### BAT conclusions specific to indoor composting

#### Overview of indoor composting process steps

The typical process stages of an indoor composting operation with the principal functions of each step are listed below:

* Feedstock acceptance and storage:
* To formally accept waste
* To provide adequate capacity for the feedstock
* To prevent fugitive emissions
* To blend feedstock’s and balance conditions in the waste to optimise treatment
* Pre-treatment of feedstock prior to composting (shredding, mixing, metal removal etc.):
* To remove unwanted materials and contaminants
* To physically prepare the feedstock for composting
* Composting:
* To sanitise the feedstocks (i.e. eradicate pathogens or reduce them to acceptably low, sanitary levels). Mainly for processes treating animal by-products this is a dedicated step of the composting process.
* To stabilise and mature the compost and produce the required outputs for end use.

In indoor composting installations, part or all the composting process takes place indoor. Indoor systems allow greater control of both the composting process and release of its by-products to the environment. In this section we have only addressed the part of the process that takes place indoor. If any part of the operation takes place outdoor, please refer to section n. xxx on outdoor composting.

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* Post-treatment (sieving, particle size screening, ballistic separator, wind sifting, etc.):
* To refine the compost (i.e. remove physical contaminants) and make it into one or more size grades for different markets.
* Storage and utilisation:
* To store the compost output ready for use. Further maturation of the compost can take place during storage.

#### Principal techniques and construction elements applied to indoor composting

**XX. In order to improve the environmental performance of indoor composting installations and reduce emissions to air and water, BAT is to use the construction and design techniques below.**

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| **Techniques** | **Description** | **Applicability** |
| Waste reception and storage area design | * The reception area is appropriately sized to accommodate the expected volume of waste, and a dedicated area for off-loading and inspections of input material loads, a dedicated quarantine area for unacceptable or rejected loads and any area allocated to pre-treatment. * When required, reception of putrescible wastes is carried out in an enclosed area * Where the waste reception area is required to be in an enclosed building it includes a building ventilation system and an emission abatement system that maintains the building under negative air pressure in order to minimise fugitive odour, and dust release from the building. * The reception area is designed to facilitate cleaning including drainage to allow discharge of wash waters into gullies and to a sump for use within the process or to be discharged into sewers. * All reception areas have an impermeable surface with self-contained drainage, to prevent any spillage entering the storage systems or escaping off-site. The design should prevent the contamination of clean surface water. | Generally applicable to biological treatments |
| Vessel or enclosed building design | * Any vessel or enclosed treatment space is designed with sufficient capacity for waste to be treated within the retention time of the treatment process or the relevant treatment step. * The process is fully enclosed with an air abatement system. * Treatment areas have engineered impermeable surfaces with kerbed areas to allow collection of runoff and leachate. * Run off and leachate (dirty water) is collected in an engineered system, collected in a sump or lagoon and where possible kept separate from clean roof or yard water. * Air extraction should be designed and maintained to move and handle the volume of air to provide a clear working environment | Generally applicable to biological treatments |
| Pre-treatment and post-treatment areas design | * All treatment areas have engineered impermeable surfaces with kerbed areas to allow collection of runoff and leachate as defined in section * Run off and leachate (dirty water) are collected in an engineered system and collected in a sump or lagoon. * When pre- and post- treatment are carried out in an enclosed area, capture, discharge and treat exhaust air. | Generally applicable to biological treatments |
| Waste storage | * Waste is stored under appropriate conditions in the quarantine area to avoid putrefaction, odour generation, the attraction of vermin and any other nuisance or objectionable condition. * Where required by the Regulator or relevant Competent Authority, the waste storage occur inside an appropriate building. * When storage is enclosed, capture, discharge and treat exhaust air and wastewater * Storage provision may have to take into account situations where the land-bank may be unavailable for prolonged periods, for example, where the land is waterlogged or frozen. | Generally applicable to biological treatments |

**XX. In order to reduce the environmental risks of composting installations and to improve waste treatment performance, BAT is to have a good knowledge of the waste input and to use the management techniques below for waste acceptance, characterisation and traceability.**

