UPDATED BAT ASSESSMENT

Introduction

The facility is currently permitted for three scheduled activities which are 1. S5.3 Part A(1) (a) (ii); 2. S5.4 Part A(1) (b) (iv) and 3. S5.6 Part A (1) (a) – see below*. 1 & 2 relate to an existing single mechanical treatment line (known throughout as the 'existing mechanical process') processing assorted wastes for the recovery of metal from this waste for recycling whilst 3 relates to the wastes stored prior to and following treatment via activity 1 (also relates to other wastes received for storage only and subsequent collection and disposal which will not change with the variation).

The variation seeks to add two new mechanical treatment lines (known throughout as the 'new mechanical processes') processing cables for the recovery of metal from this waste for recycling which will also be scheduled activities as per 1 & 2 above. This will also involve the storage of hazardous wastes prior to and following treatment via activity 1 which will be a scheduled activity as per 3 above. The variation will also involve the addition of two new LEV (local extraction ventilation systems) to and 2 x new waste codes to the wastes to be processed by the existing mechanical process. It also seeks to move the in-feed waste storage area for the existing mechanical process from inside the processing building to an external area. As such, all three activities (1, 2 & 3) will need to be varied.

*1: 5.3 Part A(1)(a)(ii) Disposal or recovery of hazardous waste with a capacity exceeding 10 tonnes per day involving…physico-chemical treatment
*2: 5.4 Part A(1)(b)(iv) Recovery or a mix of recovery and disposal of non-hazardous waste with a capacity exceeding 75 tonnes per day involving…treatment in shredders of metal waste, including waste electrical and electronic equipment and end-of-life vehicles and their components
*3: 5.6 Part A(1)(a) Temporary storage of hazardous waste with a total capacity exceeding 50 tonnes pending any of the activities listed in Sections 5.1, 5.2, 5.3 and paragraph (b) of this Section.

The relevant BAT Conclusion document (included with this appendix for reference) for these activities is:

COMMISSION IMPLEMENTING DECISION (EU) 2018/1147 of 10 August 2018 establishing best available techniques (BAT) conclusions for waste treatment, under Directive 2010/75/EU of the European Parliament and of the Council (notified under document C(2018) 5070), L208/38[1].

The BAT conclusions (53 in total) are set out in this document and each has been addressed and (where applicable) details of how each will be implemented/adhered to regarding the activities as undertaken by the existing mechanical process and updated with regards to the variations proposed for the existing mechanical process

[1] *https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018D1147&from=EN*

and the inclusion of the new mechanical processes proposed as part of this variation are provided below. All text taken from each individual BAT conclusion is shown in **BOLD** with details of how each will be implemented/adhered to shown in *italics*.

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 features (I through to XV) listed.

An Environmental Management System is being developed for the installation that incorporates all of the items listed (I through to XV) within 'BAT 1' of 'Decision document: Commission implementing decision (EU) 2018/1147 of 10 August 2018 establishing best available techniques (BAT) conclusions for waste treatment, under Directive 2010/75/EU of the European Parliament and of the Council' ('The document')'.

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**	*Details*
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).**	*The existing mechanical process is a processing line for the recovery of metal from the waste feed to this process. The feed to this mechanical process is a number of wastes containing non-ferrous metals, particularly copper, that need intensive mechanical processing to liberate and separate the metallic value that they contain. The new mechanical processes will involve the installation of 2 x duplicate granulation and separation lines for the recovery of metal from the waste feed to this process. The feed to the new mechanical processes will be electrical cable containing copper that needs mechanical processing to liberate and separate the metallic value that it contains.* *As such, ONLY these types of wastes will be accepted. Prior to acceptance, sampling will be carried out to assess the characteristics of the materials to determine if they are*

		physically and economically suitable for treatment. As part of the pre-acceptance checks – all individual input waste feeds will be accompanied with the appropriate (e.g. laboratory) analyses prior to acceptance on site. This will ensure that the waste batch is accepted under a specific EWC code and as such will also identify whether it is a hazardous or non-hazardous waste. As part of this, consideration will be given to the presence of Persistent Organic Pollutants (POPs) and other hazardous substances used as flame-retardants such as antimony trioxide for example. The waste feed for both the existing and new mechanical processes will be predominantly provided by EMR's own sites (otherwise from other suitably permitted approved authorised treatment facilities). As such, the nature of the incoming waste material means that it will be relatively stable in terms of composition & handling[2].
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).**	*As with the existing mechanical process, the new mechanical processes are being established to process a particular type of waste and are intended to recover high value metal for recycling. The material to be processed by both is visually distinct and all loads will be visually inspected upon arrival to confirm that it is the material identified in the pre-acceptance checks. In addition, as it is being handled it will be inspected by the machine operator to ensure that the material is consistent within the load and that it does not contain any other materials. Any loads that do not conform with the pre-acceptance characteristics will be quarantined and following*

[2] *The same level of pre-acceptance procedures are applied to the ASR/WWAS2 waste delivered directly by conveyor from EMR and being stored at IES prior to disposal only. Note that the ASR is referred to as WWAS2 as explained in the supporting statement accompanying this permit variation application.*

		discussion with the waste producer will either be processed (if suitable) or returned (if not). The waste feed for both the existing and new mechanical processes will be predominantly provided by EMR's own sites (otherwise from other suitably permitted approved authorised treatment facilities). The waste acceptance procedures essentially confirm the characteristics of the waste i.e. reducing time spent as the bulk of the required checks will have been undertaken at the pre-acceptance stage. Hazardous waste will only be received under the supervision of a suitably qualified person[3].
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).**	*As with the existing mechanical process, the new mechanical processes are being established to process a particular type of waste that will be processed through the same process route. All waste received at the site will be weighed and details recorded - including weight, date of receipt, waste producer, type of material and batch number. Material will be processed on a batch basis with reconciliation of the input batch weight and the weights of all outputs.* *All ASR/WWAS2 waste received at the site from EMR for storage at IES only prior to disposal (for which the facility is currently permitted for and which will NOT change as part of this variation) will also continue to have details recorded i.e. total weight received on date of receipt, type of material and batch number.*
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**	*The purpose of both the existing mechanical process and the new mechanical processes is to recover high value metal for recycling. Material will be processed on a batch basis to*

[3] *The same level of waste acceptance procedures are applied to the ASR/WWAS2 waste delivered directly by conveyor from EMR and being stored at IES prior to disposal only.*

	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).	*allow a mass balance through the process to be determined and outputs reconciled to inputs to ensure that the value of outputs is consistent with the price paid for the inputs. There will be quality control systems in place to monitor process performance, enabling process optimisation, as well as product quality to ensure that customer requirements are being met.*
e. Ensure waste segregation Waste is kept separated depending on its properties in order to enable easier and environmentally safer storage and treatment.	**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.**	*As with the existing mechanical process already developed, the new mechanical processes are being developed to process a particular type of waste but there may be variance depending on the source of the waste. Therefore wastes from different sources will be segregated in the reception/pre-processing storage areas and processed on a batch basis. Therefore, there will never be any mixing of EWC codes (and as such never any mixing of hazardous and non-hazardous wastes also which need to be segregated). With regards to the ASR/WWAS2 waste delivered directly by conveyor from EMR and being stored at IES prior to disposal only (for which the facility is currently permitted for and which will NOT change as part of this variation) then a number of hazardous and non-hazardous waste codes may be applicable to this material. If any new waste code becomes applicable to this waste and is different to the waste code in use for the waste already being stored at IES for disposal then the operator will continue to ensure that the waste stored is*

		completely emptied from its bay before accepting the incoming waste from EMR under the new code thus keeping different wastes codes and hazardous/non-hazardous waste segregated.
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).**	*Not relevant to either the existing mechanical process being undertaken or the new mechanical process proposed as part of this variation.*
Sort incoming solid waste	**Sorting of incoming solid waste aims to prevent unwanted material from entering subsequent waste treatment process(es). It may include: — manual separation by means of visual examinations; — ferrous metals, non-ferrous metals or all-metals separation; — optical separation, e.g. by near-infrared spectroscopy or X-ray systems; —density separation, e.g. by air classification, sink-float tanks, vibration tables; — size separation by screening/sieving.**	*There are three main process stages within the existing mechanical process, with the principal sorting activities as follows:* *<u>Pre- processing</u>* *Cutting material to size to make subsequent grinding more efficient and liberate other materials;* *Removing large ferrous and non ferrous metals which would not benefit from grinding;* *Removing fine inert material which would cause excessive wear in the grinder.* *<u>Grinding</u>* *Use of air classification to remove heavy lumps that might damage the grinder;* *Grinding to liberate separate materials (e.g. copper wire from plastic insulation) and shape them for subsequent efficient separation;* *Air classification to remove light 'fluff' liberated by grinding.*

