# SEPA Interpretational Guidance on the Best Available Techniques (BAT) Conclusions for

## WASTE TREATMENT

## Contents

## Who does this Guidance Apply to?

This guidance applies to all installations carrying out activities described in the waste treatment BRef and in the Scope section of the BAT conclusion (see below).

This guidance is to help Operators and SEPA staff determine if a site is designed and operating to the required standard as set down in the BAT conclusions. It may be used when considering new applications and variations to existing sites, as well as undertaking PPC permit reviews as part of the BRef revision and implementation process.

## Introduction

The Industrial Emissions Directive (IED) brought together the seven European Union Directives that covered industrial emissions, including the Integrated Pollution Prevention and Control (IPPC) Directive (2008/1/EC). The IED strengthened the position of Best Available Techniques (BAT) Reference documents (BRefs) and their associated BAT conclusions (BATc). It introduced legally binding emission levels in the form of BAT Associated Emission Levels (BAT-AELs).

One of the main aims of the IED is to ensure robust and more consistent application of BAT. The BRefs produced under the previous IPPC Directive are being reviewed, revised and republished under IED with a greater emphasis on outcomes, delivered through BATc.

Article 21 of the IED places a duty on the Competent Authority (CA) to periodically review permits and lists several reasons why such a review should be carried out. In practice, many permit reviews are carried out following the publication of the BATc relating to the main activity of the installation as described in Article 21(3). The BATc for waste treatment activities (WT BATc) were published in August 2018 and SEPA has until August 2022 to implement them through the PPC permit.

The objectives of a BATc permit review are to: (a) identify or confirm the levels of performance, and in particular emission levels, that represent BAT for the installation, and (b) ensure that the permit conditions reflect the levels of performance that are indicative of BAT for the installation.

This document is the interpretational guidance and permitting advice relating to waste treatment activities. It sets out SEPA's guidance for the use of WT BATc in determining an application for a permit for a new or modified IED installation and any review of a permit for an IED installation.

## What is the Purpose of the Interpretational Guidance?

Its purpose is to resolve any ambiguities and uncertainties that may exist in an individual waste treatment BAT Conclusion (10 August 2018) and published in the Official Journal of the European Commission Article. The BAT conclusions are part of a larger document, the Waste Treatment BRef which contains background general information on the waste treatment sector including commonly used processes and techniques, current emission and consumption levels and the techniques considered to be BAT for each sector.

This guidance should be read in conjunction with the document entitled "UK Cross-Cutting Interpretation Guidance and Permitting Advice on the Best Available Techniques (BAT) Conclusions published under the Industrial Emissions Directive (IED)". This covers issues relevant to more than one BRef which should be read in conjunction with the specific WT BRef and guidance.

## How this Interpretational Guidance is Laid Out?

Our interpretational guidance is laid out as shown below:

**General header**

**1- Waste Treatment BAT Conclusion**

The blue boxes contain the text from the Waste Treatment BAT conclusion as published in the official journal.

**2- Interpretational Guidance**

The green boxes contain the interpretational guidance relating to the BAT conclusion.

This has been developed by the joint UK regulators but contains additional specific advice or technical information relating to Scotland. This section provides interpretation for specific BAT conclusions where it is believed additional clarification may be required and also captures relevant background discussions in the EIPPCB Technical Working Group during the BRef review process.

The Interpretational Guidance shall go through each section of the BAT conclusion in turn and provide comment where we consider necessary. If no interpretational guidance is thought to be required, then this will be stated.

## How does the Interpretational Guidance relate to other Guidance?

The interpretational guidance will, where appropriate link to other more comprehensive guidance.

Other relevant guidance which should be referred to includes:

- Waste Treatment BREF
- Sector Guidance Note S5.06
- SEPA Odour Guidance
- UK Noise and Vibration Management Guidance
- Horizontal Guidance Note H1
- Storage and treatment of healthcare waste: Appropriate measures and supporting guidance 1.0

With various pieces of guidance out of date and no longer relevant, care is needed to ensure references to these are removed from the permits as part of the review

Where your site undertakes multiple activities which are covered under the scope of different BRefs and BAT conclusions reference should also be made to those documents in order to identify appropriate BAT AELs.

## Structure of the BAT conclusions (BATc) document

The BATc document is split into the following sections:

| Section | BAT Conclusions number | Applies to |
|---|---|---|
| Scope | n/a | All processes in scope |
| Definitions | | |
| General Considerations | | |
| Section 1 General BAT conclusions | BAT 1 to 24 | |
| Section 2 | BAT 25 to 32 | mechanical treatment of waste |
| Section 3 | BAT 33 to 39 | biological treatment of waste |
| Section 4 | BAT 40 to 51 | physico-chemical treatment of waste |
| Section 5 | BAT 52 to 53 | treatment of water-based liquid waste |
| Section 6 Description of techniques | n/a | All processes in scope |

Reference should be made to the Scope section when determining if a particular activity is covered by the waste treatment BATcs. This section also includes activities that are specifically excluded and sign-posts to other BRef BATcs.

BAT techniques are descriptive only, “narrative BAT”, and are neither prescriptive nor exhaustive. Other techniques may be used that ensure at least an equivalent level of environmental protection. SEPA will consider these on a case by case basis.

The BATc may contain BAT-AELs. Typically BAT-AELs will be presented as a range and are used as the basis for setting individual site emission limit values (ELV). It should be noted that due to the principle of optimisation, where the BATc presents the emission level as a range it is not appropriate to simply set the ELV for a particular site at the top of the BAT-AEL range. The appropriate ELV from the BAT-AEL range is what protects the environment and can be achieved by the optimised performance of the installation when operating normally.

This means that as part of the BAT assessment SEPA must assess and ensure that site specific performance is optimised and can achieve the performance levels within the range of the BAT- AELs. If we conclude as part of our assessment that site-specific performance is optimised, then BAT for that installation will be reflected by the emission levels associated with this optimised performance, and ELVs set accordingly

BAT-AELs to air do not apply to process releases within the process building. COSHH requirements will apply. However, BAT AELs may be used as benchmarks for BAT abatement.

Where a waste activity involves more than one waste treatment process, for example, mechanical treatment followed by physico-chemical treatment of waste, the BATc and BAT-AELs associated with each treatment process will apply to the relevant activity/emission. Where there are two BAT AELs which could apply, for example a combined emission point, there are several approaches that could be used depending on the circumstances:

1- the tighter limit is applied,

2- the main pollutant load approach is taken, I.e. if 90% of the effluent pollutants come from one activity then that BAT-AEL may be used

3- derive a flow weighted ELV.

# Waste Treatment BATc - Interpretational Guidance

## BATc Scope

These BAT conclusions concern the following activities specified in schedule 1 of the Pollution Prevention and Control (Scotland) Regulations 2012, namely:

5.3(a) recovery by distillation of oil or organic solvents, other than as part of an activity described in any other section of this chapter

- 5.3(b). Disposal or recovery of hazardous waste with a capacity exceeding 10 tonnes per day involving one or more of the following activities:

(i) biological treatment;
(ii) physico-chemical treatment;
(iii) blending or mixing prior to submission to any of the other activities listed in this section or in section 5.1;
(iv) repackaging prior to submission to any of the other activities listed in this section or in section 5.1;
(v) solvent reclamation/regeneration;
(vi) recycling/reclamation of inorganic materials other than metals or metal compounds;
(vii) regeneration of acids or bases;
(viii) recovery of components used for pollution abatement;
(ix) recovery of components from catalysts;
(x) oil re-refining or other reuses of oil;
(Note that 5.3A(xi) surface impoundment is not covered by the WT BRef.)

- 5.4. (a) Disposal of non-hazardous waste with a capacity exceeding 50 tonnes per day involving one or more of the following activities,:

(i) biological treatment;
(ii) physico-chemical treatment;
(iii) pre-treatment of waste for incineration or co-incineration;
(iv) treatment of ashes;
(v) treatment in shredders of metal waste, including waste electrical and electronic equipment and end-of-life vehicles and their components.

(b) Recovery, or a mix of recovery and disposal, of non-hazardous waste with a capacity exceeding 75 tonnes per day involving one or more of the following activities,:
(i) biological treatment;
(ii) pre-treatment of waste for incineration or co-incineration;
(iii) treatment of ashes;
(iv) treatment in shredders of metal waste, including waste electrical and electronic equipment and end-of-life vehicles and their components.

With regards to activity 5.4(b)(i) - when the only waste treatment activity carried out is anaerobic digestion, the capacity threshold for this activity shall be 100 tonnes per day.

- 5.6. Temporary storage at an installation with a capacity of more than 50 tonnes of hazardous waste pending any of the activities described in any of sections 5.1 to 5.3 and paragraph (b) of this Section, excluding temporary storage, pending collection, on the site where the waste is generated.

- 5.7. Independently operated treatment of waste water not covered by Directive 91/271/EEC and discharged by an installation undertaking activities covered under points 5.1, 5.3 or 5.5 as listed above.

Referring to independently operated treatment of waste water not covered by Directive 91/271/EEC above, these BAT conclusions also cover the combined treatment of waste water from different origins if the main pollutant load originates from the activities covered under points 5.3(b), 5.4 or 5.6 as listed above.

These BAT conclusions **do not** apply to the following activities:

- Surface impoundment.
- Disposal or recycling of animal carcases or of animal waste covered by the activity description in point 6.5 of Annex I to Directive 2010/75/EU when this is covered by the BAT conclusions on the slaughterhouses and animal by-products industries (SA).
- On-farm processing of manure when this is covered by the BAT conclusions for the intensive rearing of poultry or pigs (IRPP).
- Direct recovery (i.e. without pretreatment) of waste as a substitute for raw materials in installations carrying out activities covered by other BAT conclusions, e.g.:
    - Direct recovery of lead (e.g. from batteries), zinc or aluminium salts or recovery of the metals from catalysts. This may be covered by the BAT conclusions for the non-ferrous metals industries (NFM).
    - Processing of paper for recycling. This may be covered by the BAT conclusions for the production of pulp, paper and board (PP).
    - Use of waste as fuel/raw material in cement kilns. This may be covered by the BAT conclusions for the production of cement, lime and magnesium oxide (CLM).
- Waste (co-)incineration, pyrolysis and gasification. This may be covered by the BAT conclusions for waste incineration (WI) or the BAT conclusions for large combustion plants (LCP).
- Landfill of waste. This is covered by Directive 1999/31/EC on the landfill of waste. In particular, underground permanent and long-term storage (≥ 1 year before disposal, ≥ 3 years before recovery) are covered by Directive 1999/31/EC.
- *In situ* remediation of contaminated soil (i.e. unexcavated soil).
- Treatment of slags and bottom ashes. This may be covered by the BAT conclusions for waste incineration (WI) and/or the BAT conclusions for large combustion plants (LCP).
- Smelting of scrap metals and metal-bearing materials. This may be covered by the BAT conclusions for non-ferrous metals industries (NFM), the BAT conclusions for iron and steel production (IS), and/or the BAT conclusions for the smitheries and foundries industry (SF).Regeneration of spent acids and alkalis when this is covered by the BAT conclusions for ferrous metals processing.
- Combustion of fuels when it does not generate hot gases which come into direct contact with the waste. This may be covered by the BAT conclusions for large combustion plants (LCP) or by Directive 2015/2193/EU.

Other BAT conclusions and reference documents which could be relevant for the activities within scope of these WT BAT conclusions are the following:

- Economics and cross-media effects (ECM);
- Emissions from storage (EFS);
- Energy efficiency (ENE);
- Monitoring of emissions to air and water from IED installations (ROM);
- Production of cement, lime and magnesium oxide (CLM);

- Common waste water and waste gas treatment/management systems in the chemical sector (CWW);
- Intensive rearing of poultry or pigs (IRPP).

These BAT conclusions apply without prejudice to the relevant provisions of EU legislation, e.g. the waste hierarchy.

**Scope - Interpretational Guidance**

It should be noted that the number referencing stated in Annex 1 of the IED changed when the activities were transposed into the PPC Scotland Regulations 2012.

Some activities covered by the waste treatment BAT conclusions are carried out on sites which undertake other PPC activities captured by other BAT conclusions e.g. some co-incinerator sites undertake pre-treatment of waste prior to incineration. In such a case the Operator should agree with SEPA what the principal activity is. Once agreed, the 4-year timeframe for review will be triggered by the publication date of the BAT conclusions for the principal activity. The permit review should be primarily based on the BAT conclusions document which relates to the principal activity but will consider BAT conclusions from all other applicable published BREF's.

5.3(b)(ii) relates to physico-chemical treatment of waste. This means that waste must be subject to both physical and chemical treatment. SEPA has published separate guidance on the interpretation of this term and what activities are included. The BRef does not define "physico-chemical treatment but BAT 20 lists examples of physico-chemical processes used in waste water treatment and these include adsorption, precipitation, chemical oxidation, ion exchange and stripping. Chapter 5 of the BRef outlines the various process steps normally undertaken in physico-chemical treatment of waste. Descriptions of these techniques are in section 6.

5.4(a)(iii) and (b)(ii) relates to pre-treatment of waste for incineration or co-incineration. Whilst this may be a DAA to an incineration process, it is not covered under the Waste Incineration BRef.

5.6 Temporary Storage: the WT BRef only applies to activities that store hazardous waste prior to treatment in a facility permitted under section 5.1 (incineration), 5.2 (landfill), and 5.3 (treatment). An activity which undertakes physico- chemical treatment of hazardous waste could fall under this section if sufficient waste is stored on site.However if the waste is transferred to a WML facility it is outwith scope of the WT BRef.
5.7: In order for a site to fall within scope of the WT BRef it must not fall under the Urban Wastewater Treatment directive and accept waste from another Part A activity. Where the site's main pollutant load is from a chemicals process (a chapter 4 activity) it will be covered under the BRef for Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector.

The WT BRef applies to independent waste water treatment works not covered by the UWWTD **and** discharged by activities under 5.3, 5.4 and 5.6 of the PPCR. In section 5.7 of the PPCR, the WWTW can treat waste water discharged by any Part A activity.

The Waste Treatment BRef and BAT conclusions do not apply to disposal or recycling of animal carcases or of animal waste covered by the activity description in section 6.8(b) of the PPCR when this is covered by the BAT conclusions on the slaughterhouses and animal by-products industries (SA).

The WT BRef does not apply to on-farm processing of manure when this is covered by the BAT conclusions for the intensive rearing of poultry or pigs (IRPP). This link to an IRPP site is key- if the processing is on the site of an IRPP activity then it is out of scope of the WT BRef. It includes where they import manure from other IRPP sites. However, if the manure came from a farm not covered by IRPP then it would be in scope of the WT BRef. Note that cattle manure is not covered in this exclusion. Cattle manure is specifically included in the scope of the Waste Framework Directive where it is treated in a composting or biogas plant. Therefore, sites accepting cattle manure as feedstock are covered as a waste treatment process. If they exceed the threshold, they will be regulated as a PPC activity.

## Definitions

For the purposes of these WT BAT conclusions, the following definitions apply:

| Term used | Definition |
|---|---|
| General terms | |
| Channelled emissions | Emissions of pollutants into the environment through any kind of duct, pipe, stack, etc. This also includes emissions from open top biofilters. |
| Continuous measurement | Measurement using an 'automated measuring system' permanently installed on site. |
| Declaration of cleanliness | Written document provided by the waste producer/holder certifying that the empty waste packaging concerned (e.g. drums, containers) is clean with respect to the acceptance criteria |
| Diffuse emissions | Non-channelled emissions (e.g. of dust, organic compounds, odour) which can result from 'area' sources (e.g. tanks) or 'point' sources (e.g. pipe flanges). This also includes emissions from open-air windrow composting. |
| Direct discharge | Discharge to a receiving water body without further downstream waste water treatment |
| Emissions factors | Numbers that can be multiplied by known data such as plant/process data or throughput data to estimate emissions. |
| Existing plant | A plant that is not a new plant. |
| Flaring | High-temperature oxidation to burn combustible compounds of waste gases from industrial operations with an open flame. Flaring is primarily used for burning off flammable gas for safety reasons or during non-routine operating conditions. |
| Fly ashes | Particles from the combustion chamber or formed within the flue-gas stream, that are transported in the flue-gas. |
| Fugitive emissions | Diffuse emissions from 'point' sources. |
| Hazardous waste | Hazardous waste as defined in point 2 of Article 3 of Directive 2008/98/EC. |
| Indirect discharge | Discharge which is not a direct discharge |
| Liquid biodegradable waste | Waste of biological origin with a relatively high water content (e.g. fat separator contents, organic sludges, catering waste). |
| Major plant upgrade | A major change in the design or technology of a plant with major adjustments or replacements of the process and/or abatement technique(s) and associated equipment. |
| Mechanical biological treatment (MBT) | Treatment of mixed solid waste combining mechanical treatment with biological treatment such as aerobic or anaerobic treatment. |
| New plant | A plant first permitted at the site of the installation following the publication of these BAT conclusions or a complete replacement of a plant following the publication of these BAT conclusions. |
| Output | The treated waste exiting the waste treatment plant. |
| Pasty waste | Sludge which is not free-flowing. |
| Periodic measurement | Measurement at specified time intervals using manual or automated methods. |
| Recovery | Recovery as defined in Article 3(15) of Directive 2008/98/EC. |
| Re-refining | Treatments carried out on waste oil to transform it to base oil. |

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|---|---|
| Regeneration | Treatments and processes mainly designed to make the treated materials (e.g. spent activated carbon or spent solvent) suitable again for a similar use. |
| Sensitive receptor | Area which needs special protection, such as:<br>- residential areas;<br>- areas where human activities are carried out (e.g. neighbouring workplaces, schools, daycare centres, recreational areas, hospitals or nursing homes). |
| Surface impoundment | Placement of liquid or sludgy discards into pits, ponds, lagoons, etc. |
| Treatment of waste with calorific value | Treatment of waste wood, waste oil, waste plastics, waste solvents, etc. to obtain a fuel or to allow a better recovery of its calorific value. |
| VFCs | Volatile (hydro )fluorocarbons: VOCs consisting of fluorinated (hydro)carbons, in particular chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs). |
| VHCs | Volatile hydrocarbons: VOCs consisting entirely of hydrogen and carbon (e.g. ethane, propane, iso-butane, cyclopentane). |
| VOC | Volatile organic compound as defined in Article 3(45) of Directive 2010/75/EU. |
| Waste holder | Waste holder as defined in Article 3(6) of Directive 2008/98/EC. |
| Waste input | The incoming waste to be treated in the waste treatment plant. |
| Water-based liquid waste | Waste consisting of aqueous liquids, acids/alkalis or pumpable sludges (e.g. emulsions, waste acids, aqueous marine waste) which is not liquid biodegradable waste. |
| Pollutants/parameters | |
| AOX | Adsorbable organically bound halogens, expressed as Cl, include adsorbable organically bound chlorine, bromine and iodine. |
| Arsenic | Arsenic, expressed as As, includes all inorganic and organic arsenic compounds, dissolved or bound to particles. |
| BOD | Biochemical oxygen demand. Amount of oxygen needed for the biochemical oxidation of organic and/or inorganic matter in five (BOD5) or in seven (BOD7) days. |
| Cadmium | Cadmium, expressed as Cd, includes all inorganic and organic cadmium compounds, dissolved or bound to particles. |
| CFCs | Chlorofluorocarbons: VOCs consisting of carbon, chlorine and fluorine. |
| Chromium | Chromium, expressed as Cr, includes all inorganic and organic chromium compounds, dissolved or bound to particles. |
| Hexavalent chromium | Hexavalent chromium, expressed as Cr(VI), includes all chromium compounds where the chromium is in the oxidation state +6. |
| COD | Chemical oxygen demand. Amount of oxygen needed for the total chemical oxidation of the organic matter to carbon dioxide.<br>COD is an indicator for the mass concentration of organic compounds. |
| Copper | Copper, expressed as Cu, includes all inorganic and organic copper compounds, dissolved or bound to particles |
| Cyanide | Free cyanide, expressed as CN-. |
| Dust | Total particulate matter (in air). |
| HOI | Hydrocarbon oil index. The sum of compounds extractable with a hydrocarbon solvent (including long-chain or branched aliphatic, alicyclic, aromatic or alkyl-substituted aromatic hydrocarbons). |
| HCl | All inorganic gaseous chlorine compounds, expressed as HCl. |
| HF | All inorganic gaseous fluorine compounds, expressed as HF. |
| $H_2S$ | Hydrogen sulphide. Carbonyl sulphide and mercaptans are not included. |
| Lead | Lead, expressed as Pb, includes all inorganic and organic lead compounds, dissolved or bound to particles. |
| Mercury | Mercury, expressed as Hg, includes elementary mercury and all inorganic and organic mercury compounds, gaseous, dissolved or bound to particles. |
| $NH^3$. | Ammonia |
| Nickel | Nickel, expressed as Ni, includes all inorganic and organic nickel compounds, dissolved or bound to particles. |

