Appendix G Common Waste Water and Waste Gas Treatment / Management Systems in the Chemical Sector BATc Assessment

Agilent Environmental Permit Application: Redacted for the Public Register

Best Available Techniques & Operating Techniques

Agilent Technologies LDA UK Limited

SLR Project No.: 410.064951.00001

23 September 2024

Assessment of Indicative BAT for Common Wastewater and Waste Gas Treatment/Management Systems in the Chemical Sector

The following table provides an assessment of the operation techniques carried out by Agilent against the BAT requirements contained within the Common Wastewater and Waste Gas Treatment / Management Systems in the Chemical Sector BRef.

It should be noted that Agilent has 3 separate wastewater streams:

1) Chlorinated and unchlorinated waste solvent (containing water) which is stored in drums and collected twice a week and reused as cement kiln fuel.
2) Process cooling and equipment wash water which is discharged to sewer in compliance with a number of trade effluent consents for subsequent offsite treatment.
3) Uncontaminated storm water which is discharged directly to sewer.

There is no onsite effluent treatment plant.

Table G1 Best Available Techniques – Common Wastewater and Waste Gas Treatment/Management Systems in the Chemical Sector

BATc No.	BAT Justification	Operating to BAT	Demonstration of BAT Compliance
Scope	These BAT conclusions concern the activities specified in Sections 4 and 6.11 of Annex I to Directive 2010/75/EU, namely: — Section 4: Chemical industry. In particular, these BAT conclusions cover the following issues: ▪ Environmental management systems. ▪ Water saving. ▪ Waste water management, collection and treatment. ▪ Waste management. ▪ Treatment of waste water sludge with the exception of incineration. ▪ Waste gas management, collection and treatment. ▪ Flaring. ▪ Diffuse emissions of volatile organic compounds (VOC) to air. ▪ Odour emissions. ▪ Noise emissions.	Yes	The BRef document applies as the site activities are defined under Section 4.1 of Schedule 1 to the Environmental Permitting Regulations 2016.

BATc No.	BAT Justification	Operating to BAT	Demonstration of BAT Compliance
BATc 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) an environmental policy that includes the continuous improvement of the installation by the management; (iii) planning and establishing the necessary procedures, objectives and targets, in conjunction with financial planning and investment; (iv) implementation of procedures paying particular attention to: (a) structure and responsibility; (b) recruitment, training, awareness and competence; (c) communication; (d) employee involvement; (e) documentation; (f) effective process control; (g) maintenance programmes; (h) emergency preparedness and response; (i) safeguarding compliance with environmental legislation. (v) checking performance and taking corrective action, paying particular attention to: (a) monitoring and measurement (see also the 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 of the EMS and its continuing suitability, adequacy and effectiveness by senior management (vii) following the development of cleaner technologies; (viii) consideration for the environmental impacts from the eventual decommissioning of the plant at the design stage of a new plant, and throughout its operating life;	Yes	Agilent will operate the site under their using their Environmental, Health and Safety Management System which conforms with all the requirements of BAT1. The company wide EHS Management System is certified to ISO 14001. The site operates an Integrated Management System that is in accordance with ISO 14001. Agilent publish an annual ESG (Environmental, Social and Governance) report. The decommissioning of new plant is considered at the design stage to ensure that all potential risks to the environment are mitigated during decommissioning and demolition. Use of cleaner, more efficient technology is considered when replacing equipment. A programme of internal auditing is in place, with audits scheduled every 18 months. Benchmarking occurs against other Agilent sites. The site has established inventories of waste liquid and waste gas streams.

BATc No.	BAT Justification	Operating to BAT	Demonstration of BAT Compliance
	(ix) application of sectoral benchmarking on a regular basis; (x) waste management plan (see BAT 13). Specifically for chemical sector activities, BAT is to incorporate the following features in the EMS: (xi) on multi-operator installations/sites, establishment of a convention that sets out the roles, responsibilities and coordination of operating procedures of each plant operator in order to enhance the cooperation between the various operators; (xii) establishment of inventories of waste water and waste gas streams (see BAT 2). In some cases, the following features are part of the EMS: (xiii) odour management plan (see BAT 20); (xiv) noise management plan (see BAT 22). *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.		
BATc 2	In order to facilitate the reduction of emissions to water and air and the reduction of water usage, BAT is to establish and to maintain an inventory of waste water and waste gas streams, as part of the environmental management system (see BAT 1), that incorporates all of the following features: (i) information about the chemical production processes, including: (a) chemical reaction equations, also showing side products; (b) simplified process flow sheets that show the origin of the emissions; (c) descriptions of process-integrated techniques and waste water/waste gas treatment at source including their performances; (ii) information, as comprehensive as is reasonably possible, about the characteristics of the waste water streams, such as: (a) average values and variability of flow, pH, temperature, and conductivity; (b) average concentration and load values of relevant pollutants/parameters and their variability (e.g., COD/TOC, nitrogen species, phosphorus, metals, salts, specific organic compounds); (c) data on bio eliminability (e.g., BOD, BOD/COD ratio, Zahn-Wellens test, biological inhibition potential (e.g., nitrification));	Yes	As part of the site's Environmental, Health and Safety Management System for Operations, Agilent have procedures in place to collect process data and assess performance. (i)Information on the chemical production process is contained with the site's Environmental Management System (EMS). (ii) Agilent will undertake monitoring of waste water streams in line with BAT 2, where applicable. The majority of effluent at the site is collected as chlorinated and unchlorinated waste solvent (containing water) and transferred off site to be utilised as cement kiln fuel. This is tested for suitability by the receiving subcontractor. (iii) waste gas monitoring is undertaken at the site and recorded with the site's EMS.

