Environment Agency

Review of an Environmental Permit for an Installation subject to Chapter II of the Industrial Emissions Directive under the Environmental Permitting (England & Wales) Regulations 2016

Decision document recording our decision-making process following review of a permit

The Permit number is: EPR/NP3139LM
The Operator is: Haltermann Carless UK Limited
The Installation is: Harwich Manufacturing Centre
This Variation Notice number is: EPR/NP3139LM/V004

What this document is about

Article 21(3) of the Industrial Emissions Directive (IED) requires the Environment Agency to review conditions in permits that it has issued and to ensure that the permit delivers compliance with relevant standards, within four years of the publication of updated decisions on Best Available Techniques (BAT) conclusions.

We have reviewed the permit for this installation against the revised BAT Conclusions for the refining of mineral oil and gas industry sector published on 28th October 2014. This is our decision document, which explains the reasoning for the consolidated variation notice that we are issuing.

It explains how we have reviewed and considered the techniques used by the Operator in the operation and control of the plant and activities of the installation. This review has been undertaken with reference to the decision made by the European Commission establishing BAT conclusions ('BAT Conclusions') for the refining of mineral oil and gas as detailed in document reference IEDC-7-1. It is our record of our decision-making process and shows how we have taken into account all relevant factors in reaching our position. It also provides a justification for the inclusion of any specific conditions in the permit that are in addition to those included in our generic permit template.

As well as considering the review of the operating techniques used by the Operator for the operation of the plant and activities of the installation, the consolidated variation notice takes into account and brings together in a single document all previous variations that relate to the original permit

issued. It also modernises the entire permit to reflect the conditions contained in our current generic permit template.

The introduction of new template conditions makes the Permit consistent with our current general approach and philosophy and with other permits issued to installations in this sector. Although the wording of some conditions has changed, while others have been removed because of the new regulatory approach, it does not reduce the level of environmental protection achieved by the Permit in any way. In this document we therefore address only our determination of substantive issues relating to the new BAT Conclusions.

This is our record of our decision-making process and shows how we have taken into account all relevant factors in reaching our position.

Throughout this document we will use a number of expressions. These are as referred to in the glossary and have the same meaning as described in "Schedule 6 Interpretation" of the Permit.

We try to explain our decision as accurately, comprehensively and plainly as possible. We would welcome any feedback as to how we might improve our decision documents in future. A lot of technical terms and acronyms are inevitable in a document of this nature: we provide a glossary of acronyms near the front of the document, for ease of reference.

How this document is structured

Glossary of acronyms used in this document

(Please note that this glossary is standard for our decision documents and therefore not all these acronyms are necessarily used in this document.)

APC	Air Pollution Control
BAT	Best Available Technique(s)
BAT-AEL	BAT Associated Emission Level
BATc	BAT conclusion
BREF	Best available techniques reference document
CEM	Continuous emissions monitor
CHP	Combined heat and power
CV	Calorific value
DAA	Directly associated activity – Additional activities necessary to be carried out to allow the principal activity to be carried out
DD	Decision document
Derogation	from BAT AELs stated in BAT Conclusions under specific circumstances as detailed under Article 15(4) of IED where an assessment shows that the achievement of emission levels associated with the best available techniques as described in BAT conclusions would lead to disproportionately higher costs
ELV	Emission limit value derived under BAT or an emission limit value set out in IED
EMS	Environmental Management System
EPR	Environmental Permitting (England and Wales) Regulations 2010 (SI 2010 No. 675) as amended
EQS	Environmental quality standard
EU-EQS	European Union Environmental Quality Standard
HW	Hazardous waste
IED	Industrial Emissions Directive (2010/75/EU)
NOx	Oxides of nitrogen (NO plus NO_2 expressed as NO_2)
RGS	Regulatory Guidance Series
SGN	Sector guidance note
TGN	Technical guidance note
WFD	Water Framework Directive (200/60/EC)

1 Our decision

We have decided to issue the consolidated variation notice to the Operator. This will allow it to continue to operate the Installation, subject to the conditions in the consolidated variation notice.

As part of our decision we rejected the Operator's request for a derogation away from the requirements of BAT Conclusion 10 as identified in the refining of mineral oil and gas BAT Conclusions document. The way we assessed the Operator's requests for derogation and how we subsequently arrived at our conclusion is recorded in section 6 of this document.

We consider that, in reaching our decision, we have taken into account all relevant considerations and legal requirements. We consider that the varied permit will ensure that a high level of protection is provided for the environment and human health.

The consolidated variation notice contains many conditions taken from our standard Environmental Permit template including the relevant Annexes. We developed these conditions in consultation with industry, having regard to the legal requirements of the Environmental Permitting Regulations and other relevant legislation. This document does not therefore include an explanation for these standard conditions. Where they are included in the notice, we have considered the techniques identified by the operator for the operation of their installation, and have accepted that the details are sufficient and satisfactory to make those standard conditions appropriate. This document does, however, provide an explanation of our use of "tailor-made" or installation-specific conditions, or where our Permit template provides two or more options.

2 How we reached our decision

2.1 Requesting information to demonstrate compliance with BAT Conclusions for the refining of mineral oil and gas.

We issued a Notice under Regulation 60(1) of the Environmental Permitting (England and Wales) Regulations 2010 (a Regulation 60 Notice) on 09/11/15 requiring the Operator to provide information to demonstrate how the operation of their installation currently meets, or will subsequently meet, the revised standards described in the relevant BAT Conclusions document. The Notice also required that where the revised standards are not currently met, the operator should provide information that:

- Describes the techniques that will be implemented before 28/10/18, which will then ensure that operations meet the revised standard, or
- Justifies why standards will not be met by 28/10/18, and confirmation of the date when the operation of those processes will cease within the installation or an explanation of why the revised BAT standard is not applicable to those processes, or
- Justifies why an alternative technique will achieve the same level of environmental protection equivalent to the revised standard described in the BAT Conclusions.

Where the Operator proposed that they were not intending to meet a BAT standard that also included a BAT Associated Emission Level (BAT AEL) described in the BAT Conclusions Document, the Regulation 60 Notice requested that the Operator make a formal request for derogation from compliance with that AEL (as provisioned by Article 15(4) of IED). In this circumstance, the Notice identified that any such request for derogation must be supported and justified by sufficient technical and commercial information that would enable us to determine acceptability of the derogation request.

The Regulation 60 Notice response from the Operator was received on 29/01/16.

We considered that the response did not contain sufficient information for us to commence the permit review. We therefore issued a further information request to the Operator on 11/10/16. Further information was provided by the Operator on 13/11/16. We considered it was in the correct form and contained sufficient information for us to begin our determination of the permit review but not that it necessarily contained all the information we would need to complete that review.

Two subsequent regulation 60 notices were issued on 23/01/17 and 19/07/18 to which the operator provided responses, the final of which was received on 31/08/18. We considered that following receipt of these responses that we had sufficient information to complete the review.

2.2 Review of our own information in respect to the capability of the installation to meet revised standards included in the BAT Conclusions document

The operator has confirmed that they will not be able to comply with the conditions that we included in the permit, however based on the BAT Improvement Plan Version 2.4, submitted on 31/08/2018 we consider that they will be able to comply with the conditions in the future. These relate specifically to BAT 10. Further details are set out in the associated Regulatory Position Statement dated 28/10/2018.

In relation to BAT Conclusion(s) 12 and 49 we agree with the operator in respect to their current stated capability as recorded in their Regulation 60 Notice response that improvements are required.

We have included improvement conditions IC18, IC21 and IC22 in the consolidated variation notice, which requires them to upgrade their operational techniques so that the requirements of the BAT Conclusion are delivered by 28/10/18. This is discussed in more detail in Annex 1.

3 The legal framework

The consolidated variation notice will be issued, if appropriate, under Regulation 20 of the EPR. The Environmental Permitting regime is a legal vehicle which delivers most of the relevant legal requirements for activities falling within its scope. In particular, the regulated facility is:

- an *installation* as described by the IED;
- subject to aspects of other relevant legislation which also have to be addressed.

The listed activity under EPR has been updated in the permit from S1.2 A1(g) to 1.2 Part A(1)(e)(i) as this is the most apt description to reflect current operations. Condensate for the purposes of EPR does classify as crude oil however we consider the purpose of this facility is to process condensate it is not to refine crude oil therefore we consider the most apt description of the site to be 1.2 Part A(1)(e)(i). We have also removed references to activities on site which were referred to as further processing steps in table S1.1 but are no longer carried out. These are de-aromatisation and further distillation. No land has been removed in relation to the removal of these references.

We consider that, if the consolidated variation notice is issued, the consolidated variation notice will ensure that the operation of the Installation complies with all relevant legal requirements and that a high level of protection will be delivered for the environment and human health.

We explain how we have addressed specific statutory requirements more fully in the rest of this document.

We have set the ELVs in line with the BAT Conclusions, unless a tighter limit was previously imposed and these limits have been carried forward. The emission limits and monitoring tables have been incorporated into Schedule 3.

4 Key Issues

The key issues arising during this permit review are:

- The review and assessment of the application by the Operator for a derogation from meeting BAT 10; and
- The setting of tighter water quality limits to minimise waste water discharge to controlled waters in line with BAT 10.

We therefore describe how we determined these issues in most detail in the relevant sections of this document.

5 Decision checklist regarding relevant BAT Conclusions

BAT Conclusions for the refining of mineral oil and gas, were published by the European Commission on 28th October 2014. There are 58 BAT Conclusions.

This annex provides a record of decisions made in relation to each relevant BAT Conclusion applicable to the installation. This annex should be read in conjunction with the consolidated Variation Notice.

The overall status of compliance with the BAT conclusion is indicated in the table as:

NA Not Applicable
CC Currently Compliant
FC Compliant in the future (within 4 years of publication of BAT conclusions)
NC Not Compliant
PC Partially Compliant

BAT Conclusion Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement	Relevant permit condition(s)
General				
1	**In order to improve the overall environmental performance of the plants for the refining of mineral oil and gas, 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 of 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 (a) Structure and responsibility (b) Training (c) Communication (d) Employee involvement (e) Documentation (f) Efficient 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 Document on the General Principles of Monitoring) (b) corrective and preventive action (c) maintenance of records (d) independent (where practicable) internal and 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 installation at the stage of designing a new plant, and throughout its operating life;	CC	Environmental Management System certified to ISO14001 and externally audited.	1.1

<table>
<tr><th>BAT Conclusion Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th><th>Relevant permit condition(s)</th></tr>
<tr><td></td><td>viii. consideration for the environmental impacts from the eventual decommissioning of the installation at the stage of designing a new plant, and throughout its operating life;
ix. application of sectoral benchmarking on a regular basis.</td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>In order to use energy efficiently, BAT is to use an appropriate combination of the techniques given below.

