Coal Products Limited

Immingham Briquetting Works

Application for a Variation to Environmental Permit DP3134LK

April 2022

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Non-Technical Summary

This non-technical summary has been produced in order to support Coal Products Limited (CPL) with a variation application to their current Environmental Permit (EP) (reference: DP3134LK) at the Immingham Briquetting Works. The requirement to vary the existing EP has been prompted for the following reasons:

- The request to amend the operational profile of the existing Hydrothermal Carbonisation (HTC) plant, so that is transferred from a pilot plant (that only operates on 30 days in a year) to a fully-operational, 24-hour unit.
- Request to implement and operate a new Caustic Wash and Impregnation Unit, used for reprocessing spent carbon using caustic solution.
- The request to amend related activities, comprising the addition of one new waste code to for carbon regeneration.
- The request to increase the water discharge limit for emission point W1, in order to incorporate additional surface water run-off.

The site address is:

Coal Products Limited (trading as CPL Products)

Immingham Briquetting Works

Western Access Road

Immingham Docks

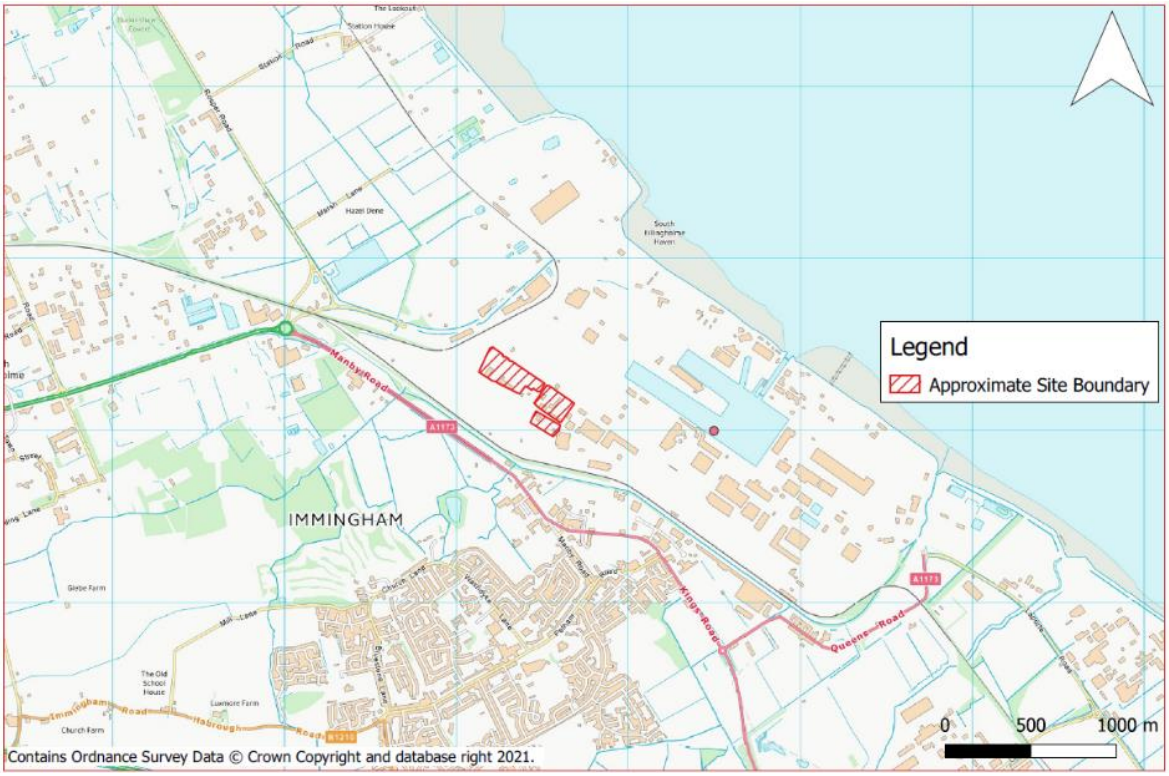
Immingham

Northeast Lincolnshire

DN40 2QR

The map in Figure i1 shows the site location and its surrounds.

Figure i1 – Site Location



The Coal Products Limited (CPL) Immingham Briquetting Works is currently permitted (Environment Agency ref DP3134LK) for "Coal Briquetting", "Carbon Regeneration" and "Receipt, storage and size reduction of coal", with the Directly Associated Activities comprising "Fines recovery and wastewater Treatment", "Operation of acid washing plant" and "Operation of pilot plant".

The Immingham Works currently has eight emission points to air and one emission point to water. The proposed changes introduced within this variation application consider three emission points to air (existing point A8 and new points A9 and A10), as well as the existing emission point to water (W1). The outstanding emission points to air remain unchanged as a result of this variation.

Hydrothermal Carbonisation (HTC) Plant

CPL has an ongoing commitment to the replacement of coal-based fuels and activated carbons with biomass-based materials. Controlled under the existing EP, the site has a directly authorised activity associated with pilot scale equipment to thermally treat biomasses from various sources to progress the development of renewable replacements.

The previous EP variation introduced the HTC plant as a new pilot plant to be built in order to increase the scale of the pilot programme on site. The unit was purchased and installed by Nottingham University with government funding through the Energy Research Acceleration funding process. CPL provided the land and services for the project and has overseen operation during University trials. In the pilot plant stage, the unit has operated in 4 to 6 hour slots and only for 30 days per year, with a maximum of 150 kg per hour input. This variation covers the request to increase the operational hours of the HTC plant to a fully-operational, 24-hour unit.

A new emission point to air will be introduced to the permit (this is currently referenced in existing permit but not regulated), serving emissions from the existing drier and boiler associated with the HTC plant. HTC process liquor will be treated and then sent to the current effluent system; there will be no new emission points to water.

Caustic Wash and Impregnation Unit

The Immingham Works currently operates two spent carbon regeneration plants and an acid wash unit. The acid wash unit is associated with the regeneration that reprocesses 'green' carbon from the potable water and food industries. The unit prepares the carbon prior to thermal regeneration to improve the quality of the final product.

As part of an ongoing development programme, this variation includes a request to carry out a similar wash process for the 'amber' carbon which comes from industrial uses. The washing process is very similar to current acid wash but utilises caustic solution rather than acid. In addition, the variation covers the request to operate an impregnation unit, which takes regenerated and/or washed carbon and adds a small amount of caustic solution to produce a product that has enhanced absorbency for specific contaminants.

The development work, which is confidential company intellectual property, indicates that for certain spent carbons, the caustic wash and impregnation is possible without further thermal processing. There are, therefore, significant benefits to be had with regards to reduced energy and caustic usage (i.e., a reduction in carbon footprint), whilst keeping the quality of the end product the same. In addition, currently the only other method for dealing with high-sulphur spent carbon is by sending to landfill; the caustic wash and impregnation unit process avoids this.

Of the incoming spent carbon, it is proposed that 25% of this is diverted to the new caustic wash and impregnation unit (i.e., throughput will remain the same as current). There will be no new emissions to water, but the new Caustic Wash and Impregnation Unit includes two new emission points to air.

Waste and Raw Materials

This variation application also covers the request to include an additional waste code for the use of pharmaceutical wastes. As a hazardous waste, this variation application also covers the measures that will be in place to ensure safe storage, handling and use of these wastes. There are no further changes proposed with regards to waste and raw materials.

Water Discharge

As a result of wastewater derived from the HTC plant, as well as an increased catchment area for the site (due to the leasing of additional land) accompanied with increasing rainfall quantities recorded at the site, this variation application covers the request to increase the water discharge limit from 500 m^3/day to 1,200 m^3/day as a seven-day rolling average. There is no request in this application to change any of the characteristics of the discharge water that are currently in place (e.g., pH, temperature or visible oil). All current characteristics are expected to remain well within the current parameters. The purpose of this variation application covers the increase in rainfall and catchment area that has taken place with the increase in land leased. Emissions to water will continue to be treated through the existing water effluent treatment plant, which is capable of handling the increased volume proposed.

Environmental Assessments

Emissions from the proposed installation have been assessed using the Environment Agency's guidance on 'Risk assessments for your environmental permit' pertaining to air and water. These assessments have demonstrated that:

- For emissions to air, under the anticipated operating profile of the plant, all concentrations in air at human receptors are projected to be below the relevant assessment level and no exceedances are predicted. For concentrations in air at ecological receptors, although exceedances have been predicted, these are due to the existing background levels and the process contribution from the site can be described as not significant. For deposition results at ecological receptors, there are two receptors for which further consideration has been required, as process contribution (PC) results are above the 1% significance threshold. However, it has been noted that as an estuarine environment, the tide is washing these areas twice a day, preventing the accumulation of deposited pollutants. In addition, as these receptors are within the boundary of the port, it is unlikely that the critical loads for acid would apply in these areas due to the habitats present in that specific location.

- For emissions to water, the addition of the effluent associated with the fully operational HTC process results in minimal increases in pollutant loading and the HTC process effluent does not push any additional parameters over the reporting limit.

The changes requested within this variation will be managed in accordance with the site's existing environmental management system, which is maintained in accordance with the installation's current EP.

1 Introduction

This report has been compiled in order to support Coal Products Limited (CPL) with their request to vary their Environmental Permit (reference: DP3134LK), under the Environmental Permitting (England and Wales) Regulation (EPR) 2018[1]. The variation notice number is EPR/DP3134LK/V007.

The requirement to vary the existing EP has been prompted following proposed operational changes to some plant on Site, as well as a requirement to manage additional surface water runoff. Further detail about the proposed changes is provided in the following sections.

This document should be read in conjunction with the Environment Agency (EA) application forms:

- Part A - About you;
- Part C2 – General - varying a bespoke permit;
- Part C3 - Variation to a bespoke installation permit; and
- Part F1 - changes and declaration

These are provided in Appendix D of this supporting document.

[1] https://www.legislation.gov.uk/ukdsi/2018/9780111163023/contents

2 About the Application

2.1 The Site and the Operator

Coal Products Limited (CPL) operates a facility to manufacture and distribute solid fuels. The site address is:

Coal Products Limited (trading as CPL Products)

Immingham Briquetting Works

Western Access Road

Immingham Docks

Immingham

North East Lincolnshire

DN40 2QR

The installation is located on the Associated British Ports (ABP) Immingham Port Industrial area, approximately 1 km to the northwest of Immingham. Figure 2.1 provides a location map of the site, whilst Figure 2.2 shows the permitted boundary at the site. The permit boundary will remain the same following the permit variation.

Figure 2.1 – Site Location

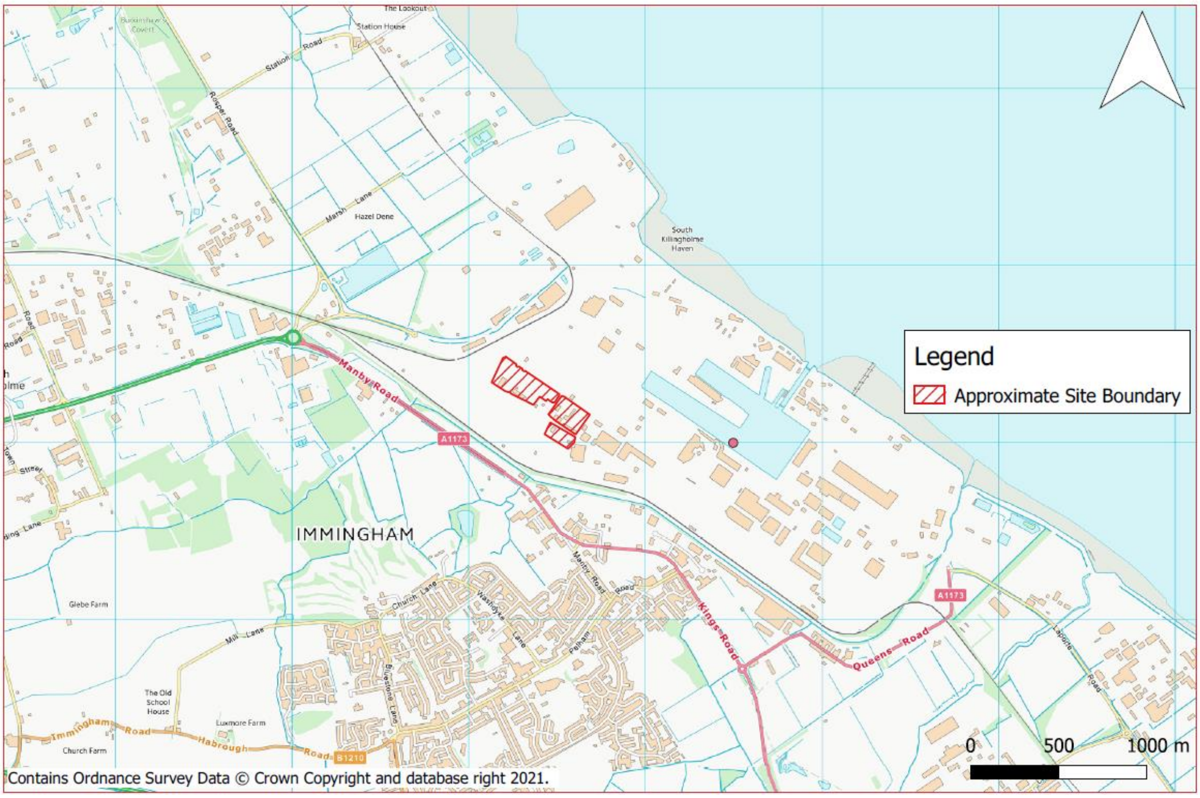
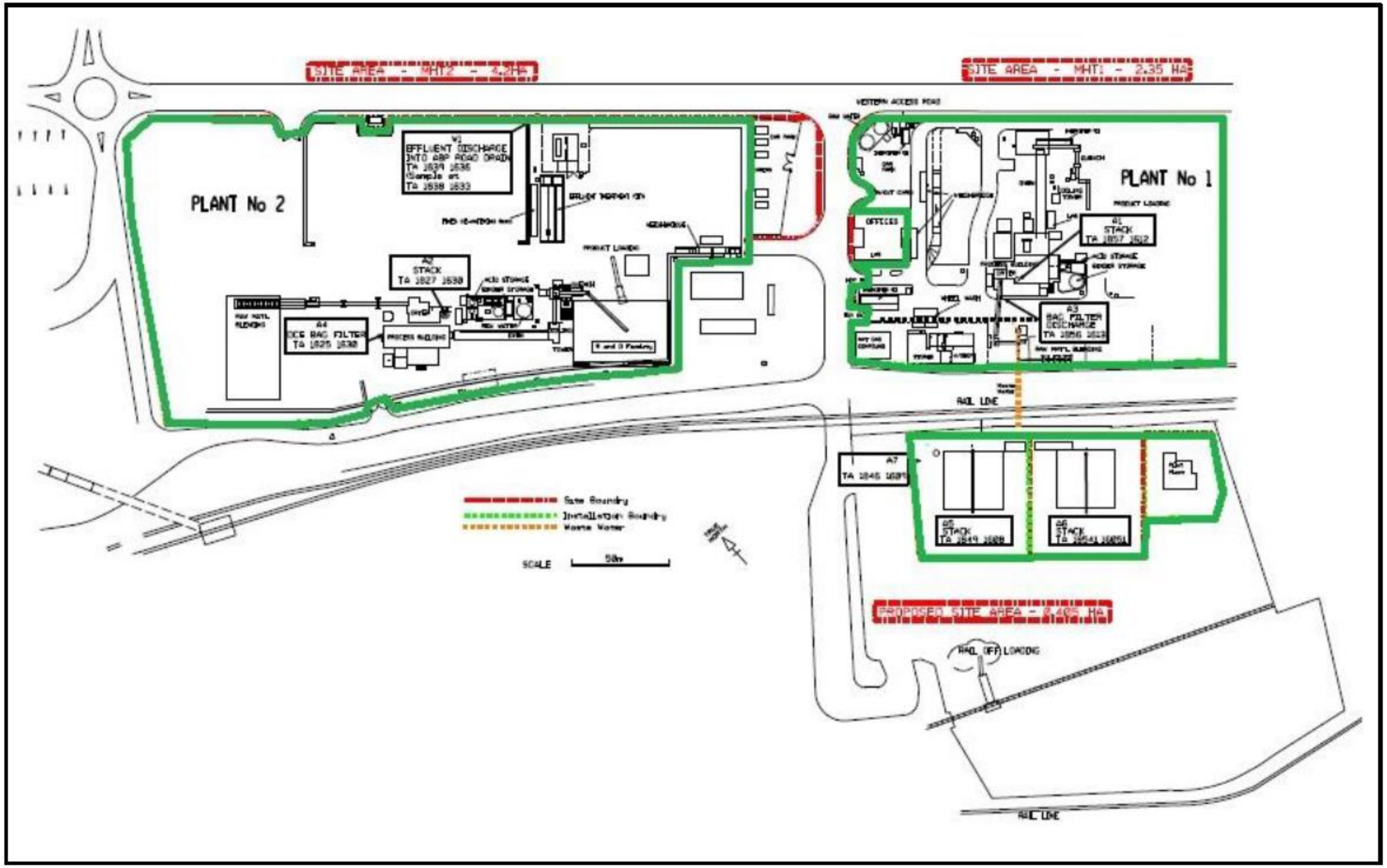


Figure 2.2 – Site Layout showing Existing Permit Boundary and Existing Emission Points



2.2 Description of Changes

The CPL Immingham Briquetting Plant is currently permitted under The Environmental Permitting (England and Wales) (Amendment) Regulations 2018 for “Coal Briquetting”, “Carbon Regeneration” and “Receipt, storage and size reduction of coal”, with Directly Associated Activities comprising “Fines recovery and wastewater Treatment”, “Operation of acid washing plant” and “Operation of pilot plant”.

