# TECHNICAL DOCUMENT

**APPLICATION FOR A VARIATION TO THE ENVIRONMENTAL PERMIT FOR THE NORTHFLEET PAPER MILL**

## KIMBERLY-CLARK

**CURRENT PERMIT REFERENCE – BJ7379IZ/V008**

**VARIATION V009**

## NEW BOILER PLANT PROJECT

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**LIST OF ABBREVIATIONS**

| | | |
|---|---|---|
| AEPL | - | Associated Performance Levels |
| ATEX | - | “Atmospheres Explosibles” |
| BAT | - | Best Available Techniques |
| BOP | - | Balance of Plant |
| CAR | - | Compliance Assessment Report |
| $CH_4$ | - | Methane |
| CCTV | - | Closed Circuit Television |
| CO | - | Carbon Monoxide |
| $CO_2$ | - | Carbon Dioxide |
| COMAH | - | Control of Major Accident Hazards |
| COSHH | - | Control of Substances Hazardous to Health |
| D/D/S | - | Duty/Duty/Standby configuration for existing boilers |
| D/S | - | Duty/Standby configuration for new boilers |
| EA | - | Environment Agency |
| ECF | - | Environmentally Certified Fibre |
| ECO 1/2 | - | Economiser |
| ELV | - | Emission Limit Value |
| EMS | - | Environmental Management Systems |
| EPR | - | Environmental Permitting Regulations |
| ETP | - | Effluent Treatment Plant |
| EU | - | European Union |
| GHG | - | Green House Gas |
| $H_2$ | - | Hydrogen |
| $H_2O$ | - | Water |

| | | |
|---|---|---|
| $H_2S$ | - | Hydrogen Sulphide |
| HAZOP | - | Hazard and Operability Study |
| HHV | - | Higher Heating Value |
| HPF | - | Hydrogen Production Facility |
| HVAC | - | Heating, Ventilation and Air Conditioning |
| IBC | - | Intermediate Bulk Container |
| IED | - | Industrial Emissions Directive |
| ISO14001 | - | The Standard for Environmental Management Systems (EMS) |
| KC | - | Kimberly-Clark Limited |
| LHV | - | Lower Heating Value |
| M1 | - | EA guidance note on Monitoring System Locations |
| MCC | - | Motor Control Centre |
| MCERTS | - | Monitoring Certification Scheme |
| MCP | - | Medium Combustion Plant |
| MCR | - | Maximum Continuous Rating |
| MEWP | - | Mobile Elevating Work Platform |
| MSDS | - | Material Safety Data Sheet |
| MWth | - | MegaWatt thermal |
| N | - | Nitrogen |
| $N_2$ | - | Nitrogen |
| NG | - | Natural Gas |
| NOx | - | Oxides of Nitrogen |
| $O_2$ | - | Oxygen |
| P | - | Phosphorus |
| PLC | - | Programmable Logic Controller |
| PRMS | - | Pressure Reduction & Monitoring Station |

| | | |
|---|---|---|
| Q1/2/3/4 | - | Quarter 1/2/3/4 etc |
| RHS | - | Relevant Hazardous Substance |
| RO | - | Reverse Osmosis |
| SMOC | - | Safety Management of Change |
| SOx | - | Oxides of Sulphur |
| SCR | - | Site Condition Report |
| TM | - | Tissue Machine |
| t/h | - | Tonnes per hour |

**NON-TECHNICAL SUMMARY – SUBSTANTIAL VARIATION APPLICATION – NEW BOILER PLANT - BJ7379IZ/V009**

The proposed development consists of the installation of replacement boilers, exhaust stacks and associated pipework/infrastructure at the Kimberly-Clark Limited (KC) existing manufacturing site in Northfleet, Kent.

The initial scope of the boiler replacement project was to replace the boilers due to their age and condition, with energy saving being a by-product of the installation.

Currently steam for the site is provided by the existing boiler plant which is located at the northern end of the site approximately 600 m from the main production building (the "Mill") which contains the Tissue Machine TM3.

TM3 is the main user of steam on-site. The manufacture of tissue requires a large steam filled cast iron cylinder (Yankee Dryer) to be rotated at high speed to dry the tissue.

The tissue-making process primarily drives the demand for steam. Additionally, there is an increased demand for ancillary items, such as HVAC, during the winter months.

The existing boiler plant was first put into operation in 1974 and consists of 4 x 12MWth input natural-gas boilers each of which are connected to a single 61m tall stack (identified as emission point to air A1 in the current permit).

One of the four existing boilers has already been decommissioned (air-gapped) and is no longer operational. The three remaining boilers are operated to satisfy the current site steam requirements. Only two are required for routine operation and the third is kept as a standby/backup and therefore the boilers operate in a Duty/Duty/Standby (D/D/S) configuration.

The operation of the three existing boilers is controlled to satisfy the site steam demand which varies according to site operational demands. Over-production/supply of steam is avoided since the production of excess steam has to be vented which is costly and wasteful.

The existing boilers operate at around 83% efficiency.

For reasons of equipment age and efficiency, KC has decided to replace the existing boiler plant at Northfleet with a new boiler plant system which will be located closer to the TM3 user than the existing boiler house and which will contain 2 new boilers capable of each

producing 12 t/h of steam (each rated at 7.6MWth input). Each new boiler will have an individual stack and the system will be operated as duty/standby.

Each new boiler will have dual-fuel capability (natural gas and hydrogen) and also have the capability to operate on a mix of hydrogen and natural gas if required.

The new boiler plant will be more efficient, more reliable and will align with KC's future sustainability plans and will contribute towards KC's target of using 100% renewable energy by 2030. The new boiler plant will assist in reducing KC's Carbon Dioxide ($CO_2$) emissions by burning green hydrogen.

The proposed changes require a permit variation for the installation of the new boiler plant and the provision of new point source emissions to air - to be designated A14 & A15.

Hydrogen is to be provided by a new hydrogen production facility (HPF) to be constructed on an area of land within the existing Northfleet site ownership boundary. KC has leased an area of land (0.29 acres) to the HPF (current operator Green Hydrogen 3 (GH3)) for the construction and operation of the HPF.

The HPF scope includes the provision of a dedicated hydrogen supply pipeline from their site area to the new boiler plant.

The HPF (in the name of Green Hydrogen 3 Limited) has already received an environmental permit (EPR/MP3624ST) for operation of the HPF which was issued by the Environment Agency in February 2025.

For the purposes of this variation the BAT-C requirements have been reviewed in order to ensure that following the modifications compliance will be achieved and that any specific requirements for new plant have been addressed during the design process/specification of the new equipment/facilities.

The assessment concludes that due to the proposed modification (Installation of a new boiler plant) KC's operations at Northfleet will continue to meet the relevant BAT-Conclusions requirements.

Overall the provision of new boiler plant to satisfy the existing site steam requirements is considered to represent BAT for the installation.

## 1. INTRODUCTION – NEW BOILER PLANT PROJECT

The proposed development consists of the installation of replacement boilers, exhaust stacks and associated pipework/infrastructure at the Kimberly-Clark Limited (KC) existing manufacturing site in Northfleet, Kent.

This report is prepared in support of an application to vary the environmental permit EPR/BJ7379IZ/V008 for the KC facility located at Northfleet Mill, Crete Hall Road, Northfleet, Kent, DA11 9AD ('Northfleet Mill').

Northfleet Paper Mill is located in Northfleet on the south bank of the River Thames at National Grid Reference TQ 62640 74189.

Site location plans/details have been included in Appendix A.

### 1.1 Site Location/Background

The Northfleet Mill is located approximately 1km from the centre of Gravesend.

The site is surrounded by the following:

| | |
|---|---|
| To the north | To the north of the site are loading jetties which adjoin the River Thames. On the North bank of the River Thames are Tilbury Docks. |
| To the east | To the east is industrial warehousing - Lidl distribution etc. |
| To the south and south west | Housing is located along the southern boundary and to the south west – London Road, The Hill, High Street Northfleet. Due to the local area topography these houses are at an elevated level relative to the KC site and from the houses and road it is possible to overlook the KC site. The KC site is located at the base of an old quarry. |
| To the west | To the west is miscellaneous industry – haulage companies, pallet storage etc. |

The nearest residential receptors are located at London Road and The Hill, Northfleet.

The site is located primarily within flood zone 2.

To support the planning application a Flood Risk Assessment and Drainage Strategy report (682039-R1(1)-FRA – April 2026) has been prepared.

The site is not located within an Air Quality Management Zone.

There are designated habitat sites within the relevant screening criteria of the installation (see Air Quality Impact Assessment).

The main raw material used on site is raw Environmentally Certified Fibre (ECF) pulp that is delivered by sea. Storage immediately after unloading is not within the installation boundary as the store also supplies other mills.

The pulp is mixed with large amounts of water (and dyes and conditioning chemicals) to supply the paper machine (TM3) with a suspension of the correct density. The paper machine forms the fibres into a web and removes most of the water to leave tissue paper. Most of the water is recycled back to the start of the process. The paper is creped by sticking it to a large drum and scraping it off again as a continuous process.

The plant manufactures tissue products and has a capacity of approximately 35,000 tonnes per annum for the current tissue machine – TM3. KC currently directly employs approximately 160 people in a variety of different roles at the site. (This figure excludes contract employees).

The permitted installation boundary area (in green) covered by the current permit EPR/BJ7379IZ/V008 is shown in Schedule 7 of the existing permit and presented in Appendix A – Figure 1.