<table><tr><th>Technique</th><th>Description</th></tr><tr><td>i. Design techniques</td><td></td></tr><tr><td>a. Pinch analysis</td><td>Methodology based on a systematic calculation of thermodynamic targets for minimising energy consumption of processes. Used as a tool for the evaluation of total systems designs</td></tr><tr><td>b. Heat integration</td><td>Heat integration of process systems ensures that a substantial proportion of the heat required in various processes is provided by exchanging heat between streams to be heated and streams to be cooled</td></tr><tr><td>c. Heat and power recovery</td><td>Use of energy recovery devices e.g.
• waste heat boilers
• expanders/power recovery in the FCC unit
• use of waste heat in district heating</td></tr><tr><td>ii. Process control and maintenance techniques</td><td></td></tr><tr><td>a. Process optimisation</td><td>Process optimisation. Automated controlled combustion in order to lower the fuel consumption per tonne of feed processed, often combined with heat integration for improving furnace efficiency</td></tr><tr><td>b. Management and reduction of steam consumption</td><td>Management and reduction of steam consumption. Systematic mapping of drain valve systems in order to reduce steam consumption and optimise its use</td></tr><tr><td>c. Use of energy benchmarking</td><td>Use of energy benchmark. Participation in ranking and benchmarking activities in order to achieve continuous improvement by learning from best practice</td></tr><tr><td colspan="2">iii. Energy efficient production techniques and description</td></tr></table></td><td>CC</td><td>Energy Management System certified to ISO50001 in and externally audited.

Pinch analysis study carried out 2018.

Heat integration confirmed.

Waste stack heat is used to supplement steam generation.

Pipework and vessels are lagged.

Modulated controls in place.

Yes

Benchmarking audit carried out in 2015.</td><td>1.2</td></tr>
</table>

<table>
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<tr><td></td><td><table>
<tr><td>a. Use of combined heat and power.</td><td>System designed for the co-production (or the cogeneration) of heat (e.g. steam) and electric power from the same fuel</td></tr>
<tr><td>b. Integrated gasification combined cycle (IGCC).</td><td>Technique whose purpose is to produce steam, hydrogen (optional) and electric power from a variety of fuel types (e.g. heavy fuel oil or coke) with a high conversion efficiency</td></tr>
</table></td><td></td><td>Yes use of CHP confirmed.

N/A</td><td></td></tr>
<tr><td>3</td><td>In order to prevent or, where that is not practicable, to reduce dust emissions from the storage and handling of dusty materials, BAT is to use one or a combination of the techniques given below:
i. store bulk powder materials in enclosed silos equipped with a dust abatement system (e.g. fabric filter);
ii. store fine materials in enclosed containers or sealed bags;
iii. keep stockpiles of coarse dusty material wetted, stabilise the surface with crusting agents, or store under cover in stockpiles;
iv. use road cleaning vehicles</td><td>N/A</td><td>Limited volumes of dusty materials held on site.</td><td>N/A</td></tr>
<tr><td>4</td><td>BAT is to monitor emissions to air by using the monitoring techniques with at least the minimum 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>Description</th><th>Unit</th><th>Minimum frequency</th><th>Monitoring technique</th></tr>
<tr><td rowspan="3">SOx, NOx and dust emissions</td><td>Catalytic cracking</td><td>continuous</td><td>Direct measurement</td></tr>
<tr><td>Combustion units ≥ 100MW ([3]) and calcining units</td><td>continuous</td><td>Direct measurement ([4])</td></tr>
<tr><td>Combustion units of 50 to 100 MW ([3])</td><td>continuous</td><td>Direct measurement or indirect monitoring</td></tr>
</table></td><td>CC</td><td>Three thermal fluid heaters each with a thermal input of less than 20MWth and three stream raising boilers each with a thermal input of less than 20MWth.

The EA has decided not to require monitoring on combustion plant below 20MWth thermal input unless previously required by the permit.

The current permit specifies periodic annual monitoring of nitrogen dioxide, sulphur dioxide and particulates for the thermal fluid heaters and steam raising boilers to MCERTS. A monthly average emission of sulphur dioxide from the boilers and fluid heaters is also specified in the permit. The limits are retained in the permit.</td><td>3.5.1</td></tr>
</table>

BAT Conclusion Number	Summary of BAT Conclusion requirement				Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement	Relevant permit condition(s)
		Combustion units < 50 MW ([3])	once a year and after significant fuel changes	Direct measurement or indirect monitoring			
		Sulphur recovery units (SRU)	continuous for SO2 only	Direct measurement or indirect monitoring ([6])			
	NH_3 emissions	All units equipped with SCR or SNCR	continuous	Direct measurement			
	CO emissions	Catalytic Cracking and combustion units >= 100MW ([3])	continuous	Direct measurement			
		Other combustion units	once every 6 months ([5])	Direct measurement			
	Metal emissions: Nickel (Ni) Antimony (Sb) Vanadium (V)	Catalytic cracking	once every 6 months and after significant changes to the unit ([5])	Direct measurement or analysis based on metals content in the catalyst fines and in the fuel			
		Combustion units ([8])					
	Polychlorinated dibenzodioxins / furans (PCDD/F) emissions	Catalytic reformer	once a year or once a regeneration, whichever is longer	Direct measurement			
	(1) Continuous measurement of SO2 emissions may be replaced by calculations based on measurements of the sulphur content						

BAT Conclusion Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement	Relevant permit condition(s)
	of the fuel or the feed; where it can be demonstrated that this leads to an equivalent level of accuracy (2) Regarding SO_X, only SO_2 is continuously measured while SO_3 is only periodically measured (e.g. during calibration of the SO_2 monitoring system) (3) Refers to the total rated thermal input of all combustion units connected to the stack where emissions occur. (4) Or indirect monitoring of SO_X (5) Monitoring frequencies may be adapted if, after a period of one year, the data series clearly demonstrate a sufficient stability. (6) SO_2 emissions measurements from SRU may be replaced by continuous material balance or other relevant process parameter monitoring, provided appropriate measurements of SRU efficiency are based on periodic (e.g. once every 2 years) plant performance tests. (7) Antimony (Sb) is monitored only in catalytic cracking units when Sb injection is used in the process (e.g. for metals passivation) (8) With the exception of combustion units firing only gaseous fuel			
5	**BAT is to monitor the relevant process parameters linked to pollutant emissions, at catalytic cracking and combustion units by using appropriate techniques and with at least the frequency given below.** **Description** / **Minimum frequency** Monitoring of parameters linked to pollution emissions, e.g. O_2 content in flue-gas, N and S content in fuel or feed ([1]) / Continuous for O_2 content. For N and S content, periodic at a frequency based on significant fuel/feed changes. [1] N and S monitoring in fuel or feed may not be necessary when continuous emission measurement of NO_X and SO_2 are carried out at the stack.	N/A	We will not require continuous oxygen monitoring where sites are carrying out periodic monitoring.	N/A
6	**BAT is to monitor diffuse VOC emissions to air from the entire site by using all of the following techniques:** i. sniffing methods associated with correlation curves for key equipment; ii. optical gas imaging techniques;	FC	The operator does not currently use all three techniques so an improvement condition has been imposed requiring the operator to agree an appropriate programme.	2.3.1 and IC18

BAT Conclusion Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement	Relevant permit condition(s)
	iii. calculations of chronic emissions based on emissions factors periodically (e.g. once every two years) validated by measurements. The screening and quantification of site emissions 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. **Description**. See section 1.20.6, Annex 1.			
7	**In order to prevent or reduce emissions to air, BAT is to operate the acid gas removal units, sulphur recovery units and all other waste gas treatment systems with a high availability and at optimal capacity.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation.	N/A
8	**In order to prevent and reduce ammonia (NH_3) emissions to air when applying selective catalytic reduction (SCR) or selective non-catalytic reduction (SNCR) techniques, BAT is to maintain suitable operating conditions of the SCR or SNCR waste gas treatment systems, with the aim of limiting emissions of unreacted NH_3.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation.	N/A
9	**In order to prevent and reduce emissions to air when using a sour water steam stripping unit, BAT is to route the acid off-gases from this unit to an SRU or any equivalent gas treatment system.** **It is not BAT to directly incinerate the untreated sour water stripping gases.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation.	N/A
10	**BAT is to monitor emissions to water by using the monitoring techniques with at least the frequency given in Table 3 (as 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 3 BAT – associated emission levels for direct waste water discharges from the refining of mineral oil and gas monitoring frequencies associated with BAT ([1])	NC	Sampling is undertaken by an auto sampler which takes flow-proportional 24hr composite samples, samples are analysed weekly for Chemical Oxygen Demand and Total Suspended Solids and Biochemical Oxygen Demand and metals. Hydrocarbon Oil Index, total nitrogen, vanadium, benzene and phenol index are not currently measured. These parameters with the exception of vanadium will be monitored by 2018. Vanadium is not applicable to effluent from gas refiners as it is a contaminant of crude oil not gas or condensate.	3.5.1

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<tr>
<td></td>
<td>
<table>
<tr><th>Parameter</th><th>Unit</th><th>BAT – AEL (yearly average)</th><th>Monitoring ([2]) frequency and analytical method (standard)</th></tr>
<tr><td>Hydrocarbon oil index (HOI)</td><td>mg/l</td><td>0.1 – 2.5</td><td>Daily
EN 9377-2</td></tr>
<tr><td>Total suspended solids (TSS)</td><td>mg/l</td><td>5 - 25</td><td>Daily</td></tr>
<tr><td>Chemical oxygen demand (COD) (4)</td><td>mg/l</td><td>30 - 125</td><td>Daily</td></tr>
<tr><td>BOD 5</td><td>mg/l</td><td>No BAT - AEL</td><td>Weekly</td></tr>
<tr><td>Total nitrogen (5) expressed as N</td><td>mg/l</td><td>1 – 25 (6)</td><td>Daily</td></tr>
<tr><td>Lead, expressed as Pb</td><td>mg/l</td><td>0.005 – 0.030</td><td>Quarterly</td></tr>
<tr><td>Cadmium expressed as Cd</td><td>mg/l</td><td>0.002 – 0.008</td><td>Quarterly</td></tr>
<tr><td>Nickel, expressed as Ni</td><td>mg/l</td><td>0.005 – 0.100</td><td>Quarterly</td></tr>
<tr><td>Mercury, expressed as Hg</td><td>mg/l</td><td>0.0001 – 0.001</td><td>Quarterly</td></tr>
<tr><td>Vanadium</td><td>mg/l</td><td>No BAT - AEL</td><td>Quarterly</td></tr>
<tr><td>Phenol index</td><td>mg/l</td><td>No BAT - AEL</td><td>Monthly
EN 14402</td></tr>
<tr><td>Benzene, toluene, ethyl benzene, xylene (BTEX)</td><td>mg/l</td><td>Benzene 0.001 – 0.050
No BAT – AEL for T, E, X</td><td>Monthly</td></tr>
<tr><td colspan="4">(1) Not all parameters and sampling frequencies are applicable to effluent from gas refining sites
(2) Refers to a flow-proportional composite sample taken over period of 24 hours, or provided that sufficient flow stability is demonstrated, a time-proportional sample
(3) Moving from the current method to EN 9377-2 may require an adaptation period
(4) Where on-site correlation is available, COD may be replaced by TOC. The correlation between COD and TOC should be</td></tr>
</table>
</td>
<td></td>
<td>Note 1 to table S3.2 specifies that for testing for hydrocarbons Test method METH 410, IP426 shall be run in parallel with test method (BS EN ISO 9377-2) for up to 12 months adaptation period. This has been included to allow a period of adaptation to the new method as this was not previously used on site.

