Pfizer Ireland Pharmaceuticals

IE License Review Application

Attachment 4-7-5 Establishing Best Available Techniques (BAT) Conclusions for Waste Treatment, August 2018

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This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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Contents

1 Introduction

This report has been prepared for the purposes of **Section 4.7** of an Industrial Emissions Licence (IE) Review application submitted by Pfizer Ireland Pharmaceuticals for their site at Ringaskiddy, County Cork. This report, which applies to IE Licence P0013-05, consists of a review of the licensed activities on site and the proposed activities to which the licence review relates in the context of any applicable Best Available Techniques (BAT).

The Industrial Emissions Directive 2010/75/EU (IED) and the European Union (Industrial Emissions) Regulations 2013 (SI 138 of 2013) define BAT, BAT Reference Document (BREF) and BAT Conclusions (BATC) as follows:

The Industrial Emissions Directive defines Best Available Techniques as follows:

'best available techniques' means the most effective and advanced stage in the development of activities and their methods of operation which indicates the practical suitability of particular techniques for providing the basis for emission limit values and other permit conditions designed to prevent and, where that is not practicable, to reduce emissions and the impact on the environment as a whole:

(a) 'techniques' includes both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned;

(b) 'available techniques' means those developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced inside the Member State in question, as long as they are reasonably accessible to the operator;

(c) 'best' means most effective in achieving a high general level of protection of the environment as a whole;

The Industrial Emissions Directive definition of BAT Reference Document is as follows:

"(11) 'BAT reference document' means a document, resulting from the exchange of information organised pursuant to Article 13, drawn up for defined activities and describing, in particular, applied techniques, present emissions and consumption levels, techniques considered for the determination of best available techniques as well as BAT conclusions and any emerging techniques, giving special consideration to the criteria listed in Annex III;"

SI 138 of 2013 has a similar definition.

The Industrial Emissions Directive and SI 138 of 2013 have the same definition of BAT conclusions, as follows:

'BAT conclusions' means a document containing the parts of a BAT reference document laying down the conclusions on best available techniques, their description, information to assess their applicability, the emission levels associated with the best available techniques, associated monitoring, associated consumption levels and, where appropriate, relevant site remediation measures;

The Industrial Emissions Directive 2010/75/EU replaced seven existing directives including the Integrated Pollution Prevention and Control (IPPC) Directive (2008/1/EC).

- Historically, the BREF process for the IPPC Directive produced guidance documents that member states had to have regard to when permitting (licensing) installations.
- However, the IED has made BAT conclusions mandatory in the permitting process (Article 14(3) of the IED).

Where BAT conclusions are available for any new installations, they are expected to achieve the associated standard before commencement of operations.

For existing installations, the IED provides that where a Commission Implementing Decision on BAT conclusions is published, within four years (relating to the main activity of the installation), the Environmental Protection Agency (EPA) should undertake that 'all permit/licence conditions for the installation concerned are reconsidered, where necessary updated' and 'ensure compliance with the BAT'.

The European IPPC Bureau (EIPPCB) organises and co-ordinates the exchange of information between Member States and the industries concerned on Best Available Techniques (BAT), as set forth in Article 13 of the IED. The EIPPCB produces BAT reference documents (BREF) and BAT conclusions.

2 Activity

2.1 Current activity

Current activities at the Pfizer Ringaskiddy site, as addressed under IE Licence P0013-05, include the following:

5.16 The production of pharmaceutical products including intermediates (production means the production on an industrial scale by chemical or biological processing)

11.2(e) Disposal or recovery of hazardous waste with a capacity exceeding 10 tonnes per day involving solvent reclamation or regeneration

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

11.6 Temporary storage of hazardous waste, (other than waste referred to in paragraph I 1.5) pending any of the activities referred to in paragraph 11.2, 11 .3, 11.5 or 1 I. 7 with a total capacity exceeding 50 tonnes, other than temporary storage, pending collection, on the site where the waste is generated.

The Pfizer site, which is located in Ballintaggart and Ballybricken, Ringaskiddy, Co. Cork, manufactures active pharmaceutical ingredients (API) by organic synthesis from raw materials for transport to other pharmaceutical plants for formulation and distribution. The site operates on a twenty-four-hour day, seven days per week shift basis.

The manufacturing facilities at the Pfizer Ringaskiddy principally comprise of four main production buildings (OSP1, NPTL, OSP3, OSP4) and the Kilo Technology Laboratory (KTL). Ancillary activities and facilities include Production Services, which include utilities, solvent recovery operations and wastewater treatment plant, laboratories; warehousing facilities for raw materials, intermediates and finished goods; an external material storage area; office buildings; workshop and stores; car park facilities and a canteen.

2.2 Licence Review Application Activities

Pfizer Ireland Pharmaceuticals propose to construct the Ringaskiddy Clinical Manufacturing Facility (RCMF) and install a replacement End-of-Line Thermal Oxidiser (EOL TO) to replace the existing Thermatrix (V13).

The RCMF will include the following; (i) a new five storey clinical manufacturing building which will include production areas, laboratories, ancillary office space, warehouse, and plant and utility space (ii) a single storey warehouse drum store building (iii) an external utility yard comprising of a two storey electrical building, an emergency generator, liquid nitrogen tank, evaporators, bunded chillers, bunded receiver tanks, bunded glycol tanks and a three storey steel frame structure to accommodate dry coolers, heat exchangers and other miscellaneous utility plant and machinery above the utility yard (iv) an elevated structural steel

piperack and (v) associated site development works such as roads, paths, yards, underground services and landscaping.

The replacement EOL TO, which will serve OSP4, will have a maximum height of 12.5m and will include a vent stack (approx. 32m in height), a new vent collection system, surface water drainage channels and the installation of three storage tanks.

An overview of the current site layout and the proposed developments are shown in Figure 1.

