Permitting decisions

Variation

We have decided to grant the variation for Greatham Works operated by Venator Materials UK Limited.

The variation number is EPR/TP3532PK/V010.

We consider in reaching that decision we have taken into account all relevant considerations and legal requirements and that the permit will ensure that the appropriate level of environmental protection is provided.

1 Purpose of this document

This decision document provides a record of the decision making process. It:

- highlights key issues in the determination
- summarises the decision making process in the decision checklist to show how all relevant factors have been taken into account
- shows how we have considered the consultation responses

Unless the decision document specifies otherwise we have accepted the applicant's proposals.

Read the permitting decisions in conjunction with the environmental permit and the variation notice.

2 Key issues of the decision

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Glossary

BAT	best available techniques
BAT-AEEL	BAT Associated Energy Efficiency Level
BAT-AEL	BAT Associated Emission Level
BREF	best available techniques reference document
CEM	continuous emissions monitor
COMAH	Control of Major Accident Hazards
ELV	emission limit value set out in either IED or LCPD
IED	Industrial Emissions Directive 2010/75/EC
LCP	large combustion plant – combustion plant subject to Chapter III of IED
MCR	Maximum Continuous Rating
MSUL/MSDL	Minimum start up load/minimum shut-down load
NOx	Oxides of nitrogen (NO plus NO_2 expressed as NO_2)
SCR	selective catalytic reduction
SNCR	selective non catalytic reduction

2.1.1 Overview of this variation

Greatham Works is a top tier COMAH installation, manufacturing titanium dioxide pigment and titanium tetrachloride via the chloride route. The scheduled activities permitted at the installation are listed below:

- Section 4.2 Part A(1)(a)(v)(a) Producing inorganic chemicals;
- Section 5.4 Part A(1)(a)(ii) Disposal of non-hazardous waste in a facility with a capacity exceeding 50 tonnes per day by physico-chemical treatment;
- Section 1.1 Part A(1)(a) Burning any fuel in an appliance with a rated input of 50 megawatts or more (Large Combustion Plant – LCP 354).

Steam at an operating pressure of 24 barg and operating temperature 245-275^{0}C is raised on site using four existing boilers that emit through a common stack (LCP 354, existing emission point A250).

Since 01/01/2016, LCP 354 has operated under the interim compliance route set by the Transitional National Plan (TNP) for Large Combustion Plants (LCP) according to Chapter III of the Industrial Emissions Directive (IED). LCP that operate under the TNP will need to meet the applicable emission limits set in Annex V of IED by the end of the TNP on 30/06/2020.

Venator Materials UK Limited assessed that remedial work to meet the IED Annex V emission limits on the existing boilers composing LCP 354 was uneconomic due to their age and the downrate that would have been necessary when modifying the burners to achieve compliance with emission limits for oxides of nitrogen.

The scope of this variation is to replace the existing LCP 354 with a new, more modern and energy efficient boiler plant (LCP 671) that will provide the same service of the existing LCP 354 to be replaced and the connection of the new boiler plant to the existing facilities at the installation. LCP 354 will be decommissioned after LCP 671 is commissioned and started-up. The remainder of the regulated facility will be unchanged.

The new LCP 671 consists of four fire tube boilers with a total capacity of 108tph steam at 255-275^{0}C and 24barg and a net rated thermal input of 81.6MW.

2.1.2 How we reached our decision

(a) **Receipt of Application**

The application was duly made on 29/07/19. This means we considered it was in the correct form and contained sufficient information for us to begin our determination but not that it necessarily contained all the information we would need to complete that determination: see below.

The applicant made no claim for commercial confidentiality. We have not received any information in relation to the application that appears to be confidential in relation to any party.

(b) Consultation on the Application

We carried out consultation on the application in accordance with the Environmental Permitting Regulations (EPR) and our statutory Public Participation Statement. We consider that this process satisfies, and frequently goes beyond the requirements of the Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, which are directly incorporated into the IED, which applies to the Installation and the application. We have also taken into account our obligations under the Local Democracy, Economic Development and Construction Act 2009 (particularly Section 23). This requires us, where we consider it appropriate, to take such steps as we consider appropriate to secure the involvement of representatives of interested persons in the exercise of our functions,

by providing them with information, consulting them or involving them in any other way. In this case, our consultation already satisfies the Act's requirements.

We advertised the application by a notice placed on our website, which contained all the information required by the IED, including telling people where and when they could see a copy of the application. The advertising period ran between 08/08/19 and 07/09/19.

We made a copy of the application and all other documents relevant to our determination (see below) available to view on our Citizenspace web based consultation portal and the public register. Anyone wishing to see these documents could also do so and arrange for copies to be made.

We sent copies of the application to the following bodies, which includes those with whom we have "Working Together Agreements":

- Public Health England
- The Director of Public Health
- The Health and Safety Executive
- The Food Standards Agency
- Hartlepool Borough Council – Environmental Health

These are bodies whose expertise, democratic accountability and/or local knowledge make it appropriate for us to seek their views directly. Note under our Working Together Agreement with Natural England, we only inform Natural England of the results of our assessment of the impact of the installation on designated Habitats sites.

Further details along with a summary of consultation comments and our response to the representations we received can be found in Section 4. We have taken all relevant representations into consideration in reaching our determination.

(c) Requests for Further Information

Although we were able to consider the application duly made, we did in fact need more information in order to determine it, and issued requests for information / information notices on 16/08/19 and 21/08/19. A copy of each information notice and the response was placed on our public register.

2.1.3 Chapter III of the Industrial Emissions Directive

Chapter III of the Industrial Emissions Directive (IED) applies to new and existing large combustion plants (LCPs) which have a total rated thermal input which is greater or equal to 50MWth. Articles 28 and 29 explain exclusions to Chapter III and aggregation rules respectively.

The aggregation rule is as follows:

- A Large Combustion Plant (LCP) has a total rated thermal input ≥50MWth.
- Where waste gases from two or more separate combustion plant discharge through a common windshield, the combination formed by the plants are considered as a single large combustion plant.
- The size of the LCP is calculated by adding the capacities of the plant discharging through the common windshield disregarding any units <15MWth.

A "common windshield" is frequently referred to as a common structure or windshield and may contain one or more flues.

The boilers on this site consist of four combustion units aggregated through a common discharge (new emission point A251), with a total rated thermal input ≥ 50MWth making it an LCP.

Chapter III lays out special provisions for LCP and mandatory maximum ELVs are defined in Part 2 of Annex V for new plant, however it is worth noting that best available techniques (BAT)

requirements may lead to the application of lower ELVs than these mandatory values. Mandatory ELVs cannot be exceeded even if a site specific assessment can be used to justify emission levels higher than BAT.

2.1.4 Large Combustion Plant(s) description and number

The Permit uses the DEFRA LCP reference numbers to identify each LCP. The LCP permitted is as follows: **LCP 671**.

This LCP consists of four 20.4 MWth boilers which vent via a single stack. The LCP units burns natural gas.

2.1.5 Net thermal input

The applicant has stated that the net thermal input of LCP671 is 81.6 MWth.

The applicant has not provided sufficient information to demonstrate the net thermal input of the LCP as the plant has not been built yet. Consequently we have set improvement condition IC12, requiring them to provide this information within 4 months from completion of commissioning of LCP 671.

2.1.6 Minimum start-up and minimum shut-down load

The applicant has proposed the following sets of three process criteria to define the minimum start-up load (MSUL) and minimum shut-down load (MSDL) for each individual boiler unit. The technical justification for the proposed parameters was set out in the document titled '*Start-up and Shut-down thresholds for New Boilers*', dated 11/09/19, submitted in response to a request for further information served by us on 16/08/19.

MSUL - when all the criteria listed below for an individual boiler have been met:

1) Steam flow ≥ 10 tph
   (Technical justification: according to the application documents this is the minimum turndown steam production rate of each boiler; the operator has explained that, according to manufacturer's information, the minimum steam flow will need to be achieved to ensure the steam is superheated to an acceptable temperature for the main steam process users, which are the fluid energy mills).
2) Steam pressure ≥ 23 barg
   (Technical justification: this is the lower range of the operating pressure of the high pressure steam distribution system)
3) Steam temperature ≥ 255^{o}C
   (Technical justification: this is the minimum operating temperature of the superheated steam at the given steam pressure. Steam at <255°C will be automatically routed to atmosphere. Once 255°C is achieved, the feed forward valve opens allowing the steam into the ring main).

MSDL - when all the criteria listed below for an individual boiler have been met:

1) Steam flow < 10 tph
2) Steam pressure < 23 barg
3) Steam temperature < 255^{o}C

The same technical justifications of MSUL apply to the settings proposed for MSDL.

We consider the discrete parameters proposed by the operator consistent with the list in the Annex of the EU Commission Implementing Decision 2012/249/EU, as referred to by Article 9 of the same EU Commission Implementing Decision, concerning the determination of start-up and shut-down periods for the purposes of the Industrial Emissions Directive (IED). We have therefore accepted the technical justification provided by the operator for the specification of these parameters and the proposed settings.

However, the proposal from the operator does not meet in full the requirements of Article 9 of the EU Commission Implementing Decision 2012/249/EU, which requires to define at least three criteria, with the end of start-up or start of shut-down periods reached when at **least two of the criteria** have been met.

We have therefore taken into account the technical justification provided by the applicant and specified MSUL and MSDL in compliance with Article 9 of EU Commission Implementing Decision 2012/249/EU as follows:

Table 1 - Minimum Start-up and Minimum Shut-down points

Emission Point and Unit Reference	**"Minimum Start-Up Load"** **When two of the criteria listed below for the LCP or unit have been met.**	**"Minimum Shut-Down Load"** **When two of the criteria listed below for the LCP or unit have been met.**
LCP 671	When two of the criteria listed below for an individual boiler of LCP 671 have been met: 1) Steam flow ≥ 10 tph 2) Steam pressure ≥ 23 barg 4) Steam temperature ≥ 255°C	When two of the criteria listed below for an individual boiler of LCP 671 have been met: 1) Steam flow < 10 tph 2) Steam pressure < 23 barg 3) Steam temperature < 255°C

The applicant has provided sufficient information to set the minimum start up and minimum shut-down load (MSUL/MSDL), however, as the plant has not been built yet, they have stated that the proposed parameters will need to be confirmed during commissioning and subject to adjustment if necessary. Consequently we have set improvement condition IC12, requiring them to provide this information within 4 months from completion of commissioning of LCP 671. Table S1.4 in the permit has also been completed to reflect this.

2.1.7 Large Combustion Plant Best Available techniques reference document conclusions

We have reviewed the permit application against the revised BAT Conclusions (BATc) for the large combustion plant sector published on 31st July 2017 (LCP BAT conclusions).

BAT conclusions 1 – 17 applicable to all sites and 40 – 45 applicable to plant combustion gaseous fuels (but excluding those relating to iron and steel and chemical industries) have been considered. The response to each is set out in section 2.1.13 of this decision document.

The BAT AELs for emissions of NOx and CO have been included in Tables S3.1 and S3.1a of the permit.

2.1.8 The Installation's environmental impact

Regulated activities can present different types of risk to the environment, these include noise and vibration, accidents, fugitive emissions to air and water; as well as point source releases to air, discharges to ground or groundwater, energy efficiency / global warming potential and

generation of waste and other environmental impacts. Consideration may also have to be given to the effect of emissions being subsequently deposited onto land (where there are ecological receptors). The key factors relevant to this determination are discussed in this and other sections of this document.

For an installation of this kind, the principal emissions are those to air, although we also consider those to land.

The next sections of this document explain how we have approached the critical issue of assessing the likely impact of the emissions to air from the Installation on human health and the environment.

(a) Assessment Methodology

(i) Application of Environment Agency Web Guide for Air Emissions Risk Assessment

A methodology for risk assessment of point source emissions to air, which we use to assess the risk of applications we receive for permits, is set out in our Web Guide and has the following steps:

- Describe emissions and receptors
- Calculate process contributions
- Screen out insignificant emissions that do not warrant further investigation
- Decide if detailed air modelling is needed
- Assess emissions against relevant standards
- Summarise the effects of emissions

The methodology uses a concept of "process contribution (PC)", which is the estimated concentration of emitted substances after dispersion into the receiving environmental media at the point where the magnitude of the concentration is greatest. The guidance provides a simple method of calculating PC primarily for screening purposes and for estimating process contributions where environmental consequences are relatively low. It is based on using dispersion factors. These factors assume worst case dispersion conditions with no allowance made for thermal or momentum plume rise and so the process contributions calculated are likely to be an overestimate of the actual maximum concentrations. More accurate calculation of process contributions can be achieved by mathematical dispersion models, which take into account relevant parameters of the release and surrounding conditions, including local meteorology.

(ii) Use of Air Dispersion Modelling

For LCP applications, we usually require the applicant to submit a full air dispersion model as part of their application, for the key pollutants. Air dispersion modelling enables the PC to be predicted at any environmental receptor that might be impacted by the plant.

Once short-term and long-term PCs have been calculated in this way, they are compared with Environmental Quality Standards (EQS).

Where an EU EQS exists, the relevant standard is the EU EQS. Where an EU EQS does not exist, our guidance sets out a National EQS (also referred to as Environmental Assessment Level - EAL) which has been derived to provide a similar level of protection to human health and the environment as the EU EQS levels. In a very small number of cases, e.g. for emissions of lead, the National EQS is more stringent that the EU EQS. In such cases, we use the National EQS standard for our assessment.

National EQSs do not have the same legal status as EU EQSs, and there is no explicit requirement to impose stricter conditions than BAT in order to comply with a national EQS. However, national EQSs are a standard for harm and any significant contribution to a breach is likely to be unacceptable.

PCs are considered **insignificant** if:

- the **long-term** process contribution is less than **1%** of the relevant EQS; and
- the **short-term** process contribution is less than **10%** of the relevant EQS.

The **long term** 1% process contribution insignificance threshold is based on the judgements that:

- It is unlikely that an emission at this level will make a significant contribution to air quality;
- The threshold provides a substantial safety margin to protect health and the environment.

The **short term** 10% process contribution insignificance threshold is based on the judgements that:

- spatial and temporal conditions mean that short term process contributions are transient and limited in comparison with long term process contributions;
- the threshold provides a substantial safety margin to protect health and the environment.

Where an emission is screened out in this way, we would normally consider that the applicant's proposals for the prevention and control of the emission to be BAT. That is because if the impact of the emission is already insignificant, it follows that any further reduction in this emission will also be insignificant.

However, where an emission cannot be screened out as insignificant, it does not mean it will necessarily be significant.

For those pollutants which do not screen out as insignificant, we determine whether exceedances of the relevant EQS are likely. This is done through detailed audit and review of the applicant's air dispersion modelling taking background concentrations and modelling uncertainties into account. Where an exceedance of an EU EQS is identified, we may require the applicant to go beyond what would normally be considered BAT for the Installation or we may refuse the application if the applicant is unable to provide suitable proposals. Whether or not exceedances are considered likely, the application is subject to the requirement to operate in accordance with BAT.

This is not the end of the risk assessment, because we also take into account local factors (for example, particularly sensitive receptors nearby such as Sites of Special Scientific Interest (SSSIs), Special Areas of Conservation (SACs) or Special Protection Areas (SPAs)). These additional factors may also lead us to include more stringent conditions than BAT.

If, as a result of reviewing of the risk assessment and taking account of any additional techniques that could be applied to limit emissions, we consider that emissions **would cause significant pollution**, we would refuse the application.

(b) Assessment of Impact on Air Quality

The Applicant's assessment of the impact of air quality is set out in *'Venator Boiler Upgrade – Air Quality Assessment Final Report'* dated September 2019 of the application. The assessment comprises:

- Dispersion modelling of emissions to air from the operation of the installation.
- A study of the impact of emissions on nearby sensitive conservation sites.

