APPLICATION TO VARY ENVIRONMENTAL PERMIT REFERENCE EPR/ BJ7395IG – SUPPORTING INFORMATION

E.ON UK CHP Limited, Kemsley

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Environmental Permit
Reference EPR/ BJ7395IG
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NON-TECHNICAL SUMMARY

The majority of the electricity and heat requirements of the DS Smith Kemsley Paper Mill are currently being met by the operation of a combined heat and power (CHP) plant known as K1 which consists of a gas turbine and heat recovery steam generators (LCP 208). Additional steam is supplied by six low pressure (LP) auxiliary boilers arranged in two banks of three (LCP 206, LCP207). K1 began operation in the 1990's and is now reaching the end of its life, there is a requirement to construct, operate and maintain a new CHP plant to continue to supply energy to the Kemsley Site. There is also a permitted paper sludge combustor unit (K2) which was previously generating up to 25 MW of steam for supply to DS Smith, however, this has now been decommissioned and is currently being demolished

E.ON CHP Limited is looking to vary environmental permit (reference EPR/BJ7395IG) for the Kemsley Paper Mill CHP to incorporate a new gas-fired CHP plant (known as K4), new medium pressure (MP) auxiliary boiler, upgrades to the auxiliary boiler plant, an emergency generator and new water treatment plant. This will require additional land to be included in the permitted site boundary. The new CHP plant shall supply electricity and steam to the adjacent existing Kemsley Paper Mill, operated by D S Smith. The new plant will be located on land within the existing Kemsley Paper Mill complex, a separate application was submitted by the Kemsley Paper Mill operator DS Smith on submitted on 28/03/2019 to secure a low risk surrender of this area from their permit (reference EPR/BJ7468IC).

Once K4 is fully commissioned, K1 will be decommissioned by DS Smith (Paper Mill operator) and rendered inoperable before being dismantled at a later date. At this time, a partial permit surrender shall be prepared to remove the K1 operations. The Sludge combustor unit K2 that is currently being demolished will also be replaced by the new gas fired medium pressure boiler and will also be subject to a separate partial permit surrender application.

Five of the six existing LP auxiliary boilers will be taken out of service and replaced by 4 new boilers (each circa 17MW_{th}). The existing LP auxiliary boiler A will remain in service; this boiler has a thermal input of approximately 15.6MW. Following this modification each bank of boilers will have a combined thermal input of <50MW_{th} and are classed as medium combustion plant. They will operate to provide back up steam in the event of a planned or unplanned temporary shutdown of K3 or K4. K4 will be situated adjacent to the E-ON CHP facility, and will be fully integrated with remaining E-ON CHP supply equipment. K3 is not part of this permitted site, it is an adjacent energy from waste plant operated by Wheelabrator to the east of the main mill complex which from 2019 will provide steam to the paper mill.

K4 CHP, K4 MP auxiliary boiler and the K1 area LP auxiliary boilers will burn natural gas which shall be connected to the existing gas supply on the site. The detailed design of the CHP is still being finalised, but it will comprise the following:

- A 143 MW_{th} input gas turbine producing ~57MW of electrical power and classed as large combustion plant (K4 CHP Limited);
- A heat recovery steam generator (HRSG), producing in the region of 105 to 110 MW_{th} of steam and steam turbine, producing in the region of 16MW of electrical power; this shall be fitted with supplementary firing natural gas burners;
- In addition, a new MP auxiliary boiler (K4 boiler) with thermal input of 9.6 MW_{th} producing medium pressure steam;

The steam produced is critical for the paper making process and is contained, de-pressurised and sent to the Paper Mill for use within the paper production process. It therefore provides an energy efficient way of providing both electricity and steam for the paper making process.

Air Quality dispersion modelling has been undertaken for the proposed development and indicates that predicted contributions and resultant environmental concentrations of all pollutants considered are 'negligible'. The resulting air quality effect of the proposed development is considered to be 'not significant' overall.

A noise and vibration assessment has been carried out for the proposed scheme and has concluded that no significant noise or vibration effects are predicted to occur as a result of the proposed development.

Based on the proposed changes, this application will constitute a substantial variation.

It is currently envisaged that K4 will be operational in 2021. DS Smith will therefore require K1 (LCP 208) to continue operating until this time at which point the plant will cease operation and be decommissioned. The existing K1 LP auxiliary boilers are due to be replaced by 2021. K4 will not run (other than commissioning) whilst K1 is still running and K1 cannot run after K4 has been commissioned.

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1 INTRODUCTION

1.1.1 This document and its supporting appendices form the application to vary environmental permit reference EPR/BJ7395IG.

1.1.2 The variation application is required as the operator has a requirement to install a new gas-fired CHP plant (K4), a new MP auxiliary boiler, and an emergency diesel generator. There will be upgrades and modifications to the six currently installed LP auxiliary boilers and the variation will include the new water treatment plant (WTP) which has already been installed. As a result of the proposed changes, additional land is required and would be occupied by the K4 CHP, its associated MP auxiliary boiler, the WTP and the emergency back-up generator.

1.2 Background

1.2.1 E.ON UK CHP Limited was issued the environmental permit on 18th April 2002 to operate the Kemsley Paper Mill CHP facility. It has subsequently had 8 variations with the last being effective from 01/01/2016. This application reference will be EPR/BJ7395IGV010

1.2.2 The environmental permit allows the operation of three large combustion plants (LCP) under the following scheduled activities:

- Section 1.1 A(1) (a): Burning any fuel in an appliance with a rated thermal input of 50 megawatts or more.
- Section 5.1 Part A(1) (b) – The incineration of non-hazardous waste in an incineration or co-incineration plant with a capacity exceeding 3 tonnes per hour

1.2.3 The six LP auxiliary boilers are arranged so that three each discharge into a single windshield with stack height of 72 metres with the following references in the permit:

- LCP 206 – three gas fired boilers totalling 71MWth
- LCP 207 – three gas fired boilers totalling 71MWth

1.2.4 The site operates a Combined Heat and Power (K1 CHP) Plant to provide heat and power in the form of electricity and steam to the Kemsley Paper Mill.

1.2.5 The CHP plant comprises a single gas turbine (GT) with two heat recovery steam generators (HRSGs) producing high pressure steam from the hot turbine exhaust gases and a single steam turbine generating electricity from the steam. The steam exiting the steam turbine is used on the paper mills of the installation. Additional steam is available from six LP auxiliary boilers.

1.2.6 Around 80 MW of electricity and 200 tonnes per hour of steam can be generated from the GT , HRSG's and steam turbine equipment. The LP auxiliary boilers are capable of producing around 172 tonnes/hr of low-pressure steam for the paper mills. The GT and all the auxiliary boilers (LP and MP) will burn natural gas fuel. The HRSG's has a common 70-metre-high chimney with 2 flues, one for each HRSG. The GT also has a 30-metre-high by-pass stack which is for use on infrequent occasions when either a heat recovery boiler is out of action, or the gas turbine is in start-up mode. The waste gases from the six LP auxiliary boilers release through separate flues in two 72 metre chimneys.

1.2.7 Raw materials used at the site include natural gas, water and water treatment chemicals, boiler wash chemicals, compressor wash chemicals, oils, greases and antifreeze.

1.2.8 De-ionised water is produced on-site as a feed stream for steam production and for the treatment of recovered condensate. Regeneration liquors are neutralised prior to discharge to the DS Smith operated effluent treatment plant.

1.2.9 Surface water is protected by interceptors and the site is designed to retain all firefighting waters.

1.3 The Site

1.3.1 The Kemsley Paper Mill lies immediately east of the Kemsley residential suburb of Sittingbourne with the town centre some 2.5km south of the site.

1.3.2 The approximate location of the site is highlighted by the red X in the map in Figure 1-1 below.

1.3.3 The site address is:

E.ON UK CHP Limited
Kemsley Paper Mill CHP
Kemsley Paper Mill
Kemsley
Sittingbourne
Kent
ME10 2SG

1.3.4 The National Grid Reference for the facility is ~TQ 91992 66312.

1.3.5 The Kemsley Paper Mill CHP site lies in the south east corner of the existing Kemsley Paper Mill site approximately 600m west of the Swale Estuary and north of Milton Creek in the Borough of Swale, Kent.

1.3.6 It is accessed from the A249 via Swale Way. An internal access road provides access to the proposal site. The site is comprised almost entirely of existing concrete hard standing.

1.3.7 The Site lies in proximity to a number of sensitive areas:

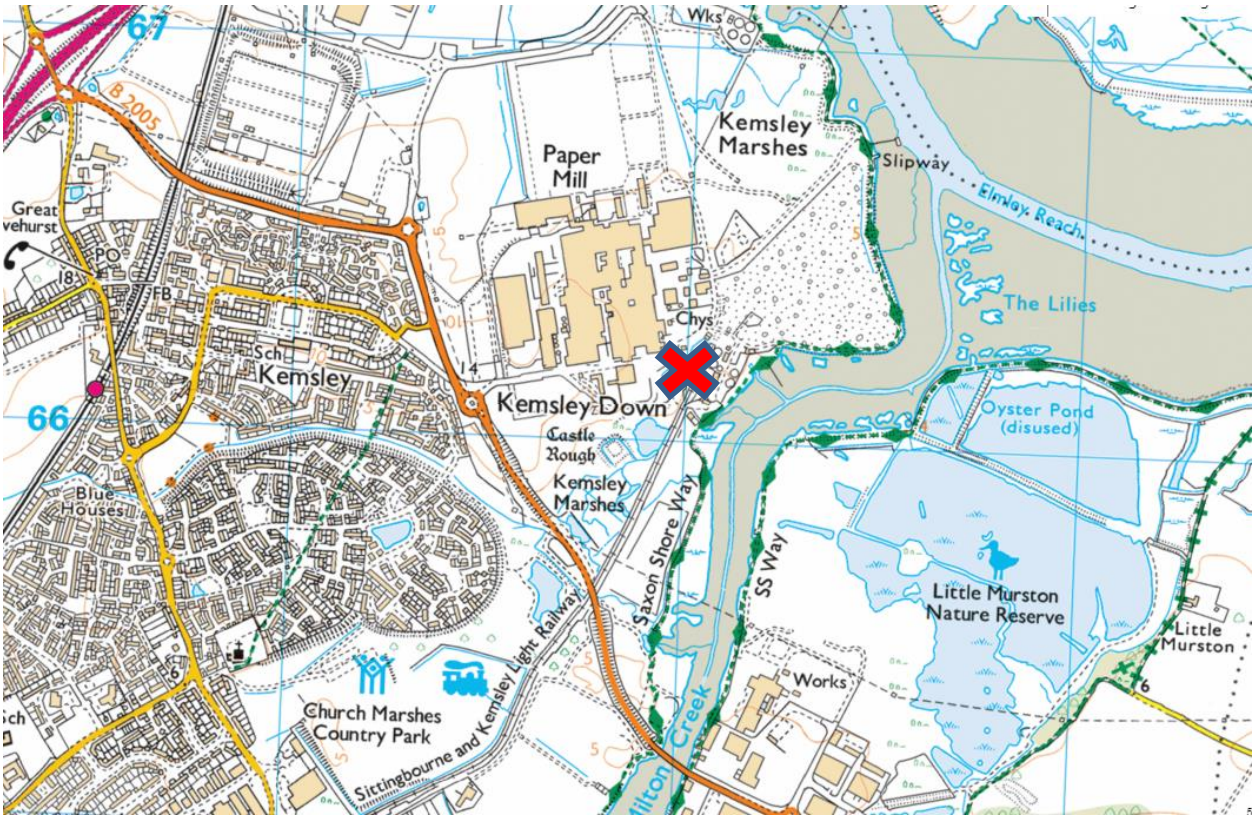
- The Swale Special Protection Area, Special Site of Scientific Interest and Ramsar site designated for its grazing
- marshes and estuarine habitats and the assemblage of breeding and overwintering birds it supports
- 'Castle Rough' a Medieval moated site (Scheduled Monument)
- Local residents in the Kemsley area of Sittingbourne
- The A249 and local highways network
- The River Swale
- The Saxon Shore Way Public Right of Way

1.3.8 The area surrounding the site is a mixture of rural/agricultural fields including the above sensitive areas, residential areas and industrial sites. To the east is the Kemsley generating station site and beyond that is The Swale, with the Elmley National Nature Reserve (NNR) and The Swale NNR on the Isle of Sheppey further to the east. Approximately 9.3 km to the south east is the town of Faversham. Immediately to the north is the DS Smith Recycling Depot and further north are some rural/agricultural fields, further sensitive sites and industrial sites including: Morrisons

distribution centre; Countrystyle Recycling; Hanson concrete; and Knauf. Approximately 7.5 km to the north of the site is the River Medway.

1.3.9 Kemsley town lies to the west, with the A249 further west and agricultural fields on the other side. The outskirts of Rainham, part of the Medway Towns conurbation, lie approximately 10 km to the west of the K4 CHP site. To the north west of the site is the village of Iwade, which is surrounded by agricultural fields. The Eurolink Industrial Estate is located around 1.4 km south of the site, with the town of Sittingbourne lying just beyond, and agricultural fields further to the south. The areas to the east, west and south of Sittingbourne are predominantly made up of agricultural fields are sporadic towns or villages.

Figure 1.1: Site Location



1.3.10 Site layout plans can be found in **Appendix B.**

1.4 Operator Details

1.4.1 E.ON UK CHP Limited is listed on Companies House as company number 02684288.

1.4.2 The company directors as listed on Companies House and their dates of birth are:

- Michael Robert Day – 6th April 1978
- Michael Robert French – 19th November 1968
- Michael Geoffrey Wake – 2nd April 1970

1.5 Structure of the Application Document

1.5.1 Supporting information in this document is set out as follows:

- .Section 2 details the proposed changes and describes the plant to be installed an operated
- Section 3 identifies the environmental risks and summarises the environmental effects associated with the changes
- Section 4 provides the BAT justification for the main techniques and describes how they comply with BAT conclusions.

1.5.2 Further supporting information and detailed assessments, including the application forms and plans are included in Appendices.