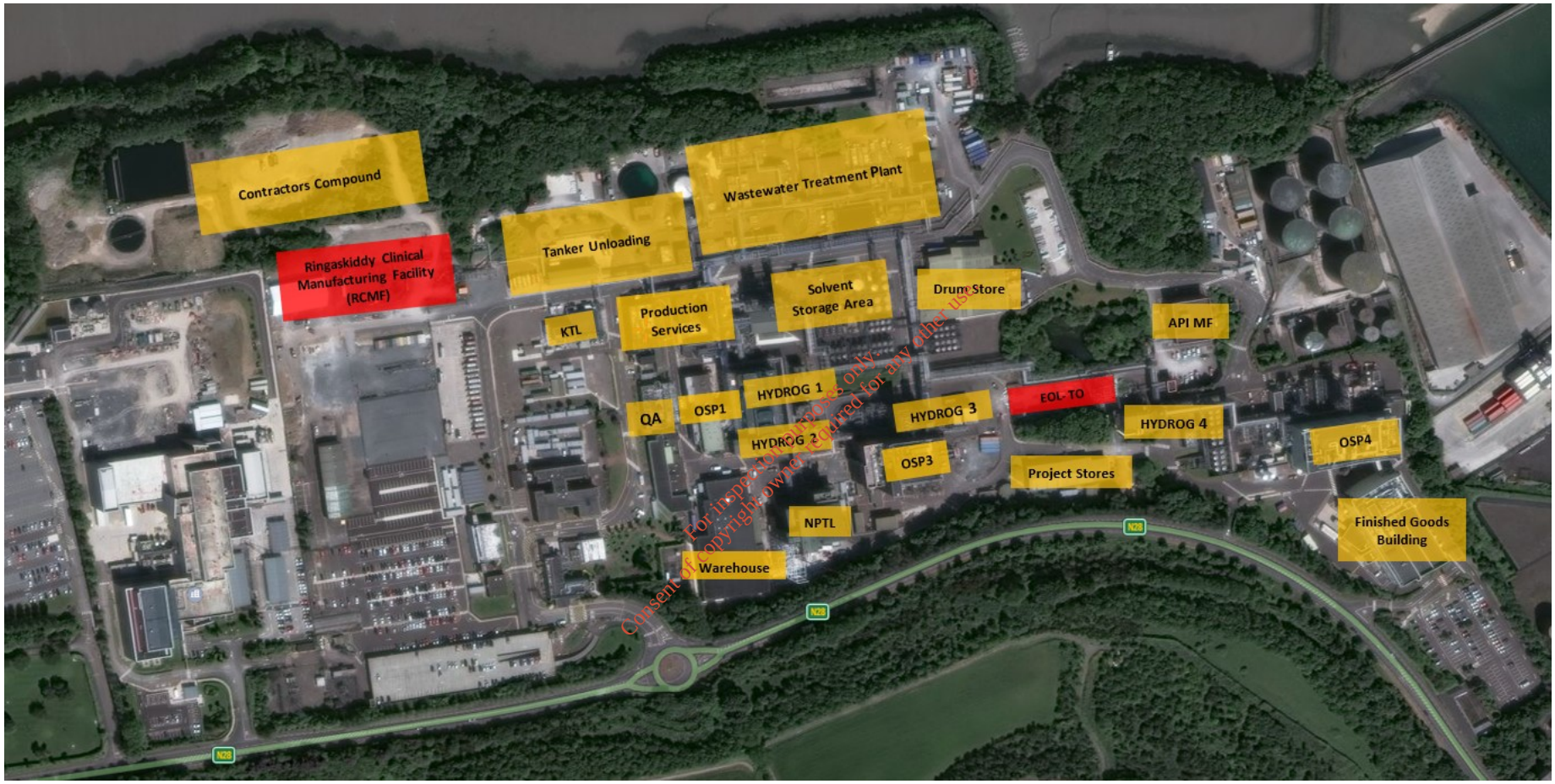

Figure 1: Overview of the Pfizer Ireland Pharmaceuticals Ringaskiddy Site | existing buildings shown in yellow, proposed developments, Ringaskiddy Clinical Manufacturing Facility (RCMF) and End-of- Line Thermal Oxidiser (EOL TO) shown in red | not to scale |

3 BAT / BREF Assessments

EPA licence P0013-05 applies in respect of the following classes of activity:

5.16 The production of pharmaceutical products including intermediates (production means the production on an industrial scale by chemical or biological processing)

11.2(e) Disposal or recovery of hazardous waste with a capacity exceeding 10 tonnes per day involving solvent reclamation or regeneration

11.4 (a)(i) Disposal of non-hazardous waste with a capacity exceeding 50 tonnes per day involving one or more of the following activities: biological treatment;

11.6 Temporary storage of hazardous waste, (other than waste referred to in paragraph I 1.5) pending any of the activities referred to in paragraph 11.2, 11.3, 11.5 or 1 I. 7 with a total capacity exceeding 50 tonnes, other than temporary storage, pending collection, on the site where the waste is generated.

The above activities correspond to the following activities listed in Annex I of the Industrial Emissions Directive 2010/75/EU:

4.5 Production of pharmaceutical products including intermediates

5.1 (a) 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;

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

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

A review of the EU Commission *best available techniques (BAT) conclusions for waste treatment* is provided in the table below.

Table 1: BAT conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste treatment

	Best Available Techniques (BAT)	Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
Overall environmental performance			
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; 17.8.2018 EN Official Journal of the European Union L 208/45 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:	Applicable. The facility Environmental Management System is ISO14001 certified and satisfies all the requirements of BAT 1.	In place. The existing environmental management system will also apply to the proposed RCMF and EOL TO developments.

	(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 wastewater 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). *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)			
2	In order to improve the overall environmental performance of the plant, BAT is to use all of the techniques given below.		Applicable Waste generated from Pfizer Ringaskiddy is managed under a Total Waste Management contract using a competent waste management	In place
	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).	broker and implements all the given techniques. Waste is accepted in a manner that does not cause environmental pollution. Incoming and outgoing hazardous, non-hazardous and inert waste is managed, stored and recorded. Waste from the proposed RCMF and EOL developments will tie in with existing waste streams on site. The waste accepted may be treated, recovered, disposed or stored at the facility depending on licence requirements.	
	b. Set up and implement waste acceptance procedures	Acceptance procedures aim to confirm the characteristics of the waste, as identified in the pre-acceptance stage. These procedures define the elements to be verified upon the arrival of the waste at the plant as well as the waste acceptance and rejection criteria. They may include waste sampling, inspection and analysis. Waste acceptance procedures are risk based considering, for example, the hazardous properties of the waste, the risks posed by the waste in terms of process safety, occupational safety and environmental impact, as well as the information provided by the previous waste holder(s).		
	c. Set up and implement a waste tracking system and inventory	A waste tracking system and inventory aim to track the location and quantity of waste in the plant. It holds all the information generated during waste pre-acceptance procedures (e.g., date of arrival at the plant and unique reference number of the waste, information on the previous waste holder(s), pre-acceptance and acceptance analysis results, intended treatment route, nature and quantity of the waste held on site including all identified hazards), acceptance, storage, treatment and/or transfer off site. The waste tracking system is risk-based considering, for example, the hazardous properties of the waste, the risks posed by the waste in terms of process safety, occupational safety and environmental impact, as		

		well as the information provided by the previous waste holder(s).		
	d. Set up and implement an output quality management system	This technique involves setting up and implementing an output quality management system, so as to ensure that the output of the waste treatment is in line with the expectations, using for example existing EN standards. This management system also allows the performance of the waste treatment to be monitored and optimised, and for this purpose may include a material flow analysis of relevant components throughout the waste treatment. The use of a material flow analysis is risk-based considering, for example, the hazardous properties of the waste, the risks posed by the waste in terms of process safety, occupational safety and environmental impact, as well as the information provided by the previous waste holder(s).		
	e. Ensure waste segregation	Waste is kept separated depending on its properties in order to enable easier and environmentally safer storage and treatment. Waste segregation relies on the physical separation of waste and on procedures that identify when and where wastes are stored.		
	f. Ensure waste compatibility prior to mixing or blending of waste	Compatibility is ensured by a set of verification measures and tests in order to detect any unwanted and/or potentially dangerous chemical reactions between wastes (e.g., polymerisation, gas evolution, exothermal reaction, decomposition, crystallisation, precipitation) when mixing, blending or carrying out other treatment operations. The compatibility tests are risk-based considering, for example, the hazardous properties of the waste, the risks posed by the waste in terms of process safety, occupational safety and environmental impact, as well as the information provided by the previous waste holder(s).		