		<u>*Separation*</u> *Screening into different size fractions to enable efficient subsequent separation;* *Magnetic separation of ferrous metals;* *Dry density separation to separate copper from plastic waste and 'fluff'.* *For the new mechanical processes, there are three MAIN process stages too for each line (please note that there is also a sink float density plastic separation stage and a drying stage should the possibility plastic to sell plastic as a product rather than disposal be possible), with the principal sorting activities as follows:* <u>*Pre- processing (Pre-shredding)*</u> *Cutting material to size to make subsequent granulation more efficient and liberate other materials;* *Removing ferrous metals which would not benefit from granulation;* <u>*Granulation*</u> *Secondary, tertiary and quaternary shredding to further cut material to size and liberate separate materials (e.g. copper wire from plastic insulation) and shape them for subsequent efficient separation; Further removal of ferrous metals;* *Air treatment to remove dust liberated by granulation.* <u>*Separation*</u> *Screening into different size fractions to enable efficient subsequent separation;* *Magnetic separation of ferrous metals;* *Dry density separation to separate copper from plastic waste.*

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[4]:

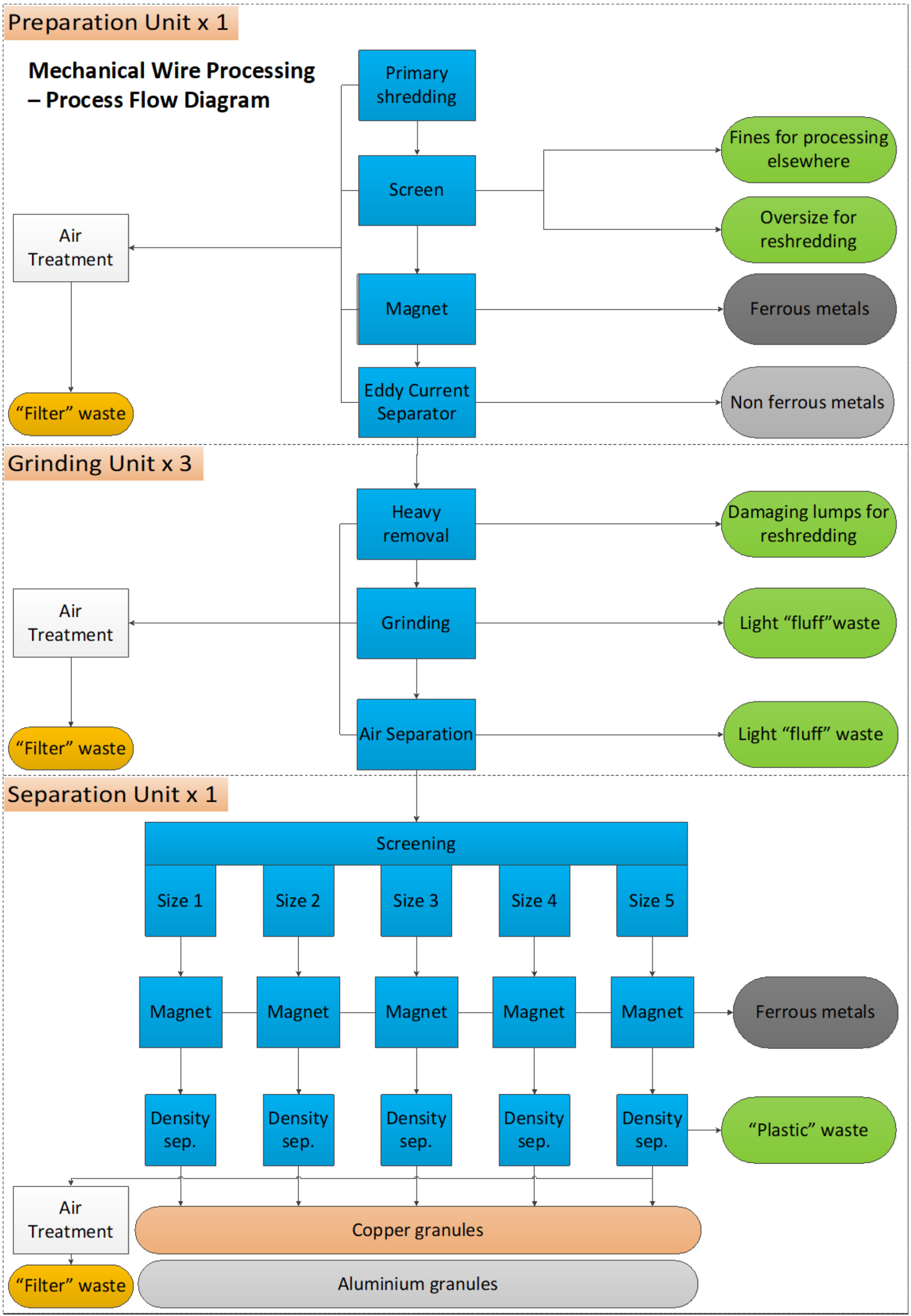
(i) information about the characteristics of the waste to be treated and the waste treatment processes, including:

(a) simplified process flow sheets that show the origin of the emissions;

See process flow diagram below of the mechanical processes –

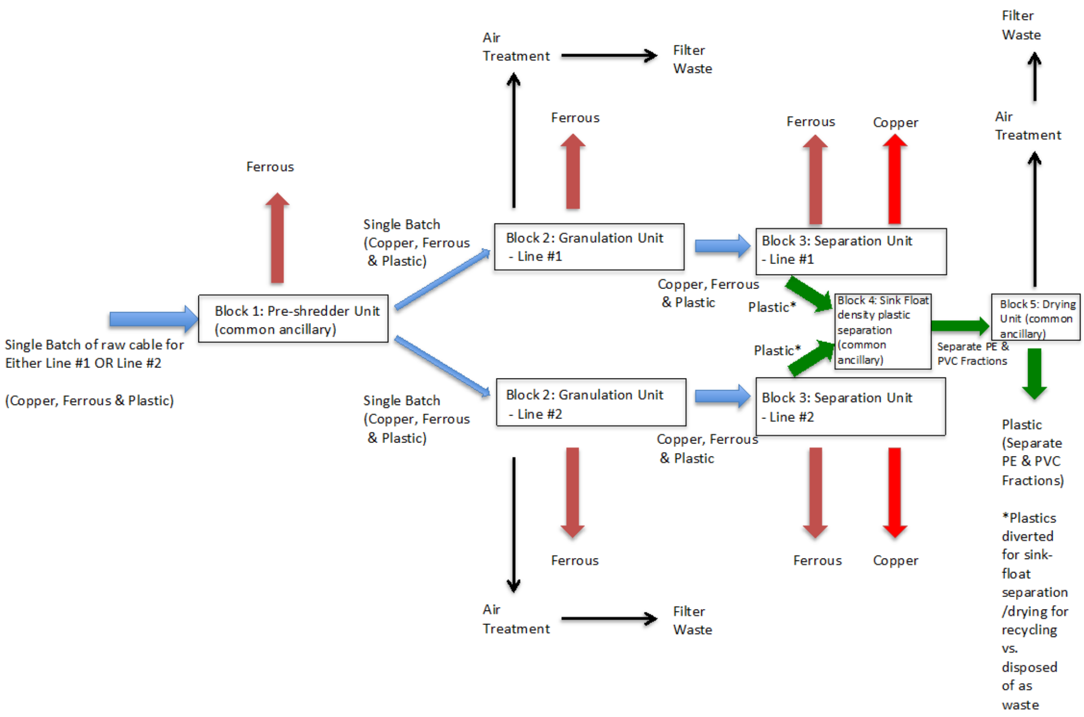
[4] *For both the existing and new mechanical processes - only emissions to Air are applicable and Emissions to water are not applicable as the mechanical processes are all dry processes. The waste gas stream inventory will be established and maintained as part of the EMS (See BAT 1).*

Existing Mechanical Process



Note: The proposed variation will add 2 x additional LEV systems to remove any airborne particulate around this existing processing line to improve even further/ensure local workplace air quality.

