Application Support Document

Endolys: Plastics to Oil Facility

December 2025

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Application Support Document

Endolys: Plastics to Oil Facility

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Acronyms and Abbreviations

Name	Description
CHP	Combined Heat and Power
ATT	Advanced thermal treatment
SG	Specified Generator
MCP	Medium Combustion Plant
MCPD	Medium Combustion Plant Directive 2015
EA	Environment Agency
EMS	Environmental Management System

IED	Industrial Emissions Directive
EPR	Environmental Permitting Regulations
ELV	Emission Limit Values
NCG	Non-condensable Combustible Gas
BREF	Best Available Techniques Reference Document
BAT	Best Available Techniques
BAT -AELs	Best Available Techniques Associated Emission Levels
DCS	Digital Control System
SCADA	Supervisory Contril and Data Acquisition
HAZOP	Hazard and Operability Study
DSEAR	Dangerous Substances and Explosive Atmosphere Regulations 2002
ATEX	Atmospheres Explosibles
HAZID	Hazard Identification
TCM	Technically Competent Manager
PPM	Planned Preventative Maintenance
AMP	Accident Management Plan
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
AQA	Air Quality Assessment
HHRA	Human Health Risk Assessment
VOC	Volatile Organic Compound
SCR	Selective Catalytic Reduction
SNCR	Selective Non-Catalytic Reduction

NON-TECHNICAL SUMMARY

Endolys Ltd (the '*Applicant*' or '*Endolys*' hereafter) is making a New Bespoke Installation Permit Application for the proposed operation of a chemical recycling facility that converts waste plastics to oil utilising a proprietary advanced thermal treatment (pyrolysis) technology.

The proposed Installation is located at the former Cleveland Bridge factory, Yarm Road, Darlington, DL1 4DE (National Grid Reference: NZ 32060 13554).

The proposed Installation combines a 'front end' waste plastic processing and treatment facility which will import and process circa 120,000 tonnes of waste plastic film per annum and convert it to a prepared feedstock that can be processed through a series of modular pyrolysis plants where it will be thermally converted to form a syngas that is subsequently condensed to for pyrolysis oil (pyoil). All pyoil produced by the process will be batched and exported for further refining under the terms of an offtake contract by a major hydrocarbon processor.

Non-condensable synthetic gas (syngas) produced by the process will be recovered and either combusted within the process or utilised within an onsite boiler for steam generation. By virtue of the fact that the syngas is produced from the thermal treatment of waste plastic, the combustion of the syngas meets the definition of a co-incineration activity. Whilst the gas is clean and devoid of contaminants, at this stage, *'End of Waste'* status is not being sought for the syngas, though this may be undertaken in the future.

The project will be undertaken in two distinct phases; 6 modular pyrolysis units will be installed in Phase 1, with a further 6 modular pyrolysis units in Phase 2. By project completion there will be a total of 12 pyrolysis units, each with a nameplate capacity of 1.3 tonnes per hour. Allowing for maintenance and downtime and assuming 90% availability the plant will process approximately 330 tonnes per day and produce approximately 81,000 tonnes per annum of pyoil.

The Applicant has undertaken and been provided with enhanced pre-application advice with the Environment Agency [EPR/MP3821LP/P001] and it has been agreed that the proposed site activities will fall under the scope of the Environmental Permitting Regulations (England and Wales) 2018 (as amended) meeting the definition of an Installation as defined by the following Schedule 1 references:

- ***Chapter 1.2*** *Gasification, Liquefaction and Refining Activities* ***Part A(1)(f)(iv)*** *Activities involving the pyrolysis, carbonisation, distillation, partial oxidation or other heat treatment of other carbonaceous material*

  This would relate to the pyrolysis process as the primary purpose of the facility is the thermal conversion and recycling of waste plastics into pyrolysis oil.

- ***Chapter 5.4*** *Disposal, recovery or a mix of disposal and recovery of non-hazardous waste* ***Part A(1)(b)(ii)*** *Recovery or a mix of recovery and disposal of non-hazardous waste with a capacity exceeding 75 tonnes per day*

  This would relate to the incoming plastics pre-processing including shredding, metals removal, agglomeration and densifying, on the basis that once project is at full capacity approximately 198 tonnes of feedstock per day will be utilised within the pyrolysis units.

Additionally, a number of gas engine generator sets (CHP units) will be present onsite to provide power to the project. During Phase 1 of this project, the CHP units will be operated on natural gas , with the intention

of switching to syngas for Phase 2 once additional gas availability is established. Each of these CHP units will be of a capacity of approximately 4MWth and will be regulated as an associated Medium Combustion Plant (MCP) & Specified Generator activity and operated in accordance with the Environmental Permitting (England and Wales) Regulations 2018 (As Amended).

The onsite steam generation boiler will operate utilising syngas from the pyrolysis process. Whilst the syngas is not certified as meeting the published 'End Of Waste' requirements and as per the pre-application advice by the EA, Chapter IV IED emission limits will be applicable to all combustion activities onsite.

An emergency diesel generator will also be present onsite. With a rated thermal input of 1.2MWth this will be subject to the Medium Combustion Plant (MCP) requirements.

Directly Associated Activities (DAA's) include the acceptance and storage of incoming wastes, handling of produced waste streams and storage of product.

General Overview

The proposed development will treat waste plastic film through an advanced thermal treatment facility utilising a proprietary pyrolysis technology manufactured by Nuitech. Following thermal conversion within the pyrolysis reactor, oil vapours are condensed, the solid carbon residues (char) discharged to a sealed and the syngas produced will be utilised within the pyrolysis systems and onsite boiler to produce steam. Oil vapours will be condensed into Pyoil (Grade 3 Intermediate), which will be transported offsite to an established offtaker for further refinement.

The proposed facility comprises the following stages:

- *Waste Reception* – Pre-accepted bales of plastic film will be delivered into bays within the Feedstock Reception Hall under supervision from a suitably trained operative. Wastes will typically be stored for up to two weeks prior to processing;
- *Pre-treatment system* – This system will include shredding, NIR, metals removal, agglomeration and densification to produce a bead which will be transferred to intermediate storage prior to use as a feedstock for the pyrolysis reactors;
- *Pyrolysis* – Each pyrolysis reactor has the capacity to process 33tpd of waste plastic, producing a yield of 60 – 75% pyrolysis oil (approximately 81,000 tpa), non-condensable combustible gas (aka syngas) and a solid waste char;
- *Oil storage* – The proposed facility will utilise oil storage tanks, typically each with the capacity of approximately 100m^3 (12 in total) for pyoil storage prior to export;
- *Char storage* – char will be stored internally prior to removal offsite;
- *Syngas Use* – The produced syngas will be utilised as fuel for the pyrolysis process under normal operation. Additionally, syngas will be utilised within an onsite boiler for steam generation for use within the heating system onsite; and
- *Electricity Generation* – The sites power requirement will be met by an onsite CHP unit, which will utilise natural gas during Phase 1, switching to syngas in Phase 2.

Emissions to Air

Emissions to atmosphere from the plant are via eight emission points as follows:

- Continuous Emission Points
  - Pyrolysis plant flue stack (A1a and A1b – dual flue);
  - Steam Generation Gas boiler flue stack (A2a and A2b – dual flue);
  - Building Extraction System Stack (A3);
  - CHP Engine (A5);
- Intermittent / Abnormal Emission Points
  - Emergency flare (A6); and
  - Emergency Generator (A7).