The scope of the proposed Environmental Permit variation relates to the following:

- The request to amend the operational profile of the existing Hydrothermal Carbonisation (HTC) plant, so that is transferred from a pilot plant (that only operates on 30 days in a year) to a fully-operational, 24-hour unit. As a result of the amendment of the operational profile of the HTC plant, A8 will be included within the permit (currently referenced in the existing permit but not regulated), serving emissions from the boiler associated with the plant scrubber. HTC process liquor will be treated for Chemical Oxygen Demand (COD) and will then be sent to the current effluent system;

- The request to operate a Caustic Wash and Impregnation Unit as a directly associated activity, resulting in two new emission points to air (reference A9 and A10);

- The request to amend related activities, comprising the addition of one new waste code (EWC 07-05-10: wastes from the MFSU of pharmaceuticals, other filter cakes and spent absorbents); and

- The request to increase the water discharge limit for emission point W1, in order to incorporate additional surface water run-off, from 500 m^3/day to 1,200 m^3/day as a seven-day rolling average.

Request to Increase Operational Hours of the HTC Pilot Plant

It is proposed that the operation of the pilot plant will be increased from a maximum of 30 days per annum, to full 24-hour, seven day per week operation. This would take the HTC plant from pilot plant to a full-fledged unit and follows successful trials of the pilot plant since 2019.

The HTC plant has been designed to thermally treat biomasses from various sources to progress the development of renewable replacements for use at the Immingham Site. The HTC process utilises high pressure and temperature to alter the physical and chemical structure of the incoming biomass, to reduce the volatile content and produce a structure nearer mineral coal with increased hydrophobicity and crushability characteristics.

The process requires the incoming biomass to be pre-mixed with water and then injected into a pressurised reactor at 200°C - 225°C. The material is held in the reactor for varying time periods, typically 4 hours, before exiting in a number of depressurising steps. The solids are recovered from the liquid by filter separation and the liquid can be recycled or as a bleed off collected for disposal. The filtered solids are then dried and pelletised if required. Nottingham University has been investigating the properties of the product from a number of biomass sources as a precursor for further treatment, to replace coal based activated carbon and specialised coals.

Request to Operate a Caustic Wash and Impregnation Unit

The Immingham Works currently operates two spent carbon regeneration plants and an acid wash unit. The acid wash unit is associated with the regeneration that reprocesses ‘green’ carbon from the potable water and food industries. The unit prepares the carbon prior to thermal regeneration to improve the final product.

As part of an ongoing development programme, this variation includes a request to carry out a similar wash process for the ‘amber’ carbon which comes from industrial uses. The washing process is very similar to current acid wash but utilises caustic solution rather than acid. In addition, the variation covers the request to operate an impregnation unit which, takes regenerated and/or washed carbon and adds a small amount of caustic solution to produce a product which has enhanced absorbency for specific contaminants.

The proposed new system uses lower temperature liquid phase processing to achieve a similar level of carbon regeneration (i.e., there is no requirement for processing at high temperature and subsequent scrubbing of off-gases). There will be no increase in throughput as a result of the new plant, since the caustic wash will use a portion (circa 25%) of the current incoming spent carbon, diverting it from the existing carbon regeneration process.

The caustic washing process will involve the use of a caustic soda solution (47%). The wash unit will be a 5 tonne per day unit, consisting of a large tank which will be manually filled by flexible Intermediate Bulk Containers (IBCs) via an upper hatch. After filling, the carbon will be pre-rinsed with water and then soaked in a warm caustic solution which is circulated through the tank for a day. The 'used' caustic will then be stored in a holding tank and then reused on the existing amber carbon plant scrubbers, as a replacement for fresh caustic as the wash only partially reduces the pH. The carbon will then be post rinsed with water to remove any surface caustic solution.

The washed carbon will then be extracted from the tank and bagged ready for impregnation and/or further thermal regeneration. The impregnation unit uses a mixer to blend in a low percentage of caustic soda into the washed or regenerated carbon. The mixer will be fed by flexible IBC in a batch process followed by a dryer to produce an active surface on the finished carbon which improves its adsorption for certain contaminants. The unit will be capable of processing 5 tonnes of washed carbon in an 8 hour shift.

The daily water requirement of the process will be consistent with the current carbon regeneration process and, therefore, no additional emissions to water will arise. With regard to emissions to air, a new 440 kW drier and a new 950 kW boiler will be used for the new plant, with the associated emissions to be discharged to air from dedicated flues (reference A9 and A10, respectively). The specification of this plant is below the 1 MW_{th} input threshold as regulated under the Medium Combustion Plant (MCP) Directive (EU) 2015/2193.

The principal benefits of the new caustic wash process will be a reduction in gas and electricity use, as well as a reduction in fresh caustic use.

Request to Add a Permitted Waste Type

Table S2.2 of Schedule 2 of the existing Environmental Permit lists the permitted waste codes for the Site.

This variation application includes a request for an additional waste code for the use of pharmaceutical wastes: EWC 07-05-10. As a hazardous waste, this variation application also covers the measures that will be in place to ensure safe storage, handling and use of these wastes. There are no further changes proposed with regards to waste and raw materials.

Request to Increase the Consented Maximum Quantity of Wastewater

Table S3.2 of Schedule 3 of the existing Environmental Permit stipulates a maximum quantity of 500 m^3/day as a seven-day rolling average for the maximum flowrate of wastewater permitted for the Site.

As a result of an increased catchment area for the site (due to the leasing of additional land) accompanied with increasing rainfall quantities recorded at the site and periods of extreme rainfall over short periods, this variation application includes the request to increase the water discharge limit from 500 m^3/day to 1,200 m^3/day, as a seven-day rolling average.

There is no request in this application to change any of the characteristics of the discharge water that are currently in place (e.g., pH, temperature or visible oil). All current characteristics are expected to remain well within the current parameters. The purpose of this variation application covers the increase in rainfall and catchment area that has taken place with the increase in land leased. Emissions to water will continue to be treated through the existing water effluent treatment plant, which is capable of handling the increased volume proposed.

2.3 Requested Amendments to the Environmental Permit

The following amendments to Permit DP3134LK are proposed in line with the scope of the changes requested within this permit variation.

The proposed variation introduces the following amendment to the Schedule 1 Table S1.1 Activities of Permit DP3134LK, comprising the removal of a limitation on operational hours for the HTC plant and the implementation of the new caustic wash unit (shown in bold, red text). The proposed variation would also result in the removal of Schedule 1 Table S4.1 Pre-operational measures for future development, as it will no longer be valid.

Table 2.1 – Proposed Amendment to Schedule 1 Table S1.1: Activities

Activity Reference	Description of Specified Activity and WFD Annex I and II Operations	Limits of Specified Activity and Waste Types
AR1	Activities involving the pyrolysis, carbonisation, distillation, partial oxidation or other heat treatment of coal (other than the drying of coal).	MHT1 - operation up to 30 tonnes per hour.
AR2		MHT2 - operation up to 30 tonnes per hour.
AR3	Disposal or recovery of hazardous waste with a capacity exceeding 10 tonnes per day involving one or more of the following activities - recovery of components used for pollution abatement.	CR1 - operation up to 320 kg/hr dry output.
AR4		CR2 - operation up to 1,000 kg/hr dry output.
AR5	Temporary storage of hazardous waste with a total capacity exceeding 50 tonnes.	Maximum storage capacity on site of 150 tonnes of spent and recovered activated carbon.
AR6	Any of the following activities unless carried out at an exempt location - crushing, grinding or otherwise breaking up coal, coke or any coal product.	Receipt, storage and size reduction of coal. From receipt of raw material to introduction to a briquetting process.
AR7	Any of the following activities unless carried out at an exempt location - screening, grading or mixing coal, coke, or any other coal product.	
AR8	Any of the following activities unless carried out at an exempt location - loading or unloading petroleum coke, coal or any other coal product except unloading on retail sale.	
Directly Associated Activity		
AR9	pH adjustment and solids settling.	From receipt of effluent to discharge into ABP drain system.
AR10	Use of dilute hydrochloric acid solution [3%w/w] to dissolve inorganic foulants from spent carbon received from the potable water treatment industry.	Includes the operation of a natural gas fired boiler <1 MW$_{th}$ (to heat the material to 50°C) with operation limited to 1 hour per day.
AR11	Heat treatment of carbonaceous material and carbon regeneration.	Operation at less than 100 kg/h throughput for R&D purposes.
AR12	***Hydrothermal Carbonisation (HTC).***	***Operation at less than 150 kg/h throughput.***
AR13	***Use of caustic soda solution to dissolve inorganic foulants from spent 'amber' carbon received from industrial uses.***	***Includes the operation of a natural gas fired boiler <1 MWth.***

The proposed variation introduces the following amendments to Schedule 2 Table S2.2 of Permit DP3134LK (shown in bold, red text).

Table 2.2 – Proposed Amendment to Schedule 2 Table S2.2, Permitted Waste Types and Quantities for Carbon Regeneration Activity

Waste Code	**Description**
Maximum Quantity	*12,000 tpa (dry basis)*
06	Wastes From Inorganic Chemical Processes
06 13	*Wastes from inorganic chemical processes not otherwise specified*
06 13 02*	Spent activated carbon (except 06 07 02)
07	Wastes From Organic Chemical Processes
07 01	*Wastes from the manufacture, formulation, supply and use (MFSU) of basic organic chemicals*
07 01 10*	Other filter cakes and spent absorbents
07 04	*Wastes from the MFSU of organic plant protection products (except 02 01 08 and 02 01 09), wood preserving agents (except 03 02) and other biocides*
07 04 10*	Other filter cakes and spent absorbents
07 05	***wastes from the MFSU of pharmaceuticals***
07 05 10	**Other filter cakes and spent absorbents**
07 07	*Wastes from the MFSU of fine chemicals and chemical products not otherwise specified*
07 07 10*	Other filter cakes and spent absorbents
10	Wastes From Thermal Processes
10 01	*Wastes from power stations and other combustion plants (except 19)*
10 01 18*	Wastes from gas cleaning containing dangerous substances
10 01 19	wastes from gas cleaning other than those mentioned in 10 01 05, 10 01 07 and 10 01 18
15	Waste Packaging; Absorbents, Wiping Cloths, Filter Materials And Protective Clothing Not Otherwise Specified
15 02	*Absorbents, filter materials, wiping cloths and protective clothing*
15 02 02*	Absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances
15 02 03	Absorbents, filter materials, wiping cloths and protective clothing other than those mentioned in 15 02 02
19	Wastes From Waste Management Facilities, Off-Site Waste Water Treatment Plants and the Preparation of Water Intended for Human Consumption and Water for Industrial Use
19 05	*Wastes from aerobic treatment of solid wastes*
19 05 99	Wastes not otherwise specified – spent carbon filtrate medium from industrial filters
19 06	*Wastes from anaerobic treatment of waste*
19 06 99	Wastes not otherwise specified – spent carbon filtrate medium from industrial filters
19 08	*Wastes from waste water treatment plants not otherwise specified*
19 08 99	Wastes not otherwise specified – spent carbon filtrate medium from industrial filters
19 09	*Wastes from the preparation of water intended for human consumption or water for industrial use*
19 09 04	Spent activated carbon
19 12	*Wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified*
19 12 11*	Other wastes (including mixtures of materials) from mechanical treatment of waste containing dangerous substances
19 13	*Wastes from soil and groundwater remediation*
19 13 05*	Sludges from groundwater remediation containing dangerous substances
19 13 06	Sludges from groundwater remediation other than those mentioned in 19 13 05

The proposed variation introduces the following amendments to Table S3.1 of Permit DP3134LK (shown in bold, red text).

Table 2.3 – Proposed Amendment to Schedule 3 Table S3.1, Point Source Emissions to Air

Emission Point Ref. & Location	Source	Parameter	Limit (including unit)	Reference Period	Monitoring Frequency	Monitoring Standard or Method
A1 [Point A1 on site plan in Schedule 2]	MHT 1	Oxides of Nitrogen[1]	150 mg/m³	Daily mean of 15 minute averages	3 monthly	ISO 10849:1996
		Sulphur dioxide[2]	300 mg/m³		3 monthly	BS EN 14791:2017
		Non Methane VOC[2]	40 mg/m³		12 monthly	PD CEN/TS 13649:2014
		Particulate matter[2]	100 mg/m³		Continuous	BS EN 13284-2:2004
		Particulate matter[2]	No set limit		12 monthly	BS EN 13284-1:2002
A2 [Point A2 on site plan in Schedule 2]	MHT 2	Oxides of Nitrogen[1]	150 mg/m³	Daily mean of 15 minute averages	3 monthly	ISO 10849:1996
		Sulphur dioxide[2]	300 mg/m³		3 monthly	BS EN 14791:2017
		Non Methane VOC[2]	40 mg/m³		12 monthly	PD CEN/TS 13649:2014
		Particulate matter[2]	100 mg/m³		Continuous	BS EN 13284-2:2004
		Particulate matter[2]	No set limit		12 monthly	BS EN 13284-1:2002
A4 [Point A4 on site plan in Schedule 2]	MHT 2 Bag filter	Particulate matter[2]	25 mg/m³	Daily mean of 15 minute averages	Continuous	BS EN 13284-2:2004
		Particulate matter	25 mg/m³		12 monthly	BS EN 13284-1:2002
A5 [Point A5 on site plan in Schedule 2]	Activated Carbon Regeneration Plant (320 kg/h)	Oxides of Nitrogen	350 mg/m³	Periodic over minimum 1-hour period	12 monthly	ISO 10849:1996
		Sulphur dioxide	50 mg/m³		12 monthly	BS EN 14791:2017
		Non Methane VOC	20 mg/m³		12 monthly	PD CEN/TS 13649:2014
		Particulate matter	20 mg/m³		12 monthly	BS EN 13284-2:2004
		Hydrogen chloride	30 mg/m³		12 monthly	BS EN 1911:2010
		Dioxins and furans	1 ng/m³		12 monthly	BS EN 1948:2006
A6 [Point A6 on site plan in Schedule 2]	Activated Carbon Regeneration Plant (1,000 kg/h)	Oxides of Nitrogen	250 mg/m³	Periodic over minimum 1-hour period	12 monthly	ISO 10849:1996
		Sulphur dioxide	50 mg/m³		12 monthly	BS EN 14791:2017
		Non Methane VOC	20 mg/m³		12 monthly	PD CEN/TS 13649:2014
		Particulate matter	20 mg/m³		12 monthly	BS EN 13284-2:2004
		Hydrogen chloride	30 mg/m³		12 monthly	BS EN 1911:2010
		Dioxins and furans	1 ng/m³		12 monthly	BS EN 1948:2006
A7 [Point A6 on site plan in Schedule 2]	Gas fired Boiler <1 MWth (Acid Washing Plant)	Oxides of Nitrogen	No limit set	-	-	-
A8	***HTC Plant Scrubber (150 kg/h)***	***Oxides of Nitrogen***	***250 mg/m³***	***Periodic over minimum 1-hour period***	***12 monthly***	***ISO 10849:1996***
		Sulphur dioxide	***50 mg/m³***		***12 monthly***	***BS EN 14791:2017***
		Particulate matter	***20 mg/m³***		***12 monthly***	***BS EN 13284-2:2004***
A9	***Impregnation Drier Exhaust <1 MWth***	***Oxides of Nitrogen***	***No limit***	***-***	***-***	***-***
A10	***Caustic Wash Unit Boiler <1 MWth***	***Oxides of Nitrogen***	***No limit***	***-***	***-***	***-***

Note: Proposed amendments highlighted in ***bold, red text***. Notes referenced in the table refer to current Permit.