New Mechanical Processes



(b) descriptions of process-integrated techniques and waste water/waste gas treatment at source including their performances;

Details of the waste gas treatment for both the existing and new mechanical processes are summarised in the following table –

	Existing Mechanical Process					Existing - New LEVs		New Mechanical Process		
Location	Pre-Chop Line	Grinder 3	Separation Line	Grinder 1	Grinder 2	LEV 1	LEV 2	Line #1	Line #1	Plastic Dryer
Filter manufacturer	Donaldson Torit (DT)	Trensso	Trensso	Trensso	Trensso	DT	DT	Trensso	Trensso	Trensso
Filter model	DLM 2/8/15	FTR150-150	FTR400-150	FTR150-150	FTR150-150	DLM 2/8/15	DLM 2/8/15	FTR600-150	FTR600-150	FTR450-150
Dust emission (mg/m3)	≤5	≤5	≤5	≤5	≤5	≤5	≤5	≤5	≤5	≤5
Max. Dust emission (mg/m3)	5	5	5	5	5	5	5	5	5	5
Flowrate (m3/hr)	27,000	15,000	40,000	15,000	15,000	25,000	25,000	**60,000**	60,000	45,000
Filtration Area (m2)	240	120	240	120	120	240	240	480	480	360
BAT-AEL (upper range) mg/m3	5									

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
All filters have pre-cyclones

(ii) information about the characteristics of the waste water streams

Not applicable as both the existing and new mechanical processes are dry systems. The new mechanical processes do include a sink float density plastic separation system in order to separate the PE and PVC fractions of the plastic recovered for recycling BUT the water within the sink float tank will be re-circulated within the system.

(iii) information about the characteristics of the waste gas streams, such as:

(a) average values and variability of flow and temperature;

All of the flow details are provided in the above table and all filters (prior to exhaust) are handling the air at ambient conditions - so at a temperature of approximately 20°C (293K).

(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).

*With regards to (b), (c) & (d)** the operator will agree with the regulator (EA) as to which tests are required and having these tests undertaken when the facility is in operation as only then will the streams be available to test.*
IMPORTANT: However, it is important to note that all gas streams will be cleaned process air only arising from the mechanical processes that are being undertaken. The existing permit for the existing mechanical process details the parameters required to be tested for the existing five exhausts with frequency and standards

along with associated emissions limit values (dust only is given an emission limit of 5 mg/Nm³) i.e. Brominated flame retardants; 2. Dioxin-like-PCBs; 3. Dust; 4. Metals; 5. Dioxins and 6. TVOC. It is expected that the same will be applied to all five exhausts associated with the new mechanical processes and the two new exhausts added to the existing mechanical process.

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[5].

Technique	**Description**	*Details*
a. Optimised storage location	**This includes techniques such as: —the storage is located as far as technically and economically possible from sensitive receptors, watercourses, etc.; — 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).**	*Fluff waste (existing mechanical process only). Directly discharged by covered conveyor into covered hooklift container for removal from site without further handling, minimising the potential for dust generation. Hooklift bins located outside the building, on concrete hardstanding near the centre of the site.* *Filter waste (existing and new mechanical processes). Discharged from the air treatment systems directly into closed top bulk bags for disposal without any further loose handling, minimising the potential for dust generation* *Plastic waste (existing and new mechanical processes). Directly discharged by covered conveyor into covered hooklift container for removal from site without further handling, minimising the potential for dust generation. Hooklift bins located outside the building, on concrete hardstanding near the centre of the site.* *Feed wastes (for existing and new mechanical processes). Delivered to site by covered vehicles and deposited directly inside the dedicated external storage areas for each (steel reinforced concrete bays with weather-proof roof over sat on impermeable surfaces) without further handling, minimising the potential for dust generation.*

[5] *a: generally applicable to new plants; b – d: generally applicable*

		<u>ASR/WWAS2 for storage only.</u> *Transported to the ASR/WWAS2 storage area inside the materials storage building via enclosed conveyor from the adjacent EMR facility without further handling, minimising the potential for dust generation.*
b. Adequate storage capacity	**Measures are taken to avoid accumulation of waste, such as: — 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; — the quantity of waste stored is regularly monitored against the maximum allowed storage capacity; — the maximum residence time of waste is clearly established.**	*<u>Fluff waste (existing mechanical process only)</u>. Directly filled alternately into one of two hooklift containers. Each container removed for emptying off site when full.* *<u>Filter waste (for existing and new mechanical processes)</u>. Bulk bags loaded out from site once sufficient generated for a full wagon load (20-25t)* *<u>Plastic waste (for existing and new mechanical processes)</u>. Directly filled alternately into hooklift containers. Each container removed for emptying off site when full.* *<u>Feed wastes for all the mechanical processes.</u> Both the existing and new mechanical processes are/will be batch processing. As such, when one of the specific waste batches is delivered to IES, it will be stored and processed completely, emptying the specific individual bay completely in which it was stored. The feed for the mechanical processes will be approximately 480m³ per day 24/7 (for the existing mechanical process) and 320m³ per day 24/7 (for the new mechanical processes – note lower volume than existing as raw cable has a higher density). With the prospective speed of process in mind, the storage bays for either feed wastes (for existing or new) are unlikely ever to meet their limits of 1095m³ (existing) / 1250m³ (new). The above therefore ensures that storage capacity is never exceeded.* *<u>ASR/WWAS2 for storage only.</u> ASR/WWAS2 will not be stored for longer than 14 days prior to disposal with storage capacity*

		taking this in to account. As with the delivery of the feed waste - the deliveries are controlled by Site Management so that should the ASR/WWAS2 not be capable of being disposed of within the agreed time, the delivery of material ceases ensuring that storage capacity is never exceeded. *<u>All waste above.</u> All of the wastes listed above are combustible and are therefore included within the updated Fire Prevention Plan (FPP) which is required specifically to relate to minimising the risk of fire arising from the storage of combustible waste materials and the potential impact of fire of human and environmental receptors outside of the site.*
c. Safe storage operation	***This includes measures such as: — equipment used for loading, unloading and storing waste is clearly documented and labelled; — wastes known to be sensitive to heat, light, air, water, etc. are protected from such ambient conditions; — containers and drums are fit for purpose and stored securely.***	*<u>Fluff waste (existing mechanical process only)</u>. Directly discharged by covered conveyor into covered hooklift container for removal from site without further handling, minimising the potential for dust generation* *<u>Filter waste (existing and new mechanical processes)</u>. Discharged from the air treatment systems directly into closed top bulk bags for disposal without any further loose handling, minimising the potential for dust generation* *<u>Plastic waste (existing and new mechanical processes)</u>. Directly discharged by covered conveyor into covered hooklift container for removal from site without further handling, minimising the potential for dust generation.* *<u>Feed wastes for the existing and new mechanical processes and ASR/WWAS2 for storage only.</u> All of these waste types are delivered and accepted on site in accordance with the pre-acceptance and waste acceptance procedures as detailed in BAT 2 above. As such, as they are accepted with all of the accompanying relevant analyses, details of all physical and chemical*

		characteristics of individual waste types are fully documented and individual waste types are always stored in separate waste piles. The ASR/WWAS2 is stored inside the materials storage building (thus never exposed to the external environment). The wastes for the new and existing (as part of this variation) mechanical processes are stored in an external area within steel reinforced concrete bays with a weather-proof roof over thus in effect preventing exposure to an external environment. None of the wastes described here i.e. those for the existing mechanical process, those for the new mechanical processes or those for ASR/WWAS2 storage only are ever handled together. *<u>All waste above.</u> All of the wastes listed above are combustible and are therefore included with in the Fire Prevention Plan (FPP) which is required specifically to relate to minimising the risk of fire arising from the storage of combustible waste materials and the potential impact of fire of human and environmental receptors outside of the site.*
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 waste.**	*Not relevant as <u>packaged</u> hazardous waste not received at the facility.*

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.