Emissions arising from the combustion of the syngas within the pyrolysis plant, gas boilers and gas engines will have no more environmental impact than those arising from the combustion of natural gas. Emissions from the pyrolysis plant, gas boilers and gas engines are low in pollutant concentrations by nature, similar to natural gas fired processes and are free from particulate, acids gases, halides, volatile organic compounds and dioxins / furans.

Nevertheless, until such time as data has been gathered to prove End of Waste status on the syngas, all emissions from the syngas combustion activities will be in accordance with Annex VI Chapter IV of the Industrial Emissions Directive (IED) and the relevant Waste Incineration BREF BAT-AELs.

Emissions from the natural gas fired CHP Engine (A5) & emergency diesel generator (A7) will be in accordance with the Medium Combustion Plant Directive (MCP).

Atmospheric emissions from the pyrolysis plant are continuously monitored using MCERTS certified CEMS equipment to ensure that emission limits are complied with and to ensure that the combustion products are free from acid gas and halide emissions such that that gas quality and cleanliness can be assured.

Fugitive Emissions

The operation of the site will not lead to any offsite odour impacts. All wastes accepted and processed by the facility are screened and free from organic (food waste) materials and are low odour in their nature.

There are no external waste activities on site.

All incoming baled waste feedstock is subjected to waste pre-acceptance and acceptance checks as well as visual site inspections and is received, unloaded and stored within the reception are of the building. Any damaged or odorous bales are processed as soon as possible.

Vehicles delivering waste to site will be enclosed. On the basis of the above, there will be no fugitive emissions from either the transport, storage or movement of wastes.

All processing of wastes will take place internally. The internal processing of wastes reduces the opportunity for any fugitive dust and odour emissions being generated.

Fugitive VOC emissions from the storage of oil within the external tank farm will be mitigated by the fitting of carbon filters to the tank breather vents.

The plant has been designed to ensure that all noise emissions are abated and mitigated as far as reasonably possible. All external plant and equipment has been fitted with attenuation or screens to prevent disturbance to nearby receptors.

An Environmental Noise Impact Assessment has been undertaken in accordance with BS 4142:2014+A1:2019 and concludes that site operations are unlikely to have a significant impact at any sensitive receptors with the attenuation proposed. Please refer to *Annex F* for more information.

Product Management

The process will result in the production of approximately 81,000 tonnes of pyrolysis oil per annum. This will be stored onsite in dedicated tanks within a bunded Tank Farm, pending export offsite for further refinement.

The Tank Farm is located to the west of the main building and will be constructed with a capacity of XXX, will be constructed of impermeable surfacing with isolated drainage and is constructed in accordance with CIRIA 736.

Waste Management

The following waste products will be produced from the proposed Installation:

- Carbonaceous Char – which will be directed to a dedicated internal storage area prior to removal offsite;
- Waste Metals – minimal quantities of metals removed during the pre-treatment stage will be stored within a skip and removed offsite for recovery;
- Reject incoming plastics – minimal quantities of rejected feedstock will be quarantined prior to return to supplier; and
- Waste water effluent arising from the sites cooling towers, steam boiler blowdown, and gas scrubbing towers.

The char produced by the process will be subject to extensive sampling and analysis to inform intended future usage, for example for carbon sequestration within the construction sector.

The process will also produce some other consumable and chemical wastes including maintenance consumables (oil, grease, chemicals) all of which will be removed off site via a third-party waste contractor.

Emissions to Controlled Water

There will be no emissions to controlled waters arising from the installation.

There will be minimal emissions from the process from the scrubbing and condensing systems. All process effluents will be contained within a bunded storage vessel and the waste water removed from site by a third-party contractor for offsite disposal.

Uncontaminated clean surface water runoff captured from roof drainage and external roadways / car parking areas will be discharged to the existing surface water drainage system.

In the event of a fire, the drainage system would be isolated to prevent any fire water escaping off site.

Emissions to Sewer

There will be no emissions to sewer arising from the Installation, with the exception of domestic foul which will utilise the existing sewer connection.

Emissions to Land

There will be no emissions to land arising from the Installation. The site will be constructed with robust protection measures in place. The entire site area comprises concrete hardstanding with no 'soft' ground being present within the installation boundary, this protects the underlying geology and groundwater.

1. INTRODUCTION

Endolys Ltd (the '*Applicant*' or '*Endolys*' hereafter) is making a New Bespoke Installation Permit Application for the proposed operation of a chemical recycling facility that converts waste plastics to oil facility utilising a proprietary advanced thermal treatment (pyrolysis) technology.

The proposed Installation is located at the former Cleveland Bridge factory, Yarm Road, Darlington, DL1 4DE (National Grid Reference: NZ 32060 13554).

The proposed Installation combines a 'front end' waste plastic processing and treatment facility which will import and process circa 120,000 tonnes of waste plastic film per annum and convert it to a prepared feedstock that can be processed through a series of modular pyrolysis plants where it will be thermally converted to form a syngas that is subsequently condensed to for pyrolysis oil (pyoil). All pyoil produced by the process will be batched and exported for further refining under the terms of an offtake contract by a major hydrocarbon processor.

Non-condensable synthetic gas (syngas) produced by the process will be either combusted within the process, utilised within an onsite boiler for steam generation or within onsite CHP units for power generation. By virtue of the fact that the syngas is produced from the thermal treatment of waste plastic, the combustion of the syngas meets the definition of a co-incineration activity. Whilst the gas is clean and devoid of contaminants, at this stage, *'End of Waste'* status is not being sought for the syngas, though this may be undertaken in the future. The project will be undertaken in three phases, of which the first two form the subject of this EPR Application;

- Phase 1: The installation of 6 modular pyrolysis units with associated steam generation / boiler plant and a single gas fired CHP engine;
- Phase 2: The installation of a further 6 modular pyrolysis units and associated CHP engines;
- Phase 3: The installation of a further 12 modular pyrolysis plans and associated CHP engines.

This application is solely for the development and operation of Phases 1 and 2. Should the future development of Phase 3 take place, it will be subject to a separate permit variation application.

By the end of Phase 2 there will be a total of 12 pyrolysis units, each with a nameplate capacity of 1.3 tonnes per hour. Allowing for maintenance and downtime and assuming 90% availability the plant will process approximately 330 tonnes per day and produce approximately 81,000 tonnes of pyoil per annum.

Folling the pre-application provided to the applicant by the Environment Agency [EPR/MP3821LP/P001], the proposed site activities will fall under the scope of the Environmental Permitting Regulations (England and Wales) 2018 (as amended) meeting the definition of an Installation as defined by the following Schedule 1 references:

- ***Chapter 1.2*** *Gasification, Liquefaction and Refining Activities* ***Part A(1)(f)(iv)*** *Activities involving the pyrolysis, carbonisation, distillation, partial oxidation or other heat treatment of other carbonaceous material*

  Relating to the advanced thermal treatment (pyrolysis) / chemical recycling of waste plastics feedstocks into pyrolysis oil.

- ***Chapter 5.4*** *Disposal, recovery or a mix of disposal and recovery of non-hazardous waste* ***Part A(1)(b)(ii)*** *Recovery or a mix of recovery and disposal of non-hazardous waste with a capacity exceeding 75 tonnes per day*

  This would relate to the incoming plastics pre-processing including shredding, metals removal, agglomeration and densifying, on the basis that upon the completion of Phase 2 the plant will have the capacity to accept and process approximately 198 tonnes of feedstock per day for utilisation within the pyrolysis units.