1.5.3 Of note, a site plan showing the new permit boundary can be found in **Appendix B** (drawing ref JER1679-SI-001).

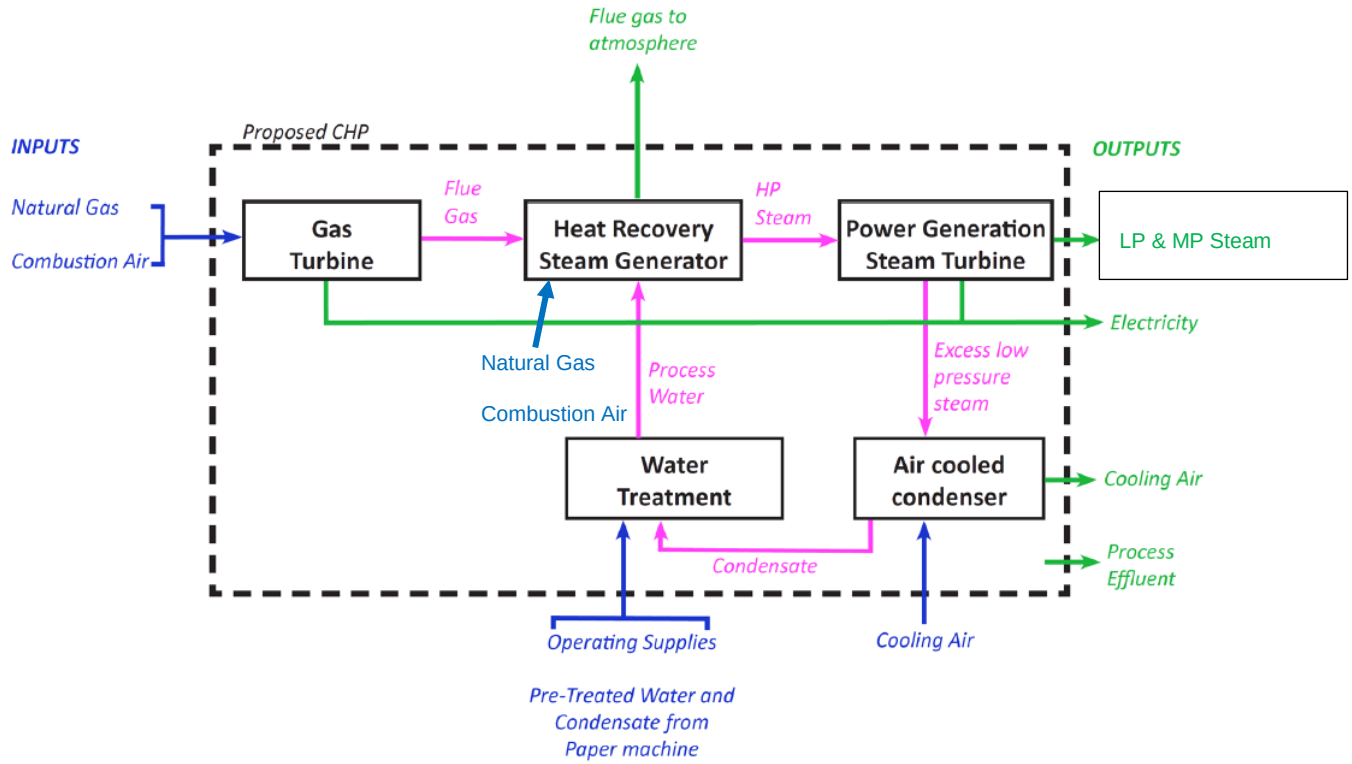
2 DESCRIPTION OF THE CHANGES

2.1 Overview

2.1.1 The proposed changes included within this variation are described in this section. All other aspects of the permitted operations, management and monitoring will remain as are currently permitted unless identified below.

2.1.2 Figure 2.1 below provides a simplified process flow diagram of the K4 CHP plant.

Figure 2.1: CHP Process



2.1.3 The key inputs for the K4 CHP process are therefore natural gas and air, together with pre-treated water and condensate from the paper machines where possible, together with cooling air. The K4 CHP plant creates electricity and low-pressure steam which are transferred to the paper mill (or exported to the grid in the case of any excess electricity) with other outputs comprising exhaust gases which are discharged to the atmosphere, cooling air and a small amount of foul water arising from welfare facilities.

2.1.4 Exported electricity will be stepped up from 11kV to 33kV via an on-site transformer and pass through existing DS Smith switchgear and export meters, through which they are currently permitted to export 43MW through outgoing 33kV breakers onto the distribution network, which is owned and operated by UK Power Networks.

2.2 New CHP Plant and associated K4 MP Auxiliary Boiler

2.2.1 Natural gas to the K4 CHP plant will be supplied through the existing gas station but a new gas conditioning plant will be provided for the K4 CHP plant. The gas will be combusted in a single gas turbine (GT) generator and heat recovery steam generator (HRSG) if required. The gas is preheated with hot feedwater. Combustion air will be drawn in through an air intake filter and then compressed and fed into the combustion chamber in which natural gas will be injected and ignited. The resulting hot combustion gases will pass through the turbine section of the GT generator, driving the blades and rotating the shaft driving the compressor and the electrical generator to produce electricity. The GT generator will produce up to 57MW of electricity, however, will be exporting 56 MW electricity under normal operating conditions. The GT has a thermal input of 143 MW_{th}.

2.2.2 The K4 CHP plant will use a DLE (dry low emissions) combustion system, to reduce peak flame temperature and minimise the formation of nitrogen oxides (NOx) (which is promoted by high temperatures). The combustion control system is fully automated and will minimise the formation of carbon monoxide (CO). A fail-safe flame detection system for the combustors with automatic trip release and gas emergency shut-off system will be installed.

2.2.3 Surplus heat in the exhaust gases from the GT generator will be used to generate steam in the HRSG. Hot gases from the GT generator enter the HRSG at a temperature of approximately 565 °C. The HRSG will include supplementary firing using low NO_x burners and will produce high pressure steam in the region of 105 to 110 MWth (rated for 131.5 t/h steam at 80.3 bar and 522°C) from the hot turbine exhaust gases. The steam will be generated within a single pressure boiler with economiser, evaporator, steam drum and superheater sections. A feedwater pre-heater stage will be included, this will use flue-gas to preheat. The feedwater will use water from the WTP and be topped up with condensate from the air-cooled condenser, when this is in operation and be topped up with water from the WTP.

2.2.4 A single steam turbine will generate up to 16 MW of electricity from the steam. The steam exiting the steam turbine is both low and medium pressure and used on the paper mills of the installation. Additional steam is available from the upgraded K1 LP auxiliary boilers as detailed below.

2.2.5 Technical specifications for the proposed CHP plant (GT and HRSG) can be found in **Appendix F.**

2.2.6 LP and MP steam is transferred to the paper mill for use within the production process, via a pipe bridge. If excess steam is created, or the mill production process is interrupted then the low-pressure steam is instead transferred to air cooled condensers where it is condensed into water, to be reused within the CHP process.

2.2.7 Exhaust gases from the K4 CHP will discharge via a new 70-metre-high stack.

2.2.8 Technical specifications for the proposed CHP plant (GT and HRSG) can be found in **Appendix F.**

2.2.9 An additional MP auxiliary boiler is to be included for the K4 CHP plant, exhaust gases from this boiler will discharge via a dedicated 35-metre-high stack. The K4 MP auxiliary boiler will have a thermal input rating of 9.6 MW_{th} and will produce medium pressure steam to supplement the system when required (during start-up / shut down periods).

2.2.10 The K1 plant (LCP206, 207 & 208) will continue to provide low pressure (LP) steam and electricity to the DS Smith papermill and will eventually be replaced by the new K4 plant and new LP auxiliary boilers. Hot commissioning of the new K4 plant is currently scheduled to take place from September 2020 to May 2021 however, this period will not see the K4 plant operating consistently or in a stable condition, therefore, the K1 plant will remain in operation providing steam and electricity to the DS Smith Papermill. The current E.ON schedule indicates the K4 plant will be fully operational in May 2021, at which time the K1 plant will be taken out of service & rendered inoperable.

2.2.11 In the event of low steam demand by the papermill, excess steam is diverted to an air-cooled condenser to condense the steam.

2.3 Changes to the Existing K1 LP Auxiliary Boilers

2.3.1 Some of the LP auxiliary boilers will be decommissioned, removed and replaced so that there will be up to three boilers in each windshield.

2.3.2 The proposed changes to the boilers are as follows:

- Boiler A - The current boiler installed was transferred from another DS Smith paper mill and installed in 2018. This boiler has a thermal input of approximately 15.6 MW and will remain in operation.
- Boilers B and C - The original 1989 manufactured boilers are planned to be demolished and replaced by two new approx. 23t/h boilers each with a thermal input of circa 17MW.

- Boilers D, E and F - Four or five of the original 1994 manufactured boilers will be demolished and two new approx. 23t/h boilers will be installed in D&E or E&F position. These new boilers will also have a thermal input of circa 17MW. (DS Smith has not decided how many boilers will be demolished). However, the emission point shall remain the same.
- Spare Boiler - The spare boiler will not be installed. It will not be brought into operation at any point.

2.3.3 The thermal input of all three boilers in bank 206 and the two boilers in bank 207 will be below 50MWth to comply with the requirements of MCPD. Bank 206 with a total thermal input of circa 49.6MW and bank 207 with a thermal input of circa 34MW. Further details on the thermal inputs for the boilers can be found in **Appendix G.**

2.3.4 The new boiler solution reduces the LP steam capacity from approx. 172t/h for the 6 boilers down to approx. 114 t/h LP steam with in total 5 installed boilers.

2.3.5 The new boiler (s) will be connected to the existing flue gas ducts used by the current LP auxiliary boilers and emissions discharged through the existing 72 m stacks with the emissions from the boilers split into two flue gas ducts

2.3.6 The layout for the boiler configuration described above can be seen in Figures 2.2 - 2.5 below:

Figure 2.2: LP Auxiliary Boilers Configuration

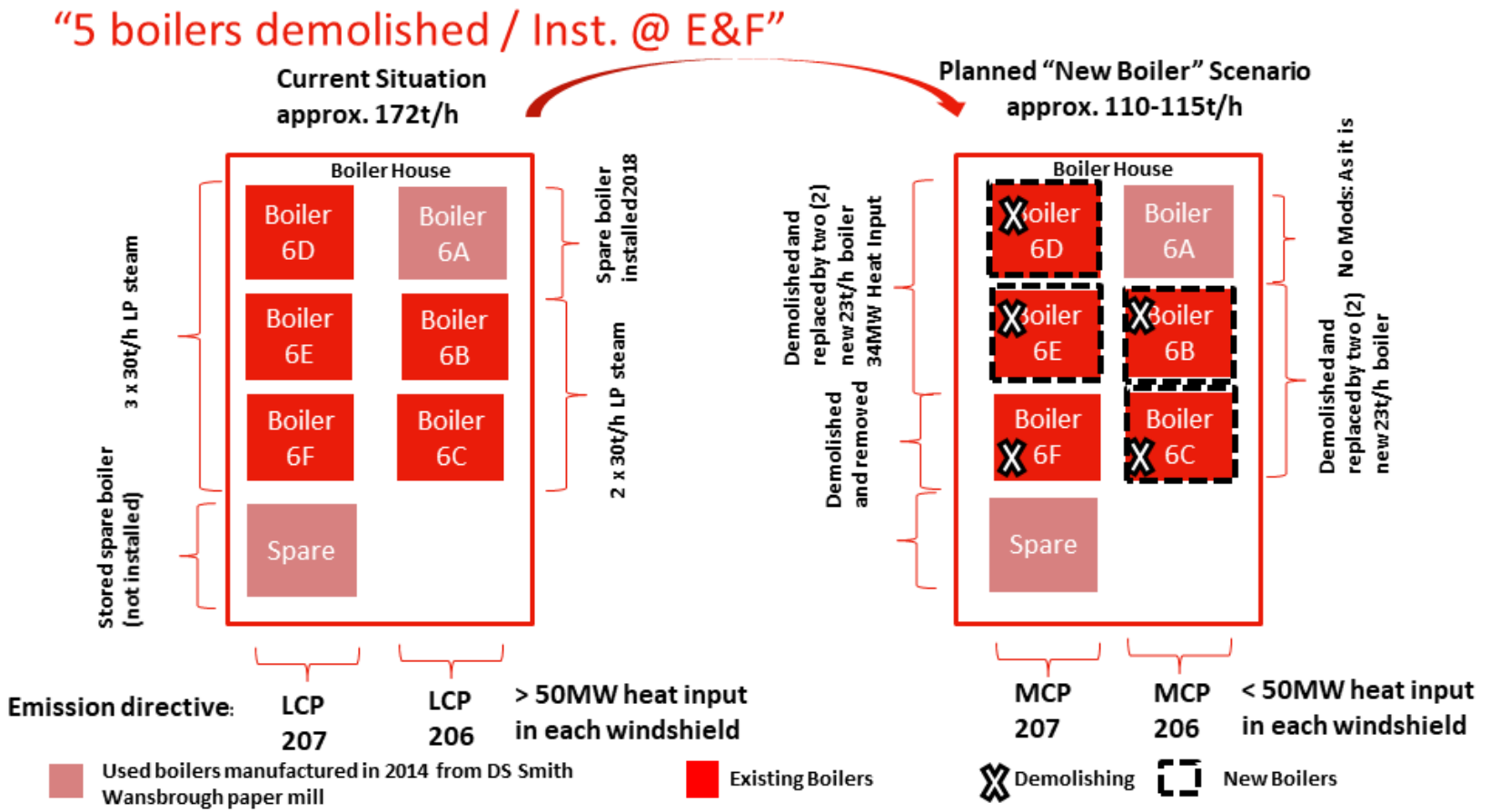
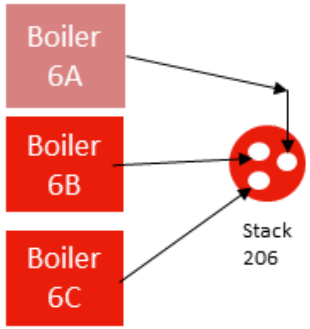


Figure 2.3: Technical and Emissions Data (Boilers A – C)

General – Technical & Emission data

	Current Situation	*5 Boilers demolished*
Boiler A	No modifications: As it is 22t/h LP steam / 16MW heat input NOx ≈ 97mg/Nm3 +/- 3 %	No modifications: As it is 23t/h LP steam / approx. 16MW heat input NOx ≈ 97mg/Nm3 +/- 3 %
Boiler B	30t/h LP steam / 23MW heat input Currently: NOx ≈ 150 - 200mg/Nm3 After Retrofit: NOx ≤ 100mg/Nm3	Demolished and replaced by two new boilers 2 x 23t/h LP steam / 17MW heat input each NOx ≤ 100mg/Nm3 Routed into independent flues
Boiler C	30t/h LP steam / 23MW heat input Currently: NOx ≈ 150 - 200mg/Nm3 After Retrofit: NOx ≤ 100mg/Nm3	



