



Coal Products Limited

Immingham Briquetting Works

Application for a Variation to Environmental Permit DP3134LK

January 2024



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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:

- Request to implement and operate a new Pyrolysis Plant used to process sustainable biomasses into a bio-stable char.
- The request to amend related activities, comprising of three new waste codes.

The site address is:

Coal Products Limited (trading as CPL Products)

Immingham Briquetting Works

Western Access Road

Immingham Docks

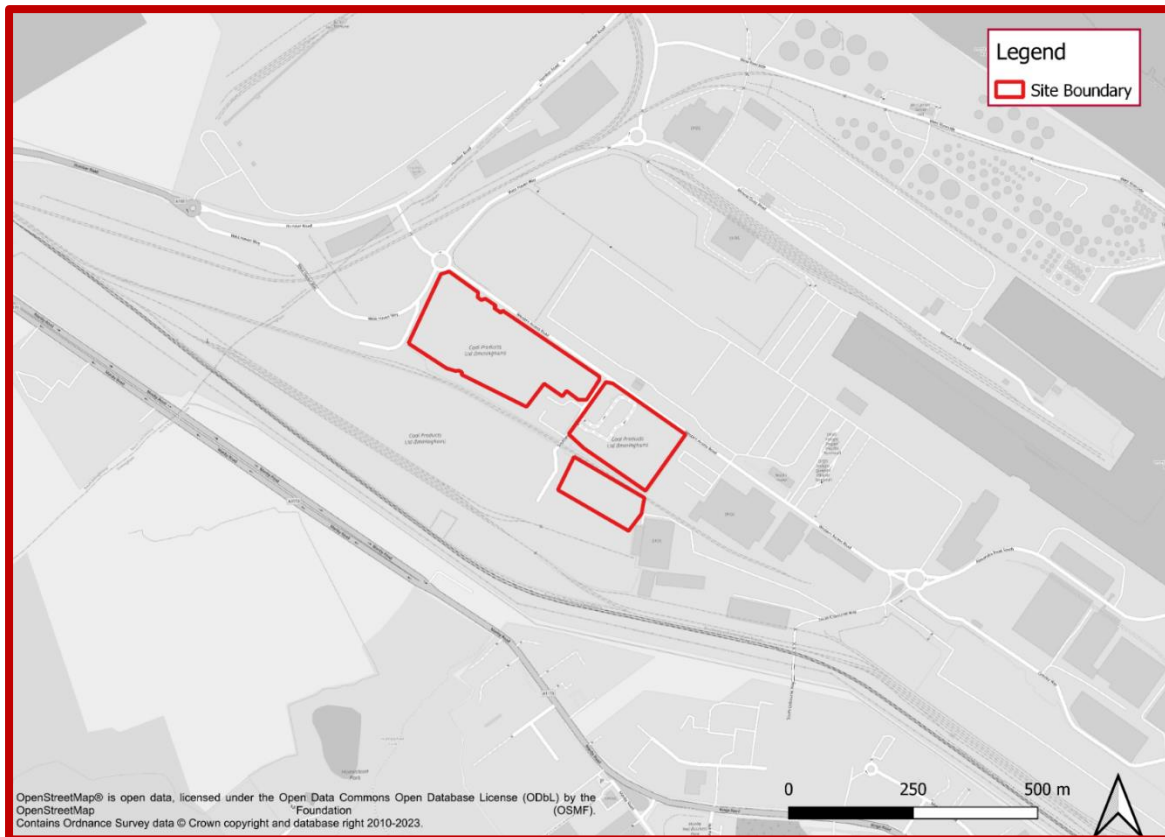
Immingham

Northeast Lincolnshire

DN40 2QR

The map in Figure NTS 1 shows the site location and its surrounds.

Figure NTS 1 – 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 ten emission points to air and one emission point to water. The proposed changes introduced within this variation application consider one new emission point to air (A11). The existing emission points to air remain unchanged as a result of this variation.

Previous Permit Variation

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’s purpose was to convert the existing HTC plant from a pilot plant, with operation limited to 30 days per year, to a fully operational plant. The variation also introduced the Caustic Wash Plant, this process is similar to the acid washing that was currently operational at this site, however, utilises caustic solution rather than acid, and is designed to process the ‘amber’ carbon which comes from industrial uses. The Impregnation Unit is also part of the previous permit variation 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.

It should be noted that at the time of writing this permit variation, the outcome of the above permit variation has not yet been determined.

Pyrolysis Plant

As part of this permit variation, CPL along with Nottingham University have been successful in winning the DESNZ (Department of Energy Security and Net Zero) sponsored project under the Green Gas Support scheme to build and operate a Pyrolysis Plant to process sustainable biomass

into a bio-stable char. The produced biochar has been demonstrated to be chemically stable over the long term when used as soil improver therefore sequestering the carbon back into the environment.

The process is divided into three sections agglomeration, drying and pyrolysis. Each process can be run independently from one another. Further details of the processes are provided within the process description in Section 3.1.1.

The process will introduce one new emission point to air.

The finished product will be made available for analysis and testing by CPL's academic partner Nottingham University to demonstrate stability, structure and chemical composition. CPL and the remaining partner will assess the commercial markets as well as seeking carbon credits. The remaining product will be used in our biomass fuel products and CPL's activated carbons business.