BATc No.	BAT Justification	Operating to BAT	Demonstration of BAT Compliance
	(iii) information, as comprehensive as is reasonably possible, 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 pollutants/parameters and their variability (e.g., VOC, CO, NOX, SOX, chlorine, hydrogen chloride); (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).		
2. Monitoring			
BATc 3	For relevant emissions to water as identified by the inventory of waste water streams (see BAT 2), BAT is to monitor key process parameters (including continuous monitoring of waste water flow, pH and temperature) at key locations (e.g., influent to pre-treatment and influent to final treatment).	Yes	There is no on-site effluent treatment plant. Process cooling and equipment wash water discharged to sewer is periodically sampled by Severn Trent to ensure that the site is meeting the agreed discharge consents. The sources of effluent above are not generated on a continuous basis, as such continuous monitoring will not be applicable. The majority of effluent on site is collected as chlorinated and unchlorinated waste solvent (containing water) is transferred off site to be utilised as cement kiln fuel. This is tested for suitability by the receiving subcontractor. Agilent will undertake monitoring of waste water streams in line with BAT 3, where applicable.

<table>
<tr><th>BATc No.</th><th>BAT Justification</th><th>Operating to BAT</th><th>Demonstration of BAT Compliance</th></tr>
<tr><td>BATc 4</td><td>BAT is to monitor emissions to water in accordance with EN standards with at least the minimum frequency given below. 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 colspan="2">Substance / parameter</th><th>Standard(s)</th><th>Minimum Monitoring Frequency (1) (2)</th></tr>
<tr><td colspan="2">Total Organic Carbon (TOC) (3)</td><td>EN 1484</td><td rowspan="6">Daily</td></tr>
<tr><td colspan="2">Chemical Oxygen Demand (COD) (3)</td><td>No EN Standard available</td></tr>
<tr><td colspan="2">Total Suspended Solids (TSS)</td><td>EN 872</td></tr>
<tr><td colspan="2">Total Nitrogen (TN) (4)</td><td>EN 12260</td></tr>
<tr><td colspan="2">Total Inorganic Nitrogen (4) (N_{inorg})</td><td>Various EN Standards available</td></tr>
<tr><td colspan="2">Total Phosphorus</td><td>Various EN Standards</td></tr>
<tr><td colspan="2">Adsorbable organically bound halogens (AOX)</td><td>EN ISO 9562</td><td>Monthly</td></tr>
<tr><td rowspan="6">Metals</td><td>Cr</td><td rowspan="6">Various EN Standards available</td><td rowspan="6">Monthly</td></tr>
<tr><td>Cu</td></tr>
<tr><td>Ni</td></tr>
<tr><td>Pb</td></tr>
<tr><td>Zn</td></tr>
<tr><td>Other metals, if relevant</td></tr>
<tr><td rowspan="3">Toxicity (5)</td><td>Fish Eggs (Danio rerio)</td><td>EN ISO 15088</td><td rowspan="3">To be decided based on a risk assessment, after an initial characterisation</td></tr>
<tr><td>Daphnia (Daphnia magna Straus)</td><td>EN ISO 6341</td></tr>
<tr><td>Luminescent bacteria (Vibrio fischeri)</td><td>EN ISO 11348-1, EN ISO 11348-2 or EN ISO 11348-3</td></tr>
</table></td><td>Yes</td><td>Agilent will undertake monitoring of waste water streams in line with BAT 4, where applicable.</td></tr>
</table>

BATc No.	BAT Justification	Operating to BAT	Demonstration of BAT Compliance
	<table><tr><td></td><td>Duckweed (*Lemna minor*)</td><td>EN ISO 20079</td><td></td></tr><tr><td></td><td>Algae</td><td>EN ISO 8692, EN ISO 10253 or EN ISO 10710</td><td></td></tr></table> Notes; (1) Monitoring frequencies may be adapted if the data series clearly demonstrate a sufficient stability. (2) The sampling point is located where the emission leaves the installation. (3) TOC monitoring and COD monitoring are alternatives. TOC monitoring is the preferred option because it does not rely on the use of very toxic compounds. (4) TN and Ninorg monitoring are alternatives. (5) An appropriate combination of these methods can be used.		
BATc 5	**Diffuse VOC's** BAT is to periodically monitor diffuse VOC emissions to air from relevant sources by using an appropriate combination of the techniques I-III or, where large amounts of VOC are handled, all of the techniques I-III. I. sniffing methods (e.g., with portable instruments according to EN 15446) associated with correlation curves for key equipment; II. optical gas imaging methods; III. Calculation of emissions based on emissions factors, periodically validated (e.g., once every two years) by measurements. Where large amounts of VOCs are handled, the screening and quantification of emissions from the installation by periodic campaigns with optical absorption-based techniques, such as Differential absorption light detection and ranging (DIAL) or Solar occultation flux (SOF), is a useful complementary technique to the techniques I to III.	Yes	No significant diffuse VOC emission sources are anticipated. • The amount of raw materials inputted into the process is low at 185.09 tonnes per year. • Pipework is located indoors and is minimal. Pipework is maintained under a planned preventative maintenance system. • VOC transfers through pipework only occur intermittently as the process is batched. There is no continuous flow of VOC material in pipework. • Controls are in place where chemicals are transferred. Chemical 2, chemical 3 and chemical 4 are all transferred to process via a Diaphragm pump from a DENIOS unit These chemicals are delivered in sealed containers, transferred via minimal sealed indoor pipework into a sealed process that vents to a channelled emission point to air. • Chemicals stored in 205 L drums are transferred into smaller containers within the drum store utilising air pumps. Agilent will review the need and options for management of diffuse VOC emissions.

