PPC PERMIT APPLICATION SUPPORT DOCUMENT

Recycling Technologies Ltd
Plastics Recycling Facility

Prepared by:
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Date:
December 2020

Project Issue Number:
SOL2012RT01

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VERSION CONTROL RECORD			
Contract/Proposal Number:	SOL2012RT01		
Authors Name:	SR		
Signature:			
Issue	Description of Status	Date	Reviewer Initials
1CC	Commercially Confidential Submission to SEPA	December 2020	[redacted]

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Glossary of Terms

Term	Definition
Advanced Conversion Technology	A suite of technologies which have the capacity to convert solid waste materials into gas for the generation of renewable energy. Technologies include Pyrolysis, Gasification and Anaerobic Digestion. The technologies used to utilise renewable fuels or waste include: – Direct firing open cycle steam turbine systems, – Integrated gasification combined cycle turbine systems, – Integrated pyrolysis combined cycle turbine systems, – Anaerobically generated biogas fuel in reciprocating engine or gas turbine systems.
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Ambient air	Outdoor air in the troposphere, excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year. Usually this is for a calendar year, but some species are reported for the period April to March, known as a pollution year. This period avoids splitting winter season between 2 years, which is useful for pollutants that have higher concentrations during the winter months.
AQMA	Air Quality Management Area.
BTEX	BTEX is an acronym that stands for benzene, toluene, ethylbenzene, and xylenes.[1] These compounds are some of the volatile organic compounds (VOCs) found in petroleum derivatives such as petrol (gasoline). Toluene, ethylbenzene, and xylenes have harmful effects on the central nervous system.
By-product	A by-product is a secondary product derived from a manufacturing process or chemical reaction. It is not the primary product or service being produced.
CHP	Combined Heat and Power Plant (CHP) integrates the production of usable heat and power (electricity), in one single, highly efficient process.
CHPQA	The CHPQA (Quality Assurance for Combined Heat and Power) programme is carried out on behalf of the Department of Energy and Climate Change, in consultation with the Scottish Executive, the National Assembly for Wales, and the Northern Ireland Department of Enterprise, Trade and Investment.

DEFRA	Department for Environment, Food and Rural Affairs.
Dioxin	Dioxins and dioxin-like compounds, a diverse range of chemical compounds which are known to exhibit "dioxin-like" toxicity. In chemistry, a dioxin is a heterocyclic 6-membered ring, where 2 carbon atoms have been replaced by oxygen atoms.
Eutrophication	Eutrophication or more precisely hypertrophication, is the ecosystem response to the addition of artificial or natural substances, such as nitrates and phosphates, through fertilisers or sewage, to an aquatic system
Exceedance	A period of time where the concentrations of a pollutant is greater than, or equal to, the appropriate air quality standard.
FGCS	Flue Gas Cleaning System
Fugitive emissions	Emissions arising from the passage of vehicles that do not arise from the exhaust system.
Gasification	Gasification is a process that converts organic or fossil based carbonaceous materials into carbon monoxide, hydrogen and carbon dioxide. This is achieved by reacting the material at high temperatures (>700°C), without combustion, with a controlled amount of oxygen and/or steam.
HVAC	HVAC (heating, ventilation, and air conditioning) is the technology of indoor and vehicular environmental comfort.
ISO14001	ISO 14000 is a family of standards related to environmental management that exists to help organizations (a) minimize how their operations (processes etc.) negatively affect the environment (i.e. cause adverse changes to air, water, or land); (b) comply with applicable laws, regulations, and other environmentally oriented requirements, and (c) continually improve in the above.
LAQM	Local Air Quality Management.
NO	Nitrogen monoxide, a.k.a. nitric oxide.
NO_2	Nitrogen dioxide.
NOx	Nitrogen oxides.
O_3	Ozone.
PAH	Polycyclic aromatic hydrocarbons (PAHs), also known as poly-aromatic hydrocarbons or polynuclear aromatic hydrocarbons, are potent atmospheric pollutants that consist of fused aromatic rings and do not contain heteroatoms or carry substituents. Naphthalene is the simplest example of a PAH. PAHs occur in oil, coal, and tar deposits, and are produced as by-products of fuel burning (whether fossil fuel or biomass). As a pollutant, they are of concern because some compounds have been identified as carcinogenic, mutagenic, and teratogenic.
Percentile	The percentage of results below a given value.

PLC	A Programmable Logic Controller, PLC or Programmable Controller is a digital computer used for automation of electromechanical processes, such as control of machinery.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
PPB parts per billion	The concentration of a pollutant in the air in terms of volume ratio. A concentration of 1 ppb means that for every billion (10^9) units of air, there is one unit of pollutant present.
PPM parts per million	The concentration of a pollutant in the air in terms of volume ratio. A concentration of 1 ppm means that for every billion (10^6) units of air, there is one unit of pollutant present.
Pyrolysis	Pyrolysis is a thermochemical decomposition of organic material at elevated temperatures in the absence of oxygen.
Ratification (Monitoring)	Involves a critical review of all information relating to a data set, in order to amend or reject the data. When the data have been ratified they represent the final data to be used (see also validation).
RPW	Residual Plastic Waste
Renewable Energy	Renewable energy is generally defined as energy that comes from resources which are continually replenished on a human timescale such as sunlight, wind, rain, tides, waves and geothermal heat. Renewable energy is also defined under the Renewable Energy Directive as comprising energy from the biomass fraction of waste.
ROC	Renewable Obligation Certificates
SCADA	SCADA (supervisory control and data acquisition) is a type of industrial control system (ICS). Industrial control systems are computer controlled systems that monitor and control industrial processes.
SCR	Selective catalytic reduction (SCR) is a means of converting nitrogen oxides, also referred to as NOx with the aid of a catalyst into diatomic nitrogen, N_2, and water, H_2O. A gaseous reductant, typically anhydrous ammonia, aqueous ammonia or urea, is added to a stream of flue or exhaust gas and is adsorbed onto a catalyst.
SRF	SRF can be distinguished from RDF in the fact that it is produced to reach a standard such as CEN/343 ANAS.
Synthesis Gas (Syngas)	Syngas, or synthesis gas, is a fuel gas mixture consisting primarily of hydrogen, carbon monoxide, and very often some carbon dioxide. The name comes from its use as intermediates in creating synthetic natural gas (SNG) and for producing ammonia or methanol.
µg/m³ micrograms per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of 1ug/m^3 means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.

UKAS	United Kingdom Accreditation Service.
Uncertainty	A measure, associated with the result of a measurement, which characterizes the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy', and has replaced it on recent European legislation.
USA	Updating and Screening Assessment.
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
Validation (monitoring)	Screening monitoring data by visual examination to check for spurious and unusual measurements (see also ratification).
VSD	Adjustable speed drive (ASD) or variable-speed drive (VSD) describes equipment used to control the speed of machinery. Many industrial processes such as assembly lines must operate at different speeds for different products. Where process conditions demand adjustment of flow from a pump or fan, varying the speed of the drive may save energy compared with other techniques for flow control.

NON TECHNICAL SUMMARY

Recycling Technologies Ltd (the '*Applicant'* or the *'Operator'*) is making a New Bespoke Installation Permit Application for the proposed operation of a Plastics Recycling Facility at their site on Binn Farm, Glenfarg.

The proposed Installation is located on land at Binn Farm, Glenfarg, PH2 9PX (Grid Reference: NO 17439 13260).

The proposed development consists of a continuous thermal cracking plant used to create wax and oil products, termed 'Plaxx®', from unrecyclable plastic residues for reconversion to plastics. The Installation has been designed to process approximately 12,000 tonnes of non-hazardous residual mixed plastic waste per annum.

The facility will typically contain the following key components:

- Reception and Processing Building containing:
  - Reception Bunkers;
  - Material Preparation Plant (including trommel screen, over-band magnet, optical scanner and shredder); and
  - Transfer and Conveyor Plant.
- External Main Processing Plant:
  - Thermal Cracking Process Area;
  - Regenerator Process Area;
  - Distillation Process Areas;
  - Gas Treatment;
  - Flue Gas Treatment and Heat Integration Process Area;
  - Associated Utilities and Ancillary Plant; and
  - Oil / Plaxx® Storage Tanks.

The proposed process will be permitted by the Scottish Environmental Protection Agency (SEPA) as a Waste Incineration Activity and will be operated in accordance with the Pollution Prevention and Control (Scotland) Regulations 2012 and Chapter IV of the Industrial Emissions Directive (IED).

The proposed process meets the definition of an Installation as defined by Section 5.1 *'Incineration and Co-Incineration of Waste'* paragraph A(1)(b) namely:

'The incineration of non-hazardous waste with the exception of waste which is biomass or animal carcasses in an incineration or co-incineration.'

General Overview

All residual plastic waste (RPW) will be delivered directly into the reception and plastics conditioning building via electrically operated roller shutter doors. RPW will be transferred into a material

preparation plant. The material preparation process area consists of industry standard, "off-the-shelf" equipment, including a screen, over-band magnet, optical sorter and shredders. This equipment is not bespoke and does not form part of Recycling Technologies core technology. The purpose of the plant is to remove undesirable material such as biomass, glass, metals, moisture and undesirable polymers / plastics prior to processing.

The continuous thermal cracking process is split into two circuits:

- The primary circuit – where hydrocarbon vapour generated from thermally cracking residual plastic waste (RPW) is circulated; and
- The secondary circuit – where a combustion reaction generates the thermal energy for the cracking process.

The primary circuit utilises a fluidised bed of sand-type material where the thermal cracking of RPW takes place resulting in hydrocarbon vapours being generated. The hydrocarbon vapour product then flows to the distillation process areas where three hydrocarbon products are extracted (Wax, Heavy Oil, Medium - Light Oil).

After the distillation, the resulting hydrocarbon gas mixture is heated above its saturation point to prevent condensation during flue gas treatment. The heated hydrocarbon gas mixture flows through a fixed adsorbent bed (Halide Guard). The fixed adsorbent bed is able to remove impurities which would produce undesirable emissions, such as halides, nitriles and sulphides from the combustion process.

A blower unit provides the motive force for fluid flow in the primary circuit. The primary use of the treated hydrocarbon gas mixture is for fluidising the bed of sand-type material in the Thermal Cracker. The temperature of the hydrocarbon gas mixture is raised, via a heat exchanger and an electric heater, before being pumped into the Thermal Cracker. The heat exchanger recovers heat from the flue gas network, whilst the electric heater raises the temperature further to the required operating temperature in the thermal cracker.

The excess hydrocarbon gas mixture generated in the process, not required by the Thermal Cracker, is used as a fuel source for the combustion process in the secondary circuit. Combustion occurs in the Regenerator, which operates a high temperature fluidised bed of sand-type material. The sand-type material is circulated between the Thermal Cracker and the Regenerator, to maintain a constant fluidised bed temperature and volume within the Thermal Cracker. The sand-type material is transferred pneumatically from the Thermal Cracker to the Regenerator using screw conveyors and Nitrogen.

The air for the combustion process in the Regenerator is provided by a blower unit. A fuel gas burner is located upstream of the Regenerator to provide the heat input during start-up. The exhaust gas from the Regenerator goes through a gas-solids separator to recover sand-type material entrained from the

Regenerator. The Regenerator exhaust gas is thermally treated in an Oxidiser before undergoing heat recovery. The Oxidiser exhaust gas is then vented to atmosphere after being filtered for particulates in a hot gas filter.

The process requires water circuits to ensure temperature control of the distillation process. Additional thermal energy in the water circuits is not recovered and is discharged to the local atmosphere.

Emissions to Air

The plant will have a 25m tall stack (A1) for the discharge of exhaust gas to atmosphere.

The exhaust gas will mainly comprise of carbon dioxide, water vapour, nitrogen and excess oxygen. Carbon monoxide emission is controlled by ensuring complete combustion of hydrocarbons in the Regenerator and the Oxidiser. Temperature in the Regenerator and Oxidiser is not sufficient to generate nitrogen oxides. Dioxins and furans are eliminated by controlling the temperature in the Oxidiser at 850°C and allowing 2 seconds residence time for the exhaust gas. The flue gas treatment system is also provided with a hot gas filter with dosing capability (with activated carbon) to safeguard against reformation of dioxins via the De Novo Synthesis process.

The hydrocarbon gas mixture from the thermal cracking of RPW is treated in the Halide Guard to remove impurities such as halides, nitriles and sulphides. This ensures clean combustion of the hydrocarbons in the secondary circuit.

Exhaust gas arising from the combustion of fuel gas and excess hydrocarbon gas from the primary circuit, is treated for chemical and physical impurities at different stages in the secondary circuit, as listed below:

- A gas-solid separator for particles recovery from the Regenerator exhaust gas;
- Oxidiser to maintain exhaust gas at 850°C for 2 seconds to ensure complete combustion of all hydrocarbons and eliminate dioxins and furans; and
- A hot gas filter with the capacity for dosing of activated carbons or other reagents prior to discharging the exhaust gas via Stack A1.

Therefore, all emissions to atmosphere will be comfortably within the stipulated Emission Limit Values (ELVs) for Chapter IV IED activities.

Please refer to the Air Quality Assessment provided within *Annex C2 – Air Quality Assessment and HHRA* for more information.

Odour

Due to the design of the building structure, the enclosed processing activities and the nature of the waste feedstock materials stored and processed on site, there is very little potential for offsite odour emissions and impacts to arise from the site.

The waste plastic material is stored in waste storage bays within the material preparation building. There are no open external storage areas for waste under normal operation.

Emissions to Controlled Water

There will be no direct process emissions to controlled water arising from the Installation.

The building roof water is collected and conveyed by drains to a series of filter trenches before discharging into a detention basin. Discharge from the detention basin into the nearby watercourse (W1) is restricted by a flow control device.

Surface water runoff will be collected and conveyed by drains to filter trenches before discharging into the existing detention basin.

Any foul drainage will be treated by a packaged treatment plant on site. Outfall from this will discharge to the same discharge point (W1).

In the event of a fire, all potentially contaminated fire water will be collected within the associated bund system, drained to the site water/oil separation system collected and tankered away to a suitable water treatment facility.

Emissions to Land

There will be no emissions to land arising from the Installation.

Waste Management

The thermal cracking process will not inherently produce significant quantities of waste. The main types of waste produced from the operation of the facility are as follows:

- Ash removed from the flue-gas treatment system;
- Sand-type material used for the fluidised bed (with traces of ash);
- Waste water with traces of oil;
- Spent adsorbents from the Halide Guard;
- Spent activated carbon from the flue-gas treatment system; and
- Sodium chloride from treatment of the hydrocarbon vapour in the primary circuit.

There will also be material removed from the incoming RPW via the material preparation plant. This will mainly consist of non-conforming plastic, metals, stone, glass and biomass.

The process produces four main products, listed below:

- Wax Product – Plaxx® 50;
- Heavy Oil Product – Plaxx® 30; and
- Medium-Light Oil Product – Plaxx® 8.

Impact

The air emissions from the proposed development have been modelled using ADMS 5.2 atmospheric dispersion modelling software.

The air quality impact assessment considered the air impact to all identified residential, sensitive habitat and ecological receptors.

It is the conclusion of the modelling that the Installation is unlikely to have a significant impact at any of the receptor locations examined and is unlikely to have a significant impact on the environment.

All of the air emissions from the Installation have been risk assessed against their potential impact on human health. The results of the assessment are that the proposed installation will not present any risk to human health.

1. INTRODUCTION

This document has been prepared on behalf Recycling Technologies Ltd ('*RT*' or the '*Applicant*' hereafter) by Sol Environment Ltd and provides supporting evidence as required by Environmental Permit Application Form Part B issued by Scottish Environment Protection Agency (SEPA).

The Applicant is making this application for a Bespoke Part A(1) Installation Permit Application under Pollution Prevention and Control (Scotland) Regulations 2012 for a Plastics Recycling Facility at their site on Binn Farm, Glenfarg.

The proposed Installation is located on land at Binn Farm, Glenfarg, PH2 9PX (Grid Reference: NO 17439 13260).

The proposed development consists of a continuous thermal cracking plant used to create wax and oil products, termed 'Plaxx®', from unrecyclable plastic residues for reconversion to plastics. The Installation has been designed to process approximately 12,000 tonnes of non-hazardous residual mixed plastic waste per annum.

The proposed process will be permitted by the Scottish Environmental Protection Agency as a Waste Incineration Activity and will be operated in accordance with the Pollution Prevention and Control (Scotland) Regulations 2012 and Chapter IV of the Industrial Emissions Directive (IED).

The proposed process meets the definition of an Installation as defined by Section 5.1 *'Incineration and Co-Incineration of Waste'* paragraph A(1)(b) namely:

'The incineration of non-hazardous waste with the exception of waste which is biomass or animal carcasses in an incineration or co-incineration.'

The remainder of this application support document is structured accordingly:

- Section 2: Provides a detailed planning history of the site and associated activities;
- Section 3: Provides specific details associated with the New Bespoke Installation Permit Application;
- Section 4: Provides specific nature and detailed description of the emissions to air, water emissions and waste associated with the Installation;
- Section 5: Provides details of all environmental monitoring associated with the Installation;

- Section 6: Provides a BAT description of the proposed technology and provides a comparison against the applicable guidance and emission limit values for the Installation; and
- Section 7: Provides an Environmental Impact and Assessment of the Installation against the requirements of the Habitats Directive.

All technical appendices associated with the Installation are included within SOL2012RT01 and comprise the following:

- Annex A: Figures;
- Annex B: Technical Information;
- Annex C1: Environmental Risk Assessment;
- Annex C2: Air Quality Assessment and HHRA;
- Annex C3: Environmental Noise Assessment;
- Annex C4: Site Condition Report;
- Annex D1: Draft Site Working Plan;
- Annex D2: Accident Management Plan;
- Annex D3: Site Closure Plan;
- Annex D4: Heat and Power Plan;
- Annex E: Planning Application and Permission.

The location of the Installation is provided overleaf in Figure 1.1.

The Site Layout and Installation Boundary is provided in Figure 1.2 and Figure 1.3.