Raw Materials

The project is to establish the production of stable biochar from sustainable biomass sources to sequester carbon in the ground and increase the fertility of land. In addition to biomass, this variation application also covers the request to include additional waste codes for the use of absolutely non-hazardous biodegradable waste, non-hazardous biodegradable kitchen waste and other non-hazardous wastes from mechanical treatment wastes other than those covered in the previous permit variation. The site is familiar with the use of these materials which have been processed already on the site through a separate processing unit designated as a hydro carbonisation unit. The use of these materials were processed under the current site permit whereby as a pilot unit CPL were authorised by the local EA inspector. Overall, the unit will process a limited range of biomasses and non-hazardous biomass wastes. All materials will be processed in discrete batches to establish the viability for those materials. No materials will be mixed. At the end of the project the results for each material will be provided to the DESNZ and the wider scientific community.

Water Discharge

The previous permit variation included the additional water discharge associated with the HTC Plant due to the increased catchment area. This variation does not change the water discharge or emissions to water and has not been included within the variation.

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. 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 and deposition 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.

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) 20181. The variation notice number is EPR/DP3134LK/V009.

The requirement to vary the existing EP has been prompted following proposed operational changes to some plant on Site. 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 - Charges and declaration

These are provided in Appendix C 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

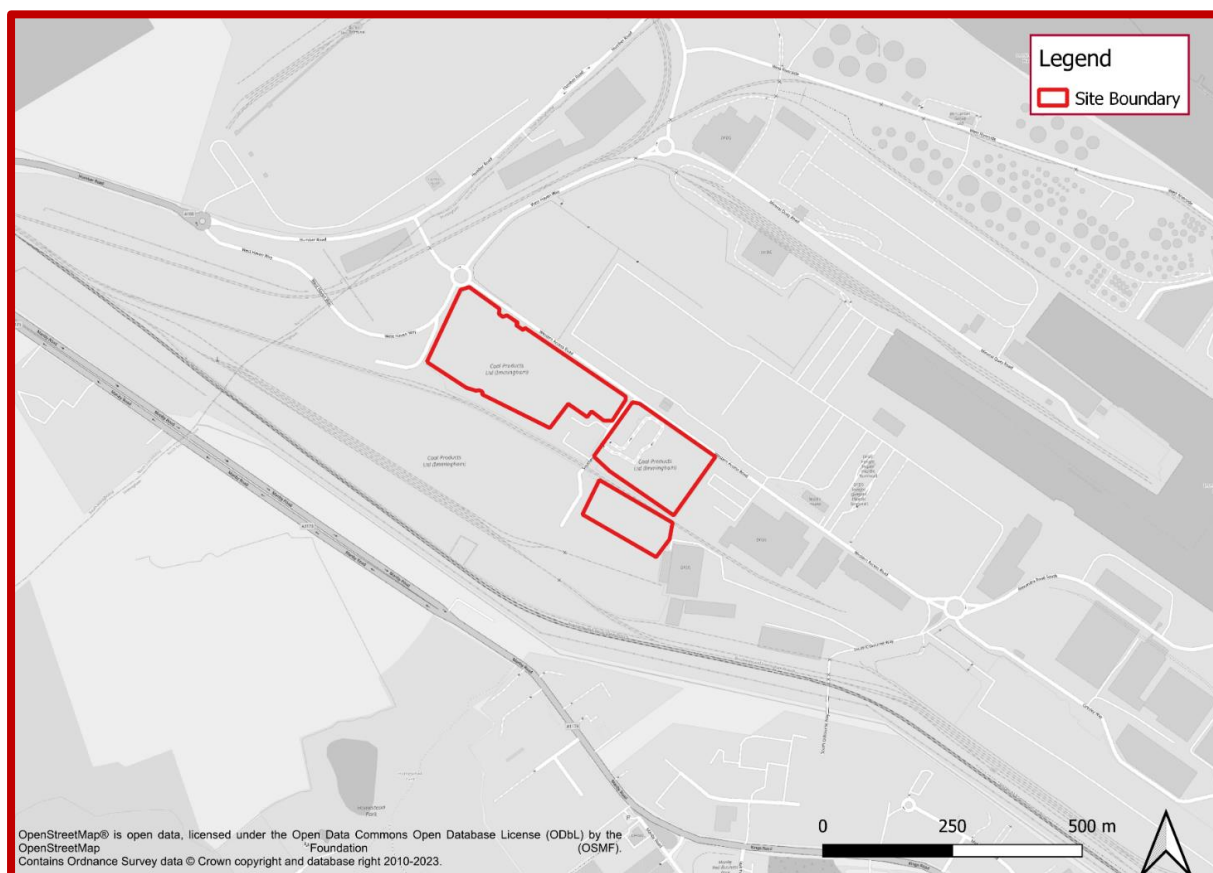
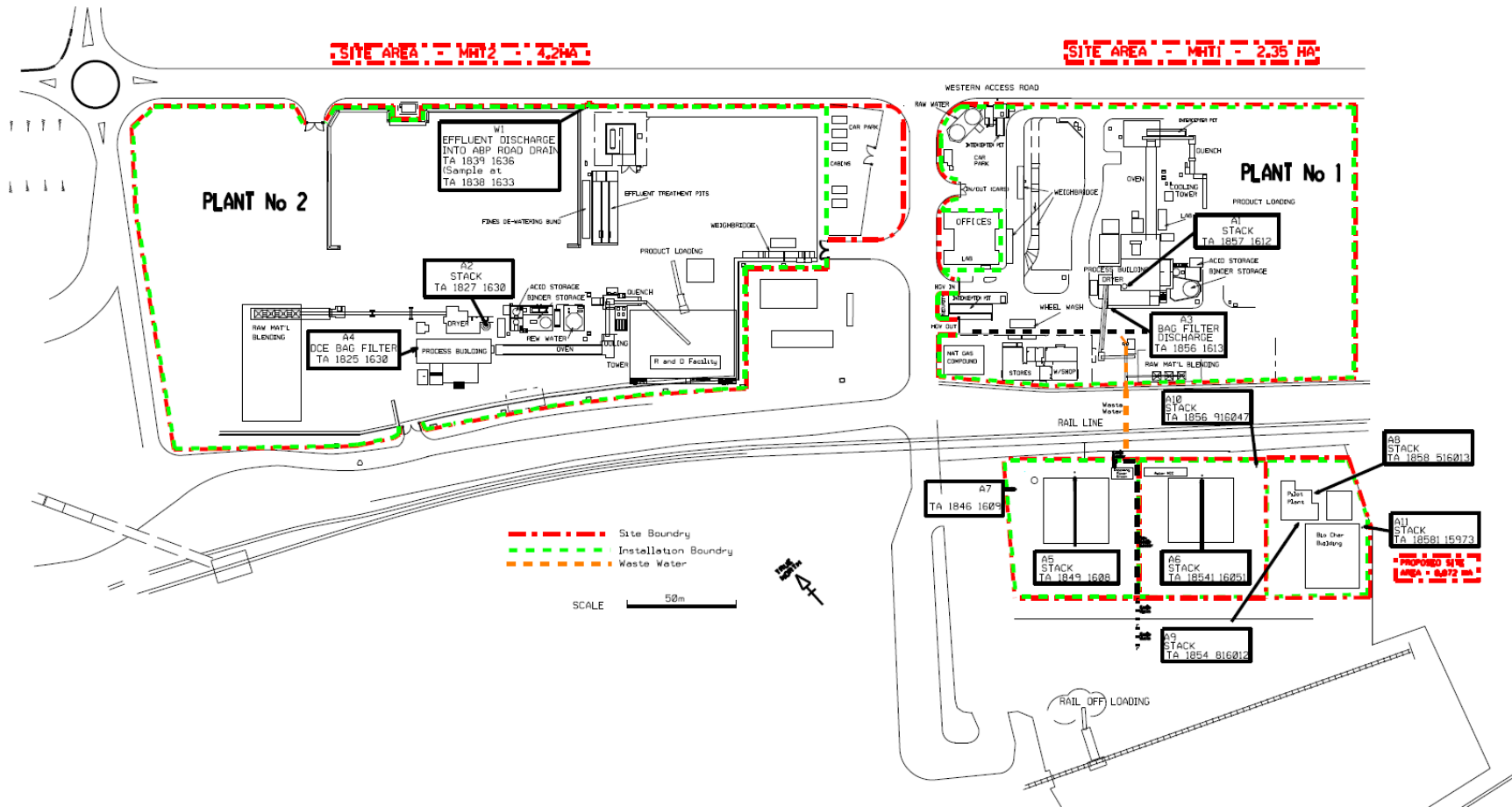