This section of the decision document deals primarily with the dispersion modelling of emissions to air from the installation and its impact on local air quality. The impact on conservation sites is considered in section 2.1.8 (c).

The Applicant has assessed the installation's potential emissions to air against the relevant air quality standards, and the potential impact upon local conservation sites and human health. These assessments predict the potential effects on local air quality from the installation's stacks emissions using the ADMS (Atmospheric Dispersion Modelling System) dispersion model, which is a commonly used computer model for regulatory dispersion modelling. The model used 5 years of meteorological data collected from the weather station at Teesside airport which is located at approximately 19 Km to the south west of the installation between 2013 and 2017. The impact of the terrain surrounding the site upon plume dispersion was not considered in the dispersion modelling because the terrain gradient is less than 1:10.

The air impact assessments, and the dispersion modelling upon which they were based, employed the following assumptions.

- Since the new boilers of LCP 671 are not installed yet, and therefore actual monitoring data cannot be obtained, the modelled emissions and process parameters for the new boilers of LCP 671 were based on information provided by the boilers' vendor. In the absence of actual monitored emission data for the new boilers, it was assumed that the emissions of oxides of nitrogen (NOx) and carbon monoxide (CO) occur at the vendor guaranteed levels, based on the Best Available Technique Associated Emission Levels (BAT-AELs) in the BAT Conclusions and / or the emission limit values (ELVs) in Annex V of the IED.
- Two operating scenarios were included in the model for the operations of the new boilers:
    - For long-term (annual average) predictions, emissions corresponding to the average annual operation of the new boilers of LCP 671 were modelled considering their annual average duty at 56% of their maximum continuous rate corresponding to an average steam production of 45 tonnes per hour; this is based on a review of the current average steam demand at the installation;
    - For short-term (daily average) predictions, emissions corresponding to the maximum steam production rate of 108 tonnes per hour from the new boilers of LCP 671 were modelled. This is a peak emission scenario, corresponding to a worst case, atypical, short term operation.
- Other equipment emitting NOx and CO from the same installation was included in the air dispersion model. These emission sources are associated with the already permitted operations of the chemical works at the installation and are unchanged as a result of this variation.

  For what concerns the existing permitted emission sources, two scenarios were modelled for short-term predictions of CO: normal operation (when the off-gases from the existing ICON 1 and ICON 2 integrated chlorination and oxidation plants are abated through the respective thermal oxidisers, existing permitted emission points A122/1, A122/2) and worse case (abnormal) operations (when the ICON 1 and 2 thermal oxidisers are not in operation, with associated emissions of unabated carbon monoxide discharged to the atmosphere via the ICON 1 and 2 divert stacks, existing permitted emission points A19 and A202).
- Since the variation consists of a proposal to replace an existing large combustion plant (LCP354) with a new plant, the applicant modelled the emissions of NOx and CO from the existing LCP354 to allow a direct comparison of impacts between the current permitted operations and the proposed operation of the new LCP671, for consistent operating scenarios.

We are in agreement with the modelling approach: the assumptions underpinning the modelled operating scenarios have been checked and are reasonably precautionary.

The applicant used the values from the DEFRA background mapping system as background concentrations.

The applicant provided us with modelled output showing the concentration of key pollutants at a number of specified locations within the surrounding area.

The Environment Agency Air Quality Modelling & Assessment Unit (AQMAU) carried out check modelling and sensitivity analysis using air dispersion modelling software ADMS 5 Version 5.2 to audit these outputs and confirm the likely predicted peak ground level concentrations as well as auditing predicted concentrations at the receptors.

The way in which the applicant used dispersion models, its selection of input data, use of background data and the assumptions it made have been reviewed by the Environment Agency to establish the robustness of the applicant's air impact assessment. The output from the model has then been used to inform further assessment of health impacts and impact on habitats and conservation sites.

Our review of the applicant's assessment leads us to agree with the applicant's conclusions.

The applicant's modelling predictions are summarised in the following sections.

(i) Assessment of Air Dispersion Modelling Outputs

The modelling predictions are summarised in the tables below.

The table below shows the ground level concentrations at the most impacted human receptors, considering LCP 671 and all the other relevant emission sources of NOx and CO at the installation, during normal operations (i.e. normal operations of ICON1 and ICON2 thermal oxidisers). Where emissions screen out as insignificant, the background pollutant levels are not considered within the assessment in accordance with our H1 screening process.

Table 2 - Process contributions at most impacted human receptors (LCP 671 + existing equipment - normal operations)

Pollutant	EQS / EAL (µg/m³)	Process Contribution (PC) (µg/m³)	PC as % of EQS / EAL
NO_2 Annual	40	0.07 Note 1	0.2%
NO_2 99.79th %ile Hourly mean	200	0.89 Note 2	0.45%
CO 8 hour mean	10,000	6 Note 2, Note 3	0.06%
CO 1-hour mean	30,000	7 Note 2, Note 3	0.02%

Notes:

1. At human receptor H10, x = 452309 y = 528820;
2. At human receptor H1, x = 450056, y = 526388;
3. Predictions are based on normal operations of the existing ICON1 and ICON2 thermal oxidisers.

From the table above the following emissions can be screened out as insignificant in that the process contribution is <1% of the long term EQS/EAL and <10% of the short term EAQ/EAL at the most impacted discrete receptors. These are:

- NO_2 annual mean (at receptors), NO_2 hourly mean, 8-hourly mean carbon monoxide and hourly mean carbon monoxide.

Therefore we consider the applicant's proposals for preventing and minimising the emissions of these substances to be BAT for LCP 671 subject to the audit of BAT considered later in this document.

For what concerns the impact of the existing permitted emission sources, the applicant modelled also the operation of the new LCP 671 boilers, along with the worse-case (abnormal) scenario when the existing ICON 1 and 2 thermal oxidisers are not in operation, with associated emissions of unabated carbon monoxide discharged to the atmosphere via the ICON 1 and 2 divert stacks (existing permitted emission points A19 and A202). When considering this scenario, the applicant predicted that PCs are not insignificant for both hourly and 8-hourly EQS/EAL for CO. However, they have also concluded that the PEC will not lead to an exceedance of any relevant EQS/EAL. The table below shows the ground level concentrations for this scenario at the most impacted human receptors:

Table 3 - Process contributions at most impacted human receptors (LCP 671 + existing equipment - abnormal operations)

Pollutant	EQS / EAL (µg/m³)	Background	Process Contribution (PC) (µg/m³)	PC as % of EQS / EAL	PEC (µg/m³)	PC as % of EQS / EAL
CO 8 hour mean	10,000	546 Note 1	6,823 Note 1	68%	7369 Note 1	74%
CO 1-hour mean	30,000	542 Note 2	8163 Note 2	27%	8705	29%

Notes:

1. At human receptor H9, x = 451607, y = 528989;
2. At human receptor H1, x = 450056, y = 526388;

(ii) Consideration of key pollutants

- Nitrogen dioxide (NO_2)

The impact on air quality from NO_2 emissions has been assessed against the EU EQS of 40 µg/m³ as a long term annual average and a short term hourly average of 200 µg/m³. The model assumes a 70% NO_x to NO_2 conversion for the long term and 35% for the short term assessment in line with Environment Agency guidance on the use of air dispersion modelling.

The above tables show that the long term PC is less than 1% of the EU EQS and the short term PC is less than 10% of the EU EQS at sensitive receptors and so can be screened out as insignificant. Therefore we consider the applicant's proposals for preventing and minimising the emissions of these substances is likely to be BAT.

- Carbon Monoxide

The above table shows that for CO emissions, for the normal operations of the installation, the peak long term PC is less than 1% of the EAL/EQS and the peak short term PC is less than 10% of the EAL/EQS and so can be screened out as insignificant. Therefore we consider the Applicant's proposals for preventing and minimising the emissions of these substances to be BAT.

When considering the abnormal operation of the installation, when the existing ICON 1 and 2 thermal oxidisers are not in operation, with associated emissions of unabated carbon monoxide (CO) discharged to the atmosphere via the ICON 1 and 2 divert stacks (existing permitted emission points A19 and A202), the emissions from the installation are such that the PEC will not lead to an exceedance of any relevant EQS/EAL.

It should be noted that the concentrations of CO at the receptors during abnormal operations of ICON1 and ICON2 stacks are essentially not affected by the emissions of CO from the new boilers of LCP 671 that are in the scope of this variation. Therefore our conclusion that the operating techniques proposed emissions for LCP 671 represent BAT remain unaffected.

- Dust

Natural gas is an ash-free fuel and high efficiency combustion in modern equipment does not generate additional particulate matter. Hence, dust emissions from burning natural gas, were not considered to be significant were not modelled by the applicant. We agree with this approach.

- Sulphur Dioxide

Natural gas, that meets the standard for acceptance into the National Transmission System, is considered to be sulphur free fuel. Hence, sulphur dioxide emissions from burning natural gas, were not considered to be significant were not modelled by the applicant. We agree with this approach.

(c) Impact on non-statutory and statutory conservation sites

(i) Sites Considered

The following non-statutory local wildlife and conservation sites are located within 2 km of the Installation:

- Teesmouth National Nature Reserve (NNR)
- Seaton Dunes and Common Local Natural Reserve (LNR)
- Queen's Meadow Local Wildlife Site (LWS)
- Phillips Tank Farm LWS
- Greatham North West LWS
- Brenda Road brownfield LWS
- Greatham Creek North Bank LWS
- Greenabella Marsh LWS
- Brenda Road Sewage Works LWS
- Hartlepool Power Station LWS
- Seaton Common LWS
- Zinc Works Field LWS

The following European conservation sites, statutorily protected according to the Conservation of Habitats and Species Regulations, are within the relevant screening distance of 10 km from the installation:

- Teesmouth and Cleveland Coast Special Protection Area (SPA) (UK9006061)
- Teesmouth and Cleveland Coast Ramsar (UK11068)

The following Sites of Special Scientific Interest (SSSI), statutorily protected according to Wildlife and Countryside Act 1981 as amended by the Countryside and Rights of Way Act (CRoW) 2000, underpin (and partially overlapping to) the designation of the above European conservation sites, within the relevant screening distance of 2 km from the installation:

- Teesmouth and Cleveland Coast SSSI
- Seals sands SSSI (archived SSSI)

The modelling predicted pollutant concentrations at ecological receptors

(ii) Non-statutory conservation sites

The applicant's modelling predicted NOx concentrations at the locations of the non-statutory ecological receptors listed above.

As per our web guidance, for local conservation sites, we consider insignificant emissions that meet both of the following criteria:

- the short-term PC is less than 100% of the short-term environmental standard
- the long-term PC is less than 100% of the long-term environmental standard

Therefore, we don't consider background concentrations in screening the impacts on local conservation sites. The table below show the ground level concentrations at the most impacted ecological receptor – Greenabella Marsh LWS:

Table 4 - Modelled NOx predictions at most affected non-statutory ecological receptor (Greenabella Marsh LWS)

Pollutant	Critical Level / Critical Load	Process Contribution (PC)	PC as % of EQS / EAL
Direct Impacts[1]			
NO_x Annual (µg/m³)	30	1.01	3.4%
NO_x Daily Mean (µg/m³)	75	10.02	13.4%
Deposition Impacts[1]			
N Deposition (kg N/ha/yr)	20	0.10	0.5%
Acidification - Nitrogen Dep (Keq/ha/yr)	N/A[2]	0.007	N/A[2]

Notes

1. Direct impact units are µg/m³ and deposition impact units are kg N/ha/yr or Keq/ha/yr.
2. According to APIS website (http://www.apis.ac.uk/), for this location and habitat (x = 451748, y = 526853, coastal saltmarsh), there is no comparable acid critical load class for which the acid critical load function in calculated. The soil base empirical critical load (based on the dominant soil) for grid square is 4.00 (keq/ha/yr) and the PC is 0.175% of this figure.

The tables above show that the PCs are below the critical levels or loads and can be considered insignificant in that the process contribution is <100% of the long term and short term critical loads / critical levels. These are:

- NO_2 annual mean, NO_2 daily mean, nitrogen deposition and acidification.

We are therefore satisfied that the Installation will not cause significant pollution at the sites.

(iii) Statutory conservation sites

Ground level concentrations of oxides of nitrogen were predicted at the location of 11 discrete receptors (E1 to E10, E15, with the same notation of the application document in *'Venator Boiler Upgrade – Air Quality Assessment Final Report'* dated September 2019) in proximity of the installation at the boundaries of the statutory conservation sites under assessment (Teesmouth and Cleveland Coast SPA / Ramsar / SSSI and Seals Sands SSSI). Ground level concentrations of oxides of nitrogen were also modelled and mapped over the modelling domain (isopleth curves).

Since the variation consists of a proposal to replace an existing large combustion plant (LCP 354) with a new plant, the applicant modelled the emissions of nitrogen oxides from the existing LCP 354 to allow a direct comparison of impacts between the current permitted operations and the proposed operation of the new LCP 671, for consistent operating scenarios.

The following tables present the modelling results taken from the assessment submitted by the applicant:

Table 5 - Impact assessment for emissions of NOx

Receptor	Critical Levels (CL)	Background [5]	Averaging Time	This variation [6] (New LCP 671 + existing chemical operations unchanged)				Existing permitted operations [6] (Existing LCP 354 + existing chemical operations unchanged)			
				NOx PC[1]		NOx PEC [1]		NOx PC [1]		NOx PEC[1]	
	µg / m³	µg / m³		µg / m³	% CL	µg / m³	% CL	µg / m³	% CL	µg / m³	% CL
E1	75	18.99	24 hrs	7.01	9.3%	-	-	**7.65**	**10.2%**	**-**	**-**
	30		1 Year	0.46	1.5%	19.44	65% [3]	0.57	1.9%	19.55	65% [3]
E2	75	21.41	24 hrs	2.67	3.6%	-	-	4.25	5.7%	-	-
	30		1 Year	0.29	0.96%	N/A [2]	N/A [2]	**0.38**	**1.3%**	**21.79**	**73%**
E3	75	42.52	24 hrs	5.68	7.6%	-	-	3.41	4.5%	-	-
	30		1 Year	**0.66**	**2.2%**	**43.18**	**144%**	**0.53**	**1.8%**	**43.05**	**144%**
E4	75	42.52	24 hrs	2.83	3.8%	-	-	7.38	9.8%	-	-
	30		1 Year	0.29	0.96%	N/A [2]	N/A [2]	**0.67**	**2.2%**	**43.19**	**144%**
E5	75	42.52	24 hrs	1.49	2.0%	-	-	5.33	7.1%	-	-

Receptor	Critical Levels (CL)	Background [5]	Averaging Time	This variation [6] (New LCP 671 + existing chemical operations unchanged)				Existing permitted operations [6] (Existing LCP 354 + existing chemical operations unchanged)			
				NOx PC [1]		NOx PEC [1]		NOx PC [1]		NOx PEC [1]	
	µg / m³	µg / m³		µg / m³	% CL	µg / m³	% CL	µg / m³	% CL	µg / m³	% CL
	30		1 Year	0.14	0.5%	N/A [2]	N/A [2]	**0.44**	**1.5%**	**42.96**	**143%**
E6	75	25.01	24 hrs	1.11	1.5%	-	-	3.83	5.1%	-	-
	30		1 Year	0.12	0.4%	N/A [2]	N/A [2]	**0.40**	**1.3%**	**25.41**	**85%**
E7	75	23.69	24 hrs	1.81	2.4%	-	-	3.95	5.3%	-	-
	30		1 Year	0.14	0.5%	N/A [2]	N/A [2]	**0.44**	**1.5%**	**24.13**	**80%**
E8	75	18.99	24 hrs	3.67	4.9%	-	-	**7.71**	**10.3%**	-	-
	30		1 Year	0.26	0.9%	N/A [2]	N/A [2]	0.48	1.6%	19.47	65% [3]
E9	75	21.41	24 hrs	4.13	5.5%	-	-	6.16	8.2%	-	-
	30		1 Year	0.28	0.9%	N/A [2]	N/A [2]	**0.46**	**1.5%**	**21.87**	**73%**
E10	75	14.90	24 hrs	1.99	2.7%	-	-	**7.84**	**10.4%**	-	-
	30		1 Year	0.07	0.2%	N/A [2]	N/A [2]	0.19	0.6%	N/A [1]	N/A [1]

Receptor	Critical Levels (CL)	Background [5]	Averaging Time	This variation [6] (New LCP 671 + existing chemical operations unchanged)				Existing permitted operations [6] (Existing LCP 354 + existing chemical operations unchanged)			
				NOx PC [1]		NOx PEC [1]		NOx PC [1]		NOx PEC [1]	
	µg / m³	µg / m³		µg / m³	% CL	µg / m³	% CL	µg / m³	% CL	µg / m³	% CL
E15	75	23.69	24 hrs	1.78	2.4%	-	-	3.59	4.8%	-	-
	30		1 Year	0.15	0.5%	N/A [2]	N/A [2]	**0.48**	**1.6%**	**24.17**	**81%**

Notes:

(1) PC = Process Contribution ; PEC = Predicted Environmental Concentration ; PEC = PC + Background
(2) As per our guidance, when the long-term PC < 1% of the long-term Critical Load, the emissions from the installation are considered insignificant. In this case we have not reported the PEC;
(3) As per our guidance, when long-term PC > 1% and the PEC < 70% of the long-term Critical Load, the risk is considered insignificant;
(4) As per our guidance, when the short-term PC < 10% of the short-term Critical Load, the emissions from the installation are considered insignificant; there is no requirement to consider short-term effects in-combination with background (PEC);
(5) Background concentrations are from APIS database (http://www.apis.ac.uk/);
(6) Modelling predictions that exceed the insignificance thresholds set in our guidance are shown in bold text.