BATc No.	BAT Justification	Operating to BAT	Demonstration of BAT Compliance
BATc 6	**Odour** BAT is to periodically monitor odour emissions from relevant sources in accordance with EN standards. Emissions can be monitored by dynamic olfactometry according to EN 13725. Emission complemented by measurement/estimation of odour exposure or estimation of odour impact. The applicability is restricted to cases where odour nuisance can be expected or has been substantiated.	Yes	The assessment of the potential for fugitive odour carried out in the ERA (410.064951.00001_ERA) of this application concludes that the likely odour effect at receptors is likely to be low, and hence periodic formal odour monitoring is not proposed.
Emissions to Water			
BATc 7	**Water Usage and Waste Water Generation** In order to reduce the usage of water and the generation of waste water, BAT is to reduce the volume and/or pollutant load of waste water streams, to enhance the reuse of waste water within the production process and to recover and reuse raw materials.	Yes	Due to the specification of the products manufactured, to keep the standard of the product high, it is not possible to re-use water used in the process. The site has a scheme in place to update manual controls and increase automation of process controls which will increase the efficiency of the process. The reverse osmosis system is controlled to ensure that only the volume of water required for the process is produced. Water usage is a key performance indicator that the site monitor and review on a periodic basis. Agilent have investigated the use of 'grey water' at the site. However, the site was considered to be too small to house the necessary equipment to operate this system.
BATc 8	**Waste Water Collection and Segregation** In order to prevent the contamination of uncontaminated water and to reduce emissions to water, BAT is to segregate uncontaminated waste water streams from waste water streams that require treatment.	Yes	Wastewater routinely generated at the site comprises separately collected streams: • Process cooling and equipment wash water which is discharged to sewer; • Chlorinated and unchlorinated waste solvent (containing water) which is stored in drums and collected twice a week and reused as cement kiln fuel; • Uncontaminated surface water in the southern portion of the site is discharged to soakaway (W1); and • Uncontaminated surface water in the north of the site is passed through an 10,000L attenuation tank prior to being

<table>
<tr><th>BATc No.</th><th>BAT Justification</th><th>Operating to BAT</th><th>Demonstration of BAT Compliance</th></tr>
<tr><td></td><td></td><td></td><td>discharged to the Severn Trent storm water drain at discharge point W2.</td></tr>
<tr><td>BATc 9</td><td>In order to prevent uncontrolled emissions to water, BAT is to provide an appropriate buffer storage capacity for waste water incurred during other than normal operating conditions based on a risk assessment (taking into account e.g., the nature of the pollutant, the effects on further treatment, and the receiving environment), and to take appropriate further measures (e.g., control, treat, reuse).
The interim storage of contaminated rainwater requires segregation, which may not be applicable in the case of existing waste water collection systems.</td><td>Yes</td><td>Process cooling and equipment wash water is discharged straight to sewer. There is no additional storage capacity in the system. However, it is noted that the majority of process effluent is not discharged to sewer but stored in drums prior to transfer off site for use as cement kiln fuel.
In the case of abnormal operating conditions, the process operates under sealed conditions and water would be held within process vessels and reactors and disposed of through the existing method (collection in drums for offsite transfer - for use as cement kiln fuel).
The surface water drainage system comprises a 10,000 L attenuation tank which can be sampled prior to pumping to the Seven Trent surface water sewer if necessary.</td></tr>
<tr><td>BATc 10</td><td>Waste Water Treatment
In order to reduce emissions to water, BAT is to use an integrated waste water management and treatment strategy that includes an appropriate combination of the techniques in the priority order given below.
<table><tr><th></th><th>Technique</th><th>Description</th></tr><tr><td>a</td><td>Process integrated techniques - prevent or reduce pollutants (1)</td><td>Techniques to prevent or reduce the generation of water pollutants.</td></tr><tr><td>b</td><td>Recovery of pollutants at source (1)</td><td>Techniques to recover pollutants prior to their discharge to the waste water collection system.</td></tr><tr><td>c</td><td>Waste water pre-treatment (1) (2)</td><td>Techniques to abate pollutants before the final waste water treatment. Pre-treatment can be carried out at the source or in combined streams.</td></tr></table></td><td>Yes</td><td>There is no on-site effluent treatment plant.
The processes has been designed to be as efficient as possible and give rise to minimal waste effluent.
Sieves and filters are used to removed particulates for wash water discharges to sewer.</td></tr>
</table>

BATc No.	BAT Justification	Operating to BAT	Demonstration of BAT Compliance
	<table><tr><td>d</td><td>Final waste water treatment (3)</td><td>Final waste water treatment by, for example, preliminary and primary treatment, biological treatment, nitrogen removal, phosphorus removal and/or final solids removal techniques before discharge to a receiving water body.</td></tr><tr><td colspan="3">(1) These techniques are further described and defined in other BAT conclusions for the chemical industry. (2) See BAT 11. (3) See BAT 12.</td></tr></table> The integrated waste water management and treatment strategy is based on the inventory of waste water streams (see BAT 2).		
BATc 11	In order to reduce emissions to water, BAT is to pre-treat waste water that contains pollutants that cannot be dealt with adequately during final waste water treatment by using appropriate techniques. *Description:* Waste water pre-treatment is carried out as part of an integrated waste water management and treatment strategy (see BAT 10) and is generally necessary to: • Protect the final waste water treatment plant (e.g., protection of a biological treatment plant against inhibitory or toxic compounds). • Remove compounds that are insufficiently abated during final treatment (e.g., toxic compounds, poorly/non- biodegradable organic compounds, organic compounds that are present in high concentrations, or metals during biological treatment). • Remove compounds that are otherwise stripped to air from the collection system or during final treatment (e.g., volatile halogenated organic compounds, benzene). • Remove compounds that have other negative effects (e.g., corrosion of equipment; unwanted reaction with other substances; contamination of waste water sludge). In general, pre-treatment is carried out as close as possible to the source in order to avoid dilution, in particular for metals. Sometimes, waste water streams with	Yes	There is no on-site effluent treatment plant, and hence no pre-treatment plant. The site processes have been designed to be as efficient as possible and give rise to minimal waste effluent. The majority of effluent onsite comprises chlorinated and unchlorinated waste solvent (containing water) that is transferred offsite to be used as cement kiln fuel. Process cooling and equipment wash water at the site will include : • Laboratory waste water containing small volumes of detergents, residual chemical 3, polymeric solids and de-ionised water from glassware washing; • Cooling water; • Compressor condensate; • Ion exchange from the reverse osmosis process; • Sieving of polymer particles containing predominantly mains water, with a small amount of inert polymeric solids. Sieves and filters are used to removed particulates for discharges to sewer; and