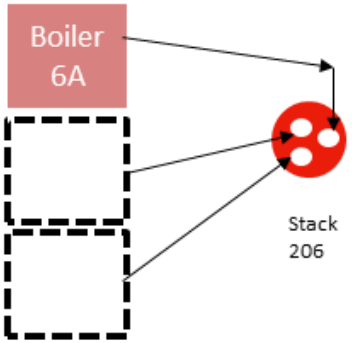
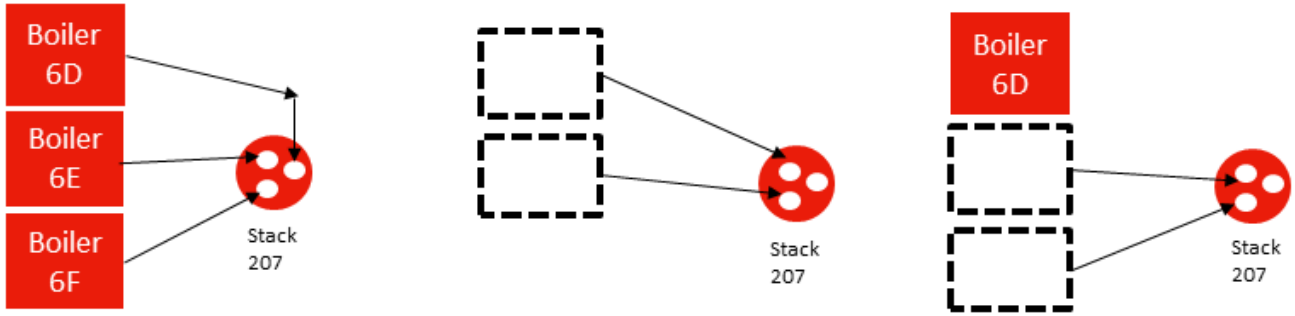


Figure 2.4: Technical and Emissions Data (Boilers D – F)

General – Technical & Emission data

	Current Situation and retrofit ≈172t/h LP	*5 boiler demolished*
Boiler D	30t/h LP steam / 23MW heat input Currently: NOx ≈ 150 - 200mg/Nm3 After Retrofit: NOx ≤ 100mg/Nm3	Demolished and replaced by two new boilers 2 x 23t/h LP steam / 17MW heat input each NOx ≤ 100mg/Nm3 Routed into independent flues
Boiler E	30t/h LP steam / 23MW heat input Currently: NOx ≈ 150 - 200mg/Nm3 After Retrofit: NOx ≤ 100mg/Nm3	
Boiler F	30t/h LP steam / 23MW heat input Currently: NOx ≈ 150 - 200mg/Nm3 After Retrofit: NOx ≤ 100mg/Nm3	Boiler disconnected, decommissioned and removed
Spare Boiler	Not used	Not installed



2.3.7 The approximate timeline for the new boilers is:
Phase 1 - Installation of Boiler B and C: Operational June 2020 to Sept. 2020
Phase 2 - Installation of Boiler D&E or E&F: Operational January to April 2021

2.3.8 Further information on the boiler options can be found in **Appendix G.**

2.4 Emergency Diesel Generator

2.4.1 The emergency diesel generator is to be installed to enable the CHP plant to be properly shutdown, should there be a power loss at the site. It prevents the steam turbine from suffering potential damages as the load is too big for the available uninterrupted power supply which itself provides power for the shutdown of everything else.

2.4.2 The generator will have a rated power output of 100 kW (input rating <1MW_{th}) and will be situated in its own dedicated container.

2.4.3 There will be a dedicated fuel tank for the emergency diesel generator within a separate tank room within the container which will store between 1,300 – 1,500 litres of diesel to maintain operation of the generator for up to 48 hours in the case of loss of power.

2.4.4 The emergency diesel generator meets the definition of a backup generator, this is a generator that is operated for the sole purpose of providing power at a site during an onsite emergency from the 1 January 2019.

2.4.5 The generator shall only operate as required for the duration of the emergency and shall operate for less than 500 hours per year, therefore, there shall be no emission limits applied for emissions from the generator. The generator shall be tested for no more than 50 hours during the year.

2.4.6 The location can be seen in the Emergency Diesel Generator Location (K4.EPC.000.LD001_0 Layoutplan_190215_AnmHu) plan in **Appendix B.**

2.5 Water Treatment Plant

2.5.1 The current WTP has been identified as being at risk of failing within the next four years, therefore it has been replaced by a new WTP.

2.5.2 The new WTP uses the same technology as the current treatment plant, however, as this plant is newly installed it has an improvement in planned reliability and efficiency, improved chemicals usage and produces a higher quality of water than previously.

2.5.3 The WTP provides high quality water for steam production to meet the Kemsley Paper Mill CHP site demand, both of which are based on the mill site. The WTP will also provide water to an adjacent energy from waste facility which is currently under construction.

2.5.4 The water treatment plant is fed from a local borehole, outside the premises, but owned by DS Smith and is pumped to the dedicated holding tanks located on the DSS site.

2.5.5 The water treatment system is designed using a combination of existing plant and new plant to produce demineralised water using Ion Exchange (IX) technology consisting of two trains each capable of producing 199 m3/hr of demineralised water.

2.5.6 The existing two stream ion-exchange treatment plant have been replaced with two new streams of treated water throughput to meet the demand required by K3 CHP Ltd and the Kemsley Paper Mill CHP site that satisfies the steam demand of the three paper mills and associated process equipment. A new control system and SCADA has been installed. The raw water, residual, effluent and bulk chemical tanks and their interface devices/pumps with other services within the WTP/CHP operational footprint have been retained.

2.5.7 Sulphuric acid is used for cation regeneration and caustic (sodium hydroxide) is used for anion regeneration. Both materials are used for the mixed bed regeneration.

2.5.8 A sodium bisulphite dosing system is used in order to counteract the oxidising effect of the sodium hypochlorite and the resulting free chlorine.

2.5.9 A condensate system treats returned condensate from the paper mill and in the event of low steam demand, condensate from the air-cooled condensers. This is routed directly to the feedwater tank.

2.5.10 The WTP layout can be seen in **Appendix B.**

2.5.11 Further details on the water treatment process can be found in **Appendix H.**

2.6 Additional area to be included in permitted site boundary

2.6.1 The proposed new K4 CHP plant, K4 MP auxiliary boiler, emergency generator and new WTP shall occupy land which is currently owned by D S Smith and part of the Kemsley Paper Mill permitted site, however, is not currently used for any of the paper mill activities. A site condition report and baseline assessment detailing the current state of the land is included as **Appendix E**.

2.6.2 The new land to be included in the permit boundary has an area of approximately 15,225m^2. The land is currently used for waste and materials storage and is made of impermeable surfacing and roadways.

2.6.3 It has been confirmed by DS Smith that they have had discussions with the EA and confirmed that they have submitted a low risk surrender application for the area of land which shall be used for the construction of the K4 CHP at the beginning of April. Civil works for construction shall commence in August 2019.

2.6.4 The six LP auxiliary boilers following the proposed changes will remain housed in the current boiler building already in the permitted site boundary.

2.7 Additional emissions points

2.7.1 There will be three new emission points to air from the K4 CHP plant, K4 MP auxiliary boiler and emergency diesel generator as part of the proposed variation.

2.7.2 The K4 CHP plant will release exhaust gases to air through a 70 m high main stack at grid reference: E 591963.173, N 166309.871

2.7.3 The new MP auxiliary boiler shall have a new emission point to air through a 35 m high stack at grid reference E 591947.768, N 166313.369

2.7.4 The emergency diesel generator shall have a new emission point to air through a ~3 m high stack at grid reference E 592004.429, N 166297.964

2.7.5 The K1 LP auxiliary boilers, following the modifications described above shall continue to use the existing emissions points (Stack 206 – grid reference 591950, 166325) and (Stack 207 – grid reference 591977, 166282) which discharge through 72 m high stacks.

2.7.6 Upon construction and commissioning of K4, the K1 CHP plant shall be decommissioned and removed from site. A partial permit surrender application shall then be prepared for submission to the EA. K4 cannot run (other than commissioning) whilst K1 is still running and K1 cannot run after K4 has been commissioned.

2.7.7 The K2 plant has been decommissioned and is currently being demolished and removed from the site. A partial permit surrender application is to be prepared for submission to the EA, this submission is expected to be made later in 2019.

2.8 Commissioning

2.8.1 The K1 plant (LCP206, 207 & 208) will continue to provide steam and electricity to the DS Smith papermill and will eventually be replaced by the new K4 CHP plant.

2.8.2 Hot commissioning of the new K4 plant is currently scheduled to take place late 2020 through to the middle of2021, however, this period will not see the K4 plant operating consistently or in a stable condition therefore the K1 plant will remain in operation providing steam and electricity to the DS Smith Papermill. See section 3.4 for further details on the operation of K1 post June 2020 until K4 comes into operation.

2.8.3 The current E.ON schedule indicates the K4 plant will be fully operational in 2021, at which time the K1 plant will be taken out of service & rendered inoperable.

2.8.4 The changes to the six LP auxiliary boilers will require the commissioning of up to 5 new boilers. The proposed commissioning timeline is provided in **Appendix G** and extends beyond June 2020. Section 3.4 outlines the plan for operation of the boilers beyond June 2020 until the new boilers are fully commissioned.

2.8.5 A commissioning plan shall be developed and agreed with the EA to cover this period.

2.9 Changes to existing permitted activities

2.9.1 The changes to the existing scheduled activities are detailed in Table 2.1 below:

Table 2.1: Changes to the existing activities

Activity Reference	Installation Schedule 1 reference	Description of the installation activity	Limits of specified activity	Proposed changes included with this variation
A1	Section 1.1 A (1) (a): Burning any fuel in an appliance with a rated thermal input of 50 megawatts or more.	**K1 Plant:** **LCP208:** Combined heat and power for production of steam and electricity. Single Gas Turbine, Two Heat Recovery Steam Generators, Steam Turbine operated in Modes 1,2,3,4. **LCP206**: LP Auxiliary Boilers for production of steam (Boilers A,B,C) **LCP207**: LP Auxiliary Boilers for production of steam (Boilers D,E,F)	From receipt of natural gas to discharge of exhaust gases, and electrical power delivered to substation. Steam from the CHP and LP Auxiliary Boilers to supply the paper mill. **LCP 208** Mode 4 -for emergency use only **LCP 208** Mode 3 -only when the Gas Turbine is not in use. *LCP 208 has the following operating modes available;* *Mode 1 – GT and 2 HRSG`s operating with, or without supplementary firing on either, or both HRSG`s (Emission Point A1/A2);* *Mode 2 – GT and 1 HRSG in operation with, or without supplementary firing (Emission Point A1, or A2, and A3);* *Mode 3 – HRSG`s only (auxiliary firing) (Emission Point A1 and/or A2);* *Mode 4 – GT Only (Emission Point A3).*	No Change to LCP208 – Existing K1 CHP, although following successful commissioning of K4, K1 will cease operation Changes to LCP206 and LCP207 configuration and new upgraded boilers to be installed. New emissions points A5 & A6 for upgraded MCP boilers included below.
A2	Section 5.1 Part A(1) (b) – The incineration of non-hazardous waste in an incineration or co-incineration plant with a capacity exceeding 3 tonnes per hour	**K2 Plant:** Operation of a Fluidised Bed Combustor for the incineration of sludges and contraries and including the production of steam for on-site use.	Sludges and contraries from the Kemsley Mill Installation, unless agreed in writing with the Environment Agency (EA) Reception hoppers to loading of ash for off-	No Change, although a separate surrender application is to be submitted

			site transport. Steam from FBC to supply the tap off low pressure steam for NOx suppression in the gas turbine.	
A3	Section 1.1 A (1) (a): Burning any fuel in an appliance with a rated thermal input of 50 megawatts or more.	**K4 Plant:** Combined heat and power for production of steam and electricity. Single Gas Turbine, and Heat Recovery Steam Generator.	From receipt of natural gas to discharge of exhaust gases, and electrical power delivered to substation. Steam from the CHP and MP Auxiliary Boiler to supply the paper mill.	New Activity – K4 CHP
A4	Medium Combustion Plant	**K4 Plant:** 9.6 MWth Heat Recovery MP Auxiliary Boiler	Operating for more than 500 hours per year.	New Activity – New backup boiler
A5	Medium Combustion Plant	**MCP206**: LP Auxiliary Boilers for production of steam (Boilers A,B and C) (<50 MW_{th})	From receipt of natural gas to discharge of exhaust gases, and steam to supply the paper mill	These will be the upgraded boilers included in activity A1 above.
A6	Medium Combustion Plant	**MCP207**: LP Auxiliary Boilers for production of steam (Boilers D and E) (<50 MW_{th})	From receipt of natural gas to discharge of exhaust gases, and steam to supply the paper mill	These will be the upgraded boilers included in activity A1 above.
	Directly Associated Activity			
A7	Treatment of Water	Water treatment plant for the conditioning of incoming water and treatment of recovered condensate.	Receipt of water from the supply lagoons for the production of boiler water.	New WTP constructed - Increased usage volume initially while K1 is being taken off-line.
A8	Surface Water Drainage	Discharge of site drainage via oil interception.	Drainage system for surface water run-off from roof and hardstanding until	No change. Additional area shall drain to DSS ETP and

			discharge to Surface Waters	kept separate from the K1 surface water discharge.
A9	Emergency Diesel Generator	Backup generator for periods of power loss	Operating for less than 500 hours per year.	Located within new K4 CHP area.

2.10 Management Systems

2.10.1 This section demonstrates the effective management system to be employed at Kemsley Paper Mill CHP. The management system to be deployed at the K4 CHP Plant has been established for the K1 CHP Plant and will be updated to reflect any changes specific to the new plant covered within this variation. E.ON operates CHP Plants at many multi-operator installations where power and steam are supplied to another part of the installation and has sound experience of the management system interface requirements for such installations.

2.10.2 Once operational it is intended that the K4 CHP Plant will form part of E.ON's fleet of CHP plants which consists of 9 plants operating in the UK. The E.ON fleet operates a single integrated management system which has been certified by an independent assurance body to BS EN ISO 14001:2015 (Environment), OHSAS 18001:2007 (Safety) and PAS 55 (Asset Management). A copy of the ISO14001 and ISO 18001 certification can be found in **Appendix I.**

2.10.3 This section covers the following key areas of management:

- operations and maintenance;
- competence and training;
- accidents/incidents /non-conformance; and,
- organisation.