Table 6 - Nitrogen deposition assessment at the most affected receptor

Receptor	Nitrogen Critical Loads (N-CLo)	This variation (New LCP 671 + existing chemical operations unchanged)			
		N-deposition PC		N-deposition PEC	
	KgN/ha/y	KgN/ha/y	% N-CLo	KgN/ha/y	% N-CLo
E3	8 (7)	0.066	0.83%	N/A (2)	N/A (2)

Notes

(1) PC = Process Contribution ; PEC = Predicted Environmental Concentration; PEC = PC + Background
(2) As per our guidance, when the long-term PC < 1% of the long-term Critical Load, the emissions from the installation are considered insignificant. In this case we have not reported the PEC;
(3) Nitrogen critical load for coastal stable dune grasslands - acid type from APIS website (http://www.apis.ac.uk/);

Table 7 - Acid deposition assessment at the most affected receptor

Receptor	N-CLo-min	N-CLo-max	S-CLo	This variation (New LCP 671 + existing chemical operations unchanged)			
				Acid-deposition PC(1)		Acid-deposition PEC (1)	
	Keq/ha/y	Keq/ha/y	Keq/ha/y	Keq/ha/y	% N-CLo	KgN/ha/y	% N-CLo
E3	0.223	1.998	1.56	0.005	0.30%	N/A (2)	N/A (2)

Notes

(1) PC = Process Contribution ; PEC = Predicted Environmental Concentration ; PEC = PC + Background
(2) As per our guidance, when the long-term PC < 1% of the long-term Critical Load, the emissions from the installation are considered insignificant. In this case we have not reported the PEC;
(3) Acid critical load function parameters from APIS website (http://www.apis.ac.uk/);

The tables above show the following:

- The short-term PC of NOx emitted by the installation as a result of this variation (new LCP 671, plus other emission sources associated with the operations of the existing chemical works unchanged) are below 10% of the daily Critical Level at all the receptors and therefore they can be considered insignificant according to our guidelines; this is an improvement compared to the existing permitted operations (existing LCP 354, plus other

emission sources associated with the operations of the existing chemical works), whose PCs exceed the 10% insignificance threshold at receptor points E1, E8 and E10;

- Although the annual mean process contributions of NOx emitted from the installation after this variation slightly exceed 1% of the annual Critical Level at discrete receptor point E1, the predicted environmental concentration (PEC) of NOx at this receptor can be considered insignificant according to our criteria, because the PEC (PEC = PC + background) at this receptor is below 70% of the long-term critical level;
- Although the annual mean process contributions of NOx emitted from the installation after this variation slightly exceeds 1% of the annual critical level at one of the discrete receptors (E3) and the PEC exceed the critical level at this receptor, therefore, the impact cannot be classed as insignificant according to our criteria, the following considerations can be made:
    - The background concentration at receptor E3 already exceeds the critical level (143%) and the PC from the installation, after the variation, is significantly smaller than the background concentration;
    - The variation is likely to introduce a betterment compared to the existing permitted operations, whose NOx emissions are responsible for PC exceedances of the 1% long-term critical load and PEC exceedances of the 70% long-term critical load at receptors E2, E3, E4, E5, E6, E7, E9 and E15; the applicant has estimated that the area of the SPA/Ramsar/SSSI where process contributions exceed 1% is reduced substantially (by 93%) from the existing operating scenario. Our audit of the applicant's air dispersion model and assessment report led us to agree with this conclusion.
- The nutrient nitrogen-deposition process contributions caused by the installation are below 1% of the nitrogen deposition critical load at all receptors and therefore can be considered insignificant according to our guidelines.
- The acid deposition process contributions caused by the installation after the variation are below 1% of the acid deposition critical load function at all receptors and therefore can be considered insignificant according to our guidelines.

In conclusion, taking into account the modelling results presented above, we consider that this variation is not likely to have significant effects on the qualifying features of the conservation sites requiring assessment, due to risks of toxic NOx contamination, nitrogen deposition and acidification, because it will introduce a betterment compared to the existing permitted operations.

The applicant is required to prevent, minimise and control emissions using BAT, this is considered further in Sections 2.1.9 and 2.1.13.

(d) **Emissions to Water**

There are no changes to emissions to water due to this variation.

LCP 671 comprising the new steam boilers will be installed within an existing process area of the Greatham Works installation and will drain according to the established drainage philosophy of the existing site.

The effluent from the steam boilers blow-down is expected to consist of similar quality and flow rate of the corresponding stream generated from the existing LCP 354 to be replaced by LCP 671.

As per existing permitted operating techniques for LCP 354, the blow-downstream from LCP 671 will be processed within the existing site liquid effluent system [existing permitted activity Section 5.4 Part A(1)(a)(ii)], where a chemical-physical treatment consisting of neutralisation and settling is undertaken, prior to discharging through the existing permitted emission point W1 to the Seaton Channel.

The boiler blow-downstream is estimated to consist of up to 24 m^3/day, which is a minor contribution to the permitted discharge of 12,000 m^3/day from W1.

As part of this variation, there are no changes to the reverse osmosis plant for production of demineralised water, boiler feed water deareation and chemical conditioning systems, as the existing permitted equipment is retained.

There is no wastewater generated from flue-gas treatment in the new LCP 671.

Since there are no changes to the wastewater flowrate, quality, operating techniques for its handling and treatment and discharge pathway, we consider that there is no likely change to the environmental risk associated with emissions to water as a result of this variation and no further assessment has been carried out.

(e) **Noise Impacts**

The installation is located within an industrial area, while the marshes and estuary to the north, south and east of the works support diverse assemblages of plant and animal species, which include both SSSI and SPA designated areas. Potential noise receptors to the activities carried out at the installation are:

- Ecological designated areas and more specifically for passage, migration and overwintering birds;
- Residential properties at Marsh House Farm 1km NW of the site;

The four new boilers proposed under this variation will replace the existing four boilers composing LCP354. The documents titled '*Environmental Risk Assessment'* and *'Design, Access and Planning Statement (Final), January 2019'*, submitted with the application, explain that the noise soundscape at the location where the new LCP will be installed is dominated by the operation of the existing chemical processing equipment at the installation, that are unchanged as a result of this variation.

We have therefore considered that the new boilers will not have significant contributory effect on operational noise from the installation, once in operation, and therefore we have not required a detailed noise impact assessment for this application.

The following combination of best available techniques is implemented in the design of the new boilers in the scope of this variation, as described in the application document titled '*BAT Assessment'*, document No. 17202108-8150-RP-00002, Revision F1, dated 04/04/19:

a. The only rotating equipment is the flue gas recirculation fans which will be supplied with acoustic foam lining to limit the operating noise level to 75 dB(A) at 1 metre at the maximum continuous steam production rate of the boilers;

d. Snorkel air inlet silencer will be fitted to all burners, complete with acoustic foam lining to limit the operating noise level to 75 dB(A) at 1 metre at the maximum continuous steam production rate of the boilers;

e. Auto vents will be fitted with silencers to reduce noise from steam venting; and

f. The equipment will be located in an area that was previously used for process plant and is partially shielded by other process buildings.

Also, according to the document submitted with the application, titled '*Design, Access and Planning Statement (Final), January 2019'*, all the plant equipment will be fully maintained and all noise control devices (e.g. engine exhaust silencers, acoustic enclosures) will be regularly checked to confirm are in good working order.

The noise management measures for the existing installation are implemented through the site EMS and maintenance management system, since the installation does not have an approved noise management plan.

At this stage, we have considered that a noise management plan is not required for the operation of the installation as the consequence of introducing the new boilers of LCP 671 in the scope of this variation, since the new boilers will replace similar existing operating equipment and therefore will not be likely to increase the environmental risk associated with pollution from noise at the site.

The noise design measures and the management measures referred above are included by reference to the application documents in the operating technique Table S1.2 of the permit and we consider that they will be implemented through the site EMS.

Permit condition 3.4.2 specifies that the Environment Agency may require the operator to develop a noise management plan, when, as part of our compliance regulation of the site, we think that the activities carried out at the installation give rise to noise and vibration pollution outside the site.

2.1.9 Application of Best Available Techniques

(a) Scope of Consideration

In this section, we explain how we have determined whether the Applicant's proposals are BAT for this installation.

- We address is the fundamental choice of combustion technology;
- We consider energy efficiency and the compliance with the Energy Efficiency Directive.

Chapter III of the IED specifies a set of maximum emission limit values. Although these limits are designed to be stringent, and to provide a high level of environmental protection, they do not necessarily reflect what can be achieved by new plant. Article 14(3) of the IED says that BAT Conclusions shall be the reference for setting the permit conditions, so it may be possible and desirable to achieve emissions below the limits referenced in Chapter III. The BAT Conclusions and a revised BREF for LCP were published in July so BAT Associated Emission Levels (AELs) are specified alongside Chapter III limits from the IED within the permit.

Operational controls complement the emission limits and should generally result in emissions below the maximum allowed; whilst the limits themselves provide headroom to allow for unavoidable process fluctuations. Actual emissions are therefore almost certain to be below emission limits in practice, because any operator who sought to operate its installation continually at the maximum permitted level would almost inevitably breach those limits regularly, simply by virtue of normal fluctuations in plant performance, resulting in enforcement action (including potentially prosecution) being taken. Assessments based on Chapter III ELVs or BAT AELs are therefore "worst-case" scenarios.

We are satisfied that emissions at the permitted limits would ensure a high level of protection for human health and the environment in any event.

(b) Consideration of Combustion Plant

The new proposed LCP 671 consists of four steam boilers designed to support the steam demand of the chemical processes carried out at the Greatham Works, under the existing permit, which is unchanged.

Most of the steam raised in the LCP 671 boilers is fed into the high-pressure (HP) steam distribution system where it is used in two specific types of equipment, fluid energy mills and calandria thermosiphon reboilers. According to the application, the remaining 18% of HP steam is reduced into a low-pressure steam distribution system at 2.9barg. Some of this is supplied by flash steam (process heat recovery) but additional make-up is required and is provided by let-down of HP steam.

The process use of the steam generated at the installation is unchanged and therefore the configuration of the new LCP 671 is similar and consistent with the configuration of LCP 354 that will be replaced.

The new boilers of LCP 671 have an aggregated net rated thermal input of 81.6 MWth, which is similar to the permitted net rated thermal input of LCP 354 (81 MWth). The increased energy efficiency, compared to the existing plant, allows for an increase in steam raising name plate capacity (from 98tph to 108tph) that, according to the application documents, will help prevent production interference during boiler maintenance.

We consider that the primary configuration of the new LCP is driven by the technical configuration of the chemical activities carried out at the installation that are already permitted and unaffected by this variation and that the applicant has provided sufficient justification for the size and configuration of the new proposed LCP 671.

The application document in '*Venator Boiler Upgrade – Air Quality Assessment Final Report*' dated September 2019, included sensitivity testing for the determination of the optimum stack height for LCP 671, based on air dispersion modelling. The applicant determined that the optimum stack height based on human health only would be 33m, however, due to the impacts at the Teesmouth and Cleveland Coast SPA/Ramsar/SSSI habitat site, the proposed stack height has been increased to 40m to reduce the impacts of annual NOx critical level. This application document shows that, although with the proposed stack height of 40m the insignificance threshold of 1% of the NOx critical level is not achieved at all the discrete receptors points of the conservation site, the variation introduces a betterment compared to the existing permitted operations, in that the area of the SPA/Ramsar/SSSI where process contributions exceed 1% is reduced substantially (by 93%) compared to the existing permitted operations. Our audit of the applicant's air dispersion model has led us to agree with the applicant that the surface area over which there is an exceedance of the insignificance criteria will be reduced under the proposed scenario offering an improvement at the site. In consideration of the improvement introduced, we have accepted that BAT justification for stack height proposed by the applicant.

(c) Consideration of emission control measures

We have reviewed the techniques proposed by the operator in the application document titled 'BAT Assessment' (document No. 17202108-8150-RP-00002, Revision F1, dated 04/04/19) and compared these with the relevant guidance notes.

According to the application, the new boilers will be fitted with low NOx burners and will make use flue-gas recirculation as primary techniques to minimise emissions of NOx. Their design includes a boiler and burner management system, an advanced control system that provides computerised control of combustion performance to achieve combustion optimisation. Further detail of the assessment of BAT is provided in section 2.1.13.

Process contributions of oxides of nitrogen at discrete receptors are either considered insignificant or are considered to have adequate headroom between the PEC and EQS/EAL to indicate that an exceedance of the EQS/EAL is unlikely at all the human receptors and most of the ecological receptor points within relevant screening distance. The only ecological receptor area where the concentration of oxides of nitrogen is likely to exceed the NOx critical level, is the strip of land between the installation and the river Tees, designated as Teesmouth and Cleveland Coast Ramsar/SPA/SSSI, which lies close to east / south-east of the installation at approx. 200m from its fence. However, at this location, the background concentrations already exceed the NOx critical level and the maximum long–term process contribution from the installation, although not insignificant according to our criteria, is significantly smaller compared to the background concentration. Furthermore, compared, to the existing permitted operation of the existing LCP 354, the proposed operation of LCP 671 will reduce the area of the Teesmouth and Cleveland Coast Ramsar/SPA/SSSI where the installation PC exceeds 1% of the NOx annual critical level, resulting in a likely betterment and overall reduction of impacts (refer to Table 5 in Section 2.1.8 (c)). Further details on air quality impacts on human receptors and conservation sites are discussed in Sections 2.1.8 (b) and 2.1.8 (c) of this document.

In conclusion, having reviewed the techniques proposed by the operator in the application against the relevant guidance notes, the significance of impacts to the relevant human and ecological receptors and having taken into account the betterment of environmental impacts introduced by this variation in comparison to the currently permitted operations, we have accepted that the emission limits proposed by the operator and included in the installation permit reflect BAT for the sector.

