Schedule 13 SWIP Permit Variation

Burcott Road, Avonmouth
PyroCore

JER1883
Schedule 13 SWIP Permit Variation
2
0
08 September 2022

rpsgroup.com

Quality Management

Version	Revision	Authored by	Reviewed by	Approved by	Date
1	0	[redacted]			-
1	1	[redacted]	[redacted]		
2	0	[redacted]	[redacted]	[redacted]	08/09/2022

Approval for issue

[redacted]	[redacted]	[redacted]	8 September 2022

File Name

220908 R JER1883 JB Avonmouth Demonstrator VariationV2 R0

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NON-TECHNICAL SUMMARY

This document provides an application to vary permit (EP290) issued to PyroCore Limited by Bristol City Council. The issued permit allows the operation of a small waste incineration plant (SWIP) (the Phoenix unit) at 203 Burcott Road, Avonmouth, BS11 8AP. This application to vary the permit seeks to include a second SWIP which will operate as a demonstration unit. The demonstration unit is currently in operation at PyroCore's Haybridge site. The Phoenix unit will continue to operate as permitted with no change, with the exception of an increase in the maximum annual throughput of biomass from 300 tonnes to 500 tonnes.

PyroCore manufacture small waste incineration plants (SWIP), more specifically, co-incineration plants. The demonstration unit is a SWIP and is based on the processes pyrolysis and subsequent high temperature oxidation of raw syngas. PyroCore has operated its demonstration unit at Haybridge on a wide range of waste materials and biomass from waste plastics to straw, grasses and woodchips from virgin sources.

The demonstration unit is to be relocated to the Avonmouth site where it will operate to conduct fully representative trials of customers own waste, or to confirm if the waste can be processed by PyroCore's pyrolysis technology. The demonstration unit has a capacity to process up to 250 kg per hour (kg/hr) of waste/fuel.

Incineration and co-incineration plant with a capacity to process less than 3 tonnes per hour of non-hazardous waste or less than 10 tonnes per day of hazardous waste require a Schedule 13 SWIP permit to operate from the local authority, in this case Bristol City Council (BCC).

Waste to be processed in the demonstration unit will be delivered by road and will be offloaded within the waste storage building and stored in segregated areas within the warehouse. The waste intended to be processed in either the Phoenix or demonstration unit will be stored in a common bunker. Waste that can only be processed in the demonstration unit will be segregated and clearly identified as separate. Waste will have been pre-shredded prior to delivery and no further treatment will be carried out onsite.

Waste will be fed into the pyrolysis reactor which will generate a char residue, typically called "charcoal" or "biochar", and hot syngas. All commercial charcoal around the world is manufactured using pyrolysis. The hot syngas will be drawn into the thermal oxidiser where it will mix with excess air and either auto ignite or be ignited by the burner to give hot combusted gases. Under normal operation, heat from the hot gases released from the thermal oxidiser will be used to pre-heat the pyrolysis reactor. At start-up heat to the thermal oxidiser will be provided by burning LPG up to a maximum output of 1 MW_{th}.

As per the Phoenix unit, the demonstration unit will comply with the emission limit values (ELVs) for pollutants specified by the Industrial Emissions Directive[1] (IED) for small waste incineration plant.

Effective pollutant abatement will be achieved through the injection of a sodium bicarbonate reactant to achieve acid gas neutralisation and powdered activated carbon to abate potential dioxins, furans, volatile heavy metals and volatile organic compounds (VOCs). A ceramic filter will facilitate removal of particulate bound heavy metals and other particulates and the reactants of the sodium bicarbonate, namely NaCl (sodium chloride), Na_2SO_4 (sodium sulphate). NOx abatement will be achieved through selective non catalytic reduction (SNCR) using urea as the reducing agent.

Continuous monitoring of emissions [CEMS] to air will confirm that levels are within IED emission limits. Where continuous monitoring is not proposed, independent periodic monitoring will be undertaken.

Abated emissions will be released from a separate 11m flue gas stack.

An air quality assessment considering both the Phoenix and demonstration unit has been completed and confirmed that the emissions to air from the facility at both human health and ecological receptors was not considered significant.

[1] EUR-Lex - 32010L0075 - EN - EUR-Lex (europa.eu)

A Human Health Risk Assessment (HHRA) considering both the Phoenix and demonstration unit has been completed and confirmed emissions to air from the demonstration unit is considered to be not significant.