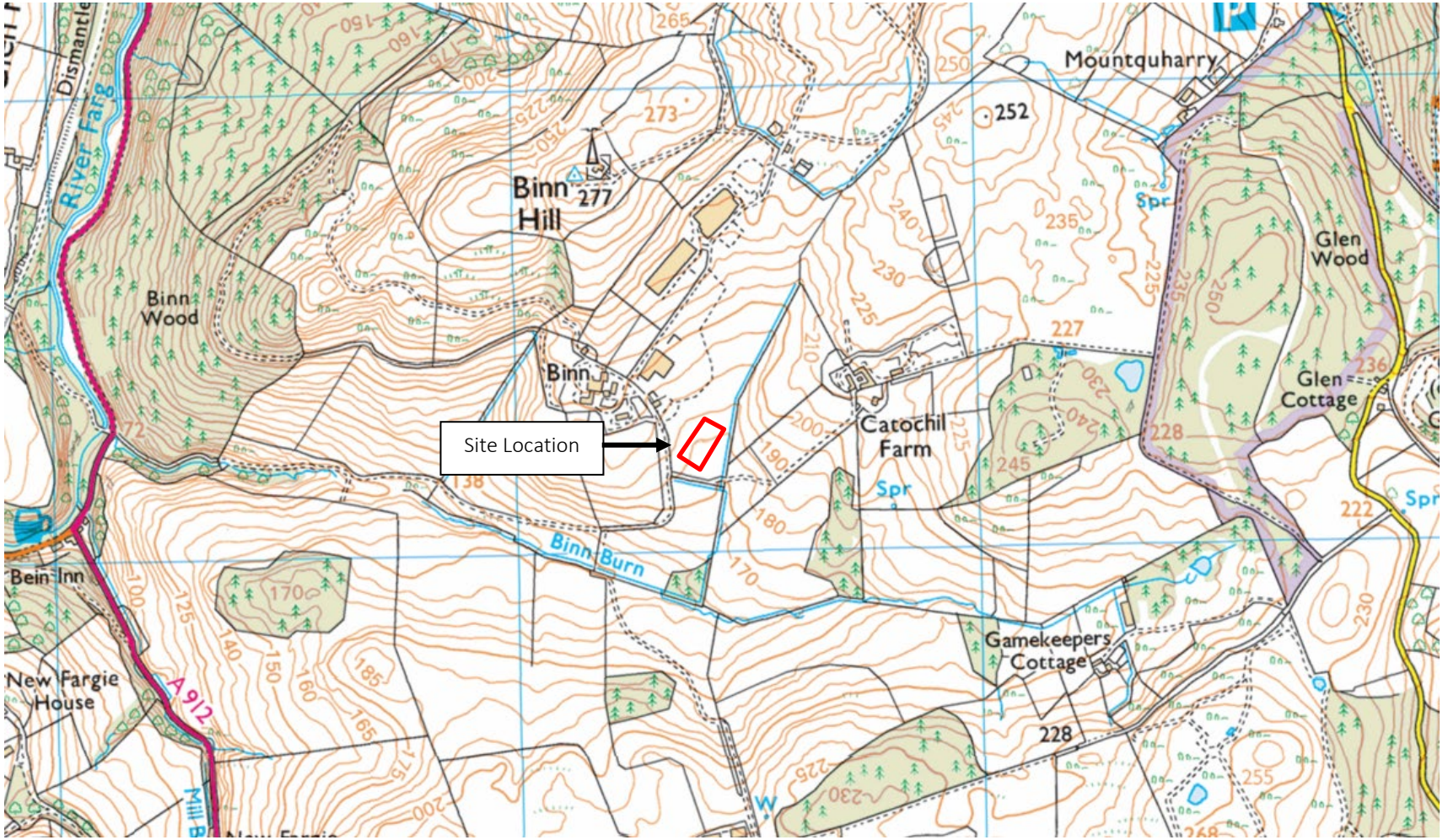

Figure 1.1: Site Location

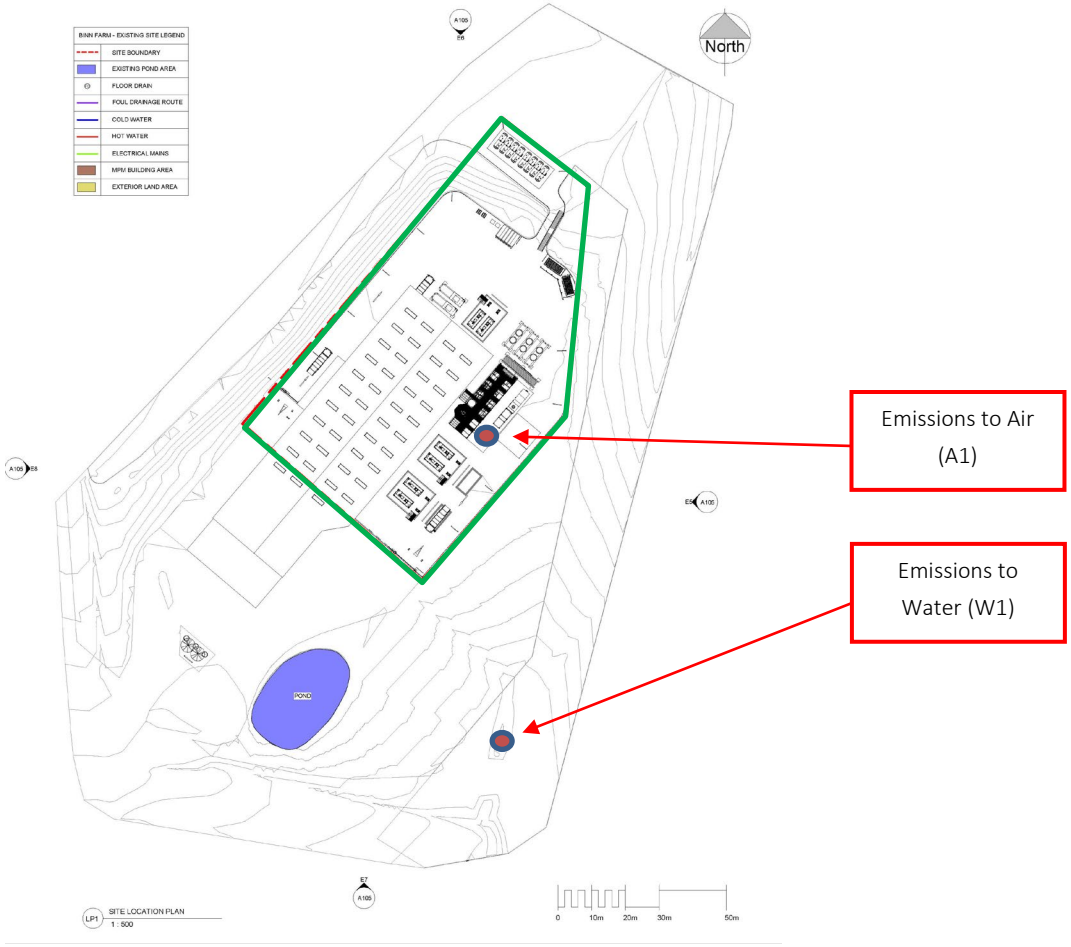

Figure 1.2: Installation Boundary and Emission Points

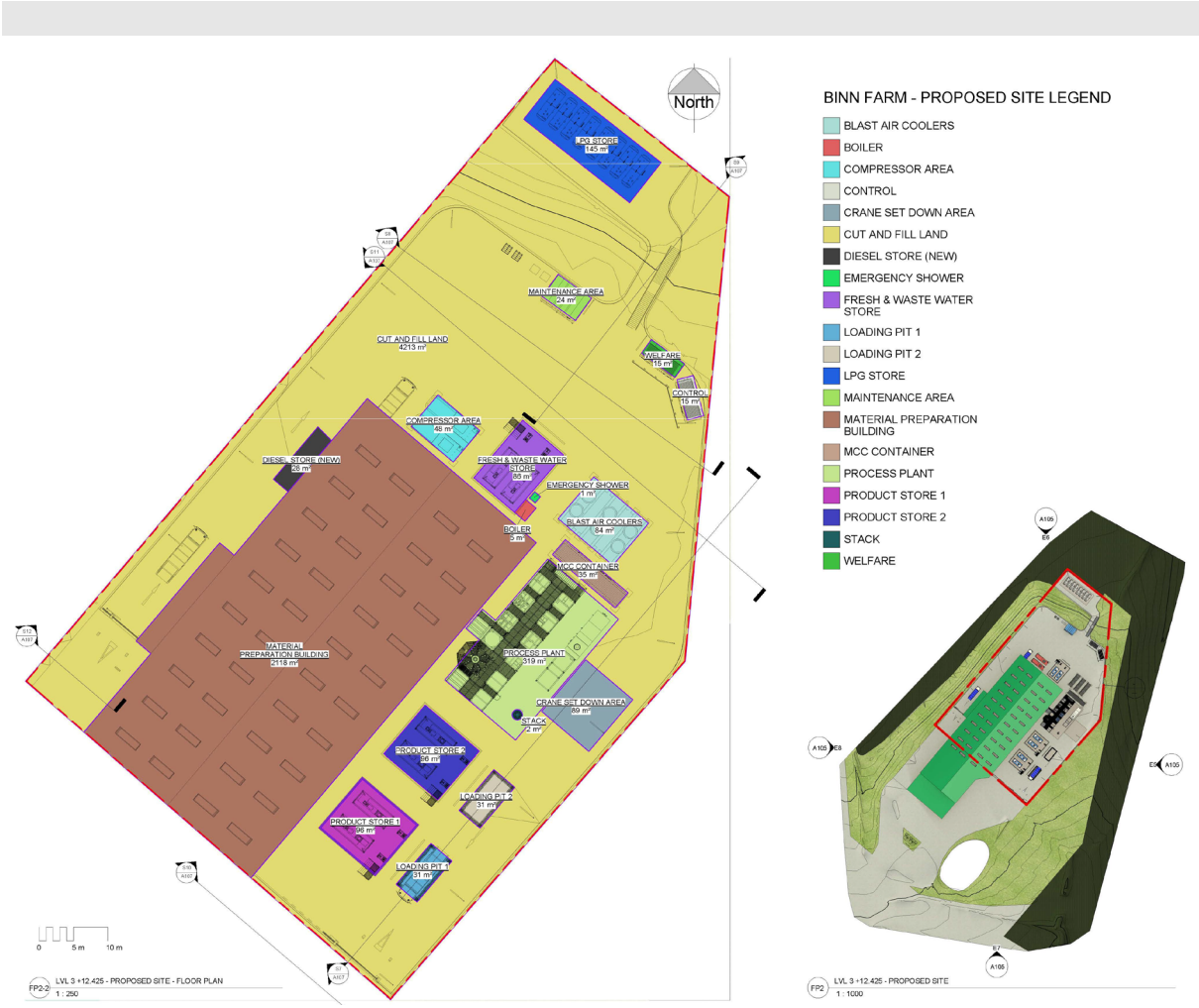

Figure 1.3: Labelled Site Layout

2. PLANNING STATUS

The Applicant has submitted an application to Perth and Kinross Council on 8th December 2020. This planning application is currently undergoing validation and determination.

The details pertaining to all known planning permissions at the site are provided in Table 2.1 below.

Table 2.1: Planning History

Reference	Description	Status	Date Granted
100338930-001	Erection of plastics processing facility and associated works	Under Determination	-

3. PROPOSED ACTIVITIES

3.1 Type of Permit

The Applicant are making an application for a Bespoke Installation Permit for the proposed operation of a Plastics Recycling Facility at their site located at Binn Farm, Glenfarg.

The use of Advanced Thermal Treatment (pyrolysis) meets the definition of a 'Co-*Incineration Plant*' as defined by Chapter 5 *'Waste Management'* of Schedule 1 of the Pollution Prevention and Control Regulations.

The Installation has been designed to accept Residual Plastic Waste (RPW) in accordance with stringent site waste acceptance procedures and contracted specification. All waste will be obliged to meet the specification provided in *Table 3.4 – Proposed Feedstock EWC Codes and Types*.

The applicant is making an application for an Environmental Permit to carry out the following activities, listed in *Table 3.1* below:

Table 3.1: IED Activities

Activity listed in PPC 2012	Description of Specified Activity	Limits of Specified Activity	Specified Waste Management Operation
Section 5.1 'Incineration and Co-incineration of Waste' paragraph A(1)(b)	Continuous Thermal Cracking (pyrolysis) of non-hazardous mixed Residual Plastic Waste (RPW). The RPW will not include biomass or animal carcasses. .	The reception, storage and Continuous Thermal Cracking (pyrolysis) of non-hazardous mixed Residual Plastic Waste. Combustion of fuel gas [Liquefied Petroleum Gas (LPG) and Light Hydrocarbon Gas by-product from process] The distillation of hydrocarbon vapours to produce hydrocarbon products (Wax, Heavy Oil, Medium Oil, and Light Oil). The installation includes utility, ancillary and storage equipment/processes.	R5: Recycling / reclamation of other inorganic materials R13: Storage of waste pending the operations numbered R1

The technical guidance notes used in the preparation of this application document are:

- Sector Guidance Note IPPC S0.01 – General Sector Guidance; and
- Sector Guidance Note IPPC S5.01 – The Incineration of Waste.

The main issues identified within these guidance documents and the relevant Best Available Techniques (BAT) have been built into the site operation procedures that will form the management systems and working plans for the site.

3.2 Installation Boundary

All proposed operations will be contained within the site ownership boundary. A figure showing the proposed building configuration and Installation boundary has been provided in Section 1, Figure 1.2 and 1.3.

A Site Report that provides a baseline conceptual model for the site has been completed and included within *Annex C4 – Site Condition Report* of this document.

The Site Condition Report does not indicate that the existing site presents either a significant contamination risk, nor does it identify any aspect of the new Installation that presents a potential risk to the environment.

All aspects of the new Installation have been designed in accordance to SEPA's Pollution Prevention Guidance.

3.3 Infrastructure and Design

The site will utilise an existing building on the site which will house the incoming storage and the material preparation plant. The facility will typically contain the following key components:

- Primary Circuit
  - Process Area 1 – Thermal Cracker;
  - Process Area 3A and 3B – Wax and Heavy Oil Distillation;
  - Process Area 4A – HCl Removal and MOLO Distillation.
- Secondary Circuit
  - Process Area 2 – Regenerator Process Area;
  - Process Area 5 – Flue Gas Treatment and Waste Heat Recovery.
- Ancillaries
  - Material Preparation Plant;
  - Process Area 6 – Heat Recovery and Flue Gas Treatment;
  - Process Area 7 – Utilities and Ancillaries; and
  - Process Area 8 – Plaxx Offtake.

Site Drainage

There will be no direct process emissions to controlled water arising from the Installation.

The building roof water is collected and conveyed by drains to a series of filter trenches before discharging into a detention basin. Discharge from the detention basin into the nearby watercourse (W1) is restricted by a flow control device.

Surface water runoff will be collected and conveyed by drains to filter trenches before discharging into the existing detention basin.

Any foul drainage will be treated by a packaged treatment plant on site. Outfall from this will discharge to the same discharge point (W1).

In the event of a fire, all potentially contaminated fire water will be collected within the associated bund system, drained to the site water/oil separation system collected and tankered away to a suitable water treatment facility.

Tanks and Bunds

All storage tanks will be installed with secondary containment and be designed to comply with the relevant SEPA standards and guidance requirements.

All storage tanks associated with the process are detailed within Table 3.4 in Section 3.5 *'Raw Materials'.*

The majority of the liquid tanks and pipework will be located above ground, however the LPG Tanks are designed to be within a mounded installation where the tanks are buried up until the top tank outlet nozzle with gravel / earth. The purpose of this design is to improve the safety of the tank design as it decreases the chance of a hazardous area forming around the tanks as it is not possible for the fuel and air to mix within the allowable void space. The tanks are mounded rather than completely buried and there will be access to a top manway / vessel entry point to carry out any inspections.

The LPG pipework must run from the tank area to the process area and this must be trenched in order not to dissect the main pathway through the site for trucks and other vehicles. The LPG consumption is monitored both at the tanks (levels) and also at the end users (flow indicators) and therefore any losses in the system would be detected and RT would be able to switch off the LPG supply before finding and rectifying the source of the leak. All trenched pipework shall be installed with removable covers such that they are accessible and able to be inspected and maintained as required.

Roadways and External Areas

An internal roadway system has been designed to give safe access to the processing building, main processing plant and product storage tanks.

Separate segregated pedestrian walkways have been provided to allow for safe access and egress of all personnel at site.

3.4 Description of the Process

Recycling Technologies have designed a highly efficient plastics recycling plant that utilises an advanced thermal cracking technology as a means of converting RPW into wax and oil products.

The principle components of the process comprise the following:

- *Waste Acceptance and Reception*: All residual plastic waste (RPW) will be delivered directly into the reception and plastics conditioning building via electrically operated roller shutter doors. All incoming waste will be stored within the plastic storage bays until required by the material preparation plant. All waste will be accepted in accordance with the sites waste acceptance procedures.

- *Material Preparation*: When required, RPW will be transferred into the material preparation plant, which will consist of a screen, over-band magnet, optical scanner and a shredder. The purpose of the plant is to remove undesirable material such as biomass, glass, metals, moisture and undesirable polymers / plastics prior to processing.

- *Thermal Cracker*: Conditioned RPW is then transferred into the thermal cracker unit via a feed system where thermal cracking (pyrolysis) takes place to produce hydrocarbon vapour. The resultant hydrocarbon vapour flows to the product distillation units. The combustion reaction generates thermal energy for the cracking process.

- *Distillation*: The hydrocarbon vapour produced by the Thermal Cracker flows to the product distillation units where three hydrocarbon products are extracted (Wax, Heavy Oil, Medium - Light Oil).

  After the product distillation takes place, the resulting hydrocarbon gas mixture is heated and flows through a fixed adsorbent bed (Halide Guard) to remove halides. A proportion of the hydrocarbon gas mixture is used for fluidising the sand bed in the Thermal Cracker. The temperature of the hydrocarbon gas mixture is raised, via a heat exchanger and an electric heater, before being pumped into the Thermal Cracker.

- *Regenerator:* Excess treated hydrocarbon gas mixture not required by the Thermal Cracker, is used as the fuel source for the combustion process within the Regenerator. Combustion occurs

in the Regenerator, which operates a high temperature fluidised bed of sand-type material. The sand-type material is circulated between the Thermal Cracker and the Regenerator, to maintain a constant fluidised bed temperature and volume within the Thermal Cracker. The sand-type material is transferred pneumatically from the Thermal Cracker to the Regenerator using screw conveyors and Nitrogen. The exhaust gas from the Regenerator goes through a gas-solids separator to recover sand-type material entrained from the Regenerator.

- *Flue Gas Treatment and Energy Recovery:* The gas clean-up process ensures that the exhaust gas from the Regenerator is treated to guarantee that the emissions meet the relevant Emission Limit Values. Thermal energy available in the exhaust gas is recovered before being released to atmosphere.

A more detailed process description has been included within Section 3.

3.5 Raw Materials

Waste Feedstocks

The Installation will typically accept approximately 12,000 tonnes (prior to conditioning in the Material Preparation Plant) of non-hazardous residual plastic waste per annum.