Where there were limits in the existing permit which were tighter than the BAT AELs we have retained these and the associated monitoring.

Compliance with a number of the AELs for emissions to water will be regulated under a Regulatory Position Statement. The installation is listed as Not Compliant for this points as it will not be compliant within 4 years of the publication of the BREF i.e. by October 2018. However, compliance is expected by the dates specified in the Regulatory Position Statement.</td>
<td></td>
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<tr><td></td><td>elaborated on a case-by-case basis. TOC monitoring would be the preferred option because it does not rely on the use of very toxic compounds
(5) Where total-nitrogen is the sum of the total Kjedahl nitrogen (TKN), nitrates and nitrites
(6) When nitrification/denitrification is used, levels below 15 mg/l can be achieved</td><td></td><td></td><td></td></tr>
<tr><td>11</td><td>In order to reduce water consumption and the volume of contaminated water, BAT is to use all of the techniques given below.
<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>i. water stream integration</td><td>Reduction of process water produced at the unit level prior to discharge by the internal reuse of water streams from e.g. cooling, condensates, especially for use in crude desalting</td><td>Generally applicable for new units. For existing units, applicability may require a complete rebuilding of the unit or the installation</td></tr>
<tr><td>ii. water and drainage system for segregation of contaminated water streams</td><td>Design of an industrial site to optimise water management, where each stream is treated as appropriate, by e.g. routing generated sour water (from distillation, cracking, coking units, etc.) to appropriate pre-treatment, such as a stripping unit</td><td>Generally applicable for new units. For existing units, applicability may require a complete rebuilding of the unit or the installation</td></tr>
<tr><td>iii. segregation of non-contaminated water streams (e.g. once-through cooling, rain water)</td><td>Design of a site in order to avoid sending non-contaminated water to general waste water treatment and to have a separate release after possible reuse for this type of stream</td><td>Generally applicable for new units.
For existing units, applicability may require a complete rebuilding of the unit or the installation</td></tr>
</table></td><td>FC</td><td>All water on site goes directly to the interceptor system. An Improvement Condition has been put in all permits to see if more can be done to segregate water streams.
i. N/A as for new units only
ii. N/A as for new units only
iii. N/A as for new units only</td><td>1.3.1 and IC22</td></tr>
</table>

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<tr><th>BAT Conclusion Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th><th>Relevant permit condition(s)</th></tr>
<tr><td></td><td><table><tr><td>iv. prevention of spillages and leaks</td><td>Practices that include the utilisation of special procedures and/or temporary equipment to maintain performances when necessary to manage special circumstances such as spills, loss of containment, etc</td><td>Generally applicable</td></tr></table></td><td></td><td>iv. On site emergency plans in place, mobile pumps and effluent recirculation is possible to maintain performance in special circumstances.</td><td></td></tr>
<tr><td>12</td><td>In order to reduce the emission load of pollutants in the waste water discharge to the receiving water body, BAT is to remove insoluble and soluble polluting substances by using all of the techniques given below.<table><tr><th>Technique</th><th>Description</th><th>Applicability</th></tr><tr><td>i. Removal of insoluble substances by recovering oil</td><td>See Section 1.21.2, Annex 1.</td><td>Generally applicable</td></tr><tr><td>ii. Removal of insoluble substances by recovering suspended solids and dispersed oil</td><td>See Section 1.21.2, Annex 1.</td><td>Generally applicable</td></tr><tr><td>iii. Removal of insoluble substances including biological treatment and clarification.</td><td>See Section 1.21.2, Annex 1.</td><td>Generally applicable</td></tr></table>BAT – associated emission levels – see Table 3</td><td>FC</td><td>The operator’s BAT Improvement Plan Version 2.4 outlines a programme of improvements proposed for the site with associated timelines. This specifies improvements identified for the site relating to effluent treatment practices. Compliance with a number of the AELs for emissions to water will be regulated under a Regulatory Position Statement and the plan to address this will result in future compliance with narrative BAT Conclusion 12.</td><td>2.3.1</td></tr>
<tr><td>13</td><td>When further removal of organic substances or nitrogen is needed, BAT is to use an additional treatment step as described in Section 1.21.2 (see Annex 1).</td><td>N/A</td><td>We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation.</td><td>N/A</td></tr>
</table>

<table>
<tr><th>BAT Conclusion Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th><th>Relevant permit condition(s)</th></tr>
<tr><td>14</td><td>In order to prevent or, where that is not practicable, to reduce waste generation, BAT is to adopt and implement a waste management plan that, in order of priority, ensures that waste is prepared for reuse, recycling, recovery or disposal.</td><td>CC</td><td>Waste is generated on an ad-hoc basis and so varies in volume and composition.

Waste management plan in place. Paper, used light fittings, steel, cans, cardboard, wood and electrical fittings all recycled.</td><td>1.4.1</td></tr>
<tr><td>15</td><td>In order to reduce the amount of sludge to be treated or disposed of, BAT is to use one or a combination of the techniques given in the BAT Conclusion.</td><td>N/A</td><td>Sludge disposed of off-site.</td><td>N/A</td></tr>
<tr><td>16</td><td>In order to reduce the generation of spent solid catalyst waste, BAT is to use one or a combination of the techniques set out in the BAT Conclusion.</td><td>NA</td><td>We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation.</td><td>N/A</td></tr>
<tr><td>17</td><td>In order to prevent or reduce noise, BAT is to use one or a combination of the techniques given below:

i. Make an environmental noise assessment and formulate a noise management plan as appropriate to the local environment;
ii. Enclose noisy equipment/operation in a separate structure/unit;
iii. Use embankments to screen the source of noise;
iv. Use noise protection walls;</td><td>CC</td><td>i. Noise management plan in place.
ii. N/A
iii. N/A
iv. N/A</td><td>3.4.1</td></tr>
<tr><td>18</td><td>In order to prevent or reduce diffuse VOC emissions, BAT is to apply the techniques given below.

<table><tr><th>Technique</th><th>Description</th><th>Applicability</th></tr><tr><td>I. Techniques related to plant design.</td><td>i. Limiting the number of potential emission sources
ii. Maximising inherent process containment features
iii. Selecting high integrity equipment
iv. Facilitating monitoring and maintenance activities by ensuring access to potentially leaking components</td><td>Applicability may be limited for existing units</td></tr></table></td><td>CC</td><td>All equipment is designed to recognised ISO (International Organisation for Standardisation), EEMUA (Engineering Equipment and Material Users Association), British Standard or IP standards.

All fabrications are pressure checked prior to final installation and inert fluids are used during commissioning wherever possible.

High level visual LDAR (Leak Detection and Repair) programme of inspection, monitoring and fixing. Operators carry tools and equipment to fix minor leaks and drips during all activities. This is focussed in areas of higher risk such as pump bays and where hoses are</td><td>3.2.1 and S3.3</td></tr>
</table>

BAT Conclusion Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement	Relevant permit condition(s)
	II. Techniques related to plant installation and commissioning: i. Well defined procedures for construction and assembly; ii. Robust commissioning and hand-over procedures to ensure that the plant is installed in line with the design requirements. — Applicability may be limited for existing units III. Techniques related to plant operation: Use of a risk based leak detection and repair (LDAR) programme in order to identify leaking components, and to repair these leaks. See table 1.20.6 under BAT 6 — Generally applicable		in use. Ongoing programme of reducing reliance on hoses and installation of fixed pipework. Process monitoring has been specified in the permit in table S3.3 to ensure compliance with BAT 6.	
19	**In order to prevent hydrofluoric acid (HF) emissions to air from the hydrofluoric acid alkylation process, BAT is to use wet scrubbing with alkaline solution to treat incondensable gas streams prior to venting to flare.** **Description:** See section 1.20.3, Annex 1. **Applicability**: Generally applicable. Safety requirements, due to the hazardous nature of hydrofluoric acid, are to be considered.	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation.	N/A
20	**In order to reduce emissions to water from the hydrofluoric acid alkylation process, BAT is to use a combination of the techniques set out in the BAT Conclusion.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation.	N/A
21	**In order to reduce the emissions to water from the sulphuric acid alkylation process, BAT is to reduce the use of sulphuric acid by regenerating the spent acid and to neutralise the waste water generated by this process before routing to waste water treatment.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation.	N/A
22	**In order to prevent and reduce the emissions of hazardous substances to air and water from base oil production processes, BAT is to use one or a combination of the techniques set out in the BAT Conclusion.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation.	N/A
23	**In order to prevent and reduce emissions to air from the bitumen production process, BAT is to treat the gaseous overhead by using one of the techniques set out in the BAT Conclusion.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation.	N/A

BAT Conclusion Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement	Relevant permit condition(s)
BAT conclusions for the fluid catalytic cracking process				
24	**In order to prevent or reduce NO_X emissions to air from the catalytic cracking process (regenerator), BAT is to use one or a combination of the techniques set out in the BAT Conclusion.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation.	N/A
25	**In order to reduce dust and metals emissions to air from the catalytic cracking process (regenerator), BAT is to use one or a combination of the techniques set out in the BAT Conclusion.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation. No catalytic cracking on site.	N/A
26	**In order to prevent or reduce SO_X emissions to air from the catalytic cracking process (regenerator), BAT is to use one or a combination of the techniques set out in the BAT Conclusions.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation. No catalytic cracking on site.	N/A
27	**In order to reduce carbon monoxide (CO) emissions to air from the catalytic cracking process (regenerator), BAT is to use one or a combination of the techniques set out in the BAT Conclusion.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation. No catalytic cracking on site.	N/A
28	**In order to reduce emissions of polychlorinated dibenzodioxins/furans (PCDD/F) to air from the catalytic reforming unit, BAT is to use one or a combination of the techniques set out in the BAT Conclusion.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation. No catalytic reforming unit.	N/A
29	**In order to reduce emissions to air from the coking production processes, BAT is to use one or a combination of the techniques set out in the BAT Conclusion.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation. No coking production processes.	N/A
30	**In order to reduce NO_X emissions to air from the calcining of green coke process, BAT is to use selective non-catalytic reduction (SNCR).**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation. No calcining.	N/A
31	**In order to reduce SO_X emissions to air from the calcining of green coke process, BAT is to use one or a combination of the techniques set out in the BAT Conclusion.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation. No calcining on site.	N/A
32	**In order to reduce dust emissions to air from the calcining of green coke process, BAT is to use a combination of the techniques set out in the BAT Conclusion.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation. No calcining on site.	N/A
33	**In order to reduce water consumption and emissions to water from the desalting process, BAT is to use one or a combination of the techniques set out in the BAT Conclusion.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation. No desalting on site.	N/A

<table>
<tr><th>BAT Conclusion Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th><th>Relevant permit condition(s)</th></tr>
<tr><td>34</td><td>BAT 34. In order to prevent or reduce NO_X emissions to air from the combustion units, BAT is to use one or a combination of the techniques given below.