The current permitted site installation area does not include other areas within the overall KC ownership boundary. For example, warehousing and distribution facilities for KC along with areas of land currently unused and/or leased to other organisations. An area to the north-east of the site is currently leased to a metal recycling company.

In Appendix A, Figure 2 - The blue line shows the KC ownership boundary and the red line boundary shows the planning boundary – the area in which work is to be undertaken. A more detailed plan is shown in Appendix A, Figure 3.

### 1.2 Permitted Activities

The installation produces soft tissue paper under the following IED Schedule 1 listed activities (Permit variation V008):

- AR1 - Section 6.1 Part A(1)(b) Producing, in an industrial plant, paper and board where the plant has a production capacity of more than 20 tonnes per day.

- AR3 - Section 5.4 Part A(1)(a)(i) Disposal of non-hazardous waste with a capacity exceeding 50 tonnes per day involving biological treatment.
- AR4 - Section 1.1 Part A(1)(a) Burning any fuel in an appliance with a rated thermal input of 50 or more megawatts

Directly Associated Activities include:

- AR5 - Conversion of sheet paper to soft paper rolls and manipulation of rolls.
- AR6 - Treatment of water abstracted from boreholes for use in the papermaking process and boiler house.

There is no activity AR2 in the current permit.

### 1.3 Current Boiler Plant/Steam Generation

The initial scope of the boiler replacement project was to replace the boilers due to their age and condition, with energy saving being a by-product of the installation.

Currently steam for the site is provided by the existing boiler plant which is located at the northern end of the site approximately 600 m from the main production building (the "Mill") which contains the Tissue Machine TM3.

TM3 is the main user of steam on-site. The manufacture of tissue requires a large steam filled cast iron cylinder (Yankee Dryer) to be rotated at high speed to dry the tissue.

The tissue-making process primarily drives the demand for steam. Additionally, there is an increased demand for ancillary items, such as HVAC, during the winter months.

The existing boiler plant was first put into operation in 1974 and consists of 4 x 12MWth input natural-gas boilers each of which are connected to a single 61m tall stack (identified as emission point to air A1) in the current permit. They have been classified as existing Medium Combustion Plant (MCP) by the Environment Agency (EA). They were designed to originally provide 26t/h of steam for supply to the site.

The boiler plant was originally designed to fulfill the site steam requirements when there were 3 tissue paper mills on-site. However over the years the site steam requirements have reduced as the production facilities have changed. For example the number of installed tissue paper machines has now been reduced to one (TM3). TM1 and TM2 having now been removed from site.

One of the four existing boilers has already been decommissioned (air-gapped) and is no longer operational. The three remaining boilers are operated to satisfy the current site

steam requirements. Only two are required for routine operation and the third is kept as a standby/backup and therefore the boilers operate in a Duty/Duty/Standby (D/D/S) configuration.

The operation of the three existing boilers is controlled to satisfy the site steam demand which varies according to site operational demands. Over-production/supply of steam is avoided since the production of excess steam has to be vented which is costly and wasteful.

The existing system still has many features associated with the original design. The existing boilers operate at around 83% efficiency.

The current Mill steam demand is variable depending on the season but is approximately 7-8 t/h – see Table below - which means that the existing system (capable of producing up to 26 t/h of steam) is significantly over-designed for the current duty. Current boilers are used in a D/D/S configuration with the standby boiler being used when the weekly low water test is carried out, and when a boiler is shutdown for annual statutory inspection, or in the case of another boiler breakdown.

Peak steam consumption has historically been up to 13 t/h on a restart for TM3. However this is a response issue resulting from the time for the boiler (approximately 600m away) to respond to load fluctuations. They are 50-year-old boilers and it is believed that a similar issue will not recur with the new boiler plant due to the closer proximity of the new boiler plant to the demand/users.

| Feature | TM3 | Steam Box | HVAC (seasonal) | Existing De-aerator (boiler house) | Steam Losses | Total |
|---|---|---|---|---|---|---|
| Nominal Consumption t/h | 5.4 | 0.65 | 0.82 | 0.84 | 0.6 | 8.31 |

The existing boilers are inefficient by modern standards which leads to higher emissions. They require regular maintenance (high costs) to ensure they continue to operate and comply with current statutory requirements. In addition due to the significant distance from the boiler plant to the TM3 which is the main user, and the age of the steam and condensate pipework, steam losses of 0.5-1 t/h currently occur due to a leaking steam

supply/distribution system. There is also the potential for a significant impact on the business/production in the event of a major breakdown.

Boiler feedwater is provided to the site from two existing site boreholes. The borehole water is treated to ensure the appropriate water quality supply for the existing boilers.

Water treatment chemicals are required in this treatment process.

The current boiler plant produces superheated steam at 15barg @ 200$^{o}$C.

The existing system produces steam for supply to the site and condensate is returned to the boiler plant for reuse. All lines are thermally insulated and some sections of pipework are located underground and/or within trenches including sections which run beneath existing roads. The existing steam supply pipework and condensate return pipework is old and in places difficult to inspect and test. Due to the distance involved steam loses heat from the pipework supply to the Mill and the condensate loses heat on the return. Condensate is currently collected within the Mill (atmospheric pressure vessel 30m$^{3}$) for return to the Boiler House and pumped back to the boiler plant at approximately 85$^{o}$C.

Blowdown occurs and make-up water is required for the system. The discharges are to the existing site drainage system which is routed to the on-site Effluent Treatment Plant (ETP) (Biological secondary treatment) where it is mixed with other discharges from the site, the surface water drains etc. and treated as required prior to final discharge to the River Thames via discharge point W1 designated in the existing permit.

Discharges from the boiler house are low and overall not significant in terms of the total volumes treated by the ETP which mainly deals with the discharges from the paper production facilities. The ETP was designed to handle wastewater from the original paper mills and has significant over-capacity for current loadings.

The quantity of solid waste produced from the existing boiler plant operations is not significant and comprises mainly waste generated from periodic maintenance activities.

Any solid wastes generated are disposed of in accordance with existing site waste management procedures.

### 1.4 New Boiler Plant Project

For reasons of equipment age and efficiency outlined in the preceding sections, KC has decided to replace the existing boiler plant at Northfleet with a new boiler plant system.

A similar project is simultaneously being undertaken at the KC Barrow site to replace their existing boilers for the same reasons. The KC Barrow and KC Northfleet projects are in close liaison and have regular discussions. The new boiler supplier is the same at each location. There are regular discussions between the project teams for each site and design information has been shared. There are many similarities between the two projects and lessons are being learnt and shared between the two projects. At KC Northfleet unlike at Barrow, the HPF is to be constructed on land within the existing KC Northfleet site. KC Northfleet initially sought pre-application advice in 2024 and this has been taken into consideration for both projects.

KC Northfleet have decided to replace the existing boiler plant with a new boiler plant system which will be located closer to the TM3 user than the existing boiler house and which will contain 2 new boilers capable of each producing 12 t/h of steam (each rated at 7.6MWth input). Each new boiler will have an individual stack and the system will be operated as duty/standby. As part of KC's commitment to sustainability, decarbonization options have been explored. One of which is that KC specify new boilers to be provided with the capability to operate 100% hydrogen firing without derating capacity.

Each new boiler will have dual-fuel capability (natural gas and hydrogen) and also have the capability to operate on a mix of hydrogen and natural gas if required. At this stage operating on a mix is currently considered unlikely (but it cannot be ruled out). KC's preference will be to operate using 100% hydrogen all the time when it is available.

The new boiler plant will be more efficient, more reliable and will align with KC's future sustainability plans and will contribute towards KC's target of using 100% renewable energy by 2030. The new boiler plant will assist in reducing KC's Carbon Dioxide ($CO_2$) emissions by burning green hydrogen.

KC has engaged vendors with experience in hydrogen combustion systems. "Hydrogen Ready" boilers as described by vendors are designed to seamlessly change from natural gas to hydrogen without compromising output.

KC evaluated alternative potential boiler suppliers prior to the final selection of Cannon Bono boilers. These boilers offer modern technology and incorporate energy efficient/energy saving opportunities and design measures (flue gas recirculation, high pressure condensate return, economisers, blowdown heat recovery, combustion air preheat) and were considered following detailed evaluation to fulfil all KC requirements and to fulfil the Best Available Technique (BAT) requirements for new boiler design. Other suppliers were unable to demonstrate similar consideration and technical familiarity with overall energy efficiency/energy saving opportunities and considerations.

KC has selected standard boiler sizing from the manufacturer to avoid potential issues with having to design bespoke boilers and systems. Two boilers are required to provide duty/standby (D/S) capability since the steam supply is critical for site operations to continue. Two boilers each operating at maximum load (12 t/h per boiler) would exceed the current steam supply requirements for the site (7-8 t/h) so the duty boiler will be operating well within design capacity.

Individual stacks have been selected in accordance with the standard supply offering/recommendation from the manufacturer and to provide flexibility/simplicity in design and for environmental monitoring. (Note: it is possible that the two new boilers could be set up to operate with one on hydrogen and the other on natural-gas so individual stacks are also considered more appropriate for compliance purposes).

The installation of the new boiler plant will enable the source of the steam required on-site to be changed from the existing boiler plant to the new boiler plant. Some steam supply pipework modifications will be required on-site but there should be no change to the steam users and they should continue to operate as currently. No changes in the operation of the site are envisaged other than those associated with the steam supply system changes.