<table>
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<tr><td></td><td>appropriate characteristics can be segregated and collected in order to undergo a dedicated combined pre-treatment.</td><td></td><td>• Effluent from the emptying of laboratory tanks comprises reserve osmosis water, deionised water and mains water. This does not contain any R&D chemicals.
Pre-treatment of process cooling and equipment wash water is not considered necessary due to its composition.
This process cooling and equipment wash water is discharged to sewer in compliance with a number of trade effluent consents.
The site processes have been designed to be as efficient as possible and give rise to minimal waste effluent.</td></tr>
<tr><td>BATc 12</td><td>In order to reduce emissions to water, BAT is to use an appropriate combination of final waste water treatment techniques.
Final waste water treatment is carried out as part of an integrated waste water management and treatment strategy (see BAT 10).
Appropriate final waste water treatment techniques, depending on the pollutant, include:
<table><tr><th></th><th>Technique [1]</th><th>Typical Pollutants Abated</th><th>Applicability</th></tr><tr><td colspan="2">Preliminary and primary treatment</td><td></td><td></td></tr><tr><td>(a)</td><td>Equalisation</td><td>All pollutants</td><td rowspan="3">Generally applicable.</td></tr><tr><td>(b)</td><td>Neutralisation</td><td>Acids, alkalis</td></tr><tr><td>(c)</td><td>Physical separation, e.g., screens, sieves, grit separators, grease separators or primary settlement tanks</td><td>Suspended solids, oil/grease</td></tr><tr><td colspan="3">Biological treatment (secondary treatment), e.g.,</td><td></td></tr><tr><td>(d)</td><td>Activated sludge process</td><td>Biodegradable organic compounds</td><td>Generally applicable</td></tr></table></td><td>Yes</td><td>There is no on-site effluent treatment plant.
The majority of effluent onsite comprises chlorinated and unchlorinated waste solvent (containing water) that is transferred offsite to be used as cement kiln fuel.
Agilent will undertake monitoring of waste water streams in line with BAT 12, where applicable.</td></tr>
</table>

BATc No.	BAT Justification	Operating to BAT	Demonstration of BAT Compliance

(e)	Membrane bioreactor		
Nitrogen removal			
(f)	Nitrification/denitrification	Total nitrogen, ammonia	Nitrification may not be applicable in case of high chloride concentrations (i.e., around 10 g/l) and provided that the reduction of the chloride concentration prior to nitrification would not be justified by the environmental benefits. Not applicable when the final treatment does not include a biological treatment.
Phosphorus removal			
(g)	Chemical precipitation	Phosphorus	Generally applicable.
Final solids removal			
(h)	Coagulation and flocculation	Suspended solids	Generally applicable.
(i)	Sedimentation		
(j)	Filtration (e.g., sand filtration, microfiltration, ultrafiltration)		
(k)	Flotation		
(1) The descriptions of the techniques are given in Section 6.1			

The BAT-associated emission levels (BAT-AELs), for emissions to water given in Table 1, Table 2 and Table 3 apply to direct emissions to a receiving water body from:

(i) the activities specified in Section 4 of Annex I to Directive 2010/75/EU;

(ii) independently operated waste water treatment plants specified in Section 6.11 of Annex I to Directive 2010/75/EU provided that the main pollutant load originates from activities specified in Section 4 of Annex I to Directive 2010/75/EU;

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<tr><td></td><td>
(iii) the combined treatment of waste water from different origins provided that the main pollutant load originates from activities specified in Section 4 of Annex I to Directive 2010/75/EU. The BAT-AELs apply at the point where the emission leaves the installation.

Table 1 BAT-AELs for direct emissions of TOC, COD and TSS to a receiving water body
<table>
<tr><th>Parameter</th><th>BAT-AEL's (Yearly Average)</th><th>Conditions</th></tr>
<tr><td>Total Organic Carbon (TOC) (1)(2)</td><td>10 - 33 mg/l (3)(4)(5)(6)</td><td>The BAT-AEL applies if the emission exceeds 3.3 Te/yr</td></tr>
<tr><td>Chemical Oxygen Demand (COD) (1)(2)</td><td>30 - 100 mg/l (3)(4)(5)(6)</td><td>The BAT-AEL applies if the emission exceeds 10Te/yr</td></tr>
<tr><td>Total Suspended Solids (TSS)</td><td>5 - 35 mg/l(7)(8)</td><td>The BAT-AEL applies if the emission exceeds 3.5 Te/yr</td></tr>
</table>
(1) No BAT-AEL applies for BOD
(2) Either BAT-AEL for TOC or COD applies. TOC monitoring is the preferred option because it does not rely on the use of very toxic compounds.
(3) The lower end of the range is typically achieved when few tributary waste water streams contain organic compounds and/or the waste water mostly contains easily biodegradable organic compounds.
(4) The upper end of the range may be up to 100 mg/l for TOC or up to 300 mg/l for COD, both as yearly averages, if both of the following conditions are fulfilled:

Condition A: Abatement efficiency ≥ 90 % as a yearly average (including both pre-treatment and final treatment).
Condition B: If a biological treatment is used, at least one of the following criteria is met:
A low-loaded biological treatment step is used (i.e., ≤ 0,25 kg COD/kg of organic dry matter of sludge). This implies that the BOD5 level in the effluent is ≤ 20 mg/l.
Nitrification is used.

(5) The upper end of the range may not apply if all of the following conditions are fulfilled:

Condition A: Abatement efficiency ≥ 95 % as a yearly average (including both pre-treatment and final treatment).