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|---|---|
| Odour concentration | Number of European Odour Units (ouE) in one cubic metre at standard conditions measured by dynamic olfactometry according to EN 13725. |
| PCB | Polychlorinated biphenyl. |
| Dioxin-like PCBs | Polychlorinated biphenyls as listed in Commission Regulation (EC) No 199/2006. |
| PCDD/F | Polychlorinated dibenzo-*p*-dioxin/furan(s). |
| PFOA | Perfluorooctanoic acid. |
| PFOS | Perfluorooctanesulphonic acid. |
| Phenol index | The sum of phenolic compounds, expressed as phenol concentration and measured according to EN ISO 14402. |
| TOC | Total organic carbon, expressed as C (in water), includes all organic compounds. |
| Total N | Total nitrogen, expressed as N, includes free ammonia and ammonium nitrogen (NH4–N), nitrite nitrogen (NO2–N), nitrate nitrogen (NO3–N) and organically bound nitrogen. |
| Total P | Total phosphorus, expressed as P, includes all inorganic and organic phosphorus compounds, dissolved or bound to particles |
| TSS | Total suspended solids. Mass concentration of all suspended solids (in water), measured via filtration through glass fibre filters and gravimetry. |
| TVOC | Total volatile organic carbon, expressed as C (in air). |
| Zinc | Zinc, expressed as Zn, includes all inorganic and organic zinc compounds, dissolved or bound to particles. |

For the purposes of these WT BAT conclusions, the following acronyms apply:

| Acronym | Definition |
|---|---|
| EMS | Environmental management system |
| EoLVs | End-of-life vehicles (as defined in Article 2(2) of Directive 2000/53/EC) |
| HEPA | High-efficiency particle air (filter) |
| IBC | Intermediate bulk container |
| LDAR | Leak detection and repair |
| LEV | Local exhaust ventilation system |
| POP | Persistent organic pollutant (as listed in Regulation No (EC) 850/2004) |
| WEEE | Waste electrical and electronic equipment (as defined in Article 3(1) of Directive2012/19/EU) |

**Definitions – Interpretational Guidance**

"New plant" is interpreted to refer to new waste treatment plant, including new gaseous emission collection and treatment plant, flares and odour treatment equipment, and noise reduction equipment.

"Indirect discharge" includes discharge to the sewage network for downstream waste water treatment.

**General considerations**

Best Available Techniques

The techniques listed and described in these WT BAT conclusions are neither prescriptive nor exhaustive. Other techniques may be used that ensure at least an equivalent level of environmental protection.

Unless otherwise stated, the BAT conclusions are generally applicable.

**Emission levels associated with the best available techniques (BAT-AELs) for emissions to air**

Unless stated otherwise, emission levels associated with the best available techniques (BAT AELs) for emissions to air given in these WT BAT conclusions refer to concentrations (mass of emitted substances per volume of waste gas) under the following standard conditions: dry gas at a temperature of 273.15 K and a pressure of 101.3 kPa, without correction for oxygen content, and expressed in mg/Nm$^3$ or mg/Nm$^3$.

For averaging periods of BAT-AELs for emissions to air, the following **definitions** apply.

| Type of measurement | Averaging period | Definition |
|---|---|---|
| Continuous | Daily average | Average over a period of one day based on valid hourly or half-hourly averages |
| Periodic | Average over the sampling period | Average value of three consecutive measurements of at least 30 minutes each (1). |
| (1) For any parameter where, due to sampling or analytical limitations, a 30-minute measurement is inappropriate, a more suitable measurement period may be employed (e.g. for the odour concentration). For PCDD/F or dioxin-like PCBs, one sampling period of 6 to 8 hours is used. | | |

Where continuous measurement is used, the BAT-AELs may be expressed as daily averages.

**Emission levels associated with the best available techniques (BAT-AELs) for emissions to water**

Unless stated otherwise, emission levels associated with the best available techniques (BAT AELs) for emissions to water given in these WT BAT conclusions refer to concentrations (mass of emitted substances per volume of water), expressed in µg/l or mg/l.

Unless stated otherwise, averaging periods associated with the BAT-AELs refer to either of the following two cases:

- in the case of continuous discharge, daily average values, i.e. 24-hour flow-proportional composite samples;
- in the case of batch discharge, average values over the release duration taken as flow proportional composite samples, or, provided that the effluent is appropriately mixed and homogeneous, a spot sample taken before discharge.

Time-proportional composite samples can be used provided that sufficient flow stability is demonstrated.

All BAT-AELs for emissions to water apply at the point where the emission leaves the installation.

**Abatement efficiency**

The calculation of the average abatement efficiency referred to in these BAT conclusions (see Table 6.1) does not include, for COD and TOC, initial treatment steps aiming at separating the bulk organic content from the water-based liquid waste, such as evapo-condensation, emulsion breaking or phase separation.

## General Considerations - Interpretational Guidance

All BATC state the "techniques listed and described in these BAT conclusions are neither prescriptive nor exhaustive". This means that where a BATC states "BAT is to use one or a combination of the techniques given below", other techniques than those listed can be used provided that the technique employed achieves BAT as stated in the BATC doc.

Where the BAT conclusions are stated as being "generally applicable" this means they apply unless there is good reason for them not to.

The emission levels associated with BAT relate to reference conditions. Please note that the reference conditions identified in the BATC [dry gas with no correction for oxygen] are different from those previously applied in the UK under SG1.

When periodic sampling is undertaken it must be undertaken at a time when the operations are at peak flow thereby releasing the highest level of emissions or inducing the highest level of stress on the abatement which is being assessed. It is critical that this information is recorded and reported as part of any report submitted.

Full list of WT BAT conclusions

| BATC | Topic | Relevant section of BRef |
|---|---|---|
| BAT 1 | Environment Management System (EMS) | 2.3.1.1 |
| BAT 2 | Overall environmental performance inc. waste acceptance, storage and tracking | 2.3.2 |
| BAT 3 | Establish and maintain a waste water and waste gas inventory | 2.3.1.2 |
| BAT 4 | Reduce the environmental risk associated with waste storage | 2.3.13.2 |
| BAT 5 | Reduce the environmental risk associated with handling and transfer of waste | 2.3.13.3 |
| BAT 6 | Monitoring key process parameters for emissions to water | 2.3.3.3 |
| BAT 7 | Monitoring frequencies for emissions to water | |
| BAT 8 | Monitoring channelled emissions to air | 2.3.3.4 |
| BAT 9 | Monitoring diffuse emissions from regeneration of spent solvents, the decontamination of equipment containing PCBs with solvents and the physico-chemical treatment of solvents for the recovery of their calorific value | 5.4.3.2 |
| BAT 10 | Periodically monitor odour emissions | 2.3.3.5 |
| BAT 11 | Monitor annual consumption of water, energy and raw materials and generation of waste water | |
| BAT 12 | Set up, implement and review an Odour Management Plan | 2.3.5.1 |
| BAT 13 | Techniques to reduce odour emissions | 2.3.5.2 |
| BAT 14 | Techniques to prevent or reduce diffuse emissions to air | 2.3.5.3 |
| BAT 15 | Flaring | 2.3.5.5 |
| BAT 16 | Reduce emissions from flaring | 2.3.5.5 |
| BAT 17 | Set up, implement, and regularly review a noise and vibration management plan | 2.3.10.1 |
| BAT 18 | Reduce noise and vibration emissions | 2.3.10.2 |
| BAT 19 | Optimise water use and reduce emissions to soil and water | 2.3.7 |
| BAT 20 | Water treatment techniques and BAT AELs for direct and indirect emissions | 2.3.6 |
| BAT 21 | Emissions from accidents and incidents | 2.3.13 |
| BAT 22 | Material efficiency- substitute materials with waste | 2.3.8 |
| BAT 23 | Energy efficiency techniques | 2.3.9 |
| BAT 24 | Maximise reuse of packaging | 2.3.12 |
| **General BAT conclusions for the mechanical treatment of waste** | | |
| BAT 25 | Techniques to minimise emissions to air (inc BAT-AELs for channelled emissions) | 3.1.3.1 |
| **BAT conclusions for mechanical treatment in shredders of metal waste** | | |
| BAT 26 | Techniques to improve overall environmental performance | 3.1.3.1.3.1 |

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| BAT 27 | Techniques to prevent deflagrations | 3.1.3.1.3.3 |
| BAT 28 | Energy efficiency | 3.1.3.3 |
| **BAT conclusions for the treatment of WEEE containing VFCs and/or VHCs** | | |
| BAT 29 | Techniques to reduce emissions to air<br>(inc BAT-AELs for channelled emissions) | 3.2.3.1 |
| BAT 30 | Techniques to prevent explosions | 3.2.3.2 |
| **BAT conclusions for the mechanical treatment of waste with calorific value** | | |
| BAT 31 | Techniques to reduce emissions to air<br>(inc BAT-AELs for channelled emissions) | 3.3.4.1 |
| **BAT conclusions for the mechanical treatment of WEEE containing mercury** | | |
| BAT 32 | Techniques to reduce mercury emissions to air<br>(inc BAT-AELs for mercury emissions) | 5.8.2.3.1 |
| **General conditions for biological treatment (applies to all biological treatment, including the relevant MBT process)** | | |
| BAT 33 | Overall environmental performance | 4.5.1.1 |
| BAT 34 | Techniques to reduce channelled emissions to air of dust, organic compounds and odorous compounds from biological treatment<br>(inc BAT-AELs for emissions to air) | 4.5.1.4 |
| BAT 35 | Reducing water usage and generation of waste water | 4.5.1.4 |
| **Specific conclusions for aerobic treatment** | | |
| BAT 36 | Improve overall environmental performance | 4.5.2.1 |
| BAT 37 | Reduce odour and diffuse emissions to air | 4.5.2.2 |
| **Specific conclusions for anaerobic treatment** | | |
| BAT 38 | Reduce emissions to air and improve overall environmental performance | 4.5.3.1 |
| **Specific conditions for mechanical biological treatment** | | |
| BAT 39 | Reduce emissions to air | 4.5.4.1 |
| **BAT conclusions for the physico-chemical treatment of solid and/or pasty waste** | | |
| BAT 40 | Improve overall environmental performance by monitoring waste input | 5.1.4.1 |
| BAT 41 | Techniques to reduce emissions to air<br>(inc BAT-AELs for channelled emissions of dust) | 5.1.4.2 |
| **BAT conclusions for the re-refining of waste oil** | | |
| BAT 42 | Improve overall environmental performance by monitoring waste input | 5.2.3.1 |
| BAT 43 | Techniques for waste minimisation | 5.2.3.3 |
| BAT 44 | Techniques to reduce emissions to air | 5.2.3.4 |
| **BAT conclusions for the physico-chemical treatment of waste with calorific value** | | |
| BAT 45 | Techniques to reduce emissions of VOCs to air | 5.3.4.1 |
| **BAT conclusions for the regeneration of spent solvents** | | |
| BAT 46 | Overall environmental performance | 5.4.3.1 |
| BAT 47 | Techniques to reduce emissions to air<br>(inc BAT-AELs for channelled emissions from re-refining of waste oil, physico-chemical treatment of waste with calorific value and regeneration of spent solvents) | 5.4.3.3 |
| **BAT conclusions for the thermal treatment of spent activated carbon, waste catalysts and excavated contaminated land** | | |
| BAT 48 | Overall environmental performance | 5.5.3,<br>5.5.4<br>5.6.3 |
| BAT 49 | Techniques to reduce emissions to air | 5.5.3.1<br>5.5.4.1 |
| **BAT conclusions for the water washing of excavated contaminated soil** | | |
| BAT 50 | Techniques to reduce emissions to air | 5.6.3.1 |
| **BAT conclusions for the decontamination of equipment containing PCBs** | | |
| BAT 51 | Overall environmental performance | 5.8.1.3.1 |
| **BAT conclusions for the treatment of water based liquid waste** | | |
| BAT 52 | Improve overall environmental performance by monitoring waste input | 5.7.3.1 |
| BAT 53 | Techniques to reduce emissions to air<br>(inc BAT-AELs for channelled emissions from the treatment of water based liquid waste) | 5.7.3.2 |

# 1. General BAT conclusions

## 1.1 Overall environmental performance

**BAT 1.**
**In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS) that incorporates all of the following features:**

I. commitment of the management, including senior management;
II. definition, by the management, of an environmental policy that includes the continuous improvement of the environmental performance of the installation;
III. planning and establishing the necessary procedures, objectives and targets, in conjunction with financial planning and investment;
IV. implementation of procedures paying particular attention to:
- (a) structure and responsibility,
- (b) recruitment, training, awareness and competence,
- (c) communication,
- (d) employee involvement,
- (e) documentation,
- (f) effective process control,
- (g) maintenance programmes,
- (h) emergency preparedness and response,
- (i) safeguarding compliance with environmental legislation;

V. checking performance and taking corrective action, paying particular attention to:
- (a) monitoring and measurement (see also the JRC Reference Report on Monitoring of emissions to air and water from IED installations – ROM),
- (b) corrective and preventive action,
- (c) maintenance of records,
- (d) independent (where practicable) internal or external auditing in order to determine whether or not the EMS conforms to planned arrangements and has been properly implemented and maintained;

VI. review, by senior management, of the EMS and its continuing suitability, adequacy and effectiveness;
VII. following the development of cleaner technologies;
VIII. consideration for the environmental impacts from the eventual decommissioning of the plant at the stage of designing a new plant, and throughout its operating life;
IX. application of sectoral benchmarking on a regular basis;
X. waste stream management (see BAT 2);
XI. an inventory of waste water and waste gas streams (see BAT 3);
XII. residues management plan (see description in Section 6.6.5);
XIII. accident management plan (see description in Section 6.6.5);[see also BAT 21]
XIV. odour management plan (see BAT 12);
XV. noise and vibration management plan (see BAT 17).

Applicability
The scope (e.g. level of detail) and nature of the EMS (e.g. standardised or non-standardised) will generally be related to the nature, scale and complexity of the installation, and the range of environmental impacts it may have (determined also by the type and amount of wastes processed).

## BAT 1. - Interpretational Guidance

In order for sites to meet this BAT conclusion we would expect the site to provide an overview of how their EMS meets each of the BAT requirements without supplying the EMS as a whole. If the operator has incorrectly stated that they meet the requirements this will become part of ongoing compliance work.

An EMS can take the form of a standardised or non-standardised (customised) system. Implementation and adherence to an internationally accepted standardised system such as ISO14001 can give higher credibility to the EMS especially when subject to a properly performed external verification. However certification to ISO14001 does not automatically mean that the system meets BAT as this standard only requires that the right framework is in place. The EMS must contain all the features listed above,

Non–standardised systems can be equally effective provided they are properly designed and implemented. Therefore, certification to ISO14001 is not a requirement to comply with this BATC although some operators may prefer a more formal system.

The associated BREF document provides further information in section 2.3.1.1 on the requirements for this BAT conclusion.

## BAT 2.
## In order to improve the overall environmental performance of the plant, BAT is to use all of the techniques given below.

| Technique | | Description |
|---|---|---|
| a. | Set up and implement waste characterisation and pre-acceptance procedures | These procedures aim to ensure the technical (and legal) suitability of waste treatment operations for a particular waste prior to the arrival of the waste at the plant. They include procedures to collect information about the waste input and may include waste sampling and characterisation to achieve sufficient knowledge of the waste composition. Waste pre-acceptance procedures 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, as well as the information provided by the previous waste holder(s). |
| b. | Set up and implement waste acceptance procedures | Acceptance procedures aim to confirm the characteristics of the waste, as identified in the pre-acceptance stage. These procedures define the elements to be verified upon the arrival of the waste at the plant as well as the waste acceptance and rejection criteria. They may include waste sampling, inspection and analysis. Waste acceptance procedures 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, as well as the information provided by the previous waste holder(s). |
| c. | Set up and implement a waste tracking system and inventory | A waste tracking system and inventory aim to track the location and quantity of waste in the plant. It holds all the information generated during waste pre-acceptance procedures (e.g. date of arrival at the plant and unique reference number of the waste, information on the previous waste holder(s), pre-acceptance and acceptance analysis results, intended treatment route, nature and quantity of the waste held on site including all identified hazards), acceptance, storage, treatment and/or transfer off site. The waste tracking system is 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, as well as the information provided by the previous waste holder(s). |
| d. | Set up and implement an output quality management system | This technique involves setting up and implementing an output quality management system, so as to ensure that the output of the waste treatment is in line with the expectations, using for example existing EN standards. This management system also allows the performance of the waste treatment to be monitored and optimised, and for this purpose may include a material flow analysis of relevant components throughout the waste treatment. The use of a material flow analysis is 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, as well as the information provided by the previous waste holder(s). |
| e. | Ensure waste segregation | Waste is kept separated depending on its properties in order to enable easier and environmentally safer storage and treatment. Waste segregation relies on the physical separation of waste and on procedures that identify when and where wastes are stored. |
| f. | Ensure waste compatibility prior to mixing or blending of waste | Compatibility is ensured by a set of verification measures and tests in order to detect any unwanted and/or potentially dangerous chemical reactions between wastes (e.g. polymerisation, gas evolution, exothermal reaction, decomposition, crystallisation, precipitation) when mixing, blending or carrying out other treatment operations. The 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, as well as the information provided by the previous waste holder(s). |
| g. | Sort incoming solid waste | Sorting of incoming solid waste (1) aims to prevent unwanted material from entering subsequent waste treatment process(es). It may include:<br>- manual separation by means of visual examinations;<br>-- ferrous metals, non-ferrous metals or all-metals separation;<br>- optical separation, e.g. by near-infrared spectroscopy or X-ray systems;<br>- density separation, e.g. by air classification, sink-float tanks, vibration tables;<br>- size separation by screening/sieving. |
| (1) Sorting techniques are described in Section 6.6.4 | | |

## BAT 2 - Interpretational Guidance

This BAT conclusion applies to management of incoming waste inputs, quality of outputs from the process and wastes generated on site.

Note the use of the phrase "*using all of the techniques given*" in this BAT, the expectation is that this will include all of the requirements (a) – (g) identified in BAT 2.

Pre-acceptance and acceptance criteria are important to ensure good quality output and good process control. The nature of these checks should be proportionate to the risk of negative impacts on the process or emissions, and the scale and types of waste being accepted (i.e. hazardous wastes, etc.).

Output quality management system- this is important to ensure outputs meet with relevant standards or defined specifications. The system may refer to the standard that the outputs must meet and detail how this will be consistently achieved. For example, specifications for PAS100, PAS110, End of waste criteria, RDF or SRF (where appropriate) may be referred to.