Figure 2.2 – Site Layout showing Existing Permit Boundary and Existing Emission Points



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 previous permit variation for the conversion of the HTC plant from a pilot plant to a fully operational plant as well as the introduction of the Caustic Wash Plant and Impregnation Unit (EPR/DP3134LK/V009) has been duly made and is currently under further review with officers at the EA.

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

- The development and operation of the pyrolysis plant with an additional emission point to air (reference A11)
- The request to amend related activities, comprising the addition of three new waste code (EWC 19-12-12, other non-hazardous wastes from mechanical treatment wastes than those in 19-12-11. 20-01-08, non-hazardous biodegradable kitchen waste and 20-02-01, non-hazardous biodegradable waste.

Request to Develop and Operate a Pyrolysis Plant

As part of this permit variation, CPL along with Nottingham University have been successful in winning the DESNZ (Department of Energy Security and Net Zero) sponsored project under the Green Gas Support scheme to build and operate a Pyrolysis Plant to process sustainable biomass into a bio-stable char. The produced biochar has been demonstrated to be chemically stable over the long term when used as soil improver therefore sequestering the carbon back into the environment.

The process is divided into three sections: agglomeration, drying and pyrolysis. Each process can be run independently from one another. A more detailed description of the processes is provided in Section 3.1.1. The process will introduce one new emission point to air.

The finished product will be made available for analysis and testing by our academic partner Nottingham University to demonstrate stability, structure and chemical composition. CPL and the remaining partner will assess the commercial markets as well as seeking carbon credits. The remaining product will be used in our biomass fuel products and our activated carbons business.

Request to Add Permitted Waste Types

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 which are as follows.

- EWC 19-12-12 - other non-hazardous wastes from mechanical treatment wastes than those in 19-12-11
- EWC 20-01-08 - non-hazardous biodegradable kitchen waste
- EWC 20-02-01 - non-hazardous biodegradable waste.

There are no further changes proposed with regards to waste and raw materials.

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 implementation of the Pyrolysis Plant (shown in bold, red text).