Handling and transfer procedures are being developed for the mechanical processes (new and existing) that will ensure that wastes are safely handled and transferred to the respective storage or treatment. They will include the following elements (as listed within BAT 5 of the document):

— 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[6]*;*

— 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 6 (Monitoring requirements for emissions to water):

Both existing and new mechanical processes are dry processes only. The new mechanical processes do include a sink float density plastic separation system in order to separate the PE and PVC fractions of the plastic recovered for recycling BUT the water within the sink float tank will be re-circulated within the system. However, should the water at any time need replacing then the water within the tank will be tested and then tankered to an authorised facility for destruction or to sewer depending upon the analytical results.

BAT 7 (Monitoring requirements for emissions to water):

Both existing and new mechanical processes are dry processes only. The new mechanical processes do include a sink float density plastic separation system in order to separate the PE and PVC fractions of the plastic recovered for recycling BUT the water within the sink float tank will be re-circulated within the system. However, should the water at any time need replacing then the water within the tank will be tested and then tankered to an authorised facility for destruction or to sewer depending upon the analytical results..

BAT 8 (Monitoring requirements for channelled emissions to air):

The new and existing mechanical processes will comply with the requirements as detailed within the table associated with BAT 8 of the document (where applicable) and it is noted that none require continuous monitoring.

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[6]All spillages will be logged.

In summary, following a detailed review undertaken for the previous variation to enable the installation and operation of the existing mechanical process, it was suggested that the following would be applicable:

"The shredding occurs in the preparation unit – associated with this is the single cyclone/bag filter and exhaust so for this exhaust only, the 'mechanical treatment in shredders of metal waste' monitoring requirements are applicable –

*1. Brominated flame retardants – This is only applicable if identified in the tests (see** - BAT 3 (iii) above).*
*2. Dioxin-like-PCBs – This is only applicable if identified in the tests**.*
3. Dust – All 5 exhausts for this.
4. Metals
*5. Dioxins - This is only applicable if identified in the tests**.*
*6. TVOC – All 5 exhausts for this but only applicable to other 4 (not the prep. unit exhaust) if any CV in gas stream identified in tests**.*

Taking the above in to account, it is concluded that all 5 exhausts will be required to be monitored for dust every six months and the 1 exhaust from the prep. unit metals (once a year) and TVOC (every six months) as well."

Subsequently, the monitoring requirements (i.e. parameters to be monitored along with associated monitoring frequencies and standards) for the existing 5 emission points associated with the existing mechanical process were then detailed within Table S3.1 of the existing permit i.e. –

Table S3.1 Point source emissions to air – emission limits and monitoring requirements

Emission point reference & location	Parameter	Source	Limit (including unit)	Reference period	Monitoring frequency	Monitoring standard(s) or method(s)
Process Unit Exhaust – Preparation unit (A4), Grinding Unit 1 (A5), Grinding Unit 2 (A7), Grinding Unit 3 (A8), and Process Unit Exhaust – Separation Unit (A6) As shown on drawing number IES-00-L00645	Brominated Flame Retardants	Bag filter exhaust from the cyclone	No limit set	–	Annually or as agreed in writing with the Environment Agency	–
	Dioxin-like PCBs		No limit set	–	Annually or as agreed in writing with the Environment Agency	EN1948-1, -2 and -4
	Dust		5 mg/Nm^3	–	Every 6 months or as agreed in writing with the Environment Agency	EN13284-1
	Metals (including As, Cd, Co, Cr, Cu, Mn, Ni, Pb, Sb, Se, Tl, V)		No limit set	–	Annually or as agreed in writing with the Environment Agency	EN14385
	Dioxins		No limit set	–	Annually or as agreed in writing with the Environment Agency	–
Grinding Units 1 (A5), 2 (A7) and 3 (A8) and Process Unit Exhaust – Separation Unit (A6) As shown on drawing number IES-00-L00645	TVOCs	Bag filter exhaust from the cyclone	–	–	Every 6 months or as agreed in writing with the Environment Agency	–

Again, note that none require continuous monitoring.

*Taking in to account all of the above, it is expected that the same monitoring requirements for ALL parameters (1. Brominated flame retardants; 2. Dioxin-like-PCBs; 3. **Dust;** 4. Metals; 5. Dioxins and 6. TVOC) are similarly applied to all three new exhausts associated with the new mechanical processes and the two new exhausts associated with the existing mechanical process (A09-A13 – see updated emissions points drawing # 031_A96 in Appendix B) as these were based on this detailed BAT review as described above.*

BAT 9:

Not applicable as not undertaking any of the activities listed.

BAT 10 (Odour):

Odour emissions do not need to be monitored as neither the existing or new mechanical processes produce odours and as such no odour nuisance is expected.

BAT 11:

Monitoring of energy, raw material etc. as stated will be undertaken for the new mechanical process as is already undertaken for the existing mechanical process and ASR/WWAS2 storage as per schedule 4 (reporting) of the existing permit.

Emissions to Air

BAT 12:

Odour – not applicable – see above (BAT 10)

BAT 13:

Odour – not applicable – see above (BAT 10)

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

Technique	**Description**	*Details*
a. Minimising the number of potential diffuse emission sources	**This includes techniques such as: — appropriate design of piping layout (e.g. minimising pipe run length, reducing the number of flanges and valves, using welded fittings and pipes); — favouring the use of gravity transfer rather than using pumps; — limiting the drop height of material; — limiting traffic speed; — using wind barriers.** **This includes techniques such as:** **— valves with double packing seals or equally efficient equipment;** **— high-integrity gaskets (such as spiral wound, ring joints) for critical applications;**	*<u>Solid wastes only</u>: Only solid wastes are processed and produced by the existing or new mechanical processes. The new mechanical waste process does include a sink float density plastic separation system but the water within the sink float tank is re-circulated within the system. For both the existing (as part of this variation) and the new mechanical processes, tipping and storage of input waste is within the dedicated external storage areas. These external storage areas are within steel reinforced concrete bays with a weather-proof roof over thus in effect preventing exposure to an external environment i.e. preventing the waste from becoming air-blown and causing diffuse emissions. The external sorted cable area from which the pre-shredded cable is moved after pre-shredding is also enclosed by steel reinforced concrete walls with a weather-proof roof over. All processing for the existing mechanical process takes place within a building. All processing for the new mechanical processes takes place within a building apart from a. the pre-shredder unit (but this is enclosed by a covered area) and the 2 x granulation units' hoppers but these are loaded with material post shredding and so the nature of this material post shredding means that there is no light material available for air-blown*

[7] *All generally applicable apart from b. (Applicability may be restricted in the case of existing plants due to operability requirements) & d. (The use of enclosed equipment or buildings may be restricted by safety considerations such as the risk of explosion or oxygen depletion. The use of enclosed equipment or buildings may also be constrained by the volume of waste).*

		dispersion when loaded thus preventing diffuse emissions. *The only handling by mobile plant is as follows:* *Existing Mechanical Process:* *a. Loading of raw feed into the preparation unit;* *b. Removal of by-products metal mixtures from separation unit;* *c. Transfer of processed material from the preparation unit to the grinding units;* *d. Transfer of grinder heavy output to the separation units.* *All other handling is by conveyors, including transport of light 'fluff' waste to covered hooklift containers. All roads and yard areas are concrete.* *New Mechanical Processes:* *a. Loading of raw feed into the pre-shredder unit;* *b. Transfer of shredded material from the pre-shredder unit to the sorted cable storage bays to the granulation unit hoppers;* *c. Transfer of granulation units' output (liberated metals and plastics) to the separation units.* *All other handling is by conveyors to covered hooklift containers. All roads and yard areas are concrete.*
b. Selection and use of high-integrity equipment	**This includes techniques such as: — valves with double packing seals or equally efficient equipment; — high-integrity gaskets (such as spiral wound, ring joints) for critical applications; — pumps/compressors/agitators fitted with mechanical seals**	*Solid wastes only, no liquid wastes are processed or produced - for either the existing or new mechanical processes (The new mechanical waste process does include a sink float density plastic separation system but the water within the sink float tank*