Sorting may include manual picking and mechanical sorting or depackaging.

It should be emphasised that sites managing and treating hazardous waste will come under additional scrutiny in relation to this aspect of their operation.

Additional guidance for Operators managing clinical waste is in development and, when published, should be adhered to.

**BAT 3.**
**In order to facilitate the reduction of emissions to water and air, BAT is to establish and to maintain an inventory of waste water and waste gas streams, as part of the environmental management system (see BAT 1), that incorporates all of the following features:**

(i) information about the characteristics of the waste to be treated and the waste treatment processes, including:
- (a) simplified process flow sheets that show the origin of the emissions;
- (b) descriptions of process-integrated techniques and waste water/waste gas treatment at source including their performances;

(ii) information about the characteristics of the waste water streams, such as:
- (a) average values and variability of flow, pH, temperature, and conductivity;
- (b) average concentration and load values of relevant substances and their variability (e.g. COD/TOC, nitrogen species, phosphorus, metals, priority substances / micropollutants);
- (c) data on bioeliminability (e.g. BOD, BOD to COD ratio, Zahn-Wellens test, biological inhibition potential (e.g. inhibition of activated sludge)) (see BAT 52);

(iii) information about the characteristics of the waste gas streams, such as:
- (a) average values and variability of flow and temperature;
- (b) average concentration and load values of relevant substances and their variability (e.g. organic compounds, POPs such as PCBs);
- (c) flammability, lower and higher explosive limits, reactivity;
- (d) presence of other substances that may affect the waste gas treatment system or plant safety (e.g. oxygen, nitrogen, water vapour, dust).

Applicability
The scope (e.g. level of detail) and nature of the inventory will generally be related to the nature, scale and complexity of the installation, and the range of environmental impacts it may have (determined also by the type and amount of wastes processed).

**BAT 3- Interpretational Guidance**

The main purpose of this BAT is to identify the specific composition and quantity of waste water and waste gas streams generated by the regulated activity, and their possible impacts. SEPA expects all sites to have an inventory which includes details on the components of the emission, their concentration, and for indirect discharges to water where it is treated and what happens to the constituent parts. You should include a copy of your trade effluent consent and either the CAR licence of the treatment facility or a permit reference number.

The inventory is key as it forms the basis of what is required to be monitored under BAT 7 and BAT 8. For certain substances, if it is not listed in the inventory, it will not be required to be monitored. When reviewing the monitoring requirements, you must cross reference the parameters in BAT 7 and 8 to check whether they are “always in” or can be ruled out.

Note the use of the phrase “using all of following features” in this BAT, the expectation is that this will include all of the requirements in (i) – (iii) identified in BAT 3. The level of detail required will be relative to the risk of the waste and the process being used.

For existing sites this information may be determined through historic sampling results or through more detailed monitoring. For new sites this may be done through a desktop evaluation of the possible content of emissions with monitoring once the site is operational to confirm the outcome of the desktop exercise.

A “process-integrated technique” is one that controls emissions as part of the process rather than an end-of -pipe abatement, e.g. controlling the temperature of a reaction or the use of specific equipment. The response should link the waste water / gas with the associated waste treatment process on site.

Emissions to water and air identified as part of the inventory can be used to determine whether associated AELs and/or monitoring should be incorporated into the permit. This BATc is applicable to both direct and indirect emissions - diffuse releases as well as channelled emissions i.e. If the inventory identifies diffuse releases which have the potential for off-site impact these should be sufficiently characterised along with the channelled emissions.

The inventory of waste water and gas emissions links to other BATc’s, for example, BAT 8 - the requirement to monitor channelled emissions to air; BAT 14- for reduction and containment where feasible/possible and LDAR.

Expanding on BAT 14 as an example, the operator is required to identify the characteristics of known or predicted emissions and where possible, quantify them. Any assumptions will need to be set out, for example, quantifying and characterising emissions from leakage from a building or for open processes. We expect such work to be informed using LDAR and be risk-based as per the ‘applicability’ criteria in BAT 3.

We would expect operators to retain the design specifications of all abatement equipment. This BAT does not apply to discharges associated with uncontaminated surface runoff only. Further clarification can be found in the BREF document in section 2.3.1.2.

Anaerobic digestion plant operators must consider their biogas clean-up process and the associated emissions. These include $CO_2$ and whether this is vented to atmosphere or captured.

**BAT 4.**
**In order to reduce the environmental risk associated with the storage of waste, BAT is to use all of the techniques given below.**

| Technique | | Description | Applicability |
|---|---|---|---|
| a. | Optimised storage location | This includes techniques such as:<br>- the storage is located as far as technically and economically possible from sensitive receptors, watercourses, etc.;<br>- the storage is located in such a way so as to eliminate or minimise the unnecessary handling of wastes within the plant (e.g. the same wastes are handled twice or more or the transport distances on site are unnecessarily long). | Generally applicable to new plants. |

| | | | |
|---|---|---|---|
| b. | Adequate storage capacity | Measures are taken to avoid accumulation of waste, such as:<br>- the maximum waste storage capacity is clearly established and not exceeded taking into account the characteristics of the wastes (e.g. regarding the risk of fire) and the treatment capacity;<br>- the quantity of waste stored is regularly monitored against the maximum allowed storage capacity;<br>- the maximum residence time of waste is clearly established. | Generally applicable |
| c. | Safe storage operation | This includes measures such as:<br>- equipment used for loading, unloading and storing waste is clearly documented and labelled;<br>- wastes known to be sensitive to heat, light, air, water, etc. are protected from such ambient conditions;<br>- containers and drums are fit for purpose and stored securely. | |
| d. | Separate area for storage and handling of packaged hazardous waste | When relevant, a dedicated area is used for storage and handling of packaged hazardous | |

**BAT 4- Interpretational Guidance**

Note the use of the phrase “using all of the techniques given” in this BAT, the expectation is that this will include all of the requirements (a) – (d) identified in BAT 4. The technique identified in (a) generally only applies to new plants but may be considered for significant upgrades.

Technique (a): existing sites are encouraged to review this if there are opportunities to improve material handling.

Technique (b): sites should consider contingency measures in the event that storage capacity is reached. When considering maximum residence time, particularly when handling putrescible waste, sites should be operating on a ‘first in first out’ basis. BAT 13 refers to minimising residence time to manage odour emissions which could include a first in, first out rule.

**BAT 5.**
**In order to reduce the environmental risk associated with the handling and transfer of waste, BAT is to set up and implement handling and transfer procedures.**

Description

Handling and transfer procedures aim to ensure that wastes are safely handled and transferred to the respective storage or treatment. They include the following elements:

- handling and transfer of waste are carried out by competent staff;
- handling and transfer of waste are duly documented, validated prior to execution and verified after execution;
- measures are taken to prevent, detect and mitigate spills;
- operation and design precautions are taken when mixing or blending wastes (e.g. vacuuming dusty/powdery wastes).

Handling and transfer procedures are risk-based considering the likelihood of accidents and incidents and their environmental impact.

**BAT 5- Interpretational Guidance**

This BAT conclusion relates to receipt, handling and transfer within the site.

Documented procedures will include:

- Duty of Care waste transfer notes,
- special waste consignment notes,
- WM3 Hazard Assessments and
- material safety data sheets where appropriate.

The BAT conclusion sets out requirements to be met with evidence required from the operator with the BRef itself setting out more detailed requirements in 2.3.2.

Sites should have established procedures in place for waste pre-acceptance and acceptance under BAT 2.

## 1.2 Monitoring

**BAT 6.**

For relevant emissions to water as identified by the inventory of waste water streams (see BAT 3), BAT is to monitor key process parameters (e.g. waste water flow, pH, temperature, conductivity, BOD) at key locations (e.g. at the inlet and/or outlet of the pre-treatment, at the inlet to the final treatment, at the point where the emission leaves the installation).

**BAT 6- Interpretational Guidance**

This refers back to the inventory in BAT 3 and highlights the need to ensure that this accurately reflects all relevant chemical and biological substances as well as physical parameters.

This requires the operator to identify what factors in the process can influence the quality/quantity of the emissions and determine the optimal operating conditions. To determine if the parameter or location is key you should consider the impact it may have on the operation of the process or the emissions.

This is not the same as monitoring the emission for prescribed substances. This is covered in BAT 7.

**BAT 7.**
**BAT is to monitor emissions to water with at least the frequency given below, and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.**

| Substance/ parameter | Standard(s) | Waste treatment process | Minimum monitoring frequency (1) (2) | Monitoring associated with |
|---|---|---|---|---|
| Adsorbable organically bound halogens (AOX) (3) (4) | EN ISO 9562 | Treatment of water based liquid waste | Once every day | BAT 20 |
| Benzene, toluene, ethylbenzene, xylene (BTEX) (3) (4) | EN ISO 15680 | Treatment of water based liquid waste | Once every month | |
| Chemical oxygen demand (COD) (5) (6) | No EN standard available | All waste treatments except treatment of water based liquid waste | Once every month | |
| | | Treatment of water based liquid waste | Once every day | |
| Free cyanide (CN-) (3) (4) | Various EN standards available (i.e. EN ISO 14403-1 and -2) | Treatment of water based liquid waste | Once every day | |
| Hydrocarbon oil index (HOI) (4) | EN ISO 9377-2 | Mechanical treatment in shredders of metal waste | Once every month | |
| | | Treatment of WEEE containing VFCs and/or VHCs | | |
| | | Re-refining of waste oil | | |
| | | Physico-chemical treatment of waste with calorific value | | |
| | | Water washing of excavated contaminated soil | | |
| | | Treatment of water based liquid waste | Once every day | |
| Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Nickel (Ni), Lead (Pb), Zinc (Zn) (3) (4) | Various EN standards available (e.g. EN ISO 11885, EN ISO 17294-2, EN ISO 15586) | Mechanical treatment in shredders of metal waste | Once every month | |
| | | Treatment of WEEE containing VFCs and/or VHCs | | |
| | | Mechanical biological treatment of waste | | |
| | | Re-refining of waste oil | | |
| | | Physico-chemical treatment of waste with calorific value | | |

| | | | | | |
|---|---|---|---|---|---|
| | | Physico-chemical treatment of solid and/or pasty waste | | | |
| | | Regeneration of spent solvents | | | |
| | | Water washing of excavated contaminated soil | | | |
| | | Treatment of water based liquid waste | Once every day | | |
| Manganese (Mn) (3) (4) | | Treatment of water based liquid waste | Once every day | | |
| Hexavalent chromium (Cr(VI)) (3) (4) | Various EN standards available (i.e. EN ISO 10304-3, EN ISO 23913) | Treatment of water based liquid waste | Once every day | | |
| Mercury (Hg) (3) (4) | Various EN standards available (i.e. EN ISO 17852, EN ISO 12846) | Mechanical treatment in shredders of metal waste | Once every month | | |
| | | Treatment of WEEE containing VFCs and/or VHCs | | | |
| | | Mechanical biological treatment of waste | | | |
| | | Re-refining of waste oil | | | |
| | | Physico-chemical treatment of waste with calorific value | | | |
| | | Physico-chemical treatment of solid and/or pasty waste | | | |
| | | Regeneration of spent solvents | | | |
| | | Water washing of excavated contaminated soil | | | |
| | | Treatment of water based liquid waste | Once every day | | |
| PFOA (3) | No EN standard available | All waste treatments | Once every six months | | |
| PFOS (3) | | | | | |
| Phenol index (6) | EN ISO 14402 | Re-refining of waste oil | Once every month | | |
| | | Physico-chemical treatment of waste with calorific value | | | |
| | | Treatment of water based liquid waste | Once every day | | |
| Total nitrogen (Total N) (6) | EN 12260, EN ISO 11905-1 | Biological treatment of waste | Once every month | | |
| | | Re-refining of waste oil | | | |
| | | Treatment of water based liquid waste | Once every day | | |
| Total organic carbon (TOC) (5) (6) | EN 1484 | All waste treatments except | Once every month | | |

| | | | | |
|---|---|---|---|---|
| | | treatment of water based liquid waste | | |
| | | Treatment of water based liquid waste | Once every day | |
| Total phosphorus (Total P) (6) | Various EN standards available (i.e. EN ISO 15681-1 and -2, EN ISO 6878, EN ISO 11885) | Biological treatment of waste | Once every month | |
| | | Treatment of water based liquid waste | Once every day | |
| Total suspended solids (TSS) (6) | EN 872 | All waste treatments except treatment of water based liquid waste | Once every month | |
| | | Treatment of water based liquid waste | Once every day | |

(1) Monitoring frequencies may be reduced if the emission levels are proven to be sufficiently stable.
(2) In the case of batch discharge less frequent than the minimum monitoring frequency, monitoring is carried out once per batch.
(3) The monitoring only applies when the substance concerned is identified as relevant in the waste water inventory mentioned in BAT 3.
(4) In the case of indirect discharge to a receiving water body, the monitoring frequency may be reduced if the downstream wastewater treatment plant abates the pollutants concerned.
(5) Either TOC or COD is monitored. TOC is the preferred option as its monitoring does not rely on the use of very toxic compounds.
(6) The monitoring applies only in the case of a direct discharge to a receiving water body.

## BAT 7- Interpretational Guidance

BAT 7 details the minimum monitoring frequency for listed substances from specified processes. This applies to both direct and indirect **channelled** emissions to water and links to BAT 20 which has BAT-AELs for direct discharges in table 6.1 and BAT-AELs for indirect discharges in table 6.2.

There are no BAT-AELs for diffuse emissions, e.g. surface runoff since the AELs in BAT20 only relate to channelled emissions. These are controlled by BAT 19 which has measures to reduce emissions to soil and water including requirements for impermeable surfaces and adequate drainage infrastructure. (This is important for metal shredders and any site dealing with putrescible wastes/hazardous wastes)

Note that these are minimum monitoring frequencies. Higher frequency may be required for particularly sensitive receptors. That said, footnote (1) allows a reduction in monitoring frequency where the emission level is sufficiently stable.

Where monitoring is required once every day and the discharge is continuous, this must be a composite sample taken over 24 hours.

The BAT review also has to take into consideration Priority Hazardous Substances and Hazardous Substances considerations under CAR (WAT-SG-53). This could add additional pollutants and monitoring requirements.

Deviations to these monitoring standards and frequencies requested by the operator will require a permit variation.

Footnote (1) - These are for both direct and indirect emissions to water and are applicable to those waste streams as identified as relevant in BAT 3. Emissions will be considered

"sufficiently stable" if they can be shown to be consistently below the BAT-AEL range with only small variation (to demonstrate stable and consistent process operation) on the basis of historical monitoring data or an accelerated sampling regime. The JRC Reference Report on Monitoring of Emissions to Air and Water from IED Installations sets out the principles behind monitoring for both emissions to air and water. We require as minimum three years data if the sampling is once a month or more. If it is less frequent then we would require at least 5 years of data. Changes to monitoring frequency will be considered after assessing the variability of results and how close they are to the limit.

A reduction in monitoring frequency will not be granted where continuous quantitative or indicative monitoring is required. These types of monitoring are needed to demonstrate at all times when the plant is operating, that either the emission limits are being complied with or that the arrestment equipment is functioning correctly.

Footnote (3) - BAT 3 will identify waste water streams likely to require monitoring. For certain parameters, e.g. PFOA/PFOS, monitoring only applies when the substance concerned is identified as relevant,. If it is relevant, then it should be monitored unless it can be shown to be “sufficiently stable” at a suitable level, or cause harm to human health or the environment. Operators may need to vary their permit if new or significantly changed waste streams are proposed.

Footnote (4) - If consented discharges (a trade effluent discharge consent) to sewer are assessed and substances are screened out as being “insignificant”, taking into account the relevant sewage treatment reduction factor for the works, then including the BAT AELs and associated monitoring requirements for those substances (as set in Table 6.2 and BAT 7) in the permit would not be mandatory. BAT 3 will identify waste water streams likely to be considered. However ELVs may need to be placed in order to ensure that discharge is to BAT taking into account treatment effectiveness of the receiving works.

The operator must show they comply with the BAT AEL using one of the following methods:

The operator can choose to analyse their effluent stream prior to passing it to a third party (the sewage undertaker) on a continuing basis. An operator may choose this option as they may be required by the sewage undertaker to sample their effluent or they may analyse their effluent as a method of process control. This should include and is not limited to the AEL analytes as listed.

• The operator can show by means of treatment factors that the limits associated with the BAT conclusion can be achieved. The provision of some historical data on the typical concentrations leaving site and the typical treatment factors can be used as a demonstration of compliance. An improvement condition will be set in the permit that requires periodic confirmation that the method used to show BAT AEL compliance remains valid.

Note the preference to measuring TOC over COD. Part of a group of parameters that are tested for only in direct discharges to water.

**BAT 8.**
**BAT is to monitor channelled emissions to air with at least the frequency given below, and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.**

| Substance/Parameter | Standard(s) | Waste treatment process | Minimum monitoring frequency (1) | Monitoring associated with |
|---|---|---|---|---|
| Brominated flame retardants (2) | No EN standard available | Mechanical treatment in shredders of metal waste | Once every year | BAT 25 |
| CFCs | No EN standard available | Treatment of WEEE containing VFCs and/or VHCs | Once every six months | BAT 29 |
| Dioxin-like PCBs | EN 1948-1, -2, and -4 (3) | Mechanical treatment in shredders of metal waste (2) | Once every year | BAT 25 |
| | | Decontamination of equipment containing PCBs | Once every three months | BAT 51 |
| Dust | EN 13284-1 | Mechanical treatment of waste | Once every six months | BAT 25 |
| | | Mechanical biological treatment of waste | | BAT 34 |
| | | Physico-chemical treatment of solid and/or pasty waste | | BAT 41 |
| | | Thermal treatment of spent activated carbon, waste catalysts and excavated contaminated soil | | BAT 49 |
| | | Water washing of excavated contaminated soil | | BAT 50 |
| HCl | EN 1911 | Thermal treatment of spent activated carbon, waste catalysts and excavated contaminated soil (2) | Once every six months | BAT 49 |
| | | Treatment of water-based liquid waste (2) | | BAT 53 |
| HF | No EN standard available | Thermal treatment of spent activated carbon, waste catalysts and excavated contaminated soil (2) | Once every six months | BAT 49 |
| Hg | EN 13211 | Treatment of WEEE containing mercury | Once every three months | BAT 32 |
| $H_2S$ | No EN standard available | Biological treatment of waste (4) | Once every six months | BAT 34 |
| Metals and metalloids Except mercury (e.g. As, Cd, Co, Cr, Cu, Mn, Ni, Pb, Sb, Se, Tl, V) (2) | EN 14385 | Mechanical treatment in shredders of metal waste | Once every year | BAT 25 |
| $NH_3$ | No EN standard available | Biological treatment of waste (4) | Once ever six months | BAT 34 |

| | | | | |
|---|---|---|---|---|
| | | Physico-chemical treatment of solid and/or pasty waste (2) | Once every six months | BAT 41 |
| | | Treatment of water-based liquid waste (2) | | BAT 53 |
| Odour concentration | EN 13725 | Biological treatment of waste (5) | Once every six months | BAT 34 |
| PCDD/F (2) | EN 1948- 1, -2 and -3 (3) | Mechanical treatment in shredders of metal waste | Once every year | BAT 25 |
| TVOC | EN 12619 | Mechanical treatment in shredders of metal waste | Once every six months | BAT 25 |
| | | Treatment of WEEE containing VFCs and/or VHCs | Once every six months | BAT 29 |
| | | Mechanical treatment of waste with calorific value (2) | Once every six months | BAT 31 |
| | | Mechanical biological treatment of waste | Once every six months | BAT 34 |
| | | Physico-chemical treatment of solid and/or pasty waste (2) | Once every six months | BAT 41 |
| | | Re-refining of waste oil | | BAT 44 |
| | | Physico-chemical treatment of waste with calorific value | | BAT 45 |
| | | Regeneration of spent solvents | | BAT 47 |
| | | Thermal treatment of spent activated carbon, waste catalysts and excavated contaminated soil | | BAT 49 |
| | | Water washing of excavated contaminated soil | | BAT 50 |
| | | Treatment of water-based liquid waste (2) | | BAT 53 |
| | | Decontamination of equipment containing PCBs (6) | Once every three months | BAT 51 |

(1) Monitoring frequencies may be reduced if the emission levels are proven to be sufficiently stable.
(2) The monitoring only applies when the substance concerned is identified as relevant in the waste gas stream based on the inventory mentioned in BAT 3.
(3) Instead of EN 1948-1, sampling may also be carried out according to CEN/TS 1948-5.
(4) The odour concentration may be monitored instead.
(5) The monitoring of $NH_3$ and $H_2S$ can be used as an alternative to the monitoring of the odour concentration.
(6) The monitoring only applies when solvent is used for cleaning the contaminated equipment.