As above the pyrolysis stage will produce a solid char residue which will be collected and initially landfilled but with a longer-term view to securing alternative re-use/recovery. A second residue is produced from the flue gas cleaning plant, this residue is separately collected and landfilled.

PyroCore will implement an Environmental Management System (EMS) to direct the operation of the demonstrator unit prior to the facility coming into operation.

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1 INTRODUCTION

1.1 Background

1.1.1 This document provides an application to vary permit EP290issued to PyroCore Limited by Bristol City Council (BCC). The issued permit allows the operation of a small waste incineration plant (SWIP) (the Phoenix unit) at 203 Burcott Road, Avonmouth, BS11 8AP. The application to vary the permit seeks to include a second SWIP which will operate as a demonstration unit. The demonstration unit is currently in operation at PyroCore's Haybridge site. The Phoenix unit will continue to operate as permitted with no change, with the exception of an increase in the maximum annual throughput of biomass from 300 tonnes to 500 tonnes.

1.1.2 This application focuses on the changes introduced as a result of operating the demonstration unit that the Avonmouth site.

1.1.3 The demonstration unit will be based on the processes of pyrolysis and high temperature oxidation followed by gas cleaning to IED limits. The demonstration unit has a capacity to process up to 250 kg/hr of waste/fuel.

1.2 Site Location

1.2.1 The Avonmouth site sits within the administrative area of BCC. The site contains PyroCore's Phoenix unit. A location plan for the demonstration unit is provided in Drawing 1.

1.2.2 The site is located approximately 2km to the north of the centre of Avonmouth and over 10km to the northwest of the centre of Bristol. The site is within an industrial area with the closest residential receptors being located on McLaren Road in Avonmouth approximately 2km south of the site.

1.2.3 The site comprises of a large end of terrace industrial unit measuring 2,077.3 m^2. The accommodation within the building comprises of a warehouse; ground floor offices and amenities; and first floor offices. The property also has a large yard, it is understood that the dimensions the yard are 60m x 23m. The site is accessed from Burcott Road through the access gates into the yard with the building being accessed from the yard through 3 sizeable roller shutter doors on the eastern elevation.

1.2.4 The site is bound to the east by Burcott Road, and to the north and south by industrial premises, the unit directly adjoins a property to the north. The western boundary is formed by a small area of open green space with a waterbody, Mere Bank Rhine, within it. In addition, Avonmouth Docks are located approximately 1km to the south-west of the site.

1.2.5 The Environmental Agency's flood map shows that there is a small area of the site adjacent to Burcott Road located within Flood Zone 2 with the remainder of the site being in flood zone 1.

1.2.6 The site is not located in a DEFRA Air Quality Management Area (AQMA).

1.3 Applicant

1.3.1 The applicant and operator of the demonstration unit, as well as the permitted Phoenix unit will be PyroCore Ltd.

2 REGULATORY CLASSIFICATION

2.1.1 The demonstration unit will pyrolyse a wide range of hazardous and non-hazardous wastes (see Table 3-1). In any one year the demonstrator will treat up to 200 tonnes of waste.

2.1.2 The Industrial Emissions Directive (IED) provides an exemption for certain types of research and development facility under Article 42 (2) (b) where they meet the requirements below:

(b) experimental plants used for research, development and testing in order to improve the incineration process and which treat less than 50 tonnes of waste per annum.

2.1.3 The demonstration unit does not fall under the above exemption.

2.1.4 Part A(1) activities are regulated by the EA and include the following processes:

Schedule 1 Part 2, Section 5.1 Incineration and co-incineration of waste

Part A(1)

(a) The incineration of hazardous waste in a waste incineration plant or waste co-incineration plant with a capacity exceeding 10 tonnes per day.

(b) The incineration of non-hazardous waste in a waste incineration plant or waste co-incineration plant with a capacity exceeding 3 tonnes per hour.

(c) The incineration, other than incidentally in the course of burning landfill gas or solid or liquid waste, of any gaseous compound containing halogens.

2.1.5 The waste will be non-hazardous, and with a maximum feed rate of 250 kg/hr it falls below the thresholds of 10 tonnes per day for hazardous waste and 3 tonnes per hour for a Section 5.1 Part A(1) waste incineration or waste co-incineration plant. The capacity of the demonstration unit and the permitted Phoenix unit combined is 750 kg/hr which is also below the 3 tonnes per hour for a Section 5.1 Part A (1) (b) facility. The Phoenix unit is not permitted to process hazardous waste.