The proposed variation introduces the following amendments to Schedule 3 Table S3.2 of Permit DP3134LK (shown in bold, red text).

Table 2.4 – Proposed Amendments to Schedule 3 Table S3.2, Point Source emissions to water

Emission Point Ref. & Location	Source	Parameter	Limit (Incl. unit)	Reference Period	Monitoring Frequency	Monitoring Standard or Method
W1 on site plant in Schedule 2 emission to ABP drainage system	Effluent Treatment Plant	***Flowrate***	***1,200 m³/day***	***Seven day rolling average***	Continuous	Permanent sampling access is not required
		Temperature	40°C	24-hour period		
		Oil and grease	No visible emission	24-hour flow proportional sample	Analysed weekly	
		pH	6-10	Instantons	Continuous	BS6068-2.50

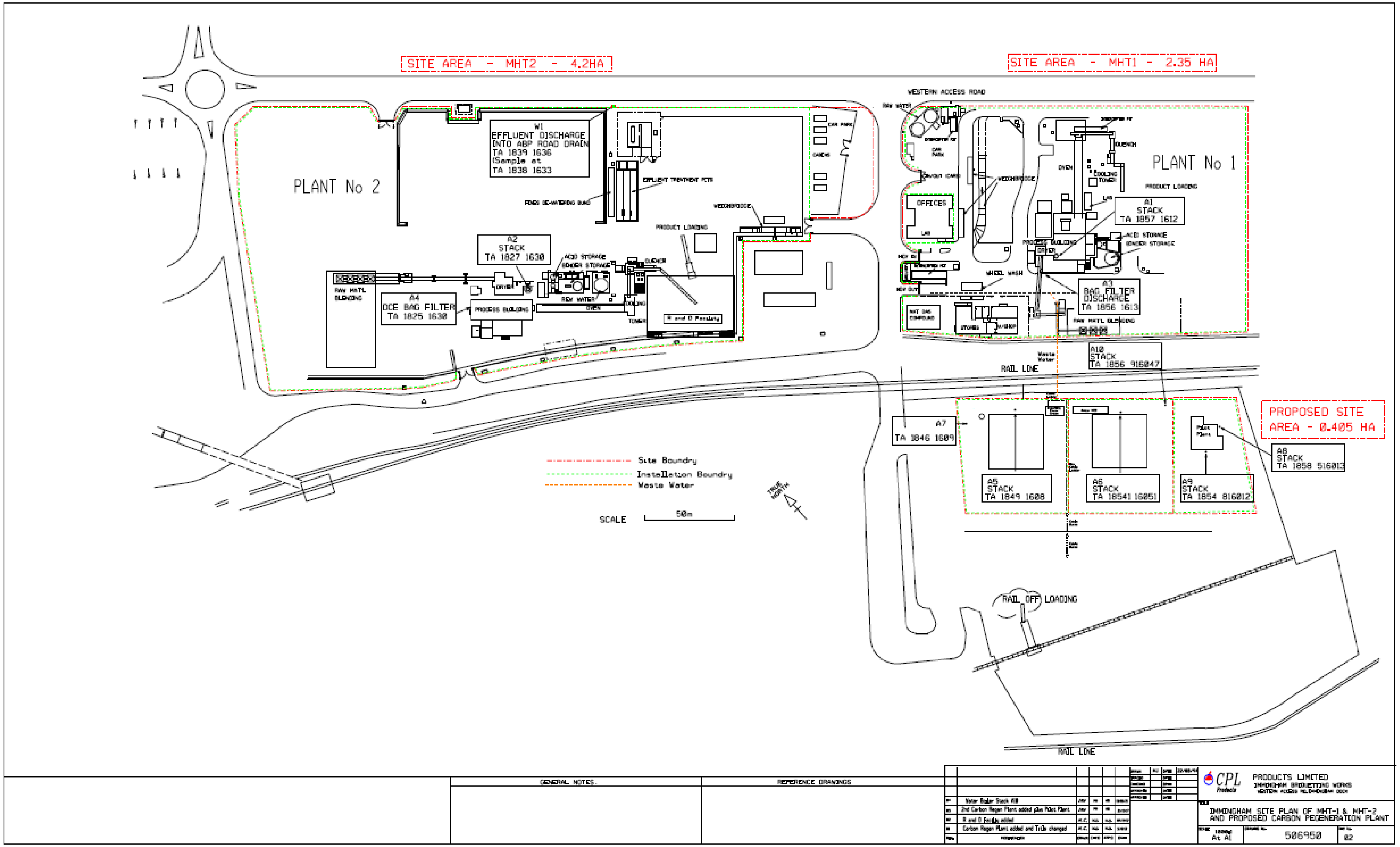
The proposed variation introduces the following amendments to Schedule 4 Table S4.1 of Permit DP3134LK (shown in bold, red text).

Table 2.5 – Proposed Amendments to Schedule 4 Table S4.1, Reporting of Monitoring Data

Parameter	Emission or Monitoring Point / Reference	Reporting Period	Period Begins
Emissions to Air Parameters as required by condition 3.5.1	A1, A2, A4	Quarterly	1 July
	A1, A2, A4, A5, A6^Note1, ***A8***	Annually	
Emissions to Water Parameters as required by condition 3.5.1	W1	Quarterly	

The proposed variation introduces one emission point to air for the HTC Plant for regulation and two new emission points to air from the Caustic Wash/Impregnation Unit that were not present on the site plan included within the existing permit. As such, Figure 2.3 provides the proposed updated site plan.

Figure 2.3 – Proposed Amendment to Schedule 7: Site Plan (showing New Permitted Release Points)



3 Operations

3.1 HTC Plant

3.1.1 Process Description

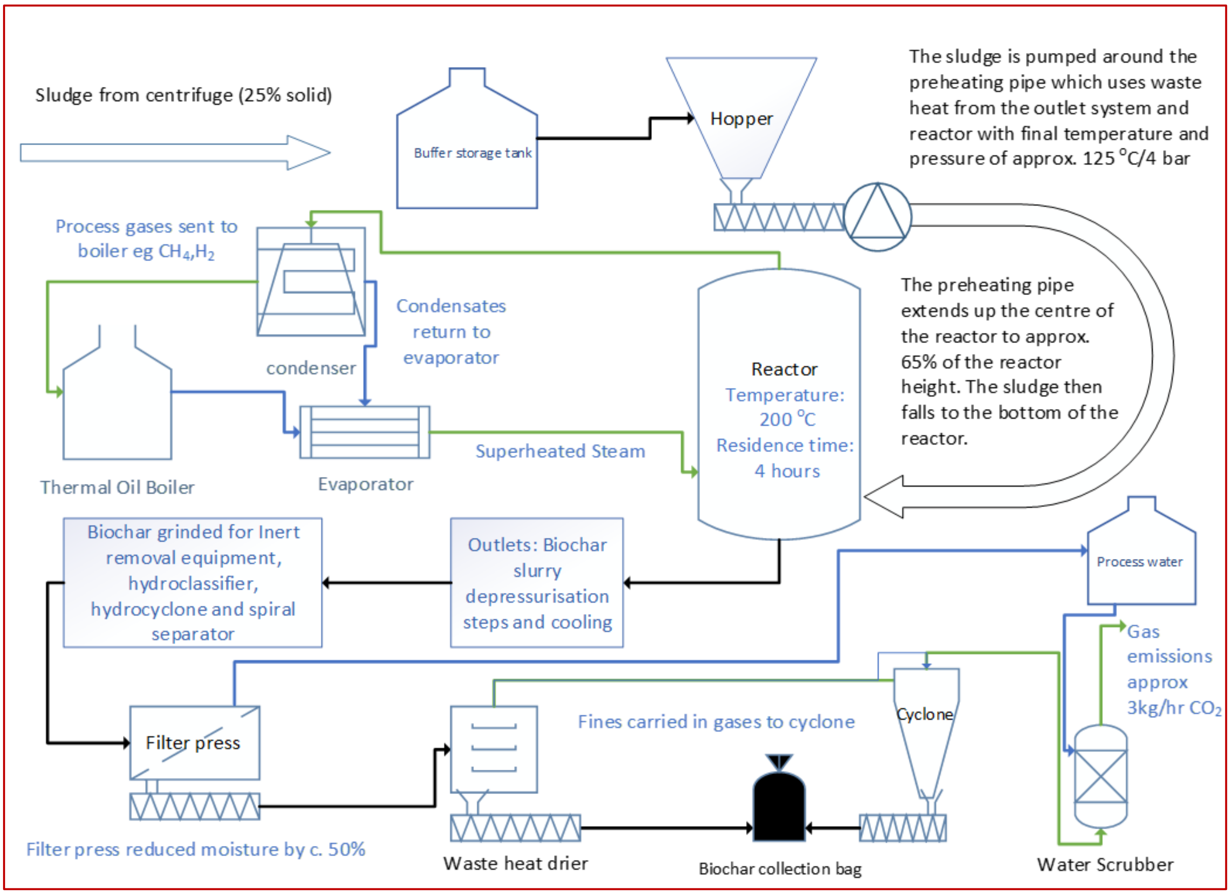
CPL has an ongoing commitment to the replacement of coal-based fuels and activated carbons with biomass-based materials. Currently, the site has a directly authorised activity associated with pilot scale equipment to thermally treat biomasses from various sources to progress the development of renewable replacements. This takes place using the Hydrothermal Carbonisation (HTC) Plant.

The previous EP variation introduced the HTC plant as a new pilot plant to be built in 2019, in order to increase the scale of the pilot programme on site. The unit was purchased and installed by Nottingham University with government funding through the Energy Research Acceleration funding process. CPL provided the land and services for the project and has overseen the operation when the University have trials to complete. The design and construction of the plant was carried out by Ingelia SA who own the technology rights to the process.

The HTC process uses a combination of heat and pressure to chemically transform organic material into a carbon dense product. This is similar to the natural process producing coal, however, instead of taking millennia, this process is carried out in around six hours.

A process flow diagram is provided in Figure 3.1.

Figure 3.1 – HTC Process Flow Diagram



With regard to feedstock, HTC is particularly suited to process wet wastes and biomasses with no required prior drying step. This is because when carbonisation is carried out in the liquid phase the process does not need to overcome the latent heat energy requirement of water, compared to competing technologies such as pyrolysis and torrefaction. This, along with a lower peak temperature, leads to increased efficiency and lower operating costs. The unit reactor is 8 m^3 in size, with a design input of 350 kg/hr at 60% moisture with a nominal output of 90 kg/hr of biochar (dry).

The liquid phase carbonisation occurs at between 200°C - 225°C, which equates to 21-24 bar of pressure (the vapour pressure of water at that temperature). The residence time of carbonisation is around 4 hours, but this can be easily varied to produce different levels of de-volatilisation.

HTC increases fixed carbon content whilst also decreasing moisture and volatile content. HTC biochar is considered hydrophobic, so storage is less of an issue compared to raw biomass or even torrefied biomass.

The process liquor is recycled through the process to maintain energy efficiency, but any excess waste liquid will be treated for Chemical Oxygen Demand (COD) and discharged through the current effluent treatment system. As a result of the increased operation of the HTC unit, process wastewater discharged via W1 is expected to increase by approximately 456 m^3/annum (existing pilot plant operation accounts for 44 m^3/annum, therefore 500 m^3/annum in total discharge).

The HTC technology used by CPL uses the waste heat generated in the process to dry the biochar down to approximately 10% moisture, prior to post-treatment extrusion processes.

3.1.2 Location

The location of the HTC Plant and associated emission point in shown in Figure 2.3. It is located within the existing permitted site boundary, adjacent to the Activated Carbon Regeneration Plant. There are no changes with regard to the location or configuration of the plant within this variation application.

3.1.3 HTC Plant Working Hours

The plant currently operates for a maximum of 30 days per year. This proposed Permit Variation application proposed to increase this to a full-operational plant, 24 hours a day, seven days per week.

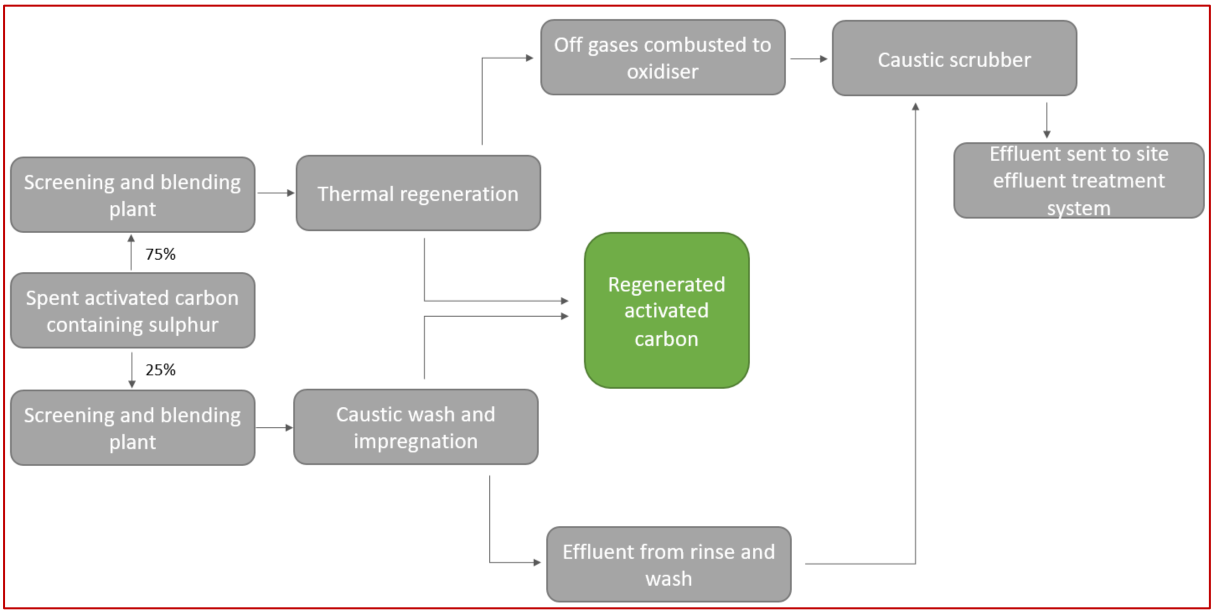
3.2 Caustic Wash and Impregnation Unit

3.2.1 Process Description

This variation covers the request to operate a new caustic wash and impregnation unit, which reprocesses incoming spent carbon material into activated carbon, which is suitable for specific sectors of the environmental control industry. The new system is designed to operate alongside the existing processes, with around 25% of the incoming spent carbon being diverted to the new caustic system, and the remaining 75% being handled through the current thermal regeneration process. There will be no change to total throughput (which is circa 4000 tonnes per annum, against a consented limit of 8,000 tonnes per annum).

A summary of the current and proposed process is provided in Figure 3.2.

Figure 3.2 – Indicative Comparison: Current and Caustic Wash Process



The caustic wash system uses caustic soda solution (47%) and is designed to react with sulphur species only. Laboratory testing and pilot plant studies have shown that other volatiles present on the incoming spent carbon (such as siloxanes and ketones) will stay on the carbon during the wash. This is because these substances require heat to be devolatised from activated carbon.

Sodium hydroxide reacts with sulphur on the carbon to produce a variety of salts, including sodium thiosulphate, sodium sulphate, sodium sulphide and sodium sulphite. During the process, these salts are treated by dissolved air floatation (DAF). The oxygen is added under pressure (4 bar) and converts the majority of the salts to sulphates. This treatment is carried out during and after the main wash process and will be running 24 hours a day to ensure the maximum treatment has taken place. It is important to note that the thermal to scrubber process also produces a small proportion of sulphides and sulphites.

Overall, however, the same amount of sulphur is being removed (when comparing the current process and the caustic wash process) as this is dictated by the amount of sulphur that is present on the incoming spent activated carbon. As such, there will be no overall change to effluent. In addition, this method ensures there is no gaseous SO_2 produced, as the sulphur is processed into sulphates.

The wash unit will be a 5 tonne per day unit consisting of a large tank which will be manually filled by flexible Intermediate Bulk Containers (IBCs) via an upper hatch. After filling, the carbon will be pre-rinsed with water and then soaked in a warm (60 °C) caustic solution which is circulated through the tank for a day. The ‘used’ caustic will then be stored in a holding tank and then reused on the existing carbon plant scrubbers as a replacement for fresh caustic (this is possible as wash only partially reduces the pH). The carbon will then be post-rinsed with water to remove any surface caustic solution.

After the wash that selectively removes sulphur, the washed carbon will be bagged ready for impregnation. The impregnation unit uses a mixer to blend in a low percentage of caustic soda into the washed or regenerated carbon. The mixer will be fed by flexible IBC in a batch process followed by a dryer (used to reduce the moisture content to circa 20%) to produce an active surface on the finished carbon which improves the adsorption for certain contaminants. The unit will be capable of processing 5 tonnes in an 8 hour shift. Post-drying, the product is stored for 7 – 10 days to stabilise. The product will then be screened and any undersized separated and sold as a different product.