## BAT 8- Interpretational Guidance

Channelled emissions are defined as:

'*Emissions of pollutants into the environment through any kind of duct, pipe, stack, etc. This also includes emissions from open-top biofilters.*' (see BAT conclusions Interpretation section).

We will refer to “point source emissions” rather than channelled emissions in our permits and our guidance.

These are direct emissions to air and are applicable to those waste streams as identified as relevant in BAT 3.

The requirements of the Medium Combustion Plant Directive ((EU) 2015/2193) may also apply to CHPs as these are classed as engines burning gaseous fuels other than natural gas. This sets emission limits for $SO_2$ and $NO_x$ where each engine is greater than 1MWth. Other types of activity may have other types of combustion processes, e.g. a boiler to heat oil for a separation process, which may fall under the MCPD if it is above the threshold.

A reduction in monitoring frequency will not be granted where continuous quantitative or indicative monitoring is required. These types of monitoring are needed to demonstrate at all times when the plant is operating, that either the emission limits are being complied with or that the arrestment equipment is functioning correctly.

Footnote (2) The requirement to monitor certain parameters, e.g. brominated flame retardants and PCDD/F, or specific substances from specific processes only applies where they have been identified as relevant in the inventory. All other monitoring requirements apply however the frequency of monitoring may be reduced under footnote 1 if the emission can be shown to be “sufficiently stable” at a suitable level, or cause harm to human health or the environment. Operators may need to vary their permit if new or significantly changed waste streams are proposed.

This may include monitoring from a process stack associated with shredding or a biofilter, etc.

Footnotes (4) & (5) For Biological Treatment sites the monitoring of $NH_3$ and $H_2S$ can be used as an alternative to the monitoring of the odour concentration and vice versa. The appropriate parameters to monitor should be based on the components of the waste gases which are found to be significant in the BAT 3 emissions inventory and the type of abatement equipment employed to treat the emissions.

Operators will need to justify that their monitoring demonstrates the continued efficacy of their abatement equipment, and that the environment is protected.

This links with BAT 34 setting AEL’s for odour concentration and ammonia. An AEL for $H_2S$ is not set in BAT 34 however SEPA can consider setting one if deemed appropriate.

**BAT 9.**
**BAT is to monitor diffuse emissions of organic compounds to air from regeneration of spent solvents, the decontamination of equipment containing PCBs with solvents and the physico-chemical treatment of solvents for the recovery of their calorific value, at least once per year using one or a combination of the techniques given below:**

| Technique | | Description |
|---|---|---|
| a | Measurement | Sniffing methods, optical gas imaging, solar occultation flux or differential absorption. See descriptions in Section 6.2. |
| b | Emissions factors | Calculation of emissions based on emissions factors, periodically validated (e.g. once every two years) by measurements. |

| | | |
|---|---|---|
| c | Mass balance | Calculation of diffuse emissions using a mass balance considering the solvent input, channelled emissions to air, emissions to water, the solvent in the process output, and process (e.g. distillation) residues |

**BAT 9- Interpretational Guidance**

'Organic compounds' are any compounds containing at least the element carbon and one or more of hydrogen, halogens, oxygen, sulphur, phosphorus, silicon, or nitrogen, with the exception of carbon oxides and inorganic carbonates and bicarbonates

'Spent solvents' is to be understood as including all those wastes from organic substances used as solvents, also including those used in organic chemical processes and from manufacture, formulation, supply, and those used in coatings (paints, varnishes and vitreous enamels), adhesives, sealants and printing inks. Solvents include aromatic hydrocarbons (e.g, benzene), chlorofluorocarbons, esters, ether, glycol, alcohols and organic acids.

**BAT 10.**
**BAT is to periodically monitor odour emissions.**

Description

Odour emissions can be monitored using:

- EN standards (e.g. dynamic olfactometry according to EN 13725 in order to determine the odour concentration or EN 16841-1 or -2 in order to determine the odour exposure);
- when applying alternative methods for which no EN standards are available (e.g. estimation of odour impact), ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.

The monitoring frequency is determined in the odour management plan (see BAT 12).

Applicability

The applicability is restricted to cases where an odour nuisance at sensitive receptors is expected and/or has been substantiated.

**BAT 10- Interpretational Guidance**

Applicability: SEPA interprets this to mean that the requirements of BAT 10 are applicable where there is a risk of odours from a process having a negative impact on receptors and/or a negative impact has been substantiated. Permits generally have a standard condition relating to odour outside the process boundary.

Once the requirement to carry out odour monitoring has been established the operator must justify the locations and frequency for the monitoring in the Odour Management Plan (OMP) required by BAT 1 (EMS) and BAT 12. See BAT 12 below for information regarding OMP's.

Whilst SEPA do not formally approve an OMP, we will intervene if the monitoring set out in the OMP is not considered adequate.

In the case were there is a risk of, or evidence that, sensitive receptors are impacted, we may stipulate monitoring frequency along with odour limits and or an engineering assessment of improvements that can be made to address odour impact.

Monitoring should take account of distance from sensitive receptors and prevailing wind direction.

BAT8 relates to odour monitoring from channelled emissions every six months as identified in the BAT3 inventory. BAT10 relates to odour monitoring from all sources, including diffuse emissions. The frequency may be set out in the OMP but may be a combination of daily olfactory assessments and regular sampling and testing. However, the permit should stipulate monitoring frequency as we can enforce against this.

The wording is that odour "***can*** *be monitored using EN standards…[or] …alternative methods…that ensure data of an equivalent scientific quality*". This does not make dynamic olfactometry a requirement. It would depend on the site and the potential for odour nuisance as to whether formal EN monitoring would be required. Note that there is no option to substitute $NH_3$ and $H_2S$ instead of odour in BAT10 as there is in BAT 8.

Guidance on regulating odour is available on the SEPA website..

**BAT 11.**
**BAT is to monitor the annual consumption of water, energy and raw materials as well as the annual generation of residues and waste water, with a frequency of at least once per year.**

Description

Monitoring includes direct measurements, calculation or recording, e.g. using suitable meters or invoices. The monitoring is broken down at the most appropriate level (e.g. at process or plant/installation level) and considers any significant changes in the plant/installation.

**BAT 11- Interpretational Guidance**

Many sites already submit quarterly waste returns to SEPA. This has proven to be extremely successful and is generally accepted by sites. SEPA considers gathering quarterly information on resource use to be best practice. By compiling information on a quarterly basis it makes compiling an annual report much easier.

Note that this is a requirement to monitor but not necessarily reduce. However, once a company records how much energy, raw materials or waste is costing them they may be encouraged to seek ways to reduce this. Techniques for the prevention or reduction of consumption of raw materials and chemicals are outlined in section 2.3.8.

SEPA will normally put a monitoring requirement in permits- see here.

## 1.3 Emissions to air

**BAT 12.**
**In order to prevent or, where that is not practicable, to reduce odour emissions, BAT is to set up, implement and regularly review an odour management plan, as part of the environmental management system (see BAT 1), that includes all of the following elements:**

- a protocol containing actions and timelines;
- a protocol for conducting odour monitoring as set out in BAT 10;
- a protocol for response to identified odour incidents, e.g. 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/or reduction measures.

Applicability

The applicability is restricted to cases where an odour nuisance at sensitive receptors is expected and/or has been substantiated.

**BAT 12- Interpretational Guidance**

Applicability: SEPA interprets this to mean that the requirements of BAT 12 are applicable where there is a risk of odours from a process having a negative impact on receptors and/or a negative impact has been substantiated. Permits generally have a standard condition relating to odour outside the process boundary.

If an Odour Management Plan (OMP) is already in place and is fit for purpose, then this will suffice in meeting the requirements of this BAT conclusion. This would also form part of the EMS checks in BAT 1.

SEPA does not formally approve OMP's and it is the responsibility of the permit holder to ensure it is fit for purpose. However, we will intervene if the OMP is not considered adequate. Certain sectors would require an OMP regardless of whether there has been a complaint due to the nature of the activity, such as biological treatment of waste. The OMP would detail the likely sources, receptors and the mitigation measures / abatement in place. The OMP will also list the procedure for taking action following a substantiated odour complaint. This would include the requirements of the BAT conclusions.

Further detail on OMP's can be found in the BREF document in section 2.3.5.1. There is also further information in the following documents:
SEPA's Odour Guidance – Appendix 4
Environment Agency Document H4: Odour Management, particularly Appendix 4.

It should be emphasised that identifying the source should build on data acquired as part of complying with BAT3. We expect operators of sites which have the potential to cause odours to have a forensic understanding of the characteristics of their emissions to air so as to assist in effective odour management.

**BAT 13. In order to prevent or, where that is not practicable, to reduce odour emissions, BAT is to use one or a combination of the techniques given below.**

| Technique | | Description | Applicability |
|---|---|---|---|
| a. | Minimising residence times | Minimising the residence time of (potentially) odorous waste in storage or in handling systems (e.g. pipes, tanks, containers), in particular under anaerobic conditions. When relevant, adequate provisions are made for the acceptance of seasonal peak volumes of waste. | Only applicable to open systems. |
| b. | Using chemical treatment | Using chemicals to destroy or to reduce the formation of odorous compounds (e.g. to oxidise or to precipitate hydrogen sulphide). | Not applicable if it may hamper the desired output quality. |
| c. | Optimising aerobic treatment | In the case of aerobic treatment of water based liquid waste, it may include:<br>- use of pure oxygen;<br>- removal of scum in tanks;<br>- frequent maintenance of the aeration system.<br>In the case of aerobic treatment of waste other than water-based liquid waste, see BAT 36. | Generally applicable |

**BAT 13- Interpretational Guidance**

a) Minimising residency times – as indicated previously, it is critical that the Operator is able to demonstrate that the installation is operated on a "first in - first out" principle. In relation to peak seasonal volumes of organic/putrescible waste – sites receiving such waste should have a well-developed contingency plan - should something happen on site (e.g. break down) waste volumes can be redirected without large quantities building up on site leading to extended residency times and odour.

Note that BAT 14 also relates to diffuse emissions of odour.

This indicative BAT and other techniques may be more appropriate. Consideration should follow SEPA's odour guidance. There are some plants where thermal treatment, biofilters or activated carbon may be more appropriate.

b) Using chemical treatments such as masking and neutralising agents is not generally considered to represent the use of BAT. SEPA's Odour Guidance Appendix 4 provides information on situations where the use of these types of agents may be appropriate. The use of chemical treatments to destroy or to reduce the formation of odorous compounds at source may form part of a more comprehensive emissions treatment plan. Chemical treatment may not be suitable in all cases, e.g. in biological processes as it may affect the ability of the microbes to break down the waste.

The success of implementing these techniques will in part depend on the understanding of the composition of the waste air stream which is to be treated hence the importance of BAT 3. This could be with the use of a chemical scrubber or with the use of dosing up stream to reduce the potential of odour formation. These techniques should meet those listed in BAT 13 and form part of the sites operating techniques.

BAT 13 states "use one or a combination of techniques given below". Applicability varies for techniques a and b. Sites should report on the applicability of each technique to their operations and should apply any which are suitable.

An enclosed system is one where all waste is contained through storage and treatment. The waste would be moved using a sealed pipework system and odorous gases are ducted to an abatement process.

An open system may use skips, hoppers or other open containers, there may be movement of waste using loading shovels.

See 2.3.5.2 of the BRef for further information on the techniques referred to above, and others.

For more information on minimising the residence time of putrescible waste in storage, see Section 4.5.1.2.

**BAT 14.**
**In order to prevent or, where that is not practicable, to reduce diffuse emissions to air, in particular of dust, organic compounds and odour, BAT is to use an appropriate combination of the techniques given below.**

Depending on the risk posed by the waste in terms of diffuse emissions to air, BAT 14d is especially relevant.

| Technique | | Description | Applicability |
|---|---|---|---|
| a. | Minimising the number of potential diffuse emission sources | This includes techniques such as:<br>- appropriate design of piping layout (e.g. minimising pipe run length, reducing the number of flanges and valves, using welded fittings and pipes);<br>- favouring the use of gravity transfer rather than using pumps;<br>- limiting the drop height of material;<br>- limiting traffic speed;<br>- using wind barriers. | Generally applicable. |
| b | Selection and use of high-integrity equipment | This includes techniques such as:<br>- valves with double packing seals or equally efficient equipment;<br>- high-integrity gaskets (such as spiral wound, ring joints) for critical applications;<br>- pumps/compressors/agitators fitted with mechanical seals instead of packing;<br>- magnetically driven pumps/ compressors/agitators;<br>- appropriate service hose access ports, piercing pliers, drill heads, e.g. when degassing WEEE containing VFCs and/or VHCs. | Applicability may be restricted in the case of existing plants due to operability requirements |
| c. | Corrosion prevention | This includes techniques such as:<br>- appropriate selection of construction materials;<br>- lining or coating of equipment and painting of pipes with corrosion inhibitors. | Generally applicable. |
| d. | Containment, collection and | This includes techniques such as:<br>- storing, treating and handling waste and material that may | The use of enclosed equipment or buildings may |

| | | | |
|---|---|---|---|
| | treatment of diffuse emissions | generate diffuse emissions in enclosed buildings and/or enclosed equipment (e.g. conveyor belts);<br>- maintaining the enclosed equipment or buildings under an adequate pressure.<br>- collecting and directing the emissions to an appropriate abatement system (see Section 6.6.1) via an air extraction system and/or air suction systems close to the emission sources. The use of enclosed equipment or buildings may be restricted by safety considerations such as the risk of explosion or oxygen depletion. | also be constrained by the volume of waste. |
| e. | Dampening | Dampening potential sources of diffuse dust emissions (e.g. waste storage, traffic areas, and open handling processes) with water or fog. | Generally applicable. |
| f. | Maintenance | This includes techniques such as:<br>- ensuring access to potentially leaky equipment;<br>- regularly controlling protective equipment such as lamellar curtains, fast-action doors. | Generally applicable. |
| g. | Cleaning of waste treatment and storage areas | This includes techniques such as regularly cleaning the whole waste treatment area (halls, traffic areas, storage areas, etc.), conveyor belts, equipment and containers. | Generally applicable. |
| h. | Leak detection and repair (LDAR) programme | See Section 6.6.2. When emissions of organic compounds are expected, a LDAR programme is set up and implemented using a risk-based approach, considering in particular the design of the plant and the amount and nature of the organic compounds concerned. | Generally applicable. |

**BAT 14- Interpretational Guidance**

BAT 14 states “use an appropriate combination of techniques given below”. Applicability varies for each of the techniques, a – h. Sites should report on the applicability of each technique to their operations and should apply any which are suitable.

The appropriate combination would consider the volume of air to be treated as well as the process being undertaken. This would include a combination of those techniques listed in the associated table.

The environmental management plan should reflect the requirements of BAT 14. Further detail of the requirements to reduce diffuse emissions can be found in the BREF document in section 2.3.5.3.

All valves/vents should meet international standard API2000 or ISO28300.

Corrosion protection: may also include ducting laid to fall so moisture doesn't pool, with knockout pots for air streams with high moisture content.

Operators of anaerobic digestion plants should implement a LDAR programme to identify diffuse emissions of methane from the process, paying particular attention to pressure relief valves and storage tanks for digestate and biogas.

**When assessing against d. reference should be made to SEPA's odour guidance and in particular section 2.3 table 1 Hierarchy of control options for odorous substances.**

**BAT 15.**
**BAT is to use flaring only for safety reasons or for non-routine operating conditions (e.g. start-ups, shutdowns) by using both of the techniques given below.**

| Technique | | Description | Applicability |
|---|---|---|---|
| a. | Correct plant design | This includes the provision of a gas recovery system with sufficient capacity and the use of high-integrity relief valves. | Generally applicable to new plants. A gas recovery system may be retrofitted in existing plants. |
| b. | Plant management | This includes balancing the gas system and using advanced process control. | Generally applicable. |

**BAT 15- Interpretational Guidance**

SEPA requires all AD sites to be fitted with flares. These may be shrouded, ground level flares although new sites will have to comply with BAT 16 on design. These shall only be used in non-routine situations.

Emissions from the flare should be considered in the emissions inventory required by BAT 3.

See section 2.3.5.5 for more information on flaring and techniques to prevent or reduce emissions.

**BAT 16.**
**In order to reduce emissions to air from flares when flaring is unavoidable, BAT is to use both of the techniques given below.**

| Technique | | Description | Applicability |
|---|---|---|---|
| a. | Correct design of flaring devices | Optimisation of height and pressure, assistance by steam, air or gas, type of flare tips, etc., to enable smokeless and reliable operation and to ensure the efficient combustion of excess gases. | Generally applicable to new flares. In existing plants, applicability may be restricted, e.g. due to maintenance time availability. |
| b. | Monitoring and recording as part of flare management | This includes continuous monitoring of the quantity of gas sent to flaring. It may include estimations of other parameters (e.g. composition of gas flow, heat content, ratio of assistance, velocity, purge gas flow rate, pollutant emissions (e.g. NOX, CO, hydrocarbons), noise). The recording of flaring events usually includes the duration and number of events and allows for the quantification of emissions and the potential prevention of future flaring events. | Generally applicable. |

**BAT 16- Interpretational Guidance**

Flare heights shall be justified using H1 or ADMS dispersion modelling. No flare height shall be lower than the calculated value without significant site specific justification.

Operators must have a system for recording and reporting flaring events and investigation of the cause.

## 1.4 Noise and vibrations

**BAT 17.**
**In order to prevent or, where that is not practicable, to reduce noise and vibration emissions, BAT is to set up, implement and regularly review a noise and vibration management plan, as part of the environmental management system (see BAT 1), that includes all of the following elements:**

I. a protocol containing appropriate actions and timelines;
II. a protocol for conducting noise and vibration monitoring;
III. a protocol for response to identified noise and vibration events, e.g. complaints;
IV. a noise and vibration reduction programme designed to identify the source(s), to measure/estimate noise and vibration exposure, to characterise the contributions of the sources and to implement prevention and/or reduction measures.

Applicability

The applicability is restricted to cases where a noise or vibration nuisance at sensitive receptors is expected and/or has been substantiated.

**BAT 17- Interpretational Guidance**

Applicability: SEPA interprets this to mean that the requirements of BAT 16 are applicable where there is a risk of noise/vibration from a process having a negative impact on receptors and/or a negative impact has been substantiated. Permits generally have a standard condition relating to noise outside the process boundary. Sites will also have to assess the risk from vibration from their activities.

If there is a Noise Management Plan (NMP) already in place and it is fit for purpose, then this will suffice in meeting the requirement of this BAT conclusion. This would also form part of the EMS checks in BAT 1. SEPA does not plan to formally approve each NMP but we must ensure it is fit for purpose.