2.1.6 The corresponding Part B scheduled activities, that are subject to local authority regulation include the following:

(a) The incineration in a small waste incineration plant with an aggregate capacity of 50 kilogrammes or more per hour of the following waste;

(i) vegetable waste from agriculture and forestry;

(ii) vegetable waste from the food processing industry, if the heat generated is recovered;

(iii) fibrous vegetable waste from virgin pulp production and from production of paper from pulp, if it is co-incinerated at the place of production and the heat generated is recovered;

(iv) cork waste;

(v) wood waste with the exception of wood waste which may contain halogenated organic compounds or heavy metals as a result of treatment with wood preservatives or coatings;

(vi) animal carcasses.

2.1.7 The waste to be processed is not included within the list of wastes that fall under the Part B scheduled activities.

2.1.8 Schedule 13 of the Environmental Permitting Regulations (EPR) 2016 (as amended) sets out the criteria for inclusion under the Schedule.

(1) This Schedule applies in relation to -

(a) every small waste incineration plant, and

(b) every waste incineration plant or waste co-incineration plant,

to which Chapter IV of the Industrial Emissions Directive applies, except those which are operated as a domestic activity in connection with a private dwelling.

2.1.9 A small waste incineration plant is defined within the EPR as follows:

"small waste incineration plant means a waste incineration plant or waste co-incineration plant with a capacity less than or equal to 10 tonnes per day for hazardous waste or 3 tonnes per hour for non-hazardous waste.

2.1.10 The proposed demonstration unit will fall within this definition and therefore is subject to the permit requirements applicable to SWIPs. To allow the operation of the demonstration unit the current permit EP290 will need to be amended.

2.1.11 Schedule 13 SWIP facilities are generally regulated by the LA. The regulator for this permit is BCC.

2.1.12 SWIPs are subject to the requirements of Chapter IV of the IED, as identified in Schedule 13 of the EPR. Information in the subsequent sections of this report set out how the proposed demonstration unit complies with these requirements.

3 OPERATION

3.1 Overview

3.1.1 The demonstration unit will operate to conduct fully representative trials of customers own waste or demonstration trials a similar waste.

3.1.2 PyroCore's clients will supply samples of their waste which will be trialled in the demonstration unit to confirm if it can be processed by PyroCore's pyrolysis technology. The demonstration unit can target difficult waste streams that would otherwise end up in landfill.

3.1.3 During testing, the unit would typically be operated on weekdays 07:30 to 17:00 (Monday-Friday), however PyroCore require the option to operate over a 24 hour period 1 day per week.PyroCore require the option to run overnight 4-5 days to reduce LPG use and thermal cycling of equipment..

3.1.4 In addition, during testing it is possible that there may be some long duration 120 hour trials on other feedstocks.

3.1.5 The principal activities proposed are as follows:

- waste reception and storage;
- waste transfer and charging;
- pyrolyser;
- thermal oxidiser;
- char recovery and storage;
- exhaust gas cleaning and stack; and
- emergency syngas vent.

3.1.6 A process flow diagram (PFD) of the proposed demonstration unit is provided in Drawing 4.

3.1.7 Operational responsibility for the demonstration unit will sit with PyroCore Ltd.

3.2 Waste Reception, Storage and Handling

3.2.1 Waste will be delivered by road. On arrival at the site the waste transfer paperwork will be checked and assuming the waste complies with the waste types expected and included on the permit the delivery will be directed to the waste storage building.

3.2.2 The weight of the waste will be recorded based on the weight provided on delivery notes.

3.2.3 The wastes to be accepted and used in the demonstration unit will be under the following EWC codes:

Table 3-1: EWC Codes to be Accepted at the Demonstration Unit

EWC	Waste Description
02 01 04	waste plastics (except packaging)
02 02 04	sludges from on-site effluent treatment
03 03 10	fibre rejects, fibre-, filler- and coating-sludges from mechanical separation
040 2 09	wastes from composite materials (impregnated textile, elastomer, plastomer)
04 02 21	wastes from unprocessed textile fibres
04 02 22	wastes from processed textile fibres
07 02 13	wastes from the MFSU of plastics, synthetic rubber and man-made fibres
07 02 16*	wastes containing hazardous silicones