Prior to processing, all wastes accepted on site will be subjected to stringent waste acceptance criteria in accordance with the site environmental management plan and associated procedures:

- RT-E01 Waste Pre-Acceptance;
- RT-E02 Waste Acceptance; and
- RT-E03 Waste Rejection.

The process mainly targets residual plastic waste arising from household, industrial and commercial sources. Residual plastic waste is a broad definition of multiple different waste streams, which can include materials that are not yet suitable for chemical recycling.

Recycling Technologies will use a three-tier system to classify plastic waste and the suitability for processing.

A detailed list of European Waste Catalogue (EWC) codes of wastes that will be accepted by the Installation is provided in Table 3.2 below.

Table 3.2: Proposed Feedstock EWC Codes and Types

Waste Code	Description
02	**AGRICULTURE, HUNTING, FISHING, FOOD PROCESSING**
02 01	**agriculture, horticulture, aquaculture, forestry, hunting and fishing**
02 01 04	waste plastics (except packaging)

07	**ORGANIC CHEMICAL PROCESSING**
07 02	**manufacture, formulation, supply and use of plastics, synthetic rubber and man-made fibres**
07 02 13	waste plastic
12	**SHAPING, PHYSICAL TREATMENT OF METALS, PLASTIC**
12 01	**wastes from shaping and physical and mechanical surface treatment of metals and plastic**
12 01 05	plastics shavings and turnings
15	**PACKAGING, ABSORBENTS, WIPING CLOTHS AND FILTERS**
15 01	**packaging (including separately collected municipal packaging waste)**
15 01 02	plastic packaging
16	**OTHER WASTES FROM INDUSTRIAL PROCESSES**
16 01	**end-of-life vehicles from different means of transport and wastes from dismantling of end-of-life vehicle and vehicle maintenance**
16 01 19	plastic
17	**CONSTRUCTION AND DEMOLITION WASTE**
17 02	**wood, glass and plastic**
17 02 03	plastic
19	**MATERIALS FROM WASTE AND WATER TREATMENT**
19 12	**wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified**
19 12 04	plastic and rubber
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 39	Plastics

Notwithstanding the EWC's codes stipulated in Table 3.2 above, waste shall not be accepted at the site which has any of the following characteristics:

- Consisting solely or mainly of dusts, powders, loose fibres or liquids;
- Defined as Infectious;
- Drummed waste; or
- Malodourous wastes.

Waste deliveries will take place during the following hours:

- Monday – Saturday: 07:00 – 18:00; and
- Sunday: 09:00 – 14:00.

The following table summarises the BAT justifications regarding the proposed raw materials.

Table 3.4 BAT Justification for Raw Materials	
Indicative BAT	Justification
List of Raw Materials	Recycling Technologies will maintain a list of raw materials and their properties as per Table 3.5 above.
Review	A review of the raw materials used by the installation shall take place annually. If any other raw materials with improved environmental profile are suitable, they will be implemented. Longer-term studies will also be implemented.
Quality Assurance	Quality-assurance procedures will be in place for controlling the impurity content of raw materials.

3.6 Process Description

The design capacity of the plant is 7,000 tonnes of RPW per year, or 1 tonne per hour. The plant is designed to produce 5,200 tonnes of Plaxx® per year (approximate 75% product recovery).

The plant will operate 24 hours per day, 7 days per week, with time allocated each year for shutdown maintenance.

The main RT7000 process can be divided into two Major Functional Systems as follows:

- The Primary Circuit – Where hydrocarbon vapour generated from thermally cracking RPW in the Thermal Cracker (TCR) is treated and separated into different product fractions.
- The Secondary Circuit – Where combustion of fuel / Light Hydrocarbon Gas (LHG) is used to generate the thermal energy required for the cracking process.

The process also requires various utilities including cold water, hot water, steam, nitrogen, LPG, electricity and compressed air. The liquid products from the primary circuit are stored in a series of product storage tanks prior to collection by road tanker. There are three kinds of products:

1. Wax Product – Plaxx® 50;
2. Heavy Oil Product – Plaxx® 30; and
3. Medium-Light Oil Product – Plaxx® 8.

The proposed development comprises five core process areas and three ancillary process areas consisting of the following:

- Primary Circuit:
  - Process Area 1 – Thermal Cracker;
  - Process Area 3A and 3B – Wax and Heavy Oil Distillation;
  - Process Area 4A – HCl Removal and MOLO Distillation.
- Secondary Circuit:
  - Process Area 2 – Regenerator Process Area;
  - Process Area 5 – Flue Gas Treatment and Waste Heat Recovery.
- Ancillaries:

- Material Preparation Plant;
- Process Area 6 – Heat Recovery and Flue Gas Treatment;
- Process Area 7 – Utilities and Ancillaries;
- Process Area 8 – Plaxx Offtake.

3.7 Fire Prevention

For the purposes of describing fire prevention measures, the RT site at Binn Farm is split into operational activity areas by type of activity. Fire prevention measures will differ across the six operational area types:

1. Commercial contract controls and weighbridge – Reducing the importation of risk to the site in the control and management of inbound and out bounds vehicles;
2. Vehicle circulation and yards;
3. MPM building and internal Waste Storage;
4. RT7000 process and ancillary equipment (esp. Diesel generator and MCC);
5. Plaxx product storage; and
6. Occupied areas including Control cabin, Welfare and Offices.

Fire prevention will be affected using the general principles of fire prevention and industry standard guidance under IEC61511 (functional safety) Process Industries. RT has incorporated these into its product development and delivery processes as follows.

- Avoiding risks using risk identification, assessment and an ALARP approach:
  - Assets and sites shall be developed, designed and specified subject to a rigorous HAZID HAZOP process that will ensure that, wherever reasonably practicable, foreseeable risks, including fire and explosion are designed out and that equipment is inherently safe or fails to safe.
  - This risk-based methodology is informed by regulatory requirements, IEC61511, industry best practice, accepted codes of practice as well as operating experience.
  - Where identified risks cannot be eliminated by design and specification then layers of additional protection, either as equipment redundancy or safety instrumented systems, are incorporated within the asset development and design phase to provide adequate mitigation.
- Regular review, audits and incident reporting shall inform the continuous reduction in risk by the adoption of the non-dangerous or less dangerous technologies; adapting to technical progress by continuously reviewing and adopting BAT;
- Risks that cannot be avoided or eliminated in development phases are identified and managed in the site-specific risk assessment and in the resulting operating standards;
- Asset and site development projects and operating procedures shall aim to combat uneliminated risks at source rather than aiming to manage their effects;
- Development and adoption of a coherent overall prevention policy covering:
  - Asset strategy;
  - The use of technology;

    - Organisation of work;
    - Management of change; and
    - Control of the working environment.
- Giving collective protective measures priority over individual protective measures; and
- Giving appropriate instructions to employees

Commercial contract controls and weighbridge

Reducing the importation of risk to the site by the control of inbound waste and traffic. Contracts for waste shall reduce and control risk and shall be enforced by the weighbridge at reception and by the RT team member supervising waste reception and undertaking waste quality checks.

Vehicle circulation and yards

Site shall be set out as a one-way system with clear demarcation of high risk zones (RT7000 and product storage) and circulation zones. Traffic to site will be minimal and will be controlled by gate access. Uncontrolled access will therefore be minimized. Waste deliveries and drivers will be marshalled whilst product collection vehicles will be driven by industry trained (ADR) drivers. Yards and plant shall carry adequate signage and guidance.

The yards shall be equipped with an installed dry riser fire main, connected to the site fire pond with permanent standing for the site fire pump. The riser shall have hydrant points at appropriate locations allowing connection of fire hoses. The yards, MPM, RT7K and ancillary systems shall be equipped with an appropriate number of relevant extinguishers.

The Site fire tender is parked 150m to the South of the RT site control cabin. RT shall contribute to the maintenance and upkeep of the site fire tender and the RT team shall form part of the trained site fire crew. The site fire tender is equipped with firefighting equipment including a petrol-powered fire pump and hoses. The fire tender is intended to allow team to fight fire whilst trained retained crews arrive from Perth Fire Station twenty minutes from the site.

MPM building and internal Waste Storage

MPM consists of a low intensity waste industry standard MRF type processing plant equipped with two 50T stores, two shredders, a dryer, a trommel, a magnet and an NIR scanning selection system along with ancillary conveyors. Equipment is designed to industry best practice standards and shall be procured from reputable EPC contractor.

The hall is equipped with a system of 50+ detectors i.e. heat, flame and multi-sensors distributed throughout the MPM building and external surrounds. Detector systems are set to trigger fire alarm when any of the following occurs:

- Smoke detected in proximity to multi-sensors
- Flames detected (external sensors)
- Rapid rate of rise in heat at heat sensors

A fixed Forward-Looking Infrared Camera (FLIR) will be installed in the MPM plant to monitor temperatures of stored waste, camera outputs will also be linked for viewing remotely through an online link.

Operational standards shall ensure that equipment is operated correctly and that all high-risk equipment (shredding and drying equipment) is "taken down" daily at close of play, cleaned and inspected. A rigorous RCM maintenance system will ensure that all equipment is properly maintained and inspected. The site will be permanently manned and regular patrols will be undertaken which will include monitoring of the MPM building.

Waste on site is limited to a maximum of 100T, 50T held in the pre process buffer and 50T in the hopper ready buffer immediately before the RT7000. A FIFO approach to stock will be in place and therefore waste will have a maximum residence of five days reducing the risk of auto-ignition

RT7000 process and ancillary equipment (including Diesel generator and MCC).
RT7000 has been developed, designed, specified and will be delivered in line with RTs rigorous product development and delivery processes. Pressures and inventory have been reduced to a level where the risk of relief is considered negligible.

The plant, comprising 20 process modules, is equipped with an IEC 61511 compliant Safety Instrumented System that will give adequate and early warning of "out of parameter" operation and SCADA controls will carry hard coded alarms and process limits to prevent and warn of out of parameter situations. The plant is also equipped with gas detection equipment, LEL monitors that will detect flammable hydrocarbon gas leaks.

The plant is separated from surrounding buildings by a safety buffer zone and mounted on a bunded concrete foundation. The total plant inventory is limited so that any escape and resulting pool fire will burn for no more than five minutes.

The plant is controlled, monitored and manned by a permanent two-man crew trained and qualified to control and manage the plant.

Plaxx product storage
Plaxx storage area has been developed, designed, specified and will be delivered in line with RTs rigorous product development and delivery processes. Pressures and inventory have been reduced to a level where the risk of relief is considered negligible.

The storage area comprising 4 x 28T ISO industry standard tanks is equipped with an IEC 61511 compliant Safety Instrumented System that will give adequate and early warning of "out of parameter" operation and SCADA controls will carry hard coded alarms and monitoring limits to prevent and warn of out of parameter situations.

The storage areas are separated from main plant and from surrounding buildings by a safety buffer zone and mounted on a bunded concrete foundation. Inventory is limited to 4 x 28T tanks and relief cases have been eliminated on an ALARP basis.

The plant is controlled, monitored and manned by a permanent two-man crew trained and qualified to control and manage the plant. Out loading is conducted by the crew into ADR approved road tankers.

Occupied areas including Control cabin, Welfare and Offices
The site cabins, control rooms and offices shall be the subject of fire risk assessments giving rise to operational standards and fire risk management protocols. All RT staff shall be fire trained and regular retraining and exercises will be carried out to test that staff understand what to do.

There will only ever be a maximum of 50 tonnes of RPW stored in the post preparation buffers and 50 tonnes stored in the plastic storage bays. RPW will only be stored on site for a maximum of 54 days. This rapid turnover of stock significantly reduces the risk of 'older' material from self-heating and practically eliminates the potential for self combustion.

3.8 Controls and Environmental Management System

The site shall be operated in accordance with corporate standards and procedures as part of a wider Environmental Management System (EMS). All aspects of the operation will be managed in accordance with a formal Environmental Management and Working Plan. The plan will define all activities throughout the lifecycle of the treatment process (i.e. pre-acceptance, acceptance, reception).

The Environment Management and Working Plan will be structured to meet the requirements of the Pollution Prevention and Control Regulations and associated pollution prevention guidance.

The EMS will be designed to ensure:

- The identification of all foreseeable environmental impacts and risk that the Operator's activities pose to the environment.
- Prevention or minimisation of any identified risks to practical minimum.
- Legal Compliance assurance.
- Identification of risks of pollution including those arising from operations, maintenance, accidents, incidents, non-conformances and complaints, and how these will be minimised.
- Activities at the site will be managed in accordance with the management system, which will be subject to continuous review, audit and improvement. Specific detailed management system reviews will take place if there is a significant change to the activities, following an accident or if a non-compliance is found.
- Furthermore, the whole management system will be subject to annual external audit by competent third parties.
- The key aspects of the EMS for the site will include:

- Preventative maintenance;
- Operator requirements;
- Training and Competence;
- Emergency response and incident management; and
- Monitoring, measurement and reporting.

The EMS and procedures will be written to ensure that the environmental risk and impact of the normal running of the site activities are documented and minimised.

The EMS will be fully developed, implemented and in operation at the time of plant commissioning and permit issue and a copy of the management system will be kept at a convenient location on site.

Working Plan

The Applicant has developed a draft working plan for the operation of the site. This working plan defines the management of the site and provides the management controls for all aspects of the site. The company will operate a suite of procedures for each of the key activities on site. Draft versions of these procedures are included in *Annex D1 – Draft Site Working Plan* and includes the following:

Table 3.5: Working Plan

Ref No:	Title	Purpose
RT-E01	Feedstock Pre-Acceptance	This procedure defines the upstream screening, checking and pre-acceptance of all incoming RPW feedstocks prior to its arrival on site.
RT-E02	Feedstock Acceptance	This procedure outlines the onsite controls and considerations that need to be applied when RPW feedstock materials arrive on site for processing.
RT-E03	Feedstock Rejection	This procedure outlines the waste rejection process for all non-conforming feedstocks that cannot be processed on site. Acceptance of non-conforming wastes will be a direct breach of the permitted conditions of the sites Environmental Permit.
RT-E04	Feedstock Reception and Storage	This procedure outlines the RPW reception and storage processes for all incoming waste.
RT-E05	Controlled Waste	This procedure provides the necessary information to enable the assessment and off site transfer of non-conforming or untreatable waste streams.
RT-E06	Environmental Records	This procedure defines the necessary Environmental Permit and Waste Records that are required to be managed by the site to ensure compliance.
RT-E07	Environmental Management and Monitoring Programme	This procedure provides an overview of all of the necessary environmental monitoring procedures and controls to ensure compliance with the Permit.
RT-E08	Accident Management Plan	This procedure refers to the sites emergency plans and response requirements.

Site Maintenance

All maintenance activities on site will be carried out in accordance to the manufacturers' recommendations and will be integrated within the company's environmental management system.

The key aspects of the maintenance management programme will include:

- A programme of Planned Preventative Maintenance (PPM) is undertaken to ensure ongoing management and replacement of key plant and equipment rather than waiting for the equipment to fail, and the maintenance of any critical environmental equipment.
- The inspection and maintenance schedules that the manufacturer recommends are adhered to, including any period of recommended shut-down.
- Predictive maintenance (e.g. assessment of vibration from bearings in motors) is carried out to prevent any catastrophic breakdown.
- Real time data collection and plant condition monitoring.

The detailed management system operated by the site will include procedures for ensuring that adequate maintenance is undertaken at the site.

The maintenance programme will ensure that all equipment or infrastructure that is deemed essential in the prevention of pollution to the environment (e.g. hard-standing, bunds etc.) or the prevention of local nuisance impacts (e.g. noise abatement equipment etc.) is maintained and kept in good operating condition.

All maintenance activities for critical pollution control equipment (engines, abatement etc.) will form a key part of the certified EMS that will be established prior to the commencement of operations at site.

During planned periods of maintenance, if any of the following situations arise, waste will cease to be charged until normal operations can be restored:

- Continuous monitoring shows that emissions are exceeding any ELVs due to failure of the abatement systems or CEMS are out of service for a total of 4 hours;
- The cumulative duration of the periods of abnormal operation over 1 calendar year has reached 60 hours; or
- The continuous emission monitors are unavailable.

The planned period of abnormal operation will end at the earliest of the following:

- When the failed equipment is repaired and brought back into normal operation;
- When the operator initiates a shutdown of the combustion activity;
- When a period of four hours has elapsed from the start of the period of abnormal operation; or
- When, in any calendar year, an aggregate of 60 hours has been reached for planned periods of abnormal operation.

3.9 Operator Competence

The facility will be fully automated to the point that all process activities will be PLC controlled and SCADA monitored. The installation will have on-line monitoring to ensure the process is optimised and operating correctly.

Notwithstanding the above, the site will be staffed at all times by the Operations team. The primary role of staff is to ensure and oversee plant loading operations, RPW transfers and management. It is expected that three staff will be present on site throughout a 24-hour period which will include one controller, one shift supervisor, and one operator.

Additional activities will include general site housekeeping and administration activities. Additional staff attending the site will be visiting engineers from the equipment manufacturers who are adequately trained to perform their duties at site. Recycling Technologies Ltd will maintain written operation instructions for all plant and monitoring equipment present on site.

All personnel working at the facility will be trained in the necessary sections of the EMS and Working Plan and any associated Procedures. All staff working for and on the behalf of the site will be suitably trained and competent (e.g. professional maintenance engineers, electricians, equipment operators etc.).

The recruitment of site operatives and site management at the Binn Farm site has not yet begun. The Operations Team will employ on a full time basis a Site Manager who is the technically competent person for site and will hold the necessary WAMITAB CoTC Level 4: Managing Thermal Treatment qualifications as required by the WAMITAB Operator Competency Scheme.

Once hired, all details of the Site Manager will be forwarded to SEPA.

In the meantime, the Operations Director at the BETA plant in Swindon will be acting as the responsible person for managing the waste activities, with suitably qualified third parties for support if required. Please refer to Annex B – Technical Information of this letter for a CV (redacted).

No operations (pre-conditional or otherwise) that involve the acceptance, handling or processing of any wastes will take place without a technically competent person being employed by the Operator.

Operational Times

The plastics recycling process will be operated on a continuous 24/7 basis with deliveries, loading and unloading operations being carried out in accordance to the schedule below:

- Monday – Saturday: 09:00 – 18:00; and
- Sunday: 09:00 – 14:00.

The pre-processing of waste is restricted to the following schedule:

- Monday – Saturday: 06:00 – 22:00; and
- Sunday: 09:00 – 14:00.

Additional activities will include general site housekeeping and administration activities. The site will maintain written operation instructions for all plant and monitoring equipment present on site.

All personnel working at the facility will be trained in the necessary sections of the Working Plan and associated Procedures.