Additionally, a number of gas engine generator sets (CHP units) will be present onsite to provide power to the project. During Phase 1 of this project, the CHP units will be operated on natural gas , with the intention of switching to syngas for Phase 2 once additional gas availability is established. Each of these CHP units will be of a capacity of approximately 4MWth and will be regulated as an associated Medium Combustion Plant (MCP) & Specified Generator activity and operated in accordance with the Environmental Permitting (England and Wales) Regulations 2018 (As Amended).

The onsite steam generation boiler will operate utilising syngas from the pyrolysis process. Whilst the syngas is not certified as meeting the published 'End Of Waste' requirements and as per the pre-application advice by the EA, Chapter IV IED emission limits will be applicable to all combustion activities onsite.

An emergency diesel generator will also be present onsite. With a rated thermal input of 1.2MWth this will be subject to the Medium Combustion Plant (MCP) requirements.

Directly Associated Activities (DAA's) include the acceptance and storage of incoming wastes, handling of produced waste streams and storage of product.

The remainder of this application support document is structured accordingly:

- Section 2: Provides a detailed site description and planning history of the site and associated activities;
- Section 3: Provides specific details associated with the New Bespoke Installation Permit Application, including proposed activities;
- Section 4: Provides a specific nature and detailed description of the emissions to air, water, and land 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 comparison against the applicable guidance and Emission Limit Values for the Installation; and
- Section 7: Provides details of the environmental impact of the Installation against the requirements of the Habitats Directive.

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

- Annex A: Site Plans and Figures;
- Annex B: Technical Information;
- Annex C: Environmental Risk Assessment;

- Annex D: Air Quality Assessment;
- Annex E: Human Health Risk Assessment;
- Annex F: Noise Impact Assessment;
- Annex G: Site Condition Report;
- Annex H: Environmental Management System Summary;
- Annex I: Fire Prevention Plan;
- Annex J: Odour Management Plan;
- Annex K: Accident Management Plan;
- Annex L: MCPD Checklist; and
- Annex M: Directors Details.