I. Primary or process-related techniques, such as:

<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td colspan="3">i. Selection or treatment of fuel</td></tr>
<tr><td>(a) Use of gas to replace liquid fuel</td><td>Gas generally contains less nitrogen than liquid and its combustion leads to a lower level of NO_X emissions.
See section 1.20.3, Annex 1.</td><td>The applicability may be limited by the constraints associated with the availability of low sulphur gas fuels, which may be impacted by the energy policy of the Member State</td></tr>
<tr><td>(b) Use of low nitrogen refinery fuel oil (RFO) e.g. by RFO selection or by hydrotreatment of RFO</td><td>Refinery fuel oil selection favours low nitrogen liquid fuels among the possible sources to be used at the unit. Hydrotreatment aims at reducing the sulphur, nitrogen and metal contents of the fuel.
See section 1.20.3, Annex 1.</td><td>Applicability is limited by the availability of low nitrogen liquid fuels, hydrogen production and hydrogen sulphide (H_2S) treatment capacity (e.g. amine and Claus units)</td></tr>
<tr><td colspan="3">ii. Combustion modifications</td></tr>
<tr><td>(a) Staged combustion:
• air staging
• fuel staging</td><td>See section 1.20.2, Annex 1.</td><td>Fuel staging for mixed or liquid firing may require a specific burner design</td></tr>
</table>
</td><td>CC</td><td>The Environment Agency expects at least one technique to be used, and this to be from the primary or process related techniques table.

The EA has not imposed limits on any combustion plant with a thermal input of less than 20 MW thermal input unless the permit already required lower limits. Existing limits in the permit are retained.

Over 80% of the fuel used on site is natural gas. The other fuel is a liquid/vapour mixture of off-gas from the distillation process.

N/A – no RFO used

No</td><td>2.3.1</td></tr>
</table>

BAT Conclusion Number	Summary of BAT Conclusion requirement			Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement	Relevant permit condition(s)
	(b) Optimisation of combustion	See section 1.20.2, Annex 1.	Generally applicable		Yes – spot monitoring of combustion and burner controls allow automated optimisation.	
	(c) Flue-gas recirculation	See section 1.20.2, Annex 1.	Applicable through the use of specific burners with internal recirculation of the flue-gas. The applicability may be restricted to retrofitting external flue-gas recirculation to units with a forced/induced draught mode of operation		No	
	(d) Diluent injection	See section 1.20.2, Annex 1.	Applicable for gas turbines where appropriate inert diluents are available		N/A	
	(e) Use of low-NO_X burners (LNB)	See section 1.20.2, Annex 1.	Generally applicable for new units taking into account, the fuel-specific limitation (e.g. for heavy oil). For existing units, applicability may be restricted by the complexity caused by site-specific conditions e.g. furnaces design, surrounding devices. In very specific cases, substantial modifications may be required. The applicability may be restricted for furnaces in the delayed coking process, due to		Partially – 1/5 burners is low NOx design	

BAT Conclusion Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement	Relevant permit condition(s)

		possible coke generation in the furnaces. In gas turbines, the applicability is restricted to low hydrogen content fuels (generally < 10 %)

II. Secondary or end-of-pipe techniques, such as:

Technique	Description	Applicability
i. Selective catalytic reduction (SCR)	See section 1.20.2, Annex 1.	Generally applicable for new units. For existing units, the applicability may be constrained due to the requirements for significant space and optimal reactant injection
ii. Selective non-catalytic reduction (SNCR)	See section 1.20.2, Annex 1.	Generally applicable for new units. For existing units, the applicability may be constrained by the requirement for the temperature window and the residence time to be reached by reactant injection
iii. Low temperature oxidation	See section 1.20.2, Annex 1.	The applicability may be limited by the need for additional scrubbing capacity and by the fact that ozone generation and the associated risk management need to be properly addressed.

N/A

N/A

N/A

BAT Conclusion Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement	Relevant permit condition(s)

		The applicability may be limited by the need for additional waste water treatment and related cross-media effects (e.g. nitrate emissions) and by an insufficient supply of liquid oxygen (for ozone generation). For existing units, the applicability of the technique may be limited by space availability
iv. SNO_X combined technique	See section 1.20.4, Annex 1.	Applicable only for high flue-gas (e.g. > 800 000 Nm3/h) flow and when combined NO_X and SO_X abatement is needed

BAT- associated emission levels: See Table 9, Table 10 and Table 11

Table 9 BAT-associated emission levels for NO_X emissions to air from a gas turbine

Parameter	Type of equipment	BAT-AEL (1) (monthly average) mg/Nm^3 at 15% O_2
NOx, expressed as NO_2	Gas turbine (including combined cycle gas turbine – CCGT) and integrated gasification combined cycle turbine (IGCC))	40 - 120 (existing gas turbine)
		20 - 50 (new turbine) (2)

(1) BAT-AEL refers to combined emissions from the gas turbine and the supplementary firing recovery boiler, where present

N/A

N/A

<table>
<tr><th>BAT Conclusion Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th><th>Relevant permit condition(s)</th></tr>
<tr><td></td><td>
(2) For fuel with high H_2 content (i.e. above 10%), the upper end of the range is 75 mg/Nm^3

Table 10 BAT- associated emission levels for NOX emissions to air from a gas-fired combustion unit, with the exception of gas turbines

<table>
<tr><th>Parameter:</th><th>Type of combustion</th><th>BAT-AEL (monthly average) mg/Nm^3</th></tr>
<tr><td rowspan="2">NOx, expressed as NO_2</td><td rowspan="2">Gas firing</td><td>30 - 150 for existing unit (1)</td></tr>
<tr><td>30 - 100 for new unit</td></tr>
<tr><td colspan="3">(1) For an existing unit using high air pre-heat (i.e. > 200 C) or with H2 content in the fuel gas higher that 50% the upper end of the BAT-AEL range is 200 mg/Nm^3</td></tr>
</table>

Table 11 BAT –associated emission levels for NO_X emissions to air from a multi-fuel fired combustion unit with the exception of gas turbines

<table>
<tr><th>Parameter:</th><th>Type of combustion</th><th>BAT-AEL (monthly average) mg/Nm^3</th></tr>
<tr><td>NO_X expressed as NO_2</td><td>Multi-fuel fired combustion unit</td><td>30 -3—for existing unit (^{1}) (^{2})</td></tr>
<tr><td colspan="3">(1) For existing units < 100 MW firing fuel oil with a nitrogen content higher that 0.5% (w/w) or with liquid firing > 50% or using air preheating values up to 450 mg/Nm^3 may occur
(2) The lower end of the range can be achieved by using the SCR technique</td></tr>
</table>

The associated monitoring is in BAT 4
</td><td></td><td>N/A

N/A</td><td></td></tr>
</table>

<table>
<tr><th>BAT Conclusion Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th><th>Relevant permit condition(s)</th></tr>
<tr>
<td>35</td>
<td>In order to prevent or reduce dust and metal emissions to air from the combustion units, BAT is to use one or a combination of the techniques given below.

I. Primary or process-related techniques, such as:

<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td colspan="3">Selection or treatment of fuel</td></tr>
<tr><td>(a) Use of gas to replace liquid fuel</td><td>Gas instead of liquid combustion leads to lower level of dust emissions
See section 1.20.3, Annex 1.</td><td>The applicability may be limited by the constraints associated with the availability of low sulphur fuels such as natural gas which may be impacted by the energy policy of the Member State</td></tr>
<tr><td>(b) Use of low sulphur refinery fuel oil (RFO) e.g. by RFO selection or by hydro-treatment of RFO</td><td>Refinery fuel oil selection favours low sulphur liquid fuels among the possible sources to be used at the unit. Hydrotreatment aims at reducing the sulphur, nitrogen and metal contents of the fuel
See section 1.20.3, Annex 1.</td><td>The applicability may be limited by the availability of low sulphur liquid fuels, hydrogen production and the hydrogen sulphide (H_2S) treatment capacity (e.g. amine and Claus units)</td></tr>
<tr><td colspan="3">Combustion modifications</td></tr>
<tr><td>(a) Optimisation of combustion</td><td>See section 1.20.2, Annex 1.</td><td>Generally applicable to all types of combustion</td></tr>
</table>
</td>
<td>CC</td>
<td>The Environment Agency expect at least one technique to be used, and this to be from the primary or process related techniques table.

Existing limits in the permit are retained as they are compliant with the requirements of BAT 35 The EA has not imposed limits on any combustion plant with a thermal input of less than 20MW thermal input unless the permit already required lower limits.

Over 80% of the fuel used at the refinery is natural gas with other fuel a liquid/vapour mixture of off-gas from the distillation process.

N/A as no RFO on site.

Yes – spot monitoring of combustion and burner controls allow automated optimisation.</td>
<td>2.3.1</td>
</tr>
</table>

BAT Conclusion Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement	Relevant permit condition(s)
	(b) Atomisation of liquid fuel: Use of high pressure to reduce the droplet size of liquid fuel. Recent optimal burner designs generally include steam atomisation — Generally applicable to liquid fuel firing II Secondary or end-of-pipe techniques, such as: **Technique** / **Description** / **Applicability** i. Electrostatic precipitator (ESP) — See section 1.20.1, Annex 1. — For existing units, the applicability may be limited by space availability ii. Third stage blowback filter — See section 1.20.1, Annex 1. — Generally applicable iii. Wet scrubbing — See section 1.20.1, Annex 1. — The applicability may be limited in arid areas and in the case where by-products from treatment (including e.g. waste water with a high level of salt) cannot be reused or appropriately disposed of. For existing units, the applicability of the technique may be limited by space availability iv. Centrifugal washers — See section 1.20.1, Annex 1. — Generally applicable		No N/A- Burning gas N/A- Burning gas N/A- Burning gas N/A	

<table>
<tr><th>BAT Conclusion Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th><th>Relevant permit condition(s)</th></tr>
<tr><td></td><td>Table 12 BAT – associated emission levels of dust emissions to air from a multi-fuel fired combustion unit with the exception of gas turbines

<table><tr><th>Parameter</th><th>Type of combustion</th><th>BAT-AEL (monthly average) mg/Nm^3</th></tr><tr><td rowspan="2">Dust</td><td rowspan="2">Multi-fuel firing</td><td>5 – 50 for existing unit (^{1}) (^{2})</td></tr><tr><td>5 – 25 for new unit < 50 MW</td></tr><tr><td colspan="3">(1) The lower end of the range is achievable for units with the use of end-of-pipe techniques
(2) The upper end of the range refers to the use of a high percentage of oil burning and where only primary techniques are applicable</td></tr></table>
The associated monitoring is in BAT 4</td><td></td><td>N/A</td><td></td></tr>
<tr><td>36</td><td>In order to prevent or reduce SO_x emissions to air from the combustion units, BAT is to use one or a combination of the techniques given below.