	instead of packing; — magnetically driven pumps/compressors/agitators; — appropriate service hose access ports, piercing pliers, drill heads, e.g. when degassing WEEE containing VFCs and/or VHCs.	*is re-circulated within the system).*
c. Corrosion prevention	**This includes techniques such as: — appropriate selection of construction materials; — lining or coating of equipment and painting of pipes with corrosion inhibitors**	*Solid wastes only, no liquid wastes are processed or produced - for either the existing or new mechanical processes (The new mechanical waste process does include a sink float density plastic separation system but the water within the sink float tank is re-circulated within the system). ALL air treatment ducting is galvanised. The sink float system is constructed in stainless steel.*
d. Containment, collection and treatment of diffuse emissions	**This includes techniques such as: — storing, treating and handling waste and material that may generate diffuse emissions in enclosed buildings and/or enclosed equipment (e.g. conveyor belts); — maintaining the enclosed equipment or buildings under an adequate pressure; — collecting and directing the emissions to an appropriate abatement system (see Section 6.1) via an air extraction system and/or air suction systems close to the emission sources.**	*For the existing (as part of this variation) and the new mechanical processes, tipping and storage of input waste is within the dedicated external storage areas. These external storage areas are within steel reinforced concrete bays with a weather-proof roof over thus in effect preventing exposure to an external environment i.e. preventing diffuse emissions. The external sorted cable area from which the pre-shredded cable is moved post pre-shredding is also enclosed by steel reinforced concrete walls with a weather-proof roof over. All processing for the existing mechanical process takes place within a building. All processing for the new mechanical processes takes place within a building apart from a. the pre-shredder unit (but this is enclosed by a covered area) and the 2 x granulation units' hoppers but these are loaded with material post shredding and so the nature of this material post shredding means that there is no light material available for air-blown dispersion when loaded thus preventing diffuse emissions.*

		For both the existing and new mechanical processes, the 'fluff' (existing only) and 'plastic' wastes are transported by enclosed conveyor to covered hooklift containers, without being handled by mobile plant. "Filter" waste from the air treatment systems are discharged directly into closed top bulk bags. *Each of the existing mechanical process' 5 process units (1 x preparation, 3 x grinding and 1 x separation) and the 2 x new mechanical processing lines have independent air treatment systems (2 x new local extraction ventilation systems are also being added to improve further/ensure local workplace air quality around the existing mechanical processing lines) comprising fans, cyclones and bag filters. These are connected to potential points of dust emissions by galvanised ducting and hoods.* *ASR/WWAS2 delivered directly to IES from adjacent EMR for storage only is done so via conveyors.*
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.**	*For the existing (as part of this variation) and the new mechanical processes, tipping and storage of input waste is within the dedicated external storage areas. These external storage areas are within steel reinforced concrete bays with a weather-proof roof over thus in effect preventing exposure to an external environment i.e. preventing diffuse emissions. The external sorted cable area from which the pre-shredded cable is moved post pre-shredding is also enclosed by steel reinforced concrete walls with a weather-proof roof over. All processing for the existing mechanical process takes place within a building. All processing for the new mechanical processes takes place within a*

		building apart from a. the pre-shredder unit (but this is enclosed by a covered area) and the 2 x granulation units' hoppers but these are loaded with material post shredding and so the nature of this material post shredding means that there is no light material available for air-blown dispersion when loaded thus preventing diffuse emissions. The 5 x process units (existing process) and 2 x new mechanical processing lines all have independent air treatment systems (as above, 2 x new local extraction ventilation systems are also being added to improve further/ensure local workplace air quality around the existing mechanical processing lines) . *The feedstock to the existing mechanical process is generally damp and does not give rise to dust when handled, however in the event that dry material is received that potentially could give rise to dust during loading, the feedstock stockpile will be damped by water.* *The feedstock to the new mechanical process i.e. raw cable is of a nature whereby it cannot give rise to dust when handled as is essentially 'intact' as such there will not be circumstances under which it will need to be dampened by water.*
f. Maintenance	**This includes techniques such as: — ensuring access to potentially leaky equipment; —regularly controlling protective equipment such as lamellar curtains, fast-action doors.**	*The existing and new mechanical processes process and produce solid wastes (The new mechanical waste process does include a sink float density plastic separation system but the water within the sink float tank is re-circulated within the system).* *The principal environmental protection equipment for both the existing and new mechanical processes are the air treatment systems. These*

		will be maintained in accordance with the manufacturer's recommendations. The air ducting and hoods will be inspected for wear, damage or blockages and replaced, repaired or cleaned as appropriate. *Differential pressures across bag filters monitored to warn of build up/blockages. Regular annual independent LEV testing. Air treatment systems are covered by a planned preventative maintenance system.*
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.**	*All roadways are swept weekly with a road sweeper; hall and external bag filter areas will be swept 12 hourly as part of the shift handover procedure, machinery areas will have local extraction to remove dust, plant will be blown down/vacuumed as part of shut down routine, loading areas and fenced off areas beneath conveyors will be swept as part of the shut down routine and proved clear as part of the start up routine.*
h. Leak detection and repair (LDAR) programme	**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.**	*Not relevant*

BAT 15:

Not applicable as no flares.

BAT 16:

Not applicable as no flares.

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.

The updated noise risk assessment (see appendix I of the supporting statement) includes an operational noise management plan, presented as a stand- alone document within the technical appendix, based upon the EA template document and referencing the outcomes of the impact assessment. The plan includes details of how the operator will prevent or minimise noise and vibration resulting from the new permit activities and it can be confirmed that the noise management plan would be in accordance with the BAT conclusion elements listed above.

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**	*Details*
Appropriate location of equipment and buildings[8]	**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 the existing mechanical, all processing takes place within a building with external sound insulation cladding in order to comply with the noise limits as detailed within Appendix I. As part of this variation, the existing in-feed waste storage will be moved from inside the building to a dedicated external storage area where it will be tipped and stored. However, this external storage area will be enclosed within steel reinforced concrete bays with a weather-proof roof over.* *For the new mechanical processes, tipping and storage of input waste is also within a dedicated external storage area. Again, this external*

[8] For existing plants, the relocation of equipment and building exits or entrances may be restricted by a lack of space or excessive costs.

		storage area will be enclosed within steel reinforced concrete bays with a weather-proof roof over. *The external storage areas are also surrounded by the existing IES buildings that will act as noise screens.* *All processing for the new mechanical processes takes place within a building with external sound insulation cladding in order to comply with the noise limits as detailed within Appendix I - apart from a. the pre-shredder unit (but this is enclosed by a covered area and is surrounded by the existing IES buildings that will act as noise screens) and the 2 x granulation units' hoppers but these are located adjacent to and surrounded by the existing IES buildings that will act as noise screens also. The external sorted cable area from which the pre-shredded cable is moved post pre-shredding is also enclosed by steel reinforced concrete walls with a weather-proof roof..* *The previous permanent large opening on the north side of the building was closed up as part of the development works required for the previous permit variation to add the (what is now) the existing mechanical process using sound insulating cladding to match that in place elsewhere in the building. All other openings have roller shutter doors.*
Operational measures[9]	**This includes techniques such as: (i)inspection and maintenance of equipment; (ii)closing of doors and windows of enclosed areas, if possible; (iii) equipment operation by experienced staff; (iv) avoidance of noisy activities at night, if possible;**	*Operational measures for both the existing and new mechanical processes are employed (as necessary) in order to comply with the noise limits as detailed within Appendix I.*

[9] Generally applicable.