EWC	Waste Description
07 02 17	wastes containing silicones other than those menitoned in 07 02 16
08 04 09*	waste adhesives and sealants containing organic solvents or other hazardous substances
08 04 10	waste adhesives and sealants other than those menitoned in 08 04 10
09 01 07	photographic film and paper containing silver or silver compounds
09 01 08	photographic film and paper free of silver or silver compounds
10 02 15	other sludges and filter cakes
10 11 03	waste glass-bound fibrous materials
10 12 13	sludge from on-site effluent treatment
11 03 02*	other waste
12 01 05	plastic shavings and turnings
15 01 02	packaging (including separately collected municipal packaging waste)
16 01 19	plastic
16 02 13*	discarded equipment containing hazardous components(1) other than those mentioned in 16 02 09 to 16 02 12
16 02 14	discarded equipment other than those mentioned in 16 02 09 to 16 02 13
17 02 03	construction and demolition wastes (including excavated soil from contaminated sites)
17 06 03*	other insulation materials consisting of or containing hazardous substances
17 06 04	insulation materials other than those mentioned in 17 06 01 and 17 06 03
17 09 03*	other construction and demolition wastes (including mixed wastes) containing hazardous substances
17 09 04	mixed construction and demolition waste
19 02 05*	sludges from physico/chemical treatment containing hazardous substances
19 12 04	plastic and rubber
19 12 10	combustible waste (refuse derived fuel)
19 12 11*	other wastes (including mixtures of materials) from mechanical treatment of waste containing hazardous substances
19 12 12	other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11
20 01 35*	discarded electrical and electronic equipment other than those mentioned in 20 01 21 and 20 01 23 containing hazardous components(1)
20 01 36	discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35
20 01 39	plastics

3.2.4 As part of the pre-acceptance checks the composition of the waste will be provided by the supplier. This would be checked against the feed specification for the demonstration unit.

3.2.5 The waste received will be pre-shredded in 1-2 m^3 bags. A maximum of 1 tonne of each waste type is expected for each trial. Waste will be offloaded within the waste acceptance building. Other loose material will arrive predominantly in dumpy bags and will be offloaded into the warehouse building and loaded into the bulk storage areas. All hazardous material will arrive in dumpy bags.

3.2.6 Material will be visually checked during offloading (e.g. for particle size, moisture content, tramp materials). A moisture meter will be used to check moisture content. Bulk density will be checked by filling a container of known volume with a sample of the load and weighing it.

3.2.7 Waste will be stored within segregated areas within the warehouse. No more than 10-12 tonnes waste for processing in the demonstration unit will be stored at any one time.

3.2.8 The waste will be transferred from the storage to the demonstrator unit conveyor belt using a telehandler to lift the dumpy bags over the feed hopper, with quick release at the bottom of the bag. Other loose feedstocks will be transferred using a telehandler with bucket.

3.2.9 Feedstock is delivered at ground level to a feed bin at the bottom of a belt conveyor. The feedstock is conveyed at a controlled rate into the lockhopper of the process. This consists of two slide valves which meter feedstock into the pyrolysis process.

3.2.10 A knife gate valve controls the flow of waste into the pyrolysis unit.

3.3 Thermal Treatment

3.3.1 The thermal treatment process comprises the pyrolysis reactor (including the insulated annulus around it), the char cyclone and the thermal oxidiser.

3.3.2 Feedstock is metered into the pyrolysis reactor where it is rapidly heated and achieves a final temperature of 400-800°C, subject to the objective of the process. Hot combustion gases from the thermal oxidiser provide the heat to the pyrolysis reactor. The hot combustion gases are fed from the thermal oxidiser into the refractory lined and insulated annulus around the pyrolysis reactor. This high temperature ensures rapid conversion of the material to a solid char, or charcoal and a combustible raw syngas.

3.3.3 The hot gases pass into a char separator and the hot char from the process drops onto a cooled char discharge screw out of the pyrolysis kiln and into an N_2 purged char receiver, allowing safe storage of the charcoal. The char is then removed to storage.

3.3.4 The remaining hot syngas is burned in the thermal oxidiser with excess air, nominally in the range of 900 - 100°C, and this excess air also controls the temperature of the burnt gases. For high nitrogen containing wastes, ammonia ($NH_{3(aq)}$) may be dosed to abate nitrogen oxides (NOx).

3.3.5 The thermal oxidiser is designed to achieve a minimum temperature of 850°C for at least 2 seconds, as required by Article 50 (2) of the IED. Evidence to support this is provided in Appendix D.

3.3.6 During start-up and shutdown (or in the event of low syngas production) the thermal oxidiser will be operated on diesel. The thermal oxidiser temperature control will maintain the exit temperature at or above 850°C during normal waste processing, diesel will also be automatically used if the temperature of the combustion gases in the 'hot volume' falls below 850°C, in compliance with Art 50(3) IED for wastes.