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<tr><td></td><td>

Condition B: same as Condition B in footnote (4).
Condition C: The influent to the final waste water treatment shows the following characteristics: TOC > 2 g/l (or COD > 6 g/l) as a yearly average and a high proportion of refractory organic compounds.

(6) The upper end of the range may not apply when the main pollutant load originates from the production of methylcellulose.
(7) The lower end of the range is typically achieved when using filtration (e.g., sand filtration, microfiltration, ultrafiltration, membrane bioreactor), while the upper end of the range is typically achieved when using sedimentation only.
(8) This BAT-AEL may not apply when the main pollutant load originates from the production of soda ash via the Solvay process or from the production of titanium dioxide.

Table 2. BAT-AELs for direct emissions of nutrients to a receiving water body
<table>
<tr><th>Parameter</th><th>BAT-AEL's (Yearly Average)</th><th>Conditions</th></tr>
<tr><td>Total Nitrogen (1)</td><td>5-25 mg/l (2) (3)</td><td>The BAT-AEL applies if the emission exceeds 2.5 Te/yr</td></tr>
<tr><td>Total Inorganic Nitrogen (1)</td><td>5-20 mg/l (2) (3)</td><td>The BAT-AEL applies if the emission exceeds 2.0 Te/yr</td></tr>
<tr><td>Total Phosphorus</td><td>0.5-3.0 mg/l (4)</td><td>The BAT-AEL applies if the emission exceeds 300 kg/yr</td></tr>
</table>
(1) Either the BAT-AEL for total nitrogen or the BAT-AEL for total inorganic nitrogen applies.
(2) The BAT-AELs for TN and N_{inorg} do not apply to installations without biological waste water treatment. The lower end of the range is typically achieved when the influent to the biological waste water treatment plant contains low levels of nitrogen and/or when nitrification/denitrification can be operated under optimum conditions.
(3) The upper end of the range may be higher and up to 40 mg/l for TN or 35 mg/l for N_{inorg}, both as yearly averages, if the abatement efficiency is ≥ 70 % as a yearly average (including both pre-treatment and final treatment).
</td><td></td><td></td></tr>
</table>

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<tr><td></td><td>
(4) The lower end of the range is typically achieved when phosphorus is added for the proper operation of the biological waste water treatment plant or when phosphorus mainly originates from heating or cooling systems. The upper end of the range is typically achieved when phosphorus-containing compounds are produced by the installation.

Table 3. BAT-AELs for direct emission of AOX and metals to a receiving water body
<table>
<tr><th>Parameter</th><th>BAT-AEL's (Yearly Average)</th><th>Conditions</th></tr>
<tr><td>Adsorbable organically bound halogens (AOX)</td><td>0.2 - 1.0 mg/l (1) (2)</td><td>The BAT-AEL applies if the emission exceeds 100 kg/yr</td></tr>
<tr><td>Chromium (expressed as Cr)</td><td>5 - 25 µg/l (3) (4) (5) (6)</td><td>The BAT-AEL applies if the emission exceeds 2.5 kg/yr</td></tr>
<tr><td>Copper (expressed as Cu)</td><td>5 - 50 µg/l (3) (4) (5) (7)</td><td>The BAT-AEL applies if the emission exceeds 50 kg/yr</td></tr>
<tr><td>Nickel (expressed as Ni)</td><td>5 - 50 µg/l (3) (4) (5)</td><td>The BAT-AEL applies if the emission exceeds 5 kg/yr</td></tr>
<tr><td>Zinc (expressed as Zn)</td><td>20 - 300 µg/l (3) (4) (5) (8)</td><td>The BAT-AEL applies if the emission exceeds 30 kg/yr</td></tr>
<tr><td colspan="3">(1) The lower end of the range is typically achieved when few halogenated organic compounds are used or produced by the installation.
(2) This BAT-AEL may not apply when the main pollutant load originates from the production of iodinated X-ray contrast agents due to the high refractory loads. This BAT-AEL may also not apply when the main pollutant load originates from the production of propylene oxide or epichlorohydrin via the chlorohydrin process due to the high loads.
(3) The lower end of the range is typically achieved when few of the corresponding metal (compounds) are used or produced by the installation.
(4) This BAT-AEL may not apply to inorganic effluents when the main pollutant load originates from the production of inorganic heavy metal compounds.</td></tr>
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</td><td></td><td></td></tr>
</table>

<table>
<tr><th>BATc No.</th><th>BAT Justification</th><th>Operating to BAT</th><th>Demonstration of BAT Compliance</th></tr>
<tr><td></td><td>(5) This BAT-AEL may not apply when the main pollutant load originates from the processing of large volumes of solid inorganic raw materials that are contaminated with metals (e.g., soda ash from the Solvay process, titanium dioxide).
(6) This BAT-AEL may not apply when the main pollutant load originates from the production of chromium-organic compounds. (7) This BAT-AEL may not apply when the main pollutant load originates from the production of copper-organic compounds or the production of vinyl chloride monomer/ethylene dichloride via the oxychlorination process.
(8) This BAT-AEL may not apply when the main pollutant load originates from the production of viscose fibres.

The associated monitoring is in BAT 4.</td><td></td><td></td></tr>
<tr><td colspan="2">4. Waste</td><td></td><td></td></tr>
<tr><td>BATc 13</td><td>Waste
In order to prevent or, where this is not practicable, to reduce the quantity of waste being sent for disposal, BAT is to set up and implement a waste management plan as part of the environmental management system (see BAT 1) that, in order of priority, ensures that waste is prevented, prepared for reuse, recycled or otherwise recovered</td><td>Yes</td><td>All wastes generated by the site processes will be managed in accordance with existing site EMS procedures. The site as a whole selects appropriate offsite waste recovery / disposal routes.
Wastes generation by the process will be minimised through appropriate design and control of the process to optimise product yield. The plant includes the option to rework off spec products to minimise the generation of waste.
Agilent will record the volume and destination of onsite waste streams in accordance with Waste Duty of Care Regulations. In accordance with their obligations as a producer of waste.</td></tr>
<tr><td>BATc 14</td><td>In order to reduce the volume of waste water sludge requiring further treatment or disposal, and to reduce its potential environmental impact, BAT is to use one or a combination of the techniques given below.