The new boiler plant is to be constructed on an area of site that is currently a disused car park area and a grassed area approximately 280m from the River Thames. This area is currently outside the existing site permitted area to the south of Crete Hall Road. The site contains an area of land previously occupied by buildings which were demolished in 1999 and re-landscaped; areas of hardstanding; and the former technical laboratory office building (Note: a prior notification of demolition application planning ref 20260264 has been submitted to demolish this building). The levels across the site are generally consistent and the site can be regarded as previously developed land.

The proposed revised permit installation  boundary is shown in Appendix A – Figure 4.

It is currently envisaged that the quantity and type of water treatment chemicals required for the new boiler plant will be similar to the existing boiler plant. Steam requirements for the site are the same so water usage/chemical usage should be similar. The types of water treatment chemicals that will be used are currently under further evaluation.

The new system will produce steam for supply to the site and condensate will be returned to the boiler plant for reuse. All lines will be thermally insulated and located aboveground from the new boiler plant to the main production building including sections on pipe bridges as appropriate. Inspection of the pipework will therefore be easier than at present as confined space access (high risk) is not required. Steam heat losses will be significantly reduced due to new design, including reduced distance, and the condensate on return

should not undergo as much heat loss. These changes will improve the overall efficiency of the new system compared to the existing system.

Blowdown will occur (up to 0.5t/h) and make-up water will be required for the system (up to 6t/h). The discharges will be into the existing site drainage system via new connections and be routed to the on-site ETP as currently.

The area surrounding the new boiler plant will also have a new surface water drainage system installed to collect primarily rainfall. The design of this system is currently under consideration and run-off will either be routed to the existing ETP or to a local public sewer system.

Discharges from the new boiler house will be low and overall not significant in terms of the total volumes treated by the ETP which mainly deals with the discharges from the paper production facilities.

*NB Except for a short transient period during commissioning process discharges from both the existing boiler plant and the new boiler plant will not occur simultaneously. The capacity of the existing ETP is sufficient to cope with such a scenario.*

### 1.5 Permit Variation Requirements

The proposed changes require a permit variation for the installation of the new boiler plant and the provision of new point source emissions to air - to be designated A14 & A15.

Activity AR4 will be affected by the proposals due to the changes to the installed MWth input for the site - see later table.

The treatment of borehole water (AR6) for use in the boilers will be similar to the existing requirements and undertaken at the new boiler plant for the new boilers.

The other activities identified in the current permit (AR1, AR3 and AR5) are not affected by the proposals.

### 1.6 Enhanced Pre-application Advice

KC originally requested enhanced pre-application discussions for the Northfleet proposals with the EA in 2024.

Following discussions advice was received from the EA in July 2024 (Ref: EPR/BJ7379IZ/P001).

At that stage it was envisaged by the EA that KC and the hydrogen plant operator, which at that stage was to be HYRO Limited ("HYRO"), would simultaneously submit permit applications so that the EA could assess them together; KC for the new boiler plant and HYRO for the new hydrogen production facility (HPF). However due to delays in government approvals (July 2025) and in securing project funding the KC project did not receive the go ahead until August 2025.

Green Hydrogen 3 Limited, "GH3", (who replaced HYRO as the operator of the HPF) applied for an environmental permit for the HPF in early 2025 and this was granted by the EA in February 2025 (See Permit reference EPR/MP3624ST).

Some of the original advice provided by the EA to KC in July 2024 is therefore no longer applicable/possible to follow due to the fact that the HPF has already been permitted. Those aspects of the original Enhanced Pre-application advice provided by the EA which are still applicable have been addressed in this application.

GH3 has subsequently applied for and received revised planning permission for the HPF (September 2025).

The requirement for a new boiler plant has also been discussed and recorded in CAR forms with the local site inspectors over a period of many years.

### 1.7 Planning

The proposed development which consists of the installation of replacement boilers, exhaust stacks and associated pipework/infrastructure at the manufacturing site in Northfleet requires planning permission from Gravesham Borough Council.

Pre-application advice for planning was sought (letter dated 07/11/25) and a response was received (Ref PRE20250203). A full planning application was submitted to the Council on 10/04/26.

As a consequence of the new HPF being built on an area of land within the KC site that is periodically used as a pulp laydown storage area an alternative laydown area is being considered. A planning application Ref. No: 2025040 was submitted by KC for a new pulp laydown area elsewhere. This proposed location overlaps some of the existing KC permitted area. This planning application has been granted.

## 2. DETAILED PROCESS DESCRIPTION

### 2.1 Boiler Plant

KC are proposing to install two “steammatic” two pass wet back fire tube steam boilers (model SG 1200/22/CH4+H2/HE/72h/OPTI) provided by Cannon Bono at the Northfleet Mill site. Each boiler is capable of producing up to 12 tonnes of steam per hour @ 15barg for use on site and operating on natural gas, hydrogen or a mixture of both fuels. Each boiler is rated at 7.6MWth input capacity.

Cannon Bono are an Italian company dedicated to the design, manufacturing, installation, service, and maintenance of industrial boilers for standard and special applications including plug-in solutions, package solutions, and site-erected plants. All products are manufactured in Italy.

Further details on Cannon Bono and the SG series of boilers can be found by following the links below:

https://www.cannonbonoenergia.com

https://www.cannonbonoenergia.com/products/steam-generators/fire-tube-boilers-sg-series/

The boilers will be supplied packaged and assembled at Northfleet Mill, complete with burners, equipment, instruments and safety devices. The boilers will be extensively fire tested in Italy before shipment to minimize on site activities for connection and start-up.

The boilers will be equipped with the latest technology (HE Smart ®) to pre-heat the boiler feed water and combustion air to increase the thermal efficiency up to 97.5%. The boilers will be thermally insulated.

### 2.2 New Boiler Plant Building

The new boiler plant will be located within a new boiler plant building to be constructed on an area of land within the existing KC site ownership boundary as shown on the attached drawing – See Appendix B – Figure 1.

The area of land to be used for the new boiler plant is currently outside the existing site permitted area under the current environmental permit (EPR/BJ7379IZ/V008) – see Appendix A – Figure 1.

The boiler house will be 25 x 15 metres with a floor area of approximately 440m$^2$ over two levels.

- Ground level - the 2 new boilers, deaerator and associated auxiliary equipment (water softener system etc.), workshop room, electrical equipment room
- Upper level - a control room, welfare facilities (kitchen, toilet etc.)

The boiler house will include two exhaust stacks at a total height of 20 metres above ground terminating above the roof. Sample monitoring points with access will be provided to each stack. Each stack will be fitted with an integral silencer for noise reduction and a rain cowl to prevent rainwater ingress. See Appendix B – Figures 2 to 5 for new plant and pipework layouts.

### 2.3 Boiler Design Data

Steam supply = 12000 kg/h from each boiler

Design pressure = 22barg

Operating pressure = 15barg

Fuel supply – natural gas and/or hydrogen @ 300mbar

NOx emission limit (@ 3% $O_2$, dry) = 100mg/Nm$^3$ for natural gas

$NO_X$ emission limit (@ 3% $O_2$, dry) =137mg/Nm$^3$ for hydrogen

CO emission limit (@ 3% $O_2$, dry) = 50mg/Nm$^3$ for both natural gas and hydrogen

Dunphy Burners have been selected as Dunphy, who are located in Rochdale, have experience with hydrogen as well as burning multiple gases. KC had several meetings with Dunphy directly as part of the overall vendor selection process, to understand their capabilities with hydrogen & gas supply switching.

The burner head will comprise two rings of jets, one for natural gas, one for hydrogen. In theory, all the time there is a flame (Hydrogen or Natural gas), the ratio of hydrogen: natural gas can be varied from 0:100 to 100:0. If the flame is lost, the system needs to be purged of fuel prior to re-lighting.

The HPF are reliant on electrical supply being "green" to make green hydrogen, so the likelihood is most will be made at night & stored; However KC need to draw off hydrogen on a 24/7 basis. In the event of the hydrogen supply getting low, KC will need to switch to natural gas (and then back to hydrogen once the supply builds up again).

## 2.4 Boilers

Each boiler will be supplied with the following features:

- Modulating feedwater system;
- Heat recovery system;
- Industrial dual block burner system suitable for both fuels with modulating combustion regulation;
- Burner management system;
- Combustion air fan with motor and frequency converter;
- $O_2$ and CO probes for combustion optimization;
- Forced flue gas recirculation;
- MCC power cabinet (to be located in a safe area) and boiler control panels;
- Each boiler has 2 passes;
- Optispark ® F3 boiler control system based on Siemens PLC – predictive control for improved control and increase efficiency;
- Safety and control devices;
- Hot standby system to guarantee a faster start-up when required. *(Steam is injected into the water side of the boiler to keep the boiler hot and thus avoid intermittent firing of the burner system which is detrimental to the burner and the boiler due to long-term cyclic stresses);*
- Length = 9150mm, Width = 3600mm (large diameter assists in reducing NOx emissions), Height = 4600mm;
- Steam quality > 99.5%

### 2.4.1 Heat Recovery System

The HE-Smart ® system is a patented heat recovery system which increases the overall efficiency of the boiler by recovering heat from the combustion flue gases keeping flue gas temperatures low even with high feedwater temperatures.

### 2.4.2 Forced Flue Gas Recirculation

Oversized fans ensure recirculation of up to 15% of flue gases to ensure a reduction in NOx emissions.