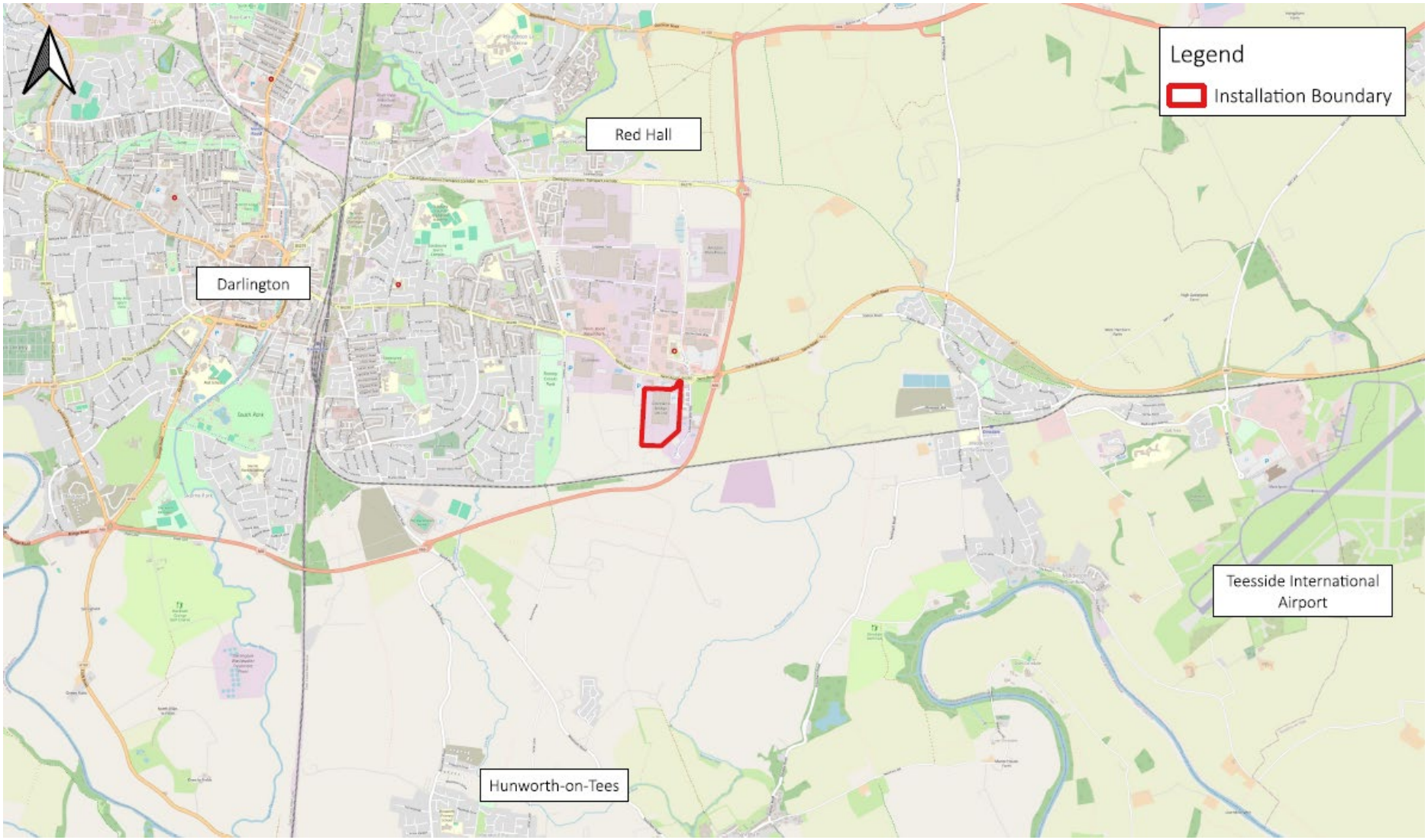

Figure 1.1 Site Location

Figure 1.2 Proposed Site Installation Boundary

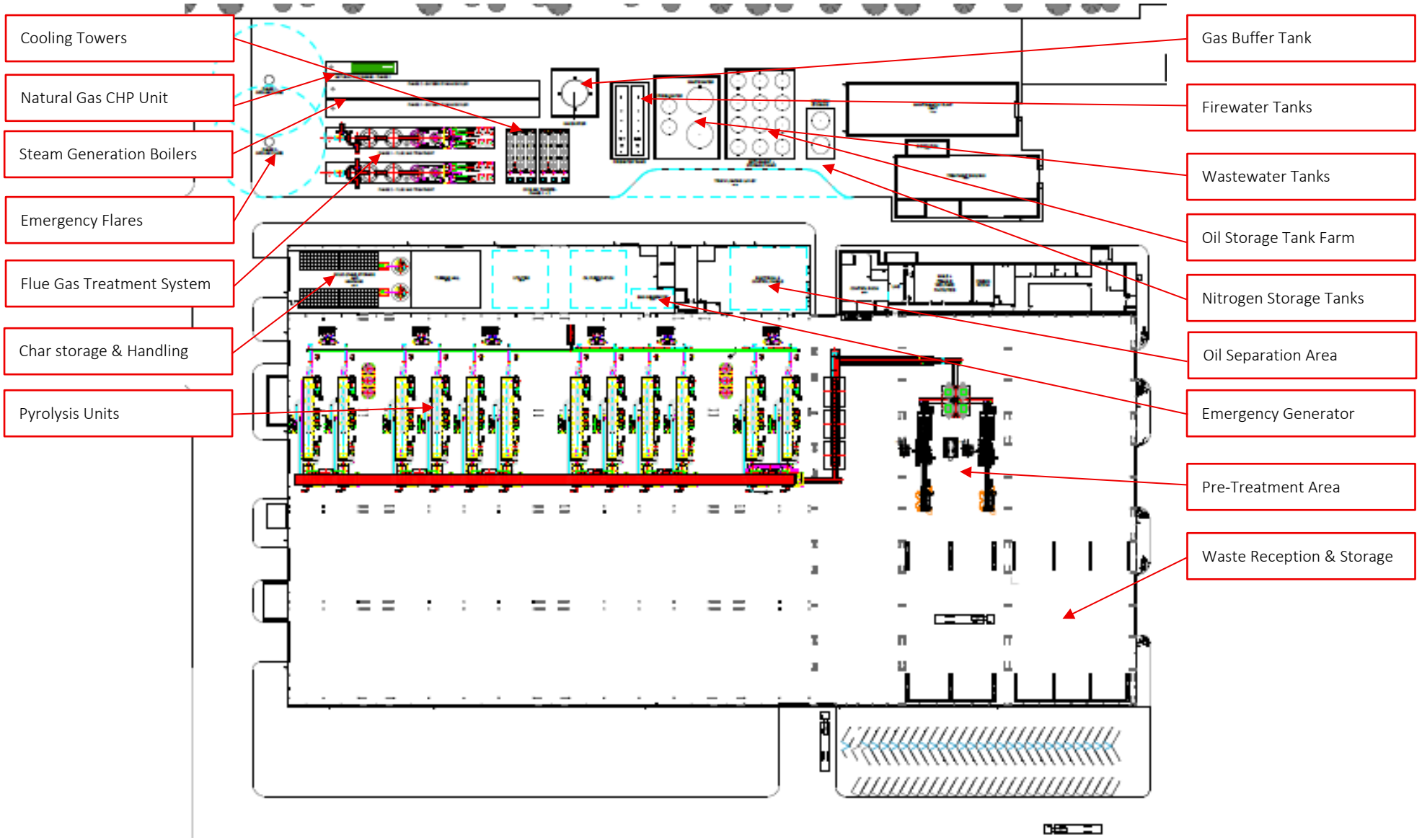

Figure 1.3 Proposed Site Layout

2. SITE DESCRIPTION

2.1 Site Setting

The proposed Installation is located at Endolys Ltd, Yarm Road, Darlington, DL1 4DE (National Grid Reference: NZ 32060 13554).

The site is located on the southeastern edge of Darlington in a predominantly agricultural and mixed industrial/commercial setting. To the north lies Morton Park shopping centre surrounded by other commercial units including a Premier Inn. Industrial units lie to the west whilst the south and east are predominantly agricultural in nature.

There are a number of ponds located to the east of and south of the site, the closest located approximately 30m east of the site boundary. The River Tees is located 3km south.

2.2 Planning and Permitting History

The site itself comprises an existing building which has a Planning B2 Use Class. Pre-application discussions with Darlington County Council have ascertained that the proposed pyrolysis process lawfully falls under this Use Class. As such, planning permission for the additional external items required for the Endolys project has been submitted to Darlington County Council on 19th December 2025.

Table 2.1 outlines the planning history of the site.

Table 2.1 Planning History

Reference	Year	Description
25/00541/FUL	2025	Demolition of existing extension on south elevation and installation of roller shutter door, removal of roof top plant and construction of pre-fabricated office building accessed by new external staircase on east elevation, together with associated refurbishment works for the conversion of the former paint plant building to HGV MOT testing station
15/00729/ADV	2015	Display of 1 No pole mounted non-illuminated sign at entrance
11/00326/FUL	2011	Erection of single storey project storage shed
08/00819/FUL	2008	Erection of portal frame paint cell
05/00471/FUL	2005	Erection of temporary open gantry structure for personnel training, stationing of six portable buildings on land and service unit commissioning
02/00570/FUL	2002	Erection of new gatehouse
01/00199/TC	2001	Erection of 15m lightweight lattice tower, nine dual polar antennas, two radio link dishes and equipment cabin. (Prior approval determination)

3. PROPOSED ACTIVITIES

3.1 Type of Permit

The Applicant is making an application for a Bespoke Part A(1) Environmental Permit for the proposed operation of an advanced thermal treatment facility that uses pyrolysis to chemically recycle waste plastics to oil. The listed activities are provided in Table 3.1.

The facility has been designed to process circa 120,000 tonnes of waste plastic film per annum. The proposed facility will process the waste plastic film through a pre-treatment process followed by pyrolysis to produce pyrolysis oil (Pyoil) which is exported for further refinement.

Non-condensable synthetic gas (syngas) produced by the process will be either combusted within the process or utilised within an onsite boiler for steam generation or onsite CHP engines for power generation (Phase 2 only).

The proposed site activities will fall under the scope of the Environmental Permitting Regulations (England and Wales) 2018 (as amended) meeting the definition of an Installation as defined by the following Schedule 1 references advised by the EA during pre-application advice (EPR/MP3821):

- ***Chapter 1.2*** *Gasification, Liquefaction and Refining Activities* ***Part A(1)(f)(iv)*** *Activities involving the pyrolysis, carbonisation, distillation, partial oxidation or other heat treatment of other carbonaceous material*
- ***Chapter 5.4*** *Disposal, recovery or a mix of disposal and recovery of non-hazardous waste* ***Part A(1)(b)(ii)*** *Recovery or a mix of recovery and disposal of non-hazardous waste with a capacity exceeding 75 tonnes per day*

The CHP engines when operating on natural gas will be regulated as Medium Combustion Plant (MCP) and Specified Generators (SG) and operated in accordance with the Environmental Permitting (England and Wales) Regulations 2018 (As Amended).

The facility has been designed to accept non-hazardous wastes in accordance with stringent site waste acceptance procedures and agreed specification. All waste will be obliged to meet the specification provided in Table 3.2.

Table 3.1 Listed Activities

Activity listed in EP Regulations 2013	Description of Specified Activity	Limits of Specified Activity	Specified Waste Management Operation
Section 1.2 Gasification, liquefaction and refining activities Part A(1)(f)	Activities involving pyrolysis, carbonisation, distillation, partial oxidation or other heat treatment	The reception, storage and combustion of non-hazardous waste feedstocks to produce syngas condensed into pyrolysis oil Installation includes all ancillary activities including syngas combustion, emissions abatement, electrical generation and oil production	R1: Use principally as a fuel or other means to generate electricity. R13: Storage of waste pending the operations numbered R1
Section 5.4 Disposal, recovery or a mix of	Recovery or a mix of recovery and disposal of non-hazardous waste with a	Pre-treatment of non-hazardous waste feedstocks consisting of shredding, separation, agglomeration	R3: Recycling/reclamation of organic substances which are not used as solvents

disposal and recovery of non-hazardous waste Part A(1)(b)(ii)	capacity exceeding 75 tonnes per day	and densification for utilisation within pyrolysis process Waste types as specified in Table 3.1 only.	R5: Recycling/reclamation of other inorganic materials R13: Storage of wastes pending any of the operations numbered R1 to R12 (excluding temporary storage, pending collection, on the site where it is produced)
Directly Associated Activities			
Steam Generation	Generation of steam for onsite use	From receipt of syngas to production of steam for heat use onsite	-
Electricity Generation	Generation of power and heat within CHP Engines – Medium Combustion Plant	From receipt of natural gas or syngas to export of heat and electricity for on-site use	-
Back-up Electricity Generation	Standby Diesel generator	Emergency use to a maximum of 500 hours operation per year.	-

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

- Non-hazardous and Inert Waste: Appropriate Measures for Permitted Facilities;
- Refining of Mineral Oil & Gas BREF BAT Conclusions;
- Waste Incineration BREF BAT Conclusions;
- Waste Treatment BREF BAT Conclusions;
- Medium combustion plant and specified generators: environmental permits;
- Regulation of Alternative Thermal Treatment or Thermal Conversion of Waste V1.0 – DRAFT (Sept 2019);
- Ricardo report, Establishing a methodology that supports the assessment of the impact of ATT processes; and
- EPR – How to Comply with your Environmental Permit (reference EPR 1.00).