Certain activities would require an NVMP regardless of whether there has been a complaint due to the nature of the activity, such as metal shredding. The NVMP would detail the likely sources, receptors and the mitigation measures / abatement at is in place. The NVMP will also list the procedure in place if there was to be a substantiated noise/vibration complaint that would include the requirements of the BAT conclusions.

In the case where there is a risk of, or evidence that, sensitive receptors are impacted, we may stipulate noise limits and or an engineering assessment of improvements that can be made to address odour impact.

Further detail on NVMP can be found in the BREF document in section 2.3.10.1.

The NVMP should reflect the requirements of BAT 17 and 18.

There is a more detailed guidance document available here:

Noise and vibration management: environmental permits - GOV.UK (www.gov.uk)

**BAT 18. In order to prevent or, where that is not practicable, to reduce noise and vibration emissions, BAT is to use one or a combination of the techniques given below.**

| Technique | | Description | Applicability |
|---|---|---|---|
| a. | Appropriate location of equipment and buildings. | Noise levels can be reduced by increasing the distance between the emitter and the receiver, by using buildings as noise screens and by relocating building exits or entrances. | For existing plants, the relocation of equipment and building exits or entrances may be restricted by a lack of space or excessive costs. |
| b | Operational measures | This includes techniques such as:<br>i. inspection and maintenance of equipment;<br>ii. closing of doors and windows of enclosed areas, if possible;<br>iii. equipment operation by experienced staff;<br>iv. avoidance of noisy activities at night, if possible;<br>v. provisions for noise control during maintenance, traffic, handling and treatment activities. | Generally applicable. |
| c | Low-noise equipment | This may include direct drive motors, compressors, pumps and flares | |
| d. | Noise and vibration control equipment | This includes techniques such as:<br>i. noise reducers;<br>ii. acoustic and vibrational insulation of equipment;<br>iii. enclosure of noisy equipment;<br>iv. soundproofing of buildings. | Applicability may be restricted by a lack of space (for existing plants). |
| e. | Noise attenuation | Noise propagation can be reduced by inserting obstacles between emitters and receivers (e.g. protection walls, embankments and buildings). | Applicable only to existing plants, as the design of new plants should make this technique unnecessary. For existing plants, the insertion of obstacles may be restricted by a lack of space.<br>For mechanical treatment in shredders of metal wastes, it is applicable within the constraints associated with the risk of deflagration in shredders. |

**BAT 18- Interpretational Guidance**

BAT 18 states “use one or a combination of techniques given below”. Applicability varies for each of the techniques. Sites should report on the applicability of each technique to their operations and should apply any which are suitable.

Note there is no restriction on applicability only to cases where noise and vibration nuisance is expected or substantiated as with BAT 17 above. SEPA expects that (b) and (c) apply to all and (a), (d) and (e) only to where noise is expected or substantiated.

Refer to guidance on Noise and vibration management: environmental permits - GOV.UK (www.gov.uk).

## 1.5 Emissions to water

**BAT 19.**
**In order to optimise water consumption, to reduce the volume of waste water generated and to prevent or, where that is not practicable, to reduce emissions to soil and water, BAT is to use an appropriate combination of the techniques given below.**

| Technique | | Description | Applicability |
|---|---|---|---|
| a. | Water management | Water consumption is optimised by using measures which may include:<br>- water-saving plans (e.g. establishment of water efficiency objectives, flow diagrams and water mass balances);<br>- optimising the use of washing water (e.g. dry cleaning instead of hosing down, using trigger control on all washing equipment);<br>- reducing the use of water for vacuum generation (e.g. use of liquid ring pumps with high boiling point liquids). | Generally applicable. |
| b. | Water recirculation | Water streams are recirculated within the plant, if necessary after treatment. The degree of recirculation is limited by the water balance of the plant, the content of impurities (e.g. odorous compounds) and/or the characteristics of the water streams (e.g. nutrient content). | Generally applicable. |
| c. | Impermeable surface | Depending on the risks posed by the waste in terms of soil and/or water contamination, the surface of the whole waste treatment area (e.g. waste reception, handling, storage, treatment and dispatch areas) is made impermeable to the liquids concerned. | Generally applicable. |
| d. | Techniques to reduce the likelihood and impact of overflows and failures from tanks and vessels | Depending on the risks posed by the liquids contained in tanks and vessels in terms of soil and/or water contamination, this includes techniques such as:<br>- overflow detectors;<br>- overflow pipes that are directed to a contained drainage system (i.e. the relevant secondary containment or another vessel);<br>- tanks for liquids that are located in a suitable secondary containment; the volume is normally sized to accommodate the loss of containment of the largest tank within the secondary containment;<br>- isolation of tanks, vessels and secondary containment (e.g. closing of valves). | Generally applicable |
| e. | Roofing of waste storage and treatment areas | Depending on the risks posed by the waste in terms of soil and/or water contamination, waste is stored and treated in covered areas to prevent contact with rainwater and thus minimise the volume of contaminated run-off water. | Applicability may be constrained when high volumes of waste are stored or treated (e.g. mechanical treatment in shredders of metal waste). |

| | | | |
|---|---|---|---|
| f. | Segregation of water streams | Each water stream (e.g. surface run-off water, process water) is collected and treated separately, based on the pollutant content and on the combination of treatment techniques. In particular, uncontaminated waste water streams are segregated from waste water streams that require treatment. | Generally applicable to new plants.<br><br>Generally applicable to existing plants within the constraints associated with the layout of the water collection system. |
| g. | Adequate drainage infrastructure | The waste treatment area is connected to drainage infrastructure. Rainwater falling on the treatment and storage areas is collected in the drainage infrastructure along with washing water, occasional spillages, etc. and, depending on the pollutant content, recirculated or sent for further treatment. | Generally applicable to new plants.<br><br>Generally applicable to existing plants within the constraints associated with the layout of the water drainage system. |
| h | Design and maintenance provisions to allow detection and repair of leaks | Regular monitoring for potential leakages is risk-based, and, when necessary, equipment is repaired. The use of underground components is minimised. When underground components are used, and depending on the risks posed by the waste contained in those components in terms of soil and/or water contamination, secondary containment of underground components is put in place. | The use of above-ground components is generally applicable to new plants. It may be limited however by the risk of freezing. The installation of secondary containment may be limited in the case of existing plants. |
| i. | Appropriate buffer storage capacity | Appropriate buffer storage capacity is provided for waste water generated during other than normal operating conditions using a risk-based approach (e.g. taking into account the nature of the pollutants, the effects of downstream waste water treatment, and the receiving environment). The discharge of waste water from this buffer storage is only possible after appropriate measures are taken (e.g. monitor, treat, reuse). | Generally applicable to new plants.<br>For existing plants, applicability may be limited by space availability and by the layout of the water collection system. |

## BAT 19- Interpretational Guidance

Impermeable surface for a clay surface means a surface with a hydraulic permeability of not greater than 1x $10^{-9}$ m/s.

There are many standards available in relation to testing of concrete surfaces and structures and may differ from the standards required for liquid-retaining concrete structures. Examples include BS 8007:1987, BS EN 1992-1-1:2004, BS EN 1992-3:2006. All construction joints should be sealed.

We require implementation of CIRIA 736 (Containment systems for the prevention of pollution), or an equivalent engineering standard.

In both cases, construction should be signed off by a qualified engineer to oversee the work and is a Certified Quality Auditor.

Note impermeable surface is an option but it is “generally applicable”. The operator must demonstrate how and why this is not applicable for their site/activity based on the particular risks posed by the waste they handle.

SEPA’s view on bunding:

- Any penetration through a bund wall is not considered BAT.

- The purpose of secondary containment should be to provide containment to the tanks or vessels or pumps alone (i.e., wherever possible, pumps should be in a separate bund to the bund containing the tanks).
- Floodgates are not considered BAT in secondary containment.
- Tertiary containment is for the wider site area (if used/required).
- Floodgates are common and remain accepted practice in tertiary containment systems.
- Operators frequently combine the design principles that are applicable to secondary and tertiary containment designs, this:
  - increases the build cost;
  - leads to problems with how maintenance is undertaken;
  - causes problems with permitablity; and
  - is not good practice or BAT.

**BAT 20.**
**In order to reduce emissions to water, BAT is to treat waste water using an appropriate combination of the techniques given below.**

| Technique [1] | | Typical pollutants targeted | Applicability |
|---|---|---|---|
| *Preliminary and primary treatment, e.g.* | | | |
| a. | Equalisation | All pollutants | Generally applicable. |
| b. | Neutralisation | Acids, alkalis | |
| c. | Physical separation, e.g. screens, sieves, grit separators, grease separators, oil-water separation or primary settlement tanks | Gross solids, suspended solids, oil/grease | |
| *Physico-chemical treatment, e.g.* | | | |
| d. | Adsorption | Adsorbable dissolved non-biodegradable or inhibitory pollutants, e.g. hydrocarbons, mercury, AOX | Generally applicable. |
| e. | Distillation/rectification | Dissolved nonbiodegradable or inhibitory pollutants that can be distilled, e.g. some solvents | |
| f. | Precipitation | Precipitable dissolved non-biodegradable or inhibitory pollutants, e.g. metals, phosphorus | |
| g. | Chemical oxidation | Oxidisable dissolved nonbiodegradable or inhibitory pollutants, e.g. nitrite, cyanide | |
| h | Chemical reduction | Reducible dissolved nonbiodegradable or inhibitory pollutants, e.g. hexavalent chromium (Cr(VI)) | |
| i. | Evaporation | Soluble contaminants | |
| j. | Ion exchange | Ionic dissolved nonbiodegradable or inhibitory pollutants, e.g. metals | |
| k. | Stripping | Purgeable pollutants, e.g. hydrogen sulphide ($H_2S$), ammonia ($NH_3$), some | |

| | | | |
|---|---|---|---|
| | | adsorbable organically bound halogens (AOX), hydrocarbons | |
| *Biological treatment, e.g.* | | | |
| l. | Activated sludge process | Biodegradable organic compounds | Generally applicable. |
| m. | Membrane bioreactor | | |
| *Nitrogen removal* | | | |
| n. | Nitrification/denitrification when the treatment includes a biological treatment | Total nitrogen, ammonia | Nitrification may not be applicable in the case of high chloride concentrations (e.g. above 10 g/l) and when the reduction of the chloride concentration prior to nitrification would not be justified by the environmental benefits. Nitrification is not applicable when the temperature of the waste water is low (e.g. below 12 °C). |
| *Solids removal, e.g.* | | | |
| o. | Coagulation and flocculation | Suspended solids and particulate-bound metals | Generally applicable. |
| p. | Sedimentation | | |
| q. | Filtration (e.g. sand filtration, microfiltration, ultrafiltration) | | |
| r. | Flotation | | |
| (1) The descriptions of the techniques are given in Section 6.6.3 | | | |

Table 6.1: BAT-associated emission levels (BAT-AELs) for direct discharges to a receiving water body

| Substance/Parameter | BAT-AEL (1) | Waste treatment process to which the BAT-AEL applies |
|---|---|---|
| Total organic carbon (TOC) (2) | 10–60 mg/l | - All waste treatments except treatment of water-based liquid waste |
| | 10–100 mg/l (3) (4) | - Treatment of water-based liquid waste |
| Chemical oxygen demand (COD) (2) | 30–180 mg/l | - All waste treatments except treatment of water-based liquid waste |
| | 30–300 mg/l (3) (4) | - Treatment of water-based liquid waste |
| Total suspended solids (TSS) | 5–60 mg/l | - All waste treatments |
| Hydrocarbon oil index (HOI) | 0.5–10 mg/l | - Mechanical treatment in shredders of metal waste<br>- Treatment of WEEE containing VFCs and/or VHCs<br>- Re-refining of waste oil<br>- Physico-chemical treatment of waste with calorific value<br>- Water washing of excavated contaminated soil<br>- Treatment of water-based liquid waste |
| Total nitrogen (Total N) | 1–25 mg/l (5) (6) | - Biological treatment of waste<br>- Re-refining of waste oil |
| | 10–60 mg/l (5) (6) (7) | - Treatment of water-based liquid waste |
| Total phosphorus (Total P) | 0.3–2 mg/l | - Biological treatment of waste |
| | 1–3 mg/l (4) | - Treatment of water-based liquid waste |
| Phenol index | 0.05– 0.2 mg/l | - Re-refining of waste oil |

| | | | |
|---|---|---|---|
| | | | - Physico-chemical treatment of waste with calorific value |
| | 0.05–0.3 mg/l | | - Treatment of water-based liquid waste |
| Free cyanide (CN-) [8] | 0.02– 0.1 mg/l | | - Treatment of water-based liquid waste |
| Adsorbable organically bound halogens (AOX) [8] | 0.2–1 mg/l | | - Treatment of water-based liquid waste |
| Metals and metalloids [8] | Arsenic (expressed as As) | 0.01–0.05 mg/l | - Mechanical treatment in shredders of metal waste<br>- Treatment of WEEE containing VFCs and/or VHCs<br>- Mechanical biological treatment of waste<br>- Re-refining of waste oil<br>-Physico-chemical treatment of waste with calorific value<br>-Physico-chemical treatment of solid and/or pasty waste<br>- Regeneration of spent solvents<br>- Water washing of excavated contaminated soil |
| | Cadmium (expressed as Cd) | 0.01–0.05 mg/l | |
| | Chromium (expressed as Cr) | 0.01–0.15 mg/l | |
| | Copper (expressed as Cu) | 0.05–0.5 mg/l | |
| | Lead (expressed as Pb) | 0.05–0.1 mg/l [9] | |
| | Nickel (expressed as Ni) | 0.05–0.5 mg/l | |
| | Mercury (expressed as Hg) | 0.5–5 µg/l | |
| | Zinc (expressed as Zn) | 0.1–1 mg/l [10] | |
| | Arsenic (expressed as As) | 0.01–0.1 mg/ | - Treatment of water-based liquid waste |
| | Cadmium (expressed as Cd) | 0.01–0.1 mg/l | |
| | Chromium (expressed as Cr) | 0.01–0.3 mg/l | |
| | Hexavalent chromium (expressed as Cr(VI)) | 0.01–0.1 mg/l | |
| | Copper (expressed as Cu) | 0.05–0.5 mg/l | |
| | Lead (expressed as Pb) | 0.05–0.3 mg/l | |
| | Nickel (expressed as Ni) | 0.05–1 mg/l | |
| | Mercury (expressed as Hg) | 1–10 µg/l | |
| | Zinc (expressed as Zn) | 0.1–2 mg/l | |
| (1) The averaging periods are defined in the General considerations.<br>(2) Either the BAT-AEL for COD or the BAT-AEL for TOC applies. TOC monitoring is the preferred option because it does not rely on the use of very toxic compounds.<br>(3) The upper end of the range may not apply: | | | |

- when the abatement efficiency is ≥ 95 % as a rolling yearly average and the waste input shows the following characteristics: TOC > 2 g/l (or COD > 6 g/l) as a daily average and a high proportion of refractory organic compounds (i.e. which are difficult to biodegrade); or
- in the case of high chloride concentrations (e.g. above 5 g/l in the waste input).
(4) The BAT-AEL may not apply to plants treating drilling muds/cuttings.
(5) The BAT-AEL may not apply when the temperature of the waste water is low (e.g. below 12 °C).
(6) The BAT-AEL may not apply in the case of high chloride concentrations (e.g. above 10 g/l in the waste input).
(7) The BAT-AEL only applies when biological treatment of waste water is used.
(8) The BAT-AELs only apply when the substance concerned is identified as relevant in the waste water inventory mentioned in BAT 3.
(9) The upper end of the range is 0.3 mg/l for mechanical treatment in shredders of metal waste.
(10) The upper end of the range is 2 mg/l for mechanical treatment in shredders of metal waste.

The associated monitoring is given in BAT 7.

Table 6.2: BAT-associated emission levels (BAT-AELs) for indirect discharges to a receiving water body

| Substance/Parameter | BAT-AEL (1)(2) | | Waste treatment process to which the BAT-AEL applies |
|---|---|---|---|
| Hydrocarbon oil index (HOI) | 0.5–10 mg/l | | - Mechanical treatment in shredders of metal waste<br>- Treatment of WEEE containing VFCs and/or VHCs<br>- Re-refining of waste oil<br>-Physico-chemical treatment of waste with calorific value<br>- Water washing of excavated contaminated soil<br>- Treatment of water-based liquid waste |
| Free cyanide (CN-) (3) | 0.02– 0.1 mg/l | | - Treatment of water-based liquid waste |
| Adsorbable organically bound halogens (AOX) (3) | 0.2–1 mg/l | | - Treatment of water-based liquid waste |
| Metals and metalloids (3) | Arsenic (expressed as As) | 0.01–0.05 mg/l | - Mechanical treatment in shredders of metal waste<br>- Treatment of WEEE containing VFCs and/or VHCs<br>- Mechanical biological treatment of waste<br>- Re-refining of waste oil<br>-Physico-chemical treatment of waste with calorific value<br>-Physico-chemical treatment of solid and/or pasty waste<br>- Regeneration of spent solvents<br>- Water washing of excavated contaminated soil |
| | Cadmium (expressed as Cd) | 0.01–0.05 mg/l | |
| | Chromium (expressed as Cr) | 0.01–0.15 mg/l | |
| | Copper (expressed as Cu) | 0.05–0.5 mg/l | |
| | Lead (expressed as Pb) | 0.05–0.1 mg/l (4) | |
| | Nickel (expressed as Ni) | 0.05–0.5 mg/l | |
| | Mercury (expressed as Hg) | 0.5–5 µg/l | |
| | Zinc (expressed as Zn) | 0.1–1 mg/l (5) | |
| | Arsenic (expressed as As) | 0.01–0.1 mg/ | - Treatment of water-based liquid waste |

| | | | |
|---|---|---|---|
| | Cadmium (expressed as Cd) | 0.01–0.1 mg/l | |
| | Chromium (expressed as Cr) | 0.01–0.3 mg/l | |
| | Hexavalent chromium (expressed as Cr(VI)) | 0.01–0.1 mg/l | |
| | Copper (expressed as Cu) | 0.05–0.5 mg/l | |
| | Lead (expressed as Pb) | 0.05–0.3 mg/l | |
| | Nickel (expressed as Ni) | 0.05–1 mg/l | |
| | Mercury (expressed as Hg) | 1–10 µg/l | |
| | Zinc (expressed as Zn) | 0.1–2 mg/l | |

(1) The averaging periods are defined in the General considerations.
(2) The BAT-AELs may not apply if the downstream waste water treatment plant abates the pollutants concerned, provided this does not lead to a higher level of pollution in the environment.
(3) The BAT-AELs only apply when the substance concerned is identified as relevant in the waste water inventory mentioned in BAT 3.
(4) The upper end of the range is 0.3 mg/l for mechanical treatment in shredders of metal waste.
(5) The upper end of the range is 2 mg/l for mechanical treatment in shredders of metal waste.

The associated monitoring is given in BAT 7.

**BAT 20- Interpretational Guidance**

The BAT review also has to take into consideration Priority Hazardous Substances and Hazardous Substances considerations under CAR (WAT-SG-53). The inventory may indicate discharge of pollutants that are not covered by AELs in the tables This could add additional pollutants and monitoring requirements.

Table 6.1 Footnote 4: The BAT-AEL for Chemical Oxygen Demand when treating water-based liquid waste may not apply to site treating drilling muds/cuttings. Sites proposing to use this exclusion will have to justify why this does not apply.

Table 6.1 Footnote 6: The BAT-AEL for total nitrogen for sites carrying out the biological treatment of waste, Re-refining of waste oil, or the treatment of water-based liquid waste does not apply where in the case of high chloride concentrations (e.g. above 10 g/l in the waste input). This will have to be justified through a programme of sampling.