### 2.4.3 Boiler Feed Water System

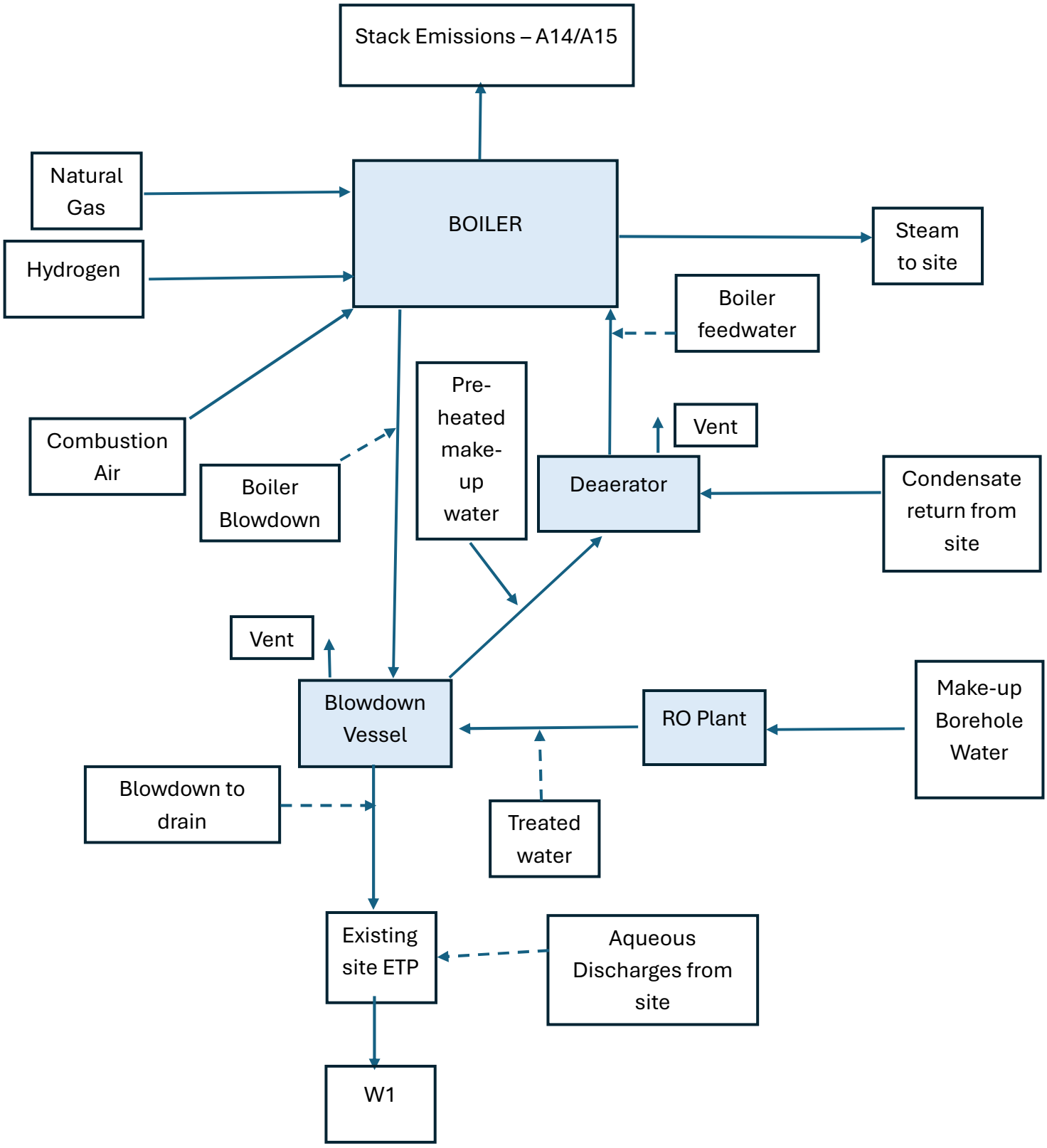
The boiler feed water system will comprise the following:

- 1 x Water softener – reverse osmosis unit for continuous supply. Rated for 20% of make-up water.
- 1 x Water pump – centrifugal type rated for 6 tonnes per hour.
- 1 x Deaerator – (ZEROGAS ® Spray Smart Deaerator)
    - 8 barg design pressure.
    - 12 tonnes per hour capacity for deaerated water.
    - Rated for 80% condensate return at 150°C and 20% make-up water at 10-15°C (up to 9.7t/h).
    - Insulation provided.
- 1 x Chemical Dosing station.
- 2 x Centrifugal feed water pumps (duty/standby) rated at 14.5$m^3$/h @ 240m, rated for high temperatures (up to 150°C)
- 1 x Blowdown tank – 2$m^3$ with heat recovery system including pipework to/from the water treatment plant.

### 2.4.4 Deaerator

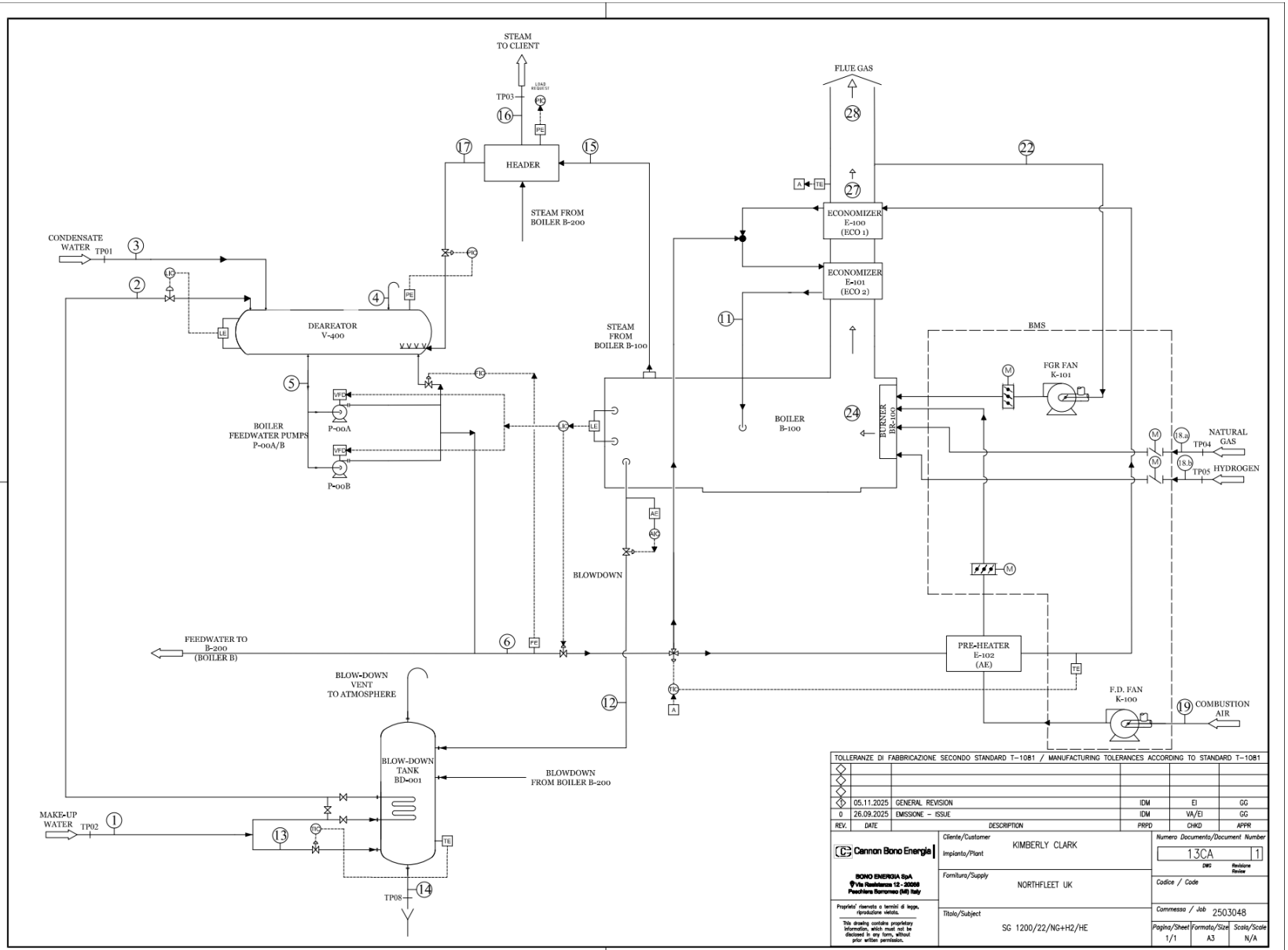
The thermo-physical deaerator removes oxygen from the boiler feed water. Oxygen and dissolved carbon dioxide are catalysts for the corrosive process on metal surfaces. The deaerator ensures that the boiler is fed with water at a high and constant temperature thus improving its efficiency and protecting it from thermal shocks. The Zerogas System allows the recovery of heat from condensation fumes.

A simplified block flow diagram of the new boiler system is presented below.