The daily water requirement of the process will be consistent with the current carbon regeneration process and, therefore, no additional emissions to water will arise. With regard to emissions to air, a new 950 kW boiler will be used for the new plant, with the associated boiler emissions to be discharged to air from a dedicated flue (reference A10). In addition, the impregnation unit will include a 440 kW drier (reference A9). The specification of this plant is below the 1 MW_{th} input threshold as regulated under the Medium Combustion Plant (MCP) Directive (EU) 2015/2193.

The proposed new system uses lower temperature liquid phase processing to achieve a similar level of carbon regeneration (i.e., there is no requirement for processing at high temperature and subsequent scrubbing of off-gases). Therefore, the principal benefits of the new caustic wash process will be a reduction in energy, caustic use and carbon footprint. In addition, currently the only other method for dealing with high-sulphur spent carbon is by sending to landfill; the caustic wash and impregnation unit process avoids this.

For a tonne of carbon processed, the total energy consumption of the proposed new process is 550 kWh. By comparison, the equivalent consumption for current thermal regeneration is 1,125 kWh. This results in an energy saving of 575 kWh per tonne and therefore, with 1,000 tonnes processed per annum (i.e., 25% of the current incoming 4,000 tonnes), this would result in an energy saving of 575 MW per annum.

3.2.2 Location and Operating Hours

The new units will stand alongside the current plant, utilising the existing infrastructure and the current throughput in the permit of 8,000 tonnes. The operating hours would also align with the current process.

3.3 Addition to Permitted Wastes

This variation application also covers the request to include an additional waste code for the use of pharmaceutical wastes. Specifically, it is wastes derived from the manufacture, formulation, supply and use (MFSU) of pharmaceuticals. The equivalent waste code is EWC 07-05-10 and the material used on Site would be carbon-based, typically with the following composition:

- 80% carbon.
- 10% ash.
- 5% moisture.
- 5% phenol.
- Trace of other compounds.

The purpose of the additional waste will be to provide activated carbon material which will be regenerated in the Activated Carbon Regeneration Plant (CR2). It is estimated that 10 tonnes per year of EWC 07-05-10 would be received for regeneration and would be delivered in from 1x one tonne vessel every 5 weeks. This material will be stored and handled in line with the existing procedures on site for the storage and handling of activated carbons.

3.4 Additional Discharges to Water

It is estimated that due to the varied operation of HTC, there will typically be an increase in process wastewater discharged via W1 by approximately 456 m^3/annum, which is equivalent to a 0.33% increase relative to the current baseline scenario.

As a result of an increased catchment area for the site (due to the leasing of additional land) accompanied with increasing rainfall quantities recorded at the site (sometimes received in very short periods as extreme rainfall), this variation application covers the request to increase the water discharge limit from 500 m^3/day to 1,200 m^3/day as a seven-day rolling average. There is no request in this application to change any of the characteristics of the discharge water that are currently in place (pH, temperature or visible oil). All current characteristics are expected to remain well within the current parameters.

There is no expectation that concentrations of contaminants will significantly increase, almost all increased volume will be rainwater runoff. Emissions to water will continue to be treated through the existing water effluent treatment plant, which is capable of handling the increased volume proposed.

3.4.1 Waste Liquid from HTC

The activities covered by the variation will not produce additional waste solids. However, the operation of the HTC Plant will lead to waste liquid in the form of excess process liquor. The process liquor is recycled through the process to maintain energy efficiency, but some waste will be produced.

With regards to wastewater produced, 24 tonnes of input to the HTC Plant produces 5 m^3 of excess process liquor. It is anticipated that 2,394 tonnes of raw material would be required for the process per annum, which would result in 456 m^3/annum waste liquid. This will be treated for COD and discharged through the existing effluent treatment system.

3.4.2 Waste Liquid from Caustic Wash Unit

The caustic wash solution at the end of the wash cycle will be stored separately and then re-used in the existing off-gas scrubbers. The pre- and post-wash rinse water will also be stored separately and used in the existing scrubbers. This will then be treated for COD and sent to the existing effluent treatment system. There will not be a requirement for an increase in potable water usage, nor will there be an increase in the liquid effluent, as the operations for the caustic wash process are offset by the decrease in throughput through the existing carbon regeneration process.

3.4.3 Increase in Plant Area

In 2018, CPL came to lease additional land from ABP at the Immingham site. This land is drained via the CPL drainage system and makes its way to the effluent system where it comprises part of the daily discharge. This has increased the “catchment area” of rainfall, all of which is concreted, hard standing and provides no natural soak away.

This figure is likely to increase further as during 2020 CPL leased a further area of concreted land, which requires draining through the CPL drainage system. This will take the volume of water through the system even higher.

3.4.4 Increased Rainfall

Table 3.2 provides rainfall data from the CPL Immingham site covering the period 2016 – 2020. The table shows the number of days in which rainfall has been recorded at CPL Immingham, the total rainfall for the year, and an estimation of the volume of rain fallen. The volume estimations are based on the size of the CPL site and the estimation that 1 mm of rain equates to 71 m^3 of water for 2016 and 2017. This increased for 2018 and 2019 to approximately 89 m^3 per mm of rain, through the leasing of additional land. In 2020, this was increased further to 111 m^3 per mm of rain, since the current site area equates to 111,000 m^2.

Table 3.1 – Rainfall Data

Parameter	2016	2017	2018	2019	2020
Days with rain	159	159	141	133	112
Total Rainfall (mm)	679	730	765	831	624
Total Estimated Volume (m^3)	48,209	51,830	68,085	73,959	69,264

The data show an increase in total annual rainfall over the last five years. All rainfall falling on the CPL Immingham site drains into the effluent system for discharge. The request to increase the water discharge limit considers the increase it site area, combined with the increased rainfall, with the requested discharge limit intended to ‘future-proof’ the Site.

3.4.5 Characteristics of Discharge Water

There is no request in this application to change any of the characteristics of the discharge water that are currently in place (e.g., pH, temperature or visible oil). All current characteristics are expected to remain well within the current parameters.

The purpose of this application for permit variation is to cover the additional discharges with respect to the increase in rainfall and the increase in rainfall catchment that has taken place with the increase in land leased.

3.5 Management

CPL recognises the importance of managing any potential environmental impacts of their operations and have processes and procedures in place, aiming to achieve continuous improvement with regard to environmental performance.

These procedures will be reviewed for compliance by CPL against the EA's requirements (Best Available Technique (BAT)) and any required changes following the permit variation will be incorporated into the current environmental management system (EMS). This is a live document that defines the processes, procedures and controls the CPL adheres to in order that all its operations are carried out safely.

The EMS covers all aspects pertaining to management and monitoring environmental performance at the site and it will be updated to ensure that it will be compliant with the updated permit, in line with guidance from the EA[2]. A brief summary of what is contained within the EMS is provided within this document (see Section 8).

Members of the team at the Immingham works have defined roles and responsibilities to ensure that all aspects of environmental performance of applicable plant, processes and discharge points and managed, controlled and reported in a timely manner to comply with any regulatory controls as defined within the permit. This includes the undertaking of regular audits of site operations by senior members on site. The results of these audits are recorded and reported to senior management in a timely manner. If necessary, appropriate corrective actions will be implemented to ensure that permit conditions remain met.

Staff at all levels have the appropriate training for their responsibilities and records of this training are maintained. This includes acknowledgement of any environmental impacts of the process they are responsible for. The training may be updated once the permit variation is issued.

CPL understands the importance of documented procedures covering the operation and maintenance of the Immingham works and these procedures are included as part of the environmental management system, taking account of manufacturer's manuals. These will be regularly reviewed and updated as required. The management system will also ensure that monitoring and reporting of results to the EA will comply with the requirements of the permit.

3.6 Maintenance

The Operations Manager has the ultimate responsibility for the effective maintenance of plant and equipment throughout the facility. There are two types of maintenance associated with the plant covered by the variation: planned maintenance and unplanned maintenance.

Planned maintenance is regular maintenance that will be completed at the timescales specified by the plant manufacturer(s). This high level of preventative maintenance is designed to avoid unscheduled downtime, maximising plant availability, its ability to operate efficiently and to maintain an efficient level of operation between maintenance activities.

The CPL maintenance team or another approved contractor (e.g. manufacturer) will undertake all maintenance on the HTC plant and caustic wash. Any waste generated by the maintenance activities will be removed from site for recycling and/or disposal.

Unplanned maintenance covers breakdown of plant and other emergencies. This is generally initiated when there is a divergence from normal operating parameters, as specified by manufacturers. Such issues that require operator intervention outside of the routine maintenance program will be identified by the operator and an appropriate response initiated.

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[2] https://www.gov.uk/guidance/develop-a-management-system-environmental-permits

4 Comparison with Indicative BAT

It is important to note that both the HTC plant and caustic wash and impregnation process are both examples of new processes/technologies. However, a comparison against indicative BAT is provided in Table 4.1, evaluating the environmental management techniques to be implemented against those given in the addendum "Treating Waste by Thermal Desorption" to Environment Agency Guidance Note EPR 5.06[3].

[3] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/300893/geho0512bwir-e-e.pdf

Table 4.1 – BAT Review: Conformity with BAT Conclusions

Item	BAT	Description of BAT	Description of Proposed Facilities
Waste Characterisation			
1	1	The technical capability of a facility must be pre-determined in terms of the nature and quantities of waste materials that can be treated at the facility, taking into account the available pre-treatment provisions, storage capacity and infrastructure, treatment capability and capacity, material handling provisions, and effectiveness of the off-gas treatment systems.	The proposed plant has been designed based upon the operator's knowledge of the specification of incoming spent activated carbon, the contaminants requiring removal and the applications of resulting activated carbon. This is supplemented by existing infrastructures and operations.
2	2	The facility must have clearly defined acceptance and rejection criteria for waste that can be safely stored on-site and treated by the thermal desorption process, including consideration of factors such as: ▪ Concentration, boiling point and flash point of volatile organic contaminants ▪ Water content, pH and physical characteristics of waste material ▪ Presence of inorganic contaminants, chlorinated compounds and odorous materials	The composition and physical characteristics of the wastes (spent activated carbon) to be regenerated at the facility is restricted to the EWC Codes within the current permit, as listed in Table 2.2.
3	3	A system should be in place to inform customers and site operatives of the type of waste that the facility is permitted to accept for storage and/or treatment, specifically considering the nature and quantity of the material and its contaminants (organic and inorganic, volatile and non-volatile).	The operation is an inter-company business with the activated carbon treated at the proposed facility received from and returned to another company within the CPL Group.
4	4	Waste should only be accepted for treatment if the material and its contaminants can be effectively treated by the thermal desorption process. Waste materials that do not contain contaminants that will be effectively treated (i.e. desorbed during treatment) should not be accepted for treatment in isolation or in combination with other wastes, unless the contaminants are below relevant hazardous waste thresholds and it is demonstrated that they will assist the treatment process.	Not applicable for the caustic wash unit until the maximum number of cycles has been carried out. Theoretically this would be five cycles, before the spent activated carbon needs to be diverted back through the existing thermal regeneration process. The existing activated carbon regeneration plant has been specifically designed for a range of activated carbons to be treated.
5	5	Representative samples must be taken and analysed in order to characterise the waste material and identify contaminants. The samples collected need to be as fully representative of the whole to be characterised as possible. Sample size and number should be large enough to adequately represent the range of waste characteristics and contaminants contained in the waste material. Waste materials that are not known to be homogenous may need to be pre-treated or sampled in a way that ensures variability is taken into account, for example, by pre-mixing the waste before sampling or by using a coring tool.	Only spent carbon from other CPL Group companies will be treated at the "Amber" facility. The spent carbon is supplied from known sources (i.e. treatment processes) which characterise the waste material and identify its contaminants. For the "Green" facility, spent carbon will be transported directly from known sources via tankers to the regeneration facility at Immingham, before being returned to the same source. Source identity will be maintained throughout the regeneration process.

6	6	Sampling highly volatile organics may require the use of specialised sampling techniques and equipment to ensure that, as far as possible, the volatile substances are not lost from the sample. Where necessary, precautions should be taken to ensure that, as far as possible, the samples do not undergo any changes before analysis. The container holding the sample should be securely sealed to prevent the loss or separation of volatile components (e.g. moisture or solvents) between the time of sample collection and analysis.	The proposed facility will not be used for the treatment of highly volatile organic wastes.
7	7	Lab-scale studies should be carried out to characterise and quantify the separate solid, oil/solvent and water fractions of the waste material, for example using retort apparatus.	The proposed facility will only treat spent activated carbon from known sources and of known composition. It is not proposed to undertake additional laboratory scale studies.
8	8	Waste samples should be taken and analysed for a full range of contaminants,(organic/inorganic, volatile/non-volatile) for example: ▪ BTEX compounds (benzene, toluene, ethylbenzene and xylenes), ▪ Total and speciated hydrocarbons, ▪ Metals (e.g. arsenic, cadmium, chromium, copper, lead, mercury and nickel) ▪ Base/Neutral/Acid compounds ▪ Polycyclic aromatic hydrocarbons ▪ Halogenated compounds (e.g. PCBs or compounds containing chlorine)	
9	9	The characterised waste should be assessed (for example, through documented literature studies, lab-scale tests, trials) to confirm whether or not it is suitable for storage and treatment by thermal desorption and to identify any potentially problematic contaminants. If confirmed suitable, treatment criteria required should be determined (i.e. in terms of pre-treatment requirement, treatment temperature and duration) to ensure that the waste will be fully treated and that the process is operated in an efficient and safe manner.	
10	10	Wastes containing PCBs and other chlorinated substances should only be accepted for treatment by thermal desorption if specific measures are in place in order to prevent the release of PCBs to atmosphere and the formation and release of dioxins and furans.	Not applicable for the caustic wash unit until the maximum number of cycles has been carried out. Theoretically this would be five cycles, before the spent activated carbon needs to be diverted back through the existing thermal regeneration process. Process gases from the carbon regeneration kiln are vented to atmosphere via a thermal oxidizer. The thermal oxidizer has been designed to maintain a temperature of 1,100°C for two seconds residence time in the presence of at least 6% v/v oxygen, dry gas to ensure complete oxidation of compounds (ref .BREF Note "Waste Treatments Industries").
11	11	Waste samples should also be analysed for a full range of inorganic contaminants, which may remain in the waste material following thermal treatment or become volatised during the treatment process (e.g. for volatile metals such as mercury).	The proposed facility will only treat spent activated carbon from known sources and of known composition. It is not proposed to undertake additional laboratory scale studies.

12	12	Where significant concentrations of volatile metals are detected in a sample the corresponding waste material should only accepted for treatment by the thermal desorption unit if the treatment temperature will be sufficiently below the boiling point of the metal (in order to prevent evaporation of the metal), unless it has been assessed that the metal will not cause unacceptable contamination of the condensate and suitable off-gas abatement systems are in place, which will ensure that any volatilised metals are fully removed from the gas before it is discharged to atmosphere.	
Waste Handling & Storage			
13	1	Untreated and treated waste material should be held in contained (bunded/kerbed) storage areas that are provided with impermeable hardstanding and sealed drainage designed to collect any liquids released from the waste material during storage. Waste material should be stored undercover or in covered containers to prevent the generation of contaminated surface waters / leachate and fugitive emissions to air and water (including dust).	The spent activated carbon will be delivered to site (and the treated activated carbon returned to the customer) in 1 m^3 bags. The bags will be stored under cover in dedicated warehouse. The proposed building will have an impermeable, concrete, floor that is bunded (stub wall around the floor area) to retain spillages in the building.
14	2	Waste storage areas should be provided with adequate ventilation and, where necessary, air extraction systems with abatement. Specifically, if untreated waste is stored in a confined/sheltered location, consideration should be given to the potential generation and accumulation of volatile gases and the formation of potentially flammable/hazardous atmospheres	The building is ventilated and designed with respect to the storage of activated carbon.
15	3	As far as it is practical to do so, organic and inorganic hazardous wastes and wastes that contain different contaminants that are at concentrations above the Hazardous Waste thresholds and will not be (or have not been) fully treated by the thermal desorption process should be stored, handled and treated separately. There are a number of reasons for this including: ▪ both the hazardous waste strategy and hazardous waste hierarchy guidance documents require that inorganic and organic wastes should be kept separate; ▪ treatment by dilution is not acceptable; and ▪ the recovery of treated materials may be compromised. Where mixing of wastes is required (e.g. for pre-treatment or co-treatment purposes) there must be a recorded assessment of the mixing process, which explains why it is necessary and demonstrates that the wastes are compatible, that dilution would not be used to change the classification of the waste (i.e. from hazardous to non-hazardous) and that the quality of the treated waste material would not be negatively affected.	A range of hazardous (i.e. activated carbon wastes that have an absolute entry in the EWC) and non-hazardous wastes are treated at the facility. Upon arrival at the site the wastes will be held in a quarantine area of the warehouse until the material has been correctly identified and the waste transfer notes / consignment notes verified. Hazardous and non-hazardous waste will be segregated during storage and handling.
16	4	Potentially dusty materials (e.g. treated/dried waste) should remain covered/contained at all times, provided with wind protection and, where necessary, water spray should be used to prevent dust generation. However, the application of water should be controlled in order to prevent the leaching or dilution of contaminants and surface run-off. Further treatment of recovered water may be necessary prior to its application as a dust control measure due to potentially odorous characteristics of recovered water.	The activated carbon is stored in bags, from which the material is charged directly into the process. Water sprays are not required for the containment of dust.