	(v) provisions for noise control during maintenance, traffic, handling and treatment activities.	
Low-noise equipment[10]	**This may include direct drive motors, compressors, pumps and flares.**	*See below - Equipment (such as ID fans) are acoustically cladded (as required) in order to comply with the noise limits as detailed within Appendix I.*
Noise and vibration control equipment[11]	**This includes techniques such as:** . **(i) noise reducers;** . **(ii) acoustic and vibrational insulation of equipment;** . **(iii) enclosure of noisy equipment;** . **(iv) soundproofing of buildings.**	*For the existing mechanical, all processing takes place within a building with external sound insulation cladding in order to comply with the noise limits as detailed within Appendix I. As part of this variation, the existing in-feed waste storage will be moved from inside the building to a dedicated external storage area where it will be tipped and stored. However, this external storage area will be enclosed within steel reinforced concrete bays with a weather-proof roof over.* *For the new mechanical processes, tipping and storage of input waste is also within a dedicated external storage area. Again, this external storage area will be enclosed within steel reinforced concrete bays with a weather-proof roof over.* *All other processing for the new mechanical processes takes place within a building with external sound insulation cladding although the 2 x granulation units' hoppers (for the granulation units which are located inside the building) which are located outside are directly adjacent to and surrounded by the existing IES buildings that are (as described already) cladded with sound insulation.* *For the existing mechanical*

[10] Generally applicable.
[11] Applicability may be restricted by a lack of space (for existing plants).

		process, the grinding mill in each grinding unit is surrounded by an acoustic enclosure. *For both the existing and new mechanical processes, equipment (such as ID fans) are acoustically cladded (as required) in order to comply with the noise limits as detailed within Appendix I.*
Noise attenuation[12]	**Noise propagation can be reduced by insert- ing obstacles between emitters and receivers (e.g. protection walls, embankments and buildings).**	*Not relevant (see footnote 12).*

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.

Both existing and new mechanical processes are dry processes only and as such, generally BAT 19 (relating to water consumption) is generally not applicable. However -

Technique	**Description**	*Details*
Water management[13]	**Water consumption is optimised by using measures which may include:** **— water-saving plans (e.g. establishment of water efficiency objectives, flow dia- grams and water mass balances);** **— optimising the use of washing water (e.g. dry cleaning instead of hosing down, using trigger control on all wash- ing equipment);** **— reducing the use of water for vacuum generation (e.g.**	*Both existing and new mechanical processes are dry processes only and as such, generally BAT 19 (relating to water consumption) is not applicable. However, the new mechanical processes do include a sink float density plastic separation system in order to separate the PE and PVC fractions of the plastic recovered for recycling BUT the water within the sink float tank will be <u>re-circulated</u> within the system in order to optimise water usage.*

[12] 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. For mechanical treatment in shredders of metal wastes, it is applicable within the constraints associated with the risk of deflagration in shredders.

[13] Generally applicable

	use of liquid ring pumps with high boiling point liquids).	
Water recirculation[14]	**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).**	*As above.*
Impermeable surface[15]	**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.**	*The whole site is covered by an impermeable surface.*
Techniques to reduce the likelihood and impact of overflows and failures from tanks and vessels[16]	**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:** **— overflow detectors;** **— overflow pipes that are directed to a contained drainage system (i.e. the relevant secondary containment or another vessel);** **— 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;** **— isolation of tanks, vessels**	*Not applicable. The water contained within the sink float tank (which is recycled within the system) poses minimal risk.*

[14] Generally applicable
[15] ibid
[16] ibid

	and secondary containment (e.g. closing of valves).	
Roofing of waste storage and treatment areas[17]	**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.**	*For the existing (as part of this variation) and the new mechanical processes, storage of input waste is within the dedicated external storage areas. These external storage areas are within steel reinforced concrete bays with a weather-proof roof over*
Segregation of water streams[18]	**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.**	*Not applicable. The water within the sink float tank will be <u>re-circulated</u> within the system*
Adequate drainage infra-structure[19]	**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.**	*For the existing (as part of this variation) and the new mechanical processes, tipping and storage of input waste is within the dedicated external storage areas. These external storage areas are within steel reinforced concrete bays with a weather-proof roof over thus in effect preventing exposure to an external environment / rainwater. The external sorted cable area from which the pre-shredded cable is moved post pre-shredding is also enclosed by steel reinforced concrete walls with a weather-proof roof over. All processing for the existing mechanical process takes place within a building. All*

[17] Applicability may be con- strained when high volumes of waste are stored or treated (e.g. mechanical treatment in shredders of metal waste).

[18] Generally applicable to new plants. Generally applicable to existing plants within the constraints associated with the layout of the water collection system.

[19] Generally applicable to new plants. Generally applicable to existing plants within the constraints associated with the layout of the water drainage system.

		processing for the new mechanical processes takes place within a building apart from a. the pre-shredder unit (but this is enclosed by a covered area) and the 2 x granulation units' hoppers but these are loaded with material post shredding and so the nature of this material post shredding means that there is no light material available for air-blown dispersion and contact with rainwater etc.
Design and maintenance provisions to allow detection and repair of leaks[20]	**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.**	*Regular monitoring for potential leakages from the sink float water tank will be undertaken and when necessary repaired – although the likelihood of this occurring is minimal. There are no underground components.*
Appropriate buffer storage capacity[21]	**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.**	*Waste water is not generated. the water within the sink float tank will be <u>re-circulated</u> within the system*

[20] 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.

[21] Generally applicable to new plants. For existing plants, applicability may be limited by space availability and by the layout of the water collection system.

	monitor, treat, re-use).	

BAT 20:

Both existing and new mechanical processes are dry processes only and as such, this is not applicable. However, the new mechanical processes do include a sink float density plastic separation system in order to separate the PE and PVC fractions of the plastic recovered for recycling BUT the water within the sink float tank will be re-circulated within the system.

BAT 21:

Accident management plan

As part of the Environmental Management System being developed for the installation, an accident management plan will be set up that will include all of the techniques listed within 'BAT 21' of the document.

Material efficiency

BAT 22:

Not applicable as no other materials are required in order to process the waste – therefore any substitution is not relevant.

Energy efficiency

BAT 23:

In order to use energy efficiently, both of the techniques listed within 'BAT 23' of the document will be used i.e. energy efficiency plan and energy balance record.

BAT 24:

Residues management plan

As part of the Environmental Management System being developed for the installation, a residues management plan will be set up in order to reduce the quantity of waste sent for disposal in accordance with 'BAT 24' of the document'.

Emissions to Air

BAT 25:

This will be met as both cyclones and fabric filters are being utilised on each of the ten exhausts (five existing and five new) to control emissions where the BAT-AEL of 5 mg/Nm³ (as already stipulated as the ELV within Table S3.1 of the current permit for the existing five exhausts and proposed for the five new exhausts) will be guaranteed.

BAT-AEL -

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.

Overall environmental performance

BAT 26:

The techniques listed here are not applicable as none of the waste types stipulated within BAT 26 will be received and processed at the installation (either within the existing or new mechanical processes). However, BAT14g (see above) will be undertaken.

Deflagarations

BAT 27:

Not relevant.

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

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.

For the existing mechanical process, the input unprocessed feedstock is loaded by front end loader / telehandler into the plate feeder of the preparation unit. This is equipped with a rotary 'rake' which pulls apart and spreads out the material that can otherwise 'clump' together. From the rake, the feed is transported into the low speed shredder by conveyor. The feed-rate of the conveyor and plate feeder is controlled by the load on the shredder in order to optimise throughput. The shredder in the preparation unit cuts the material to a small size and separation of large items means that the part processed material fed to the grinder units is more consistent and homogenised, stabilising the operating condition.

For the new mechanical processes' pre-shredder, the raw cable will be fed into the system via a mobile crane into the shredder opening. The crane driver will be able to view the levels and control the amount being fed. The shredder will also be controlled via a P&ID loop to control the load on the shredder and warn the operator of high & low levels.

Emissions to air / Explosions

BAT 29 – 30:

Not applicable.

Emissions to air

BAT 31:

Not applicable as applicable to –

5.3. (a) (iii) pre-treatment of waste for incineration or co-incineration;
5.3 (b) (iii) pre-treatment of waste for incineration or co-incineration;

BAT 32:

Not applicable.

Biological treatment

BAT 33 - 35:

Not applicable.

Aerobic treatment

BAT 36 - 37:

Not applicable.

Anaerobic treatment

BAT 38:

Not applicable.

MBT

BAT 39:

Not applicable.

Physico-chemical treatment of solid waste

Overall environmental performance
BAT 40:

Addressed within BAT 2 above.

Emissions to Air
BAT 41:

Addressed within BAT 14 above.

Waste Oil

BAT 42 - 44:

Not applicable.

Physico-chemical treatment of waste with CV

Emissions to Air
BAT 45:

Addressed within BAT 14 above.

Spent Solvents

BAT 46 - 47:

Not applicable.

Thermal treatment etc.

BAT 48 - 49:

Not applicable.

Water washing of excavated contaminated soil

BAT 50:

Not applicable.

Decontamination of equipment containing PCBs

BAT 51:

Not applicable.