Stack Emissions – A14/A15
Natural Gas
Hydrogen
BOILER
Steam to site
Boiler feedwater
Combustion Air
Boiler Blowdown
Pre-heated make-up water
Vent
Deaerator
Condensate return from site
Vent
Blowdown Vessel
RO Plant
Make-up Borehole Water
Blowdown to drain
Treated water
Existing site ETP
Aqueous Discharges from site
W1

### 2.4.5 Technical Data

| Item | Unit | 100% Natural Gas | 100% Hydrogen | Mix 50/50% |
|---|---|---|---|---|
| Feedwater temperature | °C | 130 | | |
| Ambient temperature | °C | 25 | | |
| Relative humidity of ambient air | % | 60 | | |
| Boiler load | % | 100 | | |
| Steam capacity | kg/h | 12000 | | |
| Operating pressure | barg | 15 | | |
| Steam quality | - | Saturated (>99.5%) | | |
| Fuels | | | | |
| C1 | % mol | 90 | 0 | 45 |
| C2 | % mol | 3 | 0 | 1.5 |
| C3 | % mol | 2 | 0 | 1 |
| H2 | % mol | 0 | 99.9 | 49.95 |
| N2 | % mol | 5 | 0.1 | 2.55 |
| Molecular Weight | g/mol | 17.69 | 2.04 | 9.86 |
| Fuel Density | $kg/Nm^3$ | 0.789 | 0.091 | 0.440 |
| LHV – Lower Heating Value - w | kJ/kg | 45.733 | 118.297 | 53.240 |
| LHV – Lower Heating Value - vol | $kJ/Nm^3$ | 36.089 | 10.772 | 23.431 |
| HHV – Higher Heating Value - vol | $kJ/Nm^3$ | 39.971 | 12.733 | 26.352 |
| Flue gas composition at stack | | | | |
| Carbon dioxide | % vol | 8.3 | 0 | 6.6 |
| Sulphur dioxide | % vol | 0 | 0 | 0 |
| Nitrogen | % vol | 70.6 | 64.9 | 69.4 |
| Argon | % vol | 0.8 | 0.8 | 0.8 |
| Oxygen | % vol | 2.5 | 2.0 | 2.4 |
| Water vapour | % vol | 17.8 | 32.3 | 20.8 |
| Flue Gas flowrate at stack | kg/h | 11.645 | 9.301 | 11.110 |
| Thermal efficiency | % | 97.0 +- 0.5 | 96.5 +- 0.5 | 96.7 +- 0.5 |


STEAM TO CLIENT
TP03
HEADER
STEAM FROM BOILER B-200
FLUE GAS
ECONOMIZER E-100 (ECO 1)
ECONOMIZER E-101 (ECO 2)
CONDENSATE WATER
TP01
DEAREATOR V-400
STEAM FROM BOILER B-100
BMS
FGR FAN K-101
BOILER B-100
BURNER BR-100
NATURAL GAS
TP04
HYDROGEN
TP05
BOILER FEEDWATER PUMPS P-00A/B
P-00A
P-00B
BLOWDOWN
FEEDWATER TO B-200 (BOILER B)
PRE-HEATER E-102 (AE)
F.D. FAN K-100
COMBUSTION AIR
BLOW-DOWN VENT TO ATMOSPHERE
BLOW-DOWN TANK BD-001
BLOWDOWN FROM BOILER B-200
MAKE-UP WATER
TP02
TP08
TOLLERANZE DI FABBRICAZIONE SECONDO STANDARD T-1081 / MANUFACTURING TOLERANCES ACCORDING TO STANDARD T-1081
05.11.2025 GENERAL REVISION IDM EI GG
0 26.09.2025 EMISSIONE - ISSUE IDM VA/EI GG
REV. DATE DESCRIPTION PRPD CHKD APPR
Cannon Bono Energia
BONO ENERGIA SpA
Via Resistenza 12 - 20068
Peschiera Borromeo (MI) Italy
Cliente/Customer KIMBERLY CLARK
Impianto/Plant
Fornitura/Supply NORTHFLEET UK
Titolo/Subject SG 1200/22/NG+H2/HE
Numero Documento/Document Number 13CA 1
DWG Revisione Review
Codice / Code
Commessa / Job 2503048
Pagina/Sheet 1/1
Formato/Size A3
Scala/Scale N/A

**Legend**

| Line number | Description | At 100% Maximum Continuous Rating (MCR) – 100% Natural Gas |
|---|---|---|
| 1 | Make-up Water | Max 2272kg/h |
| 2 | Pre-heated make-up water | |
| 3 | Condensate | Max 9696kg/h |
| 4 | Deaerator vent | Max 30kg/h |
| 5 | Deaerated water to Boiler Feedwater pump | |
| 6 | Feed water to Boiler | |
| 11 | Feedwater at Economizer (ECO 2) outlet | |
| 12 | Blow down (surface) from boiler | |
| 13 | Cooling water to blowdown tank | |
| 14 | Continuous blowdown water at cooling outlet | Max 471kg/h |
| 15 | Steam from boiler | Max 12000kg/h |
| 16 | Steam to process | |
| 17 | Steam to deaerator inlet | |
| 19 | Combustion air upstream of air fan | Max 11065kg/h |
| 22 | Flue gas recirculation upstream of Flue Gas Recirculation (FGR) fan | |
| 24 | Flue gas at burner outlet | |
| 27 | Flue gas at Economizer (ECO 1) outlet | |
| 28 | Flue gas at stack | Max 11669kg/h |

### 2.4.6 Natural Gas Supply

Natural gas is currently supplied to the existing boiler plant and to the Northfleet Mill for use primarily on TM3 along with heating (HVAC) for the Mill. Modifications to the existing natural gas supply pipework will be required to connect to the new boiler plant.

An existing natural gas supply exists to the Northfleet site. It currently feeds the existing boiler plant and the Yankee hood combustion systems associated with the paper machine (TM3).

The existing natural gas supply enters site via a PRMS located adjacent to the existing site reception building and the car park close to the roundabout on Crete Hall Road. Note: This location is not currently shown as within the existing site permitted installation boundary.

A new PRMS for natural gas supply to the new boiler plant is to be located in this location adjacent to the existing PRMS. The existing PRMS will be retained to supply natural gas to TM3. The new pressure reducing and monitoring station (PRMS) will reduce the natural gas supply pressure from 2 barg to 300mbarg for supply to the new boiler plant.

The route of the supply pipework to the existing boilers will be amended to feed the new boiler plant location.

The new pipework is shown on the attached drawing – See Appendix B - Figure 1.

Due to current issues with the gas supply system in the local area to the Northfleet Mill a new gas booster station will also be installed as part of the modifications to ensure the gas supply pressure to the site can be maintained. This is to be located on-site as shown in Appendix B – Figure 1.

For the foreseeable future natural gas will continue to be used in the combustion systems at TM3 as per current but natural gas usage in the boilers should reduce firstly due to the more modern and efficient new boilers and then as hydrogen becomes available and is used in preference to natural gas whenever possible.

The use of hydrogen will reduce KCs use of natural gas and is in alignment with KCs global decarbonization strategy to reduce the use of fossil fuels.

Maximum natural gas usage for the boilers will be approximately 0.6 t/h (Based on one boiler).

### 2.4.7 Hydrogen Supply

Hydrogen is to be provided by a new hydrogen production facility (HPF) to be constructed on an area of land within the existing Northfleet site ownership boundary. KC has leased an

area of land (0.29 acres) to the HPF (current operator Green Hydrogen 3 (GH3)) for the construction and operation of the HPF.

The HPF is to be constructed on a separate area of the Northfleet site that is currently used for pulp storage south of the existing boiler house - See Appendix A – Figure 5. Part of the area is currently shown as included within the KC permitted installation boundary as shown in Schedule 7 of the existing permit - see Appendix A - Figure 1. For example the route of the outfall from the ETP to the River Thames is routed through this area. The new facility is to be operated by a 3rd party who will supply hydrogen solely for use by KC.

The hydrogen will be supplied by pipeline from the HPF to a new PRMS which will be located external to the new boiler plant as shown on the attached drawing - See Appendix B – Figure 1.

The pressure reducing station will reduce the supply pressure from 3-6 barg to 300mbarg. The hydrogen pipework will run below ground from the PRMS into the new boiler house.

Pressure and flow monitoring will be installed on the hydrogen supply pipework.

There will be no designated storage of hydrogen on the KC Northfleet site: the only hydrogen present will be in the supply pipework downstream of the PRMS. Hydrogen storage however will be present on the HPF site.

The HPF has obtained government funding for the project and the proposals obtained revised planning permission (Planning Ref 20250251- Gravesham Borough Council) in September 2025 (original permission was granted in August 2024).

The HPF scope includes the provision of a dedicated hydrogen supply pipeline from their site area to the hydrogen PRMS associated with the new boiler plant. The length of the hydrogen supply pipeline is estimated to be approximately 200m. The route of the pipeline is shown in Appendix A - Figure 5).

The HPF (in the name of Green Hydrogen 3 Limited) has already received an environmental permit (EPR/MP3624ST) for operation of the HPF which was issued by the Environment Agency in February 2025.

The Environment Agency (EA) has determined that the Northfleet Paper Mill is technically connected to the HPF and therefore fulfills the requirements for a multi-operator installation.

Operation of the HPF however is not currently expected to commence until Q3 2027.

Close liaison will be required between KC and the HPF concerning the availability and supply of hydrogen for the boilers. Detailed discussions are on-going between KC and the HPF to determine the operational requirements for both facilities and to ensure appropriate co-ordination/liaison. Arrangements for the switchover from natural gas to hydrogen and vice versa are to be determined. The HPF will only be able to supply hydrogen if available and that is dependent upon the availability of the supply of green energy for the electrolysis process. There are limited hydrogen storage facilities located at the HPF. Should the supply of hydrogen need to be interrupted then switchover of the boilers to run on natural gas will be required. Similarly when a supply of hydrogen becomes available KC will want to maximise the operation of the boilers on hydrogen so transition from natural gas to hydrogen will be required.

The environmental management system for the KC site will be modified to include appropriate procedures and include liaison requirements with the HPF.

The use of hydrogen will save up to 10,600 tonnes of $CO_2$e per year once operational, which represents a significant saving on the paper mill's current greenhouse gas emissions. (Current emissions are estimated as15,600 tonnes of $CO_2$e per year).