(d) Energy efficiency

(i) Consideration of energy efficiency

We have considered the issue of energy efficiency in the following ways:

1. The use of energy within, and generated by, the installation which are normal aspects of all EPR permit determinations. This issue is dealt with in this section.
2. The applicability of the combined heat and power ready (CHP-R) guidance to the installation.
3. The extent to which the installation meets the requirement of Article 14(5)(c) of the Energy Efficiency Directive which requires new or substantially refurbished industrial installations with a total thermal input exceeding 20 MWth generating waste heat at a useful temperature level to carry out a cost-benefit assessment to "*assess the cost and benefits of utilising the waste heat to satisfy economically justified demand*".
4. The extent to which the applicant has demonstrated compliance with energy efficiency levels (EEL) in line with the BAT AEELs set out in the BAT Conclusions.

1. Use of energy within the Installation

As explained in Section 2.1.9 (b) above, we consider that the primary configuration of the new LCP is driven by the technical requirements and configuration of the chemical activities carried out at the installation that are already permitted and unaffected by this variation.

2. Combined Heat and Power Ready

Our CHP Ready Guidance - February 2013 considers that BAT for energy efficiency for new combustion power plant is the use of CHP in circumstances where there are technically and economically viable opportunities for the supply of heat from the outset. The term CHP in this context represents a plant which also provides a supply of heat from the electrical power generation process to either a district heating network or to an industrial / commercial building or process.

Since the new LCP under assessment is not a power generation plant and there is no power generation in the scope of this variation given that the proposed boilers of LCP 671 supply steam to meet process demand, we consider this requirement not applicable to this application.

3. Compliance with Article 14(5) of the Energy Efficiency Directive

The operator provided a cost-benefit assessment (CBA) under Article 14(5)(c) of the Energy Efficiency Directive, as the new LCP 671 potentially falls in the following category described by the Directive: '*new industrial installation with a total aggregated net thermal input of more than 20 MW generating waste heat at a useful temperature level, or an existing such installation where the combustion unit is to be substantially refurbished'*.

The operator's analysis is set out in the application document titled '*Technical Note – Venator Cost Benefit Analysis'*, version dated July 2019. The purpose of the document submitted by the operator was to assess whether there would be commercially viable opportunities for reusing waste heat generated by the new LCP, as required by the Energy Efficiency Directive.

The operator's assessment was based on the following key technical inputs:

- Maximum potential waste heat for reuse of 2.5 MWth, calculated by the operator based on hours of operation, loading of the boilers and heat and material balance on the flue gases;
- Low grade waste heat exportable in the form of hot water at a low grade temperature of 60 ºC, flow rate of 66 m^3/hour.

We note that our '*Draft guidance on completing cost-benefit assessments for installations under Article 14 of the Energy Efficiency Directive'* states that district heating schemes in the UK would generally require waste heat at a "useful temperature" of **65 ºC or higher**. Since the operator has assessed that waste heat from their proposed installation would be available at a lower temperature (**60 ºC**), there might be technical limitations to the heat recovery, limiting the validity of the cost-benefit assessment submitted with the application and making the application not suitable for waste heat recovery from the outset, regardless of

cost-benefit considerations. In any case, we have reviewed the CBA submitted by the applicant anyway and further details are discussed in the following paragraphs.

The CBA carried out by the operator, was also subject to certain conservative assumptions to simplify the analysis. The assumptions, are summarised below:

- A constant heat flow is available from the boilers;
- The installation of heat recovery does not have any impact on the proposed stack height. Note: we consider that this assumption may underestimate the installation costs, since the cooler flue gas leaving the waste heat recovery unit would be less buoyant and, as a consequence, higher stack height would be necessary to achieve the same level of dispersion of pollutant, where compared to the base case without heat recovery;
- The installation on-site only consists of heat exchangers and a pumping station, no heat storage/buffer is proposed;
- No heat metering or controls are costed;
- The installation costs based on simple straight lengths of flow and return pipework, trenched in soft ground; this does not include any additional mitigation, installation or planning costs for the pipe route across the local wildlife sites, marshes, roadways or around the industrial estate; and
- There is no cost allowance for any heat stations, heat exchangers, heat boosters, controls on any of the end user sites; these would need to be borne by the end user or increase the installed cost.

The operator informed their assessment with the distribution map of potential heat networks available or being developed in the area, as published by the Department for Business, Energy and Industrial Strategy (BEIS), available on the .gov.uk website at the link. According to this map, the operator identified the Middlesbrough heat network, lying at an approximate distance of 5 km to the south of the installation, within the maximum search radius of 9.5 km calculated according to amount of waste heat available from the installation (i.e. 2.5 MWth). According to the information provided in the application, the Middlesbrough heating network is currently at a feasibility stage. The operator also assessed cost and benefits of potential supply of waste heat to the Graythorp and Tofts farm industrial estate that lies at approximately 800 metres to the north of the installation. However this was subject to the speculative assumption that the industrial estate would actually be a potential heat user, which had not been confirmed between the operator and the businesses within the industrial estate. A conservative working assumption for this second assessment was the that these industrial / commercial users can take the heat throughout the year, which, according to the additional information provided by the operator, is unlikely according to the type of light industrial and commercial activities carried out at the industrial estate.

Due to the low grade of heat available, the operator assumed a sale price at 50% of the 2018 BEIS data for the gas price to large consumers. We were not able to validate this specific assumption, however, as noted above, our '*Draft guidance on completing cost-benefit assessments for installations under Article 14 of the Energy Efficiency Directive'* considers that district heating schemes in the UK would generally require waste heat at a "useful temperature" of 65 ºC or higher. Since the operator has assessed that waste heat from their proposed installation would be available at a lower temperature (60 ºC), it would be reasonable to consider that the lower grade of heat may pose a technical limitation to its effective recovery; and that, if the heat recovery was ever feasible, this limitation would result in a reduced commercial value of the waste heat and therefore lower income from its sale to be considered in the cost benefit analysis.

The assessment submitted by the operator did not keep into account the discounted cash flow associated with inflation rate and depreciation of the assets over the life of the project.

The outputs of the analysis submitted by the operator were a 'simple payback' time of 71 years for the supply of heat to the Middleborough heat network and of 11 years for the speculative supply of heat to Graythorp and Tofts farm industrial estate. Whilst it is apparent from the operator analysis that the payback would not make the heat recovery profitable for the Middleborough heat network, since the payback would be well in excess of the project operating life, we considered additional assessment was required to make conclusions for the second scenario (heat recovery to Graythorp and Tofts farm industrial estate).

For this reason we reconstructed the cost benefit analysis submitted by the operator within our cost-benefit assessment template ('*Environment Agency Article 14 CBA Template*', described within our '*Draft guidance on completing cost-benefit assessments for installations under Article 14 of the Energy Efficiency Directive'*) to apply a more detailed cash flow model, keeping into account the effects of inflation and asset depreciation, not included in the assessment submitted by the operator.

The Environment Agency cost-benefit assessment template provides the Nominal Project Net Present Value (NPV) (£m) over the project period as the result of the assessment. The NPV is the more common number used by Government to evaluate projects and is used by the Environment Agency when evaluating costs and benefits of proposals. This is the discounted pre-tax pre-finance cash flow at the operator's pre-tax pre-finance discount rate. If the NPV is positive the investors will make more than their hurdle rate of return; if the NPV is negative the investment is not profitable.

Our cost-benefit assessment template shown negative NPV over the project period for both tested scenarios, as follows:

- Nominal NPV (before financing and tax) (£m) is calculated as '– 6.31 £m' for heat recovery scenario to Middleborough heat network;
- Nominal NPV (before financing and tax) (£m) is calculated as '– 0.32 £m' for heat recovery to Graythorp and Tofts farm industrial estate.

We have also reviewed the assumptions in the application document and we agree with the operator evaluation that they are likely to underestimate the installation costs. In conclusion, we consider that, when all the simplification and conservative assumptions made by the operator were refined, the assessment would unlikely show viable economic recovery of heat from the installation. However, since the situation may evolve, new users may be found and opportunities for more profitable arrangement for the sale of waste heat than assumed by the applicant may be identified, we have specified an improvement condition (IC13) in the permit requiring the operator to reassess the commercial viability of recovering waste heat from the LCP within four years' time.

4. Compliance with energy BAT AEELs set out in BAT Conclusions

An energy efficiency level associated with the best available techniques (BAT-AEEL) refers to the ratio between the combustion unit's net energy output(s) and the combustion unit's fuel/feedstock energy input at actual unit design. The net energy output(s) is determined at the combustion unit boundaries, including auxiliary systems (e.g. flue-gas treatment systems), and for the unit operated at full load.

The table below sets out the BAT-AEELs specified in the LCP BAT Conclusions for the large combustion plant on the site and the energy efficiency levels in the application document titled '*BAT Assessment*' (document No. 17202108-8150-RP-00002, Revision F1, dated 04/04/19), based on the design specification of the plant.

Table 8 - Energy efficiency levels

BAT AEELs (%)			**Plant efficiency (%)**		
Net electrical efficiency	**Net total fuel utilisation**	**Net mechanical efficiency**	**Net electrical efficiency**	**Net total fuel utilisation**	**Net mechanical efficiency**
LCP671: gas-fired boilers (new unit)					
39-42.5	**78-95**	**None**	**NA**	**92.7**	**NA**

We consider that the design specification for energy efficiency of the plant is BAT in relation to the AEELs. However, since the plant has not been built and performance tested yet, we have specified an improvement condition IC12 requiring the operator to demonstrate compliance as part of the commissioning process in the form of a performance test report including information on the measured net total fuel utilisation of the plant according to the requirements of LCP BATc 2.

(ii) Permit conditions concerning energy efficiency

The Operator is required to report energy usage and energy generated under Condition 4.2 and Table S4.3 in Schedule 4 of the permit. This will enable the Environment Agency to monitor energy efficiency at the installation and take action if at any stage the energy efficiency is less than proposed.

There are no site-specific considerations that require the imposition of standards beyond BAT, and so the Environment Agency accepts that the applicant's proposals represent BAT for this installation.

2.1.10 Emission limits

The operator has proposed limits for LCP 671 (emission point A251) in line with Part 2 Annex V of the IED and BAT AELs set out within the BAT Conclusions for Large Combustion Plant.

The emission limits proposed by the operator are set out in the application document '*GM/00592 Venator Greatham Replacement Gas Fired Boilers - Environmental Risk Assessment'*.

As discussed in section 2.1.8 above, emissions at the relevant limits will not cause significant pollution. Consequently we have accepted the proposed limits and incorporated them into Tables 3.1 and 3.1a of the permit (see Note 3 to Table 9 below for the only exception). Annex V of the IED is a backstop and these limits are included where there is no tighter limit specified within the BAT Conclusions.

Table 9 - Emission limit values

Parameter	Reference Period	Part 2 Annex V Limits mg/m^3	BAT AEL	Permit limit mg/m3
NO_x	95%ile of hourly averages	200	None	200
	Monthly averages	100	None	85 Note 3
	Daily average	110	85	85
	Yearly average	None	60	60
CO	95%ile of hourly averages	200	None	200
	Monthly averages	100	None	100
	Daily average or average over the sampling period	110	None	110
	Yearly average	None	*15*	15
Dust	Average over the sampling period (6-monthly sampling and testing)	5.5 Note 1	None	5 Note 2
SO2	Average over the sampling period (6-monthly sampling and testing)	38.5 Note 1	None	35 Note 2

Notes

1. According to section 2 of IED Annex V Part 3, we consider continuous measurement for SO2 and dust from combustion plants firing natural gas is not required. Therefore the applicable reference period for these parameters is expressed as an average over the sampling period

and, in line with our interpretation guidance on section 2 of IED Annex V Part 4, we consider the applicable emission limit is 110% of the monthly ELVs set in Part 2 of IED Annex V.

2. We have specified the emission limit value matching the figure proposed by the applicant in the application document '*Supporting Information - Part C2 - Environmental Risk Assessment'* that is more stringent than the applicable emission limit.
3. We have set the monthly average limit for NOx lower than the limit of 100 mg/m^3 required by IED Annex V Part 2 (and proposed by the operator in the application document '*GM/00592 Venator Greatham Replacement Gas Fired Boilers - Environmental Risk Assessment'*), even if there is no monthly BAT AEL specified in the LCP BAT Conclusions. The reason for setting this lower limit is that the monthly average emission limit cannot be higher than the daily average emission limit. Since the daily average BAT AEL of 85 mg/m^3 specified by the LCP BAT Conclusions is lower than the monthly emission limit of 100 mg/m^3 specified by the IED, we have set the monthly emission limit in the permit at 85 mg/m^3 to match the daily emission limit from the BAT Conclusions.

2.1.11 Monitoring & Reporting

Gas fired plant:

We have reviewed the emissions monitoring schedule proposed by the applicant for LCP 671 and compared it against the monitoring requirements set in IED and LCP BAT conclusions. We have agreed to the following monitoring proposed by the applicant:

- Oxides of nitrogen: continuous emission monitoring;
- Carbon monoxide: continuous emission monitoring;
- Sulphur dioxide: six-monthly periodic monitoring;
- Dust: six-monthly periodic monitoring.

Standards:

Standards for assessment of the monitoring location and for measurement of oxygen, water vapour, temperature and pressure have been added to the permit.

A row has been included in tables S3.1, S3.1a which requires the operator to confirm compliance with BS EN 15259 in respect of monitoring location and stack gas velocity profile in the event there is a significant operational change (such as a change of fuel type) to the LCP.

2.1.12 Meeting the requirements of the IED

The table below shows how each requirement of the IED has been addressed by the permit conditions.

Table 10 - IED requirements permit implementation check-list

IED Article Reference	IED requirement	Permit condition
30(6)	If there is an interruption in the supply of gas, an alternative fuel may be used and the permit emission limits deferred for a period of up to 10 days, except where there is an overriding need to maintain energy supplies. The EA shall be notified immediately.	N/A – plant runs on natural gas only
32(4)	For installations that have applied to derogate from the IED Annex V emission limits by means of the transitional national plan, the monitoring and reporting requirements set by UK Government shall be complied with.	N/A to new LPC 671 – applies to existing plant only. TNP monitoring requirements relevant to LCP 354 are retained for the residual operating life of this LCP (until the end of the TNP on 30/06/2020) – Tables S3.1, S3.3, S4.1, S4.3
33(1)b	For installations that have applied to derogate from the IED Annex V emission limits by means of the Limited Life Derogation, the operator shall submit annually a record of the number of operating hours since 1 January 2016.	N/A – applies to existing plant only
37	Provisions for malfunction and breakdown of abatement equipment including notifying the EA.	N/A
38	Monitoring of air emissions in accordance with Ann V Pt 3	3.5, 3.6
40	Multi-fuel firing	N/A – no multi fuel firing
41(a)	Determination of start-up and shut-down periods	2.3.5 Schedule 1 Table S1.2, S1.4
Ann V Pt 1(1)	All emission limit values shall be calculated at a temperature of 273,15 K, a pressure of 101,3 kPa and after correction for the water vapour content of the waste gases and at a standardised O2 content of 6 % for solid fuels, 3 % for combustion plants, other than gas turbines and gas engines using liquid and gaseous fuels and 15 % for gas turbines and gas engines.	Schedule 6, Interpretation
Ann V Pt 1	Emission limit values	N/A – applies to existing plant only
Ann V Pt 1	For plants operating less than 500 hours per year, record the used operating hours	N/A – applies to existing plant only
Ann V Pt 1(6(1))	Definition of natural gas	N/A – applies to existing plant only
Ann V Pt 2	Emission limit values	3.1.2 Schedule 3, Tables S3.1, S3.1a
AnnV Pt 3(1)	Continuous monitoring for >100MWth for specified substances	3.5, 3.6 Schedule 3, Tables S3.1, S3.1a
AnnV Pt 3(2, 3, 5)	Monitoring derogations	3.5.1

IED Article Reference	IED requirement	Permit condition
		Schedule 3, Tables S3.1, S3.1a
AnnV Pt3(4)	Measurement of total mercury	N/A – applies to plants firing coal or lignite only
AnnV Pt3(6)	EA informed of significant changes in fuel type or in mode of operation so can check Pt3 (1-4) still apply	2.3.1 Schedule 1, Table S1.2
AnnV Pt3(7)	Monitoring requirements	3.5.1 Schedule 3, Tables S3.1, S3.1a
AnnV Part 3(8,9,10)	Monitoring methods	3.5, 3.6
AnnV Pt 4	Monthly, daily, 95%ile hourly emission limit value compliance	3.5.1 Schedule 3, Tables S3.1, S3.1a
AnnV Pt7	Refinery multi-fuel firing SO_2 derogation	N/A – applies to oil refineries only

2.1.13 Meeting the requirements of the BAT Conclusions

This annex provides a record of decisions made in relation to each relevant BAT Conclusion considered potentially applicable to the installation. This table should be read in conjunction with the permit.