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| **Techniques** | **Description** | **Applicability** |
| Waste pre-acceptance procedures | * Waste is only accepted at the facility if suitable for composting. The plant operator establishes and maintains detailed written procedures for the acceptance and handling of wastes. These procedures provide for the pre-clearance and characterisation of waste types proposed to be accepted at the facility. * The procedure should contain the following items depending on the type of waste/installation   + General information (contact details of the waste producer, processes producing the waste, conditioning characteristics of the waste, all relevant information necessary for planning waste handling)   + Characterisation, which may involve sampling and testing or other type of assessment   + Compliance with the proposed treatment   + Delivery plan   + Validation of the acceptance * Some waste streams may require periodic verification of the initial characterisation. | Generally applicable to biological treatments |
| Waste acceptance procedures | * Waste is accepted at the facility from known customers or new customers subject to pre-acceptance procedures. * The operator should have clear and unambiguous criteria for the rejection of wastes or any actions to be taken to remove or reduce physical contaminants or any other unsuitable content prior to processing, together with a written procedure for tracking and reporting non-conformance. * Compliance verification: verify accompanying documents and compliance with acceptance criteria. Waste arriving at the facility are certified (as to source), weighed, documented and directed to the Waste reception area. The kind, origin and quantity of feedstock arriving at the installation is recorded at the weighbridge. * Unloading: have a clear procedure to ensure that accepted waste is unloaded in the right storage area * Where possible each load of waste arriving at the waste reception facility is inspected upon tipping within this facility. Only after such inspections the waste is processed for recovery. If the inspection indicates that the wastes fail to meet the acceptance criteria, then such loads are stored in a dedicated quarantine area and dealt with appropriately. * Ensure that gates to halls and bunkers open quickly during reception; operate gate air curtain system when gates open. Tip feedstock into open bunkers, reception area and pits quickly. | Generally applicable to biological treatments |
| Traceability | Generally applicable to biological treatments | Generally applicable to biological treatments |

#### General management system of operational process with a view to enhance environmental performances

**XX. In order to improve the environmental performance of composting installations, BAT is to adhere to an environmental management system to include the following features:**

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| **Techniques** | **Description** | **Applicability** |
| Operations and maintenance procedures | Effective operational and maintenance systems are in use for all aspects of the process especially where failure could impact on the environment, in particular there should be:   * control of operations that may have an adverse impact on the environment * a defined procedure for identifying, reviewing and prioritising items of plant for which a preventative maintenance regime is necessary * documented procedures for monitoring emissions or impacts * a preventative maintenance programme covering all plant, whose failure could lead to impact on the environment, including regular inspection of major ‘non-productive’ items such as tanks, pipe work, retaining walls, bunds, ducts and filters. The maintenance system includes auditing of performance against requirements arising from the above and reporting the result of audits to top management. * Maintenance schedules are included in the management system. Repair should be initiated within the time frame specified in the plant’s management system. | Generally applicable to biological treatments |
| Competence and training procedures | * The plant employs a suitable qualified and experienced facility manager who is designated as the person in charge. The facility manager or a nominated, suitably qualified and experienced deputy is present on the facility at all times during its operation. * The plant ensures that personnel who performs specific tasks is qualified on the basis of appropriate education, training and experience as required and aware of the requirements of the permit/licence. In addition, the facility manager and his/her deputy successfully complete a recognised specific training course relevant to the management of the facility. * Training systems, covering the following items, should be in place for all relevant staff which cover: * awareness of the regulatory implications of the permit/licence and how this impacts their work responsibilities and activities; * awareness of all potential environmental effects from operation under normal and abnormal or extreme circumstances (e.g. extreme weather, plant failure, emergency) * awareness of the need to report deviation from the permit/license * prevention of accidental emissions and action to be taken when accidental emissions occur * reporting and accountability procedures within the management structure of the facility. | Generally applicable to biological treatments |
| Accidents / incidents procedures | An accident plan is in place which:   * identifies the likelihood and consequence of accidents and emergency * identifies actions to prevent accidents and mitigate any consequences   The accident management plan considers and has procedures for dealing with events which effect the day to day operation of the facility e.g. risks and impact of flooding and fires. | Generally applicable to biological treatments |
| Environmental Management Systems | A written management system is in place which provides the framework for the plant to deal with immediate and long-term environmental impact of its products, services and processes.  A management system needs consider the location, waste types treated, size of your site, and complexity of your process.  The operation of formal environmental management systems (EMSs) is equally accepted as non-certified systems. The level of information and control should be proportional to the risk each activity may have to the environment or on process control. | Generally applicable to biological treatments |