3.10 Site Security

The site will consist of the relevant security measures including:

- CCTV monitoring;
- All personnel and vehicles entering the site are strictly controlled and managed; and
- No vehicles or personnel will be allowed access to the facility without prior authorisation.

3.11 Accidents and Emergencies

Accident Management Plan

The Applicant has developed a draft Accident Management Plan based around the specific risks associated with the site operations.

The key aspects of the Site Accident Management Plan are:

- Reviewed by the Site Management annually and as soon as practicable after an accident.
- Considers hazards presented by:
  - Emergency shut-down procedures;
  - Actions in case of fire/explosion;
  - Actions in case of fire/emergencies;
  - Contaminated firewater;
  - Failure of any equipment;
  - Failure of abatement plant;
  - Spillages and uncontrolled release;
  - Plant or equipment failure (e.g. over-pressure of vessels and pipework, blocked drains);
  - Vandalism; and
  - Flooding.
- Identify events or failures that could damage the environment;
- Assesses the likelihood and the potential environmental consequences from accidents at the site.
- Proposes action to minimise the potential causes and consequences of accidents.

In the event of an accident, SEPA will be immediately informed and necessary measures to limit the environmental impact of the accident will be carried out, as well as measures to prevent further possible accidents.

The draft Accident Management Plan has been included in *Annex D2 – Accident Management Plan.*

Specific emergency response procedures will be developed by the Operator in conjunction with the plant manufacturer. These procedures will be completed prior to operations commencing at the site.

Incident Reporting

The reporting of incidents and non-conformities will form a key component of the companies Environmental Management System. Identified non-conformities under the system include, but are not limited to the following:

- Uncontrolled leaks and spillages of any materials with the potential to cause pollution to the environment (hydraulic fluid/oils, unabated dust emission to atmosphere);
- Non-compliance to any permitted condition or consent limit (emissions excursions, missing of reporting deadlines, breach of any permitted consent limits);
- Internal Audit findings (legal non-compliances, EMS procedural breaches, system non-compliances);
- External and Internal Complaints; and
- Whenever a plant malfunction, breakdown or failure, or any near miss occurs.

The company's EMS will undergo periodic external audit and review to ensure that both compliance and continuous improvement is achieved. The EMS requires that all identified incidents and non-conformities will be investigated and closed out.

All plant and equipment will be PLC controlled, monitored and alarmed using a 'SCADA' system, thus ensuring that continuous plant diagnostics can be facilitated.

Furthermore, the site management system will have documented procedures and registers to:

- Ensure that any members of the public/residents are alerted and informed if a significant plant issue arises (fire, explosion etc);
- Record, report and investigate any internal or external complaints to ensure that any necessary measures are taken to prevent, or where that is not possible to minimise, the causes; and
- Inform any members of the public about the nature of the site, key contacts and sources of further information.

The following table summarises the BAT justifications regarding management techniques.

Table 3.6 BAT Justification for Management Techniques	
Indicative BAT	**Justification**
Operations and Maintenance	
Effective operational and maintenance systems	Recycling technologies management system will include: • Controlled procedures relating to any operations which may have an adverse impact on the environment; • A procedure defining a preventative maintenance regime; • Procedures for monitoring emissions / impacts; and • A preventative maintenance programme for all plant.
Audit	The maintenance system will be audited.
Competence and Training	
Training Systems	Training systems will be in place covering: • Awareness of the regulatory implications of the permit; • Awareness of potential environmental effects; • Awareness of reporting deviation from the permit; • Prevention of accidental emissions. All records of training will be recorded. Any contactors will be provided with relevant instructions regarding protecting the environment while working on site.
WAMITAB	WAMITAB Level 4: Managing Thermal Treatment will be complied with.
Accidents / Incidents / Non-Compliance	
Accident Plan	The site has an Accident Management Plan which is provided within *Annex D2 – Accident Management Plan*.
Non-compliance	There will be a procedure in place for handling, investigating, communicating and reporting actual or potential non-compliances.
Complaints	There will be a procedure in place for handling, investigating, communicating and reporting environmental complaints.
Incidents	There will be a procedure in place for investigating incidents.

4. EMISSIONS AND THEIR ABATEMENT

4.1 Emissions to Air

Point-source Emissions to Air

All point source emissions from the plant are detailed in the table below. This table provides details of the modelled emissions parameters, concentrations and source. Additional relief valves are detailed in Section 3.6, Table 3.8 above.

All concentrations from the plant will be well below the ELV's specified in the Industrial Emissions Directive (IED).

It is important to note that due to the operation of the plant (hydrocarbon vapour clean-up, halide guard, Regenerator, flue gas treatment system including the oxidiser) the emissions from the process will mainly comprise of carbon dioxide, water vapour, nitrogen and excess oxygen which remains from the intake combustion air. Emissions such as nitrogen dioxide, dioxins and furans are effectively destroyed within the process.

The hydrocarbon gas mixture from the thermal cracking of RPW is treated in the Halide Guard to remove impurities such as halides, nitriles and sulphides. This ensures clean combustion of the hydrocarbons in the secondary circuit.

Exhaust gas arising from the combustion of fuel gas and excess hydrocarbon gas from the primary circuit, is treated for chemical and physical impurities at different stages in the secondary circuit, as listed below.

- A gas-solid separator for particles recovery from the Regenerator exhaust gas;
- Oxidiser to maintain exhaust gas at 850°C for 2 seconds to ensure complete combustion of all hydrocarbons and eliminate dioxins and furans; and
- A hot gas filter with the capacity for dosing of activated carbons or other reagents prior to discharging the exhaust gas via Stack A1.

The plant has been modelled using IED Emission Limit Values (ELVs) to represent a very worst-case scenario. These ELVs are based on typical incineration activities whereby municipal solid waste (MSW) is combusted. As the Recycling Technologies process has an input comprising only plastic waste and only involves the combustion of excess hydrocarbon gas, in reality the emissions to air will exclude a number of the pollutants listed in Table 4.1 below. The modelling has been done in this way to demonstrate that even in a worst-case scenario, the Installation will not result an impact to sensitive receptors.

Table 4.1: Stack Emission Parameters – Plastic Recycling Facility	
Parameter	**Emission Parameters**
Stack height (m)	25
Flue exit diameter (m)	0.5
Temperature of release (ºC)	226
Moisture content (%v/v)	6.62
Oxygen content (%v/v dry)	12.82
Actual flow rate (Am^3/s)	3.26
Normalised flow rate (Nm^3/s) (a)	1.36
Emission velocity at flue exit (m/s)	16.6
Emission Concentration (mg/Nm^3) (a)	**Daily (a)**
PM_{10}	10
TOC	10
HCl	10
HF	1
CO	50
SO_2	50
NOx	200
Group I (Cd, Tl)	0.05
Group II (Hg)	0.05
Group III (Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V)	0.5
Dioxins and Furans	1×10^{-7}
PAHs (as B[a]P)	9×10^{-5}
PCBs	3.6×10^{-9}

(a) Normalised to 273K, dry, 1 atmosphere and 11% O_2

Detailed emission modelling to full IED requirements have been carried out as part of this Application.

All details are provided within the *Annex C2 – Air Quality Assessment and HHRA.*

The following table summarises the BAT justifications regarding the emissions from site.

Table 4.2 BAT Justification for Emissions to Air	
Indicative BAT	**Justification**
Emissions identification and benchmark comparison	The emissions benchmarks in the Sector Guidance Note can be met.
Vent and chimney height dispersion capacity and assessment of emitted substances fate in the environment	An impact assessment has been carried out and is referenced in Section 7 of this document.

Visible particulate plumes	Particulates are removed from the flue gas stream by the gas-solid separator (GF202) and the Hot Gas Filter. The Hot Gas Filter is a bag filter technology which will remove particulates down to very low levels.
Visible condensed water plumes	There will be no visible plume from the facility and hence this is not considered to be an issue.
Particulate matter	Controlled by the flue gas treatment system (see visible particulate plumes).
NOx - Primary Measures	
Fuel selection	LPG used for the regenerator burner and as a start-up and pilot flame fuel for the thermal oxidiser.
Combustion chamber design including oxidiser	This is compliant with IED and represents BAT.
Air control – primary and secondary	Automated air control at the point of final combustion – dilution air valve. Please refer to the functional description for the thermal oxidiser provided in Annex B.
Temperature control	Temperature control is a key aspect of the control system, as is a uniform temperature gradient.
NOx – Secondary measures	
Flue gas recirculation	Flue gas recirculation is not required
SNCR	All combustion processes in the plant are designed to occur at 850°C with low residence times. This maximum temperature means low NOx formation since NOx emissions do not form in significant amounts until temperatures start getting over 1200°C. However, the hot gas filter has the capacity for reagent dosing if required.
SCR	All combustion processes in the plant are designed to occur at 850°C with low residence times. This maximum temperature means low NOx formation since NOx emissions do not form in significant amounts until temperatures start getting over 1200°C. NOx formation minimised without requirement for catalysts.
Acid gases and halogens	
Primary acid gas measures	The waste plastic for processing will exclude hazardous waste. Each supplier is governed by the RPW specification and supply contract. The wet scrubbing using aqueous sodium hydroxide and Halide Guard in Process Area 4a will effectively remove any halides (hydrogen chloride, hydrogen bromide, hydrogen fluoride etc). This means that acid gases shall

	be removed from the Light Hydrocarbon Gas prior to combustion processes.
Secondary acid gas measures	Due to the operation of the proposed process, acid gases will not be contained within the emissions from the plant. However, the hot gas filter in Process Area 5 has the capacity for reagent dosing if required.
Alkaline reagent selection	The hot gas filter has the capacity for reagent dosing if required. If required, reagents such as lime, sodium bicarbonate and / or activated carbon will be used.
Acid gas control: cost/benefit study	As this installation is a newly built facility, all measures employed are BAT, for this reason a cost benefit study on the merits of primary and secondary measures is not required. Careful consideration has been made during the design stage of this project to ensure that releases of acid gases and halogens are well managed by appropriate primary and secondary measures.
Carbon Dioxide	All measures to increase energy efficiency will also reduce CO_2 emissions.
Carbon monoxide and VOCs	CO is not significantly influenced by the conventionally employed abatement techniques. Reduction of both CO and VOCs is achieved by control of conditions in the Regenerator to ensure efficient combustion of hydrocarbons.
Dioxins and Furans	The primary method of reducing the emissions of dioxins is by reducing the chlorine content in the light hydrocarbon gas from primary circuit (see primary acid gas measures above). Secondary measures include control of the conditions in the Regenerator and minimise residence time at de novo region.
Metals	Metals are expected to settle with the particulates dropped out in the gas-solid separator and hot gas filter.

4.2 Emissions to Controlled Water

There will be no direct process emissions to controlled water arising from the Installation.

The building roof water is collected and conveyed by drains to a series of filter trenches before discharging into a detention basin. Discharge from the detention basin into the nearby watercourse (W1) is restricted by a flow control device.

Surface water runoff will be collected and conveyed by drains to filter trenches before discharging into the existing detention basin.

Any foul drainage will be treated by a packaged treatment plant on site. Outfall from this will discharge to the same discharge point (W1).

In the event of a fire, all potentially contaminated fire water will be collected within the associated bund system, drained to the site water/oil separation system collected and tankered away to a suitable water treatment facility.

4.3 Emissions to Sewer

There are no process emissions to sewer arising from the Installation.

Table 4.3 below summarises the BAT justification for emissions to water and emissions to groundwater.

Table 4.3: BAT Justification for Emissions to Water	
Indicative BAT	**Justification**
Water efficiency audit	Recycling Technologies will carry out a water efficiency audit at least every 4 years.
Water use	Water use will be minimised and recycled where possible.
Contamination identification and fate analysis	There are no process emissions to sewer or controlled water.
Filtration	No further filtration necessary.
Off-site treatment	No off-site treatment,
Benchmark comparison - Control of emissions to meet EQS and WID requirements	IED Chapter IV requirements do not apply. There are no process emissions to sewer or controlled water.
BAT Justification for Emissions to Groundwater	
Identification of List I substances	n/a
Identification of List II substances	n/a
Prior Investigation	Discussed in the Site Condition Report
Surveillance	n/a

4.4 Emissions to Land

There will be no emissions to land arising from the Installation.

4.5 Odour

The wastes that are proposed to be processed through the plastic recycling facility are by their nature stable and non-reactive and plastics do not have potential for odour generation. Furthermore, the fundamental design of the facility has a hierarchy of odour control and abatement measures to ensure that the potential for odour impacts are eliminated.

The process itself has no significant potential for odours as the combustion effectively destroys any odorous compounds.

No odorous wastes will be accepted onto site and therefore the potential for offsite odour impacts is considered negligible.

Table 4.4: Odour Management Summary		
Tier	Reference	Description
1	Inventory Control	Site will accept a maximum of 12,000 tonnes per annum of Residual Plastic Waste. Plastic is not considered to be odorous. The site will be operated such that there is never more than 4 days' inventory awaiting processing and will be managed in a manner that prevents wastes being accepted into the site in the vent that the site in inoperable. All wastes accepted on site will be required to be pre-declared and be deemed acceptable by the site manager prior to the transportation and delivery to site. All waste accepted on site will be inspected on arrival to ensure compliance with the agreed 'Waste Declaration Form' and do not have any malodourous properties. Waste Acceptance and inventory controls are covered within the site working plan documents Procedures RT-E02 to RT-E05. The delivery and reception of waste will not produce any odour emissions.
2	Internal Storage	All RPW is stored internally within the dedicated plastic storage bays. Entry to the building is via electrically controlled roller shutter doors.

Notwithstanding the above measures, due to the nature of the materials being processed at the site, the potential for odour emissions is consider low and therefore no Odour Management Plan is considered necessary.

Although no odour from the plant is anticipated, odour shall be monitored daily at points around the site boundary and observations shall be noted in the site diary and/or on a daily monitoring document.

In the unlikely event that there is any discernible odour detected at the site boundary and the odour is judged to be 'moderate' (i.e. odour Intensity Rank 3), then the Site Manager will be notified immediately, and the olfactory survey will continue to attempt to determine the source and extent of the odour plume, as follows:

- A suitable location downwind of the site and potentially sensitive receptor at which the odour plume is unlikely to extend will be selected for assessment;
- Survey will continue toward the facility until a site-related odour is perceived; and
- Assessment points perpendicular to the plume axis and equidistant from the site will then be monitored, subject to access requirements.

The main aim of monitoring will be to test if any odours emitted from the site will be causing the nearest receptors nuisance. In scenarios where nuisance is being caused then operations will be suspended until the conditions improve. The Site Manager may deem it necessary to find the precise source of the odour and attempt to eliminate it or neutralise it immediately.

The following table shows the BAT justification for odour prevention on site.

Table 4.5: BAT Justification for Odour	
Indicative BAT	**Justification**
Containment. The Operator should maintain the containment and manage the operations to prevent its release at all times.	All RPW is stored internally within the reception and processing building. All waste transfer will take place within a fully enclosed system. The doors will be closed at all times except during direct deliveries.
Assessment and Management	
For existing installations, the releases should be modelled to demonstrate the odour impact at sensitive receptors. The target should be to minimise the frequency of exposure to ground level concentrations that are likely to cause annoyance.	N/A Not an existing installation.
For new installations, or for significant changes, the releases should be modelled and it is expected that the Operator will achieve the highest level of protection that is achievable with BAT from the outset.	Dispersion modelling has been undertaken for combustion gases from the facility. No assessment for dust is considered necessary as plastic materials are not dusty and stored internally. Odour is considered low risk and is controlled by the onsite measures therefore no odour modelling is considered necessary.
Where there is no history of odour problems then modelling may not be required although it should be remembered that there can still be an underlying level of annoyance without complaints being made.	N/A.
Where, despite all reasonable steps in the design of the plant, extreme weather or other incidents are liable, in the view of the Regulator, to increase the odour impact at receptors, the Operator should take appropriate and timely action, as agreed with the Regulator, to prevent further annoyance (these agreed actions will be defined either in the Permit or in an odour management statement).	N/A.
Where odour generating activities take place in the open, (or potentially odorous materials are stored outside) a high level of management control and use of best practice will be expected.	N/A No odour generating activities are taking place outside.
Where an installation releases odours but has a low environmental impact by virtue of its remoteness from	N/A.

Table 4.5: BAT Justification for Odour	
Indicative BAT	**Justification**
sensitive receptors, it is expected that the Operator will work towards achieving the standards described in this Note, but the timescales allowed to achieve this might be adjusted according to the perceived risk.	
Specific Odour control techniques:	
Enclosing odorous areas (applicable to all).	All appropriate areas will be enclosed.
Enclosing odorous waste all the way to the furnace (ACI, CWI).	As above though the use of plastic wastes limits odour potential.
Confining waste to designated areas (all).	Designated areas designed into the layout.
Ensuring that putrescible waste is incinerated within an appropriate timescale (MWI, CWI, ACI, SSI).	Only waste plastic is used. Storage times in the storage building are minimised. No putrescible wastes will be processed on site.
Refrigeration of such waste which is to be stored for longer than an appropriate timescale (CWI, ACI).	N/A.
Regular cleaning and (for putrescible wastes) disinfection of waste handling areas (all).	All areas will be regularly cleaned.
Design of areas to facilitate cleaning (all).	Facility is new and designed to ease cleaning.
Ensuring that the transport of waste and ash is in covered vehicles, where appropriate (all).	All vehicles will be covered.
Ensuring good dispersion at all times from any release points (all).	Release points have been designed aided by modelling to ensure adequate dispersion. The location and height have been optimised.
Preventing anaerobic conditions by aeration, turning of waste and short timescales (SSI, MWI).	Storage times are minimal hence this is not anticipated to be an issue.
Chlorination of waters being returned to STW or in storage (SSI) drawing air from odorous areas at a rate which will ensure that odour is captured (all) and treating such extracted air prior to release to destroy the odours - see below.	N/A.
The use of these techniques should obviate the need for odour masking or counteractants.	No masking agents or counteractants have been specified at the plant.
Treatment of Odour	
The use of odorous air e.g. air from the waste handling area or air displaced from tanks, as furnace air is an ideal way of treating odours. The quantity of contaminated air that can be handled this way is obviously limited by the needs of the furnace. A disadvantage is the need to consider provision for odour control when the incinerator is not operating.	Odorous air is not anticipated to be a problem.

Table 4.5: BAT Justification for Odour	
Indicative BAT	Justification
Biofilters.	Biofilters will neither be used nor required.
Scrubbing for odour control.	Scrubbing for odour control will not required.
Carbon filters.	Carbon filters will not be required for odour control.
For a new plant it would normally be the case that the imposition of conditions achieving BAT also secures that no significant pollution (including odour) is caused.	The proposed plant has no potential for significant odour pollution.