The decisions are based on the operating techniques stated by the applicant in the following application documents:

- Application document titled 'BAT Assessment', document No. 17202108-8150-RP-00002, Revision F1, dated 04/04/19;
- Application document titled 'Venator Greatham, Replacement Gas Fired Boilers, Environmental Risk Assessment', document No. GM/00592;
- Response to request for information served on 16/08/19, received 11/09/19;
- Responses to Schedule 5 Notice served on 21/08/19, received 30/09/19.

The conditions in the permit through which the relevant BAT Conclusions are implemented include but are not limited to the following:

Table 11 - BAT Conclusions requirements permit implementation check-list

BAT Conclusion requirement topic	Permit condition(s)	Permit table(s)
Environmental Management System	1.1.1	S1.2
BAT AELs	3.1.1 and 3.5.1	S3.1, S3.1a
Monitoring	2.3, 3.5 and 3.6	S1.2, S1.4, S3.1, S3.1a
Energy efficiency	1.2 and 2.3	S1.2, S3.4
Noise	3.4 and 2.3	S1.2
Other operating techniques	1.2	S1.2

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

NA Not Applicable

CC Currently Compliant (where a plant is not built yet, this is based on the operating techniques stated in the application and design specification of the plant)

FC Compliant in the future (where plant not built yet and the operator has not been able to confirm its compliance at this pre-construction phase, but there is a plan to achieve compliance in the future: for example because there is a need for following-up on certain aspects, or performance of the plant in the future through an improvement condition, or there is a need for collecting validating data after the plant has been started-up)

NC Not Compliant

PC Partially Compliant

BAT Concn. 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
General			
1	**In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS) that incorporates all of the following features:** i. commitment of the management, including senior management; ii. definition 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; 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.	CC	Compliance with BATc 1 is achieved through the implementation of the site Environmental Management System (EMS), which is certified according to ISO14001:2015. All the sub-items of BATc 1 are complied, with the following notes and limitations to their applicability: viii. According to the application documents, decommissioning of process equipment would be covered as a stand-alone project at the time of decommissioning via the site management of change and risk management process. The applicant has confirmed that the construction of the new boilers takes into account the eventual decommissioning of the boilers, with design features such as modular pipe rack structures being employed. x. Refer to BATc 9 xi. Refer to BATc 10, BATc11

BAT Concn. 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
	x. quality assurance/quality control programmes to ensure that the characteristics of all fuels are fully determined and controlled (see BAT 9); xi. a management plan in order to reduce emissions to air and/or to water during other than normal operating conditions, including start-up and shutdown periods (see BAT 10 and BAT 11); xii. a waste management plan to ensure that waste is avoided, prepared for reuse, recycled or otherwise recovered, including the use of techniques given in BAT 16; xiii. a systematic method to identify and deal with potential uncontrolled and/or unplanned emissions to the environment, in particular: (a) emissions to soil and groundwater from the handling and storage of fuels, additives, by-products and wastes (b) emissions associated with self-heating and/or self-ignition of fuel in the storage and handling activities; xiv. a dust management plan to prevent or, where that is not practicable, to reduce diffuse emissions from loading, unloading, storage and/or handling of fuels, residues and additives; xv. a noise management plan where a noise nuisance at sensitive receptors is expected or sustained, including; (a) a protocol for conducting noise monitoring at the plant boundary (b) a noise reduction programme (c) a protocol for response to noise incidents containing appropriate actions and timelines (d) a review of historic noise incidents, corrective actions and dissemination of noise incident knowledge to the affected parties; xvi. for the combustion, gasification or co-incineration of malodourous substances, an odour management plan including: (a) a protocol for conducting odour monitoring (b) where necessary, an odour elimination programme to identify and eliminate or reduce the odour emissions (c) a protocol to record odour incidents and the appropriate actions and timelines (d) a review of historic odour incidents, corrective actions and the dissemination of odour incident knowledge to the affected parties. Where an assessment shows that any of the elements listed under items x to xvi are not necessary, a record is made of the decision, including the reasons. **Applicability**. The scope (e.g. level of detail) and nature of the EMS (e.g. standardised or non-standardised) will generally be related to the nature, scale and complexity of the installation, and the range of environmental impacts it may have.		xii. We consider that a specific waste management plan is not required for the operation of the new boilers proposed under this variation because natural gas fired boilers are not expected to generate significant quantity of operational waste. Compliance is considered to be achieved through the implementation of the EMS, the Waste Hierarchy stated in the application document *'GM/00592 Venator Greatham Replacement Gas Fired Boilers – Environmental Risk Assessment'* and compliance with permit condition 1.4. xvi. We consider that the requirement for a dust management plan is not applicable to the new natural gas fired boilers as their contribution to emissions of particulates is expected to be negligible. xv. We consider that a noise management plan is not required for the operation of the new boilers, since they will replace existing operating equipment and will not increase the environmental risk associated with noise at the site. Permit condition 3.4 specifies the requirement for the operator to develop a noise management plan,

<table>
<tr><th>BAT Concn. 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></tr>
<tr><td></td><td></td><td></td><td>where required by the Environment Agency.

xvi. We consider the requirement for an odour management plan not applicable to the proposed natural gas fired boilers, as their odour contribution is expected to be negligible.</td></tr>
<tr><td>2</td><td>BAT is to determine the net electrical efficiency and/or the net total fuel utilisation and/or the net mechanical energy efficiency of the gasification, IGCC and/or combustion units by carrying out a performance test at full load (1), according to EN standards, after the commissioning of the unit and after each modification that could significantly affect the net electrical efficiency and/or the net total fuel utilisation and/or the net mechanical energy efficiency of the unit. 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.</td><td>FC</td><td>The operator has committed to demonstrate compliance as part of the commissioning process and to assess any future impact on net total fuel utilisation according to their Management of Change (MoC) process and EMS.

We have set an improvement condition (IC.12) and a process monitoring requirement in table 3.4 to reflect this commitment made by the operator.</td></tr>
<tr><td>3</td><td>BAT is to monitor key process parameters relevant for emissions to air and water including those given below.
<table><tr><th>Stream</th><th>Parameter(s)</th><th>Monitoring</th></tr><tr><td rowspan="3">Flue-gas</td><td>Flow</td><td>Periodic or continuous determination</td></tr><tr><td>Oxygen content, temperature, and pressure</td><td rowspan="2">Periodic or continuous measurement</td></tr><tr><td>Water vapour content (3)</td></tr><tr><td>Waste water from flue-gas treatment</td><td>Flow, pH, and temperature</td><td>Continuous measurement</td></tr></table></td><td>CC</td><td>The design of the new boilers includes temperature transmitters and oxygen content analysers on the flue gas so continuous monitoring of these parameters is provided.

Manual sample points will be provided which allows for periodic measurement of the flue gas</td></tr>
</table>

<table>
<tr><th>BAT Concn. 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></tr>
<tr><td></td><td></td><td></td><td>stream. Monitoring of the water vapour content in the flue gas is not necessary because it is dried prior to analysis.

No waste water is generated from flue-gas treatment.</td></tr>
<tr><td>4</td><td>BAT is to monitor emissions to air with at least the frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.
<table>
<tr><th>Substance/Parameter</th><th>Fuel/Process/Type of combustion plant</th><th>Combustion plant total rated thermal input</th><th>Standard(s) (4)</th><th>Minimum monitoring frequency (5)</th><th>Monitoring associated with</th></tr>
<tr><td>NH_3</td><td>— When SCR and/or SNCR is used</td><td>All sizes</td><td>Generic EN standards</td><td>Continuous (6) (7)</td><td>BAT 7</td></tr>
<tr><td>NO_x</td><td>— Coal and/or lignite including waste co-incineration
— Solid biomass and/or peat including waste co-incineration
— HFO- and/or gas-oil-fired boilers and engines
— Gas-oil-fired gas turbines
— Natural-gas-fired boilers, engines, and turbines
— Iron and steel process gases
— Process fuels from the chemical industry
— IGCC plants</td><td>All sizes</td><td>Generic EN standards</td><td>Continuous (6) (8)</td><td>BAT 20
BAT 24
BAT 28
BAT 32
BAT 37
BAT 41
BAT 42
BAT 43
BAT 47
BAT 48
BAT 56
BAT 64
BAT 65
BAT 73</td></tr>
<tr><td></td><td>— Combustion plants on offshore platforms</td><td>All sizes</td><td>EN 14792</td><td>Once every year (9)</td><td>BAT 53</td></tr>
</table></td><td>CC</td><td>Continuous Emissions Monitoring System (CEMS), specified according to BS EN 14181, is provided for NOx and CO, as required by BATc 4, considering that the boilers are fired with natural gas.

The operator has proposed periodic measurement of SO_2 and dust emissions with a 6-monthly frequency that is not required by this BATc for combustion of natural gas.

We consider the monitoring schedule proposed by the operator in line with BAT and we have specified these monitoring requirements for LCP 671 in the permit.</td></tr>
</table>

BAT Concn. 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
	N_2O	— Coal and/or lignite in circulating fluidised bed boilers — Solid biomass and/or peat in circulating fluidised bed boilers	All sizes	EN 21258	Once every year (10)	BAT 20 BAT 24		
	CO	— Coal and/or lignite including waste co-incineration — Solid biomass and/or peat including waste co-incineration — HFO- and/or gas-oil-fired boilers and engines — Gas-oil-fired gas turbines — Natural-gas-fired boilers, engines, and turbines — Iron and steel process gases — Process fuels from the chemical industry — IGCC plants	All sizes	Generic EN standards	Continuous (6) (8)	BAT 20 BAT 24 BAT 28 BAT 33 BAT 38 BAT 44 BAT 49 BAT 56 BAT 64 BAT 65 BAT 73		
		— Combustion plants on offshore platforms	All sizes	EN 15058	Once every year (9)	BAT 54		
	SO_2	— Coal and/or lignite incl waste co-incineration — Solid biomass and/or peat incl waste co-incineration — HFO- and/or gas-oil-fired boilers — HFO- and/or gas-oil-fired engines — Gas-oil-fired gas turbines — Iron and steel process gases — Process fuels from the chemical industry in boilers — IGCC plants	All sizes	Generic EN standards and EN 14791	Continuous (6) (11) (12)	BAT 21 BAT 25 BAT 29 BAT 34 BAT 39 BAT 50 BAT 57 BAT 66 BAT 67 BAT 74		

BAT Concn. 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
	SO_3	— When SCR is used	All sizes	No EN standard available	Once every year	—		
	Gaseous chlorides, expressed as HCl	— Coal and/or lignite — Process fuels from the chemical industry in boilers	All sizes	EN 1911	Once every three months (6) (13) (14)	BAT 21 BAT 57		
		— Solid biomass and/or peat	All sizes	Generic EN standards	Continuous (15) (16)	BAT 25		
		— Waste co-incineration	All sizes	Generic EN standards	Continuous (6) (16)	BAT 66 BAT 67		
	HF	— Coal and/or lignite — Process fuels from the chemical industry in boilers	All sizes	No EN standard available	Once every three months (6) (13) (14)	BAT 21 BAT 57		
		— Solid biomass and/or peat	All sizes	No EN standard available	Once every year	BAT 25		
		— Waste co-incineration	All sizes	Generic EN standards	Continuous (6) (16)	BAT 66 BAT 67		
	Dust	— Coal and/or lignite — Solid biomass and/or peat — HFO- and/or gas-oil-fired boilers — Iron and steel process gases — Process fuels from the chemical industry in boilers — IGCC plants — HFO- and/or gas-oil-fired engines — Gas-oil-fired gas turbines	All sizes	Generic EN standards and EN 13284-1 and EN 13284-2	Continuous (6) (17)	BAT 22 BAT 26 BAT 30 BAT 35 BAT 39 BAT 51 BAT 58 BAT 75		
		— Waste co-incineration	All sizes	Generic EN standards and EN 13284-2	Continuous	BAT 68 BAT 69		
	Metals and metalloids except mercury (As, Cd, Co, Cr, Cu, Mn,	— Coal and/or lignite — Solid biomass and/or peat — HFO- and/or gas-oil-fired boilers and engines	All sizes	EN 14385	Once every year (18)	BAT 22 BAT 26 BAT 30		

BAT Concn. 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
	Ni, Pb, Sb, Se, Tl, V, Zn)	—	Waste co-incineration	< 300 MW_{th}	EN 14385	Once every six months (13)	BAT 68 BAT 69		
				≥ 300 MW_{th}	EN 14385	Once every three months (19) (13)		
		—	IGCC plants	≥ 100 MW_{th}	EN 14385	Once every year (18)	BAT 75	
	Hg	—	Coal and/or lignite including waste co-incineration	< 300 MW_{th}	EN 13211	Once every three months (13) (20)	BAT 23	
				≥ 300 MW_{th}	Generic EN standards and EN 14884	Continuous (16) (21)		
		—	Solid biomass and/or peat	All sizes	EN 13211	Once every year (22)	BAT 27	
		—	Waste co-incineration with solid biomass and/or peat	All sizes	EN 13211	Once every three months (13)	BAT 70	
		—	IGCC plants	≥ 100 MW_{th}	EN 13211	Once every year (23)	BAT 75	
	TVOC	—	HFO- and/or gas-oil-fired engines — Process fuels from chemical industry in boilers	All sizes	EN 12619	Once every six months (13)	BAT 33 BAT 59	
		—	Waste co-incineration with coal, lignite, solid biomass and/or peat	All sizes	Generic EN standards	Continuous	BAT 71	
	Formaldehyde	—	Natural-gas in spark-ignited lean-burn gas and dual fuel engines	All sizes	No EN standard available	Once every year	BAT 45	
	CH_4	—	Natural-gas-fired engines	All sizes	EN ISO 25139	Once every year (24)	BAT 45	
	PCDD/F	—	Process fuels from chemical industry in boilers — Waste co-incineration	All sizes	EN 1948-1, EN 1948-2, EN 1948-3	Once every six months (13) (25)	BAT 59 BAT 71	
5	BAT is to monitor emissions to water from flue-gas treatment with at least the frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality. **Substance/Parameter** | **Standard(s)** | **Minimum monitoring frequency** | **Monitoring associated with**						NA	There is no flue-gas treatment in this application.