<table><tr><th></th><th>Technique</th><th>Description</th><th>Applicability</th></tr><tr><td>(a)</td><td>Conditioning</td><td>Chemical conditioning (i.e., adding coagulants and/or flocculants) or thermal conditioning (i.e., heating) to improve the conditions during sludge thickening/dewatering.</td><td>Not applicable to inorganic sludges. The necessity for conditioning depends on the sludge properties and on the thickening/dewatering equipment used</td></tr></table></td><td>N/A</td><td>There is no on-site effluent treatment plant.
Waste water sludge is not generated at the site.</td></tr>
</table>

BATc No.	BAT Justification	Operating to BAT	Demonstration of BAT Compliance
	(b) Thickening/dewatering — Thickening can be carried out by sedimentation, centrifugation, flotation, gravity belts, or rotary drums. Dewatering can be carried out by belt filter presses or plate filter presses. — Generally applicable. (c) Stabilisation — Sludge stabilisation includes chemical treatment, thermal treatment, aerobic digestion, or anaerobic digestion. — Not applicable to inorganic sludges. Not applicable for short-term handling before final treatment. (d) Drying — Sludge is dried by direct or indirect contact with a heat source. — Not applicable to cases where waste heat is not available or cannot be used.		
5. Emissions to Air			
BATc 15	**Waste Gas Collection** In order to facilitate the recovery of compounds and the reduction of emissions to air, BAT is to enclose the emission sources and to treat the emissions, where possible. The applicability may be restricted by concerns on operability (access to equipment), safety (avoiding concentrations close to the lower explosive limit) and health (where operator access is required inside the enclosure).	Yes.	Currently, exhaust gas from the main production area is collected and treated in a wet scrubber described in Section 4.7 of the BAT-OT. A recent review of the inventory has resulted in further assessment, including a BAT options appraisal and technology selection for waste gas abatement (refer Section 11.1.2 of the main BATOT report). The site is committed to installing the BAT option to ensure compliance with the BAT-AEL's and BAT operating techniques. A temporary scrubber will be used to reduce concentrations of compounds further whilst the new abatement system is being designed, commissioned and installed. Agilent intends that the upgraded waste gas abatement system should be operational by approximately Q3 2025.

<table>
<tr><th>BATc No.</th><th>BAT Justification</th><th>Operating to BAT</th><th>Demonstration of BAT Compliance</th></tr>
<tr><td>BATc 16</td><td>Waste Gas Treatment
In order to reduce emissions to air, BAT is to use an integrated waste gas management and treatment strategy that includes process-integrated and waste gas treatment techniques.
The integrated waste gas management and treatment strategy is based on the inventory of waste gas streams (see BAT 2) giving priority to process-integrated techniques.</td><td>Yes.</td><td>See BAT 15 above.</td></tr>
<tr><td>BATc 17</td><td>Flaring
In order to prevent emissions to air from flares, BAT is to use flaring only for safety reasons or non-routine operational conditions (e.g., start-ups, shutdowns) by using one or both of the techniques given below.
<table>
<tr><th></th><th>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. Gas recovery systems may be retrofitted in existing plants.</td></tr>
<tr><td>(b)</td><td>Plant management</td><td>This includes balancing the fuel gas system and using advanced process control.</td><td>Generally applicable.</td></tr>
</table></td><td>N/A</td><td>No flaring is undertaken as part of the site activities.</td></tr>
<tr><td>BATc 18</td><td>Flaring
In order to reduce emissions to air from flares when flaring is unavoidable, BAT is to use one or both of the techniques given below.
<table>
<tr><th></th><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>(a)</td><td>Correct design of flaring devices</td><td>Optimisation of height, pressure, assistance by steam, air or gas, type of flare tips (either enclosed or shielded), etc., aimed to enable smokeless and reliable operation and to ensure the efficient combustion of excess gases.</td><td>Applicable to new flares. In existing plants, applicability may be restricted due to e.g., maintenance time availability during the turnaround of the plant.</td></tr>
<tr><td>(b)</td><td>Monitoring and recording as part of flare management</td><td>Continuous monitoring of the gas sent to flaring, measurements of gas flow and estimations of other</td><td>Generally applicable.</td></tr>
</table></td><td>N/A</td><td>No flaring is undertaken as part of the site activities.</td></tr>
</table>

<table>
<tr><th>BATc No.</th><th>BAT Justification</th><th>Operating to BAT</th><th>Demonstration of BAT Compliance</th></tr>
<tr><td></td><td>
<table>
<tr><td></td><td></td><td>parameters (e.g., composition, 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 estimated/ measured flare gas composition, the estimated/measured flare gas quantity and the duration of operation. The recording allows for the quantification of emissions and the potential prevention of future flaring events.</td><td></td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>BATc 19</td><td>
Diffuse VOC Emissions
In order to prevent or, where that is not practicable, to reduce diffuse VOC emissions to air, BAT is to use a combination of the techniques given below. The associated monitoring is in BAT 5.
<table>
<tr><th></th><th>Technique</th><th>Applicability</th></tr>
<tr><td colspan="3">Techniques related to plant design</td></tr>
<tr><td>(a)</td><td>Limit the number of potential emission sources</td><td rowspan="4">Applicability may be restricted in the case of existing plants due to operability requirements.</td></tr>
<tr><td>(b)</td><td>maximise process-inherent containment features</td></tr>
<tr><td>(c)</td><td>select high-integrity equipment</td></tr>
<tr><td>(d)</td><td>facilitate maintenance activities by ensuring access to potentially leaky equipment</td></tr>
</table>
</td><td>Yes</td><td>
The potential for fugitive emissions to be generated is low. No significant fugitive VOC emission sources are anticipated as:

The amount of raw materials inputted into the process is low at 185.09 tonnes per year.
Pipework is located indoors and is minimal. Pipework is maintained under a planned preventative maintenance system.
VOC transfers through pipework only occur intermittently as the process is batched. There is no continuous flow of VOC material in pipework.
Controls are in place where chemicals are transferred.
Waste VOCs are collected at source and directed to either the scrubber or vent system.
Chemical 2, chemical 3 and chemical 4 are all transferred to process via a Diaphragm pump from a DENIOS unit These chemicals are delivered in sealed containers, transferred via minimal sealed indoor pipework into a sealed process that vents to a channelled emission point to air.
Chemicals stored in 205 L drums are transferred into smaller containers within the drum store utilising air pumps.

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<table>
<tr><th>BATc No.</th><th>BAT Justification</th><th>Operating to BAT</th><th>Demonstration of BAT Compliance</th></tr>
<tr><td></td><td>
<table>
<tr><td colspan="3">Techniques related to plant/equipment construction, assembly and commissioning</td></tr>
<tr><td>(e)</td><td>Ensure well-defined and comprehensive procedures for plant/equipment construction and assembly. This includes using designed gasket stress for flanged joint assembly</td><td rowspan="2"></td></tr>
<tr><td>(f)</td><td>ensure robust plant/equipment commissioning and handover procedures in line with the design requirements</td></tr>
<tr><td colspan="3">Techniques related to plant operation</td></tr>
<tr><td>(g)</td><td>Ensure good maintenance and timely replacement of equipment</td><td rowspan="3">Generally applicable.</td></tr>
<tr><td>(h)</td><td>Use a risk-based leak detection and repair programme</td></tr>
<tr><td>(i)</td><td>As far is it is reasonable, prevent diffuse VOC emissions, collect them at source and treat them</td></tr>
</table>

The associated monitoring is in BAT 5.</td><td></td><td>• The proposed process will operate under a preventative maintenance programme to manage equipment that could potentially result in diffuse emissions to air.
• The processes use high integrity equipment.
• The process is sealed with the exception of the vent system which directs VOCs to channelled emission points.</td></tr>
<tr><td>BATc 20</td><td>Odour Emissions
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:
(i) a protocol containing appropriate actions and timelines;
(ii) a protocol for conducting odour monitoring;
(iii) a protocol for response to identified odour incidents;</td><td>Yes</td><td>The assessment of the potential for fugitive odour carried out in the ERA (410.064951.00001_ERA) of this application concludes that the likely odour effect at receptors is likely to be low.
Hence periodic formal odour monitoring is not proposed.</td></tr>
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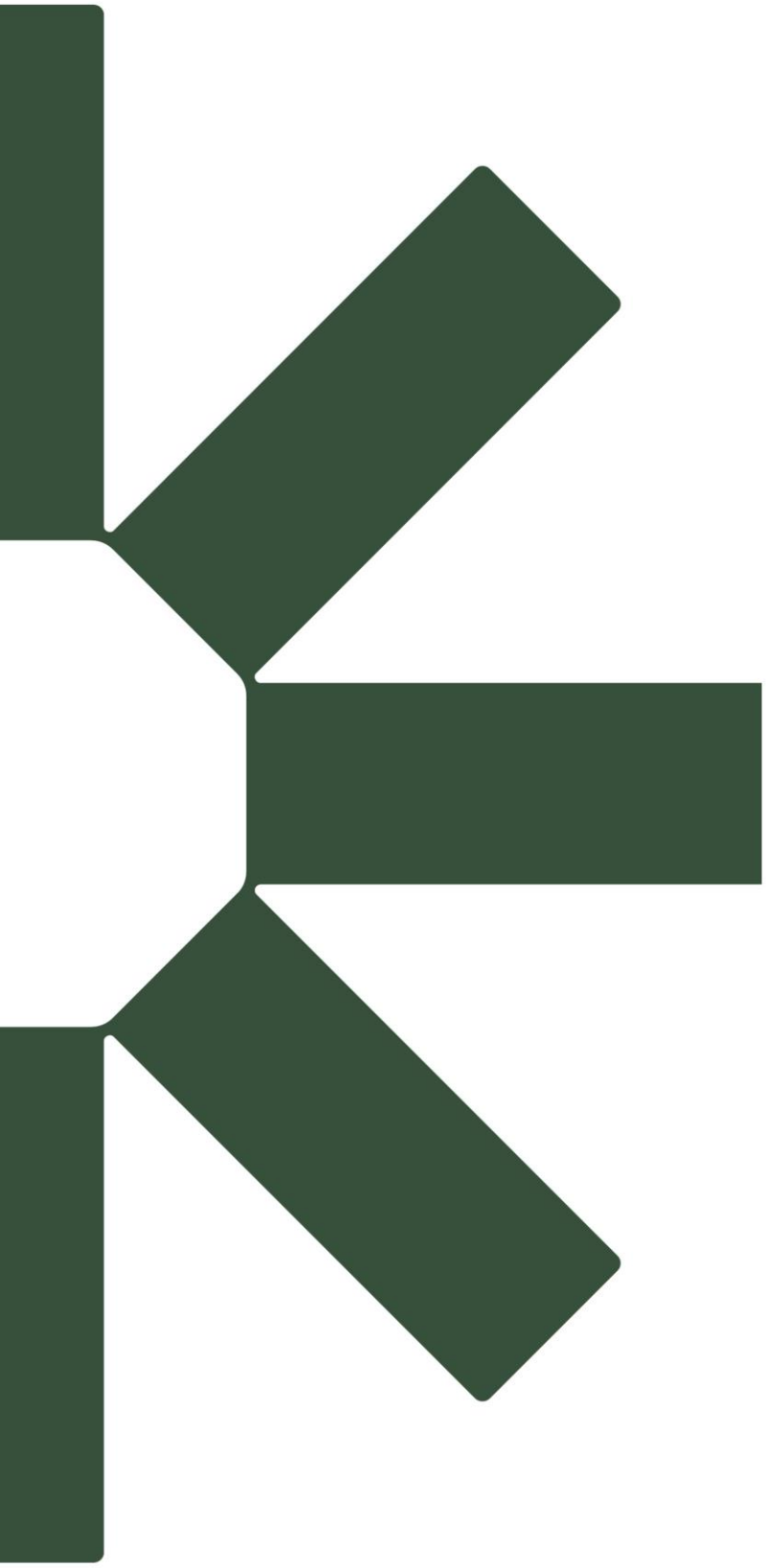
<table>
<tr><th>BATc No.</th><th>BAT Justification</th><th>Operating to BAT</th><th>Demonstration of BAT Compliance</th></tr>
<tr><td></td><td>(iv) an odour prevention and reduction programme designed to identify the source(s); to measure/estimate odour exposure; to characterise the contributions of the sources; and to implement prevention and/or reduction measures.
The associated monitoring is in BAT 6.
The applicability is restricted to cases where odour nuisance can be expected or has been substantiated.</td><td></td><td></td></tr>
<tr><td>BATc 21</td><td>Odour
In order to prevent or, where that is not practicable, to reduce odour emissions from waste water collection and treatment and from sludge treatment, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th></th><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>(a)</td><td>Minimise residence times</td><td>Minimise the residence time of waste water and sludge in collection and storage systems, in particular under anaerobic conditions.</td><td>Applicability may be restricted in the case of existing collection and storage systems.</td></tr>
<tr><td>(b)</td><td>Chemical treatment</td><td>Use chemicals to destroy or to reduce the formation of odorous compounds (e.g., oxidation or precipitation of hydrogen sulphide).</td><td>Generally applicable.</td></tr>
<tr><td>(c)</td><td>Optimise aerobic treatment</td><td>This can include: (i) controlling the oxygen content; (ii) frequent maintenance of the aeration system; (iii) use of pure oxygen; (iv) removal of scum in tanks.</td><td>Generally applicable.</td></tr>
<tr><td>(d)</td><td>Enclosure</td><td>Cover or enclose facilities for collecting and treating waste water and sludge to collect the odorous waste gas for further treatment.</td><td>Generally applicable.</td></tr>
<tr><td>(e)</td><td>End-of-pipe treatment</td><td>This can include: (i) biological treatment; (ii) thermal oxidation.</td><td>Biological treatment is only applicable to compounds that are easily soluble in water and readily bio eliminable.</td></tr>
</table></td><td>Yes</td><td>See BAT 20.</td></tr>
</table>