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)
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 MW _{th} .
AR14	Pyrolysis Plant	Operation at less than 900 kg/h throughput. and operational 6500 Hours / year

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 Pyrolysis

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 12 12	other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11
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
20	Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions.
20 01	Separately collected fractions (except 15 01)
20 01 08	Non-Hazardous biodegradable kitchen and canteen waste
20 02	Garden and park wastes (including cemetery waste)
20 02 01	Non-Hazardous biodegradable kitchen and canteen waste

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/m ³	Daily mean of 15 minute averages	3 monthly	ISO 10849:1996
		Sulphur dioxide ²	300 mg/m ³		3 monthly	BS EN 14791:2017
		Non Methane VOC ²	40 mg/m ³		12 monthly	PD CEN/TS 13649:2014
		Particulate matter ²	100 mg/m ³		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/m ³	Daily mean of 15 minute averages	3 monthly	ISO 10849:1996
		Sulphur dioxide ²	300 mg/m ³		3 monthly	BS EN 14791:2017
		Non Methane VOC ²	40 mg/m ³		12 monthly	PD CEN/TS 13649:2014
		Particulate matter ²	100 mg/m ³		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/m ³	Daily mean of 15 minute averages	Continuous	BS EN 13284-2:2004
		Particulate matter	25 mg/m ³		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/m ³	Periodic over minimum 1-hour period	12 monthly	ISO 10849:1996
		Sulphur dioxide	50 mg/m ³		12 monthly	BS EN 14791:2017
		Non Methane VOC	20 mg/m ³		12 monthly	PD CEN/TS 13649:2014
		Particulate matter	20 mg/m ³		12 monthly	BS EN 13284-2:2004
		Hydrogen chloride	30 mg/m ³		12 monthly	BS EN 1911:2010
		Dioxins and furans	1 ng/m ³		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/m ³	Periodic over minimum 1-hour period	12 monthly	ISO 10849:1996
		Sulphur dioxide	50 mg/m ³		12 monthly	BS EN 14791:2017
		Non Methane VOC	20 mg/m ³		12 monthly	PD CEN/TS 13649:2014
		Particulate matter	20 mg/m ³		12 monthly	BS EN 13284-2:2004
		Hydrogen chloride	30 mg/m ³		12 monthly	BS EN 1911:2010
		Dioxins and furans	1 ng/m ³		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/m ³	Periodic over minimum 1-hour period	12 monthly	ISO 10849:1996
		Sulphur dioxide	50 mg/m ³		12 monthly	BS EN 14791:2017
		Particulate matter	20 mg/m ³		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	-	-	-
A11	Pyrolysis Plant	Oxides of Nitrogen¹	300 mg/m³	Periodic over minimum 1-hour period	12 monthly	ISO 10849:1996
		Sulphur dioxide²	50 mg/m³		12 monthly	BS EN 14791:2017
		Particulate matter	40 mg/m³		12 monthly	BS EN 13284-2:2004

Note: Proposed amendments highlighted in **bold, red text**. Notes referenced in the table refer to Schedule 3 of current Permit.

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

Table 2.4 – 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, A8, A11	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 Pyrolysis Plant for regulation.