2.10.4 For each of the key areas, compliance with indicative BAT has been demonstrated. Further information can be found in the BAT conclusions assessment in section 4. E.ON have implemented a Management Instruction which outlines the requirements of a Management System. The Management Instruction places actions at both a business level and site level to ensure that the following will be place:

- an integrated policy which is defined and authorised within the scope of the management systems;
- procedure(s) for ongoing hazard identification and risk assessment, the identification of environmental aspects and impacts and the determination of necessary controls will be implemented and maintained;
- there will be a procedure for identifying and accessing the legal and other requirements that are applicable to each location;
- strategies and objectives will be established, implemented, maintained and documented;
- there will be sufficient availability of resources to establish, implement, maintain and improve the management system;
- all individual(s) under the control of E.ON who are performing tasks that can impact on the organisation and / or the environment will be competent on the basis of appropriate education, training or experience;

- there will be a procedure(s) for communication and consultation with regard to operational hazards, OH&S hazards, environmental aspects and performance of the management system;
- sufficient documentation will be maintained up-to-date to ensure that the management system is adequately understood and effectively and efficiently operated;
- documents required for the management system will be controlled;
- there will be operational controls to manage associated risks and comply with applicable SHE legal and other requirements;
- the potential for emergency situations that impact on SHE (Safety, Health & the Environment) will be assessed and a procedure(s) for an effective response(s) developed;
- there will be a systematic approach for measuring, monitoring and reporting performance on a regular basis, as an integral part of the overall management system;
- a procedure will be implemented and maintained for periodically evaluating compliance with the legal and other requirements to which the organisation subscribes;
- there will be a procedure(s) for reporting, investigating and analysing incidents;
- there will be a procedure(s) for identifying actual and potential nonconformities and taking corrective and preventive action;
- there will be records to demonstrate that the site is operating the management system effectively and is managing risks;
- there will be a risk based internal management system audit programme to assess the effectiveness of control procedures and review the conformity of the SHE management system to OHSAS 18001, BS EN ISO 14001 and PAS 55;
- management reviews will be carried out on the overall performance of the management system at planned intervals and / or in the event of significant changes to operations or requirements; and
- Environmental objectives/targets to achieve continual improvement are integral elements of the EMS. Where appropriate and economically feasible, the development and implementation of cleaner technologies will be considered within the EMS.

2.10.5 A high-level closure and decommissioning plan will be developed outlining key considerations, this will be reviewed and updated during the plant operation life.

2.11 Operations and Maintenance

Operational Overview

2.11.1 The local on-site team (E.ON O&M team), which will be supported by central support functions of E.ON with significant competence associated with operating, maintaining and optimising an existing fleet of industrial Power Plants which E.ON currently operates in the UK.

2.11.2 The local on-site team will consist of a fully integrated structure with management functions (Plant Manager, Plant Coordinator, O&M Coordinator, Admin Assistant), a plant operating team and a maintenance team. The typical on-site team consists of 12.5 x full time employees and the structure can be found in **Appendix J.** Some staff from the K1 CHP shall transfer to the K4 CHP once constructed.

2.11.3 The operational concept of the K4 CHP plant foresees a single manning concept but also allows unsupervised operation as the plant is fully automated and designed accordingly. e.g. For walkarounds during single manning operations the plant is unsupervised therefore the plant is planned for unsupervised operation.

2.11.4 During more than 20 years of experience of operating industrial Power Plants, E.ON has established a centralised competence centre of commercial and technical experts which will be leveraged to provide support to the proposed K4 CHP Plant Project during its development, construction and ongoing operation and maintenance.

2.11.5 This Team will take responsibility for optimisation and performance excellence, engineering and maintenance and business support. With this platform E.ON will ensure that its resources and fleet know-how are transferred and available to the K4 CHP Plant Project. The E.ON central teams will significantly support the local on-site team regarding planned and unplanned maintenance as well as contributing component experts (e.g. GT expert, water treatment expert, etc.) when required.

Control of Operations with Adverse Environmental Impact

2.11.6 E.ON will identify the operations and activities that are associated with significant environmental aspects at the K4 CHP Plant and will ensure that such operations and activities, including maintenance, will be carried out under specified conditions in order to reduce the significance of the identified aspects. Site processes and procedures will be developed which cover:

- operation of equipment;
- maintenance of equipment;
- waste handling and storage;
- spill contingency; and
- start-up and shutdown.

2.11.7 The K4 CHP plant will be replacing the K1 CHP plant, it is expected that significant impacts should be no worse than any current significant aspects for the K1 CHP.

2.11.8 The accident management plan (AMP) shall be updated once the variation has been determined and the new plant and equipment is installed and commissioned.

Prioritising Plant / Equipment for Preventative Maintenance

2.11.9 There will be recommended inspection and maintenance regimes set out in the manufacturers' manuals pertaining to the new plant and equipment installed on site. E:ON will implement these recommendations within the on-site maintenance procedures or introduce equivalent maintenance regimes according to good industry practice.

2.11.10 First line maintenance will be undertaken by site staff. If, during first line maintenance, problems are identified that require additional expertise, specialist contractors will be employed. The activities of any contractors employed would be closely supervised by E.ON.

2.11.11 Each plant item will have a status review where the items safety, environment and technical risks are assessed for severity and probability. Planners then can prioritise maintenance for those plant items with the highest scores.

Monitoring Emissions / Impacts

2.11.12 The local procedure that addresses Environmental Monitoring and Reporting requirements to ensure compliance with applicable legislation and EA requirements will be updated for the K4 CHP Plant. Some plant will be MCP, therefore different monitoring requirements will be in place for these items of plant.

2.11.13 The procedure will set the framework for reporting and detail instructions on how to retrieve data from continuous monitoring equipment, where appropriate.

2.11.14 Stack emissions from the process will be monitored in accordance with requirements of the environmental permit. The maintenance of process instrumentation and measurement devices will be managed by K4 CHP Plant engineers, with specialist contractors brought in to maintain specific items of plant such as the calibration of gas meters, pressure and temperature valves. Where appropriate, all monitoring equipment will be regularly calibrated, and records of calibration kept. The monitoring of emissions is addressed in Section 3.5.

Performance Review of Maintenance System

2.11.15 The planned maintenance system will be subjected to an internal auditing programme. A database will store and log all maintenance requirements and activities thus providing an auditable trail of maintenance performance.

2.12 Competence and Training

2.12.1 The K4 CHP Plant will adopt the requirements of the E.ON Management Instructions covering Competency, Assurance and Development. These management instructions place the following requirements on E.ON sites:

- establishing role profiles and role competency requirements;
- assessing actual competency levels;
- competency gap risk assessment and development; and
- management of dormant competencies.

2.12.2 The engineering, procurement and construction contractor and the equipment suppliers are contracted to provide full classroom and on the job training.

Environmental Training and Awareness

2.12.3 EON will develop a bespoke, comprehensive Environmental Training Pack which will be delivered to all staff & regular contractors at the K4 CHP Plant. The package will cover all relevant environmental topics including:

- overview of EPR requirements and implications for the site;
- responsibilities in the event of a breach of Permit conditions;
- outline of the European Union Emissions Trading Scheme (EU-ETS);
- waste management including Special Waste Regulations;
- overview of Integrated Management System (IMS);
- environmental controls;
- housekeeping; and,
- site specific content including:
    - staff responsibilities;
    - emissions to air and water including release points and monitoring requirements;
    - environmentally critical equipment;
    - what to do in the event of a permit breach; and,
    - emergency procedures.

2.12.4 In addition to general training, specific training will be provided to relevant staff based on the competency requirements identified within their role profile and role responsibilities. Such training may include subjects such as environmental auditing, special waste classification and EU-ETS verification.

Contractor Control

2.12.5 E.ON will ensure that environmental risks posed by contractor activities are identified, assessed and appropriate controls established. Contractors' competency relative to the risks posed will also be assessed. E.ON will ensure that all contractors are made aware of environmental permit requirements placed upon the site and that adhere of work instructions and procedures which protect the environment.

2.13 Plant Maintenance

2.13.1 Due to the same configuration principle, the maintenance strategy of the K4 CHP Plant will be in principle the same as for existing E.ON K1 CHP Plant. Many of the existing K1 CHP Plant contracts will be novated to the K4 CHP Plant for service/maintenance, however, due to a number of different equipment suppliers for the K4 CHP Plant, a number of new contracting partners will be engaged with. Notwithstanding this approach, E.ON will select experienced and long-established partners for K4 CHP Plant service/maintenance contracts.

2.13.2 The information below outlines the maintenance requirements that will be applicable to the main plant items associated with the K4 CHP Plant once operational which is in principle the same as the K1 CHP Plant.

2.13.3 In general, major maintenance involves replacing a small number of wearing components of the main plant items for new or alternatively, refurbishing these components however, wholesale or major replacement of plant items is not carried out during planned maintenance.

2.13.4 All maintenance activities will be in accordance with the requirements of the Original Equipment Manufacturers (OEM) or follow alternative maintenance procedures according to good industry practice and any regulatory requirements, for example, those prescribed in the Pressure System Safety Regulations.

Gas Turbine and Heat Recovery Boiler (HRSG) (K4)

2.13.5 The gas turbine maintenance is covered by a long-term service agreement (LTSA) with the gas turbine **o**riginal equipment manufacturer (OEM). In general, each year there will be a planned gas turbine outage either for minor or major maintenance. The yearly minor maintenance is followed by a major maintenance every 3 - 4 years depending on the annual operating hours of the gas turbine. The length of the outages varies between 2 - 3 days for minor maintenance, and up to 3 - 4 weeks for major maintenance. Maintenance of the gas turbine will be carried out on-site by OEM technicians with a small number of wearing components being removed from site for repair or refurbishment. Major maintenance will typically involve up to 10 - 15 technicians being based at the site for the duration of the maintenance period.

2.13.6 The HRSG will be inspected and maintained on a yearly basis which typically takes 2 - 7 days in parallel to the planned gas turbine outages. Maintenance of the HRSG will be carried out by an appointed contractor and typically involves up to 10 technicians being based at the site for the duration of the maintenance period.

Steam Turbine

2.13.7 The steam turbine has a typical inspection interval of 5 years for minor inspection and 10 years for major inspection. The length of the outages varies between 1 week for the minor maintenance, and up to 2 - 3 weeks for the major maintenance. Maintenance of the steam turbine will be carried out on-site by an appointed contractor with a small number of wearing components being removed from site for repair or refurbishment. Major maintenance will typically involve up to 10-15 technicians being based at the site for the duration of the maintenance period.

Auxiliary Boilers (K1) and Medium Pressure Boiler (K4)

2.13.8 The LP auxiliary boilers (K1) and MP auxiliary boiler (K4) will be inspected on an annual basis which typically takes 5 days. Inspection and resulting maintenance of the auxiliary boilers and medium pressure boiler will be carried out by an appointed contractor and typically involves up to 5 technicians being based at the site for the duration of the maintenance period.

Electrical and Auxiliary Equipment

2.13.9 The gas turbine and/or steam turbine generator minor and major inspections along with maintenance of electrical equipment like transformers, circuit breakers and auxiliary equipment will be done in parallel to the respective equipment by appointed contractors.

2.13.10 The maintenance activities outlined above will normally be planned on a long-term basis by the Kemsley CHP maintenance team and will take place in parallel of the gas turbine maintenance. Such maintenance activities take place typically in the summer months and/or in the yearly planned shutdown period of the DS Smith Papermill which is typically during Christmas time. However, it should be noted that this maintenance regime is based on operation throughout the year.

3 ENVIRONMENTAL RISKS AND EFFECTS

3.1 Environmental Risk Assessment

3.1.1 An Environmental Risk Assessment (ERA) has been carried out including consideration of the new plant (CHP and boilers). The ERA considers only the risks from hazards potentially affected by the proposed changes. Other hazards will remain unchanged. The ERA can be found in **Appendix C.**

3.1.2 There are no additional emissions points to surface water or land as a result of this change. The new area included in the permit boundary shall connect into the existing DS Smith ETP drainage system.

3.1.3 There will be new emissions to air from the new CHP plant and boiler as detailed in section 3.2 below. The current emissions from the K1 LP auxiliary boilers (206 and 207) shall continue, however, the plant feeding into the emissions points shall be upgraded.

3.1.4 There will be no new emissions points to sewer from the new CHP plant and boiler, the emissions from the new plant will feed into the existing link into the DS Smith drainage system to the DS Smith effluent treatment plant (ETP).

3.1.5 The DS Smith ETP receives wastewater from a number of sources at the Kemsley site and discharges to the Swale, a saline estuary. The discharge channel lies within the marine conservation zone (MCZ) but is outside of the SSSI, SPA and Ramsar.

3.1.6 The majority of risks such as vandalism, flooding etc. remain unchanged as a result of the proposed change.

3.1.7 The results of the ERA have shown that the risk of odour, noise and vibration, fugitive emissions, visible plumes, and accidents ranges from ‘not significant’ to ‘low’.

3.1.8 Stack emissions to air for relevant air pollutants have been screened out to be insignificant.

3.2 Point Source Emissions to Air

3.2.1 As part of the changes detailed in this variation, there shall be three new emissions points to air from the K4 CHP, K4 MP auxiliary boiler plant and emergency diesel generator. The existing emissions points to air for the K1 boilers shall remain, however the plant input to these emissions points shall change.