Table 6.2: Footnote (2) - If consented discharges (a trade effluent discharge consent) to sewer are assessed and substances are screened out as being “insignificant”, taking into account the relevant sewage treatment reduction factor for the works, then including the BAT AELs and associated monitoring requirements for those substances (as set in Table 6.2 and BAT 7) in the permit would not be mandatory. BAT 3 will identify waste water streams likely to be considered. However ELVs may need to be placed in order to ensure that discharge is to BAT taking into account treatment effectiveness of the receiving works.

The operator must show they comply with the BAT AEL using one of the following methods:

• The operator can choose to analyse their effluent stream prior to passing it to a third party (the sewage undertaker) on a continuing basis. An operator may choose this option as they may be required by the sewage undertaker to sample their effluent, or they may analyse their effluent as a method of process control. This should include and is not limited to the AEL analytes as listed.

• The operator can show by means of treatment factors that the limits associated with the BAT conclusion can be achieved. The provision of some historical data on the typical concentrations leaving site and the typical treatment factors can be used as a demonstration of compliance. An improvement condition will be set in the permit that requires periodic confirmation that the method used to show BAT AEL compliance remains valid.

However, alternative limits or monitoring requirements will be considered based on, for example, an H1 risk assessment and discussions on water quality or the shellfish and bathing water directive.

## 1.6 Emissions from accidents and incidents

**BAT 21.**
**In order to prevent or limit the environmental consequences of accidents and incidents, BAT is to use all of the techniques given below, as part of the accident management plan (see BAT 1).**

| Technique | | Description |
|---|---|---|
| a. | Protection measures | These include measures such as:<br>- protection of the plant against malevolent acts;<br>- fire and explosion protection system, containing equipment for prevention, detection, and extinction;<br>- accessibility and operability of relevant control equipment in emergency situations. |
| b | Management of incidental/accidental emissions | Procedures are established and technical provisions are in place to manage (in terms of possible containment) emissions from accidents and incidents such as emissions from spillages, firefighting water, or safety valves. |
| c. | Incident/accident registration and assessment system | This includes techniques such as:<br>- a log/diary to record all accidents, incidents, changes to procedures and the findings of inspections;<br>- procedures to identify, respond to and learn from such incidents and accidents. |

**BAT 21- Interpretational Guidance**

Note all techniques must be used.

## 1.7 Material efficiency

**BAT 22.**
**In order to use materials efficiently, BAT is to substitute materials with waste.**

Description

Waste is used instead of other materials for the treatment of wastes (e.g. waste alkalis or waste acids are used for pH adjustment, fly ashes are used as binders).

Applicability

Some applicability limitations derive from the risk of contamination posed by the presence of impurities (e.g. heavy metals, POPs, salts, pathogens) in the waste that substitutes other materials. Another limitation is the compatibility of the waste substituting other materials with the waste input (see BAT 2).

**BAT 22- Interpretational Guidance**

Operators will need to consider the implications of substituting materials with wastes, for example there may be implications for Waste Acceptance Criteria (if going to landfill) and waste classification and assessment. This should not be an opportunity to dilute hazardous waste with non-hazardous waste.

## 1.8 Energy efficiency

**BAT 23. In order to use energy efficiently, BAT is to use both of the techniques given below.**

| Technique | | Description |
|---|---|---|
| a. | Energy efficiency plan | An energy efficiency plan entails defining and calculating the specific energy consumption of the activity (or activities), setting key performance indicators on an annual basis (for example, specific energy consumption expressed in kWh/tonne of waste processed) and planning periodic improvement targets and related actions. The plan is adapted to the specificities of the waste treatment in terms of process(es) carried out, waste stream(s) treated, etc. |
| b | Energy balance record | An energy balance record provides a breakdown of the energy consumption and generation (including exportation) by the type of source (i.e. electricity, gas, conventional liquid fuels, conventional solid fuels, and waste). This includes:<br>(i) information on energy consumption in terms of delivered energy;<br>(ii) information on energy exported from the installation;<br>(iii) energy flow information (e.g. Sankey diagrams or energy balances) showing how the energy is used throughout the process.<br>The energy balance record is adapted to the specificities of the waste treatment in terms of process(es) carried out, waste stream(s) treated, etc. |

BAT 23- INTERPRETATIONAL GUIDANCE

This is covered in our resource use assessment. Section B covers a systematic assessment of raw material, water, energy and fuel consumption which includes Identifying opportunities for improvement and reviewing progress and next steps

Guidance on resource efficiency assessment is available on the website: Guidance | Scottish Environment Protection Agency (SEPA)
Further guidance for an energy efficiency plan can be found in section 2.3.9 of the BREF document.

SEPA's Thermal Treatment of Waste Guidelines apply to AD sites but only in relation to use of the biogas. AD plants should demonstrate in a Heat and Power Plan that the recovery of energy takes place with a high level of efficiency.

## 1.9 Reuse of packaging

**BAT 24.**
**In order to reduce the quantity of waste sent for disposal, BAT is to maximise the reuse of packaging, as part of the residues management plan (see BAT 1).**

Description

Packaging (drums, containers, IBCs, pallets, etc.) is reused for containing waste, when it is in good condition and sufficiently clean, depending on a compatibility check between the substances contained (in consecutive uses). If necessary, packaging is sent for appropriate treatment prior to reuse (e.g. reconditioning, cleaning).

Applicability

Some applicability restrictions derive from the risk of contamination of the waste posed by the reused packaging.

**BAT 24- Interpretational Guidance**

Where packaging is used to contain hazardous material it may be hazardous itself and may need to be thoroughly cleaned before re-use. This may need to be part of the permit.

Under the Duty of Care, where packaging cannot be reused, operators must take all reasonable steps to ensure the separate collection of recyclable waste such as plastic and metal packaging.

# 2. BAT conclusions for the mechanical treatment of waste

**BATc**

Unless otherwise stated, the BAT conclusions presented in Section 2 apply to the mechanical treatment of waste when it is not combined with biological treatment, and in addition to the general BAT conclusions in Section 1.

**Interpretational Guidance**

The conditions in section 2 apply to the treatment in mechanical shredders of metal waste, including waste electrical and electronic equipment (WEEE) and end-of-life vehicles (EoLVs) and their components. It also covers the mechanical treatment in shredders of

WEEE containing refrigerants, and the mechanical treatment of solid waste with calorific value.

They do not apply to the shredding stage of a composting process or to MBT processes. These are covered under the biological treatment conclusions.

They do not apply to cutting or shredding of waste using manually operated tools.

## 2.1 General BAT for the mechanical treatment of waste

**BAT 25**
**In order to reduce emissions to air of dust, and of particulate-bound metals, PCDD/F and dioxin-like PCBs, BAT is to apply BAT 14d and to use one or a combination of the techniques given below.**

| | Technique | Description | Applicability |
|---|---|---|---|
| a. | Cyclone | See Section 6.1.<br>Cyclones are mainly used as preliminary separators for coarse dust. | Generally applicable. |
| b. | Fabric filter | See Section 6.1. | May not be applicable to exhaust air ducts directly connected to the shredder when the effects of deflagration on the fabric filter cannot be mitigated (e.g. by using pressure relief valves). |
| c. | Wet scrubbing | See Section 6.1. | Generally applicable. |
| d. | Water injection into the shredder | The waste to be shredded is damped by injecting water into the shredder. The amount of water injected is regulated in relation to the amount of waste being shredded (which may be monitored via the energy consumed by the shredder motor). The waste gas that contains residual dust is directed to cyclone(s) and/or a wet scrubber. | Only applicable within the constraints associated with local conditions (e.g. low temperature, drought). |

Table 6.3 BAT-associated emission level (BAT-AEL) for channelled dust emissions to air from the mechanical treatment of waste

| Parameter | Unit | BAT-AEL (Average over the sampling period) |
|---|---|---|
| Dust | mg/Nm$^3$ | 2-5(1) |
| (1) When a fabric filter is not applicable, the upper end of the range is 10 mg/Nm$^3$. | | |

The associated monitoring is given in BAT 8.

BAT 25- **Interpretational Guidance**

In order to benefit from the increased upper range of the AEL, operators must clarify why a fabric filter is not applicable.

## 2.2 BAT conclusions for the mechanical treatment in shredders of metal waste

Unless otherwise stated, the BAT conclusions presented in this section (2.2) apply to the mechanical treatment in shredders of metal waste, in addition to BAT 25.

### 2.2.1 Overall environmental performance

**BAT 26. In order to improve the overall environmental performance, and to prevent emissions due to accidents and incidents, BAT is to use BAT 14g and all of the techniques given below:**

(a) implementation of a detailed inspection procedure for baled waste before shredding;
(b) removal of dangerous items from the waste input stream and their safe disposal (e.g. gas cylinders, non- depolluted EoLVs, non-depolluted WEEE, items contaminated with PCBs or mercury, radioactive items);
(c) treatment of containers only when accompanied by a declaration of cleanliness.

**BAT 26- Interpretational Guidance**

BAT 14g relates to cleaning of waste treatment and storage areas.

Further guidance can be referenced in section 3.1 of the BREF document. The EMS requires an accident management plan (AMP) that details relevant risks and defines measures to address those risks. The AMP should reflect the requirements of BAT 26.

### 2.2.2 Deflagrations

**BAT 27.**
**In order to prevent deflagrations and to reduce emissions when deflagrations occur, BAT is to use technique a. and one or both of the techniques b. and c. given below.**

| | Technique | Description | Applicability |
|---|---|---|---|
| a. | Deflagration management plan | This includes:<br>— a deflagration reduction programme designed to identify the source(s), and to implement measures to prevent deflagration occurrences, e.g. inspection of waste input as described in BAT 26a, removal of dangerous items as described in BAT 26b;<br>— a review of historical deflagration incidents and remedies and the dissemination of deflagration knowledge;<br>— a protocol for response to deflagration incidents. | Generally applicable |
| b | Pressure relief dampers | Pressure relief dampers are installed to relieve pressure waves coming from deflagrations that would otherwise cause major damage and subsequent emissions. | |
| c. | Pre-shredding | Use of a low-speed shredder installed upstream of the main shredder | Generally applicable for new plants, depending on the input material. Applicable for major plant upgrades where a significant number of deflagrations have been substantiated. |

**BAT 27- Interpretational Guidance**

All sites should have a Deflagration Management Plan. We would expect this to include a requirement to record and monitor the time of all deflagrations within the plant.

### 2.2.3 Energy efficiency

**BAT 28**
**In order to use energy efficiently, BAT is to keep the shredder feed stable.**

*Description*
The shredder feed is equalised by avoiding disruption or overload of the waste feed which would lead to unwanted shutdowns and start-ups of the shredder.

**BAT 28- Interpretational Guidance**

Technical description in section 3.1.3.3.1.

## 2.3 BAT conclusions for the treatment of WEEE containing VFCs and/or VHCs

Unless otherwise stated, the BAT conclusions presented in this section apply to the treatment of WEEE containing VFCs and/or VHCs, in addition to BAT 25.

### 2.3.1 Emissions to air

**BAT 29 In order to prevent or, where that is not practicable, to reduce emissions of organic compounds to air, BAT is to apply BAT 14d, BAT 14h and to use technique a. and one or both of the techniques b. and c. given below**

| Technique | | Description |
|---|---|---|
| a. | Optimised removal and capture of refrigerants and oils | All refrigerants and oils are removed from the WEEE containing VFCs and/or VHCs and captured by a vacuum suction system (e.g. achieving refrigerant removal of at least 90 %). Refrigerants are separated from oils and the oils are degassed. The amount of oil remaining in the compressor is reduced to a minimum (so that the compressor does not drip). |
| b. | Cryogenic condensation | Waste gas containing organic compounds such as VFCs/VHCs is sent to a cryogenic condensation unit where they are liquefied (see description in Section 6.1). The liquefied gas is stored in pressurised vessels for further treatment. |
| c | Adsorption | Waste gas containing organic compounds such as VFCs/VHCs is led into adsorption systems (see description in Section 6.1). The spent activated carbon is regenerated by means of heated air pumped into the filter to desorb the organic compounds. Subsequently, the regeneration waste gas is compressed and cooled in order to liquefy the organic compounds (in some cases by cryogenic condensation). The liquefied gas is then stored in pressurised vessels. The remaining waste gas from the compression stage is usually led back into the adsorption system in order to minimise VFC/VHC emissions. |

*Table 6.4* BAT-associated emission levels (BAT-AELs) for channelled TVOC and CFC emissions to air from the treatment of WEEE containing VFCs and/or VHCs

| Parameter | Unit | BAT-AEL (Average over the sampling period) |
|---|---|---|
| TVOC | $mg/Nm^3$ | 3-15 |
| CFCs | $mg/Nm^3$ | 0.5-10 |

The associated monitoring is given in BAT 8.

**BAT 29- Interpretational Guidance**

BAT 14h relates to leak detection and repair programme.

### 2.3.2 Explosions

**BAT 30 In order to prevent emissions due to explosions when treating WEEE containing VFCs and/or VHCs, BAT is to use either of the techniques given below.**

| Technique | | Description |
|---|---|---|
| a. | Inert atmosphere | By injecting inert gas (e.g. nitrogen), the oxygen concentration in enclosed equipment (e.g. in enclosed shredders, crushers, dust and foam collectors) is reduced (e.g. to 4 vol-%). |
| b. | Forced ventilation | By using forced ventilation, the hydrocarbon concentration in enclosed equipment (e.g. in enclosed shredders, crushers, dust and foam collectors) is reduced to < 25 % of the lower explosive limit. |

**BAT 30- Interpretational Guidance**

None

## 2.4 BAT conclusions for the mechanical treatment of waste with calorific value

In addition to BAT 25, the BAT conclusions presented in this section apply to the mechanical treatment of waste with calorific value covered by section 5.4(a)(iii) and 5.4(b)(ii) of Schedule I to the Pollution Prevention and Control (Scotland) Regulations 2012.

### 2.4.1 Emissions to air

**BAT 31.**
**In order to reduce emissions to air of organic compounds, BAT is to apply BAT 14d and to use one or a combination of the techniques given below.**

| Technique | | Description |
|---|---|---|
| a. | Adsorption | See Section 6.1 |
| b | Biofilter | |
| c. | Thermal oxidation | |
| d. | Wet scrubbing | |

Table 6.5 BAT-associated emission level (BAT-AEL) for channelled TVOC emissions to air from the mechanical treatment of waste with calorific value

| Parameter | Unit | BAT-AEL (Average over the sampling period) |
|---|---|---|
| TVOC | $mg/Nm^3$ | 10-30[(1)] |
| [(1)] The BAT-AEL only applies when organic compounds are identified as relevant in the waste gas stream, based on the inventory mentioned in BAT 3. | | |

The associated monitoring is given in BAT 8.

**BAT 31- Interpretational Guidance**

None.

## 2.5 BAT conclusions for the mechanical treatment of WEEE containing mercury

Unless otherwise stated, the BAT conclusions presented in this section apply to the mechanical treatment of WEEE containing mercury, in addition to BAT 25.

### 2.5.1 Emissions to air

**BAT 32.**
**In order to reduce mercury emissions to air, BAT is to collect mercury emissions at source, to send them to abatement and to carry out adequate monitoring.**

*Description*
This includes all of the following measures:
— equipment used to treat WEEE containing mercury is enclosed, under negative pressure and connected to a local exhaust ventilation (LEV) system;
— waste gas from the processes is treated by dedusting techniques such as cyclones, fabric filters, and HEPA filters, followed by adsorption on activated carbon (see Section 6.1);
— the efficiency of the waste gas treatment is monitored;
— mercury levels in the treatment and storage areas are measured frequently (e.g. once every week) to detect potential mercury leaks.

*Table 6.6* BAT-associated emission level (BAT-AEL) for channelled mercury emissions to air from the mechanical treatment of WEEE containing mercury

| Parameter | Unit | BAT-AEL (Average over the sampling period) |
|---|---|---|
| Mercury (Hg) | µg/Nm$^3$ | 2-7 |

The associated monitoring is given in BAT 8.

**BAT 32- Interpretational Guidance**

The efficiency of waste gas treatment may be monitored by differential measurement of mercury content in the gas entering and being emitted from the abatement equipment, continuous particulate/ mercury monitoring, differential, pressure, etc.

Measurement of mercury in the ambient air in treatment and storage areas may overlap with health and safety requirements.

# 3. BAT conclusions for the biological treatment of waste

**BATc**
Unless otherwise stated, the BAT conclusions presented in Section 3 apply to the biological treatment of waste, and in addition to the general BAT conclusions in Section 1.

The BAT conclusions in Section 3 do not apply to the treatment of water-based liquid waste.

**Interpretational Guidance**

The list below, together with information included in the scope section, outlines the treatments which are included in this activity:

- Aerobic treatment (including composting),
- Anaerobic treatment (or anaerobic digestion - AD),
- Mechanical biological treatment (MBT),
- Biodrying,
- Activated Sludge,
- Aerated Lagoons

## 3.1 General BAT conclusions for the biological treatment of waste

[Conclusions in section 3.1 apply to all biological treatments in scope.]

### 3.1.1 Overall environmental performance

**BAT 33.**
**In order to reduce odour emissions and to improve the overall environmental performance, BAT is to select the waste input.**

Description

The technique consists of carrying out the pre-acceptance, acceptance and sorting of the waste input (see BAT 2) so as to ensure the suitability of the waste input for the waste treatment, e.g. in terms of nutrient balance, moisture or toxic compounds which may reduce the biological activity.

**BAT 33- Interpretational Guidance**

Pre-acceptance procedures may include an operator carrying out up-stream audits on their feedstock suppliers to ensure waste is consistently presented in a manner which is suitable for their waste treatment operation. They may include a limit on the age of the waste by the time it reaches the facility to prevent the acceptance of highly odorous material.

Selecting the waste input can be important to balance the process such as carbon: nitrogen ratios of the mix. This can affect the emission of ammonia and other odorous compounds.

### 3.1.2 Emissions to air

**BAT 34. In order to reduce channelled emissions to air of dust, organic compounds and odorous compounds, including $H_2S$ and $NH_3$, BAT is to use one or a combination of the techniques given below.**

| Technique | | Description |
|---|---|---|
| a. | Adsorption | See Section 6.6.1. |
| b | Biofilter | See Section 6.6.1.<br>A pretreatment of the waste gas before the biofilter (e.g. with a water or acid scrubber) may be needed in the case of a high $NH_3$ content (e.g. 5– 40 mg/$Nm^3$) in order to control the media pH and to limit the formation of $N_2O$ in the biofilter.<br>Some other odorous compounds (e.g. mercaptans, $H_2S$) can cause acidification of the biofilter media and necessitate the use of a water or alkaline scrubber for pretreatment of the waste gas before the biofilter. |

| | | |
|---|---|---|
| c. | Fabric filter | See Section 6.6.1. The fabric filter is used in the case of mechanical biological treatment of waste. |
| d. | Thermal oxidation | See Section 6.6.1. |
| e. | Wet scrubbing | See Section 6.6.1. Water, acid or alkaline scrubbers are used in combination with a biofilter, thermal oxidation or adsorption on activated carbon. |

Table 6.7: BAT-associated emission levels (BAT-AELs) for channelled $NH_3$, odour, dust and TVOC emissions to air from the biological treatment of waste

| Parameter | Unit | BAT-AEL (Average over the sampling Period) | Waste treatment process |
|---|---|---|---|
| $NH_3$ (1) (2) | $mg/Nm^3$ | 0.3–20 | All biological treatments of waste |
| Odour concentration (1) (2) | $ouE/Nm^3$ | 200–1 000 | |
| Dust | $mg/Nm^3$ | 2–5 | Mechanical biological treatment of waste |
| TVOC | $mg/Nm^3$ | 5–40 (3) | |
| (1) Either the BAT-AEL for $NH_3$ or the BAT-AEL for the odour concentration applies.<br>(2) This BAT-AEL does not apply to the treatment of waste mainly composed of manure.<br>(3) The lower end of the range can be achieved by using thermal oxidation. | | | |

The associated monitoring is given in BAT 8.