TREATMENT OF WATER-BASED LIQUID WASTE

BAT 52 - 53:

Not applicable.

DECISIONS

COMMISSION IMPLEMENTING DECISION (EU) 2018/1147

of 10 August 2018

establishing best available techniques (BAT) conclusions for waste treatment, under Directive 2010/75/EU of the European Parliament and of the Council

(notified under document C(2018) 5070)

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) [1], and in particular Article 13(5) thereof,

Whereas:

(1) Best available techniques (BAT) conclusions are the reference for setting permit conditions for installations covered by Chapter II of Directive 2010/75/EU and competent authorities should set emission limit values which ensure that, under normal operating conditions, emissions do not exceed the emission levels associated with the best available techniques as laid down in the BAT conclusions.

(2) The forum composed of representatives of Member States, the industries concerned and non-governmental organisations promoting environmental protection, established by Commission Decision of 16 May 2011 [2], provided the Commission on 19 December 2017 with its opinion on the proposed content of the BAT reference document for waste treatment. That opinion is publicly available.

(3) The BAT conclusions set out in the Annex to this Decision are the key element of that BAT reference document.

(4) The measures provided for in this Decision are in accordance with the opinion of the Committee established by Article 75(1) of Directive 2010/75/EU,

HAS ADOPTED THIS DECISION:

Article 1

The best available techniques (BAT) conclusions for waste treatment, as set out in the Annex, are adopted.

Article 2

This Decision is addressed to the Member States.

Done at Brussels, 10 August 2018.

For the Commission

Karmenu VELLA

Member of the Commission

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[1] OJ L 334, 17.12.2010, p. 17.

[2] Commission Decision of 16 May 2011 establishing a forum for the exchange of information pursuant to Article 13 of Directive 2010/75/EU on industrial emissions (OJ C 146, 17.5.2011, p. 3).

ANNEX

BEST AVAILABLE TECHNIQUES (BAT) CONCLUSIONS FOR WASTE

SCOPE

These BAT conclusions concern the following activities specified in Annex I to Directive 2010/75/EU, namely:

— 5.1. Disposal or recovery of hazardous waste with a capacity exceeding 10 tonnes per day involving one or more of the following activities:

(a) biological treatment;

(b) physico-chemical treatment;

(c) blending or mixing prior to submission to any of the other activities listed in points 5.1 and 5.2 of Annex I to Directive 2010/75/EU;

(d) repackaging prior to submission to any of the other activities listed in points 5.1 and 5.2 of Annex I to Directive 2010/75/EU;

(e) solvent reclamation/regeneration;

(f) recycling/reclamation of inorganic materials other than metals or metal compounds;

(g) regeneration of acids or bases;

(h) recovery of components used for pollution abatement;

(i) recovery of components from catalysts;

(j) oil re-refining or other reuses of oil;

— 5.3. (a) Disposal of non-hazardous waste with a capacity exceeding 50 tonnes per day involving one or more of the following activities, and excluding activities covered by Council Directive 91/271/EEC ([1]):

(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, and excluding activities covered by Directive 91/271/EEC:

(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.

When the only waste treatment activity carried out is anaerobic digestion, the capacity threshold for this activity shall be 100 tonnes per day.

— 5.5. Temporary storage of hazardous waste not covered under point 5.4 of Annex I to Directive 2010/75/EU pending any of the activities listed in points 5.1, 5.2, 5.4 and 5.6 of Annex I to Directive 2010/75/EU with a total capacity exceeding 50 tonnes, excluding temporary storage, pending collection, on the site where the waste is generated.

— 6.11. 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.

([1]) Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment (OJ L 135, 30.5.1991, p. 40).

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 5.1, 5.3 or 5.5 as listed above.

These BAT conclusions do not address the following:

— 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 Council Directive 1999/31/EC ([1]). 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 (EU) 2015/2193 of the European Parliament and of the Council ([2]).

Other BAT conclusions and reference documents which could be relevant for the activities covered by these 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.

([1]) Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste (OJ L 182, 16.7.1999, p. 1).
([2]) Directive (EU) 2015/2193 of the European Parliament and of the Council of 25 November 2015 on the limitation of emissions of certain pollutants into the air from medium combustion plants (OJ L 313, 28.11.2015, p. 1).

DEFINITIONS

For the purposes of these 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.

Term used	Definition
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.
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: — residential areas; — 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 of the European Parliament and of the Council [1].
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 (BOD_5) or in seven (BOD_7) days.
Cadmium	Cadmium, expressed as Cd, includes all inorganic and organic cadmium compounds, dissolved or bound to particles.

Term used	Definition
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. 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.
Odour concentration	Number of European Odour Units (ou_E) 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 (2).
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.

Term used	Definition
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 (NH_4-N), nitrite nitrogen (NO_2-N), nitrate nitrogen (NO_3-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.

(1) Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (OJ L 312, 22.11.2008, p. 3).
(2) Commission Regulation (EC) No 199/2006 of 3 February 2006 amending Regulation (EC) No 466/2001 setting maximum levels for certain contaminants in foodstuffs as regards dioxins and dioxin-like PCBs (OJ L 32, 4.2.2006, p. 34).

For the purposes of these 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 of the European Parliament and of the Council (1))
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 (EC) No 850/2004 of the European Parliament and of the Council (2))
WEEE	Waste electrical and electronic equipment (as defined in Article 3(1) of Directive 2012/19/EU of the European Parliament and of the Council (3))

(1) Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of life vehicles (OJ L 269, 21.10.2000, p. 34).
(2) Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC (OJ L 158, 30.4.2004, p. 7).
(3) Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE) (OJ L 197, 24.7.2012, p. 38).

GENERAL CONSIDERATIONS

Best Available Techniques

The techniques listed and described in these 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 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 μg/Nm³ or mg/Nm³.

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 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.

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 6.5);

XIII. accident management plan (see description in Section 6.5);

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 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.

Technique		Description
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: — manual separation by means of visual examinations; — ferrous metals, non-ferrous metals or all-metals separation; — optical separation, e.g. by near-infrared spectroscopy or X-ray systems; — density separation, e.g. by air classification, sink-float tanks, vibration tables; — size separation by screening/sieving.

[1] Sorting techniques are described in Section 6.4

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 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: — the storage is located as far as technically and economically possible from sensitive receptors, watercourses, etc.; — 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: — 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; — the quantity of waste stored is regularly monitored against the maximum allowed storage capacity; — the maximum residence time of waste is clearly established.	Generally applicable.
c.	Safe storage operation	This includes measures such as: — equipment used for loading, unloading and storing waste is clearly documented and labelled; — wastes known to be sensitive to heat, light, air, water, etc. are protected from such ambient conditions; — 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 waste.	

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.

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 pretreatment, at the inlet to the final treatment, at the point where the emission leaves the installation).

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	

Substance/parameter	Standard(s)	Waste treatment process	Minimum monitoring frequency (1) (2)	Monitoring associated with
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	

Substance/parameter	Standard(s)	Waste treatment process	Minimum monitoring frequency ([1]) ([2])	Monitoring associated with
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 treatment of water-based liquid waste	Once every month	
		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 an indirect discharge to a receiving water body, the monitoring frequency may be reduced if the downstream waste water treatment plant abates the pollutants concerned.
([5]) Either TOC or COD is monitored. TOC is the preferred option, because 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 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

Substance/Parameter	Standard(s)	Waste treatment process	Minimum monitoring frequency (1)	Monitoring associated with
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 every 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

Substance/Parameter	Standard(s)	Waste treatment process	Minimum monitoring frequency (1)	Monitoring associated with
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 9. BAT is to monitor diffuse emissions of organic compounds to air from the regeneration of spent solvents, the decontamination of equipment containing POPs 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 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 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.

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 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: — use of pure oxygen; — removal of scum in tanks; — frequent maintenance of the aeration system. In the case of aerobic treatment of waste other than water-based liquid waste, see BAT 36.	Generally applicable.

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: — appropriate design of piping layout (e.g. minimising pipe run length, reducing the number of flanges and valves, using welded fittings and pipes); — favouring the use of gravity transfer rather than using pumps; — limiting the drop height of material; — limiting traffic speed; — using wind barriers.	Generally applicable.