The EA's draft guidance on Advanced Thermal Treatment is understood to still be under review but has been utilised as the basis for the EA's current approach to processes of this type.

The main issues identified within these guidance documents and the relevant Best Available Techniques, which are relevant to the process, have been built into the site operational 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 installation boundary. A figure showing the proposed site layout and installation boundary has been provided in Section 2, Figures 2.2 and 2.3.

A Site Condition Report (SCR) that provides a baseline conceptual model for the site has been completed and included within *Annex G.*

The SCR identifies no historical contamination at the site with no significant pollution incidents occurring. In addition, it does not identify any aspect of the new Installation that presents a potential contamination risk to the environment.

All aspects of the new installation have been designed in accordance with the Environment Agencies Pollution Prevention Guidance and Horizontal Guidance Notes.

3.3 Infrastructure and Design

The key infrastructure and design of the site will comprise the following:

- Main processing building;
- Feedstock Reception Hall;
- Pre-treatment system incorporating shredders, NIR, overband magnets, wind shifting, eddy current separation and agglomeration and densification;
- Feed system;
- Pyrolysis Units;
- Flue Gas Treatment System;
- Pyrolysis exhaust stacks (A1a & b);
- Syngas Steam Generation Boiler (A2a & b);
- Cooling Towers;
- Oil Purification Equipment;
- Settlement and Storage Tanks;
- Nitrogen Storage Tanks;
- Emergency flare (A6);
- Gas Buffer Tank;
- Char collection and cooling system;
- CHP Engine with associated exhaust stack (A5);
- Emergency diesel generator (A7) and associated auxiliary fuel storage.

3.3.1 Site Drainage Arrangements

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

All wastewater produced by the process cooling, steam generation and gas scrubbing systems will be collected within an onsite wastewater tank and tankered offsite for disposal.

Uncontaminated clean surface water runoff captured from roof drainage and external roadways / car parking areas will be discharged to the existing surface water drainage system.

Domestic foul flows will be directed to the existing sewer network.

Pyoil produced by the process will be stored within a bunded Tank Farm, designed in accordance with CIRIA 736.

All site infrastructure (roads, surfacing, drainage systems and equipment) will be inspected on a weekly basis by the competent person. Any faults and repairs will be carried out as soon as practicable and a note made of them in the site diary.

With the exception of the Tank Farm, all activities will take place internally within the onsite building. The building provides both secondary and tertiary containment. Any spillages, leaks or incidents arising within the buildings will be effectively contained and captured within the building footprint.

The only waste water emissions from the facility relate to wastewater from the scrubbing and condensing systems which will be collected within dedicated tanks and removed from the site for treatment by third parties at a suitable licenced treatment facility.

Fire Water

The site is equipped with a sealed site drainage system that meets the requirements of the Fire Prevention Plan Guidance. The site has been designed to ensure the following in the event of a fire:

- All fire water will be contained onsite;
- The drainage system can be isolated via a penstock valve; and
- All firewater is to be pumped and tankered off site for disposal.

The processing building does not have any internal drains. In an event of a fire within the building, all firewater will be contained within the building footprint via a bunding system to stop any potentially contaminated firewater escaping.

The site is equipped with suitably sized firewater tanks. All detail relating to the firewater tanks and associated drainage systems are provided within the Fire Prevention Plan in *Annex I*.

3.3.2 Tanks and Bunds

All storage tanks will be installed with secondary containment and be designed to comply with the following standards and guidance requirements:

- Environment Agency - Pollution prevention for businesses;
- Environment Agency - Report an Environmental incident;
- CIRIA 736: Design of containment systems for the prevention of Water Pollution from Industrial sites; and
- CIRIA C598: Chemical storage tank systems – good practice.

Suitable spill kits will be readily available on site with operator training made available.

3.3.3 Roadways and External Areas

All internal roadways have been designed to give safe access to all areas of the site.

Segregated pedestrian walkways and car parking areas have been provided to allow for safe access and egress of all personnel at site.

3.4 Raw Materials

Waste Feedstocks

During Phases 1 and 2 of this project, the Installation has been designed to accept up to 120,000 tpa. By the end of Phase 2 there will be a total of 12 pyrolysis units, each with a nameplate capacity of 1.3 tonnes per hour. Allowing for maintenance and downtime and assuming 90% availability the plant will process approximately 330 tonnes per day and producing approximately 81,000 tonnes of pyoil per annum.

All feedstock will be delivered to site in pre-prepared bales. Bales will be stored internally within the main processing building.

All waste being provided to site will meet the following specification outlined in Table 3.2.

Table 3.2 Incoming Waste Feedstock Specification

Parameter	Value (%)
LDPE Film	85
PP Film	2
Multilayer Film	10
Paper & Card	0.2
Metals	0
PET Tray / Bottle	0.1
PET Film	0.2
PVC	<0.1
Glass	0
Misc Plastics	2.4

Prior to storage, all wastes accepted into the site will be subject to stringent waste acceptance criteria in accordance with the Company's Environmental Management System and associated waste pre-acceptance, acceptance and rejection procedures.

The European Waste Catalogue (EWC) codes of wastes that will be accepted by the site is provided in Table 3.3 below.

Table 3.3 Proposed Feedstock EWC Codes and Types

EWC Code	Description
02	**WASTES FROM AGRICULTURE, HORTICULTURE, AQUACULTURE, FORESTRY, HUNTING AND FISHING, FOOD PREPARATION AND PROCESSING**
02 01	**wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing**
02 01 04	waste plastics (except packaging)
12	**WASTES FROM SHAPING AND PHYSICAL AND MECHANICAL SURFACE TREATMENT OF METALS AND PLASTICS**
12 01	**wastes from shaping and physical and mechanical surface treatment of metals and plastics**

12 01 05	plastics shavings and turnings
15	**WASTE PACKAGING, ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED**
15 01	**packaging (including separately collected municipal packaging waste)**
15 01 02	plastic packaging
16	**WASTES NOT OTHERWISE SPECIFIED IN THE LIST**
16 01	**end-of-life vehicles from different means of transport (including off-road machinery) and wastes from dismantling of end-of-life vehicles and vehicle maintenance (except 13, 14, 16 06 and 16 08)**
16 01 19	Plastic
17	**CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)**
17 02	**wood, glass and plastic**
17 02 03	Plastic
19	**WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE**
19 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 3.3 above, plastic films shall not be accepted at the site which has any of the following characteristics:

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

Process Consumables / Raw Materials

All Raw Materials that will be utilised on site are provided within Table 3.4 below.