Maximum hydrogen usage for the boilers will be approximately 0.2 t/h (Based on one boiler).

### 2.4.8 Electricity

Electricity will be provided from the existing site supply which will be modified. A new transformer for the new boiler house is to be installed.

**Electrical Load**

| Item | Rated power |
|---|---|
| Combustion air fans | 2 x 30kW |
| Recirculation flue gas fans | 2 x 11kW |
| Feedwater pumps | 2 x 30kW |
| Dosing pumps | 6 x 0.55kW |
| Softener | 0.55kW |
| Make-up water pump at softener | 2.2 kW |
| Boiler Power panels | 2 x 45kW, 2 x 2kW |
| Balance of Plant (BOP) power & PLC panels | 70kW, 2 x 2kW |

### 2.4.9 Water Supply

Water for the new boiler plant will be provided from the existing two abstraction sources (boreholes). Existing water supply pipework will be amended to allow a supply to be provided to the new boiler plant from either borehole. Max demand for make-up water will be approximately 6 t/h. (Make-up water is also used for cooling the blowdown tank).

### 2.4.10 Water Treatment Chemicals

The borehole water supply will need to be treated to ensure the quality of the boiler feedwater is suitable for the new boiler plant. This will be undertaken in a reverse osmosis system to produce the quality of water required in the new boiler system.

Reverse osmosis (RO) is a water purification process that uses a semi-permeable membrane to separate water molecules from other substances. RO removes dissolved or suspended chemical species as well as biological substances (principally bacteria), and is commonly used in industrial processes for water treatment.

An alternative Ion Exchange system similar to that currently used on site was considered but rejected on the basis that production of water at the required quality for the new boiler system could not be guaranteed. The purer the water provided to the boiler the fewer contaminants will build-up in the boiler ensuring efficiency and longevity of the equipment.

Water treatment chemicals (similar to those currently used on-site) will be required and these will be delivered to site by road tanker and unloaded directly into bulk storage facilities located within a container located adjacent to the north-west corner of the new boiler house. From here they will pumped as required into the mixing vessels located within the new boiler house.

The chemicals envisaged to be used are:

- Optisperse ADJ 5150 – Alkalinity builder;
- Cortrol OS5301 – Oxygen scavenger;
- Solus AP26 – Boiler scale inhibitor;
- Steamate NA0880 – Condensate treatment.

MSDS are available in Appendix C.

Annual usage of these chemicals is estimated below:

- Optisperse ADJ 5150 – current estimate approx. 350kg;
- Cortrol OS5301 – current estimate approx. 300kg;
- Solus AP26 – current estimate approx. 125kg;

- Steamate NA0880 – current estimate approx. 500kg.

Water treatment chemicals will be pumped from the bulk storage facilities as required into mixing vessels from where they will then be dosed as required.

### 2.4.11 Instrument Air

Instrument air will be required at the new boiler plant and will be provided from the existing site supply. Existing pipework routing will be modified to feed the new boiler plant.

The existing system has sufficient capacity available to accommodate the new boiler plant requirements whilst still supplying the existing boiler plant during the interim transition period. A new back up instrument air compressor package is to be installed in the new boiler plant to ensure supply of instrument air. Normal usage will be approximately 100Nm$^3$/h. Peak usage will be up to 180Nm$^3$/h during start up/shutdown of the boilers.

### 2.4.12 Condensate Return

Condensate will be returned from the Mill to the new boiler plant via new overground pipework as shown on the attached drawing – See Appendix B, Figure 4. The condensate return pipework will be thermally insulated to minimize heat loss. The route will enable easy access for inspection and identification of any leaks.

Currently condensate from the Mill is routed back to the existing boiler house via the same pipework trench that brings the steam to the Mill. Due to the distance involved heat loss is significant.

The proposed route for the new condensate return system from the Mill is aboveground to the boiler plant on the same route as the new steam supply pipework including a section on a pipe bridge across the yard area. The new pipework route will shorter and be easier to access and inspect. Heat loss is therefore envisaged as being reduced.

Overall condensate heat and mass losses will be reduced and the condensate return system efficiency will be improved significantly leading to a reduction in water make-up and water treatment chemicals usage.

### 2.4.13 Steam Supply

Steam will be supplied from the new boiler plant to the Northfleet Mill via a new overground steam header. The new steam header will be thermally insulated to minimize heat loss. The route will enable easy access for inspection and identification of any leaks.

This new routing will enable the steam pipework to be inspected more easily. The existing route is through a trench. Access to the existing trench requires confined space entry

control measures for inspection and repair purposes. The new routing can be accessed if necessary by scaffolding/MEWP and is considered to be easier and safer as confined space access is not required.

The existing pipework located in the trench will be removed as part of the existing boiler plant decommissioning programme.

Currently the steam supply pipework system from the current boiler plant to the site users is routed via a long pipe trench (800m) from the north of the site into the Northfleet Mill before being distributed to the various users.

The pipework within the pipe trench in places is difficult to access and inspect.

This new routing will enable the steam pipework to be inspected more easily. Access to the existing trench requires confined space entry control measures for inspection and repair purposes. The new routing can be accessed if necessary by scaffolding/MEWP and is considered to be easier and safer as confined space access is not required.

The existing pipework located in the trench will be removed as part of the existing boiler house decommissioning programme.

**2.4.14 Connections to drain**

Connections to drain will be provided from the new boiler plant location for boiler blowdown.

The blowdown to open drain from the blowdown tank will be approximately 0.5 t/h.

There is an existing drainage system on site which is routed to the on-site ETP. New drainage connections will be made into the existing system as necessary for discharge of process effluents (boiler blowdown etc).

**2.4.16 Commissioning of New Boiler Plant**

The current proposal is to install and commission the new boilers on natural gas in Q1 2027 and then when hydrogen is available to commission on hydrogen (Target Q3 2027).

The KC Northfleet site is to continue to operate throughout for the production of tissue.

The existing boiler plant will operate whilst the new boiler plant is constructed and the new boilers installed therefore there will be no interruption to the current steam supply whilst the new boiler plant is installed.

The steam and condensate tie-ins into the main utility headers (steam and condensate) will need to be scheduled (provisionally during the planned Christmas 2026 shutdown) to minimize impact on site production.

Once the new boilers are ready to be commissioned they will be commissioned one at a time offline. (i.e. the steam produced during commissioning will not be supplied to site but will need to be vented to atmosphere). During commissioning it will be necessary to continue to provide steam for use on site by the existing boilers since during commissioning the steam supply from the new boiler cannot be guaranteed and in the event of an upset this would adversely affect the production process.

Steam vents for commissioning purposes have been specified. Commissioning will therefore be carefully planned and controlled to ensure steam "venting" is minimized as far as possible.

Once the steam supply from each of the new boilers has been successfully commissioned the steam supply to the site can then be switched completely from the existing boiler plant to the new boiler plant. The intention however is that the existing boilers will be retained in operational readiness for a period (currently estimated as 1-2 months) in case of problems with the new boiler plant. After this the existing boiler plant will be designated as "no longer required" and the existing boiler plant can then be decommissioned.

The local site Environment Agency inspector will be informed when this occurs so that an agreement can be reached that the regular reporting requirements for the existing boiler plant can be suspended.

When the hydrogen supply is available the new boilers can then be commissioned on hydrogen one at a time. The detailed commissioning plan is to be determined but the expectation is that one new boiler will be switched to hydrogen while the other one continues to run on natural gas. Both the burner manufacturer and the boiler manufacturer are confident with this approach, i.e. the natural gas boiler will modulate to maintain steam supply while the hydrogen boiler is started up.

It is currently envisaged that the decommissioning of the existing boiler plant (including removal of the existing 61m tall stack) will be undertaken as a separate project at a later stage. The future of the existing boiler plant building and the surrounding area to the plant are currently under consideration and there is no proposed use for this building at this time.

It is currently planned to leave the existing boiler house in a good state of repair (low level lighting, fire protection, no sharp edges / trip hazards).

Removal of the existing boilers from the environmental permit will be requested at a later date.

At this stage emission point to air A1 can be removed from the permit along with all associated reporting requirements.

When the existing boilers are removed from the permit the installed thermal input of the site will also be reduced as shown in the attached table and existing activity AR4 in the permit will need to be removed as the installed capacity will no longer > 50 MWth.

The change in the installed thermal capacity at the site over time is shown in the Table below.

| **Permit Emission Point to air reference** | **Current – Existing Boilers only operational MWth** | **Interim - Both Existing & New Boilers installed and operational MWth** | **Long Term – New Boilers Only Operational MWth** |
|---|---|---|---|
| | | | |
| A1 – existing boiler | 12 | 12 | - |
| A1 – existing boiler | 12 | 12 | - |
| A1 – existing boiler | 12 | 12 | - |
| A1 – existing boiler | 12 | 12 | - |
| A6 (TM3 – burner exhaust) | 4.1 | 4.1 | 4.1 |
| A14 – new boiler | - | 7.6 | 7.6 |
| A15 – new boiler | - | 7.6 | 7.6 |
| | | | |
| **TOTAL** | **52.1** | **67.3** | **19.3** |
| ➢ 50MWth | YES | YES | NO |

*Note – Current = existing permit V008, Interim = as a result of this variation V009, Long Term = as a result of a future variation. When the existing boilers are removed from the permit the installed MWth at the site will < 50MWth and the existing activity AR4 will no longer be applicable.*

**Timescales**

The following timescales are proposed for the new boiler plant.