3.3.7 The waste feed will be automatically prevented using software interlocks in the following circumstance (in accordance with Art 50(4) IED):

- at start-up, until the temperature in paragraph 3.3.5 is met;
- whenever temperature of 850°C is not maintained while running on wastes[2]; and
- whenever the continuous measurements show that any emission limit value is exceeded due to disturbances or failures of the waste gas cleaning devices.

3.3.8 The hot combusted gases are drawn through the process by the induced draft (ID) fan and passed through a heat recovery unit (desuperheater) where heat can be removed. The desuperheater removes excess heat to reduce gas temperature to 220°C, with the resultant heat passing through the abatement system, then up the stack.

[2] The auxiliary burners will automatically be triggered at a temperature above 850 °C. If the temperature continues to fall an alarm will be triggered and an automatic shutdown will be triggered, a beit not via interlocks. As part of the shutdown waste feed to the demonstration unit will be stopped.

3.4 Flue Gas Cooling

3.4.1 Hot flue gases leaving the insulated annulus around the pyrolyser unit will be cooled by a desuperheater to 180-250°C prior to undergoing flue gas cleaning.

3.4.2 The operation of this package will be automated, with facility to switch on or off as required from the main plant programmable logic controller (PLC).

3.5 Flue Gas Cleaning

3.5.1 Flue gas cleaning will be provided to ensure emissions to air will meet IED limits. The flue gas cleaning system will comprise the injection of a mixture of sodium bicarbonate and powdered activated carbon followed by a ceramic filtration system to recover all dust, reactants and products.

3.5.2 The sodium bicarbonate ($NaHCO_{3(s)}$) is used to neutralise acid gases (SOx, HCl, etc.) which may be produced by certain wastes, whilst activated carbon removes dioxins, furans, volatile heavy metals and volatile organic compounds. The fine powder mixture is injected dry into the gases after cooling and prior to the ceramic filter system.

3.5.3 The ceramic filter is used to remove any dust entrained in the flue gases as well as any residual flue gas treatment reagent (sodium bicarbonate/activated carbon mixture) and the resultant products, i.e. sodium sulphate (Na_2SO_4), sodium chloride (NaCl), sodium fluoride (NaF) and other inert salts.

3.5.4 Cleaned gases will be drawn through an ID fan and discharged to atmosphere via single 11 m stack.

3.6 Solid Residues Management

3.6.1 The solid residues generated by the demonstration unit comprise char from the pyrolysis reactor and a gas cleaning residue from the flue gas cleaning plant.

3.6.2 Char will be discharged off the end of the pyrolysis reactor screw into the char separator. A cooled screw conveyor will transfer the char to sealed drums. The cooling system is designed to cool the char to a temperature of <60°C.

3.6.3 A slide valve is installed in the chute above the char collection container to isolate the discharge to facilitate change-over of the collection container. A level probe will be in place to detect when the bin is full.

3.6.4 Proximity switches will be installed to indicate the position of the telescopic chute and to confirm the drum is in place. The proximity switches will be interlocked with the slide valve to prevent opening of the valve in the event that either the chute is not lowered or a receiving drum is not in place.

3.6.5 Air Pollution Control (APC) residues will be collected in a sealed bin for subsequent recovery.. Under normal conditions, both char and APC residues will be stored inside.

Table 3-2: Typical Amounts of Recovered Materials and Residual Wastes from the Demonstration Unit

Product Description	Expected Tonnes per Annum	Material End Use
Char	100	Longer term view of securing alternative re-use/ recovery subject to client's requirements. Other waste char sent to disposal off site.
Air pollution control residues	10	Landfill as a recognised hazardous waste

3.7 Instrumentation

3.7.1 The demonstration unit will be equipped with a range of process instrumentation to monitor key parameters to ensure that the thermal treatment plant is operating as designed. Instruments are installed to provide continuous information to the PLC system, which monitors and adjusts key operational parameters to ensure efficient combustion of the waste at all times. The instruments will supply data to the PLC-based process control system overseen by SCADA supervisory control. This will control the combustion process and associated pollution control systems and derive key metrics for optimisation and monitoring of the combustion process by shift personnel.

3.7.2 Out of hours in the event that the demonstration unit is left in idle mode the plant will be remotely monitored by a trained site operative. The plant will be fully capable of being remotely shut down. Where required the site operative would attend the demonstration unit out of hours.