4.6 Noise Impacts

The design of the Installation has taken into account the potential impacts on the environmental and neighbouring receptors in regard to noise.

The processing plant and associated equipment has been designed in accordance with best practice and to ensure that internal noise does not present an issue to the employees at the site under the Control of Noise at Work Regulations and to ensure that noise breakout does not lead to noise nuisance at the identified sensitive receptors.

A noise assessment in accordance with statutory noise guidance has been carried out, including detailed modelling shown in *Annex C3 – Environmental Noise Assessment.* The report concludes that the noise impacts will have an insignificant effect on existing residential receptors due to the appropriate design, mitigation and intervening distances to the nearest residential receptors.

Noise Abatement Measures

All key components identified in the Table 4.6 below have been specified to meet a noise specification such that the occupational noise exposure limits as defined by the EC Physical Agents Directives and their regulations (Control of Noise at Work Regulations) are met.

Due to the level of noise control engineering that has been designed into the plant and the sound insulation that will be provided by the building fabric, there is limited potential for the installed equipment to create a noise nuisance at any neighbouring receptors.

The identified noise generating plant and equipment associated with the Installation have been identified in the table overleaf.

Table 4.6: Identified Noise Sources and Abatement						
Equipment	Description	Location of Source	Nature of Noise	Duration of Noise	Abatement Fitted	Significant Impact at Receptor
Reception and feedstock transfer	Internal and external vehicle noise, hydraulic and fan plant noise	Within the reception and processing building.	Intermittent vehicle engine noise	Intermittent	All waste is stored internally within the storage and processing building. Delivery vehicles access the building via roller shutter doors. These will be kept closed at all times unless a direct delivery of RPW is taking place. Vehicle deliveries will only take place during daytime only.	No, all reception activities will be carried out internally, resulting in no noise emissions during the delivery and reception of waste Buildings are treated to prevent noise break out. No deliveries will be carried out during night time periods.
Material Preparation Module	Internal plant noise	Internal – within the reception and processing building.	Intermediate tonal plant noise.	Intermittent	All plant is fitted with acoustic treatment.	No, all material preparation takes place within the reception and processing building.
Main Processing Plant	External plant noise	External	Continuous tonal noise – fitted with attenuation	Continuous	Enclosed within appropriate acoustic lagging or cladding where necessary.	No, the plant will be acoustically treated where necessary.
Stack	Tonal exhaust noise from stack	Elevated	Continuous tonal noise – fitted with attenuation	Continuous	Expected stack noise levels are low. Attenuation at the outlet of the stack will be added if required.	No, noise levels are expected to be low.

Table 4.7 below shows the BAT justification for noise prevention on site.

Table 4.7: BAT Justification for Noise	
Indicative BAT	**Justification**
Maintenance • Plant • Equipment • Fans • Bearings • Vents • Building Fabric • Other	Appropriate preventative maintenance will be provided for the various elements of the installation. This will ensure no deterioration of plant or equipment that would give rise to increases in noise.
Control Techniques and comparison with BAT indicative thresholds	Control techniques will be in line with BAT. The noisiest equipment is housed in acoustic enclosures.
Reasonable Cause for Annoyance – Sensitive Receptors/Complaints?	The facility will not give rise to reasonable cause for annoyance. In the unlikely event that complaints are received measures described in the integrated management system will be put in place.
Noise Survey	A noise assessment in accordance with statutory noise guidance has been carried out, including detailed modelling shown in *Annex C3 – Environmental Noise Assessment.*

4.7 Fugitive Emissions

The plant has been designed to ensure that any potential odour, vapour and fugitive emissions are contained within the reception and processing building and the main plant.

Table 4.8 shows the BAT justification for preventing fugitive emissions from the proposed development.

Table 4.8: BAT Justification for Fugitive Emissions	
Indicative BAT	**Justification**
Dust controls	
Covering of skips and vessels	There will be no open skips or vessels at the facility which could give rise to fugitive emissions.
Avoidance of outdoor or uncovered stockpiles (where possible)	There will be no outdoor or uncovered stockpiles which could give rise to fugitive emissions.
Where dust creation is unavoidable, use of sprays, binders, stockpile management techniques, windbreaks and so on	N/A.

Table 4.8: BAT Justification for Fugitive Emissions	
Indicative BAT	Justification
Regular wheel and road cleaning (avoiding transfer of pollution to water and wind blow)	Due to the nature of the operations, problems with wheel contamination are not expected to be significant. All areas of the site will have hardstanding.
Closed conveyors, pneumatic or screw conveying (noting the higher energy needs), minimising drops. Filters on the conveyors to clean the transport air prior to release	The main process feed systems are simple and enclosed. A filter system will be used to prevent dust emissions from the process.
Regular housekeeping	The site staff will be fully trained and regularly audited through the EMS to ensure that housekeeping measures are appropriate to the nature and scale of the activities and that there is minimum possibility of uncontrolled emissions.
The recycling of by-products	All waste will be removed from site by a covered tanker.
Enclosed containers or sealed bags used for smaller quantities of fine materials	No RPW will be stored outside. Small volumes of materials for maintenance etc. shall be stored in appropriate containers, sealed so as to prevent fugitive emissions.
Mobile and stationary vacuum cleaning	Mobile and stationary vacuum cleaning will be used if necessary.
Closed storage with automatic handling system	All storage is closed and transferred using an automated handling system.
Sealed charging system	The charging system is fully enclosed.
VOC control measures	N/A.

4.8 Waste Generation and Management

Types and Amounts of Waste

The plastic recycling process will not inherently produce significant quantities of waste. There are six main types of waste produced from the operation of the facility. These are:

- Ash removed from the flue-gas treatment system;
- Solids (char) and ash from the drop-out box
- Sand-type material used for the fluidised bed (with traces of ash);
- Spent adsorbents from Halide Guard;
- Sodium chloride from treatment of the hydrocarbon vapour and spent sodium hydroxide in the primary circuit (discharged as waste water).

There will also be material removed from the incoming RPW via the material preparation module. This will mainly consist of non-conforming plastic, metals, stone, glass and biomass.

The quantities removed from the Material Preparation Module is purely dependent on the waste that is received on site. The approximate quantity of the wastes removed from the module have been based on the fuel specification and is an estimation.

Table 4.9 below shows a tabular summary of site wastes.

Table 4.9: Waste Summary

Waste	EWC Code	Approx. Quant (tonnes/yr)	Source	R / D Code	Environmental Fate
Material Preparation Module Waste (other plastics, metals, stones, glass, biomass)	20 03 01 02 01 10	5,000	Material Preparation Module	D1 (Disposal)	Disposed of in landfill
Ash	19 01 13* 19 01 14	25	Flue-gas Treatment System	D1 (Disposal)	Disposed of in landfill
Adsorbent	n/a	3	Halide Guard	R5 (Off site recycling)	Returned to supplier (BASF)
Sand	10 01 24	30	Thermal Cracker and Regenerator Unit	R5 (Off site recycling)	Changed every 6 months and returned to supplier for reuse
Waste Water	13 05 07*	700	Separator Waste Water	R5 (Off site recycling)	Sent to Water Treatment Plant

All waste produced at the site will be sampled and analysed. Additional samples will be taken if the disposal or recovery route changes or it is suspected that the nature or composition of the waste has changed such that it may no longer be appropriate for its environmental fate.

Throughput of Waste

The facility principally utilises non-reactive non-hazardous residual plastic waste as a means to generate products which can be used for reconversion to plastics.

A maximum of 12,000 tonnes per annum of non-hazardous RPW will be accepted on site to be conditioned in the Material Preparation Module. 7,000 tonnes per annum of conditioned RPW will then be processed by the pyrolysis plant.

Under 11B of the Waste Framework Directive, the Installation activities fall under the generic description R5.

Waste Storage

The design of the installation has taken into account the potential impacts on the environmental and neighbouring receptors.

All incoming RPW will be stored within the plastic storage bays within the reception and processing building. All other raw materials, will be clearly identified, sealed and stored internally within a secured area protected by secondary containment.

Table 4.10 summarises the BAT justification for the proposed storage on site.

Table 4.10: BAT Justification for Storage on Site

Indicative BAT	Justification
Subsurface structures	N/A.
Appropriate surfacing and containment or drainage facilities for all operational areas, taking into consideration collection capacities, surface thicknesses, strength/reinforcement; falls, materials of construction, permeability, resistance to chemical attack, and inspection and maintenance procedures; • have an inspection and maintenance programme for impervious surfaces and containment facilities; • unless the risk is negligible, have improvement plans in place where operational areas have not been equipped with: – an impervious surface – spill containment kerbs – sealed construction joints – connection to a sealed drainage system	• Surfacing has been designed in accordance with the design standards for similar installations. There is no open ground in the process area. All joints are sealed. • The surfacing is designed to ensure that it is of the appropriate strength, reinforcement and thickness to withstand the heavy traffic which will pass over it during operations. • The installation will have an extensive maintenance programme in place which will include provision for the inspection of all appropriate plant and structures. • The detailed inspection of the impervious surfaces and containment will be in line with the construction engineer's recommendations. • Routine inspections will be undertaken on a daily basis by site personnel as part of the daily site checks. Since this is a new installation BAT will be demonstrated from commencement of operations.
Above-ground tanks	• Above ground bulk storage tanks containing liquids will be appropriately constructed to ensure they are impermeable. • Supervised deliveries will ensure that the risk of contamination of surface water is negligible. All tanks and facilities will be installed with secondary containment and be designed to comply with the relevant standards and guidance requirements.
Storage areas (IBCs, drums, bags etc.)	All storage areas will be clearly marked and labelled.

Table 4.10: BAT Justification for Storage on Site	
Indicative BAT	**Justification**
Storage areas should be located away from watercourses and sensitive boundaries, (e.g. those with public access) and should be protected against vandalism. Storage areas should have appropriate signs and notices and be clearly marked-out, and all containers and packages should be clearly labelled. Where spillage of any stored substance could be harmful to the environment, the area should be appropriately kerbed or bunded. The maximum storage capacity of storage areas should be stated and not exceeded, and the maximum storage period for containers should be specified and adhered to. • Appropriate storage facilities should be provided for substances with special requirements (e.g. flammable, sensitive to heat or light) and formal arrangements should be in hand to keep separate packages containing incompatible substances (both "pure" and waste). • Containers should be stored with lids, caps and valves secured and in place - and this also applies to emptied containers. • All stocks of containers, drums and small packages should be regularly inspected (at least weekly). • Procedures should be in place to deal with damaged or leaking containers.	Any potentially contaminative substances will be stored within bunded areas. In the event of a release it is not possible for the materials to enter the surface water drainage system. The site will have an inspection procedure to ensure that all substances are being stored correctly and are not damaged.

5. ENVIRONMENTAL MONITORING

5.1 Emissions to Air

All emissions to atmosphere (as identified within Table 4.1) will arise from Stack A1.

The plant will have continuous emissions monitors (CEMS) located on the exhaust flues of the processing plant (Emission Point A1).

The CEMS system will monitor the stack emissions and provide data reporting. The system features a single-point extraction and includes monitors for CO, O_2, NOx, SO_2, ammonia slip and opacity.

The CEMS will be IED/WID compliant and continuously monitor HF[1], HCl, NO, NO_2, N_2O, NOx, NH_3, O_2, SO_2, VOC, particulates, H_2O, temperature, pressure and flow. TOC will be analysed by a Flame Ionisation Detector.

The dust monitor provides added flow, stack pressure and temperature. All analysers are provided with remote control, calibration and maintenance.

The continuous monitoring equipment will operate on a 24-hour basis and will include the facility for on-line monitoring of the gas concentrations and provide for any out-of-tolerance indications to be monitored by remote staff.

All CEMS equipment and associated platforms and sampling ports installed on site will meet the requirements of SEPA. All CEMS equipment shall be MCERTS approved.

The CEMS will be used such that:

- The values of the 96% confidence intervals of a single measured result at the daily ELV shall not exceed the following percentages:
  - Carbon Monoxide – 10%
  - Sulphur Dioxide – 20%
  - Oxides of Nitrogen (NO and NO_2) – 20%
  - Particulate Matter – 30%
  - Total Organic Carbon – 30%
  - Hydrogen Chloride – 40%
- Valid half-hourly average values or 10-minute averages shall be determined within the effective operating time from the measured values;
- Where is it necessary to calibrate or maintain the monitor resulting in data not being available for a complete half hour period, the half-hourly average or 10-minute average shall in any case

1 Note that HF will be monitored through the surrogate monitoring of HCl.

be considered valid if measurements are available for a minimum of 20 minutes or 7 minutes during the half-hour or 10-minute period respectively;

- Daily average values shall be determined as the average of all valid half-hourly average or 10-minute average values within a calendar day; and
- No more than ten daily average values per year shall be determined not to be valid.

The process will be provided with totalisers within the control system logic to determine if any of the emissions limits (daily, half-hourly) are exceeded. In the event that the CEMS system shows that an ELV is exceeded the following operating philosophy will be adopted:

1. Instantaneous high alarm if the daily average limit is exceeded at any time: The operator shall take the following actions after being notified by alarm: Try to resolve the cause of emissions (while feeding plastic) e.g. via control actions on the abatement systems such as dosing rate of reagent in the hot gas filter and monitor emissions. If the emissions do not improve after the designated period, plastic feeding shall be stopped and the emissions shall be monitored further (stopping the plastic feed will stop production and combustion of light hydrocarbon gas within the Thermal Oxidiser). If the emissions still do not change after a pre-defined period, the secondary circuit of process will be stopped. This will stop all flue gas emissions from the plant.
2. High alarm at 80% of the half hourly average, detected at any time: The operator shall take the following actions after being notified by alarm: Stop plastic feed and try to resolve the cause of emissions via control actions on the abatement systems. If the emissions do not improve after the designated period, the secondary circuit of process will be stopped. This will stop all flue gas emissions from the plant.
3. High alarm at 80% of the daily average, detected at any time: Process operation action will be the same as 2 above.

The PC used for monitoring is an MCERT PC designed for emissions data gathering and meets all certifications standards. The PC and the operating software to log the data and report to SEPA will be supplied by a recognised company. The ethernet switch transferring data from the analyser to the data storage unit will be powered by an isolated 24 VDC (and backed up by a UPS as part of the overall control system) so as to ensure data collection is never interrupted. Data can be transferred and stored without compromising the CEMS ability to continue monitoring emissions.

Raw data files can only be viewed by RT personnel and even then, requires a password to do so, thus making tampering and editing of data extremely difficult.

Historic data files are stored on the Data Storage Unit and also on the PC, so if in the rare case where files are overwritten for any reason, they can be recovered from the second location. Furthermore, configuration files and historic data files are backed up to an external hard drive during service visits.

The hard drives used in the DSU and PC have enough storage to store 20+ years of data.

5.2 Emissions to Controlled Water

There will be no direct process emissions to controlled water arising from the Installation.

The building roof water is collected and conveyed by drains to a series of filter trenches before discharging into a detention basin. Discharge from the detention basin into the nearby watercourse (W1) is restricted by a flow control device.

Surface water runoff will be collected and conveyed by drains to filter trenches before discharging into the existing detention basin.

Any foul drainage will be treated by a packaged treatment plant on site. Outfall from this will discharge to the same discharge point (W1).

In the event of a fire, all potentially contaminated fire water will be contained within the associated bund system, drained to the site water/oil separation system, collected and tankered away to a suitable water treatment facility..

5.3 Emissions to Sewer

There are no emissions to sewer from the proposed development, therefore no monitoring is required.

Any waste water from the process is tankered offsite for treatment in a waste water treatment facility.

5.4 Emissions to Land

There are no process emissions to land arising from the process. No monitoring is required.

5.5 Monitoring Frequency

The process will be subject to a range of process monitoring which has been designed to comply with the requirements of the SEPA / EA M1, M2 and IED Guidance.

Table 5.1 Monitoring Frequency			
Emission Point	Parameter	Monitoring Frequency	Methodology
A1	• Oxides of Nitrogen • Carbon Monoxide • Particulate Matter • Hydrogen Chloride • Hydrogen Fluoride • Carbon Monoxide • Sulphur Dioxide • Ammonia • Total Organic Carbon • Temperature • Oxygen Concentration • Water	• Continuous daily & ½ hour average for all parameters	MCERTS certified CEMS equipment
A1	• Particulate Matter • Total Organic Carbon • Hydrogen Chloride • Hydrogen Fluoride • Carbon Monoxide • Sulphur Dioxide • Oxides of Nitrogen • Toxic Metals • Dioxin & Furans • Dioxin like PCB's • VOCs • Specific Individual PAH's • Ammonia	• Periodic (6 monthly) all parameters	SEPA / EA Monitoring Guidance M1 / M2 compliant extractive sampling
W1	• BOD • Total Suspended Solids • pH • Oil and Grease • Metals	• Six Monthly Check monitoring	In accordance with SEPA / EA Monitoring Guidance M18

Records will be kept of all monitoring carried out at site. The records will be made as soon as practicable and will be retained for at least 6 years from the date the records were made. More information regarding the environmental monitoring and record keeping is shown in *Annex D1 – Draft Site Working Plan*.

6. BAT APPRAISAL

6.1 Technology Appraisal

Unlike conventional waste to energy schemes where feedstocks are combusted and used for electrical energy generation, the Recycling Technologies proposals are fundamentally different in that:

- A significant majority of all of the chemical energy in the feedstocks are retained within the oil and Plaxx products produced by the plant with an overall mass yield of 75% and an energy efficiency of 70% achieved; and
- There are no combustion (of waste) activities taking place beyond those associated with the combustion of the excess hydrocarbon gas (produced as a by-product in the thermal cracking of polymers) and the resulting energy is used in the process.

There is no electrical energy generated by this process, it is a net user of electrical energy. The process utilises waste heat for the purposes of pre-heating the light hydrocarbon gas recirculated back to the Thermal Cracker.

Recycling Technologies modular design allows units to be mass-manufactured and easily transported. While the modular design and combination of technologies within the overall process are innovative, the technology risk is low due to individual components being present within the waste and petrochemical industries. Additionally, the technology has been demonstrated through an engineering prototype operating at Swindon Borough Council's Household Recycling Centre.

The residual plastic waste input is recycled into a range of basic petroleum commodity outputs that can be used in the production of new plastics and wax. The products will be sold to petrochemical companies as intermediates, thus avoiding the need for extensive on-site refining and allowing the capital cost of the system to remain low. The products produced by the process boost the development of the circular economy when used as a petrochemical feedstock for polymer production.

A summary of the advantages and disadvantages of available combustion methods is included in Table 6.1.