17	5	Individual storage tanks/vessels or bays should be provided in order to: ▪ separate batches of untreated and treated waste and avoid cross-contamination; ▪ separate batches of wastes that contain different contaminants, unless they are being treated together (subject to point 3 above); and ▪ isolate treated batches of waste if they contain high concentrations of a specific substance for recovery – e.g. if a high metal waste is received.	Not considered applicable; the activated carbon is stored in bags within a warehouse and which has an impermeable and bunded floor area. Wastes activated carbon arriving at the site will be stored within a quarantine area of the warehouse.
18	6	The separate storage areas and bays provided in accordance with point 5 above should be physically contained and segregated from each other and provided with separate sealed drainage systems.	
19	7	At sites where waste material may require pre-treatment (i.e. to improve its handling or treatment), adequate storage infrastructure and capacity should be available at the installation to allow for the storage of waste material before and after pre-treatment, whilst preventing cross contamination of batches and fugitive emissions to air, land and water.	
20	8	The selection of appropriate waste handling and conveyance systems should take into account the physical form/nature of the waste that will be accepted for treatment at the facility and of the material following treatment (i.e. taking into account how factors such as material moisture content, abrasiveness, plasticity and particle size may affect ease of handling), to ensure that they are capable of transporting it in an efficient and reliable manner. For example, screw conveyors may be more appropriate for wastes that are high in moisture than belt-conveyors, which may be better suited to dry materials, and grabs may be more appropriate for handling highly abrasive waste materials.	
21	9	Waste conveyance systems should be contained in order to prevent the generation of fugitive emissions (e.g. dust, steam), loss of material/spillage and odour. Where use can be justified, machinery (tractors / loading shovels) must be fit for purpose and regularly inspected and maintained.	The bags of activated carbon will be transported via an enclosed mechanical conveyor.
22	10	Adequate vehicular access should be provided where required, providing clearly marked routes for vehicle movements, which are kept clear of waste material and free from obstacles, surface water drainage systems and unprotected pipework. Measures should be provided to protect plant, buildings and storage infrastructure from vehicle movements (driving and lifting actions), i.e. through the provision of bollards, signs, adequate clearance.	A yard area of impermeable concrete construction and without any surface water drainage is available for the off-loading of the bags of activated carbon from delivery lorries. The bags are then transported into the warehouse by forklift truck.
23	11	Internal and external operational areas should be well lit to minimise the risk of spillage and to ease detection and clean-up of any dropped material.	The proposed facility will be provided with adequate lighting.

24	12	Treated material should be allowed to cool sufficiently before it is removed from the treatment plant and transported to a storage/disposal area. Systems used to handle, transfer and hold the treated material whilst it is cooling should be designed to minimise the double-handling of material and prevent potential fugitive emissions (e.g. of dust, steam and any residual volatile odorous compounds that may be released whilst the material is still hot),preferably using an enclosed system that is integral to the treatment plant.	Product exiting the process is passed through a water-cooled conveyor and charged to the product collection bin for bagging. Fines smaller than 0.3 mm will be separated in the Sizing Screen and bagged (the fines are a by-product of the process). Dust isolator valves on outlet of the fines and product bins allows changeover of bags and the prevention of air into the system.
25	13	Liquid residues recovered from the treatment process should be held in appropriate tanks/bulk storage vessels resistant to the material being stored, provided with appropriate containment measures (i.e. fully bunded and located on an impervious surface) and high level alarms. The vents on tanks that contain potentially volatile liquids (i.e. recovered oils and solvents) should be linked to suitable scrubbing and abatement systems. Tanks used for the storage of recovered liquids should also meet the requirements set out in PPG2 and HSG176, as appropriate	All liquids used for the treatment of the carbon will be recycled and reused as a medium within the facility.
26	14	Where necessary, compatibility testing must be carried out and recorded before different batches of wastes or collected residues are bulked up.	Not applicable.
27	15	Where it is assessed that there is the potential for cross-contamination of material or possible waste compatibility issues (e.g. between treated and untreated material or between materials that contain different contaminants), measures should be in place to ensure that waste handling equipment/plant are cleaned between batches/waste streams and, where possible, separate equipment/plant should be used for handling untreated and treated material.	Not considered applicable, the plant will process specific spent activated carbon from known sources.
28	16	Pipework and storage tanks should be located above-ground to aid their inspection and maintenance and ensure any leakage or spillage is identified and addressed as soon as possible.	All production plant is located above ground and will be subject to a planned preventative maintenance regime. There are no surface water drains on the proposed site. Clean rainwater from building roof and yard areas runs-off the site to soak-away to the undeveloped land to the south.
29	17	Pipework, and associated taps, valves and pumps, should: ▪ be resistant to the liquids they carry or come into contact with; ▪ where appropriate, resistant to heat; ▪ be above ground, or if below ground in lined inspection channels, and readily available for inspection and maintenance; ▪ where appropriate, be labelled as to their contents; ▪ have the minimum number of connections; ▪ be located away from main roadways or suitably protected from impact damage; and ▪ be located on impermeable surfaces with suitable containment and segregated away from surface water drains, soakaways and sumps.	The proposed plant has been designed to be compliant with these BAT requirements.
Waste treatment			

	1. Pre-treatment processing		
30	1	Waste materials with more consistent physical and chemical properties will generally result in more predictable and reliable waste treatment and plant operation and measures should be taken to ensure appropriate waste homogeneity prior to treatment. A variety of pre-treatment processes may be employed and some examples are provided below: a) Physical pre-treatment measures, such as crushing and screening, can be used to remove clumped masses and rocks etc., which can help improve material heat transfer during treatment and prevent jamming of feed conveyors or damage to the desorption plant. b) Fouling/plugging/caking of the plant may be prevented by pre-treating waste to improve the consistency of the material (e.g. reducing its plasticity). If the material contains an excessive amount of moisture, it may require pre-treatment to reduce moisture levels and thereby aid waste handling and improve the thermal efficiency of the treatment process. Air drying, dewatering (e.g. by filter-press), and mixing with drier waste material (subject to the requirements of Point 2 below) are pre-treatment processes that may help ensure that the untreated material has the desired moisture content. c) High concentrations of volatile contaminants, such as petroleum products, can result in high waste heating values, which could potentially result in over-heating and damage to the desorption plant. Subject to the requirements of Point 2 below, waste material containing excessive concentrations of volatile contaminants are sometimes pre-treated/mixed with treated waste material or waste with lower volatile contaminant concentrations in order to reduce the concentrations to an acceptable level. d) In order to limit equipment corrosion, it may be necessary to pre-treat highly acidic waste with lime or, subject to the requirements of Point 2below, other alkaline waste, in order to maintain a more neutral pH. Similarly, a highly alkaline waste may also require pre-treatment.	Not considered applicable. The spent activated carbon arriving at site is a free-flowing granular material that does not require pre-treatment.
31	2	Pre-mixing of waste(s) should only be carried out if it is in accordance with the requirements of Point 3, Section 3.	It is not intended to pre-mix the wastes.
32	3	Pre-treatment should be carried out using purpose built plant and machinery, located in designated area(s) of the installation, provided with appropriate measures to prevent and control fugitive emissions to air, land and water, and employing appropriate techniques to control potential noise, vibration and odour.	Not applicable.
33	4	Following mixing, batches of mixed waste should be re-assessed to confirm: ▪ the nature and concentration of the contaminants present and the characteristics of the waste material itself (i.e. pH, moisture content), ▪ relevant treatment criteria (e.g. treatment temperature(s) and duration). ▪ Suitability of the material for treatment in the installations thermal desorption unit (and whether any further pre-treatment is required).	Not applicable.
	2. Pre-treatment Trials		

34	1	Lab-scale bench tests and plant trials are required for each waste stream unless it is demonstrated through waste characterisation that a specific waste material has suitably comparable characteristics and contaminant compounds and concentrations to a batch of waste that has already been successfully trialled and treated using the installation's thermal desorption plant and results of these trial and treatment cycles have been documented and are available for reference.	The proposed facility will only treat spent activated carbon from known sources and of known composition. It is not proposed to undertake additional laboratory scale studies.
35	2	The Operator should pre-determine and optimise the specific operating criteria (max / min temperature range and duration) of the treatment cycle required for fully treating the identified volatile contaminants contained in the waste material. The treatment temperature range should be determined based upon a combination of literature reviews and/or the results of previous documented treatment trials or cycles, and evaluated using a test plant that is representative of the thermal desorption unit. The results of the studies and trials used to establish and confirm the treatment temperatures should be recorded and kept for future reference.	Not applicable.
36	4	The scaling of the test plant is very important, as it should ensure that conditions are representative of, and replicable in, the installation's thermal desorption unit. The temperature profile of a smaller test plant will be significantly different from that of a full-scale treatment plant unless the amount of material used in the test plant and the heating process is scaled to reflect variation in the heat transfer properties of the two plant. For example, typically, the smaller test plant will require a higher fill fraction than the full-scale plant if the heating process is to be representative.	
37	5	If the thermal desorption unit is designed to operate under vacuum or negative pressure conditions a boiling point calculator can be used to take into account the effect of pressure on the heating temperature required to volatilise the identified contaminants during the treatment cycle.	
	3. Treatment		
38	1	Treatment process parameters should be tailored to the specific properties and contaminants of the waste material; therefore, the thermal desorption unit will require an appropriate level of system flexibility if potentially variable waste materials are to be treated. The treatment cycle should be operated in accordance with the optimum operating criteria (e.g. for maximum and minimum temperature range, waste feed rate and residence time and air flow) determined by waste-specific studies and trials.	Plant operating conditions will be optimised by the plant designer/manufacturer during commissioning trials.

39	2	As far as possible and practical to do so, the thermal treatment process should be carried out in a sealed chamber in order to minimise air ingress and to prevent the release of fugitive emissions. Vacuum or low oxygen conditions (e.g. using steam or a nitrogen sweep gas) should be maintained to help prevent combustion of the waste material or volatile off-gases. Due to the nature of their operation, the treatment chambers of continuous feed units do not operate as closed systems and measures should be implemented to minimise air ingress, for example by having an automated damper arrangement on the waste charging system (e.g. on the waste delivery hopper or chute) and/or by using the waste material in the charging/outlet system to form a seal. To maintain a high level of control over air ingress in such a system it is important that waste input is continuously monitored and controlled in order to provide a consistent and continuous feed level.	Not applicable for this variation, no new thermal treatment processes proposed. The existing thermal treatment processes underwent a comparison against indicative BAT as part of the previous permit variation[4].
40	3	The thermal treatment process should subject the waste to a gradual or staged heating process. Employing low heating rates will help to avoid significant chemical changes to the waste material whilst promoting the evaporation and recovery of the full range of identified contaminants (ranging from those with the lowest boiling point to those with the highest) and avoiding the combustion of those with the highest volatility. Initially, the waste will heat up to a lower temperature (e.g. 90-100°C) at which the water content of the material will be evaporated, before heating to higher temperatures required to volatilise the identified contaminants (e.g. oil-based contaminants will start to be volatilised as the temperature of the waste reaches approximately 200°C).	
41	4	A process for mixing the waste in the treatment chamber will aid the transfer and distribution of heat within the waste material, helping to ensure even and consistent treatment, and the release of the desorbed gases. Mixing processes may also help to break up clumps of solid material in the treatment chamber and prevent the settlement/stratification of the waste and the potential formation of pockets of trapped gases. This is particularly relevant to oven-type TDU's, where the waste may remain in the treatment chamber for long periods of time, possibly in excess of 24 hours. The treatment chambers of rotary kiln TDU's are usually provided with helical flights, which help to mix and move the waste material through the treatment chamber, and oven-type TDUs are often provided with internal paddles or stirrers.	
42	5	A comprehensive inspection and maintenance programme is essential for maintaining system availability and efficiency, particularly if treating high molecular weight, viscous or adhesive materials. In rotary systems, it should be ensured that the material is able to move freely in the heating chamber and does not agglomerate or stick to the sides of the chamber. Oven systems should be designed so that waste material can be easily removed from the thermal desorption unit following treatment. Inspection and cleaning procedures are particularly important in batch oven units where waste material may remain for a longer period of time.	

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43	6	Thermal desorption represents a relatively new and novel process for treating hazardous waste in the UK. Therefore it is important that appropriate systems are in place to promote and maintain technical resilience through the documentation and sharing of internal technical experience and expertise, avoiding reliance upon external expertise or the knowledge and experience of one individual.	
44	7	Appropriate automated process monitoring and control measures must be in place to ensure that the waste is heated to the requisite temperature(s), and for the required duration, to ensure the full and effective desorption of the identified volatile contaminants, whilst preventing combustion of the contaminants or waste material.	Not applicable for this variation, no new thermal treatment processes proposed. The existing thermal treatment processes underwent a comparison against indicative BAT as part of the previous permit variation.
45	8	Time-at-temperature data should be recorded for the waste material treated in the TDU, and concentrations of the target contaminants should be measured in the solid waste material both before and after treatment, using representative samples taken from the waste material to demonstrate treatment efficacy.	
46	9	Thermocouples may be installed in the TDU to allow the temperature of the solid waste material and gas streams to be measured and recorded. Where thermocouples are used, careful consideration should be paid to the temperature and conditions the probes are designed to operate under, and the number and location of the probes to ensure that the readings taken are accurate and representative.	
47	10	The key operating parameters of the TDU should be automatically monitored and recorded in real-time to provide an accurate record of the completed treatment cycle and relevant operating conditions. Advanced process control and monitoring/data-logging systems should be employed at the facility (e.g. Systems that employ SCADA (supervisory control and data acquisition), PLCs (programmable logic controllers) and HMI (human machine interface)). Key operating parameters should include some or all of the following variables: ▪ treatment temperatures (e.g. of thermal oil, burner or heating element; gas temperatures, solid waste temperatures); ▪ treatment chamber pressure, oxygen levels, lower explosive limit (LEL); ▪ waste residence time; ▪ kiln/chamber rotation speed; ▪ sweep gas/off-gas flow rate; ▪ thermal oxidiser/boiler temperature; ▪ condenser operating temperature and process water temperature and flow; ▪ exit temperature of solid waste, gases and liquids; ▪ flow and pH of scrubber liquor; and ▪ waste charging/discharging.	