	g. Sort incoming solid waste	Sorting of incoming solid waste 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.		
3	In order to facilitate the reduction of emissions to water and air, BAT is to establish and to maintain an inventory of wastewater 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 wastewater/waste gas treatment at source including their performances. (ii) information about the characteristics of the wastewater 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);	Applicable. As part of the EMS appropriate details of wastewater and waste gas are recorded and maintained including: - flow diagrams and chemical equations of the processes from which the emissions originate. At source treatment techniques are included in these descriptions. As part of the EMS wastewater emissions data is recorded and maintained at the facility for: **Stormwater:** - flow - pH - Total organic carbon **Discharge to sewer:** - Flow - pH - Temperature - TOC	In place Monitoring of the new main air emission point A2-28 (V46), which is associated with the EOL development will be as described in the new licence and data will be recorded in the EMS

	(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).	- Chemical oxygen demand - Biochemical oxygen demand - Total Suspended solids - Total Ammonia - Total Nitrogen - Total Phosphorus - BOD - Manganese - Zinc - Copper - Chromium - Nickel - Lead - Detergents - Adsorbable organically bound halogens - Organic Solvents - Toxicity - Active Pharmaceuticals - Metals As part of the EMS data relating to main air emission sources are recorded and maintained at the facility for the emission points which are currently in use: **Emission Points A2-2 (V3) and A2-4 (V5)** - TA Luft Class I, Class II & Class III - Hydrogen Chloride - Ammonia - Hydrogen Bromide	

<table>
<tr>
<td></td>
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<td>
- Nitrogen Oxides
- Flow

Emission points A2-5 (V6), A6-6 (V8), A2-7 (V9),
- Total particulates

Emission points: A2-5 to A2- 27 (V10, V11, V12, V14, V15, V16, V17, V18, V19, V20, V22, V23, V28, V29, V30, V33, V34, V35, V36, and V44)
- Active Ingredients

Emission Point A2-28 (replacement EOL TO)
- VOC
- Carbon Monoxide
- Hydrogen chloride
- Hydrogen fluoride
- Hydrogen bromide
- Sulphur Oxides
- Nitrogen oxides
- Dioxins (as TEQ)
- Flow
</td>
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</tr>
<tr>
<td>4</td>
<td>In order to reduce the environmental risk associated with the storage of waste, BAT is to use all of the techniques given below.
<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a. Optimised storage location</td><td>This includes techniques such as:
- the storage is located as far as technically and economically</td><td>Generally applicable to new plants.</td></tr>
</table>
</td>
<td>Applicable

Waste currently generated on-site is managed under a Total Waste Management programme, it is segregated at source and stored in designated waste storage areas.</td>
<td>In place</td>
</tr>
</table>

		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).		Waste from the proposed RCMF and EOL developments will tie in with existing waste streams on site. Waste is transported and handled by licensed waste management contractors using licensed waste management facilities outlined in Attachment 8-1 of this licence application review.	
	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.			
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; 17.8.2018 EN Official Journal of the European Union L 208/49 - 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.			Applicable The plant has been designed and is operated in such a manner as to minimise the risk of fire or explosion in the storage and handling of flammable materials. Handling and transfer of wastes are carried out by competent staff, only as part of the TWM contract. Flammable materials are confined to sealed systems of vessels and pipes during processing. Bulk storage tanks are sprinkler or deluge protected. Warehousing is sprinkler protected. Nitrogen gas is used in manufacturing vessels to create an inert atmosphere. Rated electrical equipment is used in zoned areas, and bonding and grounding of non-conductive pipework and equipment in the process area reduces the risk of build-up of static electricity.	In place
Monitoring					
6	For relevant emissions to water as identified by the inventory of wastewater streams (see BAT 3), BAT is to monitor key process parameters (e.g. waste water flow, pH, temperature, conductivity,			Applicable. Comprehensive monitoring programme in place which ensures	In place

<table>
<tr><td></td><td colspan="5">BOD) at key locations (e.g. at the inlet and/or outlet of the pre-treatment, at the inlet to the final treatment, at the point where the emission leaves the installation).</td><td>efficient running of the WWTP. Key process parameters are monitored (including continuous monitoring of treated wastewater flow, pH, TOC) in accordance with the requirements of the site's IE Licence.</td><td></td></tr>
<tr><td>7</td><td colspan="5">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.
<table>
<tr><th>Substance/parameter</th><th>Standard(s)</th><th>Waste treatment process</th><th>Minimum monitoring frequency (1) (2)</th><th>Monitoring associated with</th></tr>
<tr><td>Adsorbable organically bound halogens (AOX) (3) (4)</td><td>EN ISO 9562</td><td>Treatment of water-based liquid waste</td><td>Once every day</td><td>BAT 20</td></tr>
<tr><td>Benzene, toluene, ethylbenzene, xylene (BTEX) (3) (4)</td><td>EN ISO 15680</td><td>Treatment of water-based liquid waste</td><td>Once every month</td><td></td></tr>
<tr><td rowspan="2">Chemical oxygen demand (COD) (5) (6)</td><td rowspan="2">No EN standard available</td><td>All waste treatments except treatment of water-based liquid waste</td><td>Once every month</td><td rowspan="5"></td></tr>
<tr><td>Treatment of water-based liquid waste</td><td>Once every day</td></tr>
<tr><td>Free cyanide (CN-) (3) (4)</td><td>Various EN standards available (i.e., EN ISO 14403-1 and -2)</td><td>Treatment of water-based liquid waste</td><td>Once every day</td></tr>
<tr><td>Hydrocarbon oil index</td><td>EN ISO 9377-2</td><td>Mechanical treatment in shredders of</td><td>Once every month</td></tr>
</table></td><td>Applicable.
Monitoring frequency at emission point reference number TE1 is as follows:

Continuous: TOC, pH, flow, temperature

Daily: COD, TSS., Total Ammonia (As N), Total Nitrogen, Total Phosphorus (as P).

Monthly: BOD, Manganese, Chromium, Copper, Nickel, Lead, Zinc, Detergents, AOX.

Quarterly: Organic Solvents

Toxicity to be carried out annually.