Table 3.4 Raw Materials Summary

Material	Total Quantity Stored	Use	Annual Consumption	Storage Arrangements	Fate
Feedstock (waste plastic film)	Internal storage – 3,340m^3	Used in the pyrolysis process	120,000 tonnes / 184616m^3	Internally with dedicated storage bays	Pyrolised by plant and equipment.
Sodium Hydroxide (50%)	TBC	SOx neutralisation	384tonnes	Internal dedicated tank	Waste water tank and removal offsite
Urea (32.5%)	TBC	NOx neutralisation	231 tonnes	Internal dedicated tank	Atmosphere via flue
Calcium oxide	14 tonnes	Neutralising HCl in reactors	168 tonnes	20kg bags on pallets internally	Within product
Liquid Nitrogen	TBC	Inerting process and product storages	1,333m^3	Dedicated tank	To atmosphere via flue and product storage tank vents
Hydraulic and Lubricating Oils	Minimal amounts required for commissioning	Use in plant and machinery		Stored in sealed containers	Disposal to waste oil re-processor
Diesel	1,000 litre mobile bowser 2,000 litre in generator package plant	For operation of emergency standby generator to safely shutdown plant in the event of grid failure & for mobile plant	3,000 litres	Stored in mobile bowser and within emergency generator package plant	Combusted

3.5 Description of the Process

The process has been designed to thermally treat waste plastic film through an advanced thermal treatment facility utilising pyrolysis technology. Following conversion within the pyrolysis reactor, oil vapours are condensed, the solid residues (char) discharged off site and the non-condensible syngas produced will be utilised within the pyrolysis systems and onsite boiler to produce steam. Oil vapours will be condensed into Pyoil (Grade 3 Intermediate), which will be transported offsite to an established offtaker for further refinement.

The proposed facility comprises the following stages:

- *Waste Reception* – Pre-accepted bales of plastic film will be delivered into bays within the Feedstock Reception Hall under supervision from a suitably trained operative. Wastes will typically be stored for up to one week prior to processing;
- *Pre-treatment system* – This system will include shredding, NIR, metals removal, agglomeration and densification to produce a bead which will be transferred to intermediate storage prior to use as a feedstock for the pyrolysis reactors;
- *Pyrolysis* – Each pyrolysis reactor has the capacity to process 33tpd of waste plastic, producing a yield of 60 – 75% pyrolysis oil (approximately 81,000 tpa), non-condensable combustible gas (aka syngas) and a solid waste char;
- *Oil storage* – The proposed facility will utilise 12 x oil storage tanks, typically each with the capacity of approximately 100m^3 for Pyoil storage prior to export;
- *Char storage* – char will be stored internally prior to removal offsite; and
- *Syngas Use* – The produced syngas will be utilised as fuel for the pyrolysis process under normal operation. Additionally, syngas will be utilised within an onsite boiler for steam generation for use within the heating system onsite; and
- *Electricity Generation* – The sites power requirement will be met by an onsite CHP unit, which will utilise natural gas during Phase 1, switching to syngas in Phase 2.

The above processes are discussed in further detail within this section.

A simplified process layout is provided in Figure 3.1 below. Additionally, a process flow and plant technical details are provided in *Annex B.*

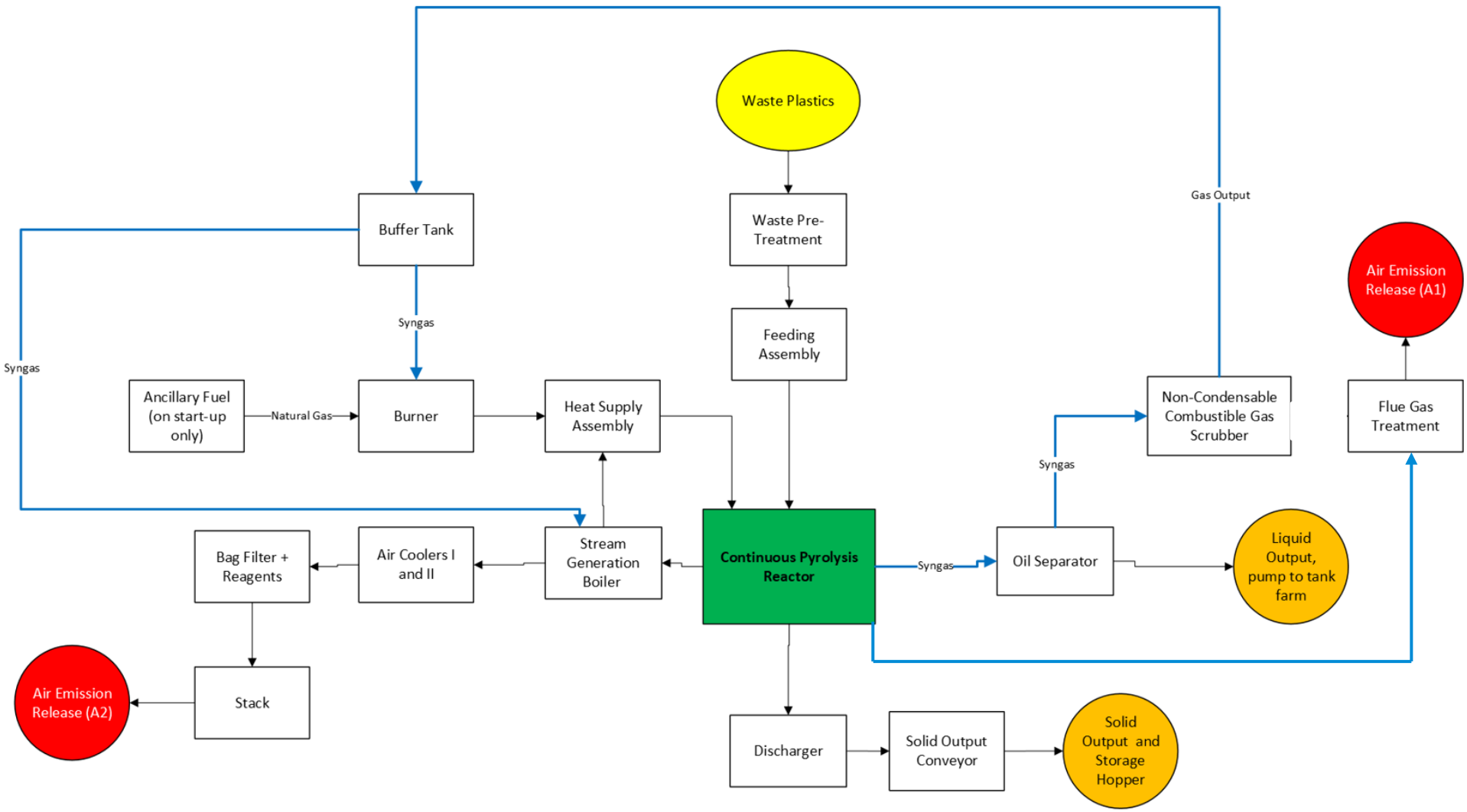

Figure 3.1 Process Flow Diagram

3.5.1 Fuel Acceptance and Reception

All incoming feedstock will be delivered to site in pre-prepared bales on curtain sided trailers. Bales will be unloaded in the Reception Hall, undergoing visual inspection and transferred to the Storage Area.

All incoming feedstock will be subjected to waste pre-acceptance and acceptance checks as well as visual site inspections. Any damaged or odorous bales will be immediately identified and prioritised for processing.

The building has fast action roller shutter doors, which remain closed at all times excepting vehicle access and egress. This ensures minimal opportunity for fugitive emissions to escape during delivery.

All waste will be stored in accordance with the site Fire Prevention Plan which is provided within *Annex I.*

The typical turnover of all incoming feedstock will be approximately 1 week. However, in the event of a plant breakdown waste may be stored for longer periods of time (no longer than 3 months).

All plastic feedstock will be utilised on a first in, first out priority system.