48	11	Records should be kept documenting the effectiveness and efficiency of the thermal desorption process for treating different waste materials and different contaminants. The records should report the efficiency achieved for different components successfully desorbed from waste and also for those that have not been affected by the process. Assessment of treatment efficacy should be based upon mass balance calculations carried out for the relevant contaminants. These records should be used to feedback and inform the waste acceptance criteria for the thermal desorption process.	The current regeneration plant is operated in accordance with the requirements of an environmental management system (EMS) that is maintained under the site Environmental Permit.
49	12	The thermal desorption unit should be provided with automated, controlled and enclosed mechanical feed and discharge systems, interlocked with relevant parameters of plant operation to ensure that it operates safely and effectively(for example, ensuring that waste feed cannot take place unless the TDU is operating correctly, waste cannot be discharged from the unit until the treatment process has been completed and the waste has cooled sufficiently or, in the case of a continuous rotary kiln unit, the level of waste in the inlet/outlet hoppers are sufficient to prevent excessive air entering the treatment chamber).	Not applicable for this variation, no new thermal treatment processes proposed. The existing thermal treatment processes underwent a comparison against indicative BAT as part of the previous permit variation.
50	13	Automatic system alarms and/or trips should be set for relevant operating parameters such as temperature, pressure, thermal oxidiser temperature, fan/air flow failure, waste feed, scrubber failure, quench/condenser failure.	
51	14	The extraction of off-gases from the treatment chamber should be carefully designed and controlled in order to prevent and minimise carry-over of fine particulates/solids in to the off-gas. Mixing of the gas and solid material in the treatment chamber is desirable as it can aid heat distribution, however too vigorous mixing may increase the carry-over of particulates into the off-gas filtration system.	
52	15	An appropriate sweep gas (e.g. an inert or low-oxygen gas) may be used in the treatment chamber to help draw the desorbed volatile gases through to the off-gas management and abatement system. The use of a sweep gas and gas extraction should be adequately monitored and controlled in order to prevent the formation of an explosive atmosphere, keeping concentrations of volatile gases in the treatment chamber at a concentration safely below the relevant LEL if not operated in an inert or low oxygen atmosphere.	
53	16	The following records should be maintained on site or at other approved location: ▪ Waste treatment verification results; ▪ Operating logs; ▪ Shutdown events; ▪ Monitoring process parameters; ▪ Emission monitoring results; and ▪ Failed batches and their re-treatment.	In accordance with BAT, process records are retained.
	4. Post-treatment		

54	1	The off-gas management system must be designed and operated to ensure optimal recovery of the volatised organics, which should be based upon an efficient and effective method of cooling and condensing the gases. The system must have the capacity and resilience to reliably handle the potential volume of off-gas and concentrations of desorbed contaminants generated by the TDU under the full range of operating conditions, which will be determined by the characterisation and quantity of the wastes accepted for treatment.	Not applicable for this variation, no new thermal treatment processes proposed. The existing thermal treatment processes underwent a comparison against indicative BAT as part of the previous permit variation.
55	2	The performance of the system used to cool and condense the off-gases and collect the desorbed contaminants must be monitored and maintained in order to ensure it continues to operate efficiently and effectively. Systems must be in place to detect failure or loss in the efficiency/effectiveness of the system, which should be interlocked with plant operation, so that the TDU cannot operate unless the cooling system is working effectively and efficiently.	Not applicable, the off-gases are vented via a thermal oxidiser once the maximum number of cycles has been processed through the caustic wash system.
56	3	As well as the condensable volatile contaminants, the design and operation of the off-gas management system should take into account the requirements for handling the potential volumes of water that will be desorbed from the treated waste materials. If wet wastes are treated a considerable quantity of water maybe evaporated and recovered by the thermal desorption system. The off-gas treatment system must be capable of safely and effectively managing the desorbed water along with the volatile organic contaminants.	The off-gases are vented via a thermal oxidiser once the maximum number of cycles has been processed through the caustic wash system. The installation vents off-gases from the thermal oxidiser at an elevated temperature (typically 400°C) to ensure adequate dispersion of combustion gases and water vapour.
57	4	Following removal of the condensable fractions, the uncondensed components of the off-gases will require further abatement before the gases can be emitted to air.	
58	5	The treated material should be adequately cooled before being discharged from a contained system in order to prevent fugitive releases (e.g. steam) and to ensure the temperature of the material is safely below the auto-ignition temperature of any potential residual volatile contaminants.	The caustic wash and impregnation unit is designed to operate at low temperatures. Product exiting the existing kiln is passed through a water-cooled conveyor and charged to the product collection bin for bagging.
59	6	Treated solid material should be representatively sampled and analysed for residual contaminants and other potential compounds of concern, including treated volatile contaminants and inorganic contaminants (e.g. heavy metals). It is important to determine the speciation of the metal contaminant, as certain compounds of the metal may be more toxic and harmful to the environment than others. If possible, sampling of the waste should be carried out before any water is added to the material.	Not applicable, the carbon regenerated is ready for further use, i.e., no longer a waste.
60	7	Post-treatment of the solid waste material typically entails water quenching in order to help cool the solid, control dust and aid handling. Water should be applied to the treated material in a gradual and controlled manner in order to achieve an appropriate consistency whilst preventing the leaching of residual contaminants and the generation of contaminated surface water. If the material is too hot the addition of water may produce significant quantities of steam, which, in an enclosed system, could result in over-pressurisation. In certain circumstances, for example when an immiscible solid is produced by the thermal desorption process (i.e. a solid that will not mix with water), it may be necessary to apply an appropriate additive to the quench water to improve the mixing process.	Not applicable.

61	8	Subsequent treatment of the thermally treated waste material on site (i.e. prior to recovery or disposal) should be carried out in accordance with the indicative BAT requirements set out in S5.06.	Not applicable, the regenerated carbon is bagged for dispatch without further treatment.
62	9	Condensed organic contaminants should be sent for further treatment and recovery as appropriate.	Not applicable, there are no condensed organic contaminants from the proposed installation.
63	10	To enhance their recovery, where possible, recovered liquids are often treated on site to separate the water and solvent/oil fractions of the condensed liquids (e.g. as a minimum using a gravity separation process). Such treatment activities should be carried out using appropriate tanks/vessels that are resistant to the material contained, fully bunded and located on an impervious surface, and provided with high level alarms. Appropriate tanks/bulk vessels should similarly be provided for the storage of the separated fractions.	Not applicable.
Emissions Control			
	1. Point Source Emissions to Air		
64	1	Emissions to air and associated emission control measures (including stack/vent heights) should be assessed following the methodology set out in Section 4.1 of S5.06 to ensure that releases are prevented, abated and dispersed in accordance with BAT. The assessment should be used to justify whether or not abatement is required, and if required which technique(s) represents BAT for the installation, taking into account the likely emissions, energy and raw material use, global warming potential and waste resulting from the candidate techniques.	Emissions to air from the proposed installation have been assessed in accordance with Environmental Agency Air Emissions Risk (AER) assessment technical guidance. It is considered that abatement is not required on the basis that the only new emissions to air arise from boilers.
65	2	As a minimum, point source emissions to air should meet the Benchmark Emission Values contained in Section 3.2 of S5.06.	Not applicable.
66	3	The facility should be designed and operated to prevent and minimise the release of visible emissions, including emissions of condensed water or particulates, and odour from the process.	The facility will be operated and maintained to minimise the release of visible emissions.
67	4	The Operator should only accept wastes that contain volatile contaminants that can be treated effectively by the plant, which includes the effective removal of the contaminants from the gas stream following desorption.	Not applicable.
68	5	The Operator should fully characterise emissions to air from the TDU by carrying out VOC speciation, for a representative range of operating conditions and wastes, in order to identify and quantify chemical constituents.	Not applicable.
69	6	It is likely that low concentrations of residual uncondensed volatile compounds will remain in the off-gas following its treatment (i.e. cooling/condensing), which will require abatement prior to discharge to atmosphere. Abatement must be provided which will efficiently remove or destroy the potential pollutants (including odorous compounds) from the gas stream before it is emitted to air (e.g. destruction by oxidation/combustion or removal by carbon adsorption).	Not applicable.

70	7	The performance (i.e. destruction/removal efficiency (DRE)) of the emission abatement system should be assessed and maintained on a regular basis and key parameters that determine DRE (e.g. thermal oxidiser temperature, condenser temperature) should be monitored continuously, alarmed and, where practical, interlocked with TDU operation.	Not applicable.
71	8	The pressure within the treatment chamber and the rate that gas is drawn out of it should be managed in a way that minimises the amount of particulate material that is carried over into the off-gas, whilst ensuring safe and effective treatment of the waste material and removal of the desorbed contaminants.	Not applicable.
72	9	Wet scrubbers give rise to liquid effluent, which, if not recycled into the process, requires treatment and disposal. This should be considered in the environmental assessment / BAT assessment of the installation.	Not applicable.
73	10	The prevention and minimisation of emissions should be a factor in the selection of the fuels used at the facility. The use of natural gas can reduce potential emissions of particulates compared to other fuels (i.e. oil or coal).	The new HTC boiler will be gas fired. The new caustic wash plant boiler will be designed to run on both diesel and natural gas. It is expected that the boiler will be running fully on natural gas within two years of commissioning. The air quality assessment has assumed worst-case operation using diesel fuel.
74	11	Combustion gases should be controlled through the selection of fuel (e.g. selection of low-sulphur fuels or use of electric drives for continuous rotary systems) and the design of the combustion plant (e.g. through the use of low-NO_x burners or selective catalytic reduction).	As above.
75	12	Combustion control systems and a regular programme of plant maintenance should be implemented to optimise and maintain plant efficiency and associated combustion conditions.	The proposed plant will be included on the plant maintenance and inspection schedule currently implemented for the existing installation.
	2. Point Source Emissions to Water		
76	1	Emissions to water and sewer from the treatment process should be minimal. Where possible, recovered water should be reused in the treatment process or other on-site processes, and condensed organic liquors should be sent for recovery (i.e. oil or solvent recovery processes).	Caustic wash solution will be recycled within the process, before eventually being discharged to the existing site effluent system, where significant dilution will occur prior to release. The HTC process liquor is recycled through the process to maintain energy efficiency, but some waste water will be discharged to the existing site effluent system, where significant dilution will occur prior to release.
77	2	Potential sources of waste waters include the water fraction of collected condensate, storm water runoff, cooling water and waste stockpile leachate. All such waste waters should be collected and treated as necessary, before being either re-used or discharged.	
	3. Fugitive Emissions to Air (Including Odour)		

78	1	Highly volatile contaminants may evaporate into the air during storage, therefore it is important that storage areas/bays holding wastes that contain such contaminants are provided with appropriate abated extractive ventilation and that containers holding such waste remain closed until the material is transferred for treatment.	The spent activated carbon used at the installation is not odorous (i.e. it is not sourced from facilities that would contaminate the carbon with odorous compounds).
79	2	Waste material should be stored within suitable physical enclosures provided with appropriate dust/vapour control measures to prevent and minimise potential fugitive emissions. Dust curtains can be used to contain potential fugitive releases, preventing their release outside of the waste treatment/storage building(s).	The activated carbon is stored in bags within a warehouse building.
80	3	Appropriate measures should be taken to prevent fugitive releases to air (e.g. dust, odour) from buildings used for the storage and treatment of waste, for example by keeping buildings under internal negative pressure and/or providing automatic shutter doors, which are kept shut when not in use.	The activated carbon is a granular material and considered unlikely to give rise to significant dust emissions.
81	4	The thermal desorption plant should be closed to prevent uncontrolled ingress of air and fugitive emissions. Operating the plant under a slight negative pressure can also help to prevent fugitive emissions, with the gases drawn to an appropriate abatement system.	Not applicable.
82	5	Post-treatment handling and cooling of the hot waste material should be carried out in process units that are fully enclosed and, where possible, integral to the TDU.	Not applicable.
83	6	If held outdoors, treated waste material should be stored under cover or in covered containers.	All materials are stored within the site buildings. There are no product, waste or raw material storage areas external to the site building.
84	7	A programme of site inspection and monitoring should be carried out to ensure that unacceptable levels of dust generated from the movement and handling of waste are not released.	A site housekeeping procedure which includes visual inspections of external yard areas and internal storage areas will be implemented at the installation.
85	8	A Leak Detection and Repair (LDAR) programme should be implemented at the facility for the control of potential fugitive releases.	Given the scale and nature of the proposed activities, an LDAR programme is not considered warranted, although all plant and equipment will be subjected to planned maintenance and inspection.
	4. Fugitive Emissions to Water and Land		
86	1	All waste material (treated and untreated) should be stored under cover or in covered containers, on impermeable hardstanding with sealed drainage.	All waste material (treated and untreated) will be stored in bags within the building, on impermeable hard standing with sealed drainage.
87	2	Waste material should be held in tanks, closed containers or, for solids, suitable bays, capable of holding any free liquid generated during storage, and within an area of the installation provided with appropriate secondary containment measures.	The carbon will be stored in bags after processing. The material does not give rise to free liquids.

88	3	If the waste material cannot be held in containers/skips it should be held in enclosed or shielded bays of suitable and robust construction that provide the material with adequate shelter and containment to prevent the loss of material and liquid residues.	The carbon will be stored in bags after processing.
89	4	Wherever feasible, material should be held and handled in enclosed systems.	Once charged to the plant, the activated carbon is held in sealed storage bins.
90	5	Water used for material dampening should be applied at a controlled and calculated rate and not to an extent that could promote leaching or the generation of contaminated run-off.	Not applicable, water is not used for material damping.
	5. Emission Monitoring Requirements		
91	1	Where continuous emission monitoring is not proposed or provided for the plant’s point source emissions to air specific justification must be provided to demonstrate that the proposed measures represent BAT.	It is proposed to undertake annual emission monitoring, as per the existing installation’s Environmental Permit.
Process Efficiency			
	1. Energy Efficiency		
92	1	Energy efficiency should be considered during the selection/design and operation of the TDU. The method and plant used to heat the waste will contribute significantly to the overall energy efficiency of the facility, and different systems are likely to have different efficiencies. Only indirect heating methods should be considered.	Not applicable for this variation. However, energy efficiency (and consequent reduction in energy use) is a key benefit to be realised as a result of the caustic wash and impregnation process.
93	2	Appropriate measures should be taken to identify and optimise the treatment temperature(s) and duration of operation at the treatment temperature(s) in order to maximise the energy efficiency of the treatment process (e.g. through thorough waste characterisation, pilot trials, process monitoring and control measures).	Not applicable.
94	3	It is important that the water content of the untreated waste material is assessed and, where necessary, controlled prior to treatment (i.e. through an appropriate pre-treatment process). If pre-treatment is required, a balance will usually need to be made between the energy required to reduce the moisture content of waste and the increase in the efficiency of the heating process gained from the removal of the water. It may also be advantageous to have a certain minimum amount of moisture in the untreated waste material to aid handling. The removal of volatile organic compounds can be helped by there being a moderate level of moisture in the waste material (typically between 10-20%).	
95	4	The potential for energy recovery should be considered during the design of the TDU and reviewed on an on-going basis once operational. Potential opportunities for energy recovery include the recovery of heat from hot gases (e.g. combustion exhaust gases, thermal oxidiser gases) to pre-heat sweep gases, re-heat off-gases or reduce the water content of untreated waste.	
	2. Efficient Use of Raw Materials and Water		

96	1	Process consumption of raw materials and water should be considered during the design of the TDU and should be reviewed on an on-going basis during operation. For example, during the comparison of waste cooling systems (requirements for use of refrigerants/coolants/treatment chemicals etc) and emission abatement systems (requirements for use of catalysts, filter material etc).	Not applicable for this variation. However, reduced consumption of caustic is a key benefit to be realised as a result of the caustic wash and impregnation process.
97	2	If carbon filters are used on-site for abatement purposes, spent activated carbon should be sent for recovery and re-use where possible.	Not applicable.
98	3	It may be possible to reuse dried treated material to condition wetter untreated material in order to improve its properties for handling and/or treatment. However, any mixing process must be carried out in a way that meets the requirements of BAT.	
99	4	Wherever possible, cooling waters used at the facility should be re-circulated and re-used.	
100	5	Water added to treated waste material (i.e. in order to dampen it and prevent fugitive dust emissions) must be applied in a controlled manner.	
	3. Waste Minimisation		
101	1	Some of the waste streams produced by the treatment process may be suitable for recycling or reuse in the process. For example, if suitable, recovered water could be re-used on-site, primarily to suppress dust emitted from the treated waste material before or after it exits the treatment plant. Opportunities for recycling/reusing waste on-site should be considered during plant design, and should be reviewed on an on-going basis during plant operation.	There are no significant wastes arising at the installation (other the small quantities of maintenance machine oils and lubricants). The carbon fines recovered from the processes are bagged and dispatched to the customer as a by-product.
102	2	The condensed desorbed contaminants should be stored on-site before being sent for further treatment and recovery (for example, as a recovered fuel oil/processed fuel oil or Cemfuel).	Not applicable, there are no condensed contaminants from the process.
103	3	Where suitable, and appropriate measures are in place to prevent potential fugitive emissions, fine material collected from the off-gas by the particulate abatement system may be mixed with the contaminated feedstock for reprocessing/ re-conditioning.	Not applicable, the proposed installation does not require a particulate abatement system.
104	4	Spent carbon filter material should be sent for reactivation and reuse i.e. to the original supplier or other processor.	Not applicable, the proposed installation does not use carbon filters.
105	5	Where possible, consideration should be given to the use of processed fuel oil as a source for the heating/drive energy generation.	The new HTC boiler will be gas fired. The new caustic wash plant boiler will be designed to run on both diesel and natural gas. It is expected that the boiler will be running fully on natural gas within two years of commissioning. The air quality assessment has assumed worst-case operation using diesel fuel.
Accident Management			

106	1	Process control systems should be designed to include provisions for a safe shut-down with minimum emissions (point-source and fugitive) from the plant. Measures should be in place to ensure that waste feed supply is controlled or terminated, as appropriate, followed, where necessary, by a pre-programmed and automated sequence of plant shut-down, which is designed to ensure that the treatment process is controlled in a safe manner and potential emissions are minimised.	The proposed plant will include a PLC controlled automatic shut-down system.
107	2	Where necessary, an uninterrupted power supply should be guaranteed for key process plant and other plant designed to fail to safe in the event of power failure.	The plant includes an emergency drive that runs off a 24VDC system and is designed to run for 2 hours off a battery support system.
108	3	Appropriate precautions should be taken to minimise the risk of fire or explosion and to minimise the environmental consequences should a fire occur. Volatile gases released/desorbed from the waste material may have the potential to form explosive atmospheres. Areas of the site where flammable or explosive atmospheres may occur (e.g. waste storage, handling and processing areas) should be assessed and, where appropriate, classified into hazardous zones, in accordance with the requirements of DSEAR.	An emergency plan will be prepared for the proposed installation prior to plant start-up.
109	4	The Operator should produce emergency response plans for the potential accidents identified and assessed by the facility's accident management plan. Emergency plans should provide information on the layout of premises, type, quantity and hazards of materials onsite, location and type of firefighting equipment, the name of contacts in case of emergency and, where possible, be drawn up in consultation with the local fire service.	
110	5	Procedures and training should be in place to manage identified risks and ensure the rapid initiation of the emergency plan should an accident occur. Where possible, the Operator should involve the emergency services in relevant emergency training activities.	Emergency response and training procedures have been implemented in accordance the installation's existing Environmental Permit. These procedures will be amended to include the proposed plant.
111	6	The design and operation of sealed batch-operated TDUs, and other plant /equipment that operate under pressure (e.g. vessels, pressurised storage containers, heat exchangers, shell and water tube boilers, pipework, safety devices and pressure accessories) may be subject to the requirements of the Pressure Systems Safety Regulations (PSSR).	The plant equipment will be reviewed and included as appropriate on the existing installations pressure systems register.
112	7	At sites where combustible fine dusts are generated, handled or processed the design and operation of the facility should take into consideration the potential for dust explosion hazards.	A risk assessment will be undertaken and included in the emergency response plan for the proposed installation.