<table>
<tr><th>BAT Concn. 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></tr>
<tr><td></td><td>
<table>
<tr><td colspan="2">Total organic carbon (TOC) (26)</td><td>EN 1484</td><td>Once every month</td><td>BAT 15</td></tr>
<tr><td colspan="2">Chemical oxygen demand (COD) (26)</td><td>No EN standard available</td><td rowspan="11"></td><td rowspan="9"></td></tr>
<tr><td colspan="2">Total suspended solids (TSS)</td><td>EN 872</td></tr>
<tr><td colspan="2">Fluoride (F^-)</td><td>EN ISO 10304-1</td></tr>
<tr><td colspan="2">Sulphate (SO_4^{2-})</td><td>EN ISO 10304-1</td></tr>
<tr><td colspan="2">Sulphide, easily released (S^{2-})</td><td>No EN standard available</td></tr>
<tr><td colspan="2">Sulphite (SO_3^{2-})</td><td>EN ISO 10304-3</td></tr>
<tr><td rowspan="7">Metals and metalloids</td><td>As</td><td rowspan="7">Various EN standards available (e.g. EN ISO 11885 or EN ISO 17294-2)</td></tr>
<tr><td>Cd</td></tr>
<tr><td>Cr</td></tr>
<tr><td>Cu</td></tr>
<tr><td>Ni</td></tr>
<tr><td>Pb</td></tr>
<tr><td>Zn</td></tr>
<tr><td>Hg</td><td>Various EN standards available (e.g. EN ISO 12846 or EN ISO 17852)</td><td></td></tr>
<tr><td colspan="2">Chloride (Cl^-)</td><td>Various EN standards available (e.g. EN ISO 10304-1 or EN ISO 15682)</td><td>—</td></tr>
<tr><td colspan="2">Total nitrogen</td><td>EN 12260</td><td>—</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>6</td><td>
In order to improve the general environmental performance of combustion plants and to reduce emissions to air of CO and unburnt substances, BAT is to ensure optimised combustion and to use an appropriate combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Fuel blending and mixing</td><td>Ensure stable combustion conditions and/or reduce the emission of pollutants by mixing different qualities of the same fuel type</td><td>Generally applicable</td></tr>
</table>
</td><td>CC</td><td>According to the application document titled ‘BAT Assessment’, the following combination of techniques specified by BATc 6 are implemented:

b. Maintenance of the combustion system will be applied according to the operator’s maintenance management system and EMS.</td></tr>
</table>

BAT Concn. 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
	b. Maintenance of the combustion system — Regular planned maintenance according to suppliers' recommendations c. Advanced control system — See description in Section 8.1 — The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system d. Good design of the combustion equipment — Good design of furnace, combustion chambers, burners and associated devices — Generally applicable to new combustion plants e. Fuel choice — Select or switch totally or partially to another fuel(s) with a better environmental profile (e.g. with low sulphur and/or mercury content) amongst the available fuels, including in start-up situations or when back-up fuels are used — Applicable within the constraints associated with the availability of suitable types of fuel with a better environmental profile as a whole, which may be impacted by the energy policy of the Member State, or by the integrated site's fuel balance in the case of combustion of industrial process fuels. For existing combustion plants, the type of fuel chosen may be limited by the configuration and the design of the plant		c. and d. Advanced control system and good design of the combustion equipment are implemented in the boiler and burner management system. Refer also to BATc 41. e. Fuel choice: natural gas is used which has a better environmental profile compared to other fossil fuels. We consider the techniques proposed in the application an appropriate combination in compliance with BATc 6.
7	In order to reduce emissions of ammonia to air from the use of selective catalytic reduction (SCR) and/or selective non-catalytic reduction (SNCR) for the abatement of NO_X emissions, BAT is to optimise the design and/or operation of SCR and/or SNCR (e.g. optimised reagent to NO_X ratio, homogeneous reagent distribution and optimum size of the reagent drops). **BAT-associated emission levels** The BAT-associated emission level (BAT-AEL) for emissions of NH_3 to air from the use of SCR and/or SNCR is < 3–10 mg/Nm^3 as a yearly average or average over the sampling period. The lower end of the range can be achieved when using SCR and the upper end of the range can be achieved when using SNCR without wet abatement techniques. In the case of plants combusting biomass and operating at variable loads as well as in the case of engines combusting HFO and/or gas oil, the higher end of the BAT-AEL range is 15 mg/Nm^3.	NA	The use of SCR or SNCR is not proposed for the new boilers as part of this application.

<table>
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<tr><td>8</td><td>In order to prevent or reduce emissions to air during normal operating conditions, BAT is to ensure, by appropriate design, operation and maintenance, that the emission abatement systems are used at optimal capacity and availability.</td><td>NA</td><td>The design of the new LCP consists of primary pollution prevention techniques and does not include secondary abatement systems. Thus, this BAT-c is not applicable.</td></tr>
<tr><td>9</td><td>In order to improve the general environmental performance of combustion and/or gasification plants and to reduce emissions to air, BAT is to include the following elements in the quality assurance/quality control programmes for all the fuels used, as part of the environmental management system (see BAT 1):
(i) Initial full characterisation of the fuel used including at least the parameters listed below and in accordance with EN standards. ISO, national or other international standards may be used provided they ensure the provision of data of an equivalent scientific quality;
(ii) Regular testing of the fuel quality to check that it is consistent with the initial characterisation and according to the plant design specifications. The frequency of testing and the parameters chosen from the table below are based on the variability of the fuel and an assessment of the relevance of pollutant releases (e.g. concentration in fuel, flue-gas treatment employed);
(iii) Subsequent adjustment of the plant settings as and when needed and practicable (e.g. integration of the fuel characterisation and control in the advanced control system (see description in Section 8.1)).
Description
Initial characterisation and regular testing of the fuel can be performed by the operator and/or the fuel supplier. If performed by the supplier, the full results are provided to the operator in the form of a product (fuel) supplier specification and/or guarantee.
<table>
<tr><th>Fuel(s)</th><th>Substances/Parameters subject to characterisation</th></tr>
<tr><td rowspan="2">Biomass/peat</td><td>— LHV
— moisture</td></tr>
<tr><td>— Ash
— C, Cl, F, N, S, K, Na
— Metals and metalloids (As, Cd, Cr, Cu, Hg, Pb, Zn)</td></tr>
<tr><td rowspan="3">Coal/lignite</td><td>— LHV
— Moisture
— Volatiles, ash, fixed carbon, C, H, N, O, S</td></tr>
<tr><td>— Br, Cl, F</td></tr>
<tr><td>— Metals and metalloids (As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Tl, V, Zn)</td></tr>
</table></td><td>CC</td><td>The natural gas proposed to be used in the boilers in the scope of this application will be supplied from the UK National Transmission System and is therefore subject to a product quality specification and assurance that we consider to meet the requirements of this BATc.</td></tr>
</table>

BAT Concn. 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
	<table><tr><td>HFO</td><td>— Ash — C, S, N, Ni, V</td></tr><tr><td>Gas oil</td><td>— Ash — N, C, S</td></tr><tr><td>Natural gas</td><td>— LHV — CH_4, C_2H_6, C_3, C_4+, CO_2, N_2, Wobbe index</td></tr><tr><td>Process fuels from the chemical industry (27)</td><td>— Br, C, Cl, F, H, N, O, S — Metals and metalloids (As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Tl, V, Zn)</td></tr><tr><td>Iron and steel process gases</td><td>— LHV, CH_4 (for COG), C_XH_Y (for COG), CO_2, H_2, N_2, total sulphur, dust, Wobbe index</td></tr><tr><td>Waste (28)</td><td>— LHV — Moisture — Volatiles, ash, Br, C, Cl, F, H, N, O, S — Metals and metalloids (As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Tl, V, Zn)</td></tr></table>		
10	In order to reduce emissions to air and/or to water during other than normal operating conditions (OTNOC), BAT is to set up and implement a management plan as part of the environmental management system (see BAT 1), commensurate with the relevance of potential pollutant releases, that includes the following elements: — appropriate design of the systems considered relevant in causing OTNOC that may have an impact on emissions to air, water and/or soil (e.g. low-load design concepts for reducing the minimum start-up and shutdown loads for stable generation in gas turbines), — set-up and implementation of a specific preventive maintenance plan for these relevant systems, — review and recording of emissions caused by OTNOC and associated circumstances and implementation of corrective actions if necessary, — periodic assessment of the overall emissions during OTNOC (e.g. frequency of events, duration, emissions quantification/estimation) and implementation of corrective actions if necessary.	FC	As part of the application, the operator has submitted a plan addressing the commissioning phase of LCP 671 (application document 'GM/00592 Greatham Replacement Boilers Environmental Permit Variation - Commissioning Plan' that we have included in the operating techniques to be followed by the operator (Table S1.2). The operator has also provided a review of other OTNOC identified at the design stage (response to Schedule 5 Notice served 21/08/19

BAT Concn. 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
			and responded 30/09//19) and addressed how OTNOC will be prevented, periodically reviewed and monitored by mean of management plans within their EMS. The operator has stated that preventative maintenance will be carried out on the LCP by implementing a service agreement with the boilers' manufacturer under the operator's supervision. We have set an improvement condition (IC11) to follow up on the set up and implementation of specific EMS plans and procedures relating to the operations of the new LPC 671, including the requirements of this BATc for OTNOC. We have also taken into account the fact that the site is a top tier COMAH installation and it is therefore required to assess and mitigate its risks according to the Safety Report.
11	BAT is to appropriately monitor emissions to air and/or to water during OTNOC. ***Description*** The monitoring can be carried out by direct measurement of emissions or by monitoring of surrogate parameters if this proves to be of equal or better scientific quality than the direct measurement of emissions. Emissions during start-up and shutdown (SU/SD) may be assessed based on a detailed emission measurement carried out for a typical SU/SD procedure at least once every year, and using the results of this measurement to estimate the emissions for each and every SU/SD throughout the year.	CC	The response to Schedule 5 Notice served 21/08/19 (received 30/09/19) sets out the proposed plan for monitoring emissions to air from LCP 671 during OTNOC, as described in the following: emissions of NOx and CO will be monitored by the CEMS during most OTNOC. The only OTNOC

<table>
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<tr><td></td><td></td><td></td><td>during which the CEMS will not monitor emissions are:
- Total plant power outage; in this case the boilers will shut down stopping emissions;
- Outage of the CEMS. This will be mitigate by a service contract with third-party including emergency call-out service.

The operator has stated they don’t foresee OTNOC of LCP 671 leading to abnormal discharges of water with a potential of causing increased environmental risk.

We have reviewed the response provided by the operator and we consider it satisfactorily addresses the requirements of this BATc. We have also taken into account the fact that the site is a top tier COMAH installation and it is therefore required to assess and mitigate its risks according to the Safety Report.</td></tr>
<tr><td>12</td><td>In order to increase the energy efficiency of combustion, gasification and/or IGCC units operated ≥ 1 500 h/yr, BAT is to use an appropriate combination of the techniques given below.<table><tr><th>Technique</th><th>Description</th><th>Applicability</th></tr></table></td><td>CC</td><td>The following combination of techniques is implemented in the design of the new boilers in the scope of this variation:</td></tr>
</table>

BAT Concn. 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
	a.	Combustion optimisation	See description in Section 8.2. Optimising the combustion minimises the content of unburnt substances in the flue-gases and in solid combustion residues	Generally applicable		a. Implemented as part of the boiler and burner management system; b. This technique is claimed to be implemented as part of the design in the application documents. However we consider it not applicable, because there is not a power generation cycle, with a working medium, in the scope of the application. LCP 671 consists of boilers to generate steam as heating medium to meet the demand chemical process permitted at the installation; d. The design of the boilers includes flue gas economisers; g. Computerised control of the main process parameters is implemented as part of the design; h. Boiler feed-water is preheated in the economiser. We note this technique is not applicable
	b.	Optimisation of the working medium conditions	Operate at the highest possible pressure and temperature of the working medium gas or steam, within the constraints associated with, for example, the control of NO_X emissions or the characteristics of energy demanded			
	c.	Optimisation of the steam cycle	Operate with lower turbine exhaust pressure by utilisation of the lowest possible temperature of the condenser cooling water, within the design conditions			
	d.	Minimisation of energy consumption	Minimising the internal energy consumption (e.g. greater efficiency of the feed-water pump)			
	e.	Preheating of combustion air	Reuse of part of the heat recovered from the combustion flue-gas to preheat the air used in combustion	Generally applicable within the constraints related to the need to control NO_X emissions		
	f.	Fuel preheating	Preheating of fuel using recovered heat	Generally applicable within the constraints associated with the boiler design and the need to control NO_Xemissions		
	g.	Advanced control system	See description in Section 8.2. Computerised control of the main combustion parameters enables the combustion efficiency to be improved	Generally applicable to new units. The applicability to old units may be constrained by the need to retrofit the combustion system and/or control command system		
	h.	Feed-water preheating using recovered heat	Preheat water coming out of the steam condenser with recovered heat, before reusing it in the boiler	Only applicable to steam circuits and not to hot boilers. Applicability to existing units may be limited due to constraints associated with the plant configuration and the amount of recoverable heat		
	i.	Heat recovery by cogeneration (CHP)	Recovery of heat (mainly from the steam system) for producing hot water/steam to be used in	Applicable within the constraints associated with the local heat and power demand.		

BAT Concn. 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
						to hot boilers, as those included in this application; o. Fuel is supplied as a dry gas. We consider this an appropriate combination of the techniques specified in this BATc. The applicant has also assessed opportunities of recovering and exporting heat from the boilers, and provided a cost benefit analysis pursuant the requirements of Article 14 of Energy Efficiency Directive, that is discussed in section 2.1.9.(d)
			industrial processes/activities or in a public network for district heating. Additional heat recovery is possible from: — flue-gas — grate cooling — circulating fluidised bed	The applicability may be limited in the case of gas compressors with an unpredictable operational heat profile		
	j.	CHP readiness	See description in Section 8.2.	Only applicable to new units where there is a realistic potential for the future use of heat in the vicinity of the unit		
	k.	Flue-gas condenser	See description in Section 8.2.	Generally applicable to CHP units provided there is enough demand for low-temperature heat		
	l.	Heat accumulation	Heat accumulation storage in CHP mode	Only applicable to CHP plants. The applicability may be limited in the case of low heat load demand		
	m.	Wet stack	See description in Section 8.2.	Generally applicable to new and existing units fitted with wet FGD		
	n.	Cooling tower discharge	The release of emissions to air through a cooling tower and not via a dedicated stack	Only applicable to units fitted with wet FGD where reheating of the flue-gas is necessary before release, and where the unit cooling system is a cooling tower		
	o.	Fuel pre-drying	The reduction of fuel moisture content before combustion to improve combustion conditions	Applicable to the combustion of biomass and/or peat within the constraints associated with spontaneous combustion risks (e.g. the moisture content of peat is kept above 40 % throughout the delivery chain). The retrofit of existing plants may be restricted by the extra calorific value that can be obtained from the drying operation and by the limited retrofit possibilities offered by some boiler designs or plant configurations		

<table>
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<tr><td></td><td>
<table>
<tr><td>p.</td><td>Minimisation of heat losses</td><td>Minimising residual heat losses, e.g. those that occur via the slag or those that can be reduced by insulating radiating sources</td><td>Only applicable to solid-fuel-fired combustion units and to gasification/IGCC units</td></tr>
<tr><td>q.</td><td>Advanced materials</td><td>Use of advanced materials proven to be capable of withstanding high operating temperatures and pressures and thus to achieve increased steam/combustion process efficiencies</td><td>Only applicable to new plants</td></tr>
<tr><td>r.</td><td>Steam turbine upgrades</td><td>This includes techniques such as increasing the temperature and pressure of medium-pressure steam, addition of a low-pressure turbine, and modifications to the geometry of the turbine rotor blades</td><td>The applicability may be restricted by demand, steam conditions and/or limited plant lifetime</td></tr>
<tr><td>s.</td><td>Supercritical and ultra-supercritical steam conditions</td><td>Use of a steam circuit, including steam reheating systems, in which steam can reach pressures above 220,6 bar and temperatures above 374 °C in the case of supercritical conditions, and above 250 – 300 bar and temperatures above 580 – 600 °C in the case of ultra-supercritical conditions</td><td>Only applicable to new units of ≥ 600 MW_{th} operated > 4 000 h/yr.

Not applicable when the purpose of the unit is to produce low steam temperatures and/or pressures in process industries.