Feedstocks are then transferred through the pre-treatment, agglomeration and feeding systems into the pyrolysis process. Pre-treatment and agglomeration processes take place internally, segregated from the pyrolysis process area via firewalls. The feed system is within the pyrolysis process area.

3.5.2 Pretreatment

The feed Pre-treatment System will comprise of two independent pretreatment lines, allowing for continuous operation during times of routine maintenance.

Initial pre-treatment comprises shredding, to reduce the material size to a nominal 70mm x 70mm in size. Bales are fed into the shredder without debaling, as such bale straps which can be metal or polyester are incorporated into the shredded material. This is then subject to a number of contaminant removal stages including overband magnets, wind sifting and eddy current separation to remove metals and heavies and near infra-red (NIR) to remove PVC.

Contaminants are rejected directly into roll on roll off skips for removal. The remaining shredded feed is then conveyed at height to the downstream hopper prior to agglomeration.

3.5.3 Agglomeration & Feeding System

The shredded materials are then conveyed and gravity fed into the Agglomerater feed hopper where the material is compressed into pellets via a roller/die process. The pellets are of a size 10-20mm diameter, 30-50mm length.

The agglomerated plastic pellets are then blown to a pellet buffer storage bin / silo. They are then transferred into the feeding system through a firewall partition into the loading feeder and inclined conveyor. Then transferred to the respective transitional hoppers for the pyrolysis units, controlled by the pyrolysis reactor feeding and distribution device.

3.5.4 Pyrolysis

All incoming fuels are passed into the pyrolysis units and thermochemically converted to synthesis gas. The pyrolysis process provides the correct oxygen free conditions to occur to enable the production of a high purity synthesis gas, which is then condensed to produce pyrolysis oil. The pyrolysis technology is provided

by Niutech Environmental Technology Corporation -please refer to the Technical Details provided in *Annex B* for more information on the technical specifications of the units.

During normal operation, the pyrolysis process will utilise syngas produced in the process. Natural gas will be utilised only at initial start up.

The pyrolysis process works at atmospheric pressure, low temperature (<500°C) in an oxygen free environment to thermochemically convert the polymers in the raw material through the combined effects of decomposition and condensation into smaller molecular masses of gas, liquid and solid components.

The plastic pellets are continuously fed from the hopper into the pyrolysis reactor via the feeding system which comprises a transitional hopper, conveyor, feeding assembly, scatter device and screw feeder. The pellet is fed continuously into the reactor with a catalyst (de-chlorination) agent.

To prevent air entering the reactor during continuous feeding (and continuous discharge of solid outputs), dynamic sealing technology is utilised. This prevents any incurrence or escape of gaseous outputs from the reactor and ensures a safe, stable and continuous reaction inside the pyrolysis unit.

Residence time within the reactors is 1 second/1000°C.

Pyrolysis of plastics within the unit produces syngas and char. The syngas is then either directed to the oil production line, the Steam Generation Boiler or directly recirculated as fuel into the pyrolysis process.

Char produced within the reactors is successively cooled and transported to a discharge point from which is it transferred to a hopper for temporary storage pending export.

3.5.5 Oil Production

Oil separation and cooling occurs in a dedicated part of the main building and in essence is the process of condensation of the syngas. The system comprises a pre-cooler, heavy oil transfer pump, front oil separating and cooling assembly, back oil separating and cooling assembly, front oil transfer pump and back oil transfer pump.

Following cooling and separation of the syngas produced from the front cap of the continuous pyrolysis reactor, the liquid oil enters the liquid gathering tank at the bottom of the front oil separating and cooling assembly, from which it is transported to the tank farm for storage. The non-condensable combustible gas (NCG) is then directed to the NCG scrubber before being recirculated through the pyrolysis process, sent to the steam generation boiler or emitted via the flue gas treatment system.

Syngas from the back cap of the continuous pyrolysis reactor, passes the precooler and is cooled to 380°C. Condensed heavy oil fractions are pumped back to the reactors for secondary pyrolysis, while the uncondensed syngas enters the back oil separating and cooling assembly for condensation and separation. It is then transported to the tank farm with non-condensable combustible gas entering the NCG scrubbing system.

The process utilised anti-polymerisation which is key to long term stable and continuous operation of the process. The olefin-based small molecule organics produced during pyrolysis are prone to polymerisation, generating large molecule chain substances such as gums and asphaltenes, which can easily cause blockage of equipment and pipelines. The Endolys process uses gas-liquid mixing according to the different boiling points of the syngas output to rapidly reduce the syngas temperature to the design temperature, realising the quick separation of the gas-liquid output, hereby reducing the opportunity for the polymerisation

reaction to occur. Ultimately improving the oil yield and ensuring the long-term stable operation of the pyrolysis production line.

The specification of the final oil product is provided in the table below.

Table 3.5 Pyrolysis Oil Specification

Parameter	Maximum Limit	Unit
Final Boiling Point	550	°C
Nitrogen	750	Ppm
Oxygen	0.2	W%
Total oxygenates	750	ppm
Sulphur	750	ppm
Total Metals including silicon	50	ppm
Mercury	5	ppm
Total chlorides	100	ppm
Total bromide	5	ppm
Total fluoride	10	ppm
Pour point	18	°C
Appearance	Free from suspended matter	-
Free water or water in emulsion	NIL	-
Dissolved water content	750	ppm
Sediment & water	750	ppm

3.5.6 Non-Condensable Combustible Gas Scrubber

Non-condensable combustible gases (NCG) from the oil separation phases, are directed through the NCG scrubber, liquid removal tank and water seal tank under a pressure control device, prior to storage in a buffer tank. From the buffer tank the NCG is pressurised and stabilised and sent to the burner for use as fuel in the pyrolysis heat supply system.

The scrubber is a caustic spray design utilising 8 – 10% NaOH, with removal efficiencies of >99% for HCl & SO_2.

The NCG scrubber utilises NaOH solution to absorb acidic contaminants such as sulphide and chlorides.

3.5.7 Flue Gas Treatment System

The proposed flue gas treatment system comprises of a number of stages as follows:

- *Air cooler*
- *SCR*
- *Water Spray Cooler*
- *NaOH Scrubber*
- *Wet Electrostatic Precipitator (WESP).*

Emissions to atmosphere from the flue gas treatment line are then emitted through the 25m high stack (A1).

The wet scrubbing system utilises 8-10% NAOH and has removal efficiencies of >99% for HCl and SO_2.

Niutech have provided details of the flue gas composition from their reference plant in China operating on similar feedstocks. The reference facility utilises waste plastics (mainly shredded PP and PE plastic) and is technically identical in scale and operation.

The results demonstrate that the relevant BREF BAT-AELs are achievable and are provided in *Annex B*.

3.5.8 Steam Generation

Excess syngas is combusted within the sites steam generation boiler for the production of steam required by the process.

The boiler will be of fire tube design with an efficiency of approximately 80%. The maximum thermal input will be 8MWth with a boiler rating of 8.8MWth. The output will be 6.4MWth per phase.

Flue gas treatment for the boiler comprises a bag filter with reagent injection including sodium bicarbonate and activated carbon. Emissions to atmosphere are then via the 25m high stack (A2).

3.5.9 Heat Recovery

Heat will be recovered as far as possible by the system. High temperature flue gas produced by the heat supply assembly is mixed with recycled flue gas to provide the heat required for the pyrolysis of materials, while reducing fuel consumption and decreasing flue gas emissions.

The efficiency of the combustion system is 57.4%.