3.8 Emissions to Air

3.8.1 The demonstration unit will operate under the terms and conditions of a Schedule 13 permit which requires compliance with the following pollutants specified by the IED for small waste incineration plant.

Table 3-3: IED Compliance Limits

Pollutant	Scenario 1	Scenario 2
	Short-Term Emission Limits ($mg.Nm^3$)	Daily-Mean Emission Limits ($mg.Nm^3$)
Particles	30	10
TOC	20	10
HCl	60	10
HF	4	1
SO_2	200	50
NO_x	400	200
CO	100	50
Group 1 metals (a)	-	0.05 (d)
Group 2 metals (b)	-	0.05 (d)
Group 3 metals (c)	-	0.5 (d)
Dioxins and furans	-	0.0000001 (e)

Notes: All concentrations referenced to temperature 273 K, pressure 101.3 kPa, 11% oxygen, dry gas.

(a) Cadmium (Cd) and thallium (Tl).

(b) Mercury (Hg).

(c) Antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni), and vanadium (V).

(d) All average values over a sample period of a minimum of 30 minutes and a maximum of 8 hours.

(e) Average values over a sample period of a minimum of 6 hours and a maximum of 8 hours. The emission limit value refers to the total concentration of dioxins and furans calculated using the concept of toxic equivalence (TEQ).

3.8.2 Effective control of emissions to air will be achieved via the thermal oxidiser and flue gas treatment plant as detailed within Section 3.3 and 3.4.

3.8.3 An assessment of impacts on air quality from the operation of the phoenix and demonstration unit is included in Appendix B. The assessment included consideration of stack height and concluded that a 11 m stack was appropriate for this site. Modelling was therefore carried out on the basis of a 11 m stack.

3.8.4 The assessment considered impacts at both human health and ecological receptors. Modelling was based on a number of conservative assumptions and overall concluded that the effects from operation of the demonstration unit are not considered significant.

3.8.5 A detailed human health risk assessment (HHRA) has been completed to identify potential health risks associated with exposure to emissions from the demonstration unit. Full details of the assessment are provided within Appendix C.

3.8.6 The HHRA focused on contaminants of potential concern (COPCs) to the health of humans including dioxins/furans and dioxin-like polychlorinated biphenyls (PCBs). The assessment considered both primary effects from direct exposure (inhalation etc) and also potential secondary exposure, following deposition and subsequent uptake of these COPCs into the food chain.

3.8.7 This concluded that overall, the human health risk from emissions of dioxins and furans and dioxin-like PCBs from the demonstration unit is considered to be not significant.

3.9 Emissions to Water and Sewer

3.9.1 There will be no emissions to surface water, groundwater or sewer from the demonstration unit.

3.9.2 In the event of a fire, contaminated fire water from firefighting would be contained on the site (see details in section 4.4).

3.10 Monitoring

3.10.1 A CEMS unit is used to measure emissions for the gases. Dust levels previously confirmed using the CEMS unit to be consistently < 0.1 mg/m^3.

3.10.2 To enable demonstration of compliance with the IED emission limit values, an IED compatible, MCERTS Continuous Emissions Monitoring System (CEMS) will be installed in the exhaust stack to enable continuous monitoring and recording of emissions concentrations for the following pollutants:

- oxides of nitrogen (NO_X);
- sulphur dioxide (SO_2);
- carbon monoxide (CO);
- particulates;
- hydrogen chloride (HCl);
- total organic carbon (TOC); in addition to;
- water vapour (H_2O) (unless measured dry);
- oxygen;
- temperature; and,
- pressure.

3.10.3 In accordance with Annex VI part 6 IED, HF will not be monitored continuously as treatment stages for HCl will be used, which will ensure that the emission limit value for HCl is not being exceeded. Emissions of HF will however be subject to periodic measurements.

3.10.4 In order to comply with Art 45(1) IED any technically unavoidable stoppages, disturbances, or failures of the purification devices or the measurement devices, during which the emissions into the air may exceed the prescribed emission limit values will be monitored and recorded to ensure that the maximum permissible period set out in the permit is not exceeded.

3.10.5 In order to comply with Art 46(6) IED any period where emission limit values are exceeded will be recorded to ensure that the plant does not continue to incinerate waste for a period of more than 4

hours and that the cumulative duration of operation in such conditions over 1 year does not exceed 60 hours.