3.2.2 Details of all emissions points to air can be found in Tables 3.1, 3.2 and 3.3 below:

Table 3.1: Existing and Additional Point Source Emissions to Air and Associated Monitoring (Large Combustion Plant)

Installation name			**Kemsley Paper Mill CHP**			
Point source emissions to air from Large Combustion Plant						
Emission point reference and location	***Parameter***	***Source***	****Limit (including unit)***	***Reference Period***	***Monitoring Frequency***	***Monitoring standard or method***
A1/A2 & A3 (when Mode 2) [Points 1 and 2 in in Drawing reference JER1679-SI-002] (**NB** - emissions from this point will cease once the K4 CHP plant is commissioned)	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)	**K1 - LCP No. 208 Modes 1, 2, 3** Gas turbine and HRSG A&B fired on natural gas	90 mg/m3	Monthly mean of validated hourly averages	Continuous	BS EN 14181
	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)		99 mg/m3	95% of validated daily means within a calendar year	Continuous	BS EN 14181
	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)		180 mg/m3	95% of validated hourly averages within a calendar year	Continuous	BS EN 14181
	Carbon Monoxide		100 mg/m3	Monthly mean of validated hourly averages	Continuous	BS EN 14181

	Carbon Monoxide		110 mg/m3	Daily mean of validated hourly averages	Continuous	BS EN 14181
	Carbon Monoxide		200 mg/m3	95% of validated hourly averages within a calendar year	Continuous	BS EN 14181
	Sulphur Dioxide		-	-	6 monthly by calculation	Agreed in writing with the Environment Agency
	Duct Survey		-	-	Pre-operation and when there is a significant operational change	BS EN 15259
A3 [Point 1 in Drawing reference JER1679-SI-002] (**NB** - emissions from this point will ceases once the K4 CHP plant is commissioned)	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)	**K1 - LCP No. 208** **Mode 4** Gas turbine fired on natural gas in Open Cycle	-	-	Concentration by calculation, every 4380 operational hours or 2 years, whichever is sooner.	Agreed in writing with the Environment Agency
	Carbon Monoxide		-	-	Concentration by calculation, every 4380 operational hours or 2 years,	Agreed in writing with the Environment Agency

					whichever is sooner.	
	Sulphur Dioxide		-	-	Concentration by calculation, every 4380 operational hours or 2 years, whichever is sooner.	Agreed in writing with the Environment Agency
A4 [Point 3 in Drawing reference JER1679-SI-002] (**NB** - emissions from this point will change once the boiler plant is upgraded and will become MCP as detailed in Table 3.2 below)	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)	**LCP 206** Boiler plant fired on natural gas	200 mg/m3	-	Twice per year with at least 3 months between	BS EN 14792
	Carbon Monoxide		300 mg/m3	-	Twice per year with at least 3 months between	BS EN 15058
	Sulphur Dioxide		35mg/m3	-	At least every 6 months	Concentration by calculation, as agreed in writing with the Environment Agency
	Dust		5mg/m3	-	At least every 6 months	Concentration by calculation, as agreed in writing with the

						Environment Agency
	Duct Survey		-	Pre-operation and when there is a significant operational change	BS EN 15259	-
A5 [Point 4 in Drawing reference JER1679-SI-002] (**NB** - emissions from this point will change once the boiler plant is upgraded and will become MCP as detailed in Table 3.2 below)	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)	**LCP 207** Boiler plant fired on natural gas	200 mg/m3	-	Twice per year with at least 3 months between	BS EN 14792
	Carbon Monoxide		300 mg/m3	-	Twice per year with at least 3 months between	BS EN 15058
	Sulphur Dioxide		35mg/m3	-	At least every 6 months	Concentration by calculation, as agreed in writing with the Environment Agency
	Dust		5mg/m3	-	At least every 6 months	Concentration by calculation, as agreed in writing with the Environment Agency
	Duct Survey		-	Pre-operation and when there is a	BS EN 15259	-

				significant operational change		
A8 [Point 6 in Drawing reference JER1679-SI-002]	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)	***New K4 CHP Plant (Mode 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 BAT-AEL range, corresponding to [higher end] × EE/55, where EE is the net electrical efficiency of the plant determined at ISO baseload conditions. This shall be determined after commissioning.*	Yearly Average	Continuous	BS EN 14181
	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)		40 mg/Nm^3	Daily average or average over the sampling period	Continuous	BS EN 14181
	Carbon Monoxide		30 mg/Nm^3 **For plants with a net electrical efficiency (EE) greater than 55 %, a correction factor*	Yearly Average	Continuous	BS EN 14181

			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. This shall be determined after commissioning.			
A8 [Point 6 in Drawing reference JER1679-SI-002]	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)	***New K4 CHP Plant (Mode 6)***	35 mg/Nm^3	Yearly Average	Continuous	BS EN 14181
	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)		50 mg/Nm^3	Daily average or average over the sampling period	Continuous	BS EN 14181
	Carbon Monoxide		100 mg/Nm^3	Yearly Average	Continuous	BS EN 14181

Mode 1 – GT and 2 HRSG`s operating with, or without supplementary firing on either, or both HRSG`s (Emission Point A1/A2);
Mode 2 – GT and 1 HRSG in operation with, or without supplementary firing (Emission Point A1, or A2, and A3);
Mode 3 – HRSG`s only (auxiliary firing) (Emission Point A1 and/or A2);
Mode 4 – GT Only (Emission Point A3).
Mode 5 – GT and HRSG without supplementary firing
Mode 6 - GT and HRSG with supplementary firing

* Unless otherwise stated, any references in this permit to concentrations of substances in emissions into air means:

- in relation to emissions from combustion processes, the concentration in dry air at a temperature of 273K, at a pressure of 101.3 kPa and with an oxygen content of 3% dry for liquid and gaseous fuels, 6% dry for solid fuels; and/or
- in relation to emissions from combustion processes comprising a gas turbine with a waste heat boiler, the concentration in dry air at a temperature of 273K, at a pressure of 101.3kPa and with an oxygen content of 15% dry;

Table 3.2: Additional Point Source Emissions to Air and Associated Monitoring (Medium Combustion Plant)

Installation name			**Kemsley Paper Mill CHP**		
Point source emissions to air from Medium Combustion Plant					
Emission point reference and location	***Parameter***	***Source***	****Limit (including unit)***	***Monitoring Frequency***	***Monitoring standard or method***
A4 [Point 3 in Drawing reference JER1679-SI-002] (**NB** – ELV's to be applied once boilers have been upgraded)	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)	**MCP 206** Boiler plant fired on natural gas	100 mg/Nm^3	Once every 3 years	BS EN 14792
A5 [Point 4 in Drawing reference JER1679-SI-002] (**NB** – ELV's to be applied once boilers have been upgraded)	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)	**MCP 207** Boiler plant fired on natural gas	100 mg/Nm^3	Once every 3 years	BS EN 14792

A9 [Point 7 in Drawing reference JER1679-SI-002]	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)	**K4 MP Auxiliary Boiler**	100 mg/Nm^3	Once every 3 years	BS EN 14792

*All limits are defined 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 at a standardised O2 content of 3%.

Table 3.3: Additional Point Source Emissions to Air and Associated Monitoring (DAA)

Installation name			**Kemsley Paper Mill CHP**		
Point source emissions to air from Medium Combustion Plant					
Emission point reference and location	***Parameter***	***Source***	****Limit (including unit)***	***Monitoring Frequency***	***Monitoring standard or method***
A10 [Point 8 in Drawing reference JER1679-SI-002]	-	***Emergency Diesel Generator***	**-**	-	-

3.3 Air Quality Assessment

3.3.1 An air quality assessment of the potential impacts on sensitive human and ecological receptors was undertaken and can be found in **Appendix D.** The air quality assessment has considered both K1, K4 and the modified LP auxiliary boilers all operating in combination, however, this is a very conservative approach as upon commissioning of the K4 plant, the K1 plant shall stop operating and be decommissioned and removed.

3.3.2 The original air quality assessment included the current K1 LP auxiliary boilers which are to be replaced. A further assessment has been done to consider the proposed changes against the original purpose of this assessment is to show how the proposed boilers compare to the existing boilers. This assessment can also be found in Appendix D and assesses the worst-case scenario for the two options for the boilers being considered.

3.3.3 A number of human and ecological receptors have been modelled as part of the assessment, these are shown in tables 3.2 and 3.3 below:

Table 3.4: Modelled Sensitive Human Receptors

Receptor	Approximate distance to the site	Grid Reference	
		X	Y
Recreation Way	670	591391	166087
Premier Way	970	590967	166509
Grovehurst Road	1,540	590404	166463
Grovehurst Road	1,510	590746	165486
Saffron Way	1,580	590924	165184
Straymarsh Farm	4,200	592706	170419
Wigeon Road	1,790	590368	167295
Howt Green	2,250	589762	165887

Lorimar Court	2,870	589256	165287
Key Street	4,360	588127	164204
Newlands Avenue	3,880	588855	163953
East Street	2,870	591165	163568
Frogham Gardens	4,900	595060	162529
Hartlip Hill	7,600	584437	165225
Rookery Close	6,500	588203	160829
Wren's Hill	8,600	597167	159333
Nunfield House	8,100	584481	163112
Squirrels Farm	9,500	584146	160880

Table 3.5: Modelled Sensitive Ecological Receptors

Site Type	Site Name	Closest Distance from K4 CHP (km)
Special Areas of Conservation (cSAC or SAC)	Queendown Warren (SAC)	9.2 (SW)
Special Protection Area (pSPA or SPA)	Outer Thames Estuary (SPA)	9.9 (NW)
Special Protection Area (pSPA or SPA)	The Swale (SPA)	0.25 (E)
Special Protection Area (pSPA or SPA)	Medway Estuary & Marshes (SPA)	3.6 (NW)
Special Protection Area (pSPA or SPA)	Thames	9.9 (NW)

	Estuary & Marshes (SPA)	
Ramsar	The Swale (Ramsar)	0.25 (E)
Ramsar	Medway Estuary & Marshes (Ramsar)	3.6 (NW)
Ramsar	Thames Estuary & Marshes (Ramsar)	9.9 (NW)
Sites of Special Scientific Interest (SSSI)	The Swale (SSSI)	0.25 (SE)
National Nature Reserve (NNR)	Elmley (NNR)	0.9 (NE)
Local Wildlife Sites (LWS)	Milton Creek, Sittingbourne	0.25 (SE)

3.3.4 Supplementary firing for K4 CHP: The supplementary firing of K4 HRSG is necessary to fulfil the steam requirements from DS Smith. Supplementary firing expected operating time is approx. 8000 h/a.

3.3.5 Banking mode for auxiliary boilers: As the boilers need to be kept as back-up to quickly provide steam, steam pressure inside boilers needs to be maintained by firing to compensate for heat losses. The gas consumption (and therefore) the emissions can be considered negligible in comparison with full load operation as used for modelled scenarios. Our estimation for the gas consumption during banking mode (without steam production): 1500-2000 hours per year (burners actually firing) with a gas consumption of 0.4kg/s per boiler.

3.3.6 The supplementary firing and banking mode has not been included in the air quality assessment, however, on the basis that K1 CHP and K2 will be decommissioned and assuming that emissions from the proposed K1 boilers in banking mode are no more than the emissions from the proposed K1 boilers when operational, it is unlikely that the predicted environmental concentration for K3 (permitted), K4 and proposed K1 boilers will be higher than the PECs presented in paragraphs 5.1.2 and 5.1.3 of the air quality assessment in **Appendix D**.

3.3.7 The long-term impacts at all modelled sensitive human receptors have been assessed to be negligible. (less than 1% of the long-term environmental standards and have therefore been screened out as insignificant.)

3.3.8 The short-term impacts at all modelled sensitive human receptors have been assessed to be negligible. (less than 10% of the short-term environmental standards and have therefore been screened out as insignificant.)

3.3.9 The impacts at ecological receptors for all pollutants and habitat sites, the operational effects are assessed as insignificant.

3.4 IED Transitional National Plan (TNP)

3.4.1 K1 is currently entered into the IED TNP compliance pathway. The TNP runs until June 2020 at which point participating plant have a variety of options available which include, closure, running hour restrictions or full compliance with IED Emission Limit Values (ELV's)

3.4.2 K1 will be required to operate in an unrestricted way until 2021 when K4 comes online. To do this K1 will be required to comply with the ELV's outlined in Annex V of IED.

3.4.3 It is E.ON's intention for K1 to comply Annex V ELV's and we expect the following ELV's to be applied:

Mode 1: GT and 2 HRSGs operating with, or without supplementary firing on either, or both HRSGs

- NOx - 50 or 75 mg/m3 (75 mg/m3 if plant efficiency can be shown to be >75%). Emissions corrected to 15% O_2.

- CO – 100mg/m3 Emissions corrected to 15% O_2.

Mode 2: GT and 1 HRSG in operation with, or without supplementary firing

- NOx - 50 or 75 mg/m3 (75 mg/m3 if plant efficiency can be shown to be >75%). Emissions corrected to 15% O_2.
- CO – 100mg/m3 Emissions corrected to 15% O_2.

Mode 3: HRSGs only (Auxiliary firing)

- NOx - 100 mg/m3. Emissions corrected to 15% O_2.
- CO – 100mg/m3 Emissions corrected to 15% O_2.

*****The limits applied to mode 3 of operation are outlined in the JEP IED Protocol which states the following:

For auxiliary firing, the oxygen reference condition for reporting and the boiler ELV reference shall therefore also be increased to 15% O_2 (for short periods when the gas turbine is unavailable). The boiler ELV is taken to be the same numerical value as that applied at 3% O_2.

3.4.4 This NOx limit will only apply in circumstances where E.ON has a recovery plan to bring the gas turbine back into service.

3.4.5 Similarly, the existing LP auxiliary boilers are also entered into the TNP. As commissioning timescales for the new boiler could require operation beyond June 2020 until commissioning is complete a regulatory position statement will be agreed with the EA to cover the limited operation of these units.

3.5 Point Source Emissions to Water

3.5.1 There are no additional emissions points to surface water or land as a result of this change. Clean water from the building roof and vehicle parking areas for the new area included in the permit boundary shall discharge via the DS Smith effluent plant and not connect into the existing surface water drainage system which is then discharged via the current W1 emissions point into the Swale.

3.5.2 The drainage strategy and drainage plan can be found in **Appendix K.**

3.5.3 Point source emissions shall remain as shown in table 3.4 below:

Table 3.6: Point Source Emissions to water (other than sewer) – emissions limits and monitoring requirements

Installation name			*K4 Kemsley CHP*			
Point source emissions to water (other than sewer) – emission limits and monitoring requirements						
Emission point reference and location	***Parameter***	***Source***	***Limit (including unit)***	***Reference Period***	***Monitoring Frequency***	***Monitoring standard or method***
W1	*pH*	*K1 CHP surface water, via interceptor*	6-9	Instantaneous	Monthly spot sample	-
	Oil & Grease		No visible oil or grease in the discharge	Instantaneous	Monthly spot sample	Visual
W2	*pH*	*K2 Plant surface water, via interceptor*	6-9	Instantaneous	Monthly spot sample	-
	Oil & Grease		No visible oil or grease in the discharge	Instantaneous	Monthly spot sample	Visual
W3	*pH*	*K2 Plant roof drainage only*	6-9	Instantaneous	Monthly spot sample	-
	Oil & Grease		No visible oil or grease in the discharge	Instantaneous	Monthly spot sample	Visual

3.6 Point Source Emissions to Sewer, Effluent Treatment Plant or Other Transfers Off-Site

3.6.1 There will be no new emissions points to sewer from the new K4 CHP plant, MP auxiliary boiler and WTP. The emissions from the new plant will feed into the existing link into the DS Smith drainage system to the DS Smith effluent treatment plant as shown in Table 3.5. The nature (composition) and volumes of these discharges will be no greater than those for the permitted scheme.