Not applicable to gas turbines and engines generating steam in CHP mode.

For units combusting biomass, the applicability may be constrained by high-temperature corrosion in the case of certain biomasses</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>13</td><td>In order to reduce water usage and the volume of contaminated waste water discharged, BAT is to use one or both of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Water recycling</td><td>Residual aqueous streams, including run-off water, from the plant are reused for other purposes. The degree of</td><td>Not applicable to waste water from cooling systems when water treatment chemicals</td></tr>
</table>
</td><td>NA</td><td>The application documents and the response to Schedule 5 Notice served 21/08/19 (received 30/09/19) demonstrate that satisfactory consideration has been given by the operator to opportunities for including water</td></tr>
</table>

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			recycling is limited by the quality requirements of the recipient water stream and the water balance of the plant	and/or high concentrations of salts from seawater are present		recycling features in the design. This included: - Consideration of opportunity for recycling boiler blow-down stream as cooling tower make-up; - Consideration of opportunity for recycling economiser bleed stream as boiler feed water to the deaerator; - Consideration of opportunity for segregation, treatment and reuse of surface run-off stream.
	b.	Dry bottom ash handling	Dry, hot bottom ash falls from the furnace onto a mechanical conveyor system and is cooled down by ambient air. No water is used in the process.	Only applicable to plants combusting solid fuels. There may be technical restrictions that prevent retrofitting to existing combustion plants		

			These options were discarded by the operator with a justification that the flow of recovered water would be minimal when compared to the water balance of the site and that therefore they considered that the capital costs to implement them would be disproportionate to the achieved benefits. Quantitative evidence of this justification was provided as follows: the effluent system at the installation is designed to treat up to 12,000m^3/day. The boiler blowdown from the new boilers will be approximately 24m^3/day, insignificant compared to the total effluent process at the installation. Also, since the new LCP 671 will provide the same service of the existing LCP 354 to be replaced, there is no likely change to the environmental risk associated with emissions to water as a result of this variation. The justification was further supported by the fact that, although LCP 671 is new, it will be installed within an existing permitted chemical site, with the constraints of the existing drainage system and underground services. We have accepted the justifications provided by the operator and consider this narrative BATc not applicable to the proposed variation due to the constraints associated with the overall water balance of the installation and the configuration of the drainage system at the existing installation site.

<table>
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<tr><td>14</td><td>In order to prevent the contamination of uncontaminated waste water and to reduce emissions to water, BAT is to segregate waste water streams and to treat them separately, depending on the pollutant content.
Description
Waste water streams that are typically segregated and treated include surface run-off water, cooling water, and waste water from flue-gas treatment.
Applicability
The applicability may be restricted in the case of existing plants due to the configuration of the drainage systems.</td><td>NA</td><td>The application documents and the response to Schedule 5 Notice served 21/08/19 (received 30/09/19) provide the operator’s justification on the restricted applicability of this BATc to this variation: although LCP 671 is new, it will be installed within an existing permitted chemical site, with the constraints of the existing drainage system and underground services.

We have accepted the justification provided by the operator and considered this narrative BATc not applicable to the proposed variation, due to the constraints associated with the existing installation site and the configuration of its drainage system.</td></tr>
<tr><td>15</td><td>In order to reduce emissions to water from flue-gas treatment, BAT is to use an appropriate combination of the techniques given below, and to use secondary techniques as close as possible to the source in order to avoid dilution.
<table>
<tr><th colspan="2">Technique</th><th>Typical pollutants prevented/abated</th><th>Applicability</th></tr>
<tr><td colspan="4">Primary techniques</td></tr>
<tr><td>a.</td><td>Optimised combustion (see BAT 6) and flue-gas treatment systems (e.g. SCR/SNCR, see BAT 7)</td><td>Organic compounds, ammonia (NH_3)</td><td>Generally applicable</td></tr>
<tr><td colspan="4">Secondary techniques (29)</td></tr>
<tr><td>b.</td><td>Adsorption on activated carbon</td><td>Organic compounds, mercury (Hg)</td><td>Generally applicable</td></tr>
<tr><td>c.</td><td>Aerobic biological treatment</td><td>Biodegradable organic compounds, ammonium (NH_4^+)</td><td>Generally applicable for the treatment of organic compounds. Aerobic biological treatment of ammonium (NH_4^+) may not be applicable in the case of high chloride concentrations (i.e. around 10 g/l)</td></tr>
</table></td><td>NA</td><td>Not applicable, there is no flue gas treatment in the scope of this variation.</td></tr>
</table>

BAT Concn. 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

d.	Anoxic/anaerobic biological treatment	Mercury (Hg), nitrate (NO_3^-), nitrite (NO_2^-)	Generally applicable
e.	Coagulation and flocculation	Suspended solids	Generally applicable
f.	Crystallisation	Metals and metalloids, sulphate (SO_4^{2-}), fluoride (F^-)	Generally applicable
g.	Filtration (e.g. sand filtration, microfiltration, ultrafiltration)	Suspended solids, metals	Generally applicable
h.	Flotation	Suspended solids, free oil	Generally applicable
i.	Ion exchange	Metals	Generally applicable
j.	Neutralisation	Acids, alkalis	Generally applicable
k.	Oxidation	Sulphide (S^{2-}), sulphite (SO_3^{2-})	Generally applicable
l.	Precipitation	Metals and metalloids, sulphate (SO_4^{2-}), fluoride (F^-)	Generally applicable
m.	Sedimentation	Suspended solids	Generally applicable
n.	Stripping	Ammonia (NH_3)	Generally applicable

The BAT-AELs refer to direct discharges to a receiving water body at the point where the emission leaves the installation.

BAT-AELs for direct discharges to a receiving water body from flue-gas treatment

Substance/Parameter		BAT-AELs
		Daily average
Total organic carbon (TOC)		20–50 mg/l [30] [31] [32]
Chemical oxygen demand (COD)		60–150 mg/l [30] [31] [32]
Total suspended solids (TSS)		10–30 mg/l
Fluoride (F^-)		10–25 mg/l [32]
Sulphate (SO_4^{2-})		1,3–2,0 g/l [32] [33] [34] [35]
Sulphide (S^{2-}), easily released		0,1–0,2 mg/l [32]
Sulphite (SO_3^{2-})		1–20 mg/l [32]
Metals and metalloids	As	10–50 µg/l
	Cd	2–5 µg/l
	Cr	10–50 µg/l
	Cu	10–50 µg/l
	Hg	0,2–3 µg/l
	Ni	10–50 µg/l

<table>
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<tr><td></td><td><table><tr><td></td><td>Pb</td><td>10–20 µg/l</td></tr><tr><td></td><td>Zn</td><td>50–200 µg/l</td></tr></table></td><td></td><td></td></tr>
<tr><td>16</td><td>In order to reduce the quantity of waste sent for disposal from the combustion and/or gasification process and abatement techniques, BAT is to organise operations so as to maximise, in order of priority and taking into account life-cycle thinking:

(a) waste prevention, e.g. maximise the proportion of residues which arise as by-products;

(b) waste preparation for reuse, e.g. according to the specific requested quality criteria;

(c) waste recycling;

(d) other waste recovery (e.g. energy recovery),

by implementing an appropriate combination of techniques such as:

<table><tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr><tr><td>a.</td><td>Generation of gypsum as a by-product</td><td>Quality optimisation of the calcium-based reaction residues generated by the wet FGD so that they can be used as a substitute for mined gypsum (e.g. as raw material in the plasterboard industry). The quality of limestone used in the wet FGD influences the purity of the gypsum produced</td><td>Generally applicable within the constraints associated with the required gypsum quality, the health requirements associated to each specific use, and by the market conditions</td></tr><tr><td>b.</td><td>Recycling or recovery of residues in the construction sector</td><td>Recycling or recovery of residues (e.g. from semi-dry desulphurisation processes, fly ash, bottom ash) as a construction material (e.g. in road building, to replace sand in concrete production, or in the cement industry)</td><td>Generally applicable within the constraints associated with the required material quality (e.g. physical properties, content of harmful substances) associated to each specific use, and by the market conditions</td></tr></table></td><td>NA</td><td>None of the techniques are applicable to this variation as there is no generation of waste, such as gypsum, ashes or spent catalysts, from the proposed operation of the new natural gas fired boilers.</td></tr>
</table>

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<table>
<tr><td>c.</td><td>Energy recovery by using waste in the fuel mix</td><td>The residual energy content of carbon-rich ash and sludges generated by the combustion of coal, lignite, heavy fuel oil, peat or biomass can be recovered for example by mixing with the fuel</td><td>Generally applicable where plants can accept waste in the fuel mix and are technically able to feed the fuels into the combustion chamber</td></tr>
<tr><td>d.</td><td>Preparation of spent catalyst for reuse</td><td>Preparation of catalyst for reuse (e.g. up to four times for SCR catalysts) restores some or all of the original performance, extending the service life of the catalyst to several decades. Preparation of spent catalyst for reuse is integrated in a catalyst management scheme</td><td>The applicability may be limited by the mechanical condition of the catalyst and the required performance with respect to controlling NO_X and NH_3 emissions</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>17</td><td>In order to reduce noise emissions, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Operational measures</td><td>These include:
— improved inspection and maintenance of equipment
— closing of doors and windows of enclosed areas, if possible
— equipment operated by experienced staff
— avoidance of noisy activities at night, if possible
— provisions for noise control during maintenance activities</td><td>Generally applicable</td></tr>
</table>
</td><td>CC</td><td>The following appropriate combination of techniques is implemented in the design of the new boilers in the scope of this variation:
b. Implemented through the site EMS and maintenance management system
c. The only rotating equipment is the flue gas recirculation fans which are supplied with acoustic foam lining to limit the operating noise level to 75 dB(A) at 1 metre at the maximum continuous steam production rate of the boilers
g. Snorkel air inlet silencer to be fitted to all burners as</td></tr>
</table>

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	b. Low-noise equipment — This potentially includes compressors, pumps and disks — Generally applicable when the equipment is new or replaced c. Noise attenuation — Noise propagation can be reduced by inserting obstacles between the emitter and the receiver. Appropriate obstacles include protection walls, embankments and buildings — Generally applicable to new plants. In the case of existing plants, the insertion of obstacles may be restricted by lack of space d. Noise-control equipment — This includes: — noise-reducers — equipment insulation — enclosure of noisy equipment — soundproofing of buildings — The applicability may be restricted by lack of space e. Appropriate location of equipment and buildings — Noise levels can be reduced by increasing the distance between the emitter and the receiver and by using buildings as noise screens — Generally applicable to new plant		standard, and is complete with acoustic foam lining to limit the operating noise level to 75 dB(A) at 1 metre at the rated capacity of the boilers. Auto vents will be fitted with silencers to reduce noise from steam venting h. The equipment will be located in an area that was previously used for process plant and is shielded by other process buildings.
Combustion of gaseous fuels			
40	In order to increase the energy efficiency of natural gas combustion, BAT is to use an appropriate combination of the techniques given in BAT 12 and below. a. Combined cycle — See description in Section 8.2 — Generally applicable to new gas turbines and engines except when operated < 1 500 h/yr. Applicable to existing gas turbines and engines within the constraints associated with the steam cycle design and the space availability. Not applicable to existing gas turbines and engines operated < 1 500 h/yr. Not applicable to mechanical drive gas turbines operated in discontinuous mode with extended load variations and frequent start-ups and shutdowns. Not applicable to boilers **BAT-associated energy efficiency levels (BAT-AEELs) for the combustion of natural gas** **BAT-AEELs ([136]) ([137])**	FC	Refer to BATc 12 for the combination of energy efficiency techniques implemented in the design. The design net total fuel utilisation for the new boilers, as stated in the application documents, is 92.7%, which is compliant with the BAT-AEEL for gas-fired boilers.

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<table>
<tr><th rowspan="2">Type of combustion unit</th><th colspan="2">Net electrical efficiency (%)</th><th rowspan="2">Net total fuel utilisation (%) (138) (139)</th><th colspan="2">Net mechanical energy efficiency (%) (139) (140)</th></tr>
<tr><th>New unit</th><th>Existing unit</th><th>New unit</th><th>Existing unit</th></tr>
<tr><td>Gas engine</td><td>39,5–44 (141)</td><td>35–44 (141)</td><td>56–85 (141)</td><td colspan="2">No BAT-AEEL.</td></tr>
<tr><td>Gas-fired boiler</td><td>39–42,5</td><td>38–40</td><td>78–95</td><td colspan="2">No BAT-AEEL.</td></tr>
<tr><td>Open cycle gas turbine, ≥ 50 MWth</td><td>36–41,5</td><td>33–41,5</td><td>No BAT-AEEL</td><td>36,5–41</td><td>33,5–41</td></tr>
<tr><td colspan="6">Combined cycle gas turbine (CCGT)</td></tr>
<tr><td>CCGT, 50–600 MW_{th}</td><td>53–58,5</td><td>46–54</td><td>No BAT-AEEL</td><td colspan="2">No BAT-AEEL</td></tr>
<tr><td>CCGT, ≥ 600 MW_{th}</td><td>57–60,5</td><td>50–60</td><td>No BAT-AEEL</td><td colspan="2">No BAT-AEEL</td></tr>
<tr><td>CHP CCGT, 50–600 MW_{th}</td><td>53–58,5</td><td>46–54</td><td>65–95</td><td colspan="2">No BAT-AEEL</td></tr>
<tr><td>CHP CCGT, ≥ 600 MW_{th}</td><td>57–60,5</td><td>50–60</td><td>65–95</td><td colspan="2">No BAT-AEEL</td></tr>
</table>
</td><td></td><td>We have set an improvement condition to confirm this figure at the performance test of the plant.</td></tr>
<tr><td>41</td><td>In order to prevent or reduce NO_X emissions to air from the combustion of natural gas in boilers, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Air and/or fuel staging</td><td>See descriptions in Section 8.3.
Air staging is often associated with low-NO_X burners</td><td rowspan="3">Generally applicable</td></tr>
<tr><td>b.</td><td>Flue-gas recirculation</td><td rowspan="2">See description in Section 8.3</td></tr>
<tr><td>c.</td><td>Low-NO_X burners (LNB)</td></tr>
<tr><td>d.</td><td>Advanced control system</td><td>See description in Section 8.3.</td><td>The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system</td></tr>
</table>
</td><td>CC</td><td>The application documents confirm that the techniques (b.), (c.), (d.) and (e.) are included in the design.
We consider this an appropriate combination of the techniques specified in this BATc.</td></tr>
</table>

BAT Concn. 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

		This technique is often used in combination with other techniques or may be used alone for combustion plants operated < 500 h/yr	
e.	Reduction of the combustion air temperature	See description in Section 8.3	Generally applicable within the constraints associated with the process needs
f.	Selective non–catalytic reduction (SNCR)		Not applicable to combustion plants operated < 500 h/yr with highly variable boiler loads. The applicability may be limited in the case of combustion plants operated between 500 h/yr and 1 500 h/yr with highly variable boiler loads
g.	Selective catalytic reduction (SCR)		Not applicable to combustion plants operated < 500 h/yr. Not generally applicable to combustion plants of < 100 MW_{th}. There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr

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In order to prevent or reduce NO_X emissions to air from the combustion of natural gas in gas turbines, BAT is to use one or a combination of the techniques given below.

NA

Not applicable, there are no gas turbines in the scope of the application.