Monitoring frequency for Active Pharmaceuticals and Metals to be agreed with the Agency.</td><td>In place</td></tr>
</table>

	(HOI) (4)		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	Once every day			
	Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Nickel (Ni), Lead (Pb), Zinc (Zn) (3) (4)	Various EN standards available (e.g. EN ISO 11885, EN ISO 17294-2, EN ISO 15586)	Mechanical treatment in shredders of metal waste	Once every month			
			Treatment of WEEE containing VFCs and/or VHCs				
			Mechanical biological treatment of waste				
			Re-refining of waste oil				
			Physico-chemical treatment of waste with calorific value				
			Physico-chemical treatment of solid and/or pasty waste				
			Regeneration of spent solvents				

			Water washing of excavated contaminated soil	Once every day			
			Treatment of water-based liquid waste	Once every day			
	Manganese (Mn) (3) (4)		Treatment of water-based liquid waste	Once every day			
	Hexavalent chromium (Cr(VI)) (3) (4)	Various EN standards available (i.e., EN ISO 10304-3, EN ISO 23913)	Treatment of water-based liquid waste	Once every day			
	Mercury (Hg) (3) (4)	Various EN standards available (i.e., EN ISO 17852, EN ISO 12846)	Mechanical treatment in shredders of metal waste	Once every month			
			Treatment of WEEE containing VFCs and /or VHCs				
			Mechanical biological treatment of waste				
			Re-refining of waste oil				
			Physico-chemical treatment of waste with calorific value				
			Physico-chemical treatment of solid and/or pasty waste				
			Regeneration of spent solvents				

			Water washing of excavated contaminated soil				
			Treatment of water-based liquid waste	Once every day			
	PFOA (3) PFOS (3)	No EN standard available	All waste treatments	Once every six months			
	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,	Biological treatment of waste	Once every month			
			Treatment of water-based liquid waste	Once every day			

		EN ISO 6878, EN ISO 11885)					
	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.						
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.					Applicable: As part of the EMS air emission data is recorded and maintained at the facility for the emission points currently in use: **Emission Points A2-2 (V3) and A2-4 (V5)** - TA Luft Class I, Class II & Class III - Hydrogen Chloride - Ammonia - Hydrogen Bromide - Nitrogen Oxides	In place

Substance/parameter	**Standard(s)**	**Waste treatment process**	**Minimum monitoring frequency (1) (2)**	**Monitoring**
Brominated flame retardants (2)	No EN standard available	Mechanical treatment in shredders of metal waste	Once every year	BAT 25

		CFCs	No EN standard available	Treatment of WEEE containing VFCs and/or VHCs	Once every six months	BAT 29		- Flow **Emission points A2-5 (V6), A6-6 (V8), A2-7 (V9),** - Total particulates **Emission points: A2-5 to A2- 27 (V10, V11, V12, V14, V15, V16, V17, V18, V19, V20, V22, V23, V28, V29, V30, V33, V34, V35, V36, and V44)** - Active Ingredients **Emission Point A2-28 (replacement EOL TO)** - VOC - Carbon Monoxide - Hydrogen chloride - Hydrogen fluoride - Hydrogen bromide - Sulphur Oxides - Nitrogen oxides - Dioxins (as TEQ) - Flow Monitoring of the new main air emission point A2-28 (V46), which is associated with the EOL development will be as described in the new licence and data will be recorded in the EMS.	
		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		BAT 50			

	contaminated soil			
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
H2S	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

		NH3	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		
		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 NH3 and H2S 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.						
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 b – Emissions factors – Calculation of emissions based on emissions factors, periodically validated 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.					Applicable. VOC emissions to air from relevant sources are to be calculated annually using technique III *III. Calculation of emissions based on emissions factors, periodically validated.* and to be periodically validated (once every two years) using technique I I. *Sniffing methods associated with correlation curves for key equipment.*	A methodology for a monitoring and estimation programme for diffuse emissions is currently in development in conjunction with external consultants. It is anticipated that an initial working methodology will be ready for implementation by Q3 2022.
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);					Not applicable. Odour nuisance is neither expected nor substantiated at the facility. Notwithstanding this, there are	Not applicable

	- 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.	routine walkovers of operating areas including WWTP, solvent recovery, tank farm areas per shift. Atypical conditions including odour would be routinely reported and investigated	
11	BAT is to monitor the annual consumption of water, energy and raw materials as well as the annual generation of residues and wastewater, 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.	Applicable The Annual Environmental report produced by the Pfizer Ringaskiddy Facility outlines the annual consumption of water, energy, and raw materials.	In place
Emissions to air			
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.	Not applicable. Odour nuisance is neither expected nor substantiated at the facility. Notwithstanding this, there are routine walkovers of operating areas including WWTP, solvent recovery, tank farm areas per shift. Atypical conditions including odour would be routinely reported and investigated	Not applicable
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**	Not applicable. Odour nuisance is neither expected nor substantiated at the facility. Notwithstanding this, there are	Not applicable.

	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.		routine walkovers of operating areas including WWTP, solvent recovery, tank farm areas per shift. Atypical conditions including odour would be routinely reported and investigated	
	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.			
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.					Applicable. The following techniques are in place which reduce diffuse VOC emissions: (a) Items of plant are designed and constructed in accordance with best practice and established engineering standards for eliminating diffuse emissions. Process vents containing vapours arising from production activities	In place Process gases arising from OSP4 will be abated by the replacement End-of-Line Thermal Oxidiser. The final emission to atmosphere from the
	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);	Generally applicable.			

		- favouring the use of gravity transfer rather than using pumps. - limiting the drop height of material; - limiting traffic speed. - using wind barriers.		are routed to the Absorption Units at OSP1 or OSP3. (b) Process inherent containment features are maximised as reactors and tanks are closed and sealed. Process vessels are closed, the production buildings are fully closed and serviced by mechanical ventilation throughout. Process reactors are nitrogen blanketed. Nitrogen blanketing of vessels where VOCs are handled is a typical safety feature of plant design. Reactors are connected to overhead condensers. (c) Items of plant are designed and constructed in accordance with best practice and established engineering standards for eliminating diffuse emissions. Common areas for diffuse emissions include valve stems and flanges. Strict and well-defined procedures for construction and assembly are in place. Reactors and tankage are closed and sealed. (d) There are good maintenance procedures in place and implemented and timely replacement of equipment. A Computerised Maintenance Management System (CMMS)	replacement EOL TO will be at emission point A2-28 (V46). Fugitive VOC emissions associated with the contents of the warehouse drum store will be designed and constructed in accordance with best practice and established engineering standards for eliminating diffuse emissions.
	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.	The use of enclosed equipment or buildings may be restricted by safety considerations such as the risk of	

		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.	explosion or oxygen depletion. The use of enclosed equipment or buildings may also be constrained by the volume of waste.	and scheduled planned maintenance routines are in place for process reactors, tanks, storage vessels and associated components. Maintenance programme and procedures are in place in accordance with IE Licence requirements. There are absorption plants for the removal of VOCs from the emissions to air from two plants on site: OSP1 and OSP3. Process emissions from each plant are minimised by condensation. The combined process emissions are then treated in an emission treatment system comprising scrubbers and a VOC absorption unit. The emissions from each plant are monitored continuously for TOC and discharged to the atmosphere at the licensed emission points A2-2 (V3) (OSP1)), and A2-4 (V5) (OSP3)). Further monthly monitoring is carried out in accordance with Schedule C.1.2. To reduce fugitive emissions from solvent storage tanks in production services these are fitted with conservation vents designed to minimise fugitive emissions of solvent vapour to atmosphere from the tanks. The conservation vent is	
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.		
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		

<table>
<tr><td></td><td></td><td>normally closed and so prevents emissions to air from the storage tank.