#### Indoor composting process monitoring

**XX. In order to ensure stable process operation and optimisation and to minimise operational difficulties, BAT is to have a suitable monitoring system, both manual and instrumental. Parameters monitored may include, but are not limited to, the following:**

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| --- | --- | --- | --- |
| **Parameter** | **Unit** | **Measurement frequency** | **Critical limits** |
| Temperature and temperature distribution | °C | Continuous or periodic monitoring. Frequency as specified in operators’ management system. | As specified in operators’ management system. |
| Moisture |  | Periodic monitoring. Frequency as specified in operators’ management system. | As specified in operators’ management system. |
| CO2 / O2 | % | Continuous or periodic monitoring. Frequency as specified in operators’ management system. | As specified in operators’ management system. |
|  |  |  |  |

#### Emissions to water

**XX. In order to reduce or prevent emissions to water, BAT is to use the following operational and management techniques.**

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| **Techniques** | **Description** | **Applicability** |
| Procedures to manage discharge of leachate and/or contaminated storm water to surface water | Unless otherwise agreed by the Regulator or relevant Competent Authority, no leachate and/or contaminated storm water is  discharged to surface water drains and courses. | Generally applicable to biological treatments |
| Procedures to manage direct or indirect emissions to groundwater | Unless otherwise agreed by the Regulator or relevant Competent Authority, no leachate and/or contaminated storm water is  discharged directly or indirectly to groundwater. | Generally applicable to biological treatments |
| Procedures to manage discharge of leachate and/or contaminated storm water to sewers or for treatment at sewage treatment work off-site | Where effluent is treated off-site at a sewage treatment works:   * action plans are appropriate to prevent direct discharge of the waste-waters in the event of sewer bypass, (via storm/emergency overflows or at intermediate sewage pumping stations) for example, knowing when bypass is occurring, rescheduling activities such as cleaning or even shutting down when bypass is occurring. * a suitable monitoring programme is in place for emissions to sewer. * the operator conducts visual checks on the effluent management system and maintain a log. * the operator has in place procedures to ensure that the effluent specification is suitable for the on-site effluent treatment system or discharge criteria * measures are in place to isolate effluent where samples indicate a breach of specification. Incidents of this nature are recorded in the effluent log. | Generally applicable to biological treatments |
| Closed loop cooling systems | Wherever possible, closed loop cooling systems are used and procedures in place to ensure blow down from abatement systems is minimised | Generally applicable to biological treatments |
| Leachate management | Leachate is managed via a sealed drainage system that collects and separately contains it from non-contaminated surface water at the facility. All systems are fitted with high level alarms and a record of inspection of levels kept on site.  Prevention of excessive leachate as a priority through design is needed, diverting rainfall from stored feedstock, active composting and product maturation areas where possible*.* The amounts collected can be minimised by providing separate drainage for clean roof water and clean yard water*.* Clean and dirty drainage are clearly identified. | Generally applicable to biological treatments |
| Re-use of leachate or process water | Where possible reuse of leachate or other water helps maintaining moisture content in the active composting phase. Leachate from unsanitised waste is not applied to sanitised wastes. | Applicable to composting |

**XX. In order to prevent, or where it is not practicable, to reduce emissions to water from indoor composting, when wastewaters/liquor are not discharged directly to sewers or tinkered to WWTWs, BAT is to use one or a combination of the following abatement systems.**