3.10.6 The proposed CEMS is capable of measuring all of the above gaseous species and is MCERTS-accredited. The monitoring equipment will be certified to EN15267-3 as required by EA Guidance 'Monitoring stack emissions: technical guidance for selecting a monitoring approach'[3]. Periodic monitoring will be carried out in accordance with EA Guidance 'Monitoring stack emissions: techniques and standards for periodic monitoring' [4]. The monitoring frequencies and methods are provided in Table 3-4 below.

Table 3-4. Monitoring Frequency

Emission Point	Parameter	Monitoring Frequency	Method
A3	Particulates; Total organic carbon; Oxides of nitrogen; Sulphur dioxide; Hydrogen chloride; Carbon monoxide; Oxygen; Pressure; Temperature; Water vapour content (unless measured dry).	Continuous daily and half hourly average for all parameters	MCERTS certified CEMS equipment (BS EN 14181, BS EN 15267-3)

3.10.7 All monitoring equipment will be calibrated in accordance with the relevant standard in accordance with Art 48(2) IED.

3.10.8 To enable periodic compliance check monitoring to be undertaken, the exhaust stack is equipped with sample ports. The location of the sample ports will ensure that a full traverse on both sampling planes can be achieved during the annual compliance monitoring programme that will be a condition of the permit. A permanent sampling platform will be installed to enable full and unfettered access to the sample ports by the specialist contractors appointed to undertake the compliance monitoring programme.

3.10.9 All monitoring results will be recorded, processed and presented in such a way as to enable the competent authority to verify compliance with the operating conditions and emission limit values which are included in the permit.

3.10.10 The emission limit values for air shall be regarded as being complied with if the conditions described in Part 8 of Annex VI IED are fulfilled.

3.10.11 During periods when waste is stored on the site, the PyroCore Site Manager will undertake a routine daily inspection of the site which includes visual monitoring for dust. Details of inspections are recorded in line with PyroCore's Environmental Management System (EMS).

[3] Environment Agency Guidance, Monitoring stack emissions: technical guidance for selecting a monitoring approach, December 2019. https://www.gov.uk/guidance/monitoring-stack-emissions-technical-guidance-for-selecting-a-monitoring-approach

[4] Environment Agency Guidance, Monitoring stack emissions: techniques and standards for periodic monitoring, December 2019 https://www.gov.uk/government/publications/monitoring-stack-emissions-techniques-and-standards-for-periodic-monitoring/monitoring-stack-emissions-techniques-and-standards-for-periodic-monitoring

4 ENVIRONMENTAL MANAGEMENT

4.1.1 PyroCore Ltd will review and where necessary amend their current Environmental Management System (EMS) to cover the operation of the demonstration unit.

4.2 Operations and Maintenance

4.2.1 Procedures will be incorporated within the EMS place to ensure that those operations associated with the demonstration unit which have the potential to give rise to significant environmental effects are controlled. Procedures will cover testing activities including start-up and shutdown and will also address accidents and incidents.

4.2.2 In particular the existing procedures for the following will be extended to cover the demonstration unit:

- waste reception, handling and storage within the waste storage building;
- good housekeeping measures;
- maintenance of key plant and equipment; and
- handling of char, cyclone dust and flue gas treatment residues and removal of residues from the site.

4.2.3 Regular site inspections will be extended to cover the demonstration unit in order to check that the additional SWIP unit remains in good working order.

4.2.4 Housekeeping measures that will be extended to cover the demonstration unit include:

- the waste storage areas will be kept clean and tidy;
- any spillages of materials and wastes will be immediately cleaned up;
- the Site Manager will undertake site inspections which will include checking for dust and litter across site and implementing corrective measures should any be identified. The site inspections will be recorded on the site inspection form; and
- As part of the factory acceptance test, the demonstration unit will be inspected daily.

4.2.5 Key plant/infrastructure of the demonstration unit that will be subject to routine inspection will include:

- routine inspection of the waste storage building fabric;
- routine inspection and maintenance of the building doors to the waste storage building to ensure they remain in good working order; and
- routine inspection of the demonstration unit will be undertaken during each trial to ensure that no significant air in-leakage points exist and that key systems are working effectively (ID fan, reagent injection systems).

4.2.6 Records of inspections and checks on the demonstration unit will be retained in the site office.

4.3 Training and Competence

4.3.1 The Operator will ensure that all personnel employed to operate the demonstration unit have appropriate skills and technical capabilities to understand the operation of the process, and their obligations under the terms and conditions of the Permit. The operators will therefore be suitably qualified and experienced personnel (SQEP). This will be managed via an update to the existing management systems.