A major category of pumps on site are seal-less pumps. These pumps are totally enclosed and cannot leak because of seal failure.</td><td></td></tr>
<tr><td>15</td><td>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.
<table><tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr><tr><td>A</td><td>Correct plant design</td><td>This includes the provision of a gas recovery system with sufficient capacity and the use of high-integrity relief valves.</td><td>Generally applicable to new plants.
A gas recovery system may be retrofitted in existing plants.</td></tr><tr><td>B</td><td>Plant management</td><td>This includes balancing the gas sy</td><td>Generally applicable</td></tr></table></td><td>Not applicable.
Flaring is not in use at the facility</td><td>Not applicable</td></tr>
<tr><td>16</td><td>In order to reduce emissions to air from flares when flaring is unavoidable, BAT is to use both of the techniques given below.
<table><tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr><tr><td>A</td><td>Correct design of flaring devices</td><td>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.</td><td>Generally applicable to new flares. In existing plants, applicability may be restricted,
e.g. due to maintenance time
availability</td></tr><tr><td>B</td><td>Monitoring and recording as part of flare management</td><td>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,</td><td>Generally applicable</td></tr></table></td><td>Not applicable.
Flaring is not in use at the facility</td><td>Not applicable</td></tr>
</table>

			heat content, ratio of assistance, velocity, purge gas flow rate, pollutant emissions (e.g. NOX, CO, hydrocarbons), noise). The recording of flaring events usually includes the duration and number of events and allows for the quantification of emissions and the potential prevention of future flaring events.			
Noise and vibrations						
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.				Not applicable. A noise monitoring plan is not required for the facility as a noise nuisance is not expected or has not been substantiated. The current IE Licence provides for annual noise monitoring. The noise levels associated with Pfizer operations, as recorded at noise-sensitive locations, and reported annually to the EPA, have demonstrated consistent compliance with the limits.	Not applicable Operation of the proposed RCMF and EOL TO will be in accordance with the noise limits as set out in the IE licence.
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.				(a) Where possible. Existing project lifecycle includes for the assessment of environmental impact of new buildings and equipment, including noise impact assessment of significant sources of noise. The siting of new	Operation of the proposed RCMF and EOL TO will be in compliance with the noise limits as set out in the IE licence.
	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	For existing plants, the relocation of equipment and building exits or entrances may be		

			and by relocating building exits or entrances.	restricted by a lack of space or excessive costs.		buildings and equipment takes account of theses impact assessments. (b) Is generally applicable. Measures undertaken at the facility include: - appropriate inspection and maintenance of equipment. - closing of doors and windows of enclosed areas, if possible; - equipment operation by experienced staff; - avoidance of noisy activities e.g. construction/ maintenance, at night, if possible; - provisions for noise control during maintenance activities as required. (c) Is applicable to new or replacement equipment as required. (d) Is applicable. Pfizer uses noise reducers; equipment insulation, enclosure of noisy equipment and soundproofing of buildings where required. (e) Not applicable. Annual noise measurements at offsite NSLs have demonstrated continued compliance with IE licence limit values for noise emissions.	
	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).			
	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.		
Emissions to water						
19	In order to optimise water consumption, to reduce the volume of wastewater 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.				Applicable. A key objective of Pfizer's Environmental Management Programme is Reduction of Emissions to Water. An estimated 52,000 m^3 of water were recycled on site in 2020. Production liquid waste streams on site include organics, chlorinated organics and residues are isolated for reuse where practicable. To reduce water usage, enhance reuse of water in the production process and reduce load a number of objectives are set each year and included in the facilities environmental program submitted to the EPA. Examples of recent measures to reduce the usage of water/ generation of wastewater include the following: - To reduce solid wastes removed from site, a review of waste streams currently not suitable for treatment in the wastewater treatment plant was undertaken.	In place
	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	Generally applicable.		

		of the water streams (e.g. nutrient content).				
C	Impermeable surface	Depending on the risks posed by the waste in terms of soil and/or water contamination, the surface of the whole waste treatment area (e.g. waste reception, handling, storage, treatment and dispatch areas) is made impermeable to the liquids concerned.	Generally applicable			
D	Techniques to reduce the likelihood and impact of overflows and failures from tanks and vessels	Depending on the risks posed by the liquids contained in tanks and vessels in terms of soil and/or water contamination, this includes techniques such as: - 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	Applicability may be constrained when high volumes of waste are stored or treated (e.g. mechanical treatment in		During 2019 any aqueous or solvent streams which could potentially be treated in the WWTP upon removal of solids will be trialled in the evaporator. - The installation of membranes which are now fully operational and continuously in use. The new membranes have replaced the use of clarifiers and older membranes and have achieved reduced total suspended solids in the final effluent. Installation of additional monitoring to support reduction of water usage by 1%. The addition of extra monitoring and reporting will promptly identify leaks and issues to facilitate prompt resolution.	

			minimise the volume of contaminated runoff water.	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.		
	I	Appropriate buffer storage capacity	Appropriate buffer storage capacity is provided for wastewater generated during other than normal operating	Generally applicable to new plants.		

			conditions using a risk-based approach (e.g., taking into account the nature of the pollutants, the effects of downstream wastewater treatment, and the receiving environment). The discharge of wastewater from this buffer storage is only possible after appropriate measures are taken (e.g., monitor, treat, reuse).	For existing plants, applicability may be limited by space availability and by the layout of the water collection system.		
	Refer to Appendix A of this report for BAT-associated emission levels (BAT-AELs) for direct discharges to a receiving water body					
20	In order to reduce emissions to water, BAT is to treat wastewater using an appropriate combination of the techniques given below.				Applicable. The following final wastewater treatment techniques are undertaken at the plant in accordance with BAT: Preliminary and Primary Treatment: - Equalisation - Neutralisation (pH adjustment) is undertaken for strong effluent (effluent with a relatively high BOD load) Biological treatment (Secondary treatment) for biodegradable organic compounds: - Activated sludge process - Membrane bioreactors Final solids removal: - Filtration (belt filter press) - Nitrification/ denitrification: not required as influent is nitrogen deficient - chemical precipitation: not required as influent is phosphorus deficient,	
	Technique		**Description**	**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, oilwater 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		- sedimentation - existing first stage clarifiers (serving 100% hydraulic load) and - Ultrafiltration: existing MBR system serving 100% hydraulic load.	
	G	Chemical oxidation	Oxidisable dissolved non-biodegradable or inhibitory pollutants, e.g. nitrite, cyanide			
	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 (H2S), ammonia (NH3), 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.					
Emissions from accidents and incidents						
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.				Applicable. The site has a detailed and documented Internal Emergency Plan. The Plan describes the emergency response system onsite and also contains specific action plans in the event of particular incidents such as the release of gaseous materials, liquids, solids, etc. The site has a designated Emergency Controller available during plant operation. A trained emergency response team is also available during plant operation, with members drawn from across the site operations.	In place

	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.		
Material efficiency					
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).			Applicable Waste is used instead of other materials for the treatment of wastes where applicable and suitable on site and where there is no risk of impacts. Substitute fuelling with waste or excess solvent is considered in the flameless thermal oxidation process. In the wastewater treatment activities, final treated effluent is recirculated as required to optimise COD reduction. A key objective of Pfizer's Environmental Management Programme is Reduction of Emissions to Water. An estimated 52,000 m3 of water were recycled on site in 2020. Production liquid waste streams on site include organics, chlorinated organics and residues are isolated for reuse where practicable.	In place
Energy efficiency					

<table>
<tr>
<td>23</td>
<td>In order to use energy efficiently, BAT is to use both of the techniques given below.