I. Primary or process-related techniques

<table><tr><th>Technique</th><th>Description</th><th>Applicability</th></tr><tr><td>i. Use of gas to replace liquid fuel</td><td>See section 1.20.3, Annex 1.</td><td>The applicability may be limited by the constraints associated with the availability of low sulphur fuels such as natural gas, which may be impacted by the energy policy of the Member State</td></tr><tr><td>ii. Treatment of refinery fuel gas (RFG)</td><td>Residual H2S concentration in RFG depends on the</td><td>For low calorific gas containing carbonyl sulphide (COS) e.g.</td></tr></table></td><td>N/A</td><td>There is no applicable BAT-AEL for natural gas fired plant in BAT 36. However there are existing ELVs in the permit which have been retained.

The EA has not imposed limits on any combustion plant with a thermal input of less than 20MW thermal input unless the permit already required lower limits.</td><td>N/A</td></tr>
</table>

BAT Conclusion Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement	Relevant permit condition(s)

	treatment process parameter, e.g. the amine-scrubbing pressure. See Section 1.20.3, Annex 1.	from coking units, a converter may be required prior to H_2S removal
iii. Use of low sulphur refinery fuel oil (RFO) e.g. by RFO selection or by hydrotreatment of RFO	Refinery fuel oil selection favours low sulphur liquid fuels among the possible sources to be used at the unit. Hydrotreatment aims at reducing the sulphur, nitrogen and metal contents of the fuel. See Section 1.20.3, Annex 1.	The applicability is limited by the availability of low sulphur liquid fuels, hydrogen production and the hydrogen sulphide (H_2S) treatment capacity (e.g. amine and Claus units

II. Secondary or end-of-pipe techniques

Technique	Description	Applicability
i. Non-regenerative scrubbing	Wet scrubbing or seawater scrubbing. See Section 1.20.3, Annex 1.	The applicability may be limited in arid areas and in the case where the by-products from treatment (including e.g. waste water with high level of salts) cannot be reused or appropriately disposed of. For existing units, the applicability of the technique may be

BAT Conclusion Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement	Relevant permit condition(s)
	<table><tr><td></td><td></td><td>limited by space availability</td></tr></table> **Table 13 BAT – associated emission levels for SO_2 emissions to air from combustion unit firing refinery fuel gas (RFG), with the exception of gas turbines** <table><tr><th>Parameter</th><th>BAT-AEL (monthly average) mg/Nm³</th></tr><tr><td>SO2</td><td>5 – 35 (1)</td></tr><tr><td colspan="2">(1) In the specific configuration of RFG treatment with a low scrubber operative pressure and with refinery fuel gas with an H/C molar ratio above 5, the upper end of the BAT-AEL range can be as high as 45 mg/Nm3</td></tr></table> The associated monitoring is in BAT 4 **Table 14 BAT- associated emission levels for SO_2 emissions to air from multi-fuel fired combustion units, with the exception of gas turbines and stationary engines** <table><tr><th>Parameter</th><th>BAT-AEL (monthly average) mg/Nm³</th></tr><tr><td>SO_2</td><td>35 - 600</td></tr></table> The associated monitoring is in BAT 4			
37	**In order to reduce carbon monoxide (CO) emissions to air from the combustion units, BAT is to use a combustion operation control.** **Table 15 BAT – associated emission levels for carbon monoxide emissions to air from combustion unit** <table><tr><th>Parameter</th><th>BAT- AEL (monthly average) mg/Nm³</th></tr><tr><td>Carbon monoxide expressed as CO</td><td>≤ 100</td></tr></table> Associated monitoring is in BAT 4.	N/A	The Environment Agency has decided not to require monitoring on combustion plant below 20MW thermal input unless previously required by the permit.	N/A

BAT Conclusion Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement	Relevant permit condition(s)
38	**In order to reduce emissions to air from the etherification process, BAT is to ensure the appropriate treatment of process off-gases by routing them to the refinery fuel gas system.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation. No etherification process on site.	N/A
39	**In order to prevent upset of the biotreatment, BAT is to use a storage tank and an appropriate unit production plan management to control the toxic components dissolved content (e.g. methanol, formic acid, ethers) of the waste water stream prior to final treatment.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation.	N/A
40	**In order to reduce emissions to air of chlorinated compounds, BAT is to optimise the use of chlorinated organic compounds used to maintain catalyst activity when such a process is in place or to use non-chlorinated catalytic systems.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation.	N/A
41	**In order to reduce sulphur dioxide emissions to air from the natural gas plant, BAT is to apply BAT 54.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation.	N/A
42	**In order to reduce nitrogen oxides (NO_X) emissions to air from the natural gas plant, BAT is to apply BAT 34**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation.	N/A
43	**In order to prevent emissions of mercury when present in raw natural gas, BAT is to remove the mercury and recover the mercury-containing sludge for waste disposal.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation.	N/A
44	**In order to prevent or reduce waste water flow generation from the distillation process, BAT is to use liquid ring vacuum pumps or surface condensers.** **Applicability**. May not be applicable in some retrofit cases. For new units, vacuum pumps, either in or not in combination with the steam ejectors, may be needed to achieve a high volume (10 mm Hg). Also, a spare should be available in case the vacuum pump fails.	CC	Liquid ring vacuum pumps in use.	2.3.1
45	**In order to prevent or reduce water pollution from the distillation process, BAT is to route sour water to the stripping unit.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation.	N/A

BAT Conclusion Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement	Relevant permit condition(s)
46	In order to prevent or reduce emissions to air from distillation units, BAT is to ensure the appropriate treatment of process off-gases, especially incondensable off-gases, by acid gas removal prior to further use. **Applicability**. Generally applicable for crude and vacuum distillation units. May not be applicable for standalone lubricant and bitumen refineries, with emissions of less than 1 t/d of sulphur compounds. In specific refinery configurations, applicability may be restricted, due to the need for e.g. large piping, compressors or additional amine treating capacity.	N/A	No acid gas removal system in place. Gases from the distillation system are condensed and burnt as liquid/vapour mixture. Vent gases from vacuum systems are caustic scrubbed before discharge to atmosphere.	N/A
47	**In order to reduce emissions to air from the products treatment process, BAT is to ensure the appropriate disposal of off-gases, especially odorous spent air from sweetening units, by routing them to destruction, e.g. by incineration.** **Applicability**. Generally applicable to products treatment processes where the gas streams can be safely processed to the destruction units. May not be applicable to sweetening units, due to safety reasons.	CC	No acid gas removal system in place. Gases from the distillation process are condensed and burnt as liquid/vapour mixture. Vent gases from vacuum systems are caustic scrubbed before discharge to atmosphere. Gases from sweetening units are also caustic scrubbed before discharge to atmosphere.	2.3.1
48	**In order to reduce waste and waste water generation when a products treatment process using caustic is in place, BAT is to use cascading caustic solution and a global management of spent caustic, including recycling after appropriate treatment, e.g. by stripping.**	CC	Caustic is generally regenerated until it needs replacing. Replacement is based on weekly tests and when replacement is needed the spent caustic is recycled.	2.3.1
49	**In order to reduce VOC emissions to air from the storage of volatile liquid hydrocarbon compounds, BAT is to use floating roof storage tanks equipped with high efficiency seals or a fixed roof tank connected to a vapour recovery system.** **Description**. High efficiency seals are specific devices for limiting losses of vapour e.g. improved primary seals, additional multiple (secondary or tertiary) seals (according to quantity emitted). **Applicability**. The applicability of high efficiency seals may be restricted for retrofitting tertiary seals in existing tanks.	FC	There are 175 storage tanks on the site and none have a dedicated duty. Large volume volatile materials are stored in floating roof tanks with primary and secondary rim seals. Smaller volume materials (many of which are not defined VOCs) are stored in atmospheric storage tanks fitted with pressure/vacuum valves. Primary and secondary seals in most cases. VOC monitoring plan specified through improvement condition.	2.3.1

<table>
<tr><th>BAT Conclusion Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th><th>Relevant permit condition(s)</th></tr>
<tr><td>50</td><td>In order to reduce VOC emissions to air from the storage of volatile liquid hydrocarbon compounds, BAT is to use one or a combination of the techniques given below.

<table><tr><th>Technique</th><th>Description</th><th>Applicability</th></tr><tr><td>i. Manual crude oil tank cleaning</td><td>Oil tank cleaning is performed by workers entering the tank and removing sludge manually</td><td>Generally applicable</td></tr><tr><td>ii. Use of a closed-loop system</td><td>For internal inspections, tanks are periodically emptied, cleaned and rendered gas-free. This cleaning includes dissolving the tank bottom. Closed-loop systems that can be combined with end-of-pipe mobile abatement techniques prevent or reduce VOC emissions</td><td>The applicability may be limited by e.g. the type of residues, tank roof construction or tank materials</td></tr></table></td><td>CC</td><td>There is no crude stored on the site. Tanks management follows the recommended HSE guidance and EEMUA standards. Tanks are on a rolling annual maintenance programme. One technique is used fully and therefore the BAT Conclusion is complied with.

Yes notice response confirms that this is complied with.

Tank bottom not dissolved but internal inspection requires emptying, gas freeing and cleaning.</td><td>2.3.1</td></tr>
<tr><td>51</td><td>In order to prevent or reduce emissions to soil and groundwater from the storage of liquid hydrocarbon compounds, BAT is to use one or a combination of the techniques given below.