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| --- | --- | --- |
| **Techniques** | **Description** | **Applicability** |
| Activated sludge process |  | Generally applicable to biological treatments |
| Chemical treatment |  | Generally applicable to biological treatments |
| Upflow anaerobic sludge blanket (UASB) reactor |  | Generally applicable to biological treatments |
| Sequencing Batch Reactors (SVR) |  | Generally applicable to biological treatments |
| … |  | Generally applicable to biological treatments |
| … |  | Generally applicable to biological treatments |
| [other] |  | Generally applicable to biological treatments |

#### Emissions to air – odours, bioaerosols, dust, point source emissions (e.g. ammonia from biofilter)

**XX. In order to operate low-emission composting installations, BAT is to have the following operational and management techniques.**

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| --- | --- | --- |
| **Process step** | **Operational Techniques** | **Applicability** |
| Intensive or main decomposition (enclosed) | * Control active aeration system to ensure sufficient air is supplied to the composting material | Applicable to composting |
| Batch formation | * Produce the feedstock blend while ensuring adequate levels of structurally stable substances (wood chips, screenings etc.), favourable water levels, favourable C:N ratio, adequate air pore volume. * Form batches while respecting the underlying design and ballast loads to guarantee adequate air pore volume. | Applicable to composting |
| Intensive or main decomposition  (enclosed) | * Control active aeration system to ensure sufficient air is supplied to the composting material * Irrigate composting material in the case of insufficient moisture content (but do not waterlog). | Applicable to composting |
| Post-treatment | * If drum screens are used: * wet material (> 35% water) => Reduced screening capability, low screening yield, high screen overflow. * dry material (< 35% water) => Good screening capability, good screening yield; significant dust emissions possibly associated with microbe emissions as water levels decrease (< 20%). | Applicable to composting |
| Final product storage | * Do not overly agitate product with very compact layers. | Applicable to composting |

**XX. In order to reduce or prevent odour, dust and bioaerosol emissions, BAT is to use the following techniques.**

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| **Techniques** | **Description** | **Applicability** |
| Odour management plan/system | An odour management system is in place including measures aimed at minimising, or where possible preventing, odour emissions. Features include (but are not limited to:   * Composting process is optimised by controlling parameters listed in 1.1.1.5 | Generally applicable to biological treatments |
| Dust management plan | In dry weather, site roads and any other areas used by vehicles are sprayed with water as and when required to minimise airborne dust nuisance.  Other measures include:   * Covering of skips to and from site and in storage. * Where dust creation is unavoidable, use of sprays, binders, stockpile management techniques, windbreaks etc. are employed based on risk assessment * Wheel and road cleaning (avoiding transfer of pollution to water and wind blown particulate) * Closed conveyors, pneumatic or screw conveying (noting the higher energy needs). Filters on the conveyors to clean the transport air prior to release * Regular housekeeping | Generally applicable to biological treatments |
| Identification of activities that could potentially generate bioaerosols | A full and complete identification of activities that could potentially generate bioaerosols is carried out. | Generally applicable to biological treatments |
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| Scrubber and biofilter and design and optimisation | Scrubbers and biofilters are designed, commissioned and monitored to ensure optimum performance, i.e. operating at correct pH, ensuring adequate chemical wash replenishment and replacement and pressure drop monitoring. | Generally applicable to biological treatments |
| Recording of weather data | Weather data are recorded or obtained from national weather agency | Generally applicable to biological treatments |
| Use of misting devices | Misting and atomising units at the boundary or operationally placed. If used will be fully operational and maintained. | Generally applicable to biological treatments |

**XX. In order to prevent, or where it is not practicable, to reduce emissions to air from indoor composting, BAT is to use one or a combination of the following abatement systems.**

|  |  |  |
| --- | --- | --- |
| **Techniques** | **Description** | **Applicability** |
| Biofilter |  | Generally applicable to biological treatments |
| Wet scrubber |  | Generally applicable to biological treatments |
| Activated carbon |  | Generally applicable to biological treatments |
| Bioscrubber |  | Generally applicable to biological treatments |
| Ozone treatment |  | Generally applicable to biological treatments |
| Acidic scrubber |  | Generally applicable to biological treatments |
| [other] |  | Generally applicable to biological treatments |