From Q1 (January 2027) – Installation/Commissioning of the new boiler plant on natural gas

Q3 2027 – Commissioning of the new boiler plant on hydrogen.

### 2.4.16 Operational Scenarios

Current – 3 existing operational boilers - operated as 1duty/1 “hot” standby (pressurized and ready to run if the duty boiler fails)/ 1 off (or undergoing maintenance). Discharge point A1.

Commissioning new boilers on natural gas – as above + 1 new boiler being commissioned at a time (controlled to minimize steam venting requirements). New discharge points for air emissions A14/A15.

Interim (New boilers on natural gas) – 2 new boilers – operated as 1 duty/1 standby. Existing boiler plant maintained in operational readiness in case of problems.

Commissioning new boilers on hydrogen - new boilers to be commissioned on hydrogen one at a time whilst the other is operating on natural gas. Existing boilers on standby if not already taken out of service – to be determined.

Long Term – new boilers operational – duty/standby – on natural gas/hydrogen. Emission points A14/A15. Existing boiler plant decommissioned. Emission point A1 can be removed from the permit.

## 2.5 Environmental Management Systems

The operation of the current boiler plant is covered by existing operational & maintenance procedures. New procedures will generated as required for the operation of the new boiler plant. The site environmental management system (EMS) is not currently certified to ISO 14001 however accreditation for the existing system is currently scheduled for 2026 and the existing system is in-line with ISO 14001 requirements and expectations. A summary of the existing EMS is given in Appendix D.

## 2.6 Monitoring

Natural gas and hydrogen usage will be monitored and recorded for the new boiler plant.

The quantities of water & water treatment chemicals used will be recorded.

The operating hours for each boiler will also be recorded.

Monitoring of emissions to air will be undertaken during commissioning. After the system has been commissioned independent 3rd party monitoring will be undertaken by an MCERTS approved contractor to verify the performance of boilers and emissions to air.

Other emissions points are already monitored on-site and the new boiler plant will be added to the existing schedule/agreement.

Monitoring points are to be installed in each stack in accordance with EN 15259 and the EAs guidance note M1. The sample points can be reached from the roof of the new boiler plant and access walkways will be provided.

## 3. IMPACTS

### 3.1 Emissions to Air (including Odour)

There will be an emission point to air resulting from each of the new boilers. These emissions to air will be at a height of 20m from individual stacks.

When firing on natural gas the emissions will be combustion gases (NOx, CO, $CO_2$ etc). No sulphurous compounds are present in natural gas supplies so Oxides of Sulphur ($SO_X$) are not considered to be present. The combustion of natural gas also does not generate emissions of dust/particulate matter.

When firing on hydrogen the emissions will be NOx, $H_2O$. There will be no emissions of CO or $CO_2$. No sulphurous compounds will be present in the hydrogen supply so Oxides of Sulphur ($SO_X$) are not considered to be present. The combustion of hydrogen also does not generate emissions of dust/particulate matter.

The NOx ELVs identified in the Table below have been considered for design purposes.

| **Substitution of hydrogen (% v/v)** | **ELV – NOx mg/Nm$^3$** |
|---|---|
| 0 – 20 % | 100 |
| >20 – 50 % | 107 |
| >50 – 75 % | 115 |
| >75 – 90 % | 125 |
| >90 – 95 % | 130 |
| >95 – 100 % | 137 |

An Air Quality Impact Assessment has been prepared (See Appendix E) to evaluate the potential impact of emissions from the new boiler plant operations.

The combustion of natural gas and hydrogen will not lead to any odorous emissions from site. In the event of a leak of natural gas an odour will be present but any such leak can be

anticipated to be detected and resolved as a matter of priority. Long-term odorous emissions are not therefore considered likely to occur from the new boiler plant operations. Hydrogen is inherently odourless.

Monitoring point locations in accordance with the EA's guidance will be installed to enable the emissions to be periodically monitored by an independent 3rd party organization with MCERTS accreditation.

### 3.2 Emissions to Water

Emissions to water associated with the new boiler plant operations will result from the periodic blowdown of the boiler treatment water to drain. However existing emissions from the current boiler plant will no longer be present once existing boilers are taken out of service so the overall impact is not envisaged to change from the current situation. By using RO water blowdowns should be less frequent so there should be less impact in the future. The water treatment chemicals to be used for the new boiler plant are currently envisaged to be the same as those currently used for the boiler plant water treatment facilities at Barrow. These are slightly different from those currently in use at Northfleet. This is undergoing further evaluation at this stage.

### 3.3 Emissions to Land

There are no direct emissions to land associated with the operation of the new boiler plant.

### 3.4 Noise

Noise will be generated as a result of the operation of the new boiler plant. Mitigation measures are being included as part of the design of the new boiler house including the inclusion of silencers in the exhaust stacks from the new boiler plant. As the new boiler plant becomes operational the existing boiler plant will no longer be used. The overall site noise profile should not increase as a result of these proposals.

A Noise Impact Assessment has been prepared (See Appendix F) to evaluate the potential impact of noise generated from the new boiler plant operations.

### 3.5 Waste Management

The quantities of wastes generated from the new boiler plant operations are not significant.

Wastes are not generated as a result of the combustion of natural gas or hydrogen.

Some wastes will be generated as a result of the use of water treatment chemicals and the operation of water treatment plant (chemical containers etc) but these are envisaged as being similar in quantity to the wastes currently generated by the operation of the existing boiler plant. Overall no significant increase in the quantities of waste generated are envisaged.

All wastes generated will be sent for disposal in accordance with existing waste management procedures. The quantities to be removed are not significant.

Waste generation on-site is minimized as far as possible.

### 3.6 Site Condition Report Update

The new boiler plant operations are to be undertaken outside the existing permitted site installation boundary so this variation application involves an extension to the existing permitted area.

There will be no direct emissions to ground and groundwater from the new facilities. No such discharges exist from the existing facilities.

No amendments were identified as being necessary at this stage to the existing Site Condition Report (SCR) covering the existing permitted area as a result of the proposals. There is no foreseen significant impact on the existing ground conditions in these areas as a result of the proposals. However for the new area an SCR update has been prepared which considers the baseline ground contamination and the potential risk of future ground contamination occurring from the boiler plant activities. See Appendix G.

For the purposes of supporting the planning application a site investigation was undertaken by Dunelm Associates (November 2025). The information from this investigation provides additional information for incorporation into the SCR for the Northfleet site alongside existing historical ground investigation reports from previous work undertaken in this area of the new boiler plant.

For the purposes of this variation application the chemicals to be used in the new boiler plant have been reviewed and a stage 1-3 assessment undertaken as appropriate - See Appendix G – Site Condition Report Update - for further details.

Hydrogen and natural gas have been assessed as relevant hazardous substances (RHS) but not having an actual pollution risk to ground. The usage of hydrogen, natural gas and water treatment chemicals in the new boiler plant has been categorized as low risk.

An SCR was prepared in 2020 for the whole of the existing Northfleet permitted site area and considered the installation and the chemicals in use at that time. Baseline ground contamination data is already available for the site. The SCR was revised in 2025 in accordance with condition 3.1.4 of the permit which requires periodic monitoring to be undertaken at least once every 5 years for groundwater.

The SCR is an on-going "live" document that should be regularly reviewed and updated as required. The current version is available if requested.

### 3.7 Energy Efficiency

Energy efficiency/energy usage was considered during the selection of the new boiler plant. The new equipment will be significantly more efficient than the existing plant which is over 40 years old. The new boiler plant has been specified to satisfy the site steam requirements with suitable installed spare capacity in the event of equipment failure to be able to maintain the site steam supply. The recovery/re-use of heat for inlet combustion air pre-heating is integral to the design along with the return/reuse of condensate.

### 3.8 Climate Change

There is an umbrella climate change agreement sector agreement for the paper sector – dated 14 February 2022. See Appendix H.

The site also has a Greenhouse gas emissions permit (UK-E-IN-11467 v19) issued 7 August 2025 that will also need to be revised as a result of the new boiler plant installation. See Appendix H.

### 3.9 Safety

KC operates a Safety Management of Change (SMOC) procedure which ensures that all changes are fully assessed prior to being implemented. These procedures apply to the proposed modifications and the Project team have been required to follow the procedures.

KC also has Chemical Management Procedures and COSHH procedures which govern any changes or new chemicals to be used on-site.

Both natural gas and hydrogen present a significant risk if loss of containment should occur from supply pipework to the boiler plant. However KC are already familiar with the issues and requirements of handling natural gas on-site.

Boiler plant operation at elevated temperatures and pressures, and steam and condensate at elevated temperature and pressures also represent significant hazards.

Accordingly KC has undertaken detailed evaluation of the potential safety issues associated with the new boiler plant operation. This was based on their own knowledge along with consultants in the fields of boilers, process engineering and process safety and understanding of the potential risks associated with boiler plant operation and the use of natural gas, steam and condensate along with the knowledge and understanding of the new boiler plant design and operation from Cannon Bono.

A detailed HAZOP was undertaken in January 2026 to identify any potential safety and/or environmental issues and to ensure that the risks were acceptable.

A preliminary study has identified that ATEX requirements are not applicable.

No hydrogen or natural gas is to be stored on-site. They are only present in the supply pipework to the boilers. Accordingly the site will operate below the relevant Hazardous Substances Consent and COMAH (Control of Major Accident Hazards) substance thresholds and no specific requirements are required.

Hydrogen is lighter than air so although highly flammable is “buoyant” and will readily disperse into the atmosphere. Accordingly hydrogen supply into the boiler house will be at a high level. Increased ventilation will also be provided at high level to vent any leaked hydrogen. The ceiling design will be considered to prevent pockets of hydrogen collecting.

