen)
Nickel (Ni)	0.1-1.6	refs in Li and Fang
Nitriles	90 - 28000 Acrylonitrile and Acetonitrile respectively mg/l	Ref Blum and Speece
Nitrobenzenes	13 nitrobenzene	Ref Blum and Speece
Nitrophenols	4-12 mg/l	Depending on the structure (Blum and Speece)
Phenol and alkylphenols	phenol 1850; o,m,and p-cresol 850, 925, 975 mg/l	Ref Fang

Parameter	Anaerobic Treatment threshold g/L	Comments/ Test methodology/Reference
Potassium (K)	2.8-14	sodium has antagonistic effects on potassium toxicity (Chen)
Silver (Ag)	0.1	100 mg/L is safe;
Sodium (Na)	5.6-53	differences attributed to adaptation period, antagonistic/synergistic effects, substrate and reactor configuration (Chen)
Sulphate	N/A	methane production is reduced by one mole for every mole of sulphate added due to sulphate reduction dominating over methanogenesis (Chen)
Sulphide	100-800	strong dependence on pH and speciation (Chen)
Surfactants	e.g. alkyl dimethylbenzylammonium chloride: 6.7; sodium alkyl ethersulfate: 11 mg/l	Madsen and Rasmussen
TiO <sub>2</sub> (mg/gTS)	150	not toxic (Mu et al.)
Total ammonia nitrogen	1.7-14	differences attributed to substrates, inocula, environmental conditions (temperature, pH and acclimation periods) (Chen)
Zinc (Zn)	0.03	as ZnO nanoparticles (Mu et al. )

**(Inhibitory values are under review. Subject to that review, substances may be added or removed or values amended).**