**XX. In order to prevent, or where it is not practicable, to reduce emissions to air from indoor composting, BAT is to use one or a combination of the following types of containment.**

|  |  |  |
| --- | --- | --- |
| **Techniques** | **Description** | **Applicability** |
| Tunnels |  | Applicable to enclosed biological treatments |
| Rotating Drums |  | Applicable to enclosed biological treatments |
| Enclosed halls |  | Applicable to enclosed biological treatments |
| Silos |  | Applicable to enclosed biological treatments |
| Agitated bays |  | Applicable to enclosed biological treatments |
| [others] |  | Applicable to enclosed biological treatments |

**XX. In order to reduce or prevent litter, BAT is to use the following techniques.**

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| --- | --- | --- |
| **Techniques** | **Description** | **Applicability** |
| Management procedures for litter control | All loose litter or other waste, placed on or in the vicinity of the facility, other than in accordance with the requirements of the permit/licence, is removed in a timely manner, subject to the agreement of the landowners. | Generally applicable to biological treatments |

**XX. In order to reduce or prevent the presence of pests/ vermin, BAT is to follow any or a combination of the following techniques:**

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| --- | --- | --- |
| **Techniques** | **Description** | **Applicability** |
| Management procedures for pests/vermin control | The operator has documented procedures in place to ensure pests/vermin are controlled. These include inspections at the facility and its immediate surrounds for nuisances caused by vermin, birds, and flies. The operator maintains a record of all nuisance inspections. | Generally applicable to biological treatments |

#### Noise and vibrations

**XX. In order to reduce or prevent noise and vibration, BAT is to follow any or a combination of the following techniques:**

|  |  |  |
| --- | --- | --- |
| **Techniques** | **Description** | **Applicability** |
| Noise survey and management plan | The plant carries out a noise survey of the site operations. The survey programme identifies: the main sources of noise and including infrequent sources); the nearest noise sensitive locations and relevant environmental surveys which have been undertaken; and the proposed techniques and measures for the control of noise. | Generally applicable to biological treatments |
| Measures for the control of noise, including maintenance | The operator employs basic good practice measures for the control of noise, including adequate maintenance of any parts of plant or equipment whose deterioration may give rise to increases in noise (for example, bearings, air handling plant, the building fabric, and specific noise attenuation kit associated with plant or machinery). | Generally applicable to biological treatments |

#### Resource and energy efficiency (waste and materials use, water consumption etc.)

**XX. In order to use energy efficiently and to reduce raw materials and chemicals consumption, BAT is to follow any or a combination of the following techniques:**

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| **Techniques** | **Description** | **Applicability** |
| Energy efficiency audit | The plant carries out an audit of the energy efficiency of the site within one year of the date of commencement of the plant activity. The energy efficiency audit is repeated at intervals as required by the Regulator. The audit identifies all practicable opportunities for energy use reduction and efficiency and the recommendations of the audit will be incorporated into the plant management system targets. | Generally applicable to biological treatments |
| Water recycling and reuse | The plant identifies opportunities for reduction in the quantity of water used on site including recycling and reuse initiatives, wherever possible. Reductions in water usage shall be incorporated into the plant management system targets.  Optimise the water reuse, taking into account the legal requirements (odour minimsation), technical requirements (need of water for optimised aerobic degradation) and sanitisation requirements (non recontamination of compost). | Generally applicable to biological treatments |
| Assessment of efficiency of use of raw materials | The plant undertakes an assessment of the efficiency of use of raw materials in all processes, having particular regard to the reduction in waste generated. The assessment takes account of best international practice for this type of activity. Where improvements are identified, these are incorporated into the plant management system targets. | Generally applicable to biological treatments |

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