4.3.2 On-site operational staff will be trained for normal operation of the demonstration unit as well as routine interventions, response to alarm conditions, and start-up and shut down procedures. Training records of the personnel involved will be recorded and copies kept on site. Only SQEPs will be

permitted to operate the plant. Following commissioning of the plant any new operational staff will be trained under the supervision of experienced operational staff.

4.3.3 Training records will be prepared for all operational staff and training needs will be reviewed on a regular basis as part of the Operator's EMS procedures. Copies of all training records will be available for inspection upon request.

4.4 Accidents and Incidents

4.4.1 The demonstration unit has been designed to be fully compliant with the relevant operational requirements of the IED.

4.4.2 Site staff and visitors must complete the Site Induction Plan and training.

4.4.3 An Accident Management Plan (AMP) will be amended to include the demonstration unit. The AMP will detail management procedures for the prevention of accidents as well as the procedures in the event of an accident. Of note the AMP will set out procedures in the event of a fire including measures for containment of fire waters. As per the current permit, PyroCore have purchased poly booms of sufficient length to enclose the perimeter of the facility. There will be no change as a result of the permit variation. Spent fire waters would be removed by a specialist third party contractor.

4.4.4 The Operator will undertake frequent inspections of the demonstration unit to mitigate against potential problems with the process equipment that may adversely affect performance. This will include a programme of preventative maintenance of major components of the installation.

4.5 Review and Record Keeping

4.5.1 As per the Phoenix unit, the site inspections will be recorded in the Site Manager's Site Diary.

4.5.2 The site inspection will include:

- Compliance with the environmental permit and EMS;
- Waste storage;
- Diesel storage;
- Sodium bicarbonate and activated carbon storage;
- Signage;
- Integrity of waste storage building fabric including floor surfaces;
- Dust and odour emissions as well as presence of litter and pests (should there be any); and
- Complaints received.

4.5.3 Records will be retained at least 6 years from the date the records were made, or in the case of the records pertaining to off-site environmental and health effects, until the permit is surrendered.

4.5.4 BCC may request copies of the site diary and site inspection records relating to SWIP operations at any time.

4.6 Energy Recovery

4.6.1 It is recognised that there are both environmental and financial benefits associated with the reduction and minimisation of energy usage. Even small percentage savings in energy consumption can represent considerable financial savings and environmental benefits through emission reductions.

4.6.2 As described in Section 3, the facility is designed to make use of heat from the hot combustion gases to sustain the pyrolysis stage.

4.6.3 As per the Phoenix unit, basic energy efficiency measures will be in place at the site. The facility will only operate when needed, hot systems will be insulated to prevent gross heat losses and energy efficient lighting will be provided.

4.7 Raw Material Management

4.7.1 Other than waste, the raw materials that will be used at the demonstration unit are identified in Table 4-1. Expected usage, storage arrangements and capacities are also identified in this Table 4-1.

Table 4-1 – Raw Materials

Raw Material	Maximum storage capacity (tonnes)	Storage Arrangements	Annual Consumption
Sodium Bicarbonate and Powdered Activated Carbon	0.5	Sealed 25 kg dumpy bags x 20	<5
Nitrogen	1	12 (1.45 m tall x 0.23 m diameter) size N_2 bottles	5
Diesel	1.2	Double skinned tank	25
Urea	0.25	Bagged urea prills in a dry area	0.5

5 CHANGES TO THE ENVIRONMENTAL PERMIT

5.1.1 Question B2.8 of the application form requires detail on the conditions to be changed in the current permit. The conditions in the permit will need to be reviewed as a result of adding a new demonstration unit. Updates to the permit conditions will include, but will not be limited to, the following:

- Schedule 1, Table 1.1.3 to include the additional permitted waste types as set out in Table 3-1
- 1.1.4 - 1.1.6. to permit the processing of hazardous waste within the demonstration unit only
- Table 6.1.1 and associated emission point plan to include emission point A3;
- Condition 6.1.2 and Tables 6.1.2 a, b and c to include emission limits and monitoring of emissions associated with the demonstration unit emission point (A3).
- Condition 6.6.1 to include emission point A3.

Drawings

Drawing 1 Site Location Plan

Drawing 2 Layout Plan Indicating the Boundary and Emission Points

Drawing 3 Drainage Plan

Drawing 4 Process Flow Diagram

Appendices

Appendix A

Application Form

Appendix B

Air Quality Assessment

Appendix C

Human Health Risk Assessment

Appendix D

Evidence to Support Compliance with Article 50 (2)