<table><tr><th>Technique</th><th>Description</th><th>Applicability</th></tr><tr><td>i. Maintenance programme including corrosion monitoring, prevention and control</td><td>A management system including leak detection and operational controls to prevent overfilling, inventory control and risk-based inspection</td><td>Generally applicable</td></tr></table></td><td>CC</td><td>All tanks are on piled concrete bases with appropriate containment bunds.</td><td>1.1
2.3.1
3.2.3</td></tr>
</table>

BAT Conclusion Number	Summary of BAT Conclusion requirement			Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement	Relevant permit condition(s)
		procedures on tanks at intervals to prove their integrity, and maintenance to improve tank containment. It also includes a system response to spill consequences to act before spills can reach the groundwater. To be especially reinforced during maintenance periods				
	ii. Double bottomed tanks	A second impervious bottom that provides a measure of protection against releases from the first material	Generally applicable for new tanks and after an overhaul of existing tanks (1)			
	iii. Impervious membrane liners	A continuous leak barrier under the entire bottom surface of the tank	Generally applicable for new tanks and after an overhaul of existing tanks ([1])			
	iv. Sufficient tank farm bund containment	A tank farm bund is designed to contain large spills potentially caused by a shell rupture or overfilling (for both environmental and safety reasons). Size and associated building rules are generally defined by local regulations	Generally applicable			

<table>
<tr><th>BAT Conclusion Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th><th>Relevant permit condition(s)</th></tr>
<tr><td></td><td>(1) Techniques ii and iii may be generally applicable where tanks are dedicated to products that require heat for liquid handling (e.g. bitumen) and where no leak is likely because of solidification</td><td></td><td></td><td></td></tr>
<tr><td>52</td><td>In order to prevent or reduce VOC emissions to air from loading and unloading operations of volatile liquid hydrocarbon compounds, BAT is to use one or a combination of the techniques given below to achieve a recovery rate of at least 95 %.

<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>Vapour recovery by:
i. Condensation
ii. Absorption
iii. Adsorption
iv. Membrane separation
v. Hybrid systems</td><td>See section 1.20.6, Annex 1.</td><td>Generally applicable to loading/unloading operations where annual throughput is > 5 000 m^3/yr. Not applicable to loading/unloading operations for sea-going vessels with an annual throughput < 1 million m^3/yr (1)</td></tr>
<tr><td colspan="3">(1) A vapour destruction unit (e.g. by incineration) may be substituted for a vapour recovery unit, if vapour recovery is unsafe or technically impossible because of the volume of return vapour</td></tr>
</table>

Table 16 BAT- associated emission levels for non-methane VOC and benzene emissions to air from loading and unloading operations of volatile liquid hydrocarbon compounds

<table>
<tr><th>Parameter</th><th>BAT-AEL (hourly average) (1)</th></tr>
<tr><td>NMVOC</td><td>0.15 - 10g/Nm^3 (2) (3)</td></tr>
<tr><td>Benzene (3)</td><td><1 mg/Nm^3</td></tr>
<tr><td colspan="2">(1) Hourly values in continuous operation expressed and measured according to Directive 94/63/EA
(2) Lower value achievable with two-stage hybrid systems. Upper value achievable with single-stage adsorption or membrane system</td></tr>
</table></td><td>N/A</td><td>Loading operations are below the threshold of 5000m^3/year for materials with an RVP of >4KPa.</td><td>N/A</td></tr>
</table>

BAT Conclusion Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement	Relevant permit condition(s)
	(3) Benzene monitoring may not be necessary where emissions of NMVOC are at the lower end of the range.			
53	**In order to reduce emissions to water from visbreaking and other thermal processes, BAT is to ensure the appropriate treatment of waste water streams by applying the techniques of BAT 11.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation.	N/A
54	**In order to reduce sulphur emissions to air from off-gases containing hydrogen sulphides (H_2S), BAT is to use all of the techniques set out in the BAT Conclusion.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation.	N/A
55	**In order to prevent emissions to air from flares, BAT is to use flaring only for safety reasons or for non-routine operational conditions (e.g. start-ups, shutdown).**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation.	N/A
56	**In order to reduce emissions to air from flares when flaring is unavoidable, BAT is to use the techniques set out in the BAT Conclusions.**	N/A	We agree this BAT Conclusion is not applicable to the relevant activities carried out at this installation.	N/A
57	**In order to achieve an overall reduction of NO_X emissions to air from combustion units and fluid catalytic cracking (FCC) units, BAT is to use an integrated emission management technique as an alternative to applying BAT 24 and BAT 34.** **Description:** The technique consists of managing NO_X emissions from several or all combustion units and FCC units on a refinery site in an integrated manner, by implementing and operating the most appropriate combination of BAT across the different units concerned and monitoring the effectiveness thereof, in such a way that the resulting total emissions are equal to or lower than the emissions that would be achieved through a unit-by-unit application of the BAT-AELs referred to in BAT 24 and BAT 34. This technique is especially suitable to oil refining sites: • with a recognised site complexity, multiplicity of combustion and process units interlinked in terms of their feedstock and energy supply; • with frequent process adjustments required in function of the quality of the crude received;	N/A	The operator has not requested to use an integrated emission management technique.	N/A

BAT Conclusion Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement	Relevant permit condition(s)
	• with a technical necessity to use a part of process residues as internal fuels, causing frequent adjustments of the fuel mix according to process requirements.			
58	**In order to achieve an overall reduction of SO_2 emissions to air from combustion units, fluid catalytic cracking (FCC) units and waste gas sulphur recovery units, BAT is to use an integrated emission management technique as an alternative to applying BAT 26, BAT 36 and BAT 54.** **Description:** The technique consists of managing SO_2 emissions from several or all combustion units, FCC units and waste gas sulphur recovery units on a refinery site in an integrated manner, by implementing and operating the most appropriate combination of BAT across the different units concerned and monitoring the effectiveness thereof, in such a way that the resulting total emissions are equal to or lower than the emissions that would be achieved through a unit-by-unit application of the BAT-AELs referred to in BAT 26 and BAT 36 as well as the BAT-AEPL set out under BAT 54. This technique is especially suitable to oil refining sites: • with a recognised site complexity, multiplicity of combustion and process units interlinked in terms of their feedstock and energy supply; • with frequent process adjustments required in function of the quality of the crude received; • with a technical necessity to use a part of process residues as internal fuels, causing frequent adjustments of the fuel mix according to process requirements.	N/A	The operator has not requested to use an integrated emission management technique.	N/A

6 Review and assessment of derogation requests made by the operator in relation to BAT Conclusions which include an associated emission level (AEL) value

The IED enables a competent authority to allow derogations from BAT AELs stated in BAT Conclusions under specific circumstances as detailed under Article 15(4):

By way of derogation from paragraph 3, and without prejudice to Article 18, the competent authority may, in specific cases, set less strict emission limit values. Such a derogation may apply only where an assessment shows that the achievement of emission levels associated with the best available techniques as described in BAT conclusions would lead to disproportionately higher costs compared to the environmental benefits due to:

> *(a) the geographical location or the local environmental conditions of the installation concerned; or*
>
> *(b) the technical characteristics of the installation concerned.*

As part of their Regulation 60 Notice response, the operator has requested a derogation from compliance with the AEL values included in BAT Conclusion 10.

The Regulation 60 notice to initiate the permit review was issued on 11/11/2015 and the response was received on 29/01/2016. Although information was provided in their response to allow us to commence assessment of the derogation requests it was insufficient to enable us to complete the determination and further information was requested and subsequently supplied as outlined below.

- Additional information was requested by email on 11/10/2016 and a response was received on 13/10/2016.
- An additional response in relation to the first stage of the derogation application was made on 08/06/2017.
- Additional information was requested by email on 12/07/2017 in relation to the information received on 08/06/2017 and a response was received on 13/07/2017.

A further Regulation 61 notice (EPR 2016 amended the terminology from Regulation 60 notice to Regulation notice) in relation to the first stage of the derogation application with a deadline for receipt of information by 22/12/2017. A response was received on 29/11/2017 – BAT Derogation Submission, dated 20/11/2017 and formed the basis for this derogation application.

We decided to reject the derogation requested by the operator in respect to the AEL values described in BAT Conclusion 10. We made this decision in line with the methodology set out in the following document *'Environment Agency - Derogation Assessment Methodology for BAT-AELS'*, Version 1.3, 22 January 2015. We have included the AEL values within table S3.1 of the consolidated variation notice.

We have rejected the derogation application because we do not consider that the derogation application demonstrated that there is a technical characteristic justifying

a derogation as defined in Article 15 (4) of the Industrial Emissions Directive. A Regulatory Position Statement associated with the BAT AELs set out in BAT Conclusion 10 dated X is included in Annex X of this decision document?

7 Emissions to Water

The consolidated permit incorporates the current discharge to controlled waters identified as W1.

Our review of the emission limits considered the BAT conclusions and also whether existing limits will maintain Water Quality Objectives (WQOs) in the receiving watercourse to ensure the water quality objectives under the Water Framework Directive will be met through improvements identified in the Operator's BAT Improvement plan Version 2.4.

We have set ELVs and monitoring in accordance with Table 3 referenced in BATs 10 and 12. Where limits in the permit already existed, such as the maximum daily limits, these have been retained in addition to the new annual average monitoring requirements. Monitoring of Chemical Oxygen Demand has been set at weekly rather than the daily frequency specified in the BAT Conclusions to retain consistency across the monitoring frequencies and because there are two weekly monitoring requirements specified in the permit.

In addition to the review of compliance against the relevant BAT Conclusions for emissions to water, this Permit review also provides an opportunity to consider whether the discharge to surface water will maintain River Quality Objectives (RQOs) in the receiving watercourse to ensure the water quality objectives under Water Framework Directive will be met.

The Operator does not currently have sufficient information for this assessment to be made. Improvement Conditions IC19 and IC20 have been added to Table S1.3 Improvement Programme Requirements to address this. Details of the Improvement Conditions are included in Annex 2 below.

8 Additional IED Chapter II requirements:

Condition 3.1.3 relating to protection of soil, groundwater and groundwater monitoring, has been added in compliance with IED requirements. Conditions 4.3.1 and 4.3.2 relating to notifications have been amended in compliance with IED requirements.

9 Review and assessment of changes that are not part of the BAT Conclusions derived permit review.

This document should be read in conjunction with the application, supporting information and permit/notice.