Hydrogen detectors will be installed at appropriate locations.

Hydrogen awareness training will be provided to operational staff for the boilers.

## 4. ENVIRONMENTAL IMPACT ASSESSMENT

| Hazard | Pathway | Receptor | Risk Management Techniques | Probability of Exposure | Consequence | Overall Risk (following mitigation) |
|---|---|---|---|---|---|---|
| Emissions to air - Odour | Airborne | Local residents | There is no odour associated with boiler plant operations and the combustion of natural gas and hydrogen. There are no sulphurous compounds present in the natural gas or hydrogen supplies in quantities likely to result in an odour from the products of combustion.<br><br>No odour is envisaged as being present either inside or outside the new boiler plant. | N/A | N/A | N/A |
| Emissions to air - Dust | Airborne | Local residents; Nature and Conservation Sites | There will be no dust/particulate matter generated from the combustion of natural gas or hydrogen. | N/A | N/A | N/A |
| Emissions to air – Combustion products (NOx etc) | Airborne | Local residents; Nature and Conservation Sites | The products of combustion from natural gas and hydrogen include NOx, CO, $CO_2$, water vapour. These products of combustion will be discharged from individual stacks at an elevation of 20m. An Air Quality Impact Assessment has been prepared – see Appendix E.<br><br>New burner systems have been specified to achieve low levels of emissions. The emissions from the new boiler plant should be reduced by comparison to those from the existing boiler plant resulting in an overall reduction in emissions and hence impact.<br><br>Routine inspection, monitoring and maintenance will be undertaken to ensure equipment performance and efficiency is maintained. | Low | Nuisance/human health | Low |

| Hazard | Pathway | Receptor | Risk Management Techniques | Probability of Exposure | Consequence | Overall Risk (following mitigation) |
|---|---|---|---|---|---|---|
| Emissions to air - others | Airborne | Local residents; Nature and Conservation Sites | Steam/water will be vented to atmosphere from relief valves and as a result of routine venting. However whilst the release of steam may result in short-term noise and visually a white cloud only water will be released and this has no overall environmental impact. Releases will be minimised as far as possible and are envisaged to be similar to those which already occur as a result of the operation of the existing boiler plant.<br><br>In the event of complaints concerning emissions to air from the new boiler plant, these would be dealt with in accordance with the existing complaints procedure for the site. | Low | Nuisance | Low |
| Noise from plant | Airborne | Local residents; Nature and Conservation Sites | Noise will be generated by the operation of the new boiler plant. However the new boiler plant will be located within a new boiler house and appropriate noise mitigation is being installed to minimize the external noise that is generated. Silencers are being installed in the stacks to mitigate the noise produced.<br><br>A noise impact assessment has been prepared - see Appendix F.<br><br>All equipment has been designed in accordance with best practice and to ensure that noise does not present an issue to the employees and the identified sensitive receptors.<br><br>The majority of potentially noisy plant will be enclosed within buildings. Plant located in outdoor areas will be acoustically enclosed and/or fitted with attenuation/silencers. | Low | Nuisance | Low |

| Hazard | Pathway | Receptor | Risk Management Techniques | Probability of Exposure | Consequence | Overall Risk (following mitigation) |
|---|---|---|---|---|---|---|
| | | | The site preventive maintenance plan will be revised to include the new facilities in order to maintain operational performance and control noise.<br><br>In the event of noise complaints, these would be dealt with in accordance with the existing complaints procedure for the site. | | | |
| Accident - Leaks and spillages from the new Boiler plant operations | Airborne | Local residents; Nature and Conservation Sites | Spillage of water treatment chemicals within the new boiler plant could potentially cause an emission in the workplace areas. This would naturally disperse and/or be discharged to atmosphere via building extraction ventilation and discharged at roof level.<br><br>Water treatment chemicals are kept in sealed containers until required for use and are only present in limited quantities. Limited storage facilities for water treatment chemicals are present on site. Water treatment chemicals are not odorous and any emissions to air would be minimal.<br><br>Any incidents on-site are recorded and investigated according to the site incident management procedures and reporting requirements of the environmental permit. | Low | Nuisance | Very Low |
| Accident - Leaks and spillages from the new Boiler plant operations | Migration through hardstanding surfaces | Water; ground; and groundwater | The water treatment chemicals will be used/stored in the new boiler plant and/or stored outside under cover in a contained area.<br><br>In the new boiler plant containers will be located in bunded facilities. | Low | Contamination | Very Low |

| Hazard | Pathway | Receptor | Risk Management Techniques | Probability of Exposure | Consequence | Overall Risk (following mitigation) |
|---|---|---|---|---|---|---|
| | | | In the event of a spillage occurring clean-up kits are available and would be used. Contaminated clean-up material would then be disposed of as a waste in accordance with existing site waste disposal procedures.<br><br>Internal hardstanding floors are maintained in good condition and contamination of the ground/groundwater beneath the site is considered unlikely.<br><br>Any incidents on-site are recorded and investigated according to the site incident management procedures and reporting requirements of the environmental permit. | | | |
| Accident - Leaks and spillages from the transport of water treatment chemicals for the boiler plant around site | Ground | Water; ground; and groundwater | Only limited quantities of water treatment chemicals in individual containers are required to be moved around site when deliveries are received. In the event of the contents of a container being released spillage could occur to ground and/or enter a local surface water drain and be discharged off-site. In the event of a spillage local drains would be isolated and spillage contained to minimise the off-site impact. It would then be removed for off-site disposal in accordance with existing waste disposal procedures. | Low | Contamination | Very Low |
| Emissions to controlled waters – Process effluent | Drainage | Water | Discharge to drain of blowdown from the boiler water circuit will occur on a continuous basis. This will be directed into the existing site process drainage system which is routed to the on-site ETP. In the ETP the discharges are mixed with effluent from the paper processing facilities and surface water from site prior to treatment before final discharge off-site into the Thames estuary.<br><br>The quantities of water to be discharged from the new boiler plant are envisaged as being less than currently discharged from the existing boiler plant due to the | Low | Contamination | Very Low |

| Hazard | Pathway | Receptor | Risk Management Techniques | Probability of Exposure | Consequence | Overall Risk (following mitigation) |
|---|---|---|---|---|---|---|
| | | | improvements in the design, efficiency, improved condensate return/re-use etc.<br><br>The existing ETP has significant storage and processing capacity having previously been designed for when the site had additional operational paper mills. | | | |
| Litter / Waste | Blown by the wind | Local residents; Nature and Conservation Sites | Good housekeeping procedures will be implemented indoors around the new boiler plant. Empty water treatment containers (IBCs etc) will be generated for periodic disposal/reuse when empty.<br><br>All waste generated is stored and disposed of following the existing site waste management procedures. | Low | Contamination | Very Low |
| Waste | Ground | Water; ground; and groundwater | The operation of the new boiler plant will not generate significant quantities of waste for disposal. Periodic replacement of ion exchange media will be required. Other wastes will be generated from periodic maintenance activities and cleaning.<br><br>The types of waste and quantities generated are envisaged as being similar to those currently generated from existing boiler plant operations.<br><br>All waste generated will be stored and disposed of following the existing site waste management procedures. | Low | Contamination | Very Low |
| Pests | Airborne; ground | Local residents | Pests are not likely to be a problem on-site due to the new boiler plant operations and the lack of food/organic wastes generated and stored on-site<br>A pest prevention plan has been implemented on-site as part of food safety requirements. | Low | Nuisance; Contamination | Very Low |

| Hazard | Pathway | Receptor | Risk Management Techniques | Probability of Exposure | Consequence | Overall Risk (following mitigation) |
|---|---|---|---|---|---|---|
| Arson / Vandalism – contaminated firewater, smoke | Water run-off through drainage; airborne | Local residents; Nature and Conservation Sites | The site is in operation and manned 24/7, with CCTV systems installed across several areas. Unauthorised access is prohibited onsite and controlled access is enforced.<br><br>A fire risk assessment has been undertaken for the wider area occupied by the site. Preventive and control actions have been implemented accordingly. | Low | Nuisance; contamination | Very Low |
| Operator error | Air / water / ground | Local residents; Nature and Conservation Sites | Processing activities carried out within the site are well understood and controlled. The potential for operator error exists but training, documentation, supervision should mitigate the potential for this to occur.<br><br>All operational staff are periodically trained/re-trained on the site operating procedures.<br><br>All incidents are recorded and investigated appropriately according to the site incident procedure. | Low | Nuisance; contamination | Very Low |

## 5. BAT JUSTIFICATION

Activities in the pulp, paper & board sector, and hence the KC operations are covered by the following document:

2014/687/EU – BAT -Conclusions for the production of pulp, paper and board.

For the purposes of this variation the BAT-C requirements have been reviewed in order to ensure that following the modifications compliance will be achieved and that any specific requirements for new plant have been addressed during the design process/specification of the new equipment/facilities.

As this variation is for the installation of new boiler plant and the remainder of the Mill operations (tissue manufacture, converting, operation of the onsite effluent treatment plant etc.) will continue as per the existing arrangements only those BAT-C requirements relevant to the boiler plant project have been considered – see Appendix I.

This assessment concludes that due to the proposed modification (Installation of a new boiler plant) KC's operations at Northfleet will continue to meet the relevant BAT-Conclusions requirements.

Overall the provision of new boiler plant to satisfy the existing site steam requirements is considered to represent BAT for the installation.