## BAT 34- Interpretational Guidance

This applies to channelled emissions, e.g. ducts, pipes and stacks but remember these also include open-topped biofilters.

Odour, ammonia and hydrogen sulphide are likely to be relevant emissions (BAT 3) but this must be confirmed by characterisation of the odour. Limits may be set for odour and ammonia through BAT 34. BAT 8 may also require monitoring for $H_2S$ although there is no AEL in the BRef for this parameter. Additional limits may be site specific and set in order to demonstrate the efficacy of the abatement equipment, to protect the environment and minimise impact on sensitive receptors.

Footnote (1) states that 'either the BAT-AEL for $NH_3$ or the BAT-AEL for the odour concentration applies' This will be based on which parameters are required to be monitored by applying BAT8 (See information at BAT 8 above)

Where substances are detected at significant levels in the BAT 3 waste gas inventory and these pose a risk to the environment or human health, SEPA may consider requiring monitoring of these and can set appropriate limits. Therefore, the setting of limits at biological treatment sites may not be restricted to either odour concentration or $NH_3$.

Operating efficiency is an important factor in abatement. This should be covered in the environmental management system (within the OMP). This should detail the manufacturers stated efficiency and measurement method and a threshold below which corrective action will be taken. The OMP should detail how abatement efficiency is monitored and how often.

### 3.1.3 Emissions to water and water usage

**BAT 35.**
**In order to reduce the generation of waste water and to reduce water usage, BAT is to use all of the techniques given below.**

| Technique | | Description | Applicability |
|---|---|---|---|
| a. | Segregation of water streams | Leachate seeping from compost piles and windrows is segregated from surface run-off water (see BAT 19f). | Generally applicable to new plants.<br>Generally applicable to existing plants within the constraints associated with the layout of the water circuits. |
| b. | Water recirculation | Recirculating process water streams (e.g. from dewatering of liquid digestate in anaerobic processes) or using as much as possible other water streams (e.g. water condensate, rinsing water, surface run-off water).<br>The degree of recirculation is limited by the water balance of the plant, the content of impurities (e.g. heavy metals, salts, pathogens, odorous compounds) and/or the characteristics of the water streams (e.g. nutrient content). | Generally applicable |
| c. | Minimisation of the generation of leachate | Optimising the moisture content of the waste in order to minimise the generation of leachate. | Generally applicable. |

**BAT 35- Interpretational Guidance**

None

## 3.2 BAT conclusions for the aerobic treatment of waste

Unless otherwise stated, the BAT conclusions presented in this section apply to the aerobic treatment of waste, and in addition to the general BAT conclusions for the biological treatment of waste in Section 6.3.1.

### 3.2.1 Overall environmental performance

**BAT 36. In order to reduce emissions to air and to improve the overall environmental performance, BAT is to monitor and/or control the key waste and process parameters.**

Description
Monitoring and/or control of key waste and process parameters, including:
- waste input characteristics (e.g. C to N ratio, particle size);
- temperature and moisture content at different points in the windrow;
- aeration of the windrow (e.g. via the windrow turning frequency, $O_2$ and/or $CO_2$ concentration in the windrow, temperature of air streams in the case of forced aeration);
- windrow porosity, height and width.

Applicability
Monitoring of the moisture content in the windrow is not applicable to enclosed processes when health and/or safety issues have been identified. In that case, the moisture content can be monitored before loading the waste into the enclosed composting stage and adjusted when it exits the enclosed composting stage.

BAT 36- **Interpretational Guidance**

Monitoring "including" but not restricted to the parameters listed. There are many different forms of monitoring, including visual or physical assessment, the use of handheld equipment such as a probe, or laboratory analysis. The level of monitoring/control carried out should be relative to the risk to the process through a failure to monitor/control.

Operators should state what they monitor for, the frequency, and how this is carried out.

## 3.2.2 Odour and diffuse emissions to air

**BAT 37.**
**In order to reduce diffuse emissions to air of dust, odour and bioaerosols from open-air treatment steps, BAT is to use one or both of the techniques given below**

| Technique | | Description | Applicability |
|---|---|---|---|
| a. | Use of semipermeable membrane covers | Active composting windrows are covered by semipermeable membranes. | Generally applicable |
| b. | Adaptation of operations to the meteorological conditions | This includes techniques such as the following:<br>- Taking into account weather conditions and forecasts when undertaking major outdoor process activities. For instance, avoiding formation or turning of windrows or piles, screening or shredding in the case of adverse meteorological conditions in terms of emissions dispersion (e.g. the wind speed is too low or too high, or the wind blows in the direction of sensitive receptors).<br>- Orientating windrows, so that the smallest possible area of composting mass is exposed to the prevailing wind, to reduce the dispersion of pollutants from the windrow surface. The windrows and piles are preferably located at the lowest elevation within the overall site layout. | Generally applicable |

**BAT 37- Interpretational Guidance**

This BAT refers to mitigation of diffuse emissions, e.g. from open air treatment and not from open or closed biofilters (this is controlled elsewhere). This does not prevent the inclusion of bioaerosol related conditions in a permit where there is justification. These techniques are in addition to the requirements of BAT 14 which are more detailed.

SEPA does not consider this requires all aerobic treatment sites to install semi-permeable membrane covers. Only where it is unlikely the risk of offensive odour causing a negative impact to receptors is sufficiently mitigated using technique b in BAT 37 will both of these techniques be required.

Sites that are located within 250m of a sensitive receptor will be expected to put in place all measures necessary to restrict the emissions of bioaerosols outwith the site boundary unless the operator can demonstrate that such measures are not required. Such measures may include negative aeration or enclosure of the process.

## 3.3 BAT conclusions for the anaerobic treatment of waste

Unless otherwise stated, the BAT conclusions presented in this section apply to the anaerobic treatment of waste, and in addition to the general BAT conclusions for the biological treatment of waste in Section 6.3.1.

### 3.3.1 Emissions to air

**BAT 38. In order to reduce emissions to air and to improve the overall environmental performance, BAT is to monitor and/or control the key waste and process parameters.**

Description
Implementation of a manual and/or automatic monitoring system to:
- ensure a stable digester operation;
- 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.

This includes monitoring and/or control of key waste and process parameters, e.g.:
- 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 (e.g. $H_2S$) and pressure;
- liquid and foam levels in the digester.

**BAT 38- Interpretational Guidance**

Operators should monitor for the signs of grit build-up in the bottom of digesters and have a regular de-sludging programme. Where digesters fill with grit, the retention time is reduced and the resulting digestate will have a higher RBP than usual.

As well as $H_2S$, operators should also monitor $CO_2$ and moisture in the biogas stream.

## 3.4 BAT conclusions for the mechanical biological treatment (MBT) of waste

Unless otherwise stated, the BAT conclusions presented in this section apply to MBT, and in addition to the general BAT conclusions for the biological treatment of waste in Section 6.3.1.

The BAT conclusions for the aerobic treatment (Section 6.3.2) and anaerobic treatment (Section 6.3.3) of waste apply, when relevant, to the mechanical biological treatment of waste.

### 3.4.1 Emissions to air

**BAT 39. In order to reduce emissions to air, BAT is to use both of the techniques given below.**

| Technique | | Description | Applicability |
|---|---|---|---|
| a. | Segregation of the waste gas streams | Splitting of 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 the inventory mentioned in BAT 3. | Generally applicable to new plants. |

| | | | |
|---|---|---|---|
| b. | Recirculation of waste gas | Recirculation of waste gas with a low pollutant content in the biological process followed by waste gas treatment adapted to the concentration of pollutants (see BAT 34).<br>The use of waste gas in the biological process may be limited by the waste gas temperature and/or the pollutant content. It may be necessary 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 (see BAT 35) or treated before discharge. | Generally applicable to existing plants within the constraints associated with the layout of the air circuits. |

**BAT 39- Interpretational Guidance**

None.

# 4. BAT conclusions for the physico-chemical treatment of waste

Unless otherwise stated, the BAT conclusions presented in Section 4 apply to the physico-chemical treatment of waste, and in addition to the general BAT conclusions in Section 1.

## 4.1 BAT conclusions for the physico-chemical treatment of solid and/or pasty waste

**Interpretational Guidance**

The two main processes referred to in the BRef for physico-chemical treatment of solid and/or pasty waste are:
-immobilisation of solid and/or pasty waste (Section 5.1.2.1), which includes stabilisation and solidification, and
- physico-chemical treatment of solid and/or pasty waste before backfilling

Immobilisation aims at minimising the rate of contaminant migration to the environment and/or reducing the level of toxicity of contaminants, in order to alter or improve the characteristics of the waste so that it can be disposed of. The objective encompasses both a reduction in the waste toxicity and mobility as well as an improvement in the engineering properties of the stabilised material. Immobilisation changes the chemical composition by some chemical reactions but does not reduce the content of any contaminant in the waste input.

The purpose of stabilisation is to fully or partially bind contaminants (e.g. heavy metals) by the addition of supporting media, binders, or other modifiers. Stabilisation is accomplished by mixing the waste with a reagent to minimise the rate of contamination migration from the waste, thereby reducing the toxicity of the waste and improving the handling properties of the waste at the landfill. To achieve this, the process includes a physico-chemical interaction between the reagent and waste, rather than just dilution.

In principle, all treatment options can be applied to solid and/or pasty waste. However, the characteristics of the treated material and the effectiveness of a treatment technology can vary greatly depending on the specific properties of the original waste input and on the type of cleaning system applied.

### 4.1.1 Overall environmental performance

**BAT 40.**
**In order to improve the overall environmental performance, BAT is to monitor the waste input as part of the waste pre-acceptance and acceptance procedures (see BAT 2).**

*Description*
Monitoring the waste input, e.g. in terms of:
— content of organics, oxidising agents, metals (e.g. mercury), salts, odorous compounds;
— $H_2$ formation potential upon mixing of flue-gas treatment residues, e.g. fly ashes, with water.

**BAT 40- Interpretational Guidance**
The pre acceptance and acceptance procedures should also consider WM3 classification, compatibility and proof of treatment criteria.

### 4.1.2 Emissions to air

**BAT 41.**
**In order to reduce emissions of dust, organic compounds and $NH_3$ to air, BAT is to apply BAT 14d and to use one or a combination of the techniques given below.**

| | Technique | Description |
|---|---|---|
| a. | Adsorption | See Section 6.1. |
| b | Biofilter | |
| c | Fabric filter | |
| d. | Wet scrubbing | |

Table 6.8 BAT-associated emission level (BAT-AEL) for channelled emissions of dust to air from the physico- chemical treatment of solid and/or pasty waste

| Parameter | Unit | BAT-AEL (Average over the sampling period) |
|---|---|---|
| Dust | $mg/Nm^3$ | 2-5 |

The associated monitoring is given in BAT 8.

**BAT 41- Interpretational Guidance**

This is in addition to other relevant compounds identified in the inventory of air emissions.

Limits for other relevant compounds may be set in permits where necessary to protect sensitive receptors.

## 4.2 BAT conclusions for the re-refining of waste oil

**Interpretational Guidance**

In the BRef, re-refining of waste oil is described as

- The recovery of waste oil to be used as a fuel or reductant. This includes treatments such as thermal cracking and gasification, but also milder treatments of waste oils, or
- The treatment of waste oil to reconvert it into a material that can be reused or used as a base oil to produce lubricants. In the BRef this is referred to as 're-refining'.

Treatment of oily wastes such as drilling mud is covered under section 5- treatment of water based liquid waste.

### 4.2.1 Overall environmental performance

**BAT 42.**
**In order to improve the overall environmental performance, BAT is to monitor the waste input as part of the waste pre-acceptance and acceptance procedures (see BAT 2).**

*Description*
Monitoring of the waste input in terms of content of chlorinated compounds (e.g. chlorinated solvents or PCBs).

**BAT 42- Interpretational Guidance**

The requirement to monitor for chlorinated compounds may not apply for all waste oil streams- it should be driven by the characteristics of the individual oils. Chlorinated compounds may not be present in all waste oils, e.g. marine wastes.

The pre-acceptance and acceptance procedure should identify the minimum sampling frequency. This should be established through a programme of sampling until a reliable range can be demonstrated.

**BAT 43.**
**In order to reduce the quantity of waste sent for disposal, BAT is to use one or both of the techniques given below.**

| Technique | | Description |
|---|---|---|
| a. | Material recovery | Using the organic residues from vacuum distillation, solvent extraction, thin film evaporators, etc. in asphalt products, etc. |
| b. | Energy recovery | Using the organic residues from vacuum distillation, solvent extraction, thin film evaporators, etc. to recover energy. |

BAT 43- **Interpretational Guidance**

None.

### 4.2.2. Emissions to air

**BAT 44. In order to reduce emissions of organic compounds to air, BAT is to apply BAT 14d and to use one or a combination of the techniques given below.**

| Technique | | Description |
|---|---|---|
| a. | Adsorption | See Section 6.1 |
| b. | Thermal oxidation | See Section 6.1. This includes when the waste gas is sent to a process furnace or a boiler. |
| c | Wet scrubbing | See Section 6.1. |

The BAT-AEL set in Section 4.5 applies.
The associated monitoring is given in BAT 8.

**BAT 44- Interpretational Guidance**

It may be necessary to monitor for additional pollutants if thermal oxidation is used (e.g CO, $H_2S$, VOCs etc).

## 4.3 BAT conclusions for the physico-chemical treatment of waste with calorific value

### 4.3.1 Emissions to air

**BAT 45.**
**In order to reduce emissions of organic compounds to air, BAT is to apply BAT 14d and to use one or a combination of the techniques given below.**

| Technique | | Description |
|---|---|---|
| a. | Adsorption | See Section 6.1 |
| b. | Cryogenic condensation | |
| c. | Thermal oxidation | |
| d. | Wet scrubbing | |

The BAT-AEL set in Section 4.5 applies.
The associated monitoring is given in BAT 8.

BAT 45- **Interpretational Guidance**

The BAT-AEL in section 4.5 relates to TVOC. Additional limits may be set in permits as necessary.

## 4.4 BAT conclusions for the regeneration of spent solvents

### 4.4.1 Overall environmental performance

**BAT 46.**
**In order to improve the overall environmental performance of the regeneration of spent solvents, BAT is to use one or both of the techniques given below.**

| Technique | | Description | Applicability |
|---|---|---|---|
| a. | Material recovery | Solvents are recovered from the distillation residues by evaporation. | Applicability may be restricted when the energy demand is excessive with regards to the quantity of solvent recovered. |

| | | | |
|---|---|---|---|
| b. | Energy recovery | The residues from distillation are used to recover energy. | Generally applicable. |

**BAT 46**- INTERPRETATIONAL GUIDANCE

Achieving End of Waste will improve the environmental performance of the activity.

### 4.4.2 Emissions to air

**BAT 47.**
**In order to reduce emissions of organic compounds to air, BAT is to apply BAT 14d and to use a combination of the techniques given below.**

| Technique | | Description | Applicability |
|---|---|---|---|
| a. | Recirculation of process off-gases in a steam boiler | The process off-gases from the condensers are sent to the steam boiler supplying the plant. | May not be applicable to the treatment of halogenated solvent wastes, in order to avoid generating and emitting PCBs and/or PCDD/F. |
| b. | Adsorption | See Section 6.1. | There may be limitations to the applicability of the technique due to safety reasons (e.g. activated carbon beds tend to self-ignite when loaded with ketones). |
| c. | Thermal oxidation | See Section 6.1. | May not be applicable to the treatment of halogenated solvent wastes, in order to avoid generating and emitting PCBs and/or PCDD/F |
| d. | Condensation or cryogenic condensation | See Section 6.1. | Generally applicable. |
| e. | Wet scrubbing | See Section 6.1 | Generally applicable. |

The BAT-AEL set in Section 4.5 applies.
The associated monitoring is given in BAT 8.

**BAT 47- Interpretational Guidance**

It may be necessary to monitor for additional pollutants if thermal oxidation is used (e.g. CO, $H_2S$, VOCs etc).

## 4.5 BAT-AEL for emissions of organic compounds to air from the re-refining of waste oil, the physico- chemical treatment of waste with calorific value and the regeneration of spent solvents

**BATc**

Table 6.9 BAT-associated emission level (BAT-AEL) for channelled emissions of TVOC to air from the re-refining of waste oil, the physico-chemical treatment of waste with calorific value and the regeneration of spent solvents

| Parameter | Unit | BAT-AEL(1) (Average over the sampling period) |
|---|---|---|
| TVOC | $mg/Nm^3$ | 5-30 |
| (1) The BAT-AEL does not apply when the emission load is below 2 kg/h at the emission point provided that no CMR substances are identified as relevant in the waste gas stream, based on the inventory mentioned in BAT 3. | | |

BAT 48- INTERPRETATIONAL GUIDANCE

CMR substances are substances that are carcinogenic, mutagenic or toxic to reproduction (CMR). They are of specific concern due to the long term and serious effects that they may exert on human health. More detail on CMR substances is available here.

In order to apply the footnote, operators must demonstrate that both the emission load is less than 2kg/hr and that no CMR are present in the waste gas stream. The emissions test should provide a release rate in g/hr which is used as the basis for this consideration. Testing should be carried out at peak emission rate and a suitable number of tests to provide a robust result.

## 4.6 BAT conclusions for the thermal treatment of spent activated carbon, waste catalysts and excavated contaminated soil

### 4.6.1 Overall environmental performance

**BAT 48.**
**In order to improve the overall environmental performance of the thermal treatment of spent activated carbon, waste catalysts and excavated contaminated soil, BAT is to use all of the techniques given below.**

| Technique | | Description | Applicability |
|---|---|---|---|
| a. | Heat recovery from the furnace off-gas | Recovered heat may be used, for example, for preheating of combustion air or for the generation of steam, which is also used in the reactivation of the spent activated carbon. | Generally applicable. |
| b. | Indirectly fired furnace | An indirectly fired furnace is used to avoid contact between the contents of the furnace and the flue-gases from the burner(s). | Indirectly fired furnaces are normally constructed with a metal tube and applicability may be restricted due to corrosion problems. There may be also economic restrictions for retrofitting existing plants. |
| c. | Process-integrated techniques to reduce emissions to air | This includes techniques such as:<br>— control of the furnace temperature and of the rotation speed of the rotary furnace;<br>— choice of fuel;<br>— use of a sealed furnace or operation of the furnace at a reduced pressure to avoid diffuse emissions to air. | Generally applicable. |

BAT 48- INTERPRETATIONAL GUIDANCE

None

### 4.6.2 Emissions to air

**BAT 49.**
**In order to reduce emissions of HCl, HF, dust and organic compounds to air, BAT is to apply BAT 14d and to use one or a combination of the techniques given below.**

| Technique | | Description |
|---|---|---|
| a. | Cyclone | See Section 6.1. The technique is used in combination with further abatement techniques. |
| b. | Electrostatic precipitator (ESP) | See Section 6.1 |
| c. | Fabric filter | |
| d. | Wet scrubbing | |
| e. | Adsorption | |
| f. | Condensation | |
| g. | Thermal oxidation(1) | |
| (1) Thermal oxidation is carried out with a minimum temperature of 1 100 °C and a two-second residence time for the regeneration of activated carbon used in industrial applications where refractory halogenated or other thermally resistant substances are likely to be present. In the case of activated carbon used for potable water- and food-grade applications, an afterburner with a minimum heating temperature of 850 °C and a two-second residence time is sufficient (see Section 6.1). | | |

The associated monitoring is given in BAT 8.

**BAT 49- Interpretational Guidance**

It may be necessary to monitor for additional pollutants if thermal oxidation is used (e.g CO, $H_2S$, VOCs etc).