<table>
<tr><th>BATc No.</th><th>BAT Justification</th><th>Operating to BAT</th><th>Demonstration of BAT Compliance</th></tr>
<tr><td>BATc 22</td><td>Noise Emissions
In order to prevent or, where that is not practicable, to reduce noise emissions, BAT is to set up and implement a noise 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 monitoring;
(iii) a protocol for response to identified noise ;
(iv) a noise prevention and reduction programme designed to identify the source(s), to measure/estimate noise exposure, to characterise the contributions of the sources and to implement prevention and/or reduction measures.</td><td>Yes</td><td>A Noise Management Plan (NMP) has been prepared (refer 410.064951.00001_NMP), to lessen the impact of potential adverse impacts reducing impacts to ‘low’ at the closest receptors.</td></tr>
<tr><td>BATc 23</td><td>Noise Emissions
In order to prevent or, where that is not practicable, to reduce noise emissions, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th></th><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>(a)</td><td>Appropriate location of equipment and buildings</td><td>Increasing the distance between the emitter and the receiver and using buildings as noise screens.</td><td>For existing plants, the relocation of equipment may be restricted by a lack of space or excessive costs.</td></tr>
<tr><td>(b)</td><td>Operational measures</td><td>This includes: (i)improved 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 activities.</td><td>Generally applicable.</td></tr>
<tr><td>(c)</td><td>Low-noise equipment</td><td>This includes low-noise compressors, pumps and flares.</td><td>Applicable only when the equipment is new or replaced.</td></tr>
<tr><td>(d)</td><td>Noise-control equipment</td><td>This includes: (i) noise-reducers; (ii) equipment insulation; (iii) enclosure of noisy equipment; (iv) soundproofing of buildings.</td><td>Applicability may be restricted due to space requirements (for existing plants), health, and safety issues.</td></tr>
<tr><td>(e)</td><td>Noise abatement</td><td>Inserting obstacles between emitters and receivers (e.g.,</td><td>Applicable only to existing plants; since the design of</td></tr>
</table></td><td>Yes</td><td>The following processes and checks will be carried out to minimise the potential for noise emissions:
• Regular inspections by the relevant department manager or designated personnel will be made to ensure that the equipment is well maintained.
• Maintenance records will be kept up to date and be available upon request.
• Regular maintenance will be carried out periodically.
• Periodic maintenance checks will be undertaken in accordance with the manufacturer’s instructions, to ensure efficient running of engine machinery. e.g., lubrication of moving parts to reduce noise.
• Plant will be commissioned to operate at suitable duty levels, to minimise noise emissions as far as practicable.
• Periodic checks of plant operation will be undertaken, to ensure that plant is running at the appropriate (lowest) operating duty.
• Equipment will be operated by trained, competent staff.
• Potentially noisy activities will not be undertaken at night.</td></tr>
</table>

BATc No.	BAT Justification				Operating to BAT	Demonstration of BAT Compliance
			protection walls, embankments and buildings).	new plants should make this technique unnecessary. For existing plants, the insertion of obstacles may be restricted by a lack of space.		



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