3 Operations

3.1 Pyrolysis Plant

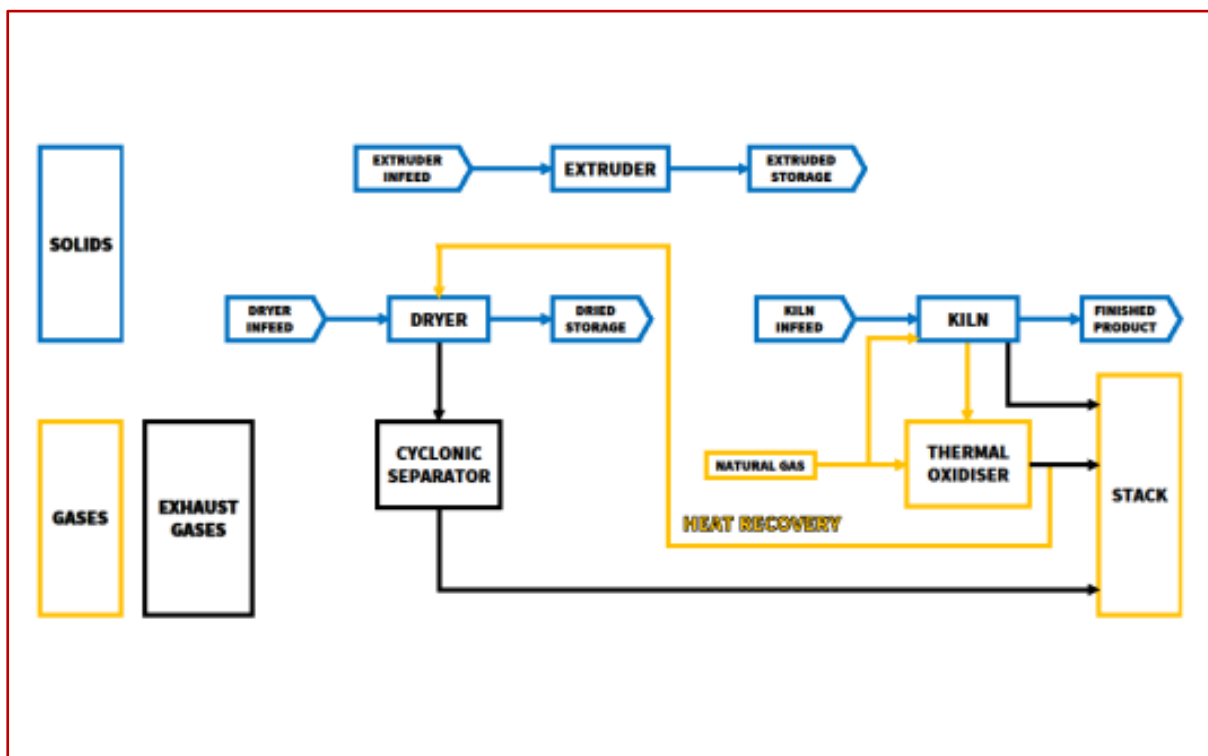
3.1.1 Process Description

CPL along with Nottingham University and a leading UK utility provider have been successful in winning the DESNZ (Department of Energy Security and Net Zero) sponsored project under the Green Gas Support scheme to build and operate a pyrolysis plant to process sustainable biomasses into a bio-stable char. The produced biochar has been demonstrated to be chemically stable over the long term when used as soil improver therefore sequestering the carbon back into the environment. The project seeks to demonstrate at a commercial scale the sustainability and viability of this process to capture carbon dioxide and sequestrate the carbon in a way that is possible to do at scale at multiple geographic locations.

The process in this application is to effectively pyrolyse/charcoal sustainable biomasses by heating in an oxygen depleted atmosphere. The finished product is a very stable char containing the majority of the fixed carbon from the input material. This carbon is fixed and when sowed back into the ground is recognized as significant soil improver, significantly increasing soil fertility.

The process is divided into three sections agglomeration, drying and pyrolysis A process flow diagram is provided in Figure 3.1.

Figure 3.1 – Pyrolysis Process Flow Diagram



The input raw material will be delivered into concrete storage bays on an impermeable surface. The input materials will be selected to have an appropriate moisture content to be non-dusting and low odour. The input materials will enter the process building via an inclined conveyor fed by mobile plant which delivers directly to the feed hopper of the extruder. The extruder is a proprietary extrusion press which forms the material into a small pellet.

Should the input material require drying prior to pyrolysis the process has a standalone slow rotation direct fired dryer. The material is brought by mobile plant from the in-process storage bay and delivered into an airlocked infeed hopper through into the dryer. The dryer is heated either by a direct fired natural gas burner and/or by hot air from the pyrolysis kiln process. The design is to reduce the moisture level

to 10-15% (i.e. not fully dry) as a precursor to the material being processed through the pyrolysis kiln. The combustion gases/hot air then pass through a cyclonic separator to remove any entrained particles from the drying process and then exit via the plant stack.

The hot air stream is created by diluting exhaust gases from the pyrolysis kiln with air to produce a temperature controlled hot gas. This reuses heat to increase the viability of the process. Any solids recovered from the cyclonic separator are contained in a suitable flexible container and reprocessed in the extruder as required.

The pyrolysis kiln is indirectly fired by natural gas. Input material is fed into an airlocked infeed hopper from the appropriate in-process bay by mobile plant. The kiln is then screw fed into the slow rotating inner chamber. Here the temperature is increased to 650 – 750 centigrade over the length of the kiln heating tube. Under these conditions in the absence of air the biomass is decarbonized by the release of a mix of hydrocarbons as a highly calorific gas. The remaining solid is a stable biochar which is discharged via a series of enclosed cooling screws into a sealed flexible container.

The combustion is self-sustaining by using the waste heat from the thermal oxidiser but has a natural gas burner which initiates the combustion and acts as a pilot flame to ensure the oxidation is complete. The exhaust gases are then passed through into the main stack.

The finished product will be made available for analysis and testing by our academic partner Nottingham University to demonstrate stability, structure and chemical composition. CPL and the remaining partner will assess the commercial markets as well as seeking carbon credits. The remaining product will be used in our biomass fuel products and our activated carbons business.

3.1.2 Location

The location of the Pyrolysis Plant and associated emission point is shown in Figure 2.2 is located within the existing permitted site boundary, within the Biochar building below the HTC Plant. There are no changes with regard to the location or configuration of the existing plant within this variation application.

3.1.3 Pyrolysis Plant Working Hours

The Pyrolysis plant is proposed to operate at 6500 hours per year.

3.2 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 EA². 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.

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

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.

3.3 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 pyrolysis plant. 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.

4 Comparison with Indicative BAT

It is important to note that the Pyrolysis plant process is an example of a new process/technology. 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 5.06³.