3.6.2 All surface water and process water will drain to the DS Smith ETP for treatment prior to discharge to the Swale.

3.6.3 The drainage strategy and drainage plan can be found in **Appendix K.**

Table 3.7: Point Source Emissions to water (other than sewer) – emissions limits and monitoring requirements

Installation name			*K4 Kemsley CHP*			
Point source emissions to water (other than sewer) – emission limits and monitoring requirements						
Emission point reference and location	***Parameter***	***Source***	***Limit (including unit)***	***Reference Period***	***Monitoring Frequency***	***Monitoring standard or method***
E1	Flow (m^3)	Boiler blowdown, neutralised ion exchange regeneration liquors, compressor wash and overflows, cooling waters. Collected surface waters, raw waters and demineralised waters.	No limit set	Instantaneous	Continuous	As agreed in writing with the Environment Agency
	pH			Instantaneous	Continuous	
	Mercury (kgs)			n/a	n/a	
	Cadmium (kgs)			n/a	n/a	

3.7 Emissions Monitoring

3.7.1 Continuous emissions monitoring systems (CEMS) will be installed for the new K4 CHP plant to measure their emissions concentrations continuously in line with the European Standard for Quality Assurance of Automated Measurement Systems, EN 14181. These shall monitor for carbon monoxide, oxides of nitrogen, exhaust gas temperature, exhaust gas pressure and exhaust gas oxygen content.

3.7.2 All of the CEMs models shall be registered under the UK Monitoring Certification Scheme (MCERTS). The CEMs will be installed in a vertical section of duct. The location of the CEMs will comply with BS EN 15259, the EA M1[1] (sampling requirements for stack emission monitoring) guidance and M20[2] (quality assurance of continuous emission monitoring systems) guidance.

3.7.3 Monitoring of air polluting substances shall be carried out in accordance with the provisions of Part 3 of IED Annex V.

3.7.4 Annual testing shall be completed by an external, accredited, test team to either produce a calibration function or verify the additional calibration function as outlined below.

3.7.5 Six monthly monitoring shall be undertaken to ensure that the plant remains compliant with prescribed emission limit values (ELVs) for species not monitored continuously.

3.7.6 Periodic extractive testing will be employed in order to calibrate the CEMs, and also to assess other pollutant levels as required by the permit including exhaust gas oxygen content and water vapour content.

3.7.7 Additional to the requirements for testing above, as the site is participating in the Transitional National Plan (TNP) for IED compliance, it is required to report mass emissions values and so must either measure the volumetric flow of the stack or calculate the volumetric flow. These sites must complete flow verification testing to BS EN 16911.

3.7.8 All testing is to be completed by MCERTS accredited personnel who possess MCERTS Technical Endorsement qualifications for the sampling undertaken. Testing laboratories are to be accredited under the MCERTS for organisations and certified to ISO 17025. All testing laboratories are to hold UKAS accreditation for all techniques required.

3.7.9 Auxiliary boilers (LP and MP) shall not be fitted with CEMs as they will be MCP and therefore periodic monitoring shall be carried out on these boilers as required by MCPD.

[1] https://www.gov.uk/government/publications/m1-sampling-requirements-for-stack-emission-monitoring

[2] https://www.gov.uk/government/publications/m20-quality-assurance-of-continuous-emission-monitoring-systems

3.8 Fugitive Emissions to Air, Land, Water and Sewer

3.8.1 Potential fugitive emissions (spillages dust, litter and chemicals/oil releases) from the site have been assessed in the ERA in **Appendix C.** This has concluded that the risk from fugitive emissions from the site is low.

3.9 Odour

3.9.1 The CHP plant and boilers will be run on natural gas with the emissions to air unlikely to contain any odorous constituents during normal operations.

3.9.2 The CHP plant and boilers currently operated as K1 have not had any historic issues with regards to odour or any complaints received. This is therefore assessed to be the same case for the K4 plant.

3.9.3 The ERA has assessed the risk of odour and has concluded that there is no increased risk of odours as a result of the proposed variation.

3.10 Accident Management

3.10.1 The ERA has assessed accident risks and has concluded that there is no increased risk of accidents as a result of the proposed variation.

3.10.2 SDS/COSHH for raw materials used at the site have been assessed as part of the site condition report and baseline assessment included in **Appendix E.**

3.11 Noise

3.11.1 The area immediately surrounding the proposed K4 facility is industrial in nature, with residential properties well-separated from the development area.

3.11.2 A noise assessment was carried out for the DCO application and can be found in **Appendix L**. this concluded that the immediate existing noise environment is characterised by industrial noise, meaning that additional industrial noise, provided it is not too great in magnitude, will not materially change the immediate existing noise environment. Noise or vibration from construction and the normal operation of the K4 facility will have no significant adverse impact on the surrounding sensitive receptors.

3.11.3 A further noise assessment has been carried out for the auxiliary boilers and can be found in **Appendix L**. The results of the assessment show that there is a minimal risk of adverse noise impact at surrounding sensitive receptors.

3.12 Raw Materials

3.12.1 This variation shall add no new raw materials to those already in use at the site.

3.12.2 The K4 CHP plant is to be a direct replacement for the K1 CHP plant and therefore there shall be no net increase in raw materials used at the site once the K1 CHP plant is decommissioned, the plant will be more efficient therefore overall there shall be a reduction in raw materials usage.

3.12.3 The new WTP is more efficient than the current WTP and there is a reduction in raw materials usage at the site.

3.12.4 The raw materials used at the site are detailed in Table 3.6 below:

Table 3.8: Types and Amounts of Raw Materials

Schedule 1 Activity	*Description of raw material and composition*	*Maximum Amount Stored*	*Annual Usage*	*Use of the raw material*
Section 1.1 A (1) (a): Burning any fuel in an appliance with a rated thermal input of 50 megawatts or more.	Natural Gas	N/A	Gas consumption – 1,481,913 MWh Gas consumption – 110,259 t/a (This is for the currently installed K1)	CHP
DAA	Sulphuric Acid	50 tonnes (existing tank in current WTP)	644 tonnes	Water Treatment Plant - used to regenerate the ion exchange unit for boiler water treatment
DAA	Caustic Soda	50 tonnes (existing tank in current WTP)	803 tonnes	Water Treatment Plant - used to regenerate the ion exchange unit for boiler water treatment
DAA	Sodium Bisulphite	2000 litres	11.79 tonnes	Water Treatment Plant
DAA	Raw Water	N/A	998,233 m^3	Water Treatment Plant for Steam Production
DAA	Diesel	1,500 litres	1,500 litres	Fuel for emergency generator

3.12.5 As well as the above raw materials, the following chemicals are used in the water treatment process and cleaning:

- **Anti-freeze and corrosion inhibitor such as Antifrogen N containing** Monoethylene glycol (1,2-ethane diol) with corrosion inhibitors - stored in 5 * 210 litre containers stored within the old water treatment plant which is a bunded building
- **Phosphate based corrosion inhibitor such as OPTISPERSE HP3100** - stored in 500 litre purpose-built container in the LP auxiliary boiler house with secondary containment. Also 6*23kg containers stored in site chemical store which itself is bunded

- **Neutralising agent such as OPTISPERSE HP3100** - stored in 1000 litre purpose-built container in the deaerator building with secondary containment. Also 6*23kg containers stored in site chemical store which itself is bunded
- **Compressor Cleaner such as TURBOTECT 2020** - GT wash skid stored in 1000 litre purpose-built container which is stored on a purpose-built stand with secondary containment. Approximately 200 litres used annually.

3.12.6 There is no change to these water treatment chemicals as a result of this variation, the above raw materials are used within the current permitted facility and usage will not increase.

3.13 Waste

3.13.1 As a result of the changes, similar types and quantities of waste as currently produced are expected. The types and amounts of waste currently produced quarterly by K1 CHP plant are shown in Table 3-7 below:

Table 3.9: Types and Amounts of Waste

EWC Code	*Description of waste*	*Amount (tonnes)*
13 05 08	Waste Oil	6
15 01 01	Paper and Cardboard	10.8
15 02 02	Oil Filters	2
16 01 14	Antifreeze	19.7
16 06 02	Batteries	5.8
16 10 01	Hazardous Aqueous Waste	2
17 04 07	Metal	27
20 01 38	Wood	4
20 03 01	General Waste	279

3.13.2 Wood, paper and cardboard and general waste all go to DS Smith. Metal goes to LKM metal in Sittingbourne for recycling.

3.13.3 E.ON apply the waste hierarchy and minimise waste production where possible.

3.13.4 All waste being generated at the Kemsley CHP Plant will be managed in accordance with the E.ON UK CHP Limited management system. A waste minimisation audit will be undertaken within two years of permit issue and every four years thereafter. The E.ON UK CHP Limited management System and Duty of Care measures will allow for waste transport carriers and the holders of waste permit who receive these wastes to be appropriately audited in order to prevent or minimise environmental effects, both during their transportation and their end use or disposal.

3.14 Energy Efficiency

3.14.1 Energy usage following the proposed changes

Table 3.10: Annual Energy Consumption

Energy Source	*Delivered (MWh)*	*Primary (MWh)*
Kemsley CHP Energy Demand		
Natural Gas	1,513,835	1,513,835
Electricity (from K4 CHP parasitic demand)	9,636	10,730
Electricity (from grid start-up/shutdown)	4	9.6
Energy Produced		
Electricity (exported)	597,689	665,547
Steam (exported) - CHP	723,494	805,635
Steam (exported) – MP Boilers	17,885	19,231
Steam (exported) – LP Boilers	11,930	12,691

Notes: Natural gas consumption includes gas to K4 CHP, MP and LP boilers. Gas consumption to CHP has been based on an assumed likely annual operating profile and accounts for 1,481,913 MWh of the total natural gas figure above. K4 CHP delivered to primary energy conversion factor is 1.11 and has been calculated on the basis of K4 CHP efficiency (89.8% i.e. (9,636+597,689+723,494)*100/1,481,913). Electricity from the grid assumes the standard H1 factor of 2.4 for primary to delivered energy.

3.14.2 K4 will be a CHP that works by burning gas to fire the gas turbine and create mechanical energy that produces electricity. This process generates excess heat which rather than wasted is then used to heat water and create high pressured steam which is fed though a second turbine to greater further electricity thereby maximising electricity generation.

3.14.3 The steam produced is also critical for the paper making process and is contained, de-pressurised and sent to the Paper Mill for use within the paper production process. It therefore provides an energy efficient way of providing both electricity and steam for the paper making process.

3.14.4 The new plant is replacing existing plant at the site and as the technologies have improved over the years then the new plant shall be more efficient than existing plant.

3.14.5 The new plant utilises the following techniques in order to improve energy efficiency:

- **Combustion optimisation** – The plant will use an advanced control system and good design of the combustion equipment shall ensure combustion and temperature optimisation.
- **Optimisation of the working medium conditions** - Almost full available natural grid pressure will be used for gas turbine operation
- **Optimisation of the steam cycle** - Steam turbine exhaust pressure closely matches the low-pressure steam requirements of customer's heat load
- **Minimisation of energy consumption** - All drivers will have high efficiency motors. Feed water pumps use both high efficiency motors and variable speed drives (VSDs). Some other main drivers will be also be equipped with VSDs
- **Fuel preheating** - Fuel gas preheating using waste heat for gas turbine fuel is applied
- Advanced control system – An advanced control system shall be used, this shall give a computerised control of the main combustion parameters enabling an improvement of the combustion efficiency.
- **Feed-water preheating using recovered heat** - Auxiliary condenser operating parameters are selected for maximal recovery of heat (operated nearly above low-pressure system)
- **Heat recovery by cogeneration (CHP)** - Feed water for auxiliary is degassed/preheated with flue gas
- **CHP readiness** - Plant will be CHP from outset. A CHP-ready assessment is included as **Appendix M**.
- **Advanced materials** - High pressure steam systems designed with high-alloy steel to withstand high temperature/pressure
- **Steam turbine upgrades** - Steam turbine especially designed to supply maximum power at given conditions and supply two separate steam system (medium and low pressure).

3.14.6 Technical specifications for new plant can be found in **Appendix F.**

3.14.7 A review of suitable opportunities to improve the energy efficiency of the activities shall be undertaken every four years and any further appropriate measures identified by a review shall be undertaken.

3.14.8 Further assessment against BAT-associated energy efficiency levels (BAT-AEELs) can be found in section 4 below.

3.15 CHP Ready Assessment

3.15.1 The proposed Kemsley K4 CHP plant will provide CHP from the outset. It will be replacing an existing end-of-life CHP plant on the same site (K1 CHP).

3.15.2 The potential heat demand in the local area has been considered and a heat load and CHP envelope have been identified for the proposed plant. The operation of the plant with the identified heat load has been set out together with the technical provisions and any future space requirements.

3.15.3 As the proposed K4 CHP plant will be CHP from the outset, it is considered BAT and an economic assessment is not required. The EA have confirmed that a CHP Ready assessment is not required for this permit variation application, however, one has been produced to demonstrate the plant is CHP read and is included as **Appendix M.**

3.16 Site Closure

3.16.1 A site closure plan will be developed for the Kemsley Paper Mill CHP prior to the changes included within this variation coming into operation. The site closure plan will be incorporated within the IMS and will be maintained as part of the system throughput the operational life of the facility.

3.16.2 The site condition and baseline report for the K4 CHP area to be included as part of this variation will also be maintained as part of the IMS. This document includes information that will be collated throughout the operational phase and also sets out the information to be provided at the end of the operational life at the point where the permit is surrendered.

4 BEST AVAILABLE TECHNIQUES (BAT) ASSESSMENT

4.1 Introduction

4.1.1 This section of the application provides information for the selected BAT for the key items of plant as follows:

- Selection of the gas turbine
- Selection of the cooling system
- Control of emissions to air

4.1.2 As part of pre-application discussions, the EA has confirmed that the new plant needs to meet the requirements of the Large Combustion Plants BAT conclusions[3] and take into consideration the requirements for the Production of Pulp, Paper and Board BAT conclusions[4] which apply to the Kemsley Paper Mill installation within the which the Kemsley CHP Plant is located, therefore the proposed new plant which is the subject of this variation has been assessed against both these as detailed below.