5 Emissions and Monitoring

5.1 Emissions to Air

All of the existing emission points are listed in Table 5.1, inclusive of the new emission points.

Table 5.1 – Existing Point Source Emissions to Air

Emission Point Reference	Source	Location
A1	MHT1 vent stack	See Figure 2.3
A2	MHT2 vent stack	
A3	No longer in use	
A4	MHT2 bag filter exhaust	
A5	CR1	
A6	CR2	
A7	Gas fired boiler	
A8*	HTC Plant	
A9 (new)	Impregnation Drier Exhaust	
A10 (New)	Caustic Wash Boiler Exhaust	

*Referenced in existing permit but not regulated due to the HTC plant being included as a pilot plant.

Considering the proposal under the EP variation, only emission point A8 will be affected. In addition, the variation introduces new emissions to air, through A9 and A10. As such, A8, A9 and A10 have been put forward for further consideration.

The nature of the emissions arising from A8 will primarily consist of:

- Oxides of nitrogen (NO_x);
- Particulate Matter (PM);
- Sulphur dioxide (SO_2); and
- Carbon monoxide (CO).

The nature of the emissions arising from A9 will primarily consist of:

- Oxides of nitrogen (NO_x); and
- Carbon monoxide (CO).

New emission point A10 will be designed to run on both diesel and natural gas. However, it is expected that the boiler will be running fully on natural gas within two years of commissioning. The nature of the emissions arising from A10 will primarily consist of:

- Oxides of nitrogen (NO_x);
- Carbon monoxide (CO); and
- Sulphur dioxide (SO_2) (only applicable if diesel is used).

Other emissions will include carbon dioxide and water vapour.

Further details regarding the new emission points are provided in Table 5.2. Emission rates and stack parameters for the new emission points have been derived from manufacturer's information.

Table 5.2 – Point Source Emissions to Air Considered Further

Release point ref.	Point Source Description	Location X, Y (m)	Stack height (m)	Stack diameter (m)	Efflux velocity (m/s)	Total flow (Am^3/h)	Exhaust temp (°C)
A8	HTC Scrubber exhaust	TA 1856116012	7.5	0.45	8.73	5,500	30
A9	Impregnation Drier Exhaust	TA 1854816012	15	0.3	1.96	500	300
A10	Caustic Wash Boiler Exhaust	TA 1856916047	4	0.25	2.88	508	205

5.2 Emissions to Water

The proposed variation does not introduce any additional emission points to water, however, this EP variation includes the proposal to increase the water flowrate limit from 500 m^3/day to 1,200 m^3/day as a seven-day rolling average. In terms of process wastewater, full operation of the HTC unit is expected to increase wastewater discharged via W1 by approximately 456 m^3/annum, which is equivalent to a 0.33% increase relative to the current baseline scenario.

Therefore, W1 (effluent discharge) has been taken forward for further consideration. Its location is shown on Figure 2.3, approximate OS grid coordinates are TA 1839 1636.

5.3 Odour

The proposed changes will not introduce a source of odorous emission or affect current production operations, which do not give rise to odour effects at off-site receptors. If CPL are notified by the Environment Agency that the activities are giving rise to pollution outside the site due to odour, an odour management plan which identifies and minimises the risks of pollution from odour will be submitted to the Environment Agency for approval.

5.4 Noise and Vibration

Current production activities do not give rise to noise or vibration impacts. The proposed changes will not significantly affect noise and vibration levels at the site. If CPL are notified by the Environment Agency that the activities are giving rise to pollution outside the site due to noise and vibration, a noise and vibration management plan which identifies and minimises the risks of pollution from noise and vibration will be submitted to the Environment Agency for approval.

5.5 Monitoring

This section describes the proposed monitoring strategy for emissions monitoring for the emission points considered within this variation, which will align with what is already contained within the permit for existing emission points.

CPL is committed to monitoring its pollutant releases as covered in the permit and has an appropriate management structure in place to ensure monitoring is effectively carried out and reported to the Environment Agency in a timely manner.

5.5.1 Monitoring Emissions to Air

Pollutant emission levels are dependent on the efficiency of the processes, as well as the quality and quantity of the fuel used. The emissions are controlled by the plant design and adherence to appropriate operating parameters. The proposed sampling methodologies for key pollutants are in line with those for emission point A6, shown in Table 2.3.

5.5.2 Monitoring Emissions to Water

In line with the minimal changes proposed, it is considered that the current requirements pertaining to monitoring of emissions to water should remain. This includes the measurement and reporting of flowrate, temperature, oil and grease and pH, as reported in Table 2.4.

5.5.3 Off-Site Monitoring

Off-site monitoring (e.g., odour, noise, dust, etc.) is not considered necessary given the low potential environmental impact of the proposed changes to the permit.

6 Impact Assessment

An impact assessment has been undertaken for the Immingham Works in order to assess the potential environment impact from its emissions and to evaluate those impacts in line with sensitive receptors which may be affected by activities undertaken at the Site.

The impacts of releases from activities at the Site are discussed in this section and include:

- H1 Environmental Risk Assessment for Emissions to Air and subsequent detailed dispersion modelling; and
- H1 Environmental Risk Assessment for Emissions to Water.

6.1 Summary of Emissions to Air

The following section collates the information presented in the assessment of emissions to air and summarises the impacts in terms of the following:

- Calculation of Process Contribution (PC) from all emission points to air currently operational;
- Estimation of Predicted Environmental Concentration (PEC);
- Conclusions

Sources of emissions to air from the Immingham site are described in Section 3 of this report, as well as the Air Quality Impact Assessment report, presented in Appendix B. Details of the stack parameters modelled for each of the emission points summarised in Table 5.2 are provided in Table 6.1, including the reasoning for differing operating conditions for emission point A10.

Table 6.1 – Modelled Stack Parameters

Parameter	A1	A2	A4	A5	A6	A7	A8	A9	A10 (high fire)	A10 (combined low + high fire)
Exhaust Conditions										
Temperature (°C)	-	195	65	107	120	200	30	300	234	205
Stack diameter (m)	1.25	1.03	0.47	0.65	0.5	0.5	0.45	0.3	0.25	0.25
Stack height (m)[A]	29.8	38	9.2	18.5	18.5	7	0.45	0.3	4	4
Volume flow (Am^3/s)	-	26713	2412	3279	1332	706	5000	500	2100	508
Actual oxygen content (%)	-	11.5	19.6	12	12	3.5	19	5	5	5
Actual moisture content (%)	-	22.5	6.2	23	7	8	4	9.5	6.2	6.2
Mass Emission Rates										
NO_x (mg/m^3)	-	98.1	-	118	100	475	414	0.12 (g/kWh)*	192	123
NO_x (g/s)	-	0.173	-	0.03	0.012	0.093	0.053	0.014	0.069	0.011
PM (mg/m^3)	-	31	43.7	1.3	7.5	-	176	-	-	-
PM** (g/s)	-	0.055	0.002	0	0.001	-	0.022	-	-	-
SO_2 (mg/m^3)	-	206.5	-	0.3	10.8	-	14	-	2.62	2.62
SO_2 (g/s)	-	0.364	-	0.0001	0.001	-	0.002	-	0.0009	0.0002

[A]: metres above ground level. Reported at 273 K, 101.3 kPa, dry gas.

*Data from technical specification sheet reported in g/kWh.

**No data available on particle size analysis, so total particulate matter data used to assess against the relevant air quality limits for PM_{10} and $PM_{2.5}$.

6.1.1 Environmental Assessment Levels (EALs)

The Environment Agency's Risk Assessment for a specific activity provides methods for quantifying environmental impacts of emissions to all media. The *air emission risk assessment for your environmental permit guidance* (AER guidance) contains long- and short-term Environment Assessment Levels (EALs) and Environmental Quality Standards (EQSs) for releases to air. For the pollutants considered in this assessment, these assessment levels are equivalent to the AQSs and AQOs set out in legislation in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland.

The AER guidance provides a three-tiered approach to assessment the significance of emissions to atmosphere. The first stage calculates the appropriate PC from each source and "screen out" insignificant emissions to air, which incorporate emission sources that emit in small quantities such that they are unlikely to cause a significant impact at sensitive receptors. The screening criteria is provided in Figure 6.1.

Figure 6.1 – Screening Criteria for Insignificant PCs

> To screen out a PC for any substance so that you don't need to do any further assessment of it, the PC must meet both of the following criteria:
>
> - the short-term PC is less than 10% of the short-term environmental standard
> - the long-term PC is less than 1% of the long-term environmental standard
>
> If you meet both of these criteria you don't need to do any further assessment of the substance.
>
> If you don't meet them you need to carry out a second stage of screening to determine the impact of the PEC. Record the PCs for your insignificant emissions in your risk assessment.

The second stage is to calculate the PEC from each source (incorporating existing background pollutant levels) and to assess the need for detailed dispersion modelling of emissions to air (see Figure 5.2) If the second stage indicates that a more detailed assessment is required, appropriate dispersion modelling software, such as ADMS or AERMOD should be used. Detailed dispersion modelling constitutes the third stage of the assessment approach.

Figure 6.2 – Criteria for Detailed Modelling

> In the second stage of screening if you meet both of the following requirements you don't need to do any further assessment of that substance. You'll need to do detailed modelling of emissions that don't meet both of the following requirements:
>
> - the short-term PC is less than 20% of the short-term environmental standards minus twice the long-term background concentration
> - the long-term PEC is less than 70% of the long-term environmental standards

The AER guidance effectively supersedes the old H1 guidance, using a similar methodology. For consistency with previous permit variations at the Immingham site a screenshot of the H1 Environmental Risk Assessment for Emission to Air has, however, been submitted as part of the air quality assessment.

6.2 Summary of Emissions to Water

The following section collates the information presented in the assessment of emissions to water and summarises the impacts in terms of the following:

- Estuaries and coastal waters specific pollutants and operational environmental quality standards (EQS); and

- Estuaries and coastal waters priority hazardous substances, priority substances and other pollutants environmental quality standards (EQS).

Sources of emissions to water from the Immingham site are described in Section 3 of this report, as well as the Water Impact Assessment report, presented in Appendix C.

The site currently operates with a discharge consent of 500 m^3/day as a seven-day rolling average from emission point W1. CPL wish to increase this to 1,200 m^3/day. This has been prompted by the need to discharge a greater volume of surface water runoff since more land has been acquired at the Site. On-site process wastewater also discharges to W1 after having been treated through the Site's effluent treatment system.

It is estimated therefore that due to the varied operation of HTC as detailed within this variation, there will typically be an increase in process wastewater discharged via W1 by approximately 456 m^3/annum, which is equivalent to a 0.33% increase relative to the current baseline scenario.

The following scenarios were considered with regard to emissions to W1, for assessment against the Environment Agency Surface Water Pollution Risk Assessment[5] (SWPR) guidance:

- Scenario 1: baseline scenario (as currently operating).
- Scenario 2: proposed scenario (current operations + full operational HTC unit).

6.3 Impact Assessment of Emissions to Air

An H1 assessment of emissions to air was undertaken, this indicated that a detailed assessment would be required to fully assess any air quality impacts. Consequently, a detailed dispersion modelling assessment was undertaken, which is presented in Appendix B.

The dispersion modelling assessment has included all emission points to air listed in Table 6.1. The model has been based on all sources operating for all hours of the year (8,760 hours) and a conservative assessment has been demonstrated by using worst-case meteorological data for the reporting of results and inclusion of the impacts of buildings. A summary of those receptors experiencing the highest pollutant concentration as a predicted Process Contribution is presented in Table 6.2.

Human receptors included in the assessment comprise long-term receptors (e.g., residential properties) and short-term receptors (e.g., within industrial park) and ecological receptors comprise those at the nearby Humber Estuary Ramsar/SSSI/SAC/SPA.

[5] https://www.gov.uk/guidance/surface-water-pollution-risk-assessment-for-your-environmental-permit

Table 6.2 – Maximum Impacts at Human and Ecological Receptors

Pollutant averaging period	AQAL ($\mu g\ m^{-3}$)	Max. PC ($\mu g\ m^{-3}$)	PEC ($\mu g\ m^{-3}$)	% max. PC of AQAL	% PEC of AQAL
Human receptors					
Annual mean NO_2	40	0.10	13.73	0.2%	34.3%
99.79 percentile 1-hour mean NO_2	200	2.56	29.81	1.3%	14.9%
Annual mean PM_{10}	40	0.02	13.37	0.1%	33.4%
90.41 percentile 24-hour mean PM_{10}	50	0.11	26.81	0.2%	53.6%
Annual mean $PM_{2.5}$	20	0.02	8.30	0.1%	41.5%
99.9 percentile 15-minute mean SO_2	266	1.51	15.51	0.6%	5.8%
99.73 percentile 1-hour mean SO_2	350	1.14	17.64	0.3%	5.0%
99.18 percentile 24-hour mean SO_2	125	0.65	14.65	0.5%	11.7%
Ecological receptors					
Annual mean NO_x	30	0.26	21.70	0.9%	72.3%
Daily mean NO_x	75	4.24	90.97	5.7%	121.3%
Annual mean SO_2	20	0.19	10.18	1.0%	50.9%

All maximum results predicted by the model are below the relevant assessment metric for human receptors and, as such, it is considered that air quality impacts from the Immingham Site will not have a detrimental impact at human health receptors in the proximity of the Site.

For concentrations in air at ecological receptors, although exceedances have been predicted, these are due to the existing background levels and the process contribution from the site can be described as not significant.

For deposition results at ecological receptors (see Appendix B, Air Quality Assessment), there are two receptors for which further consideration has been required, as PC results are above the 1% significance threshold. However, it has been noted that as an estuarine environment, the tide is washing these areas twice a day, preventing the accumulation of deposited pollutants. In addition, as these receptors are within the boundary of the port, it is uncertain whether the critical loads for acid would apply in these areas.

It can be considered, therefore, that the air quality impacts of the existing and new plant at the Immingham Briquetting Works can be considered as not significant for concentrations in air. With regard to deposition results, nitrogen deposition results can be described as not significant. For acid deposition, given it is unlikely that qualifying ecological features are present in these areas and the PC increment compared to the existing background levels is extremely low, it is considered that effects of acid deposition from the CPL site on the Humber Estuary is unlikely.

6.4 Impact Assessment of Emissions to Water

The only additional process wastewater as a result of the permit variation will be as a result of amending the current HTC pilot plant to a fully-fledged operational unit. Wastewater from the caustic wash and impregnation processes has not been included within the scope of this assessment, due to there being no additional wastewater resulting from this plant (see section 3.4).

The primary reasoning behind the request to increase the water discharge limit from 500 m^3/day to 1,200 m^3/day as a seven-day rolling average is to incorporate an increase in surface water runoff. However, in order to demonstrate a worst-case assessment, this assessment only focuses on the change in process wastewater (i.e., including effluent from the proposed HTC unit increased usage).