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 non-hazardous biomass, the contaminants requiring removal and the applications of resulting biochar. 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: <ul style="list-style-type: none"> ▪ 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 to be processed 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 proposed plant will process a limited number of sustainable biomasses into a bio-stable char. The site personnel are already familiar with these materials through our pilot HTC unit where these materials were tested following permission from the Environment Agency. The finished product will be made available for analysis and testing by our academic partner Nottingham University to demonstrate stability, structure and chemical composition. The remaining products will be used as a soil improver, fossil carbon replacement in fuel or as a precursor material for activated carbon.
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.	Only sustainable biomasses and non-hazardous waste that can be processed by the proposed plant will be accepted and processed on site.
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.	The non-hazardous biomass is supplied from known sources (i.e. treatment processes) which characterise the waste material and identify its contaminants. Waste will be transferred via bulk tipper and transported directly from known sources to the facility at Immingham. Source identity will be maintained throughout the 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 non-hazardous biomass from known sources and of known composition. It is not proposed to undertake additional laboratory scale studies. These materials have already been processed through our existing HTC unit under the supervision of the local Environment Agency inspector.
8	8	Waste samples should be taken and analysed for a full range of contaminants,(organic/inorganic, volatile/non-volatile) for example: <ul style="list-style-type: none"> ▪ 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 pyrolysis plant. All process gases are directed to the thermal oxidizer. The thermal oxidizer has been designed to maintain a temperature of 850°C in the presence of at least 15% v/v oxygen, dry gas to ensure complete oxidation of compounds.
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 volatilised during the treatment process (e.g. for volatile metals such as mercury).	The proposed facility will only treat non-hazardous biomass from known sources and of known composition and that have been previously processed on the site for other processes. 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	<p>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).</p>	<p>Waste will be received in bulk tipper and be stored on the impermeable concrete floor which is presently uncovered. Any water runoff is captured and returned to the site effluent systems. Concrete walls will ensure the majority of runoff is prevented.</p>
14	2	<p>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</p>	<p>It is proposed the waste will be stored outside, however the building is also ventilated and designed with respect to the storage of non-hazardous biomass.</p>
15	3	<p>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:</p> <ul style="list-style-type: none"> ▪ 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. <p>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.</p>	<p>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. All deliveries report to a single manned weighbridge immediately on arrival where the material details and weights are recorded. The drivers are then advised to where to go on site and in all cases are met by an employee prior to unloading to ensure the incoming load is correct and the unloading is recorded. Waste 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.</p>
16	4	<p>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.</p>	<p>The raw materials proposed are stored loose externally, however it is wet and therefore non-dusty. Additional water sprays are not required for the containment of dust. All processing will be carried out within the building.</p>
17	5	<p>Individual storage tanks/vessels or bays should be provided in order to:</p> <ul style="list-style-type: none"> ▪ 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. 	<p>Not considered applicable; the waste is stored externally. Material will be sourced in batches and there will be no mixing of batches. All of one material batch will be used prior to delivery of a different material. Throughput is low so the logistics are easily managed.</p>
18	6	<p>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.</p>	

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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 biochar will be transported via an enclosed mechanical conveyor. All the conveyor systems on site are enclosed.
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 has been specifically designed to handle material from bulk tippers..
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.	All products will leave the process building in large enclosed bags for storage and/or transport to other processing areas onsite or sale.
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	No liquid residue is expected from the proposed process.
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 non-hazardous biomass 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	<p>Pipework, and associated taps, valves and pumps, should:</p> <ul style="list-style-type: none"> ▪ 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	<p>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:</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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 2 below, other alkaline waste, in order to maintain a more neutral pH. Similarly, a highly alkaline waste may also require pre-treatment.</p>	<p>Not considered applicable. The non-hazardous biomass arriving at site is a free-flowing granular material that does not require pre-treatment.</p>
31	2	<p>Pre-mixing of waste(s) should only be carried out if it is in accordance with the requirements of Point 3, Section 3.</p>	<p>It is not intended to pre-mix the wastes, materials will be processed in discrete batches and not mixed.</p>
32	3	<p>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.</p>	<p>Not applicable.</p>
33	4	<p>Following mixing, batches of mixed waste should be re-assessed to confirm:</p> <ul style="list-style-type: none"> ▪ 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). 	<p>Not applicable.</p>
<p>2. Pre-treatment Trials</p>			



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 non-hazardous biomass from known sources and of known composition. The site has previously handled these materials under the control of our local Environment Agency inspector as part of our pilot plant development. It is not proposed to undertake additional laboratory scale study
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. The site has been pyrolysing various sustainable biomasses and biomass wastes for 10 years using a 50kg pilot scale kiln and oxidizer of the same design as the kiln in this application. In addition the existing spent activated carbons kilns and oxidisers are of the same design and have been operated over the last 6 years on various wastes. This gives CPL the confidence that this new facility will perform as per the indicated emission levels.

39	2	<p>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.</p>	<p>The rotary kiln and thermal oxidiser process for the Pyrolysis plant are fitted with the industry standard seals to minimise air ingress and release of fugitive emissions.</p>
40	3	<p>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).</p>	<p>The process involves a three staged heating process from the agglomeration where the input material is process into pellets through heating up to 100°C. The drying stage is designed to reduce the moisture level to 10-15% this is at around 350°C and then finally the pyrolysis process the temperature is increased to 650 – 750°C.</p>
41	4	<p>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.</p>	<p>As part of the drying process, the combustion gases/hot air then pass through a cyclonic separator to remove any entrained particles from the drying process and then exit via the plant stack. Any solids recovered from the cyclonic separator are contained in a suitable flexible container and reprocessed in the extruder as required. The process is self-sustaining.</p>
42	5	<p>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.</p>	<p>The plant will operate continuously to process batches of material, upon completion of batches, the plant will undergo an inspection and cleaning regime. The size of batch will vary depending on material being processed but will typically be less than 150 tonne.</p>



43	6	<p>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.</p>	<p>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. All deliveries report to a single manned weighbridge immediately on arrival where the material details and weights are recorded. The drivers are then advised to where to go on site and in all cases are met by an employee prior to unloading to ensure the incoming load is correct and the unloading is recorded. Waste 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.</p>
44	7	<p>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.</p>	
45	8	<p>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.</p>	<p>The thermal processes being used is the same presently used by the carbon regeneration processes in the existing permit. The existing thermal treatment processes underwent a comparison against indicative BAT as part of the previous permit variation.</p>
46	9	<p>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.</p>	