Table 6.1: BAT Comparison for Combustion Methods				
BAT Criteria	Moving Grate (MG) Combustion	Fluidised Bed Combustion	ATT	
			Gasification	Pyrolysis
Emissions	Abated emissions meet IED, lower levels are achieved by many plants.	Lower temperature leads to low NOx levels, but abatement will still be required to guarantee IED.	Abated emissions meet IED, and lower levels are achievable.	Abated emissions meet IED, and lower levels are achievable.
Waste	Municipal Waste is main application.	Only suitable for reasonably homogenous material. May be used for waste that has been sufficiently treated.	Homogenous feedstock required. Opportunity to link to waste management facility and allow increased recycling.	Homogenous feedstock required. Opportunity to link to waste management facility and allow increased recycling.
Residue Generation	Produces bottom ash (<3% carbon) and air pollution control (APC) residues.	Produces larger volumes of residues for disposal.	Raw material consumption is lower than conventional incineration options and hence residue production is lower. Produces bottom ash (<5% TOC/3% LOI) and APC residues.	Raw material consumption is lower than conventional incineration options and hence residue production is lower. Produces carbon char / ash and APC residues. Char can then be gasified or directly combusted to create process heat.
Odour	Odour management typically avoids nuisance.	Odour management typically avoids nuisance.	Odour management typically avoids nuisance. Due to pre-treatment feedstock less likely to be odour producing than untreated municipal waste.	Odour management typically avoids nuisance. Due to pre-treatment feedstock less likely to be odour producing than untreated municipal waste.
Raw Materials	Depends on flue gas treatment option selected.	Higher due to fluidised bed requirements.	Selection of appropriate flue gas treatment minimises raw material consumption. Typically less than conventional incineration options.	Selection of appropriate flue gas treatment minimises raw material consumption. Typically less than conventional incineration options.

Table 6.1: BAT Comparison for Combustion Methods				
BAT Criteria	Moving Grate (MG) Combustion	Fluidised Bed Combustion	ATT	
			Gasification	Pyrolysis
Noise	With appropriate abatement noise can successfully be controlled.	Similar to MG, although pre-treatment plant may cause additional noise requiring abatement.	With appropriate abatement noise can successfully be controlled.	With appropriate abatement noise can successfully be controlled.
Accidents	Proven technology with a large number of operational facilities. Similar accident potential as for other incineration options, mainly related to loss of storage of FGT reagents, supplementary fuel and residues.	Some operational experience, with mixed performance. Similar accident potential as for other incineration options, mainly related to loss of storage of FGT reagents, supplementary fuel and residues.	Operated on a smaller scale to conventional incineration options. Increased accident potential from storage of oxygen and pressurised oxygen delivery systems*.	Operated on a smaller scale to conventional incineration options. Not considered to have any greater accident potential as other incineration options. Gas containment and storage issues (similar to AD) associated with storage of pyro gas.

6.2 The Industrial Emissions Directive (IED) and Best Available Technology (BAT) Compliance

Chapter VI of the IED describes all aspects of management and operation of a process as well as the environmental impact but allows for the Member State to vary the requirements of the IED where there is good reason. Please refer to Table 6.2 overleaf, which outlines the IED technical requirements that apply and a justification of how they have been met.

Table 6.2: Chapter IV Compliance - SPECIAL PROVISIONS FOR WASTE INCINERATION PLANTS AND WASTE CO-INCINERATION PLANTS	
IED technical requirement	Justification
Article 41 – 45	NA
Article 46 Control of Emissions (1) Waste gases from waste incineration plants and waste co-incineration plants shall be discharged in a controlled way by means of a stack the height of which is calculated in such a way as to safeguard human health and the environment.	Significant ground level pollution will not arise as a result of this installation. Section 4 and 7 of this application discuss this in detail. Atmospheric Dispersion Modelling and Human Health Risk Assessment have been completed by the applicant.
(2) Emissions into air from waste incineration plants and waste co-incineration plants shall not exceed the emission limit values set out in parts 3 and 4 of Annex VI or determined in accordance with Part 4 of that Annex. If in a waste co-incineration plant more than 40 % of the resulting heat release comes from hazardous waste, or the plant co-incinerates untreated mixed municipal waste, the emission limit values set out in Part 3 of Annex VI shall apply.	All Chapter VI IED Emission Limit Values will be met by the Installation.
(3) Discharges to the aquatic environment of waste water resulting from the cleaning of waste gases shall be limited as far as practicable and the concentrations of polluting substances shall not exceed the emission limit values set out in Part 5 of Annex VI.	There are no waste water discharges resulting from the flue gas cleaning process. The exhaust gases will be cleaned using dry processes, namely filter systems. There will be no aqueous flue gas cleaning effluents.
(4) The Emission Limit Values shall apply at the point where waste waters from the cleaning of waste gases are discharged from the waste incineration plant or waste co-incineration plant. When waste waters from the cleaning of waste gases are treated outside the waste incineration plant or waste co-incineration plant at a treatment plant intended only for the treatment of this sort of waste water, the emission limit values set out in Part 5 of Annex VI shall be applied at the point where the waste waters leave the treatment plant. Where the waste water from the cleaning of waste gases is treated collectively with other sources of waste water, either on site or off site, the operator shall make the appropriate mass balance calculations,	N/A There are no waste water discharges resulting from the flue gas cleaning process. The exhaust gases will be cleaned using dry processes, namely filter systems. There will be no aqueous gas cleaning effluents.

Table 6.2: Chapter IV Compliance - SPECIAL PROVISIONS FOR WASTE INCINERATION PLANTS AND WASTE CO-INCINERATION PLANTS	
IED technical requirement	**Justification**
using the results of the measurements set out in point 2 of Part 6 of Annex VI in order to determine the emission levels in the final waste water discharge that can be attributed to the waste water arising from the cleaning of waste gases. Under no circumstances shall dilution of waste water take place for the purpose of complying with the emission limit values set out in Part 5 of Annex VI.	
(5) Waste incineration plant sites and waste co-incineration plant sites, including associated storage areas for waste, shall be designed and operated in such a way as to prevent the unauthorised and accidental release of any polluting substances into soil, surface water and groundwater. Storage capacity shall be provided for contaminated rainwater run-off from the waste incineration plant site or waste co-incineration plant site or for contaminated water arising from spillage or fire-fighting operations. The storage capacity shall be adequate to ensure that such waters can be tested and treated before discharge where necessary.	There will be an environmental management system (EMS) in place to include procedures to manage waste delivery and reception. Hazardous waste will not be accepted at the Installation. All feedstock will be stored within the reception and processing building. Roadways, floor and store surfaces will be designed and constructed so as to prevent any emissions to groundwater, surface water and soil. All waste handling activities will take place inside the reception and processing building. All external process areas will be hardstanding served by appropriate drainage systems. All fire water will be contained and tankered away to a suitable water treatment facility. The site surface water drainage systems will discharge to the existing detention basin.
(6) Without prejudice to Article 50(4)(c), the waste incineration plant or waste co-incineration plant or individual furnaces being part of a waste incineration plant or waste co-incineration plant shall under no circumstances continue to incinerate waste for a period of more than 4 hours uninterrupted where emission limit values are exceeded. The cumulative duration of operation in such conditions over 1year shall not exceed 60 hours.	The plant will be operated with a single CEMS which will be linked into the controls system for continuous emissions monitoring.

Table 6.2: Chapter IV Compliance - SPECIAL PROVISIONS FOR WASTE INCINERATION PLANTS AND WASTE CO-INCINERATION PLANTS	
IED technical requirement	**Justification**
The time limit set out in the second subparagraph shall apply to those furnaces which are linked to one single waste gas cleaning device.	
Article 47 Breakdown In the case of a breakdown, the operator shall reduce or closedown operations as soon as practicable until normal operations can be restored.	The feed system for the process is automated and in the event of temperature loss or departure from operating conditions the process will automatically shut down in a controlled manner.
Article 48 Monitoring of Emissions (1) Member States shall ensure that the monitoring of emissions is carried out in accordance with Parts 6 and 7 of Annex VI.	Monitoring will meet all the requirements of Article 48. The plant is designed to have continuous emissions monitors (CEMS) located on the exhaust stack (Emission Point A1). The CEMS will be IED/WID complaint and monitor HF (surrogate method), HCl, NO, NO_2, N_2O, NOx, NH_3, O_2, SO_2, VOC, particulates, H_2O, temperature, pressure and flow. TOC will be analysed by a Flame Ionisation Detector.
(2) The installation and functioning of the automated measuring systems shall be subject to control and to annual surveillance tests as set out in point 1 of Part 6 of Annex VI.	CEMS will be installed in the stack for continuous monitoring of emissions to air to comply with IED. Please see section 5.1 for more details.
(3) The competent authority shall determine the location of the sampling or measurement points to be used for monitoring of emissions.	The exact positions of all sampling points will be agreed with SEPA prior to commencement of operation.
(4) All monitoring results shall 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.	Reporting format will be agreed with SEPA prior to commencement of operation and will reflect the requirements of the permit. CEMS will be backed up by non-continuous check monitoring to comply with the IED.
(5) As soon as appropriate measurement techniques are available within the Union, the Commission shall, by means of delegated acts in accordance with Article 76 and subject to the conditions laid down in Articles 77 and 78, set the date from which continuous measurements of emissions into the air of heavy metals and dioxins and furans are to be carried out.	Should such a technique become available, it will be adopted as required.

Table 6.2: Chapter IV Compliance - SPECIAL PROVISIONS FOR WASTE INCINERATION PLANTS AND WASTE CO-INCINERATION PLANTS	
IED technical requirement	Justification
Article 49 Compliance with the Emission Limit Values The emission limit values for air and water shall be regarded as being complied with if the conditions described in Part 8 of Annex VI are fulfilled.	The plant has been designed to comply with the specific ELV's stipulated by Part 8 of Annex VI of the IED. The flue gas temperature and pressure shall be constantly monitored and corrected for the reference conditions of Temperature 273 K; Pressure 101.3 kPa, 11% oxygen; Dry Gas.
Article 50 Operating Conditions (1) Waste incineration plants shall be operated in such a way as to achieve a level of incineration such that the total organic carbon content of slag and bottom ashes is less than 3 % or their loss on ignition is less than 5 % of the dry weight of the material. If necessary, waste pre-treatment techniques shall be used.	The process does not incinerate waste as such but combusts light hydrocarbon gas and ash produced as by-products in the thermal cracking of waste polymers. The waste intake will be treated so the recoverable organic fraction will be removed by upstream processing. Ash will therefore comply with the 3% TOC / 5% LOI limits. Testing will be undertaken quarterly for the first year and annually thereafter to demonstrate this. The EMS includes procedures for the checking of waste composition and removal of contaminants.
(2) Waste incineration plants shall be designed, equipped, built and operated in such a way that the gas resulting from the incineration of waste is raised, after the last injection of combustion air, in a controlled and homogeneous fashion and even under the most unfavourable conditions, to a temperature of at least 850°C for at least two seconds. Waste co-incineration plants shall be designed, equipped, built and operated in such a way that the gas resulting from the co-incineration of waste is raised in a controlled and homogeneous fashion and even under the most unfavourable conditions, to a temperature of at least 850 °C for at least two seconds.	This is a co-incinerator, not an incinerator. The design ensures that the minimum temperature of 850°C is met at the final point of combustion whenever waste is being fed, and the residence time of combustion gases at this temperature will be above 2 seconds.

Table 6.2: Chapter IV Compliance - SPECIAL PROVISIONS FOR WASTE INCINERATION PLANTS AND WASTE CO-INCINERATION PLANTS	
IED technical requirement	**Justification**
If hazardous waste with a content of more than 1% of halogenated organic substances, expressed as chlorine, is incinerated or co-incinerated, the temperature required to comply with the first and second subparagraphs shall be at least 1100°C. In waste incineration plants, the temperatures set out in the first and third subparagraphs shall be measured near the inner wall of the combustion chamber. The competent authority may authorise the measurements at another representative point of the combustion chamber.	
(3) Each combustion chamber of a waste incineration plant shall be equipped with at least one auxiliary burner. This burner shall be switched on automatically when the temperature of the combustion gases after the last injection of combustion air falls below the temperatures set out in paragraph 2. It shall also be used during plant start-up and shut-down operations in order to ensure that those temperatures are maintained at all times during these operations and as long as unburned waste is in the combustion chamber. The auxiliary burner shall not be fed with fuels which can cause higher emissions than those resulting from the burning of gas oil as defined in Article 2(2) of Council Directive 1999/32/EC of 26 April 1999 relating to a reduction in the sulphur content of certain liquid fuels, liquefied gas or natural gas.	The Regenerator shall be provided with a Pre-Regenerator Burner as well as "side burners or injectors" used to inject fuel gas (LPG or light hydrocarbon gas) into the burner unit for direct combustion within the Regenerator. In the event that the temperature of the Regenerator flue falls below the temperature set point, the rate of fuel gas injection into the Regenerator shall be modulated to ensure that set point- conditions are maintained.
(4). Waste incineration plants and waste co-incineration plants shall operate an automatic system to prevent waste feed in the following situations: (a) at start-up, until the temperature set out in paragraph 2 of this Article or the temperature specified in accordance with Article 51(1) has been reached; (b) whenever the temperature set out in paragraph 2 of this Article or the temperature specified in accordance with Article 51(1) is not maintained; (c) whenever the continuous measurements show that any emission limit value is exceeded due to disturbances or failures of the waste gas cleaning devices.	Conditioned RPW shall be transferred to the plastic feed system, used to transfer plastic material into the Thermal Cracker. The process control system will prevent extrusion of plastic into the Thermal Cracker until the temperature set point conditions within the Thermal Cracker (550°C) and Regenerator (850°C) are reached. Whenever the temperature set points deviate from ideal conditions, the control system shall stop the plastic feed system.

Table 6.2: Chapter IV Compliance - SPECIAL PROVISIONS FOR WASTE INCINERATION PLANTS AND WASTE CO-INCINERATION PLANTS	
IED technical requirement	Justification
	The control system via the CEMS package shall stop the plastic feed system and the process when the emissions exceed the limits. There are 3 thermocouples located on the oxidiser chamber that will be used to take the process to a standby mode by stopping plastic feed in the event that the temperature in the chamber drops below 850°C. The process trip action will be programmed with a 30 second delay to avoid any spurious trips accounting for instrument error / noise.
Article 51 Authorisation to change operating conditions	No requests to change operating conditions will be required.
Article 52 Delivery and reception of waste (1) The operator of the waste incineration plant or waste co-incineration plant shall take all necessary precautions concerning the delivery and reception of waste in order to prevent or to limit as far as practicable the pollution of air, soil, surface water and groundwater as well as other negative effects on the environment, odours and noise, and direct risks to human health.	All waste will be received directly into the enclosed reception and processing building. All pollution abatement and prevention methodologies are detailed in main application document.
(2) The operator shall determine the mass of each type of waste, if possible according to the European Waste List established by Decision 2000/532/EC, prior to accepting the waste at the waste incineration plant or waste co-incineration plant.	The site will only receive non-hazardous residual plastic waste. The range of waste codes from the List of Wastes (England) Regulations 2005 that will constitute this prepared RPW is included in Section 3.5 of the application. This will be weighed at the weighbridge. Unsuitable material and material that is hazardous, or contains unwanted materials, will not be accepted.
(3) Prior to accepting hazardous waste at the waste incineration plant or waste co-incineration plant, the operator shall collect available information about the waste for the purpose of verifying compliance with the permit requirements specified in Article 45(2).	No hazardous waste will be accepted into the plant. All wastes will be non-hazardous residual plastic waste only.

Table 6.2: Chapter IV Compliance - SPECIAL PROVISIONS FOR WASTE INCINERATION PLANTS AND WASTE CO-INCINERATION PLANTS	
IED technical requirement	**Justification**
(4) Prior to accepting hazardous waste at the waste incineration plant or waste co-incineration plant, at least the following procedures shall be carried out by the operator:	No hazardous waste will be accepted into the plant. All wastes will be non-hazardous residual plastic waste. only.
Article 53 Residues (1) Residues shall be minimised in their amount and harmfulness. Residues shall be recycled, where appropriate, directly in the plant or outside.	The process has been designed to produce wax and oil products for reconversion to plastics. The plastic recycling process will not inherently produce significant quantities of waste. It is a new installation, so a waste minimisation audit is yet to be carried out. This will be done in compliance with the permit condition specified.
(2) Transport and intermediate storage of dry residues in the form of dust shall take place in such a way as to prevent dispersal of those residues in the environment.	Ash will be stored and transferred off site in an enclosed container. It will be removed by road in covered vehicles on a regular basis (once every 3 to 6 months). Chemical analysis will be undertaken on a more frequent basis.
(3) Prior to determining the routes for the disposal or recycling of the residues, appropriate tests shall be carried out to establish the physical and chemical characteristics and the polluting potential of the residues. Those tests shall concern the total soluble fraction and heavy metals soluble fraction.	Chemical analysis will be undertaken regularly.
Other requirements (former WID compliance requirement not specifically stated under the IED) Technical Competence Former WID Article 6 (8) The management of the incineration or the co-incineration plant shall be in the hands of a natural person who is competent to manage the plant.	The operator will employ on a full time basis a site manager / technically competent person who holds the necessary WAMITAB CoTC Level 4 qualifications as required by the WAMITAB, in this case WAMITAB Level 4: Managing Thermal Treatment. The operator will also meet all the other requirements of operator competence as stipulated in the Environmental Permitting Regulations. There will be named individuals with the relevant qualifications to supervise the operation of this facility.
Former WID Article 11 (3) The residence time as well as the minimum temperature and the oxygen content of the exhaust gases shall be subject to appropriate verification, at least once when the incineration or co-incineration plant is brought into service and under the most unfavourable operating conditions anticipated.	During the plant's first year of operation we would seek to discuss with SEPA the need for a validation study to measure residence times through the Oxidiser at above 850°C.