Screening of emissions to water is required when any of the following conditions are met:

- Take the water from groundwater and discharge it to surface water.
- Use the water in a process which concentrates the existing pollutants before it's discharged, for example water which is used for cooling and therefore partially evaporates.
- Keep the water before you discharge it, and you make the quality of river worse than its quality when the water was taken.

Whilst the varied process therefore meets the above criteria and therefore the screening of emissions to water is required, it should be noted that there are no new point source emissions to water associated with the requested permit variation.

The existing wastewater from Site is mainly associated with cooling related activities associated with the briquetting and, to a lesser extent, with the carbon regeneration processes (the majority of the water is recycled), in addition to the site surface drainage. On this basis, the most appropriate screening is therefore that for discharges into cooling water which are then discharged to estuaries or coastal waters.

There are three stages to the SWPR screening process:

- Identify the pollutants released from your plant.
- Gather data on your pollutants before screening them.
- Carry out screening tests on the data.

The first stage of the screening process requires identification of any hazardous pollutants that are likely to be in the discharge from the site. Potentially hazardous pollutants of relevance to this study are listed in the following tables:

- Estuaries and coastal waters specific pollutants and operational environmental quality standards (EQS).
- Estuaries and coastal waters priority hazardous substances, priority substances and other pollutants.

EQSs are provided for long-term and short-term averaging periods in the form of Annual Average EQS (AA-EQS) and Maximum Allowable Concentration EQS (MAC-EQS).

On the basis of the screening tests, the parameters scoped into the assessment are shown to be above the water screening AA-EQS' and MAC-EQS'. However, this is the case for Scenario 1 (baseline) as well as Scenario 2 (proposed).

Therefore, the focus of the assessment is to evaluate the potential change in levels as a result of the expanded HTC process i.e., the change as a result of the proposed permit variation. This recognises that the screening criteria are conservative and apply at the point of discharge when, in fact, the CPL discharge will be further diluted in the ABP drainage system before being discharged to the Humber Estuary (where it will then be diluted even further).

Table 6.3 provides a comparison of water screening results between Scenarios 1 and 2. It demonstrates minimal changes with regards to increases in contaminant loadings. It is also important to note that Scenario 2 data is based on one sample from the HTC process effluent, for which the majority of parameters were below the limit of detection; it is therefore likely that the actual contaminant figures associated with the expanded HTC process effluent will be less than the values reported.

Table 6.3 – Summary of Water Screening Results

Parameter	Scenario 1 Average Concentration (µg/l)	Scenario 2 Average Concentration (µg/l)	Percentage Change from Scenario 1 to Scenario 2
Copper (Cu)	299	299	<0.01%
Zinc (Zn)	760	829	9.1%
Lead (Pb)	10	<11.6	<16.0%

Parameter	Scenario 1 Average Concentration (µg/l)	Scenario 2 Average Concentration (µg/l)	Percentage Change from Scenario 1 to Scenario 2
Cadmium (Cd)	0.19	<0.22	<15.8%
Mercury (Hg)	-	-	-
Nickel (Ni)	136	<136.2	<0.2%
Chromium (Cr)	61	<61.5	<0.8%
Arsenic (As)	79	<80.4	<1.8%

Given that the EA request bulk discharge data from CPL on an annual basis, a summary of the potential changes as a result of the addition of the HTC unit to a fully-fledged unit is provided in Table 6.4 below.

Again, it is important to note that Scenario 2 data is based on one sample from the HTC process effluent, where the majority of parameters were below the limit of detection.

2022 bulk discharge data has been estimated for comparison, based on the following:

- 2022 (estimated), which uses 2021 data + HTC data.
- 2022 (YTD scaled), which uses pro-rata data from January and February 2022 + HTC data.

When incorporating the HTC effluent values into the 2022 bulk discharge returns, the results remain consistent with the 2021 return, in that the addition of HTC does not push parameters over the reporting limit. Those results shaded green are below the relevant limit.

Table 6.4 – Proposed Bulk Discharge Data (kg)

Parameter	As	Cd	Cr	Cu	Hg	Ni	Pb	Zn
Reporting Limit (kg)	**5**	**1**	**20**	**20**	**0.1**	**20**	**20**	**100**
2021 (current)	9.43	0.028	9.25	45.40	0.007	20.6	1.51	115.5
HTC only	<0.23	<0.005	<0.09	0.10	<0.023	<0.1	<0.23	9.9
2022 (estimated)	<9.66	<0.033	<9.34	45.50	<0.030	<20.7	<1.74	125.4
2022 (YTD scaled)	<14.80	<0.04	<8.32	9.81	<0.01	<21.33	<1.41	67.89
% change (2022 YTD versus 2021)	<57%	<33%	-10%	-78%	-22%	<3%	-7%	-41%

It is important to note that through 2022 contaminant loading of some pollutants is expected to decrease, due to plant refurbishment through 2021 and increases in the price of copper reducing the amount used in the impregnation process (see water assessment for details[6]).

Putting the results into context, it is important to note that the Humber Estuary is one of the largest estuaries, going into the North Sea. As such, it follows that significant dilution will take place upon discharge.

[6] AIR10541342_CPL_Immingham_WIA_Final_i1.pdf, Bureau Veritas, April 2022

On this basis, releases to water as a consequence of the varied site activities as detailed within this variation are not expected to cause adverse effects upon the Humber Estuary.

7 Resource Efficiency

7.1 Raw Materials Consumption

The material input to the HTC process is detailed in section 3.2, and comprises wastes from the MFSU of pharmaceuticals. It is primarily carbon-based (80%), with small amounts of ash (10%), moisture (5%), phenol (5%) and of trace compounds.

This is the only additional raw material to be brought in as a result of the variation and the raw materials that are already used will continue to be handled in line with the existing site procedures. Relevant operating personnel are experienced in acceptance and handling of the raw materials and new personnel will be given appropriate training and personnel training records will be maintained in accordance with existing management system procedures.

The amount of pharmaceutical waste to be used in the HTC process will be approximately 10 tonnes per annum. The raw materials will be transported to site in a one tonne vessel every five weeks. The raw material will be safely transferred and stored according to the existing procedures for the carbon regeneration process. 100% of the raw materials delivered will be used within the process.

Relevant operating personnel are experienced in the acceptance and handling of the spent activated carbon. Any new personnel will be given appropriate training and personnel training records will be maintained in accordance with existing management system procedures.

In addition, one of the benefits of the new caustic wash and impregnation unit will be a reduction in raw materials use, in the form of a reduced requirement for caustic soda. The current thermal regeneration process uses 0.33 t/t of caustic soda; use of the new caustic wash and impregnation process will reduce this to 0.28 t/t, equivalent to a ~15% reduction.

7.2 Water Consumption

Water consumption at the Site is monitored as part of the requirements of the current EP and EMS, which is reported to the Environment Agency annually.

The operation of the varied site activities as detailed within this Variation will not significantly affect site water consumption. The proposed HTC activities covered by this permit will incur additional water consumption of approximately 0.2 m^3 per tonne of input, which would equate to an extra ~456 m^3 per annum. This is against an overall total water consumption at the site of 170,982 m^3 in 2020 and represents an increase in water consumption of less than 1%.

7.3 Energy Efficiency

Energy efficiency at the installation is managed in accordance with current Permit conditions. The energy consumption at the site is expected to rise as a result of the variation to the HTC unit, but the process is designed to assist CPL with its ongoing commitment to replace coal-based fuels and activated carbons with biomass-based materials.

The caustic wash and impregnation unit uses lower temperature liquid phase processing to achieve a similar level of carbon regeneration (i.e., there is no requirement for processing at high temperature and subsequent scrubbing of off-gases). For a tonne of carbon processed, the total energy consumption of the proposed new process is 550 kWh. By comparison, the equivalent consumption for current thermal regeneration is 1,125 kWh. This results in an energy saving of 575 kWh per tonne and therefore, with 1,000 tonnes processed per annum (i.e., 25% of the current incoming 4,000 tonnes), this would result in an energy saving of 575 MW per annum on this process.

Gas and electricity consumption at the site are monitored and reported to the Environment Agency every year. Depending on production throughput, consumption associated with the current site operations is currently:

- a) Natural gas – 53,453 MWh/y.

- b) Electricity – 8,696 MWh/y.

An estimation of the additional energy usage based on the system requirements is based on standard assumptions with regard to operational hours, and is as follows:

- Natural gas: 10 m^3/hr per 100 kW → 285 days at 100 kW = 615 MWh/y.
- Electricity: 285 days at 30 kW = 205 MWh/y.

7.4 Waste Disposal

The activities covered by the variation will not produce additional waste solids. In fact, the caustic wash and impregnation unit provides a benefit in this respect, as currently, the only other way to deal with high-sulphur spent carbon is to process it through landfill, which the new process avoids by offering a method of recycling.

However, the operation of the HTC Plant will lead to waste liquid in the form of excess process liquor. The process liquor is recycled through the process to maintain energy efficiency, but some waste will be produced.

With regards to waste produced, 24 tonnes of input to the HTC Plant produces 5 m^3 of excess process liquor. Using the data provided in section 7.1, 2,394 tonnes of raw material would result in ~500 m^3/annum waste liquid. The additional wastewater will be treated through the existing effluent system, as described in section 3.4.

8 Environmental Management System and Emergency Response

The works operates an integrated management system which fully integrates the Safety, Health, Environment and Quality (SHEQ) Management Systems. Further detail is provided in the following sections.

8.1 Planning

The senior management of CPL are committed to high standards of protection for people and the environment; this is further stated via company policies and procedures. The key commitments include the establishment of management systems to aid control of Safety, Health, Environment and Quality; the communication of information to those that work on behalf of the organisation that could potentially have an impact upon these systems; selection criteria for personnel within key roles which have a potential impact upon these systems; training of personnel; objectives and targets to drive continual improvement and allocation of resources to ensure systems are implemented and developed to a high standard. Roles and responsibilities within the management system are defined within the integrated management system procedures and documented in specific employee job descriptions. A full analysis of significant environmental aspects has been undertaken and is managed in accordance with documented operational control procedures of the integrated management system.

The CPL Safety, Health, Environment and Quality Management System requires that all major hazards are identified, and the risks associated with those hazards are either eliminated or reduced through the implementation of operational controls (e.g. instrumented process controls, procedures, work instructions, training, etc). Compliance with these objectives is achieved through Works Management Monitoring Programme that includes on-site risk assessments; internal maintenance and inspections programmes; and the auditing procedures of the integrated management systems.

Objectives and Targets are established and documented within the management system for improving the environmental performance of the installation. Specific performance monitoring programmes have been established for:

- Maintenance and Inspections;
- Legal Compliance;
- Monitoring and Measurement;
- Site Drainage;
- Occupational Health and Safety;
- Personnel Management;
- Training, Awareness and Competence;
- Emergency Preparedness and Response;
- Record Review and Documentation; and
- Operational Control.

8.2 Competence and Training

A core principle of the site integrated management system is that all employees are adequately trained by both induction and continuous job specific training; this is to ensure that employees carry out their duties in a safe, controlled, and effective manner. Site procedures fully detail staff training and competency assessments requirements.

All job positions on site have 'Training Needs Schedules' which detail the training requirements with respect to the employee's roles and responsibilities.

Job specific training is provided by the employee's line manager, with refresher training undertaken where identified through the Training Needs Schedule. A separate competency assessment is also undertaken, which must be passed before an employee is allowed to work unsupervised on the site. All training and competency assessments are recorded in the employee training logs which are retained on site.

The contractor selection process includes an assessment of the type and nature of the work, previous work undertaken; references; and proposed working methods. All contractors are required to attend induction training prior to working on site. The induction programme includes an explanation of the site's expectations in respect of general behaviour, site hazards, personal protective clothing, response to alarms, incident reporting, and operation of the permit-to-work system.

8.3 Operations and Maintenance

A formalised procedure is incorporated within the EMS to identify the organisation's activities and aspects that have a direct/indirect impact upon the environment. Further systems are used to manage the major risks arising from all changes in storage facilities, installations, systems and resources.

Inspection, testing and maintenance performance is measured using reactive and proactive techniques. Reactive techniques include formal systems for reporting, investigating, analysing accidents, near-miss, dangerous occurrences, non-conformances and defects in plant and equipment. Proactive techniques include supervision and surveillance. The measurement, inspection, testing, condition monitoring and maintenance is carried out through a centralised computer Asset Management System, which enable the site management to monitor the completion and retain historical records of all work completed on site.

8.4 Audit

The management system and operational control procedures are subject to internal audits by appropriately trained personnel. The frequency of audits is documented within an audit schedule and the findings recorded and actions taken via the Works Manager.

The appropriateness, effectiveness and relevance of the management system are assessed through a Management System Audit. The audit comprises a formal audit of all components of the system and includes ensuring internal audits and any subsequent actions are carried out according to agreed timescales.

The audit programme addresses maintenance/manufacturing; legal compliance; monitoring and measurement; inspections; drainage; waste; training awareness and competence; aspect management; and operational control.

In addition, documented procedures have been prepared for the reporting and investigation of accidents/incidents on site and for evaluating and assigning appropriate corrective and preventative actions for identified non-conformances.

8.5 Emergency Response

CPL already have a detailed Emergency Plan for the site, a copy of which is provided in Appendix E.

The objectives of the Emergency Plan are to contain and control major incidents on-site and to react to major incidents at other sites on the dock. The Plan follows an assessment of the situation followed by a hierarchy of responses:

- Primarily to safeguard employees working on the site and any other persons which may be affected by an on-site incident;
- Secondly to safeguard the environment by adequate containment of the incident to minimise emissions; and
- Thirdly to minimise damage to plant.

The Emergency Plan is designed to be capable of dealing with the largest incident that can be reasonably foreseen but concentrates on those events that are most probable. The Plan is flexible so that the response can be tailored to the severity of the incident. The assessment is carried out by the experienced supervisors on site and then reassessed by the senior plant management. The following key elements are included in the Emergency Plan:

- Activation of Emergency Plan;
- Key Emergency Personnel;
- Duties of Key Personnel;
- Key Emergency Areas and Services;
- Plant Shutdown/Isolation;
- Details of Hazardous Materials on Site;
- Emergency Call-out listing Tel Numbers and Addresses;
- Civil Disturbance, Bomb Threat etc;
- Communications with the Media;
- Incident Reporting Procedure;
- Flooding Plan;
- ABP Emergency Plan;
- Spillage Action Plan;
- Fire Extinguisher Listing; and
- Fire Prevention and Control.

The Plan is a live document and is currently in the process of being updated to be representative of the updated site processes as prescribed in this requested permit variation. The updated Plan will be cascaded through the SHEQ Management Systems so that all CPL employees have the necessary awareness to safeguard CPL employees' wellbeing and that of the local environment should an emergency arise.

9 Information

9.1 Records

Documents are retained electronically where possible, although some records are hard copies (e.g., copies of plant conditions and performance). All records are:

- Legible;
- Compiled as soon as reasonably practicable;
- Document in such a way that, where amendments are made, the original record and any changes are recorded and retrievable; and
- Retained for a minimum of four years or until permit surrender.

9.2 Reporting

All reports required to comply with the permit will be provided to the Environment Agency to the address that will be provided. The reports will be retained in accordance with the procedures outlined in the appropriate sections of the permit.

9.3 Notification

CPL will notify the Environment Agency without delay following the detection of:

- Any malfunction, breakdown or failure of equipment or techniques, accident or emission of a substance not controlled by an emissions limit which has caused or may cause significant pollution; and
- Any significant adverse environmental effect.

All notifications will be recorded and reported in line with the appropriate sections of the permit.

Appendix A – Terms and Definitions

Term	Definition
AQO	Air Quality Objective
AQS	Air Quality Standard
BAT	Best Available Technique
BOD	Biological Oxygen Demand
BREF	BAT Reference Documents
CERC	Cambridge Environmental Research Consultants
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
Defra	Department for Environment, Food and Rural Affairs
EAL	Environmental Assessment Level
ELV	Emission Limit Value
EMS	Environmental Management System
EPR	Environmental Permitting Regulations
EQS	Environmental Quality Standard
EU	European Union
g/s	Gram per second
HTC	Hydrothermal Carbonisation
LAQM	Local Air Quality Management
MAC	Maximum Allowable Concentration
mg/l	Milligram per litre
mg/m^3	Milligram per cubic metre
m/s	Metres per second
NO_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen
PC	Process Contribution
PEC	Predicted Environmental Concentration
TOC	Total Organic Carbon
µg/l	Microgram per litre
$µg/m^3$	Microgram per cubic metre

Appendix B – Air Quality Impact Assessment

Appendix C – Water Impact Assessment

Appendix D – Application Forms

Appendix E – Emergency Plan