47	10	<p>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:</p> <ul style="list-style-type: none"> ▪ 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	<p>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.</p>	<p>The biochar plant is operated in accordance with the requirements of an environmental management system (EMS) that is maintained under the site Environmental Permit.</p>
49	12	<p>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).</p>	<p>The thermal processes being used is the same presently used by the carbon regeneration processes in the existing permit. The existing thermal treatment processes underwent a comparison against indicative BAT as part of the previous permit variation.</p>
50	13	<p>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.</p>	
51	14	<p>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.</p>	

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: <ul style="list-style-type: none"> ▪ 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 volatilised 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.	All off gas is processed via the thermal oxidiser
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 pyrolysis process.
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 pyrolysis process. 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.	Product exiting the pyrolysis process is cooled through a combination of indirect and direct cooling screwings.

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 biochar 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 biochar 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			

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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 the natural gas burners. The site has been pyrolysing various sustainable biomasses and biomass wastes for 10 years using a 50kg pilot scale kiln and oxidizer of the same design as the kiln in this application. In addition, the existing spent activated carbons kilns and oxidisers are of the same design and have been operated over the last 6 years on various wastes. This gives CPL the confidence that this new facility will perform as per the indicated emission levels
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 process is initiated using a natural gas burner; however, it is also self-sustaining with the waste heat from the oxidiser outlet also used in the drying stage.
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).	There are no emissions to water associated with the pyrolysis process.
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 non-hazardous biomass used at the installation is not odorous (i.e. it is not sourced from facilities that would contaminate the sustainable biomasses 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 produced and non-hazardous biomass is stored externally and is wet and non-dusting.
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 non-hazardous biomass 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 incoming material is stored externally, product may be stored externally in sealed FIBC.

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 incoming material is stored externally, product may be stored externally in sealed FIBC. It is stored 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 biochar 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 biochar will be stored in bags after processing.
89	4	Wherever feasible, material should be held and handled in enclosed systems.	Process contains open hoppers but material not considered dusty due to particle size.
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 as it is a self-sustaining 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.
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 biochar product will be sent for analysis and additional product used in CPL's biomass fuel products.
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 process is initiated using a natural gas burner; however, it is also self-sustaining with the waste heat from the thermal oxidiser also used in the drying stage.
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 point.

Table 5.1 – Existing Point Source Emissions to Air

Emission Point Reference	Source	Location
A1	MHT1 vent stack	Figure 2.2
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	Impregnation Drier Exhaust	
A10	Caustic Wash Boiler Exhaust	
A11 (new)	Pyrolysis Plant	

Considering the proposal under the EP variation, the only new emission source is A11.

The nature of the emissions arising from A11 will primarily consist of:

- Oxides of nitrogen (NO_x);
- Particulate Matter (PM);
- Sulphur dioxide (SO₂); and

Other emissions will include carbon dioxide and water vapour.

Further details regarding the new emission point is provided in Table 5.2. Emission rates and stack parameters for the new emission point 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)
A11	Pyrolysis Plant	518564, 415985	15.0	1.1	12.06	2,676	409

5.2 Emissions to Water

The proposed variation does not introduce any additional emission points to water.

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 A11, shown in Table 2.3.

5.5.2 Monitoring Emissions to Water

As no changes are proposed, it is considered that the current requirements pertaining to monitoring of emissions to water should remain as detailed within the previous EP variation.

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 Site 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.

Appendix E includes the risk assessment for fugitive emissions and accidents.

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***	A11
Exhaust Conditions											
Annual Operating Hours	-	5464	8760	3639	6739	1500	4500	8760	-	400	6500
Temperature (°C)	-	195	65	107	120	200	30	300	234	205	409
Stack diameter (m)	1.25	1.03	0.47	0.65	0.5	0.5	0.45	0.3	0.25	0.25	1.1
Stack height (m) ^A	29.8	38	9.2	18.5	18.5	7	0.45	0.3	4	4	15.0
Volume flow (Am ³ /s)	-	26713	2412	3279	1332	706	5000	500	2100	508	41156
Actual oxygen content (%)	-	11.5	19.6	12	12	3.5	19	5	5	5	18
Actual moisture content (%)	-	22.5	6.2	23	7	8	4	9.5	6.2	6.2	0
Mass Emission Rates											
NO _x (mg/m ³)	-	136.0	-	126.5	31	475	414	0.12 (g/kWh) [*]	192	123	300
NO _x (g/s)	-	0.240	-	0.032	0.004	0.093	0.053	0.014	0.069	0.011	0.223
PM (mg/m ³)	-	57.2	20.0	1.5	24.0	-	176	-	-	-	40
PM** (g/s)	-	0.101	0.001	0.0004	0.003	-	0.022	-	-	-	0.030
SO ₂ (mg/m ³)	-	19.9	-	1.0	19.0	-	14	-	2.62	2.62	50
SO ₂ (g/s)	-	0.035	-	0.00024	0.002	-	0.002	-	0.0009	0.0002	0.0372

^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 PM₁₀ and PM_{2.5}.

^{***} combined low + high fire.

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 assess 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 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 the hours listed in Table 6.1 to calculate the long-term with short term impacts not based on the operating hours. 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.