## 4.7 BAT conclusions for the water washing of excavated contaminated soil

### 4.7.1 Emissions to air

**BAT 50.**
**In order to reduce emissions of dust and organic compounds to air from the storage, handling, and washing steps, BAT is to apply BAT 14d and to use one or a combination of the techniques given below.**

| Technique | | Description |
|---|---|---|
| a. | Adsorption | See Section 6.1. |
| b. | Fabric filter | |
| c. | Wet scrubbing | |

The associated monitoring is given in BAT 8.

BAT 50- **Interpretational Guidance**

None.

## 4.8 BAT conclusions for the decontamination of equipment containing PCBs

### 4.8.1 Overall environmental performance

**BAT 51.**
**In order to improve the overall environmental performance and to reduce channelled emissions of PCBs and organic compounds to air, BAT is to use all of the techniques given below.**

| Technique | | Description |
|---|---|---|
| a. | Coating of the storage and treatment areas | This includes techniques such as:<br>— resin coating applied to the concrete floor of the whole storage and treatment area. |
| b | Implementation of staff access rules to prevent dispersion of contamination | This includes techniques such as:<br>— access points to storage and treatment areas are locked;<br>—special qualification is required to access the area where the contaminated equipment is stored and handled;<br>— separate 'clean' and 'dirty' cloakrooms to put on/remove individual protective outfit. |
| c. | Optimised equipment cleaning and drainage | This includes techniques such as:<br>— external surfaces of the contaminated equipment are cleaned with anionic detergent;<br>— emptying of the equipment with a pump or under vacuum instead of gravity emptying;<br>—procedures are defined and used for filling, emptying and (dis)connecting the vacuum vessel;<br>— a long period of drainage (at least 12 hours) is ensured to avoid any dripping of contaminated liquid during further treatment operations, after the separation of the core from the casing of an electrical transformer. |
| d. | Control and monitoring of emissions to air | This includes techniques such as:<br>— the air of the decontamination area is collected and treated with activated carbon filters;<br>— the exhaust of the vacuum pump mentioned in technique c. above is connected to an end-of-pipe abatement system (e.g. a high-temperature incinerator, thermal oxidation or adsorption on activated carbon);<br>— the channelled emissions are monitored (see BAT 8);<br>— the potential atmospheric deposition of PCBs is monitored (e.g. through physico-chemical measurements or biomonitoring). |
| e. | Disposal of waste treatment residues | This includes techniques such as:<br>— porous, contaminated parts of the electrical transformer (wood and paper) are sent to high-temperature incineration;<br>— PCBs in the oils are destroyed (e.g. dechlorination, hydrogenation, solvated electron processes, high-temperature incineration). |
| f. | Recovery of solvent when solvent washing is used | Organic solvent is collected and distilled to be reused in the process. |

The associated monitoring is given in BAT 8.

**BAT 51- Interpretational Guidance**

Note all techniques must be used.

# 5. BAT conclusions for the treatment of water-based liquid waste

Unless otherwise stated, the BAT conclusions presented in Section 5 apply to the treatment of water-based liquid waste, and in addition to the general BAT conclusions in Section 1.

(Note this does not include biological treatment of liquid waste. This is covered in section 3.)

## 5.1 Overall environmental performance

**BAT 52. In order to improve the overall environmental performance, BAT is to monitor the waste input as part of the waste pre-acceptance and acceptance procedures (see BAT 2).**

*Description*

Monitoring the waste input, e.g. in terms of:

— bioeliminability (e.g. BOD, BOD to COD ratio, Zahn-Wellens test, biological inhibition potential (e.g. inhibition of activated sludge);

— feasibility of emulsion breaking, e.g. by means of laboratory-scale tests**.**

BAT 52- INTERPRETATIONAL GUIDANCE

None

## 5.2 Emissions to air

**BAT 53. In order to reduce emissions of HCl, $NH_3$ and organic compounds to air, BAT is to apply BAT 14d and to use one or a combination of the techniques given below.**

| Technique | | Description |
|---|---|---|
| a. | Adsorption | See Section 6.1. |
| b. | Biofilter | |
| c. | Thermal oxidation | |
| d. | Wet scrubbing | |

Table 6.10 BAT-associated emission levels (BAT-AELs) for channelled emissions of HCl and TVOC to air from the treatment of water-based liquid waste

| Parameter | Unit | BAT-AEL(1) (Average over the sampling period) |
|---|---|---|
| Hydrogen chloride (HCl) | $mg/Nm^3$ | 1-5 |
| TVOC | | 3-20(2) |

(1) These BAT-AELs only apply when the substance concerned is identified as relevant in the waste gas stream, based on the inventory mentioned in BAT 3.

(2) The upper end of the range is 45 $mg/Nm^3$ when the emission load is below 0,5 kg/h at the emission point.

The associated monitoring is given in BAT 8.

BAT 53- INTERPRETATIONAL GUIDANCE

It may be necessary to monitor for additional pollutants if thermal oxidation is used (e.g CO, $H_2S$, VOCs etc).

# 6. Description of techniques

## 6.1 Channelled emissions to air

| Technique | Typical pollutant(s) abated | Description |
|---|---|---|
| Adsorption | Mercury, volatile organic compounds, hydrogen sulphide, odorous compounds | Adsorption is a heterogeneous reaction in which gas molecules are retained on a solid or liquid surface that prefers specific compounds to others and thus removes them from effluent streams. When the surface has adsorbed as much as it can, the adsorbent is replaced or the adsorbed content is desorbed as part of the regeneration of the adsorbent. When desorbed, the contaminants are usually at a higher concentration and can either be recovered or disposed of. The most common adsorbent is granular activated carbon. |
| Biofilter | Ammonia, hydrogen sulphide, volatile organic compounds, odorous compounds | The waste gas stream is passed through a bed of organic material (such as peat, heather, compost, root, tree bark, softwood and different combinations) or some inert material (such as clay, activated carbon, and polyurethane), where it is biologically oxidised by naturally occurring microorganisms into carbon dioxide, water, inorganic salts and biomass. A biofilter is designed considering the type(s) of waste input. An appropriate bed material, e.g. in terms of water retention capacity, bulk density, porosity, structural integrity, is selected. Also important are an appropriate height and surface area of the filter bed. The biofilter is connected to a suitable ventilation and air circulation system in order to ensure a uniform air distribution through the bed and a sufficient residence time of the waste gas inside the bed. |
| Condensation and cryogenic condensation | Volatile organic compounds | Condensation is a technique that eliminates solvent vapours from a waste gas stream by reducing its temperature below its dew point. For cryogenic condensation, the operating temperature can be down to -120 °C, but in practice it is often between -40 °C and -80 °C in the condensation device. Cryogenic condensation can cope with all VOCs and volatile inorganic pollutants, irrespective of their individual vapour pressures. The low temperatures applied allow for very high condensation efficiencies which make it well-suited as a final VOC emission control technique. |
| Cyclone | Dust | Cyclone filters are used to remove heavier particulates, which 'fall out' as the waste gases are forced into a rotating motion before they leave the separator. Cyclones are used to control particulate material, primarily PM10. |
| Electrostatic Precipitator (ESP) | Dust | Electrostatic precipitators operate such that particles are charged and separated under the influence of an electrical field. Electrostatic precipitators are capable of operating under a wide range of conditions. In a dry ESP, the collected material is mechanically removed (e.g. by shaking, vibration, compressed air), while in a wet ESP it is flushed with a suitable liquid, usually water. |
| Fabric filter | Dust | Fabric filters, often referred to as bag filters, are constructed from porous woven or felted fabric through which gases are passed to remove particles. The use of a fabric filter requires the selection of a fabric suitable for the characteristics of the waste gas and the maximum operating temperature. |
| HEPA filter | Dust | HEPA filters (high-efficiency particle air filters) are absolute filters. The filter medium consists of paper or matted glass fibre with a high packing density. The waste |

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| | | gas stream is passed through the filter medium, where particulate matter is collected. |
| Thermal oxidation<br>The removal of | Volatile organic compounds | The oxidation of combustible gases and odorants in a waste gas stream by heating the mixture of contaminants with air or oxygen to above its auto-ignition point in a combustion chamber and maintaining it at a high temperature long enough to complete its combustion to carbon dioxide and water. |
| Wet scrubbing | Dust, volatile organic compounds, gaseous acidic compounds (alkaline scrubber), gaseous alkaline compounds (acid scrubber) | gaseous or particulate pollutants from a gas stream via mass transfer to a liquid solvent, often water or an aqueous solution. It may involve a chemical reaction (e.g. in an acid or alkaline scrubber). In some cases, the compounds may be recovered from the solvent. |

INTERPRETATIONAL GUIDANCE

None

## 6.2 Diffuse emissions of organic compounds to air

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| Leak detection and repair (LDAR) programme | Volatile organic compounds | A structured approach to reduce fugitive emissions of organic compounds by detection and subsequent repair or replacement of leaking components. Currently, sniffing (described by EN 15446) and optical gas imaging methods are available for the identification of leaks.<br>**Sniffing method**: The first step is the detection using hand-held organic compound analysers measuring the concentration adjacent to the equipment (e.g. using flame ionisation or photoionisation). The second step consists of enclosing the component in an impermeable bag to carry out a direct measurement at the source of the emission. This second step is sometimes replaced by mathematical correlation curves derived from statistical results obtained from a large number of previous measurements made on similar components.<br>**Optical gas imaging methods**: Optical imaging uses small lightweight hand-held cameras which enable the visualisation of gas leaks in real time, so that they appear as 'smoke' on a video recorder together with the normal image of the component concerned, to easily and rapidly locate significant organic compound leaks. Active systems produce an image with a back-scattered infrared laser light reflected on the component and its surroundings. Passive systems are based on the natural infrared radiation of the equipment and its surroundings. |
| Measurement of diffuse VOC emissions | Volatile organic compounds | Sniffing and optical gas imaging methods are described under leak detection and repair programme.<br>Full screening and quantification of emissions from the installation can be undertaken with an appropriate combination of complementary methods, e.g. Solar occultation flux (SOF) or Differential absorption LIDAR (DIAL) campaigns. These results can be used for trend evaluation over time, cross-checking and updating/validation of the ongoing LDAR programme.<br>**Solar occultation flux (SOF)**: The technique is based on the recording and spectrometric Fourier Transform analysis of a broadband infrared or ultraviolet/visible sunlight spectrum along a given geographical itinerary, crossing the wind direction and cutting through VOC plumes. |

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| | | **Differential absorption LIDAR (DIAL)**: This is a laser-based technique using differential absorption LIDAR (light detection and ranging), which is the optical analogue of radio wave-based RADAR. The technique relies on the backscattering of laser beam pulses by atmospheric aerosols, and the analysis of the spectral properties of the returned light collected with a telescope. |

INTERPRETATIONAL GUIDANCE

None

## 6.3 Emissions to water

| Technique | Typical pollutant(s) targeted | Description |
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| Activated sludge process | Biodegradable organic compounds | The biological oxidation of dissolved organic pollutants with oxygen using the metabolism of microorganisms. In the presence of dissolved oxygen (Injected as air or pure oxygen), the organic components are transformed into carbon dioxide, water or other metabolites and biomass (i.e. the activated sludge). The microorganisms are maintained in suspension in the waste water and the whole mixture is mechanically aerated. The activated sludge mixture is sent to a separation facility from where the sludge is recycled to the aeration tank. |
| Adsorption | Adsorbable dissolved non-biodegradable or inhibitory pollutants, e.g. hydrocarbons, mercury, AOX | Separation method in which compounds (i.e. pollutants) in a fluid (i.e. waste water) are retained on a solid surface (typically activated carbon). |
| Chemical oxidation | Oxidisable dissolved non-biodegradable or inhibitory pollutants, e.g. nitrite, cyanide | Organic compounds are oxidised to less harmful and more easily biodegradable compounds. Techniques include wet oxidation or oxidation with ozone or hydrogen Peroxide, optionally supported by catalysts or UV radiation. Chemical oxidation is also used to degrade organic compounds causing odour, taste and colour and for disinfection purposes. |
| Chemical reduction | Reducible dissolved non-biodegradable or inhibitory pollutants, e.g. hexavalent chromium (Cr(VI)) | Chemical reduction is the conversion of pollutants by chemical reducing agents into similar but less harmful or hazardous compounds. |
| Coagulation and flocculation | Suspended solids and particulate-bound metals | Coagulation and flocculation are used to separate suspended solids from waste water and are often carried out in successive steps. Coagulation is carried out by adding coagulants with charges opposite to those of the suspended solids. Flocculation is carried out by adding polymers, so that collisions of microfloc particles cause them to bond to produce larger flocs. The flocs formed are subsequently separated by sedimentation, air flotation or filtration. |
| Distillation/rectification | Dissolved non-biodegradable or inhibitory pollutants that can be distilled, e.g. some solvents | Distillation is a technique to separate compounds with different boiling points by partial evaporation and recondensation. Waste water distillation is the removal of low-boiling contaminants from waste water by transferring them into the vapour phase. Distillation is carried out in columns, equipped with |

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| | | plates or packing material, and a downstream condenser. |
| Equalisation | All pollutants | Balancing of flows and pollutant loads by using tanks or other management techniques |
| Evaporation | Soluble pollutants | The use of distillation (see above) to concentrate aqueous solutions of high boiling substances for further use, processing or disposal (e.g. waste water incineration) by transferring water to the vapour phase. It is typically carried out in multistage units with increasing vacuum, to reduce the energy demand. The water vapours are condensed, to be reused or discharged as waste water. |
| Filtration | Suspended solids and particulate-bound metals | The separation of solids from waste water by passing them through a porous medium, e.g. sand filtration, microfiltration and ultrafiltration. |
| Flotation | | The separation of solid or liquid particles from waste water by attaching them to fine gas bubbles, usually air. The buoyant particles accumulate at the water surface and are collected with skimmers. |
| Ion exchange | Ionic dissolved non biodegradable or inhibitory pollutants, e.g. metals | The retention of undesired or hazardous ionic constituents of waste water and their replacement by more acceptable ions using an ion exchange resin. The pollutants are temporarily retained and afterwards released into a regeneration or backwashing liquid. |
| Membrane bioreactor | Biodegradable organic compounds | A combination of activated sludge treatment and membrane filtration. Two variants are used: a) an external recirculation loop between the activated sludge tank and the membrane module; and b) immersion of the membrane module in the aerated activated sludge tank, where the effluent is filtered through a hollow fibre membrane, the biomass remaining in the tank. |
| Membrane filtration | Suspended solids and particulate-bound metals | Microfiltration (MF) and ultrafiltration (UF) are membrane filtration processes that retain and concentrate, on one side of the membrane, pollutants such as suspended particles and colloidal particles contained in waste waters. |
| Neutralisation | Acids, alkalis | The adjustment of the pH of waste water to a neutral level (approximately 7) by the addition of chemicals. Sodium hydroxide (NaOH) or calcium hydroxide (Ca(OH)2) may be used to increase the pH, whereas sulphuric acid (H2SO4), hydrochloric acid (HCl) or carbon dioxide (CO2) may be used to decrease the pH. The precipitation of some pollutants may occur during neutralisation. |
| Nitrification/denitrification | Total nitrogen, ammonia | A two-step process that is typically incorporated into biological waste water treatment plants. The first step is aerobic nitrification where microorganisms oxidise ammonium ($NH_4^+$) to the intermediate nitrite ($NO_2^-$), which is then further oxidised to nitrate ($NO_3^-$). In the subsequent anoxic denitrification step, microorganisms chemically reduce nitrate to nitrogen gas. |
| Oil-water separation | Oil/grease | The separation of oil and water and subsequent oil removal by gravity separation of free oil, using separation equipment or emulsion breaking (using emulsion breaking chemicals such as metal salts, mineral acids, adsorbents and organic polymers). |
| Sedimentation | Suspended solids and particulate-bound metals | The separation of suspended particles by gravitational settling. |
| Precipitation | Precipitable dissolved non-biodegradable or | The conversion of dissolved pollutants into insoluble compounds by adding precipitants. The |

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| | inhibitory pollutants, e.g.metals, phosphorus | solid precipitates formed are subsequently separated by sedimentation, air flotation or filtration. |
| Stripping | Purgeable pollutants, e.g. hydrogen sulphide (H2S), ammonia (NH3), some adsorbable organically bound halogens (AOX), hydrocarbons | The removal of purgeable pollutants from the aqueous phase by a gaseous phase (e.g. steam, nitrogen or air) that is passed through the liquid. They are subsequently recovered (e.g. by condensation) for further use or disposal. The removal efficiency may be enhanced by increasing the temperature or reducing the pressure. |

INTERPRETATIONAL GUIDANCE

None

## 6.4 Sorting techniques

| Technique | Description |
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| Air classification | Air classification (or air separation, or aeraulic separation) is a process of approximate sizing of dry mixtures of different particle sizes into groups or grades at cut points ranging from 10 mesh to sub-mesh sizes. Air classifiers (also called windsifters) complement screens in applications requiring cut points below commercial screen sizes, and supplement sieves and screens for coarser cuts where the special advantages of air classification warrant it. |
| All-metal separator | Metals (ferrous and non-ferrous) are sorted by means of a detection coil, in which the magnetic field is influenced by metal particles, linked to a processor that controls the air jet for ejecting the materials that have been detected. |
| Electromagnetic separation of nonferrous metals | Non-ferrous metals are sorted by means of eddy current separators. An eddy current is induced by a series of rare earth magnetic or ceramic rotors at the head of a conveyor that spins at high speed independently of the conveyor. This process induces temporary magnetic forces in non-magnetic metals of the same polarity as the rotor, causing the metals to be repelled away and then separated from the other feedstock. |
| Manual separation | Material is manually separated by means of visual examination by staff on a picking line or on the floor, either to selectively remove a target material from a general waste stream or to remove contamination from an output stream to increase purity. This technique generally targets recyclables (glass, plastic, etc.) and any contaminants, hazardous materials and oversized materials such as WEEE |
| Magnetic separation | Ferrous metals are sorted by means of a magnet which attracts ferrous metal materials. This can be carried out, for example, by an overband magnetic separator or a magnetic drum. |
| Near-infrared spectroscopy (NIRS) | Materials are sorted by means of a near-infrared sensor which scans the whole width of the belt conveyor and transmits the characteristic spectra of the different materials to a data processor which controls an air jet for ejecting the materials that have been detected. Generally NIRS is not suitable for sorting black materials. |
| Sink-float tanks | Solid materials are separated into two flows by exploiting the different material densities. |
| Size separation | Materials are sorted according to their particle size. This can be carried out by drum screens, linear and circular oscillating screens, flip-flop screens, flat screens, tumbler screens and moving grates. |
| Vibration table | Materials are separated according to their density and size, moving (in slurry in the case of wet tables or wet density separators) across an inclined table, which oscillates backwards and forwards. |
| X-ray systems | Material composites are sorted according to various material densities, halogen components, or organic components, with the aid of X-rays. The characteristics of the different materials are transmitted to a data processor which controls an air jet for ejecting the materials that have been detected. |

| INTERPRETATIONAL GUIDANCE |
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| None |

## 6.5 Management techniques

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| Accident management plan | The accident management plan is part of the EMS (see BAT 1) and identifies hazards posed by the plant and the associated risks and defines measures to address these risks. It considers the inventory of pollutants present or likely to be present which could have environmental consequences if they escape. |
| Residues management plan | A residues management plan is part of the EMS (see BAT 1) and is a set of measures aiming to 1) minimise the generation of residues arising from the treatment of waste, 2) optimise the reuse, regeneration, recycling and/or recovery of energy of the residues, and 3) ensure the proper disposal of residues. |

| INTERPRETATIONAL GUIDANCE |
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| None |