Table 6.2: Chapter IV Compliance - SPECIAL PROVISIONS FOR WASTE INCINERATION PLANTS AND WASTE CO-INCINERATION PLANTS	
IED technical requirement	Justification
	Oxygen, moisture and temperature measurements will be made via the CEMS as well as spot sampling and analysis.
Former WID Article 11 (4) The continuous measurement of HF may be omitted if treatment stages for HCl are used which ensure that the emission limit value for HCl is not being exceeded. In this case the emissions of HF shall be subject to periodic measurements as laid down in paragraph 2(c).	HF will be monitored via the surrogate method of HCl.
Former WID Article 11 (5) The continuous measurement of the water vapour content shall not be required if the sampled exhaust gas is dried before the emissions are analysed.	Water vapour is continuously monitored to correct emissions for dry gas conditions.
Former WID Article 11 (6) Periodic measurements as laid down in paragraph 2(c) of HCl, HF and SO2 instead of continuous measuring may be authorised in the permit by the competent authority in incineration or co-incineration plants, if the operator can prove that the emissions of those pollutants can under no circumstances be higher than the prescribed emission limit values.	CEMS will be provided for continuous HCl, HF (surrogate method) and SO_2 measurement.
Former WID Article 11 (7) The reduction of the frequency of the periodic measurements for heavy metals from twice a year to once every two years and for dioxins and furans from twice a year to once every year may be authorised in the permit by the competent authority provided that the emissions resulting from co-incineration or incineration are below 50 % of the emission limit values determined according to Annex II or Annex V respectively and provided that criteria for the requirements to be met, developed in accordance with the procedure laid down in Article 17, are available. These criteria shall at least be based on the provisions of the second subparagraph, points (a) and (d). Until 1 January 2005 the reduction of the frequency may be authorised even if no such criteria are available provided that: L 332/100 EN Official Journal of the European Communities 28.12.2000	After one year of operation sampling and measurement of heavy metals will be reduced from twice a year to once every two years as well as sampling and measurement for dioxins and furans will be reduced from twice a year to once a year, once it is demonstrated that the emissions are shown to be 50% of those stated in Annex V.

Table 6.2: Chapter IV Compliance - SPECIAL PROVISIONS FOR WASTE INCINERATION PLANTS AND WASTE CO-INCINERATION PLANTS	
IED technical requirement	Justification
(a) the waste to be co-incinerated or incinerated consists only of certain sorted combustible fractions of non-hazardous waste not suitable for recycling and presenting certain characteristics, and which is further specified on the basis of the assessment referred to in subparagraph (d); (b) national quality criteria, which have been reported to the Commission, are available for these wastes; (c) co-incineration and incineration of these wastes is in line with the relevant waste management plans referred to in Article 7 of Directive 75/442/EEC; (d) the operator can prove to the competent authority that the emissions are under all circumstances significantly below the emission limit values set out in Annex II or Annex V for heavy metals, dioxins and furans; this assessment shall be based on information on the quality of the waste concerned and measurements of the emissions of the said pollutants; (e) the quality criteria and the new period for the periodic measurements are specified in the permit; and (f) all decisions on the frequency of measurements referred to in this paragraph, supplemented with information on the amount and quality of the waste concerned, shall be communicated on a yearly basis to the Commission.	
Former WID Article 13 (3) The incineration plant or co-incineration plant or incineration line shall under no circumstances continue to incinerate waste for a period of more than four hours uninterrupted where emission limit values are exceeded; moreover, the cumulative duration of operation in such conditions over one year shall be less than 60 hours. The 60-hour duration applies to those lines of the entire plant which are linked to one single flue gas cleaning device.	The plant will be operated with CEMS which will be linked into the controls system.
Former WID Article 13 (4) The total dust content of the emissions into the air of an incineration plant shall under no circumstances exceed 150 mg/m^3 expressed as a half-	The applicant does not request the abnormal emission limit value for particulates available under Article 13(4). Emissions of CO and TOC are limited in the process by

Table 6.2: Chapter IV Compliance - SPECIAL PROVISIONS FOR WASTE INCINERATION PLANTS AND WASTE CO-INCINERATION PLANTS	
IED technical requirement	Justification
hourly average; moreover, the air emission limit values for CO and TOC shall not be exceeded. All other conditions referred to in Article 6 shall be complied with.	ensuring controlled and efficient combustion. The use of oxidiser in which the gas is maintained at 850°C for 2 seconds with presence of oxygen facilitates oxidation of CO and TOC. The hot gas filter uses filter elements rated to 3 mg/Nm^3. A dust probe is used in the process and is linked to CEMS.

BAT

The following BAT demonstration is based on the BREF document for incineration and the sector guidance. The BAT demonstration is summarised in the following table, which details all of the indicative BAT requirements insofar as they apply to this process.

Table 6.3: BAT Justification

Indicative Requirement	BAT justification
Incoming waste and raw materials management	
Waste code	The proposed technology uses non-hazardous residual plastic waste. The waste codes from the List of Wastes (England) Regulations 2005 are identified in Table 3.5.
Conditioning step	The RPW will be conditioned within the material preparation plant on site.
EMS	Recycling Technologies will operate to an environmental management system which will ensure that procedures are in place for RPW input and raw material management. All necessary operating procedures will be in place and documented and stored within the company EMS.
Odour control – internal storage	RPW shall be contained inside the reception and processing building. Delivery vehicles access the reception and storage building via roller shutter doors. These will be kept closed at all times unless a direct delivery of RPW is taking place. During periods of planned shutdown, the feedstock within the storage system will be run down prior to the shutdown. All doors will remain closed as far as practicable. RPW stores will only start to be increased again slightly in advance of the planned recommencement date. If there are extended periods of unplanned shutdowns deliveries will be diverted to other suitably permitted facilities. For longer unplanned shutdowns the feedstock will be removed from site.
Fire fighting	All fire water will enter the drainage system and overflow into the attenuation pond. The fire water will be tankered away to a suitable water treatment facility. All fire water is drawn from the fire pond. All fire water used on process equipment will enter the drainage system and be captured in an oil water separation system equipped with attenuation. Contaminated fire water will be tankered away to a suitable water treatment facility. RT will limit unprocessed waste to a maximum of 50 tonnes of RPW stored in preparation buffers and 50 tonnes stored in the plastic storage bays. RPW will be subject to contract specification, inbound visual inspection and processed on a FIFO basis. There will only ever be a maximum of 50 tonnes of RPW stored in the post preparation buffers and 50 tonnes stored in the plastic storage bays. RPW will only be stored on site for a maximum of 4 days. This rapid turnover of stock significantly reduces the risk of 'older' material from self-heating and practically eliminates the potential of self combustion.

Table 6.3: BAT Justification	
Indicative Requirement	**BAT justification**
Storage of RPW and treatment chemicals	RPW is stored in the storage bay inside a building. Other raw materials will be stored in drums or tanks or bags (whichever are required for the quantity needed to be held in storage). These will be stored in the building and/or on hardstanding, within bunded areas that can contain 110% of the largest drum or 25% of the total storage capacity, whichever is the greater.
Preventing rainwater contamination	All external process areas will have hardstanding. Surface water run-off from the site roads will enter the surface water drainage system.
Incoming waste covered	Incoming waste will be delivered in covered vehicles with walking floor trailers. It will be off-loaded from these vehicles into the reception and processing building.
Litter avoidance	It is not anticipated that litter will be a problem. If litter does arise a litter patrol will be initiated at the end of each working day.
Maximisation of homogeneity of feed	Homogeneity of the waste is achieved in the conditioning step. A RPW specification is in place which stipulates the parameters that must be achieved.
Inspection and removal	The waste acceptance procedures include the validation of a load against the pre-acceptance documentation. Loads may be inspected at the weighbridge, during unloading to the plastic storage bays and prior to transfer to the thermal cracker. A waste rejection procedure is in place for unsuitable loads/part loads/items within a load.
Feed transfer	Waste is transferred by conveyor into the thermal cracker module to allow continuous feed. This is an automated system. The control system automatically controls the feed transfer. Due to the intermittent delivery of RPW to the installation (day time only) the RPW will be stockpiled in the reception and processing building to provide a maximum of approximately 2 days of continuous operation during periods of no deliveries being received; i.e. night-time, periods of maintenance.
Control of dust emissions	The waste will neither be dry or friable (i.e. the moisture content will be sufficiently high so to avoid excessive dust) therefore dust generation is unlikely. The waste is also delivered and stored within a building and transferred in enclosed conveyors, so dust generation is further minimised. A filter system is also used to reduce dust emissions. Ash residues will be stored in enclosed containers and removed from the facility in enclosed vehicles.
Odour prevention Storage time within the buffer store	Delivery vehicles access the building via roller shutter doors. These will be kept closed at all times unless a direct delivery of RPW is taking place. During short-term shutdowns the reception and processing building will be kept closed, the stocks of feedstock will be reduced, and the buffer stores cleared. During long-term shutdowns in addition to the previous actions, no incoming waste will be accepted.

Table 6.3: BAT Justification	
Indicative Requirement	**BAT justification**
	The Applicant will operate to an environmental management system (EMS) that includes procedures relating to all reception and handling areas.
Waste Charging	
Automatic waste feed prevention system	The installation is provided with a control system that automatically controls the feed of waste to the thermal cracker. At start-up waste cannot be fed to the Thermal Cracker until the process has reached the desired start-up conditions. The feed system for the process is automated and in the event of temperature loss or deviation from operating conditions the process will automatically put into stand-by mode or shut down in a controlled manner depending on the scenario. There are 3 thermocouples located on the oxidiser chamber that will be used to take the process to a standby mode by stopping plastic feed in the event that the temperature in the chamber drops below 850oC. The process trip action will be programmed with a 30 second delay to avoid any spurious trips accounting for instrument error / noise.
Furnace interlock	The plastic feed system is interlocked with the Thermal Cracker / Regenerator operating conditions (including temperature) to prevent feeding taking place when conditions within the Thermal Cracker and Regenerator are not ideal.
Airtight charging design, with interlock for chute or hopper	The transfer of waste to the thermal cracker is controlled. The waste will be transferred via a conveyor to the plastic feed system. The RPW is continuously fed into the thermal cracker via a screw conveyor feed system that prevents the ingress of air into the process. In the event of the system deviating from its normal operating conditions, the control system will automatically alter the output variables to bring back the system back to normal operating conditions. Failing to do so, plant will go into stand-by mode or shut down in a controlled manner depending on the scenario.
Charging rate and firing diagram, throughput rate, optimised combustion, waste residence time	Firing diagrams are not relevant as conventional burning does not take place of solid fuel/waste in this process.
Pyrolysis	The primary circuit, including the Thermal Cracker is purged with Nitrogen to ensure an oxygen free environment and is operated at pressure above atmospheric to avoid oxygen ingress into the control volume. Therefore, when plastic is introduced into the Thermal cracker, pyrolysis occurs at 550°C.
Feed of RPW	The RPW will be conditioned within the material preparation plant on site.
Combustion Requirements	Combustion in the Regenerator takes place at temperatures of 850°C. CFD modelling of the process will demonstrate that residence times above 850°C in excess of 2 seconds are achieved. Following commissioning of this installation, the results will be validated.

Table 6.3: BAT Justification	
Indicative Requirement	BAT justification
	Secondary combustion takes place in the oxidiser, where the temperature is maintained at 850°C and the exhaust gas is held for 2 seconds. The combustion in the oxidiser is controlled on temperature and remains above 65% O_2 at all times.
Validation of combustion conditions	CFD modelling of the combustion process within the Oxidiser shall be used to demonstrate that residence times above 850°C in excess of 2 seconds. This information shall be used to size the Oxidiser.
Measuring oxygen levels	Measurement of oxygen is taken by extractive measurement in the stack as part of the emissions monitoring package to allow sample data to be converted to standard conditions.
Combustion Control	There are numerous temperature measuring positions throughout the thermal process which ensure correct combustion conditions at all times including at the point of final combustion.
Dump stacks and by-passes	There will not be any dump stacks or by-passes during normal operation at the installation.
Flue gas recirculation	Flue gas recirculation is not required.
Cooling systems	Cooling will be provided by cooling heat exchangers. There will be no cooling towers required; however, the water used in the system shall be dosed with biocides and rust inhibitors. In any circumstances there will be no release to land. The system shall be charged from and drained into 1000 litre IBC tanks in a controlled manner, if ever required.
Regenerator design	The Regenerator and oxidiser design have been chosen to prevent, as far as possible, the formation of dioxins and furans.
Environmental Performance Indicators	Key process performance indicators will be devised in discussion with SEPA prior to commencement of operation of the facility.

6.3 Resource Efficiency and Climate Change

The plant and ancillaries have been designed to maximise the energy efficiency of the process. Within the plant design the following actions have been undertaken to improve the energy efficiency of the design;

- Combustion of the Light Hydrocarbon Gas product within the Regenerator and Thermal Oxidiser.
- Heat Integration of the high temperature flue with the fluidisation gas for the thermal cracker.
- Use of variable speed drives for pumps, compressors and fans to minimise the energy consumption across a range of process conditions.
- The selection of suppliers who are able to offer more efficient equipment.

The resultant energy efficiency of the process is currently 70%, accounting for the energy requirements of the material preparation module, the RT7000 process area and all utility and ancillaries.

Energy Efficiency = Energy Ouput / Energy Input = 9002kW / 12868kW = 70%

Please refer to the Energy Efficiency Calculation provided in Annex B.

There are opportunities to improve the energy efficiency of the technology going forward and Recycling Technologies is committed to doing that as part of its technology journey. It is expected that in the future it will be possible to further integrate the use of light hydrocarbon gas within the system such that no LPG is required in the process during normal operation. This would improve the energy efficiency from 70 to 76.7%.

The next way that the energy efficiency can be improved is by integrating the MPM within existing waste process infrastructure or through the provision of the feed ready residual plastic waste at the site boundary. Due to uncertainty on feed quality the machine at Binn Farm has been provided with a full material preparation module which has a very high energy demand (350kW). It is expected that by better design integration with waste infrastructure the equipment requirement can be minimised and the demand reduce by at least 50%. This would improve the energy efficiency to 80.3% when combined with the LPG action above.

It may be possible to also find further energy efficiency improvements through further heat integration and product quality improvements but this has not yes been quantified.

Development of KPI's

The Operator will establish Key Performance Indicators (KPIs) when site electricity generation figures are available. The composition of the waste materials in the process will not vary greatly over the life of the plant. Should any site equipment or technology be replaced, efforts will be made to replace the unit with one which is more energy efficient, if available.

The Operator will create KPIs based on monitoring data from how much energy is used to run the site and whether this can be reduced. Within six months of operating the Applicant will produce a report detailing the energy uses at the site and where energy use improvements, if any, can be made.

Avoidance, Recovery and Disposal of Waste

- All feedstock delivered to the site will be subject to an acceptance and pre-acceptance process that should ensure that the potential for inappropriate feedstock delivery is minimised;
- The site has a detailed inspection process to avoid unsuitable wastes to be introduced to the process; and

- The safe storage of rejected loads has been provided within and procedures will be in place for dealing with such loads to ensure that they are safely stored and dispatched for onward disposal. The storage times will be minimised.

6.4 BAT Comparison

An assessment of the applicable indicative BAT requirements for the sector has been carried out. The following indicative BAT measures are considered to be met by the process.

Operations

- Very high levels of housekeeping will be employed throughout the site;
- All vehicles will be loaded and unloaded under cover and on sealed concrete hardstanding and engineered containment;
- All RPW will be stored internally within the reception and processing building;
- Segregated water systems have been incorporated into the design of the plant to minimise the contamination of rainwater; and
- All building doors will be self-closing.

Waste Charging

- All feedstock into the Thermal Cracker will be on an automatic feed system to prevent waste feed:
  - Until the required temperature has been reached during start-up;
  - Whenever the required temperature is not maintained;
  - Whenever the CEMS show that any emission limit value is exceeded due to disturbances or failures of the purification devices; and
  - During minor or major events.
- Combustion of light hydrocarbon gas in the Regenerator and the Oxidiser will be interlocked so that combustion cannot take place when:
  - The temperatures and air-flows are inadequate;
  - Any flue gas cleaning bypasses are open;
  - Where the CEMS show that the emission limit values are being exceeded for a period of time in excess of the limits set within IED; or
  - Monitoring results required to demonstrate compliance with emission limit values are unavailable.
- The charging process has been designed to be sealed and all pressure controls have been designed to avoid escape of fumes or excess air flows.

Legislative Requirements

- The exhaust gas shall be maintained at 850°C for at least 2 seconds;
- The combustion temperature and residence time and the oxygen content of the stack gases have been validated under the most unfavourable operational conditions;
- Ash produced by the plant will comply with the IED/WID 3% TOC requirements; and

- The installation will not give rise to significant ground level air pollution as demonstrated by Section 7 '*Environmental Impact'*.

Emissions to Air

- A filter system will be used to provide reliable abatement of particulate matter;
- The gas is cooled quickly to avoid de novo synthesis of dioxin;
- Hot gas filter with a doser unit, that can dose reagent of choice (e.g. activated carbon, sodium bicarbonate) if required; and
- All indicative IED ELV's will be met.

Odour Emissions

Odour will be minimised through the following measures:

- Containing waste to designated reception area;
- Ensuring that no putrescible waste is processed at the plant;
- Regular cleaning of waste handling areas; and
- The design of all waste handling areas facilitates cleaning.

6.5 BREF Incineration BAT Conclusions

The Best Available Techniques (BAT) Reference Document (BREF) for Waste Incineration was produced by the European Integrated Pollution Prevention and Control Bureau (EIPPCB) and adopted in December 2019.

This document was drawn up in the framework of the implementation of the Industrial Emissions Directive (2010/75/EU) and is the result of the exchange of information provided for in Article 13 of the Directive.

The document clearly states that it covers the disposal or recovery of waste in waste incineration plants for non-hazardous waste with a capacity exceeding 3 tonnes per hour and for hazardous waste with a capacity exceeding 10 tonnes per day.

Due to the proposed plant only processing 1 tonne per hour of non-hazardous waste, the BREF does not apply to the proposed activities. For this reason, the plant will not need to meet the new Emission Limit Values (ELVs) and instead will be regulated against the Industrial Emission Directive ELVs which is reflected in the Air Quality modelling that has been carried out for the site. Although the plant does not meet the threshold required to implement the BREF, the Applicant has carried out a review against the BREF at the request of SEPA.

Please refer to Table 6.4 for more information.

Table 6.4

: BREF BAT Justification Table

BAT Reference	BAT Conclusion	Justification
BAT 1	In order to improve the overall environmental performance, BAT is to elaborate and implement an environmental management system (EMS) that incorporates the features provided within the BREF document.	There will be an Environmental Management System in place that incorporates the features provided within the BREF document.
BAT 2	BAT is to determine either the gross electrical efficiency, the gross energy efficiency, or the boiler efficiency of the incineration plant as a whole or of all the relevant parts of the incineration plant.	The gross energy efficiency of the plant is 70%.
BAT 3	BAT is to monitor key process parameters relevant for emissions to air and water including those given in the Guidance.	Emissions to air will be monitored by CEMS in accordance with the sites permit.
BAT 4	BAT is to monitor channelled emissions to air with at least the frequency given below and in accordance with EN standards. If the EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	Emissions to air will be monitored by CEMS in accordance with the sites permit.
BAT 5	BAT is to appropriately monitor channelled emissions to air from the incineration plant during Other Than Normal Operating Conditions (OTNOC)	Emissions to air will need to be monitored appropriately during abnormal operation.
BAT 6	BAT is to monitor emissions to water from FGC and/or bottom ash treatment with at least the frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	There are no waste water discharges resulting from the flue gas cleaning process. The exhaust gases will be cleaned using dry processes, namely filter systems. There will be no aqueous gas cleaning effluents. There is no bottom ash treatment carried out on site.
BAT 7	BAT is to monitor the content of unburnt substances in slags and bottom ashes at the incineration plant with at least the frequency given below and in accordance with EN standards.	n/a – no bottom ash is produced by the plant.
BAT 8	For the incineration of hazardous waste containing POPs, BAT is to determine the POP content in the output streams (e.g. slags and bottom ashes, flue-gas, waste water) after the commissioning of the incineration plant and after each change that may significantly affect the POP content in the output streams.	n/a – no hazardous waste is incinerated.