Aspect considered	Decision
Receipt of application	
Confidential information	A claim for commercial or industrial confidentiality has not been made.
Identifying confidential information	We have not identified information provided as part of the application that we consider to be confidential.
The site	
Biodiversity, heritage, landscape and nature conservation	The application is within the relevant distance criteria of a site of heritage, landscape or nature conservation, and/or protected species or habitat. We have not carried out an assessment of potential impacts on habitats sites as part of this permit review as there will be no increase in impacts of these sites as a result of the review.
Permit conditions	
Updating permit conditions during consolidation	We have updated permit conditions to those in the current generic permit template as part of permit consolidation. The conditions will provide a higher level of environmental protection than the previous permit conditions.
Use of conditions other than those from the template	Based on the information in the application, we consider that we do not need to impose conditions other than those in our permit template.
Improvement programme	Based on the information on the application, we consider that we need to impose an improvement programme as outlined in sections 2, 5, 7 and Annex 2 of this decision document.
Emission limits	We have decided that emission limits should be set for the parameters listed in the permit. The following substances have been identified as being emitted in significant quantities and ELVs and equivalent parameters or technical measures based on BAT have been set for those substances. Emissions to water; • HOl 2.5 mg/l • TSS 25 mg/l • COD 125 mg/l • Total nitrogen 25 mg/l • Lead 0.03 mg/l • Cadmium 0.1 mg/l • Nickel 0.1 mg/l • Mercury 0.001 mg/l • Benzene 0.05 mg/l

Aspect considered	Decision
	It is considered that the ELVs/equivalent parameters or technical measures described above will ensure that significant pollution of the environment is prevented and a high level of protection for the environment secured.
Monitoring	We have decided that monitoring should be carried out for the parameters listed in the permit, using the methods detailed and to the frequencies specified.
Reporting	We have specified reporting in the permit.
Operator competence	
Management system	There is no known reason to consider that the operator will not have the management system to enable it to comply with the permit conditions.
Growth Duty	
Section 108 Deregulation Act 2015 – Growth duty	We have considered our duty to have regard to the desirability of promoting economic growth set out in section 108(1) of the Deregulation Act 2015 and the guidance issued under section 110 of that Act in deciding whether to grant this permit. Paragraph 1.3 of the guidance says: "The primary role of regulators, in delivering regulation, is to achieve the regulatory outcomes for which they are responsible. For a number of regulators, these regulatory outcomes include an explicit reference to development or growth. The growth duty establishes economic growth as a factor that all specified regulators should have regard to, alongside the delivery of the protections set out in the relevant legislation." We have addressed the legislative requirements and environmental standards to be set for this operation in the body of the decision document above. The guidance is clear at paragraph 1.5 that the growth duty does not legitimise non-compliance and its purpose is not to achieve or pursue economic growth at the expense of necessary protections. We consider the requirements and standards we have set in this permit are reasonable and necessary to avoid a risk of an unacceptable level of pollution. This also promotes growth amongst legitimate operators because the standards applied to the operator are consistent across businesses in this sector and have been set to achieve the required legislative standards.

Annex 1: BAT conclusions for the Refining of Mineral Oil and Gas.

BAT conclusions for the Refining of Mineral Oil and Gas - Glossary

1.20 Description of techniques for the prevention and control of emissions to air.

1.20.1 Dust

Technique	Description
Electrostatic precipitator (ESP)	Electrostatic precipitators operate such that particles are charged and separated under the influence of an electrical field. Electrostatic precipitators are capable of operating under a wide range of conditions. Abatement efficiency may depend on the number of fields, residence time (size), catalyst properties and upstream particles removal devices. At FCC units, 3-field ESPs and 4-field ESPs are commonly used. ESPs may be used on a dry mode or with ammonia injection to improve the particle collection. For the calcining of green coke, the ESP capture efficiency may be reduced due to the difficulty for coke particles to be electrically charged
Multistage cyclone separators	Cyclonic collection device or system installed following the two stages of cyclones. Generally known as a third stage separator, common configuration consists of a single vessel containing many conventional cyclones or improved swirl-tube technology. For FCC, performance mainly depends on the particle concentration and size distribution of the catalyst fines downstream of the regenerator internal cyclones
Centrifugal washers	Centrifugal washers combine the cyclone principle and an intensive contact with water e.g. venturi washer
Third stage blowback filter	Reverse flow (blowback) ceramic or sintered metal filters where, after retention at the surface as a cake, the solids are dislodged by initiating a reverse flow. The dislodged solids are then purged from the filter system

1.20.2. Nitrogen oxides (NO_X)

Technique	Description
Combustion modifications	
Staged combustion	- Air staging — involves substoichiometric firing in a first step and the subsequent addition of the remaining air or oxygen into the furnace to complete combustion - Fuel staging — a low impulse primary flame is developed in the port neck; a secondary flame covers the root of the primary flame reducing its core temperature
Flue-gas recirculation	Reinjection of waste gas from the furnace into the flame to reduce the oxygen content and therefore the temperature of the flame. Special burners using the internal recirculation of combustion gases to cool the root of the flames and reduce the oxygen content in the hottest part of the flames
Use of low-NO_X burners (LNB)	The technique (including ultra-low-NO_X burners) is based on the principles of reducing peak flame temperatures, delaying but completing the combustion and increasing the heat transfer (increased emissivity of the flame). It may be associated with a modified design of the furnace combustion chamber. The design of ultra-low-NOX burners (ULNB) includes combustion staging (air/fuel) and flue-gas recirculation. Dry low-NO_X burners (DLNB) are used for gas turbines
Optimisation of combustion	Based on permanent monitoring of appropriate combustion parameters (e.g. O_2, CO content, fuel to air (or oxygen) ratio, unburnt components), the technique uses control technology for achieving the best combustion conditions
Diluent injection	Inert diluents, e.g. flue-gas, steam, water, nitrogen added to combustion equipment reduce the flame temperature and consequently the concentration of NO_X in the flue-gases

Selective catalytic reduction (SCR)	The technique is based on the reduction of NO_X to nitrogen in a catalytic bed by reaction with ammonia (in general aqueous solution) at an optimum operating temperature of around 300-450 °C. One or two layers of catalyst may be applied. A higher NO_X reduction is achieved with the use of higher amounts of catalyst (two layers)
Selective non-catalytic reduction (SNCR)	The technique is based on the reduction of NOX to nitrogen by reaction with ammonia or urea at a high temperature. The operating temperature window must be maintained between 900 °C and 1 050 °C for optimal reaction
Low temperature NO_X oxidation	The low temperature oxidation process injects ozone into a flue-gas stream at optimal temperatures below 150 °C, to oxidise insoluble NO and NO_2 to highly soluble N_2O_5. The N_2O_5 is removed in a wet scrubber by forming dilute nitric acid waste water that can be used in plant processes or neutralised for release and may need additional nitrogen removal

1.20.3. Sulphur oxides (SO_X)

Technique	Description
Treatment of refinery fuel gas (RFG)	Some refinery fuel gases may be sulphur-free at source (e.g. from catalytic reforming and isomerisation processes) but most other processes produce sulphur-containing gases (e.g. off-gases from the visbreaker, hydrotreater or catalytic cracking units). These gas streams require an appropriate treatment for gas desulphurisation (e.g. by acid gas removal — see below — to remove H_2S) before being released to the refinery fuel gas system
Refinery fuel oil (RFO)	desulphurisation by hydrotreatment In addition to selection of low-sulphur crude, fuel desulphurisation is achieved by the hydrotreatment process (see below) where hydrogenation reactions take place and lead to a reduction in sulphur content
Use of gas to replace liquid fuel	Decrease the use of liquid refinery fuel (generally heavy fuel oil containing sulphur, nitrogen, metals, etc.) by replacing it with on-site Liquefied Petroleum Gas (LPG) or refinery fuel gas (RFG) or by externally supplied gaseous fuel (e.g. natural gas) with a low level of sulphur and other undesirable substances. At the individual combustion unit level, under multi-fuel firing, a minimum level of liquid firing is necessary to ensure flame stability
Use of SO_X reducing catalysts additives	Use of a substance (e.g. metallic oxides catalyst) that transfers the sulphur associated with coke from the regenerator back to the reactor. It operates most efficiently in full combustion mode rather than in deep partial-combustion mode. NB: SO_X reducing catalysts additives might have a detrimental effect on dust emissions by increasing catalyst losses due to attrition, and on NO_X emissions by participating in CO promotion, together with the oxidation of SO_2 to SO_3
Hydrotreatment	Based on hydrogenation reactions, hydrotreatment aims mainly at producing low-sulphur fuels (e.g. 10 ppm gasoline and diesel) and optimising the process configuration (heavy residue conversion and middle distillate production). It reduces the sulphur, nitrogen and metal content of the feed. As hydrogen is required, sufficient production capacity is needed. As the technique transfer sulphur from the feed to hydrogen sulphide (H_2S) in the process gas, treatment capacity (e.g. amine and Claus units) is also a possible bottleneck
Acid gas removal e.g. by amine treating	Separation of acid gas (mainly hydrogen sulphide) from the fuel gases by dissolving it in a chemical solvent (absorption). The commonly used solvents are amines. This is generally the first step treatment needed before elemental sulphur can be recovered in the SRU
Sulphur recovery unit (SRU)	Specific unit that generally consists of a Claus process for sulphur removal of hydrogen sulphide (H_2S)-rich gas streams from amine treating units and sour water strippers. SRU is generally followed by a tail gas treatment unit (TGTU) for remaining H_2S removal

Tail gas treatment unit (TGTU)	A family of techniques, additional to the SRU in order to enhance the removal of sulphur compounds. They can be divided into four categories according to the principles applied: - direct oxidation to sulphur - continuation of the Claus reaction (sub-dewpoint conditions) - oxidation to SO_2 and recovering sulphur from SO_2 - reduction to H_2S and recovery of sulphur from this H_2S (e.g. amine process)
Wet scrubbing	In the wet scrubbing process, gaseous compounds are dissolved in a suitable liquid (water or alkaline solution). Simultaneous removal of solid and gaseous compounds may be achieved. Downstream of the wet scrubber, the flue-gases are saturated with water and a separation of the droplets is required before discharging the flue-gases. The resulting liquid has to be treated by a waste water process and the insoluble matter is collected by sedimentation or filtration According to the type of scrubbing solution, it can be: - a non-regenerative technique (e.g. sodium or magnesium-based) - a regenerative technique (e.g. amine or soda solution) According to the contact method, the various techniques may require e.g.: - Venturi using the energy from inlet gas by spraying it with the liquid - packed towers, plate towers, spray chambers. Where scrubbers are mainly intended for SO_X removal, a suitable design is needed to also efficiently remove dust. The typical indicative SO_X removal efficiency is in the range 85-98 %.
Non-regenerative scrubbing	Sodium or magnesium-based solution is used as alkaline reagent to absorb SO_X generally as sulphates. Techniques are based on e.g.: — wet limestone — aqueous ammonia — seawater (see infra)
Seawater scrubbing	A specific type of non-regenerative scrubbing using the alkalinity of the seawater as solvent. Generally requires an upstream abatement of dust
Regenerative scrubbing	Use of specific SO_X absorbing reagent (e.g. absorbing solution) that generally enables the recovery of sulphur as a by-product during a regenerating cycle where the reagent is reused

1.20.4. Combined techniques (SOx, NOx and dust)

Technique	Description
Wet scrubbing	See Section 1.20.3
SNO_X combined technique	Combined technique to remove SOX, NOX and dust where a first dust removal stage (ESP) takes place followed by some specific catalytic processes. The sulphur compounds are recovered as commercial-grade concentrated sulphuric acid, while NO_X is reduced to N_2. Overall SO_X removal is in the range: 94-96,6 %. Overall NO_X removal is in the range: 87-90 %

1.20.5. Carbon monoxide (CO) Technique

Technique	Description
Combustion operation control	The increase in CO emissions due to the application of combustion modifications (primary techniques) for the reduction of NO_X emissions can be limited by a careful control of the operational parameters
Catalysts with carbon monoxide (CO) oxidation promoters	Use of a substance which selectively promotes the oxidation of CO into CO_2 (combustion
Carbon monoxide (CO) boiler	Specific post-combustion device where CO present in the flue-gas is consumed downstream of the catalyst regenerator to recover the energy It is usually used only with partial-combustion FCC units