4.1.3 Control of emissions to air is covered via the assessment of compliance with the BAT conclusion requirements.

4.2 Selection of the Gas Turbine

Selection of a Natural Gas Fired Combined Cycle Gas Turbine (CCGT)

4.2.1 The primary reasons for selecting a natural gas fired CCGT technology are summarised below:

- The K4 plant is a direct replacement for the K1 CHP therefore existing infrastructure can be utilised;
- Natural gas fired CCGT power plants are highly efficient and will result in lower emissions than oil or coal fired plant, of NO_X, CO, CO_2 and negligible amounts of sulphur dioxide (SO_2) and particulate matter (PM);
- Natural gas CCGT power plants are reliable and flexible and capable of co-generation;
- Natural gas fired CCGT power plants require minimal land take and smaller structures than many other forms of power generation technology;
- CCGT power plants produce very low amounts of solid waste (no ash) in the combustion process.

[3] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1503383091262&uri=CELEX:32017D1442

[4] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:JOL_2014_284_R_0017

4.2.2 A comparison of average emissions and electrical efficiency from the various combustion processes (based on the Large Combustion Plant BAT Conclusions and data from Digest of UK Energy Statistics (DUKES) 2018 – Annex A[5]) is shown in Table 4.1 below.

Table 4.1: Efficiencies and Emissions from Different Combustion Processes

	Net electrical Efficiency (%)	NO_X Emissions (mg/Nm^3)	CO Emissions (mg/Nm^3)	CO_2 Emissions (kg/KWh)
Coal with CCGT	36.5 - 41.5	100 – 150*	<30 - 140	0.322
Oil with CCGT	>40	**102 – 1085	**44-200	0.254
Natural Gas with OCGT	36 – 41.5	5 – 40	5 – 40	0.184
Natural Gas with CCGT	53 – 58.5	5 - 30	5 - 30	0.184

** Solid fuel reference conditions are at 3% O_2; liquid and gas fuels are at 15% O_2. Coal NO_x BAT AELs corrected to 15% are 33-50 mg/Nm^3 and CO is 10 – 23 mg/Nm^3)*

*** No BAT-AELs for gas turbines, therefore, BREF performance range included. Note also IED includes a NOx limit of 50 mg/Nm^3 and CO limit of 100 mg/Nm^3 for gas turbines burning light and middle distillate liquid fuels.*

4.2.3 As shown in the table 4.1 above:

- The use of a combined gas and steam turbine equipment results in the highest efficiency of fuel usage;
- The use of natural gas reduces NO_X and CO emissions compared to coal and oil; and
- The proposed CCGT power plant will emit almost half the quantity of CO_2 emissions compared to a coal fired power plant.

[5] https://www.gov.uk/government/statistics/digest-of-uk-energy-statistics-dukes-2018-main-report

4.2.4 CCGT plant are BAT for gas turbine installations in the UK since they offer high net thermal efficiency with the latest designs achieving greater than 58% thermal efficiency (average through life) in combined cycle operation. The analysis provided in Table 4.1 does not take account of the CHP opportunity at this site, which will boost the efficiency to up to approximately 96% in integrated mode.

4.3 Selection of the cooling system

4.3.1 There are four main types of cooling systems commonly employed at this type of facility:

- Once-through sea or river water;
- Evaporative cooling tower;
- Hybrid cooling tower; and
- Air cooled condenser.

4.3.2 Each of these cooling technologies has its associated advantages and disadvantages. The CHP plant's chosen cooling system is an auxiliary air-cooled condenser for excess steam. During normal operation this air condenser is not in use. This system has been selected for the following reasons:

- Although the site is situated next to the Swale, this is a tidal system and a designated SAC therefore it is not suitable for large volume water abstraction or discharge of warm return water;
- Air cooled systems do not require any chemical or biocide treatment which evaporative systems do;
- There is no visible plume from air cooled systems; and
- There is no requirement for water demand.

4.3.3 The chosen cooling system is therefore considered to represent BAT for the K4 CHP plant.

4.4 Production of Pulp, Paper and Board BAT Conclusions Assessment

4.4.1 The best available techniques (BAT) conclusions for the production of pulp, paper and board has been reviewed and the assessment against the BAT conclusions for the CHP plant, auxiliary boilers and the water treatment plant are detailed below.

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

4.4.3 Only indicative BAT applicable to the new CHP, boilers or water treatment plant which are the subject of this variation application are assessed below.

4.4.4 The assessment does not include an assessment against the BAT conclusions document for any of the other activities currently undertaken at the site, namely the current CHP plant or the current water treatment plant.

Table 4.2: Production of Pulp, Paper and Board BAT Conclusions Assessment

BAT 1 – Environmental Management System	**In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS) that incorporates a list of features (as identified in the BAT Conclusions document).**
E.ON justification / evidence	Once operational it is intended that the K4 CHP Plant will form part of E.ON's fleet of CHP plants which consists of 9 plants operating in the UK. The E.ON fleet operates a single integrated management system which has been accredited by an independent assurance body to BS EN ISO 14001:2015 (Environment), OHSAS 18001:2007 (Safety) and PAS 55 (Asset Management). It is intended that the K4 CHP Plant will adopt this integrated management system (IMS) and gain certification to ISO14001, OHSAS 18001 and PAS 55 via a change to approval of the existing certification. Certification will be achieved within one year of commercial operation beginning. Further information on the management system can be found in section 2.6 above.
Compliant / Not Compliant	Compliant upon integration into the E.ON integrated management system.
Action	The operator will consider including sectoral benchmarking in the EMS once the plant is constructed and commissioned.

BAT 6 – Energy Consumption and Efficiency	**In order to reduce fuel and energy consumption in pulp and paper mills, BAT is to use technique (a) and a combination of the other techniques (as identified in the BAT Conclusions document).** **(a) Use an energy management system that includes all of the following features:** **(i) Assessment of the mill's overall energy consumption and production** **(ii) Locating, quantifying and optimising the potentials for energy recovery** **(iii) Monitoring and safeguarding the optimised situation for energy consumption**
E.ON justification / evidence	Ultimately DS Smith will be responsible for optimising the energy efficiency of the paper making process and reducing its demands. Where DS Smith requires heat and power, the Kemsley Paper Mill CHP contributes towards minimising fuel consumption through a design that has been customised to meet D S Smiths needs and through maximising the efficiency of the generating plant. E.ON's CHP solution for K4 is a bespoke thermodynamic design. The design begins with a thorough understanding of a client's current heat /power demands and future needs. The energy needs are defined as a number of critical operational heat / power load points. These load points shape the thermodynamic design since they are critical operational conditions of the end user's process that must be achieved. Other factors such as the ability to respond to any sudden changes in demand such as a paper cut must also be incorporated. E.ON utilises thermodynamic modelling tools such as Thermoflow together with in house modelling tools to optimise a design that meets the client's expectations. Supplier engagement is extremely important at this stage to ensure the design incorporates the latest advancements in technology particularly the prime mover e.g. gas turbine, from both performance and environmental perspectives.

	A heat mass balance has been carried out on the whole systems for the K4 CHP and this can be found in **Appendix N**. This identifies the parasitic loading of the system requirements, the inputs and outputs based on demand etc.
Compliant / Not Compliant	Compliant
Action	No further action required

BAT 8	**BAT is to monitor the key process parameters according to the table given below.** **Monitoring key process parameters relevant for emissions to air** **Pressure, temperature, oxygen, CO and water vapour content in flue-gas for combustion processes**
E.ON justification / evidence	CEMs shall be fitted to monitor emissions from the K4 CHP plant. The CEMs shall monitor for oxides of nitrogen, carbon monoxide, exhaust gas temperature, exhaust gas pressure and exhaust gas oxygen content. Periodic extractive sampling is undertaken, and this will check the exhaust gas oxygen content and water vapour content. Further information on emissions monitoring can be found in section 3.6 above.
Compliant / Not Compliant	Compliant
Action	No further action required

BAT 10	**BAT is to carry out the monitoring of emissions to water, as indicated below, with the indicated frequency and according to 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.**
E.ON justification / evidence	Continuous monitoring is installed on the process water emission point E1 to monitor flow (m^3) and pH.
Compliant / Not Compliant	Compliant
Action	No further action required

BAT 12	**In order to reduce the quantities of wastes sent for disposal, BAT is to implement a waste assessment (including waste inventories) and management system, so as to facilitate waste reuse, or failing that, waste recycling, or failing that, 'other recovery', including a combination of the techniques detailed in the BAT conclusions document.**
E.ON justification / evidence	The activities associated with the permit application do not produce large amounts of waste. E.ON currently have separate segregated waste collections for wood, paper and cardboard and general waste all go to DS Smith where it is bulked for offsite recycling. Metal waste goes to LKM metal in Sittingbourne for recovery. Waste oils will be produced during service and maintenance and are taken by the service contractor for recovery at a permitted facility. Where possible waste is kept to a minimum and if possible, waste such as packaging/pallets shall be re-used. Document EMI06 Waste Storage and Disposal in **Appendix O** details waste minimisation processes in use at the site. Each waste stream is reviewed annually to assess if the waste produced can be eliminated at source, reduced in quantity, reused with in the installation or recycled, with the intention to reduce the quantities ending up in land fill, resulting in both economic and environmental benefits. Further information on waste can be found in Section 3.12 above.
Compliant / Not Compliant	Compliant
Action	No further action required

BAT 53	**In order to reduce the consumption of thermal and electrical energy, BAT is to use a combination of the techniques as detailed below:**
E.ON justification / evidence	• **Steam condensate recovery and use of efficient exhaust air heat recovery systems -** Steam turbine especially designed to supply maximum power at given conditions and supply two separate steam system (medium and low pressure). Condensate from DS Smith and the air-cooled condensers is returned to the water treatment plant and re-used. • **Reduction of direct use of steam by careful process integration using e.g. pinch analysis –** This is carried out by the DS Smith energy manager to ensure that the required steam for the paper mill is correctly supplied using the different sources. • **Generation optimisation and distribution network maintenance - D**egassing in the deaerator will be done with LP steam so no waste heat is used. After the deaerator, there is a feedwater re-cooler to cool down the feed water out of the deaerator in order to reduce the feedwater temperature inlet temperature into the economizer to reduce the flue gas temperature in the stack. • **Optimisation of heat recovery, air system, insulation –** The feed water for all auxiliary boilers is degassed/preheated using waste heat from the fluegas. • **Use of high efficiency motors (EFF1)** - All drivers will have high efficiency motors. Feed water pumps use both high efficiency motors and VSDs. Some other main drivers will also be equipped with VSDs.
Compliant / Not Compliant	Compliant
Action	No further action required

4.5 Large Combustion Plants BAT Conclusions Assessment

4.5.1 A BAT assessment for the K4 CHP is detailed below in table 4.3, the auxiliary boilers have not been included in the assessment as they are categorised as medium combustion plant and therefore out of the scope of the assessment.

Table 4.3: Large Combustion Plants BAT Conclusions Assessment

BAT 1 – Environmental Management System	**In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS) that incorporates a list of features (as identified in the BAT Conclusions document).**
E.ON justification / evidence	Once operational it is intended that the K4 CHP Plant will form part of E.ON's fleet of CHP plants which consists of 9 plants operating in the UK. The E.ON fleet operates a single integrated management system which has been accredited by an independent assurance body to BS EN ISO 14001:2015 (Environment), OHSAS 18001:2007 (Safety) and PAS 55 (Asset Management). It is intended that the K4 CHP Plant will adopt this integrated management system (IMS) and gain certification to ISO14001, OHSAS 18001 and PAS 55 via a change to approval of the existing certification. Certification will be achieved within one year of commercial operation beginning. Further information on the management system can be found in section 2.6 above.
Compliant / Not Compliant	Compliant upon integration into the E.ON integrated management system.
Action	The operator will consider including sectoral benchmarking in the EMS once the plant is constructed and commissioned.

BAT 2	**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.**
E.ON justification / evidence	The requirements for BAT 2 shall be carried out after commissioning the new K4 CHP and would be repeated following a change that could significantly affect the CHP plant efficiency. The test will be carried out at full load and in accordance with current EN standards at the time. In the event that an alternative standard is proposed this would be agreed with the EA prior to carrying out the test.
Compliant / Not Compliant	To be confirmed following commissioning
Action	Performance tests as detailed above to be carried out as part of the commissioning of the new plant.

BAT 4	**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.** • **NOx – using CEMS** • **CO – using CEMS**
E.ON justification / evidence	CEMs shall be fitted to monitor emissions from the combustion process. The CEMs shall monitor for oxides of nitrogen, carbon monoxide, exhaust gas temperature, exhaust gas pressure and exhaust gas oxygen content. Periodic extractive sampling is undertaken, and this will check the exhaust gas oxygen content, water vapour content and annually shall check for methane. Monitoring of point source emissions to air shall be undertaken in line with the requirements of the environmental permit and using the standards detailed in the BAT conclusions (BS EN 14181) Further information on emissions monitoring can be found in section 3.6 above.
Compliant / Not Compliant	Compliant
Action	No further action

BAT 6	**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.**
E.ON justification / evidence	A gas chromatograph shall be installed for continuous analysis of the incoming gas fuel. This shall be maintained and calibrated by a specialist contractor in line with the suppliers and E.ON's specific requirements and maintenance records and calibration certificates shall be kept on site and available for inspection as required. This will ensure that stable combustion conditions are maintained. Regular planned maintenance of the combustion system will be implemented as part of the management system in operation at the site. This shall be done in line with the manufacturer's recommendations. The site shall utilise an advanced control system for the operation of the CHP plant to ensure the maximum efficiency of the fuel usage and reduce emissions where possible. A good design of the combustion equipment has been chosen to ensure good environmental performance. The CHP plant has been chosen as it is designed to optimise efficiency and reduce emissions. A technical specification and further details on the plant design can be found in the technical specifications documents in **Appendix F.**
Compliant / Not Compliant	Compliant
Action	No further action

BAT 9	**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):**
E.ON justification / evidence	Annual characterisation of the fuel and it's quality are carried out for the following parameters: • LHV • CH_4 • C_2H_6 • C_3 • C_4+ • CO_2 • N_2 • Wobbe index An example of gas fuel annual testing is included as **Appendix P**. A gas chromatograph will be installed at K4 for continuous analysis of the listed parameters. The gas chromatograph will be maintained and calibrated by a specialist contractor in line with the suppliers and E.ON's requirements; and maintenance records and calibration certificates kept. The advanced control system is linked to the gas chromatogram and will automatically adjust settings of the plant to optimise combustion and emissions as required based on the gas characterisation.
Compliant / Not Compliant	Compliant

Action	No further action

BAT 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.**
E.ON justification / evidence	The main function of the CHP is to deliver heat and electricity to DS Smith Kemsley Paper Mill. As such, the plant is typically under normal operating conditions the majority of the time offering a baseload output. Start up and shut down occurrences are therefore less frequent than an equivalent flexible CCGT plant. Start up and shut down times are minimised through use of advanced control techniques and experienced operators. Start up and shut down periods are governed by a suite of operating instructions in order to deliver safe, reliable and replicable SUSD sequences optimised to minimise mass emissions whilst maintaining plant integrity. Maintenance requiring shut down of the plant or otherwise leading to OTNOC is minimised by scheduling significant works to occur within specific planned outages (typically one major outage per year). The CHP plant is included in the ongoing servicing and maintenance regime in place at the site as part of the site management systems. This shall ensure that the plant is maintained to the manufacturer's requirements and that any potential faults are identified at the earliest opportunity and rectified before any issues arise. The

	servicing and maintenance regime shall also take in to account the frequency of any OTNOC events in order to identify and alleviate problems.
Compliant / Not Compliant	Compliant
Action	Systems above are to be incorporated upon commissioning of the plant.