BAT 9	In order to improve the overall environmental performance of the incineration plant by waste stream management (see BAT 1), BAT is to use all of the techniques (a) to (c) given in the Guidance, and, where relevant, also techniques (d), (e) and (f).	The sites EMS will be complete with details on the following: • The waste that can be processed on site; • Pre-acceptance procedures; • Waste acceptance procedures; • A waste tracking system and inventory; and • Waste segregation. These are detailed within the sites waste acceptance procedures.
BAT 10	In order to improve the overall environmental performance of the bottom ash treatment plant, BAT is to set up and implement an output quality management system (see BAT 1).	n/a – there is no bottom ash treatment plant on site.
BAT 11	In order to improve the overall environmental performance of the incineration plant, BAT is to monitor the waste deliveries as part of the waste acceptance procedures (see BAT 9 c) including, depending on the risk posed by the incoming waste, the elements given in the guidance.	The waste acceptance procedure will include the monitoring of waste deliveries for: • Weighing of the waste deliveries; • Visual inspection; and • Periodic sampling of waste deliveries and analysis of key properties/substances (e.g. calorific value, content of halogens and metals/metalloids). Radioactivity detection is not necessary due to the proposed waste types.
BAT 12	In order to reduce the environmental risks associated with the reception, handling and storage of waste, BAT is to use both of the techniques given in the guidance.	Waste reception, waste handling and the storage of waste will take place internally on impermeable surfaces with sealed drainage. No waste will be accepted on site unless the site has adequate waste storage capacity. This will be achieved by: • The maximum waste storage capacity being clearly established on site; and • Regular monitoring of the waste stored on site against the maximum allowed storage capacity.

BAT 13	In order to reduce the environmental risk associated with the storage and handling of clinical waste, BAT is to use a combination of the techniques given in the guidance.	n/a – no clinical waste is accepted on site.
BAT 14	In order to improve the overall environmental performance of the incineration of waste, to reduce the content of unburnt substances in slags and bottom ashes, and to reduce emissions to air from the incineration of waste, BAT is to use an appropriate combination of the techniques given in the Guidance.	All vehicles will be directed from the weighbridge to the reception and processing building via electrically operated roller shutter doors. Waste will then be deposited directly into the plastic storage bays within the building. The material preparation module prepares the RPW received on site by removing undesirable material such as biomass, glass, metals stones, moisture etc. and unwanted polymers prior to entry into the Thermal Cracker. The plant will be controlled by an advanced control system which will optimise and control the process with special attention to combustion, abatement and monitoring.
BAT 15	In order to improve the overall environmental performance of the incineration plant and to reduce emissions to air, BAT is to set up and implement procedures for the adjustment of the plant's settings, e.g. through the advanced control system (see description in Section 5.2.1), as and when needed and practicable, based on the characterisation and control of the waste (see BAT 11).	The plant will be controlled by an advanced control system which will optimise and control the process with special attention to combustion, abatement and monitoring.
BAT 16	In order to improve the overall environmental performance of the incineration plant and to reduce emissions to air, BAT is to set up and implement operational procedures (e.g. organisation of the supply chain, continuous rather than batch operation) to limit as far as practicable shutdown and start-up operations.	Procedures will be in place to limit shut-down and start-up operations as far as practically possible.
BAT 17	In order to reduce emissions to air and, where relevant, to water from the incineration plant, BAT is to ensure that the FGC system and the waste water treatment plant are appropriately designed (e.g. considering the maximum flow rate and pollutant concentrations), operated within their design range, and maintained so as to ensure optimal availability	The flue gas treatment is appropriately designed for the facility, will be operated within the design range and maintained to ensure optimal availability. There is no water treatment plant on site.

BAT 18	In order to reduce the frequency of the occurrence of OTNOC and to reduce emissions to air and, where relevant, to water from the incineration plant during OTNOC, BAT is to set up and implement a risk-based OTNOC management plan as part of the environmental management system (see BAT 1) that includes all of the elements within the guidance.	If required, an OTNOC management plan will be produced as part of the EMS in accordance with the guidance.
BAT 19	In order to increase the resource efficiency of the incineration plant, BAT is to use a heat recovery boiler.	The heat recovery and flue gas treatment module recovers energy from the exhaust gas from the Regenerator. Heat is recovered from the exhaust gas to pre-heat combustion air to the Regenerator, pre-heat light hydrocarbon gas to the Thermal Cracker, dry feed materials, and heat pipework that are required to be maintained at elevated temperatures. This is considered BAT for the plant.
BAT 20	In order to increase the energy efficiency of the incineration plant, BAT is to use an appropriate combination of the techniques given in the Guidance.	In order to increase energy efficiency the following is carried out: • Minimisation of heat loses; and • The use of heat exchangers. The plant has insulation via both refractory lining in the Regenerator and thermal jackets throughout the plant. The flue gas train includes two heat exchangers that both recover heat and reduce the de-novo synthesis effect.
BAT 21	In order to prevent or reduce diffuse emissions from the incineration plant, including odour emissions, BAT is to: • store solid and bulk pasty wastes that are odorous and/or prone to releasing volatile substances in enclosed buildings under controlled sub-atmospheric pressure and use the extracted air as combustion air for incineration or send it to another suitable abatement system in the case of a risk of explosion; • store liquid wastes in tanks under appropriate controlled pressure and duct the tank vents to the combustion air feed or to another suitable abatement system; • control the risk of odour during complete shutdown periods when no incineration capacity is available, e.g. by ▪ sending the vented or extracted air to an alternative abatement system, e.g. a wet scrubber, a fixed adsorption bed;	The wastes that are proposed to be processed through the plastic recycling facility are by their nature stable and non-reactive and plastics do not have potential for odour generation. Furthermore, the fundamental design of the facility has a hierarchy of odour control and abatement measures to ensure that the potential for odour impacts are eliminated. The process itself has no significant potential for odours as the combustion effectively destroys any odorous compounds.

	▪ minimising the amount of waste in storage, e.g. by interrupting, reducing or transferring waste deliveries, as a part of waste stream management (see BAT 9); ▪ storing waste in properly sealed bales.	No odorous wastes will be accepted onto site and therefore the potential for offsite odour impacts is considered negligible.
BAT 22	In order to prevent diffuse emissions of volatile compounds from the handling of gaseous and liquid wastes that are odorous and/or prone to releasing volatile substances at incineration plants, BAT is to feed them to the furnace by direct feeding.	n/a – no gaseous and liquid wastes are processed on site.
BAT 23	In order to prevent or reduce diffuse dust emissions to air from the treatment of slags and bottom ashes, BAT is to include in the environmental management system (see BAT 1) the following diffuse dust emissions management features: • identification of the most relevant diffuse dust emission sources (e.g. using EN 15445); • definition and implementation of appropriate actions and techniques to prevent or reduce diffuse emissions over a given time frame.	n/a – there is no treatment of slags and bottom ashes on site. No bottom ash is produced by the process.
BAT 24	In order to prevent or reduce diffuse dust emissions to air from the treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques given in the guidance.	n/a – there is no treatment of slags and bottom ashes on site.
BAT 25	In order to reduce channelled emissions to air of dust, metals and metalloids from the incineration of waste, BAT is to use one or a combination of the techniques given in the Guidance.	Particulate is controlled by the hot gas filter. Metals are expected to settle with the particulates dropped out in the gas-solid separator and hot gas filter This is considered BAT for the plant and the IED BAT ELVs will be met.
BAT 26	In order to reduce channelled dust emissions to air from the enclosed treatment of slags and bottom ashes with extraction of air (see BAT 24 f), BAT is to treat the extracted air with a bag filter (see Section 5.2.2).	n/a – there is no treatment of slags and bottom ashes on site.
BAT 27	In order to reduce channelled emissions of HCl, HF and SO_2 to air from the incineration of waste, BAT is to use one or a combination of the techniques given in the Guidance.	The TCR vapour clean-up, the wet scrubbing using aqueous sodium hydroxide and the Halide Guard will effectively remove any halides (hydrogen chloride, hydrogen bromide, hydrogen fluoride etc). This means that acid gases shall be removed from the Light Hydrocarbon Gas prior to combustion processes.

		Due to the operation of the proposed process, acid gases will not be contained within the emissions from the plant. However, the hot gas filter has the capacity for reagent dosing if required This is considered BAT for the plant.
BAT 28	In order to reduce channelled peak emissions of HCl, HF and SO2 to air from the incineration of waste while limiting the consumption of reagents and the amount of residues generated from dry sorbent injection and semi-wet absorbers, BAT is to use technique (a) or both of the techniques given in the Guidance.	Reagent dosage will be automated based on continuous monitoring. This is considered BAT for the plant and the IED BAT ELVs will be met.
BAT 29	In order to reduce channelled NOX emissions to air while limiting the emissions of CO and N2O from the incineration of waste and the emissions of NH_3 from the use of SNCR and/or SCR, BAT is to use an appropriate combination of the techniques given in the Guidance.	All combustion processes in the plant are designed to occur at 850°C with low residence times. This maximum temperature means low NOx formation since NOx emissions do not form in significant amounts until temperatures start getting over 1200°C. However, the hot gas filter has the capacity for reagent dosing if required. Flue gas recirculation is not required. This is considered BAT for the plant and the IED BAT ELVs will be met.
BAT 30	In order to reduce channelled emissions to air of organic compounds including PCDD/F and PCBs from the incineration of waste, BAT is to use techniques (a), (b), (c), (d), and one or a combination of techniques (e) to (i) given in the Guidance.	Dioxins and furans are eliminated by controlling the temperature in the Oxidiser at 850°C and allowing 2 seconds residence time for the exhaust gas. The flue gas treatment system is also provided with a hot gas filter with dosing capability (with sodium hydroxide and activated carbon) to safeguard against reformation of dioxins via the De Novo Synthesis process. The plant uses the following techniques: • Rapid flue-gas cooling; and

		• Dry sorbent injection – a dosing mechanism upstream of the hot gas filter doses sodium bicarbonate and activated carbon. The activated carbon reduces dioxins/furans. This is considered BAT for the plant and the IED BAT ELVs will be met.
BAT 31	In order to reduce channelled mercury emissions to air (including mercury emission peaks) from the incineration of waste, BAT is to use one or a combination of the techniques given in the Guidance.	The plant uses the following techniques: • Dry sorbent injection; and • Fixed bed adsorption. Mercury would be adsorbed in the activated carbon and accumulate in the hot gas filter. However, it is important to note that the input materials have no mercury containing waste streams so mercury will not be present within the emissions from the plant. This is considered BAT for the plant and the IED BAT ELVs will be met.
BAT 32	In order to prevent the contamination of uncontaminated water, to reduce emissions to water, and to increase resource efficiency, BAT is to segregate waste water streams and to treat them separately, depending on their characteristics	Uncontaminated clean surface water runoff captured from roof drainage and external hardstanding areas will be discharged to the existing surface water drainage system (W1). All domestic effluent (i.e from the welfare facilities) will be treated via a packaged treatment plant and discharged to the same connection (W1). Waste water from the plant will be collected and transferred to a water treatment plant for disposal.
BAT 33	In order to reduce water usage and to prevent or reduce the generation of waste water from the incineration plant, BAT is to use one or a combination of the techniques given in the Guidance.	A dry system is proposed for flue gas cleaning which does not generate waste water.

		There is no bottom ash produced by the process.
BAT 34	In order to reduce emissions to water from FGC and/or from the storage and treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques given below, and to use secondary techniques as close as possible to the source in order to avoid dilution.	A dry system is proposed for flue gas cleaning which does not generate waste water. There is no treatment of slags and bottom ashes on site. There is no bottom ash produced by the process.
BAT 35	In order to increase resource efficiency, BAT is to handle and treat bottom ashes separately from FGC residues.	The is no bottom ash produced by the process. Ash from the flue-gas treatment system will be exported off site for disposal.
BAT 36	In order to increase resource efficiency for the treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques given below based on a risk assessment depending on the hazardous properties of the slags and bottom ashes.	n/a – there is no treatment of slags and bottom ashes on site.
BAT 37	In order to prevent or, where that is not practicable, to reduce noise emissions, BAT is to use one or a combination of the techniques in the Guidance.	A noise impact assessment has been carried out as part of the permit application which demonstrates that the noise impacts from site will have an insignificant effect on existing residential receptors due to the appropriate design, mitigation and intervening distances to the nearest residential receptors. All operational measures provided within the guidance will be carried out with noise attenuation being used where necessary. In line with BAT the following techniques will be used on site: • Appropriate location of equipment and buildings; • Operational measures; • Low-noise equipment; • Noise Attenuation; and • Noise-control equipment / infrastructure.

7. IMPACT TO THE ENVIRONMENT

7.1 Impacts to Air

An assessment has been carried out to determine the potential air quality impacts associated with the proposed development at Binn Farm.

Scope of the Assessment

The scope of the assessment has been determined in the following way:

- review of air quality data for the area surrounding the site, including data from the Defra Air Quality Information Resource (UK-AIR);
- desk study to confirm the location of nearby areas that may be sensitive to changes in local air quality; and
- review and modelling of emissions data which have been used as input to the UK ADMS dispersion modelling assessment.

The assessment for the proposed development comprises a review of emission parameters for the plant and dispersion modelling to predict ground-level concentrations of pollutants at sensitive human and habitat receptor locations.

Predicted ground level concentrations have been compared with relevant air quality standards for the protection of health and critical level / loads for the protection of sensitive ecosystems and vegetation. This modelling presented within *Annex C2 – Air Quality Assessment and HHRA.*

7.1.1 Sensitive Human Health Receptors

Specific receptors have been identified where people are likely to be regularly exposed for prolonged periods of time (e.g. residential areas). The location of the discrete sensitive receptors is presented in Table 7.1 below.

Table 7.1: Human Health Receptors

ID	Receptor	Type	Easting	Northing
D1	Binn Farm Complex	Commercial/industrial	317223	713297
D2	Catochil House	Residential	317770	713320
D3	Balvaird Byre Cottage	Residential	317028	712206
D4	Bein Inn	Residential/leisure	316027	713057
D5	Binn Farm Cottage	Residential	317144	713441
D6	Binn Hill Masts	Commercial/industrial	317187	713833

The report concludes that for a proposed stack height of 25 m, predicted maximum off-site concentrations are assessed as 'not significant' and well below the relevant air quality standards for all pollutants considered.

Please refer to *Annex C2 – Air Quality Assessment and HHRA* for more information.

7.1.2 Impact on Sensitive Habitat Sites

The IPPC H1 guidance states that the impact of emissions to air on vegetation and ecosystems should be assessed for the following habitat sites within 10 km of the source:

- Special Areas of Conservation (SACs) and candidate SACs (cSACs) designated under the EC Habitats Directive[2];
- Special Protection Areas (SPAs) and potential SPAs designated under the EC Birds Directive[3]; and
- Ramsar Sites designated under the Convention on Wetlands of International Importance[4].

Within 2km of the source:

- Sites of Special Scientific Interest (SSSI) established by the 1981 Wildlife and Countryside Act;
- National Nature Reserves (NNR);
- Local Nature Reserves (LNR);
- Local wildlife sites (Sites of Interest for Nature Conservation, SINC and Sites of Local Interest for Nature Conservation, SLINC); and
- Ancient woodland.

The location of the sensitive habitat sites is presented in Table 7.2 overleaf. The nearest habitat site to the proposed development is Turflundie Wood which is designated as a SSSI and a SAC. The other habitats are in excess of 5 km from the development site.

2 Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora.

3 Council Directive 79/409/EEC on the conservation of wild birds

4 Ramsar (1971), The Convention of Wetlands of International Importance especially as Waterfowl Habitat.

Table 7.2: Sensitive Habitat Receptors		
Receptor	Primary Habitat	Approx. Location (Relative to the Site)
H1. Turflundie Wood SSSI, SAC	Great crested newt	1.6 km east-northeast
H2. River Tay SAC	Permanent oligotrophic waters: softwater lakes	5.7 km north-northeast
H3. Pitkeathly Mires SSSI, SAC	Transition mires and quaking bogs	6.3 km west
H4. Loch Leven Ramsar, SSSI, SPA	Wintering of Pink-footed goose	9.7 km south
H5. Firth of Tay and Eden Estuary Ramsar, SAC, SPA	Pioneer, low-mid, mid-upper saltmarshes	5.7 km north-northeast
H6. Ballo and Harperleas Reservoir SSSI	Mesotrophic Loch	8.5 km south-southeast
H7. Bishop Hill SSSI	Moss and lichen dominated mountain summits	8.6 km south
H8. Black Loch (Abdie) SSSI	Open water transition fen	8.7 km east
H9. Craigmead Meadows SSSI	Calcareous grassland	9.0 km southeast
H10. Lacesston Muir & Glen Burn Gorge SSSI	Subalpine dry heath – dwarf shrub heath	6.2 km south
H11. Lindores Loch SSSI	Open water transition fen	9.0 km east-northeast
H12. Lochmill Loch SSSI	Upland heathland	5.0 km northeast
H13. Binn Wood AW	Woodland	1.1 km west
H14. Pottiehill Wood AW	Woodland	1.5 km northwest
H15. Glen Wood AW	Woodland	0.9 km east
H16. Glenfarg Wood AW	Woodland	1.4 km west

The report concludes that the predicted process contributions are 'not significant' compared with the critical levels for NOx, SO_2, NH_3 and HF and critical loads for nutrient nitrogen deposition and acidification at nearby European habitat sites.

7.1.3 Human Health Risk

A Human Health Risk Assessment has also been carried out as part of the permit application, where the release of substances from the proposed facility which have the potential to harm human health have been assessed.

The report concludes that the impact of the proposed development in isolation and cumulatively will not result in appreciable heath risks from its operation.

Please refer to *Annex C2 – Air Quality Assessment and HHRA* for more information.

7.2 Impacts to Land

There are no impacts to land relating to this permit application.

7.3 Impacts to Controlled Waters

There are no impacts to controlled waters relating to this permit application.

7.4 Impact to Sewer

There are no impacts to sewer relating to this permit application.