Technique		Description	Applicability
b.	Selection and use of high-integrity equipment	This includes techniques such as: — valves with double packing seals or equally efficient equipment; — high-integrity gaskets (such as spiral wound, ring joints) for critical applications; — pumps/compressors/agitators fitted with mechanical seals instead of packing; — magnetically driven pumps/compressors/agitators; — 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: — appropriate selection of construction materials; — lining or coating of equipment and painting of pipes with corrosion inhibitors.	Generally applicable.
d.	Containment, collection and treatment of diffuse emissions	This includes techniques such as: — storing, treating and handling waste and material that may generate diffuse emissions in enclosed buildings and/or enclosed equipment (e.g. conveyor belts); — maintaining the enclosed equipment or buildings under an adequate pressure; — collecting and directing the emissions to an appropriate abatement system (see Section 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. The use of enclosed equipment or buildings may 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: — ensuring access to potentially leaky equipment; — regularly controlling protective equipment such as lamellar curtains, fast-action doors.	Generally applicable.

Technique		Description	Applicability
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 6.2. 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 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 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. NO_X, 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.

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 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: (i) inspection and maintenance of equipment; (ii) closing of doors and windows of enclosed areas, if possible; (iii) equipment operation by experienced staff; (iv) avoidance of noisy activities at night, if possible; (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: (i) noise reducers; (ii) acoustic and vibrational insulation of equipment; (iii) enclosure of noisy equipment; (iv) soundproofing of buildings.	Applicability may be restricted by a lack of space (for existing plants).

Technique		Description	Applicability
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. For mechanical treatment in shredders of metal wastes, it is applicable within the constraints associated with the risk of deflagration in shredders.

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: — water-saving plans (e.g. establishment of water efficiency objectives, flow diagrams and water mass balances); — optimising the use of washing water (e.g. dry cleaning instead of hosing down, using trigger control on all washing equipment); — 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.

Technique		Description	Applicability
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: — overflow detectors; — overflow pipes that are directed to a contained drainage system (i.e. the relevant secondary containment or another vessel); — 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; — 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. 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. 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.

Technique		Description	Applicability
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, re-use).	Generally applicable to new plants. For existing plants, applicability may be limited by space availability and by the layout of the water collection system.

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 non-biodegradable 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 non-biodegradable or inhibitory pollutants, e.g. nitrite, cyanide	

Technique [1]		Typical pollutants targeted	Applicability
h.	Chemical reduction	Reducible dissolved non-biodegradable or inhibitory pollutants, e.g. hexavalent chromium (Cr(VI))	
i.	Evaporation	Soluble contaminants	
j.	Ion exchange	Ionic dissolved non-biodegradable 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 6.3.

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 — 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
Total nitrogen (Total N)	1-25 mg/l (5) (6)	— Biological treatment of waste — 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

Substance/Parameter		BAT-AEL [1]	Waste treatment process to which the BAT-AEL applies
Metals and metalloids [8]	Arsenic (expressed as As)	0,01-0,05 mg/l	— Mechanical treatment in shredders of metal waste — 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
	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/l	— 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) 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.
(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 — 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
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 — 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
	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/l	— 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	

Substance/Parameter		BAT-AEL [1] [2]	Waste treatment process to which the BAT-AEL applies
	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.

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: — protection of the plant against malevolent acts; — fire and explosion protection system, containing equipment for prevention, detection, and extinction; — 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: — a log/diary to record all accidents, incidents, changes to procedures and the findings of inspections; — procedures to identify, respond to and learn from such incidents and accidents.

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).

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: (i) information on energy consumption in terms of delivered energy; (ii) information on energy exported from the installation; (iii) energy flow information (e.g. Sankey diagrams or energy balances) showing how the energy is used throughout the process. 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.

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.

2. BAT CONCLUSIONS FOR THE MECHANICAL TREATMENT OF WASTE

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.

2.1. General BAT conclusions for the mechanical treatment of waste

2.1.1. Emissions to air

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. 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/Nm³	2-5 (1)

(1) When a fabric filter is not applicable, the upper end of the range is 10 mg/Nm³.

The associated monitoring is given in BAT 8.

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

Unless otherwise stated, the BAT conclusions presented in this section 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.

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: — 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; — a review of historical deflagration incidents and remedies and the dissemination of deflagration knowledge; — 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.

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.

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.

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.

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 points 5.3(a)(iii) and 5.3(b)(ii) of Annex I to Directive 2010/75/EU.

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.

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/Nm³	2-7

The associated monitoring is given in BAT 8.

3. BAT CONCLUSIONS FOR THE BIOLOGICAL TREATMENT OF WASTE

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.

3.1. General BAT conclusions for the biological treatment of waste

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.

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 6.1.
b.	Biofilter	See Section 6.1. 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/Nm³) in order to control the media pH and to limit the formation of N_2O in the biofilter. 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 6.1. The fabric filter is used in the case of mechanical biological treatment of waste.
d.	Thermal oxidation	See Section 6.1.
e.	Wet scrubbing	See Section 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)	ou_E/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.
(2) This BAT-AEL does not apply to the treatment of waste mainly composed of manure.
(3) The lower end of the range can be achieved by using thermal oxidation.

The associated monitoring is given in BAT 8.

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. 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). 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.

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 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.

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: — 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). — 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.

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 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.

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 3.1.

The BAT conclusions for the aerobic treatment (Section 3.2) and anaerobic treatment (Section 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. Generally applicable to existing plants within the constraints associated with the layout of the air circuits.
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). 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.	

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

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.

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.

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

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 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.

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.

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.

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.

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.

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

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.

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: — control of the furnace temperature and of the rotation speed of the rotary furnace; — choice of fuel; — use of a sealed furnace or operation of the furnace at a reduced pressure to avoid diffuse emissions to air.	Generally applicable.

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.

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.

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: — resin coating applied to the concrete floor of the whole storage and treatment area.

Technique		Description
b.	Implementation of staff access rules to prevent dispersion of contamination	This includes techniques such as: — access points to storage and treatment areas are locked; — special qualification is required to access the area where the contaminated equipment is stored and handled; — separate 'clean' and 'dirty' cloakrooms to put on/remove individual protective outfit.
c.	Optimised equipment cleaning and drainage	This includes techniques such as: — external surfaces of the contaminated equipment are cleaned with anionic detergent; — emptying of the equipment with a pump or under vacuum instead of gravity emptying; — procedures are defined and used for filling, emptying and (dis)connecting the vacuum vessel; — 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: — the air of the decontamination area is collected and treated with activated carbon filters; — 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); — the channelled emissions are monitored (see BAT 8); — 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: — porous, contaminated parts of the electrical transformer (wood and paper) are sent to high-temperature incineration; — 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.

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.

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.

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/Nm³	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/Nm³ when the emission load is below 0,5 kg/h at the emission point.

The associated monitoring is given in BAT 8.

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.

Technique	Typical pollutant(s) abated	Description
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 PM_{10}.
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.

Technique	Typical pollutant(s) abated	Description
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 gas stream is passed through the filter medium, where particulate matter is collected.
Thermal oxidation	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)	The removal of 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.

6.2. **Diffuse emissions of organic compounds to air**

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. **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 photo-ionisation). 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. **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. 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. **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. **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 back-scattering of laser beam pulses by atmospheric aerosols, and the analysis of the spectral properties of the returned light collected with a telescope.

6.3. **Emissions to water**

Technique	Typical pollutant(s) targeted	Description
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).

Technique	Typical pollutant(s) targeted	Description
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 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 multi-stage units with increasing vacuum, to reduce the energy demand. The water vapours are condensed, to be reused or discharged as waste water.

Technique	Typical pollutant(s) targeted	Description
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 (H_2SO_4), hydrochloric acid (HCl) or carbon dioxide (CO_2) 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.

Technique	Typical pollutant(s) targeted	Description
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 inhibitory pollutants, e.g. metals, phosphorus	The conversion of dissolved pollutants into insoluble compounds by adding precipitants. The solid precipitates formed are subsequently separated by sedimentation, air flotation or filtration.
Stripping	Purgeable pollutants, e.g. hydrogen sulphide (H_2S), ammonia (NH_3), 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.

6.4. **Sorting techniques**

Technique	Description
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 non-ferrous 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.

Technique	Description
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.

6.5. **Management techniques**

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.