<table>
<tr><th colspan="2">Technique</th><th>Description</th></tr>
<tr><td>A</td><td>Energy efficiency plan</td><td>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.</td></tr>
<tr><td>B</td><td>Energy balance record</td><td>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.</td></tr>
</table>
</td>
<td>Applicable.

The site measures energy use and sets targets to improve the energy efficiency of activities and reduce overall use, where possible. These are outlined in the Annual Environmental Report.

Some targets set out in the Annual Environmental Report for the site in 2020 include:
• Install a Pressure Swing Adsorption [PSA] Plant to supply the nitrogen requirements for the entire site.
• Reviewing product recipes for energy optimisation. Audits were done on the Distributed Control Systems focussing primarily on condenser set up.
• Complete a nitrogen valve survey within the tank farm.
• Review the hot water floating set point for the air handling units in OSP3.
• Set up an energy dashboard for the HVAC in OSP3.
• OSP1 Chiller Heat Recovery.</td>
<td>In place</td>
</tr>
</table>

<table>
<tr><td></td><td></td><td>• Review Solar Photovoltaic [PV] feasibility</td><td></td></tr>
<tr><td colspan="4">Reuse of packaging</td></tr>
<tr><td>24</td><td>In order to reduce the quantity of waste sent for disposal, BAT is to maximise the reuse of packaging, as part of the residuals 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.</td><td>This Residuals Management Plan (RMP) was revised in 2020 and outlines the processes to store, dispose, and reuse waste packaging.</td><td>In place</td></tr>
<tr><td colspan="4">General BAT conclusions for the mechanical treatment of waste</td></tr>
<tr><td>25</td><td>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.

<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>A</td><td>Cyclone</td><td>See Section 6.1.
Cyclones are mainly used as preliminary separators for coarse dust.</td><td>Generally applicable</td></tr>
<tr><td>B</td><td>Fabric filter</td><td>See Section 6.1.</td><td>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).</td></tr>
<tr><td>C</td><td>Wet scrubbing</td><td>See Section 6.1.</td><td>Generally applicable</td></tr>
</table></td><td>Not Applicable

Mechanical treatment of waste is not carried out on site.</td><td>Not applicable</td></tr>
</table>

	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).		

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.

BAT conclusions for the mechanical treatment in shredders of metal waste			
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.	Not applicable. There is no mechanical treatment in shredders of metal waste on the site.	Not applicable
27	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**	Not applicable. There is no mechanical treatment in shredders of metal waste on the site.	Not applicable

	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.		
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.				Not applicable. There is no Mechanical treatment in shredders of metal waste on the site.	Not applicable

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

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.	Not applicable No treatment of WEEE is carried out on site.	Not applicable

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.

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/Nm3	3-15
CFCs	mg/Nm3	0,5-10

<table>
<tr><td></td><td>The associated monitoring is given in BAT 8</td><td></td><td></td></tr>
<tr><td>30</td><td>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.
<table><tr><th colspan="2">Technique</th><th>Description</th></tr><tr><td>A</td><td>Inert atmosphere</td><td>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-%).</td></tr><tr><td>B</td><td>Forced ventilation</td><td>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.</td></tr></table></td><td>Not applicable.

No treatment of WEEE is carried out on site.</td><td>Not applicable</td></tr>
<tr><td colspan="4">BAT conclusions for the mechanical treatment of waste with calorific value</td></tr>
<tr><td>31</td><td>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.
<table><tr><th colspan="2">Technique</th><th>Description</th></tr><tr><td>A</td><td>Adsorption</td><td rowspan="4">See Section 6.1</td></tr><tr><td>B</td><td>Biofilter</td></tr><tr><td>C</td><td>Thermal oxidation</td></tr><tr><td>D</td><td>Wet scrubbing</td></tr></table>
<table><tr><th>Parameter</th><th>Unit</th><th>BAT-AEL (Average over the sampling period)</th></tr><tr><td>TVOC</td><td>mg/Nm3</td><td>10-30 (1)</td></tr></table></td><td>Applicable.

The measures in place to reduce emissions to air of organic compounds are:
- VOC Absorption Systems
- Vent Condensers
- Biofilters/ HEPA Filters
- Thermal oxidation.</td><td>In place</td></tr>
</table>

<table>
<tr><td></td><td>(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.</td><td>These measures are further described in Attachment-9-1 Environmental Management Techniques</td><td></td></tr>
<tr><td colspan="4">BAT conclusions for the mechanical treatment of WEEE containing mercury</td></tr>
<tr><td>32</td><td>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 6.11).
- 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.

BAT-associated emission level (BAT-AEL) for channelled mercury emissions to air from the mechanical

<table><tr><th>Parameter</th><th>Unit</th><th>BAT-AEL
(Average over the sampling period)</th></tr><tr><td>Mercury (Hg)</td><td>µg/Nm3</td><td>2-7</td></tr></table>
The associated monitoring is given in BAT 8.</td><td>Not applicable.

There are no mercury emissions on site.</td><td>Not applicable</td></tr>
<tr><td colspan="4">General BAT conclusions for the biological treatment of waste</td></tr>
<tr><td>33</td><td>In order to reduce odour emissions and to improve the overall environmental performance, BAT is to select the waste input.</td><td>Not applicable.

Odour nuisance is neither expected nor substantiated at the facility.</td><td>Not applicable</td></tr>
</table>

	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.	Notwithstanding this, there are routine walkovers of operating areas including WWTP, solvent recovery, tank farm areas per shift. Atypical conditions including odour would be routinely reported and investigated	

34	In order to reduce channelled emissions to air of dust, organic compounds and odorous compounds, including H2S and NH3, 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 NH3 content (e.g. 5-40 mg/Nm3) in order to control the media pH and to limit the formation of N2O in the biofilter. Some other odorous compounds (e.g., mercaptans, H2S) 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. BAT-associated emission levels (BAT-AELs) for channelled NH3, 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** NH3 (1) (2) — mg/Nm3 — 0,3-20 — All biological treatments of waste Odour concentration (1) (2) — ouE/Nm3 — 200-1 000 Dust — mg/Nm3 — 2-5 — Mechanical biological treatment of waste TVOC — mg/Nm3 — 5-40 (3) (1) Either the BAT-AEL for NH3 or the BAT-AEL for the odour concentration applies.	Applicable The WWTP equalisation tanks and the aeration basins are roofed to minimise odour and VOC emissions. The headspace air from the first-stage basins is passed through biofilters packed with peat fibre material for odour control. There are four biofilters installed on each first stage basin. Process vessels are vented to either the VOC Absorption Units in OSP1 or OSP3. Process gases arising from OSP4 will be abated by the replacement End- of-Line Thermal Oxidiser. Overhead condensers are in place which minimise the VOC load to the abatement systems and which can, if required, recycle the solvent back into the vessel. Acidic and basic components in waste gas streams are neutralised in scrubber systems prior to final abatement.	In place

	(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.		