Table 6.2 – Maximum Impacts at Human and Ecological Receptors

Pollutant averaging period	AQAL ($\mu\text{g m}^{-3}$)	Max. PC ($\mu\text{g m}^{-3}$)	PEC ($\mu\text{g m}^{-3}$)	% max. PC of AQAL	% PEC of AQAL
Human receptors					
Annual mean NO ₂	40	0.06	18.76	0.2%	46.9%
99.79 percentile 1-hour mean NO ₂	200	3.38	39.27	1.7%	19.6%
Annual mean PM ₁₀	40	0.02	16.71	<0.0%	41.8%
90.41 percentile 24-hour mean PM ₁₀	50	0.15	33.42	0.3%	66.8%
Annual mean PM _{2.5}	20	0.02	8.30	0.1%	41.5%
99.9 percentile 15-minute mean SO ₂	266	0.76	29.12	0.3%	10.9%
99.73 percentile 1-hour mean SO ₂	350	0.46	29.05	0.1%	8.3%
99.18 percentile 24-hour mean SO ₂	125	0.19	29.01	0.2%	23.2%
Ecological receptors					
Annual mean NO _x	30	0.18	42.63	0.6%	142.1%
Daily mean NO _x	75	3.00	87.00	4.0%	116.0%
Annual mean SO ₂	20	0.02	10.01	0.1%	50.1%

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 and deposition 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.

It can be considered, therefore, that the air quality impacts of the existing and new pyrolysis plant at the Immingham Briquetting Works can be considered as not significant for concentrations in air. With regard to deposition results, nitrogen and acid deposition results can also be described as not significant, as although background concentrations for nitrogen and acid deposition exceed critical levels, the contribution from the process is not significant.

7 Resource Efficiency

7.1 Raw Materials Consumption

The material input to the pyrolysis process is detailed in Section 3 and comprises of a limited range of sustainable biomasses and non-hazardous biomass wastes, non-dusting and of sufficient moisture to be handled by mobile plant.

The raw materials that are already used will continue to be handled in line with the existing site procedures, including being processed in discrete batches and not mixed. 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 waste biomass will be delivered into concrete storage bays on an impermeable surface. The bays will have concrete walls and the materials will be stocked below the height of the walls. The input materials will be selected to have an appropriate moisture content to be non-dusting and low odour. The storage area is limited in and as this is a proof-of-concept installation the stock levels will be minimal with only one type of material held at any one time. Waste biomass will be input at 900kg/hour.

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.

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 affect site water consumption.

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 with the inclusion of the Pyrolysis Plant, but the process is designed to assist CPL with its ongoing commitment to replace coal-based fuels and activated carbons with biomass-based materials.

Overall, the pyrolysis plant is a self-sustaining process so the overall energy efficiency is high. The total energy consumption of the proposed new process is 400 kWh. By comparison, the equivalent consumption for current thermal regeneration is 1,125 kWh. This results in an energy saving of 725 kWh per tonne and therefore, with 1,000 tonnes processed per annum, this would result in an energy saving of 725 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 54,050 MWh/y.
- b) Electricity – 8,901 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: 460 MWh/y.
- Electricity: 108 MWh/y.

7.4 Waste Disposal

The activities covered by the variation will not produce additional waste solids. In fact, the pyrolysis plant provides a benefit in this respect as waste is able to be recycled through the process.

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 D.

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 – Application Forms

Appendix D – Emergency Plan

Appendix E – Risk Assessment – Fugitive Emissions and Accidents

Hazard	Receptor	Pathway	Risk Management Technique	Probability of Exposure	Consequence	Overall Risk
Fugitive Emissions						
Dust	Employees, General Environment	Windborne	Raw material is delivered, stored and handled wet and is non-dusting. Stored in a purpose built storage area. Raw Material inventory is always less than 60 tonnes at any time. Finished product is generated within the process building and is packed in large bags in an enclosed building. Process is PLC controlled, manned at all times with automatic and operator shutdown at any stage – with a very limited inventory in process at any time	Minor very localized dust is possible under extraordinary situation – material is non-hazardous	No significant issue	Low
Odour	Employees, General Environment	Windborne	Raw material inventory is kept low in a well ventilated purpose built storage area. Operators are experienced in handling materials with potentially strong odours. Works operates a weekly odour monitoring procedure which is logged, recorded and circulated to Senior Managers. Prompt actions are required. Established liaison with neighbouring companies in place	Highly unlikely in a well ventilated area	No significant issue	Low
Accidents						
Site Accidents	People, General Environment	Equipment failure, PLC failure, plant equipment hitting plant equipment causing liquid spills	Process is PLC controlled and is manned at all times with automatic and operator shutdown at any stage – The in process inventory is very low at any time. Written emergency plan and experienced management and operators with significant experience with the process steps. HAZOP and full operating documentation.	Potential every 100 times of operation ie. 3 times per annum	Minor release of dust within the building which has no exposure hazard to the environment	Low
Fire	Employees, general environment local industrial units	Airborne smoke, odour	Dryer and kiln inventory (less than 1000 kgs) is batch operated by operator command and PLC controlled. Any fire would very small and easily doused with water sprays. Finished product is stored in discrete large bags the total inventory will kept low. Very high carbon content and does not combust readily Experience on site of use of temperature probes to check any post production heating.	Potential every 100 times of operation ie. 3 times per annum	Limited potential and any event would be very small scale	Low