Technique		Description	Applicability
a.	Advanced control system	See description in Section 8.3. This technique is often used in combination with other techniques or may be used alone for combustion plants operated < 500 h/yr	The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system
b.	Water/steam addition	See description in Section 8.3	The applicability may be limited due to water availability

BAT Concn. 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
	c.	Dry low-NO_X burners (DLN)		The applicability may be limited in the case of turbines where a retrofit package is not available or when water/steam addition systems are installed		
	d.	Low-load design concept	Adaptation of the process control and related equipment to maintain good combustion efficiency when the demand in energy varies, e.g. by improving the inlet airflow control capability or by splitting the combustion process into decoupled combustion stages	The applicability may be limited by the gas turbine design		
	e.	Low-NO_X burners (LNB)	See description in Section 8.3	Generally applicable to supplementary firing for heat recovery steam generators (HRSGs) in the case of combined-cycle gas turbine (CCGT) combustion plants		
	f.	Selective catalytic reduction (SCR)		Not applicable in the case of combustion plants operated < 500 h/yr. Not generally applicable to existing combustion plants of < 100 MW_{th}. Retrofitting existing combustion plants may be constrained by the availability of sufficient space. There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr		
43	In order to prevent or reduce NO_X emissions to air from the combustion of natural gas in engines, BAT is to use one or a combination of the techniques given below. **Technique** / **Description** / **Applicability**				NA	Not applicable, there are no gas engines in the scope of the application.

<table>
<tr><th>BAT Concn. 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></tr>
<tr><td></td><td>
<table>
<tr><td>a.</td><td>Advanced control system</td><td>See description in Section 8.3.
This technique is often used in combination with other techniques or may be used alone for combustion plants operated < 500 h/yr</td><td>The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system</td></tr>
<tr><td>b.</td><td>Lean-burn concept</td><td>See description in Section 8.3.
Generally used in combination with SCR</td><td>Only applicable to new gas-fired engines</td></tr>
<tr><td>c.</td><td>Advanced lean-burn concept</td><td rowspan="2">See descriptions in Section 8.3</td><td>Only applicable to new spark plug ignited engines</td></tr>
<tr><td>d.</td><td>Selective catalytic reduction (SCR)</td><td>Retrofitting existing combustion plants may be constrained by the availability of sufficient space.
Not applicable to combustion plants operated < 500 h/yr.
There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>44</td><td>In order to prevent or reduce CO emissions to air from the combustion of natural gas, BAT is to ensure optimised combustion and/or to use oxidation catalysts.
Description - See descriptions in Section 8.3.
BAT-associated emission levels (BAT-AELs) for NO_X emissions to air from the combustion of natural gas in gas turbines
<table>
<tr><th rowspan="2">Type of combustion plant</th><th rowspan="2">Combustion plant total rated thermal input (MW_{th})</th><th colspan="2">BAT-AELs (mg/Nm^3) (142) (143)</th></tr>
<tr><th>Yearly average (144) (145)</th><th>Daily average or average over the sampling period</th></tr>
<tr><td colspan="4">Open-cycle gas turbines (OCGTs) (146) (147)</td></tr>
<tr><td>New OCGT</td><td>≥ 50</td><td>15–35</td><td>25–50</td></tr>
<tr><td>Existing OCGT (excluding turbines for mechanical drive applications) — All but plants operated < 500 h/yr</td><td>≥ 50</td><td>15–50</td><td>25–55 (148)</td></tr>
<tr><td colspan="4">Combined-cycle gas turbines (CCGTs) (146) (149)</td></tr>
<tr><td>New CCGT</td><td>≥ 50</td><td>10–30</td><td>15–40</td></tr>
</table>
</td><td>CC</td><td>Advanced control system is included in the design.
The new boilers are designed to operate below the annual BAT-AEL of 60 mg/Nm^3 for NOx and within the indicative emission level of 15 mg/Nm^3 applicable to new boilers.</td></tr>
</table>

BAT Concn. 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

Existing CCGT with a net total fuel utilisation of < 75 %	≥ 600	10–40	18–50
Existing CCGT with a net total fuel utilisation of ≥ 75 %	≥ 600	10–50	18–55 (150)
Existing CCGT with a net total fuel utilisation of < 75 %	50–600	10–45	35–55
Existing CCGT with a net total fuel utilisation of ≥ 75 %	50–600	25–50 (151)	35–55 (152)

Open- and combined-cycle gas turbines

Gas turbine put into operation no later than 27 November 2003, or existing gas turbine for emergency use and operated < 500 h/yr	≥ 50	No BAT-AEL	60–140 (153) (154)
Existing gas turbine for mechanical drive applications — All but plants operated < 500 h/yr	≥ 50	15–50 (155)	25–55 (156)

As an indication, the yearly average CO emission levels for each type of existing combustion plant operated ≥ 1 500 h/yr and for each type of new combustion plant will generally be as follows:

- New OCGT of ≥ 50 MW_{th}: < 5–40 mg/Nm^3. For plants with a net electrical efficiency (EE) greater than 39 %, a correction factor may be applied to the higher end of this range, corresponding to [higher end] × EE/39, where EE is the net electrical energy efficiency or net mechanical energy efficiency of the plant determined at ISO baseload conditions.
- Existing OCGT of ≥ 50 MW_{th} (excluding turbines for mechanical drive applications): < 5–40 mg/Nm^3. The higher end of this range will generally be 80 mg/Nm^3 in the case of existing plants that cannot be fitted with dry techniques for NO_X reduction, or 50 mg/Nm^3 for plants that operate at low load.
- New CCGT of ≥ 50 MW_{th}: < 5–30 mg/Nm^3. For plants with a net electrical efficiency (EE) greater than 55 %, a correction factor may be applied to the higher end of the range, corresponding to [higher end] × EE/55, where EE is the net electrical energy efficiency of the plant determined at ISO baseload conditions.
- Existing CCGT of ≥ 50 MW_{th}: < 5–30 mg/Nm^3. The higher end of this range will generally be 50 mg/Nm^3 for plants that operate at low load.
- Existing gas turbines of ≥ 50 MW_{th} for mechanical drive applications: < 5–40 mg/Nm^3. The higher end of the range will generally be 50 mg/Nm^3 when plants operate at low load.

In the case of a gas turbine equipped with DLN burners, these indicative levels correspond to when the DLN operation is effective.

BAT-associated emission levels (BAT-AELs) for NO_X emissions to air from the combustion of natural gas in boilers and engines

Type of combustion plant	BAT-AELs (mg/Nm^3)			
	Yearly average (157)		Daily average or average over the sampling period	
	New plant	Existing plant (158)	New plant	Existing plant (159)

<table>
<tr><th>BAT Concn. 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></tr>
<tr><td></td><td>
<table>
<tr><td>Boiler</td><td>10–60</td><td>50–100</td><td>30–85</td><td>85–110</td></tr>
<tr><td>Engine (160)</td><td>20–75</td><td>20–100</td><td>55–85</td><td>55–110 (161)</td></tr>
</table>
As an indication, the yearly average CO emission levels will generally be:
— < 5–40 mg/Nm^3 for existing boilers operated ≥ 1 500 h/yr,
— < 5–15 mg/Nm^3 for new boilers,
— 30–100 mg/Nm^3 for existing engines operated ≥ 1 500 h/yr and for new engines.
</td><td></td><td></td></tr>
<tr><td>45</td><td>
In order to reduce non-methane volatile organic compounds (NMVOC) and methane (CH_4) emissions to air from the combustion of natural gas in spark-ignited lean-burn gas engines, BAT is to ensure optimised combustion and/or to use oxidation catalysts.
Description
See descriptions in Section 8.3. Oxidation catalysts are not effective at reducing the emissions of saturated hydrocarbons containing less than four carbon atoms.
BAT-associated emission levels (BAT-AELs) for formaldehyde and CH_4 emissions to air from the combustion of natural gas in a spark-ignited lean-burn gas engine
<table>
<tr><th rowspan="4">Combustion plant total rated thermal input (MW_{th})</th><th colspan="3">BAT-AELs (mg/Nm^3)</th></tr>
<tr><th>Formaldehyde</th><th colspan="2">CH_4</th></tr>
<tr><th colspan="3">Average over the sampling period</th></tr>
<tr><th>New or existing plant</th><th>New plant</th><th>Existing plant</th></tr>
<tr><td>≥ 50</td><td>5–15 (162)</td><td>215–500 (163)</td><td>215–560 (162) (163)</td></tr>
</table>
</td><td>NA</td><td>Not applicable as the application does not include gas engines.</td></tr>
</table>

3 Decision checklist

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.
Consultation	
Consultation	The consultation requirements were identified in accordance with the Environmental Permitting Regulations and our public participation statement. The application was publicised on the GOV.UK website. We consulted the following organisations: - Environmental Health – Hartlepool Borough Council - Health and Safety Executive - Food Standards Agency - Director of Public Health - Public Health England The comments and our responses are summarised in the consultation section.
The facility	
The regulated facility	We considered the extent and nature of the facility at the site in accordance with RGN2 'Understanding the meaning of regulated facility', Appendix 2 of RGN 2 'Defining the scope of the installation', Appendix 1 of RGN 2 'Interpretation of Schedule 1'. The extent of the facility defined in the site plan and in the permit. The activities are defined in table S1.1 of the permit.
The site	
Extent of the site of the facility	The operator has provided a plan which we consider is satisfactory, showing the extent of the site of the facility. The plan is included in the permit.
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. The following conservation sites protected under the Habitats Regulations are within relevant screening distance from the installation: - Teesmouth and Cleveland Coast Special Protection Area (SPA) - Teesmouth and Cleveland Coast Ramsar The following sites protected under the Countryside and Rights of Way Act are within relevant screening distance from the installation:

Aspect considered	Decision
	- Teesmouth and Cleveland Coast Site of Special Scientific Interest (SSSI) - Seals Sands SSSI (archived SSSI) The following non-statutorily protected conservation sites are within relevant screening distance: - Teesmouth National Nature Reserve (NNR) - Seaton Dunes and Common Local Natural Reserve (LNR) - Queen's Meadow Local Wildlife Site (LWS) - Phillips Tank Farm LWS - Greatham North West LWS - Brenda Road brownfield LWS - Greatham Creek North Bank LWS - Greenabella Marsh LWS - Brenda Road Sewage Works LWS - Hartlepool Power Station LWS - Seaton Common LWS - Zinc Works Field LWS We have assessed the application and its potential to affect all known sites of nature conservation, landscape and heritage and/or protected species or habitats identified in the nature conservation screening report as part of the permitting process. We consider that the application will not affect any sites of nature conservation, landscape and heritage, and/or protected species or habitats identified. Refer to the key issues (Section 2.1.8 (c)) for further details. We have not consulted Natural England on the application. The decision was taken in accordance with our guidance.
Environmental risk assessment	
Environmental risk	We have reviewed the operator's assessment of the environmental risk from the facility. The operator's risk assessment is satisfactory. The assessment shows that, applying the conservative criteria in our guidance on environmental risk assessment, all emissions may be categorised as environmentally insignificant with the exception of oxides of nitrogen for one ecological receptor. However, the variation introduces a betterment compared to the existing permitted operations, in that the area of the ecological conservation site where process contributions of nitrogen oxides exceed the insignificance threshold specified in our guidance is substantially reduced compared to the existing permitted operations. Refer to key issues (Section 2.1.8) for further details.
Operating techniques	
General operating techniques	We have reviewed the techniques used by the operator and compared these with the relevant guidance notes and we consider them to represent appropriate techniques for the facility. The operating techniques that the applicant must use are specified in table S1.2 in the environmental permit.

Aspect considered	Decision
Operating techniques for emissions that do not screen out as insignificant	Emissions of oxides of nitrogen cannot be screened out as insignificant (at one ecological receptor). However, the variation introduces a betterment compared to the existing permitted operations, in that the area of the ecological conservation site where process contributions of nitrogen oxides exceed the insignificance threshold specified in our guidance is substantially reduced compared to the existing permitted operations. Refer to key issues (Section 2.1.8) for further details. We have assessed whether the proposed techniques are BAT. According to the application documents, the new boilers will be fitted with low NOx burners and will make use flue-gas recirculation as primary techniques to minimise emissions of NOx. Their design includes a boiler and burner management system, an advanced control system that provides computerised control of combustion performance to achieve combustion optimisation. Further detail of the assessment of BAT is provided in section 2.1.13. The proposed techniques/ emission levels for emissions that do not screen out as insignificant are in line with the techniques and benchmark levels contained in the technical guidance and we consider them to represent appropriate techniques for the facility. The permit conditions ensure compliance with relevant BREFs and BAT Conclusions, and ELVs deliver compliance with BAT-AELs.
Operating techniques for emissions that screen out as insignificant	Emissions of oxides of nitrogen (for human receptors) and carbon monoxide have been screened out as insignificant, and so we agree that the applicant's proposed techniques are BAT for the installation. We consider that the emission limits included in the installation permit reflect the BAT for the sector.
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 the same level of protection as those in the previous permit (see also 'Use of conditions other than those from the template' below, for bespoke conditions that have been retained from the previous permit).
Use of conditions other than those from the template	We consider that we need to impose conditions other than those in our permit template: we have modernised the permit to the current permit template, however: - Conditions 4.3.1(d), 4.3.2 and Schedule 5 Part C have been worded to retain the same notification arrangement of the previous permit in case of malfunctioning / breakdown of abatement equipment on the existing ICON1 and ICON2 chemical processing facilities, that are unchanged as a result of this variation; - We have retained bespoke condition 4.2.5 from the previous permit (formerly numbered as condition 4.1.4 in the previous consolidation notice EPR/TP3532PK/V008). This condition specifies that the operator shall review fugitive emissions on an annual basis and report to the Agency such releases and the measures taken to reduce them.

Aspect considered	Decision
	We have made this decision because these bespoke conditions were already in the previous permit.
Raw materials	We have not specified limits and controls on the use of raw materials and fuels, however we have retained the applicable specifications for raw material from the existing permit that has been consolidated and modernised during this variation.
Improvement programme	Based on the information on the application, we consider that we need to impose an improvement programme. We have imposed an improvement programme to ensure that: - IC11 – the site EMS is updated to manage the operation of the new LCP 671, during normal and other than normal conditions; - IC12 – the environmental performance of the LCP 671 as installed is reviewed against the design parameters set out in the application; Net Thermal Input and Net Total Fuel Utilisation of the plant based on performance tests are carried out; MSUL/MSDL points and criteria are confirmed; - IC13 – the technical and commercial viability of recovering waste heat from LCP 671 is reviewed to assess whether more favourable conditions arise in the future.
Emission limits	ELVs based on IED Chapter III and BAT have been added for the following substances: - Oxides of nitrogen from emission point A251 - Carbon Monoxide from emission point A251 - Dust from emission point A251 - Sulphur Dioxide from emission point A251 Refer to the key issues for further details.
Monitoring	We have decided that monitoring should be added for the following parameters, using the methods detailed and to the frequencies specified: - Oxides of nitrogen from emission point A251 - Carbon Monoxide from emission point A251 - Dust from emission point A251 - Sulphur Dioxide from emission point A251 These monitoring requirements have been imposed in order to monitor the performance of LCP 671. We made these decisions in accordance with LCP BAT conclusions and Chapter III of the IED.
Reporting	We have added reporting in the permit for the following parameters: - Oxides of nitrogen from emission point A251 - Carbon Monoxide from emission point A251 - Dust from emission point A251 - Sulphur Dioxide from emission point A251 We made these decisions in accordance with our guidance.

Aspect considered	Decision
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.

4 Consultation

The following summarises the responses to consultation with other organisations, our notice on GOV.UK for the public, and the way in which we have considered these in the determination process.

Responses from organisations listed in the consultation section

Response received from
Public Health England
Brief summary of issues raised
Public Health England responded to the consultation that they had no significant concerns regarding the risk to the health of the local population from the installation detailed within this variation.
Summary of actions taken or show how this has been covered
No specific action taken, since no concerns were expressed. Refer to the key issues section for details on what we have considered in our determination.

Response received from
- Environmental Health – Hartlepool Borough Council - Health and Safety Executive - Food Standards Agency - Director of Public Health
Brief summary of issues raised
No response received from these consultees.
Summary of actions taken or show how this has been covered
Not applicable.