<table>
<tr>
<td>35</td>
<td>In order to reduce the generation of wastewater and to reduce water usage, BAT is to use all of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>A</td><td>Segregation of water streams</td><td>Leachate seeping from compost piles and windrows are segregated from surface run-off water (see BAT 19f).</td><td>Generally applicable to new plants.
Generally applicable to existing plants within the constraints associated with the layout of the water circuits.</td></tr>
<tr><td>B</td><td>Water recirculation</td><td>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).</td><td>Generally applicable.</td></tr>
<tr><td>C</td><td>Minimisation of the generation of leachate</td><td>Optimising the moisture content of the waste in order to minimise the generation of leachate.</td><td>Generally applicable</td></tr>
</table>
</td>
<td>Applicable.
A key objective of Pfizer’s Environmental Management Programme is Reduction of Emissions to Water. An estimated 52,000 m3 of water were recycled on site in 2020. Production liquid waste streams on site include organics, chlorinated organics and residues are isolated for reuse where practicable.

To reduce water usage, enhance reuse of water in the production process and reduce load a number of objectives are set each year and included in the facilities environmental program submitted to the EPA. Examples of recent measures to reduce the usage of water/ generation of wastewater include the following:
- To reduce solid wastes removed from site, a review of waste streams currently not suitable for treatment in the wastewater treatment plant was undertaken. During 2019 any aqueous or solvent streams which could potentially be treated in the WWTP upon removal of solids will be trialled in the evaporator.
- The installation of membranes which are now fully operational and continuously in use. The new membranes have replaced the use</td>
<td>In place</td>
</tr>
</table>

		of clarifiers and older membranes and have achieved reduced total suspended solids in the final effluent. Installation of additional monitoring to support reduction of water usage by 1%. The addition of extra monitoring and reporting will promptly identify leaks and issues to facilitate prompt resolution.	
BAT conclusions for the aerobic treatment of waste			
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, O2 and/or CO2 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.	Applicable The weak and strong effluent streams on site are combined in the equalisation tanks prior to treatment in the aerobic biological treatment system in the wastewater treatment system. The proposed RCMF and EOL developments will tie in with the current waste streams on site. Waste and process parameters are carefully monitored as part of the sites TWM contract. Sludge waste from the WWTP varies from 20-60 tonnes per week, averaging at 40 tonnes of waste sludge per week. This is collected by an external contractor and transferred offsite for incineration.	In place

<table>
<tr>
<td>37</td>
<td>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.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>A</td><td>Use of semipermeable membrane covers</td><td>Active composting windrows are covered by semipermeable membranes.</td><td>Generally applicable.</td></tr>
<tr><td>B</td><td>Adaptation of operations to the meteorological conditions</td><td>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.</td><td>Generally applicable.</td></tr>
</table>
</td>
<td>Not applicable.

There are no diffuse emissions to air of dust, odour and bioaerosols from open-air treatment steps on site.</td>
<td>Not applicable</td>
</tr>
<tr>
<td colspan="4">BAT conclusions for the anaerobic treatment of waste</td>
</tr>
<tr>
<td>38</td>
<td>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.</td>
<td>Not applicable

There is no anaerobic treatment of waste carried out on site.</td>
<td>Not applicable</td>
</tr>
</table>

<table>
<tr><td></td><td>- 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., H2S) and pressure.
- liquid and foam levels in the digester.</td><td></td><td></td></tr>
<tr><td colspan="4">BAT conclusions for the mechanical biological treatment (MBT) of waste</td></tr>
<tr><td>39</td><td>In order to reduce emissions to air, BAT is to use both of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>A</td><td>Segregation of the waste gas streams</td><td>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.</td><td rowspan="2">Generally applicable to new plants.
Generally applicable to existing plants within the constraints associated with the layout of the air circuits.</td></tr>
<tr><td>B</td><td>Recirculation of waste gas</td><td>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</td></tr>
</table></td><td>Not applicable.

No mechanical biological treatment of waste is carried out on site.</td><td>Not applicable</td></tr>
</table>

	gas before reuse. In this case, cooling is necessary, and the condensed water is recirculated when possible (see BAT 35) or treated before discharge.		

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

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; - H2 formation potential upon mixing of flue-gas treatment residues, e.g. fly ashes, with water.	Not Applicable There is no physico-chemical treatment of solid and/or pasty waste on site.	Not applicable
41	In order to reduce emissions of dust, organic compounds and NH3 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 BAT-associated emission level (BAT-AEL) for channelled emissions of dust to air from the physicochemical treatment of solid and/or pasty waste. **Parameter** / **Unit** / **BAT-AEL (Average over the sampling period)** Dust / mg/Nm3 / 2-5 The associated monitoring is given in BAT 8.	Not Applicable There is no physico-chemical treatment of solid and/or pasty waste on site.	Not applicable

BAT conclusions for the re-refining of waste oil

<table>
<tr>
<td>42</td>
<td>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)</td>
<td>Not applicable

Re-refining of waste oil is not carried out on site.</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>In order to reduce the quantity of waste sent for disposal, BAT is to use one or both of the techniques given below.

<table>
<tr><th colspan="2">Technique</th><th>Description</th></tr>
<tr><td>A</td><td>Material recovery</td><td>Using the organic residues from vacuum distillation, solvent extraction, thin film evaporators, etc. in asphalt products, etc.</td></tr>
<tr><td>B</td><td>Energy recovery</td><td>Using the organic residues from vacuum distillation, solvent extraction, thin film evaporators, etc. to recover energy.</td></tr>
</table>
</td>
<td>Not applicable

Re-refining of waste oil is not carried out on site.</td>
<td>Not applicable</td>
</tr>
<tr>
<td>44</td>
<td>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.

<table>
<tr><th colspan="2">Technique</th><th>Description</th></tr>
<tr><td>A</td><td>Adsorption</td><td>See Section 6.1.</td></tr>
<tr><td>B</td><td>Thermal oxidation</td><td>See Section 6.1. This includes when the waste gas is sent to a process furnace or a boiler.</td></tr>
<tr><td>C</td><td>Wet scrubbing</td><td>See Section 6.1.</td></tr>
</table>

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
<table>
<tr><th>Parameter</th><th>Unit</th><th>BAT-AEL (1) (Average over the sampling period)</th></tr>
<tr><td>TVOC</td><td>mg/Nm3</td><td>5-30</td></tr>
<tr><td colspan="3">(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.</td></tr>
</table>

The associated monitoring is given in BAT 8</td>
<td>Not applicable

Re-refining of waste oil is not carried out on site.</td>
<td>Not applicable</td>
</tr>
</table>

<table>
<tr><td colspan="4">BAT conclusions for the physico-chemical treatment of waste with calorific value</td></tr>
<tr><td>45</td><td>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.
<table>
<tr><th colspan="2">Technique</th><th>Description</th></tr>
<tr><td>A</td><td>Adsorption</td><td rowspan="4">See Section 6.1</td></tr>
<tr><td>B</td><td>Cryogenic condensation</td></tr>
<tr><td>C</td><td>Thermal oxidation</td></tr>
<tr><td>D</td><td>Wet scrubbing</td></tr>
</table>
The BAT-AEL set in BAT 44 applies.

The associated monitoring is given in BAT 8</td><td>Not applicable.