1.20.6. Volatile organic compounds (VOC)

Technique	Description
Vapour recovery	Volatile organic compounds emissions from loading and unloading operations of most volatile products, especially crude oil and lighter products, can be abated by various techniques e.g.: - Absorption: the vapour molecules dissolve in a suitable absorption liquid (e.g. glycols or mineral oil fractions such as kerosene or reformate). The loaded scrubbing solution is desorbed by reheating in a further step. The desorbed gases must either be condensed, further processed, and incinerated or re-absorbed in an appropriate stream (e.g. of the product being recovered) - Adsorption: the vapour molecules are retained by activate sites on the surface of adsorbent solid materials, e.g. activated carbon (AC) or zeolite. The adsorbent is periodically regenerated. The resulting desorbate is then absorbed in a circulating stream of the product being recovered in a downstream wash column. Residual gas from wash column is sent to further treatment - Membrane **gas separation**: the vapour molecules are processed through selective membranes to separate the vapour/air mixture into a hydrocarbon- enriched phase (permeate), which is subsequently condensed or absorbed, and a hydrocarbon-depleted phase (retentate). - Two-**stage refrigeration/condensation**: by cooling of the vapour/gas mixture the vapour molecules condense and are separated as a liquid. As the humidity leads to the icing-up of the heat exchanger, a two-stage condensation process providing for alternate operation is required. - Hybrid **systems**: combinations of available techniques *NB* Absorption and adsorption processes cannot notably reduce methane emissions
Vapour destruction	Destruction of VOCs can be achieved through e.g. **thermal oxidation** (incineration) or **catalytic oxidation** when recovery is not easily feasible. Safety requirements (e.g. flame arrestors) are needed to prevent explosion. **Thermal oxidation** occurs typically in single chamber, refractory-lined oxidisers equipped with gas burner and a stack. If gasoline is present, heat exchanger efficiency is limited and preheat temperatures are maintained below 180 °C to reduce ignition risk. Operating temperatures range from 760 °C to 870 °C and residence times are typically 1 second. When a specific incinerator is not available for this purpose, an existing furnace may be used to provide the required temperature and residence times. **Catalytic oxidation** requires a catalyst to accelerate the rate of oxidation by adsorbing the oxygen and the VOCs on its surface The catalyst enables the oxidation reaction to occur at lower temperature than required by thermal oxidation: typically ranging from 320 °C to 540 °C. A first preheating step (electrically or with gas) takes place to reach a temperature necessary to initiate the VOCs catalytic oxidation. An oxidation step occurs when the air is passed through a bed of solid catalysts
LDAR (leak detection and repair) programme	An LDAR (leak detection and repair) programme is a structured approach to reduce fugitive VOC emissions by detection and subsequent repair or replacement of leaking components. Currently, sniffing (described by EN 15446) and optical gas imaging methods are available for the identification of the leaks. **Sniffing method**: The first step is the detection using hand-held VOC analysers measuring the concentration adjacent to the equipment (e.g. by using flame ionisation or photo-ionisation). The second step consists of bagging the component to carry out a direct measurement at the source

	of emission. This second step is sometimes replaced by mathematical correlation curves derived from statistical results obtained from a large number of previous measurements made on similar components. **Optical gas imaging methods**: Optical imaging uses small lightweight hand- held cameras which enable the visualisation of gas leaks in real time, so that they appear as 'smoke' on a video recorder together with the normal image of the component concerned to easily and rapidly locate significant VOC leaks. Active systems produce an image with a back-scattered infrared laser light reflected on the component and its surroundings. Passive systems are based on the natural infrared radiation of the equipment and its surroundings
VOC diffuse emissions monitoring	Full screening and quantification of site emissions can be undertaken with an appropriate combination of complementary methods, e.g. Solar occultation flux (SOF) or differential absorption lidar (DIAL) campaigns. These results can be used for trend evaluation in time, cross checking and updating/validation of the ongoing LDAR programme. **Solar occultation flux (SOF)**: The technique is based on the recording and spectrometric Fourier Transform analysis of a broadband infrared or ultraviolet/ visible sunlight spectrum along a given geographical itinerary, crossing the wind direction and cutting through VOC plumes. **Differential absorption LIDAR (DIAL)**: DIAL is a laser-based technique using differential adsorption LIDAR (light detection and ranging) which is the optical analogue of sonic radio wave-based RADAR. The technique relies on the back- scattering of laser beam pulses by atmospheric aerosols, and the analysis of spectral properties of the returned light collected with a telescope
High-integrity equipment	High-integrity equipment includes e.g.: - valves with double packing seals - magnetically driven pumps/compressors/agitators - pumps/compressors/agitators fitted with mechanical seals instead of packing - high-integrity gaskets (such as spiral wound, ring joints) for critical applications

1.20.7. Other techniques

Techniques to prevent or reduce emissions from flaring	**Correct plant design**: includes sufficient flare gas recovery system capacity, the use of high-integrity relief valves and other measures to use flaring only as a safety system for other than normal operations (start-up, shutdown, emergency). **Plant management**: includes organisational and control measures to reduce flaring events by balancing RFG system, using advanced process control, etc. **Flaring devices design**: includes height, pressure, assistance by steam, air or gas, type of flare tips, etc. It aims at enabling smokeless and reliable operations and ensuring an efficient combustion of excess gases when flaring from non- routine operations. **Monitoring and reporting**: Continuous monitoring (measurements of gas flow and estimations of other parameters) of gas sent to flaring and associated parameters of combustion (e.g. flow gas mixture and heat content, ratio of assistance, velocity, purge gas flow rate, pollutant emissions). Reporting of flaring events makes it possible to use flaring ratio as a requirement included in the EMS and to prevent future events. Visual remote monitoring of the flare can also be carried out by using colour TV monitors during flare events
Choice of the catalyst promoter to avoid dioxins formation	During the regeneration of the reformer catalyst, organic chloride is generally needed for effective reforming catalyst performance (to re-establish the proper chloride balance in the catalyst and to assure the correct dispersion of the metals). The choice of the appropriate

	chlorinated compound will have an influence on the possibility of emissions of dioxins and furans
Solvent recovery for base oil production processes	The **solvent recovery** unit consists of a distillation step where the solvents are recovered from the oil stream and a stripping step (with steam or an inert gas) in a fractionator. The solvents used may be a mixture (DiMe) of 1,2-dichloroethane (DCE) and dichloromethane (DCM). In wax-processing units, solvent recovery (e.g. for DCE) is carried out using two systems: one for the deoiled wax and another one for the soft wax. Both consist of heat-integrated flashdrums and a vacuum stripper. Streams from the dewaxed oil and waxes product are stripped for removal of traces of solvents

1.21 Description of techniques for the prevention and control of emissions to water

1.21.1. Waste water pretreatment

Pretreatment of sour water streams before reuse or treatment	Send generated sour water (e.g. from distillation, cracking, coking units) to appropriate pretreatment (e.g. stripper unit)
Pretreatment of other waste water streams prior to treatment	To maintain treatment performance, appropriate pretreatment may be required

1.21.2. Waste water treatment

Removal of insoluble substances by recovering oil	These techniques generally include: - API Separators (APIs) - Corrugated Plate Interceptors (CPIs) - Parallel Plate Interceptors (PPIs) - Tilted Plate Interceptors (TPIs) - Buffer and/or equalisation tanks
Removal of insoluble substances by recovering suspended solid and dispersed oil	These techniques generally include: - Dissolved Gas Flotation (DGF) - Induced Gas Flotation (IGF) - Sand Filtration
Removal of soluble substances including biological treatment and clarification	Biological treatment techniques may include: - Fixed bed systems - Suspended bed systems. One of the most commonly used suspended bed system in refineries WWTP is the activated sludge process. Fixed bed systems may include a biofilter or trickling filter
Additional treatment step	A specific waste water treatment intended to complement the previous treatment steps e.g. for further reducing nitrogen or carbon compounds. Generally used where specific local requirements for water preservation exist.

Annex 2: Improvement Conditions

Based in the information in the Operators Regulation 60 Notice responses and our own records of the capability and performance of the installation at this site, we consider that we need to set improvement conditions so that the outcome of the techniques detailed in the BAT Conclusions are achieved by the installation. These additional improvement conditions are set out below - justifications for them are provided at the relevant section of the decision document.

Table S1.3 Improvement programme requirements		
Reference	**Requirement**	**Date**
IC18	The Operator shall submit a diffuse VOC monitoring plan to the Environment Agency for written approval. This shall include but not be limited to: • The nature of the material handled; • The sources of emissions; • Justification of the monitoring techniques selected • How the monitoring data will be recorded and reviewed The plan shall take into account the appropriate techniques for VOC monitoring specified in BAT conclusion 6 for the Refining of Mineral Oil and Gas. The Operator shall implement the approved plan and produce and submit an annual report on the results of the monitoring undertaken under the plan.	01/11/2019
IC19	The operator shall submit a written monitoring plan to the Environment Agency for approval that includes: (a) proposals to undertake representative monitoring of hazardous pollutants (as set out in the Environment Agency's Surface Water Pollution Risk Assessment guidance) in the discharge to surface water from point W1 including the parameters to be monitored, frequencies of monitoring and methods to be used. The operator shall carry out the monitoring in accordance with the Environment Agency's written approval.	01/07/2019
IC20	The operator shall submit a written report to the Environment Agency for approval that includes: the results of an assessment of the impact of the emissions to surface water from the site in accordance with the Environment Agency's Surface Water Pollution Risk Assessment Guidance available on our website. The report shall: a) be based on the parameters monitored in IC19 above; and b) include proposals for appropriate measures to mitigate the impact of any emissions where the assessment determines they are liable to cause pollution, including timescales for implementation of individual measures.	01/11/2020

Table S1.3 Improvement programme requirements		
Reference	**Requirement**	**Date**
IC21	The Operator shall review the measures and procedures in place to prevent and reduce/mitigate venting of gas from the process. The review must consider in detail all available options, both combustion and non-combustion based (including but not necessarily limited to flaring, vapour recovery, scrubbing and adsorption), for the reduction/abatement/mitigation of waste gas so as to minimise its environmental impacts as far as available techniques allow. A written report summarising the findings shall be submitted to the Agency for approval, along with a timetable for implementing improvements. The Operator shall implement the improvements to the approved timetable.	01/05/2020
IC22	The Operator shall carry out an assessment of the options available for segregation of waste water streams and the viability of their implementation; to reduce the volume of process water produced, as detailed in BAT conclusion 11 for the Refining of Mineral Oil and Gas. A written report summarising the findings shall be submitted to the Agency for approval, along with a timetable for implementing viable improvements identified. The Operator shall implement the improvements to the approved timetable.	30/04/2019