BAT 11	**BAT is to appropriately monitor emissions to air and/or to water during OTNOC.**
E.ON justification / evidence	Emissions to air shall be continuously monitored during OTNOC with real time displays and alarms using the CEMs systems to alert operators to any deviation in emissions performance. Process water emissions will also be monitored for the same parameters and to the same frequency as undertaken during normal operation.
Compliant / Not Compliant	Compliant
Action	No further action

BAT 12	**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 in the BAT conclusions document**
E.ON justification / evidence	The descriptions listed below shall be used to increase the energy efficiency of the plant: a) **Combustion optimisation –** The plant will use an advanced control system and good design of the combustion equipment shall ensure combustion and temperature optimisation. b) **Optimisation of the working medium conditions -** Almost full available natural grid pressure will be used for gas turbine operation c) **Optimisation of the steam cycle -** Steam turbine exhaust pressure closely matches the low-pressure steam requirements of customer's heat load d) **Minimisation of energy consumption -** All drivers will have high efficiency motors. Feed water pumps use both high efficiency motors and VSDs. Some other main drivers will be also be equipped with VSDs e) **Fuel preheating -** Fuel gas preheating using waste heat for gas turbine fuel is applied f) **Advanced control system –** An advanced control system shall be used, this shall give a computerised control of the main combustion parameters enabling an improvement of the combustion efficiency. g) **Feed-water preheating using recovered heat -** Auxiliary condenser operating parameters are selected for maximal recovery of heat (operated nearly above low-pressure system) h) **Heat recovery by cogeneration (CHP) -** Feed water for auxiliary is degassed/preheated using waste heat from the flue gas i) **CHP readiness -** Plant will be CHP from outset. A CHP-ready assessment is included as **Appendix M**.

	j) **Flue-gas condenser –** Not used at the site as there is minimum demand for low temperature heat. k) **Heat accumulation –** Not used at the site. l) **Wet stack –** Not applicable. m) **Cooling tower discharge –** Not applicable n) **Fuel pre-drying –** Not applicable o) **Minimisation of heat losses –** Not applicable p) **Advanced materials** - High pressure steam systems designed with high-alloy steel to withstand high temperature/pressure. The GT is one of the most advanced small GT's and is manufactured from advanced materials q) **Steam turbine upgrades** - Steam turbine especially designed to supply maximum power at given conditions and supply two separate steam system (medium and low pressure). r) **Supercritical and ultra-supercritical steam conditions** – Not applicable s) After the deaerator, there is a feedwater re-cooler to cool down the feed water out of the deaerator in order to reduce the feedwater temperature inlet temperature into the economizer to reduce the flue gas temperature in the stack.
Compliant / Not Compliant	Compliant
Action	No further action

BAT 16	**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:**
E.ON justification / evidence	Waste prevention – is incorporated via: • The selection of natural gas as a fuel prevents the generation of residues such as ash, tar that require disposal; • the plant design and control system can meet BAT AELs without the need for abatement plant; and • the only waste generated by the process itself is boiler blowdown and WTP effluent. Both of these are sent to D S Smith for further treatment in the effluent treatment plant and final discharge into the Swale watercourse Further information on waste minimisation and prevention can be found in section 3.13 above.

Compliant / Not Compliant	Compliant
Action	No further action

BAT 17	**In order to reduce noise emissions, BAT is to use one or a combination of the techniques given below.**
E.ON justification / evidence	Noise has been considered in the design of the facility. Regular inspections and maintenance of equipment are undertaken as part of the site management systems, these will include checks on any noisy plant or equipment. Plant will be housed in buildings or acoustic enclosures in order to reduce any noise impacts and staff be operated by trained and experienced staff. The plant is located in a predominantly industrial area and therefore potential impacts on any nearby housing are minimised due to the location. A noise assessment detailing the operation of the plant has been undertaken and is included as **Appendix L**. This has concluded that noise or vibration from construction and the normal operation of the K4 facility will have no significant adverse impact on the surrounding sensitive receptors.
Compliant / Not Compliant	Compliant
Action	No further action

BAT 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:** • **Combined Cycle**
E.ON justification / evidence	The site shall be installing a GT and HRSG. The GT shall operate in combined cycle to ensure that heat loss from the flue gas of the gas turbine is utilised by the steam turbine. The GT specification provides a maximum efficiency of 53.8 - 58.0% combined cycle efficiency. Taking into account the CHP utilisation, efficiencies up to approximately 96% could be achieved. A technical specification for the gas turbine can be found in **Appendix F**.
Compliant / Not Compliant	Compliant
Action	No further action

Table 23	BAT-associated energy efficiency levels (BAT-AEELs) for the combustion of natural gas
E.ON justification / evidence	For a CHP combined cycle gas turbine (CCGT), 50-600 MW_{th}, the net electrical efficiency shall be between 53% and 58.5%. The GT operates at a maximum of 53.8 – 58.0% combined cycle efficiency. As the plant will operate with CHP providing steam as well as electricity, in CHP mode the electrical efficiency will be approximately 40%, however, the overall efficiency in CHP mode will be up to approximately 96%. A technical specification for the gas turbine can be found in **Appendix F.**
Compliant / Not Compliant	Compliant
Action	No further action

BAT 42	**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.**
E.ON justification / evidence	The GT is capable of controlling NOx emissions to <10mg/Nm^3. A technical specification for the gas turbine can be found in **Appendix F.** The following shall also be utilised at the site to reduce NO_x emissions. • **Advanced control system –** An advanced control system shall be used, this shall give a computerised control of the main combustion parameters enabling an improvement of the combustion efficiency • **Low – NO_x burners (LNB)** - For the HRSG supplementary firing & the MP auxiliary boiler, low NO_x shall be used to reduce emissions. • **Dry Low Emissions (DLE) combustion system –** this reduces the peak flame temperature and minimises the thermal formation of nitrogen oxides (NOx).
Compliant / Not Compliant	Compliant
Action	No further action required

BAT 44	**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.**
E.ON justification / evidence	The Gas Turbine is capable of <10mg/Nm3 CO emissions. A technical specification for the gas turbine can be found in **Appendix F.** Optimised combustion is achieved using advanced control systems which will constantly assess the combustion parameters to ensure combustion efficiency and reduce CO emissions from the process. The design of the combustion equipment has been considered in order to reduce emissions the advanced control systems shall ensure optimisation of the temperature.
Compliant / Not Compliant	Compliant
Action	No further action

Table 24	**BAT-associated emission levels (BAT-AELs) for NO_X emissions to air from the combustion of natural gas in gas turbines**
E.ON justification / evidence	For a new combined cycle gas turbine (CCGT), >50 MW_{th}, the BAT-AELs are as follows: • Yearly average: 10-30 mg/Nm^3 • Daily average or average over the sampling period: 15–40 mg/Nm^3 The K4 CHP plant is capable of <10mg/Nm^3 NO_x emissions and is therefore able to meet the BAT-AELs detailed above. A technical specification for the gas turbine can be found in **Appendix F.**
Compliant / Not Compliant	Compliant
Action	No further action

4.5.2 Any BAT conclusions not listed in the assessments above are not included as they have been assessed as not relevant to the new plant which is the subject of this variation application.

4.6 BAT Assessment Conclusions

4.6.1 The following BAT conclusions will be met upon construction and commissioning of the plant based on a review of all available information:

Production of Pulp, Paper and Board BAT Conclusions

- **BAT 1** – Environmental Management System
- **BAT 6** - Energy consumption and efficiency
- **BAT 8** - Monitoring of key process parameters and of emissions to water and air
- **BAT 10** - Monitoring of key process parameters and of emissions to water and air: monitoring of emissions to water
- **BAT 12** – Waste Management
- **BAT 53** - Energy consumption and efficiency

Large Combustion Plant BAT Conclusions

- **BAT 2** - Monitoring: Performance Test at Full Load
- **BAT 4** - Monitoring: Emissions to Air Frequency
- **BAT 6** - General Environmental and Combustion Performance: Reduce Emissions to Air
- **BAT 9** - BAT-associated emission levels: quality assurance/quality control programmes for fuels
- **BAT 10** - BAT-associated emission levels: Reduce Emissions to Air/Water during OTNOC
- **BAT 11** - BAT-associated emission levels: Monitoring of Emissions to Air/Water during OTNOC
- **BAT 12** - Energy Efficiency
- **BAT 17** - Noise Emissions
- **BAT 40** - Energy efficiency of natural gas combustion
- **TABLE 23** - BAT-associated energy efficiency levels (BAT-AEELs) for the combustion of natural gas
- **BAT 42** - NO_X, CO, NMVOC and CH_4 emissions to air: prevent or reduce NO_X
- **BAT 44** - NO_X, CO, NMVOC and CH_4 emissions to air: prevent or reduce CO
- **TABLE 24** - BAT-associated emission levels (BAT-AELs) for NOX emissions to air from the combustion of natural gas in gas turbines

4.6.2 There are no BAT conclusions relating to the plant to be installed as part of this variation that the operator requires derogation from for the construction and commissioning of the proposed combustion plant.

5 CHANGES TO PERMIT CONDITIONS

5.1 Changes to Permit Conditions

5.1.1 As a result of this variation, the following changes are required to the permit:

- **Table S1.1** activities – update Activities to include new activity reference A3: Section 1.1 A (1) (a): Burning any fuel in an appliance with a rated thermal input of 50 megawatts or more.
- **Table S1.1** activities – update Activities to include new activity reference A4: Medium Combustion Plant
- **Table S1.1** activities – update Activities to include new activity reference A6: Emergency Diesel Generator
- **Table S1.4** Start-up and Shut-down thresholds – update to include new CHP and boiler plant
- **Table S3.1 (a)** Point source emissions to air from Large Combustion Plant – update to include emissions point A8 as identified in table 3.1 above.
- **Table S3.1 (d)** to be added for Point source emissions to air from Medium Combustion Plant – this will include emissions points A4, A5 and A9 as identified in table 3.2 above.
- **Table S3.1 (e)** to be added for Point source emissions to air from Directly Associated Activities – this will include emissions points A10 as identified in table 3.3 above.
- **Table S3.5** Process monitoring requirements – update to include emission points A8 as identified in table 3.1 above.
- **Table S4.1** Reporting of monitoring data – update to include new emissions A8 and A9 as identified in table 3.1 above.
- **Schedule 7** Site plan - update plan with revised permit boundary as per drawing JER1679_SI_001_D_190329_PermitBoundary

References

1. M1 sampling requirements for stack emission monitoring - https://www.gov.uk/government/publications/m1-sampling-requirements-for-stack-emission-monitoring

2. M20 quality assurance of continuous emission monitoring systems - https://www.gov.uk/government/publications/m20-quality-assurance-of-continuous-emission-monitoring-systems

3. Best available techniques (BAT) conclusions for large combustion plants - https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017D1442&from=EN

4. Best available techniques (BAT) conclusions for Production of Pulp, Paper and Board - https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:JOL_2014_284_R_0017

5. Digest of UK Energy Statistics (DUKES) 2018 - https://www.gov.uk/government/statistics/digest-of-uk-energy-statistics-dukes-2018-main-report

6. The Environmental Permitting (England and Wales) Regulations 2016 - http://www.legislation.gov.uk/uksi/2016/1154/contents/made

7. The Environmental Permitting (England and Wales) (Amendment) Regulations 2018 - https://www.legislation.gov.uk/ukdsi/2018/9780111163023/contents

Glossary

AEL	Associated Emissions Level
AEEL	Associated Energy Efficiency Level
AMP	Accident Management Plan
AQA	Air Quality Assessment
BAT	Best Available Technique
BSEN	British Standard European Norm
CCGT	Combined Cycle Gas Turbine
CEMS	Continuous Emissions Monitoring Systems
CHP	Combined Heat and Power
CO	Carbon Monoxide
DAA	Directly Associated Activity
EA	Environment Agency
ELV	Emissions Limit Value
EPR	Environmental Permitting (England and Wales) Regulations 2016
ERA	Environmental Risk Assessment
FBC	Fluidised Bed Combustor
GT	Gas Turbine
HRSG	Heat Recovery Steam Generator
IMS	Integrated Management System
ISO	International Standards Organisation
LCP	Large Combustion Plant
LP	Low Pressure
MCERTS	Monitoring Certification Scheme
MCP	Medium Combustion Plant
MP	Medium Pressure
NOx	Oxides of Nitrogen
OCGT	Open Cycle Gas Turbine
OHSAS	Occupational Health and Safety Assessment Series
OTNOC	Other Than Normal Operating Conditions
PAS	Publicly Available Specification
PFD	Process Flow Diagram
PRW	Paper Related Waste
SCR	Site Condition Report
SDS	Safety Data Sheets
VOC	Volatile Organic Compounds
VSD	Variable Speed Drive
WTP	Water Treatment Plant

APPENDICES

Appendix A

Application Forms

Appendix B

Site Plans

Appendix C

Environmental Risk Assessment & H1

Appendix D

Air Quality Assessment

Appendix E

Site Condition Report & Baseline Assessment

Appendix F

Technical Specifications

Appendix G

LP Auxiliary Boiler Options

Appendix H

Water Treatment Process

Appendix I

ISO14001 Certificate & Environmental Policy

Appendix J

K4 O&M Structure

Appendix K

Drainage Strategy

Appendix L

Noise Assessments

Appendix M

CHP-Ready Assessment

Appendix N

Heat Mass Balance

Appendix O

Waste Storage and Disposal Procedure

Appendix P

Example of Gas Fuel Annual Testing

Appendix Q

Environmental Statement

Appendix R

Nature and Heritage Conservation

Appendix S

Pre-Application Discussions Email

Appendix T

Application Documents List