There is no physico-chemical treatment of waste with calorific value on site.</td><td>Not applicable</td></tr>
<tr><td colspan="4">BAT conclusions for the regeneration of spent solvents</td></tr>
<tr><td>46</td><td>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.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>A</td><td>Material recovery</td><td>Solvents are recovered from the distillation residues by evaporation.</td><td>Applicability may be restricted when the energy demand is excessive with regards to the quantity of solvent recovered.</td></tr>
<tr><td>B</td><td>Energy recovery</td><td>The residues from distillation are used to recover energy.</td><td>Generally applicable</td></tr>
</table></td><td>Applicable
(a) there are eight distillation towers and a pervaporation recovery unit on site for solvent recovery. Over the past 5 years Pfizer Ringaskiddy has reclaimed/ regenerated approximately 10,000 tonnes of solvents on-site. Recovery programmes continue to be developed and optimised for the Ringaskiddy operations and the Viatris facility in Little Island.

(b) Energy recovery: Pfizer successfully commissioned a project in 2014 whereby wastes generated at the Ringaskiddy site, which were</td><td>In place</td></tr>
</table>

<table>
<tr><td></td><td></td><td>previously sent to landfill, were recategorized as Refuse Derived Fuel (RDF) and used as a fuel source in cement kilns. Since 2014, approximately 32,000 tonnes of waste have been recovered and used as a fuel and/or energy source.</td><td></td></tr>
<tr><td>47</td><td>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.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>A</td><td>Recirculation of process off-gases in a steam boiler</td><td>The process off-gases from the condensers are sent to the steam boiler supplying the plant</td><td>May not be applicable to the treatment of halogenated solvent wastes, in order to avoid generating and emitting PCBs and/or PCDD/F.</td></tr>
<tr><td>B</td><td>Adsorption</td><td>See Section 6.1.</td><td>here 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).</td></tr>
<tr><td>C</td><td>Thermal oxidation</td><td>See Section 6.1.</td><td>May not be applicable to the treatment of halogenated solvent wastes, in order to avoid generating and emitting PCBs and/or PCDD/F.</td></tr>
<tr><td>D</td><td>Condensation or cryogenic condensation</td><td>See Section 6.1.</td><td>Generally applicable</td></tr>
<tr><td>E</td><td>Wet scrubbing</td><td>See Section 6.1.</td><td>Generally applicable</td></tr>
</table>
The BAT-AEL set in BAT 44 applies.
The associated monitoring is given in BAT 8</td><td>Applicable.
The following techniques are in place which reduce emissions of organic compounds to air:

Process vents containing vapours arising from production activities are routed to the Absorption Units at OSP1 or OSP3.

Process inherent containment features are maximised asl reactors and tanks are closed and sealed. Process vessels are closed, the production buildings are fully closed and serviced by mechanical ventilation throughout. Process reactors are nitrogen blanketed. Nitrogen blanketing of vessels where VOCs are handled is a typical safety feature of plant design. Reactors are connected to overhead condensers.

There are good maintenance procedures in place and implemented and timely replacement of equipment.</td><td>In place</td></tr>
</table>

		A Computerised Maintenance Management System (CMMS) and scheduled planned maintenance routines are in place for process reactors, tanks, storage vessels and associated components. Maintenance programme and procedures are in place in accordance with IE Licence. There are absorption plants for the removal of VOCs from the emissions to air from two plants on site: OSP1 and OSP3. Process emissions from each plant are minimised by condensation. The combined process emissions are then treated in an emission treatment system comprising scrubbers and a VOC absorption unit. The emissions from each plant are monitored continuously for TOC and discharged to the atmosphere at the licensed emission points A2-2 (V3) (OSP1)), and A2-4 (V5) (OSP3)). Further monthly monitoring is carried out in accordance with Schedule C.1.2. Process gases arising from OSP4 will be abated by the replacement End- of-Line Thermal Oxidiser. The final emission to atmosphere from the replacement EOL TO will be at emission point A2-28.	

<table>
<tr><td colspan="4">BAT conclusions for the thermal treatment of spent activated carbon, waste catalysts and excavated contaminated soil</td></tr>
<tr><td>48</td><td>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.

<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>A</td><td>Heat recovery from the furnace off-gas</td><td>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.</td><td>Generally applicable.</td></tr>
<tr><td>B</td><td>Indirectly fired furnace</td><td>An indirectly fired furnace is used to avoid contact between the contents of the furnace and the flue-gases from the burner(s).</td><td>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.</td></tr>
<tr><td>C</td><td>Process-integrated techniques to reduce emissions to air</td><td>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.</td><td>Generally applicable.</td></tr>
</table></td><td>Not applicable

No thermal treatment of spent activated carbon, waste catalysts and excavated contaminated soil is carried out on site.</td><td>Not applicable</td></tr>
<tr><td>49</td><td>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.

<table>
<tr><th>Technique</th><th>Description</th></tr>
</table></td><td>Applicable
The measures in place to reduce emissions to air of dust, organic compounds are:</td><td>In place</td></tr>
</table>

	<table><tr><td>A</td><td>Cyclone</td><td>See Section 6.1. The technique is used in combination with further abatement techniques.</td></tr><tr><td>B</td><td>Electrostatic precipitator (ESP)</td><td rowspan="7">See Section 6.1.</td></tr><tr><td>C</td><td>Fabric filter</td></tr><tr><td>D</td><td>Wet scrubbing</td></tr><tr><td>E</td><td>Adsorption</td></tr><tr><td>F</td><td>Condensation</td></tr><tr><td>G</td><td>Thermal oxidation (1)</td></tr><tr><td colspan="3">(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).</td></tr></table> The associated monitoring is given in BAT 8.	- VOC Absorption Systems - Vent Condensers: - Biofilters/ HEPA filters - Thermal oxidation; and These measures are further described in Attachment-9-1 Environmental Management Techniques	
BAT conclusions for the water washing of excavated contaminated soil				
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. <table><tr><th colspan="2">Technique</th><th>Description</th></tr><tr><td>A</td><td>Adsorption</td><td rowspan="3">See Section 6.1.</td></tr><tr><td>B</td><td>Fabric filter</td></tr><tr><td>C</td><td>Wet scrubbing</td></tr></table> The associated monitoring is given in BAT 8.	Not applicable If impacted soil is encountered during the construction of the proposed developments, it will be managed and dispatched to appropriately licenced waste facilities for recovery/ disposal as appropriate, incorporating the given techniques.	Not applicable
BAT conclusions for the decontamination of equipment containing PCBs				
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.	Not applicable.	Not applicable

	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.	There is no treatment of equipment containing PCBs on site.	
	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.				
Overall environmental performance					
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.			Applicable See BAT 2.	In place
Emissions to air					
53	In order to reduce emissions of HCl, NH3 and organic compounds to air, BAT is to apply BAT 14d and to use one or a combination of the techniques given below.			Applicable The measures in place to reduce emissions to air of organic compounds and NH3 are: - VOC Absorption Systems - Vent Condensers:	In place

Technique		Description
A	Adsorption	See Section 6.1.
B	Biofilter	
C	Thermal oxidation	

	D	Wet scrubbing		- Biofilters/ HEPA Filters - Thermal oxidation. These measures are further described in Attachment-9-1 Environmental Management techniques.	

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.