3.5.10 Electrical Generation

Power required by the plant will be generated onsite via the 4MWth CHP engine (emission point A5). During Phase 1 this will be operated utilising Natural Gas as a fuel and as such will be subject to the requirements of the Medium Combustion Plant Directive (MCPD).

It is proposed that during Phase 2, when the syngas production is stable and continuous, the fuel source for the CHP will be switched to syngas.

It is acknowledged that unless End of Waste status for the syngas has been achieved, emissions from the combustion of syngas activities will be in accordance with Chapter IV of the Industrial Emissions Directive (IED).

Additionally, an emergency diesel generator (thermal input 1.2MWth) is included in the site design for use in the unlikely failure of power from the CHP units. This will be subject to the requirements of the Medium Combustion Plant Directive (MCPD) as both an MCP and Specified generator.

An energy mass balance is provided within *Annex B.*

Char Production

The temperature zone within the pyrolysis retort is sufficiently elevated and oxygen free to ensure that all material is fully converted to elemental carbon and ash. Char is subsequently extracted from the process by a cooled scroll units and stored within a dedicated external sealed container.

The char material is a very high-grade carbonaceous material which has a potential commercial value. The biomass content of the feedstock determines the composition of the char materials.

Analysis of the char material from the Niutech reference plant in China operating on similar feedstocks (mainly shredded PP and PE plastic) has identified the below typical char composition.

Table 3.6 Niutech Reference Data – Char

Parameter	Unit	Typical Value
Carbon	% m/m	37.5
Hydrogen	% m/m	2.2
Oxygen	% m/m	30.4
Aluminium	% m/m	1.23
Barium	% m/m	0.12
Calcium	% m/m	13.22
Chromium	% m/m	0.07
Copper	% m/m	0.02
Iron	% m/m	2.33
Potassium	% m/m	0.34
Magnesium	% m/m	0.53
Manganese	% m/m	0.03
Molybdenum	% m/m	0.01
Sodium	% m/m	1.54
Nickel	% m/m	0.03
Phosphorous	% m/m	0.16
Silicon	% m/m	6.51
Strontium	% m/m	0.02
Titanium	% m/m	2.63

The char produced by the process will be exported as a waste product, likely for use as a low carbon fuels in cement kilns.

Gas Flare

In order to comply with Gas Safety Regulations the site will be fitted with an emergency flare which will only be used in emergency scenarios and / or abnormal operating conditions. The flare is a low level, sealed unit that will combust the gas in a combustion chamber in the event of a controlled shutdown.

All of the gas that is produced by the plant will be continuously monitored by an OFGEM approved Gas Chromatograph which will monitor gas composition, temperature etc.

In the event that the plant has to undergo an emergency shutdown, any gas within the system will be directed to the emergency flare systems. The flare systems have been designed to ensure complete thermal destruction of the gas.

The flare will only be used during abnormal and emergency situations.

Plant Process Control Parameters

There are a number of key controls associated with the retort and associated ancillary plant. The entire system will be controlled using a digital control system (DCS) linked to a SCADA. All aspects of the pyrolysis plant and ancillary equipment have been subject to a detailed HAZOP study, with the overall process designed to fail safe.

Some applicable control parameters are provided below:

- *Temperature Control:* The temperature of the retort is controlled within a narrow temperature band through the use of thermocouple banks that are linked back to the control system and interlocked to shut the combustion system down if the plant falls outside of the setpoint range. The retort is controlled so that the syngas remains at approximately 500^{o}C and the thermal cracker operated at approximately 1250^{o}C.
- *Combustion Control:* The burner control systems are operated through the continuous monitoring of the O_2, CO and NOx concentrations in the exhaust to ensure that efficient combustion is achieved at all times. The retort burners are initially fed with natural gas until such a time that the burners are ready to switch to synthesis gas.
- *Auger Rotational Speed:* The rotational speed of the Inlet and Outlet Auger is controlled using variable speed drive. The system is interlocked so it cannot introduce feedstock unless the pyrolysis plant (and other critical systems) are at their set points.
- *Retort Rotational Speed:* Continuously monitored and varied dependant on the gas pressure and volume generated.
- *Retort Pressure:* The retort is designed to operate at a slight negative pressure and monitored continuously.
- *Gas scrubbing and Cooling:* All water systems associated with the gas quenching and scrubbing systems are continuously monitored for water flow rate, temperature and pressure. The gas scrubbing systems are also monitored for pH.
- *Water Cooling:* All cooling plant is continuously monitored for water level, temperature, pump operation and flow rate.

The system monitors its status independently and checks all measured values and messages to ensure continued operation within the relevant limits and ranges. Any deviations cause the implementation of safety measures (such as power reduction or shut down) and transmits a message to a higher-level control system.

The instrumentation and control components, including all safety related sensors and actuators are supplied by an uninterruptible power supply, ensuring controlled shutdown of the digital control system and continued recording of measured values in the unlikely event of a power failure at the site.

The plant has been fully designed to the appropriate DSEAR and ATEX standards.

The Niutech technology has undergone extensive safety assessment through the HAZID and HAZOP processes and the plant designed to operate safely under all normal, abnormal and emergency conditions.

All key plant and ancillaries have been designed with adequate resilience, redundancy and safety features. The plant has been designed to shut down safely in all instances and has both auxiliary power and fuel supplies to ensure that the plant can be safely shut down without any risk to the environment.

3.6 Controls and Environmental Management System

The site shall be operated in accordance with corporate standards and procedures as part of an Environmental Management System (EMS). The system will be designed to meet the requirements of ISO 14001:2015.

All assets owned and operated by Endolys will be operated in accordance with a suite of procedures, policies and controls. All aspects of the site operations will be managed in accordance with the management system through a lifecycle approach, e.g. pre-acceptance, acceptance, rejection procedures.

The EMS will be structed to meet the requirements of the Environmental Permitting Regulations and associated pollution prevention guidance. The EMS will be designed to ensure:

- The identification of all foreseeable environmental impacts and risks that the operators 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 an annual external audit by a competent third party; and
- The keys 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 when the permit is issued and a copy of the EMS will be kept at a convenient location on site.

3.7 Operator Competence

All personnel, irrespective of discipline will be trained in necessary sections of Endolys' operational procedures and management plans.

The site will employ a technically competent manager (TCM) holding the relevant qualifications i.e. Level 4 WAMITAB. They will be employed prior to plant operations.

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

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. The operator will maintain written operation instructions for all plant and monitoring equipment present on site.

Operational Times

The site will be operational 24/7 with deliveries and collections of waste limited to daylight hours.

3.8 Site Security

The site will be secured by a 2.4m high steel paladin type fence and gates. All visitors will be required to sign in for admission to the site.

The site will be manned 24/7.

The site will be fully covered by CCTV and the building will be protected with a burglar alarm. Motion detection security lighting will be in operation at the site.

3.9 Site Inspections and Maintenance

The site will be subject to a regular inspection and maintenance program to ensure the integrity of the site infrastructure remains high in order to prevent pollution to the environment. Site inspections will aim to detect signs of degradation, damage or erosion of any of the site features, including (but not limited to) hardstanding, drainage systems, fencing, tanks and bunds.

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 is carried out to prevent any catastrophic breakdown.

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, abatement plant etc.) or the prevention of local nuisance impacts is maintained and kept in good operating condition.

3.10 Accidents and Emergencies

The site has developed and implemented an Accident Management Plan (AMP) based around the specific risks associated with the site operations.

The key aspects of the sites AMP 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;
  - Spillages and uncontrolled release;
  - Plant or equipment failure;
  - Vandalism; and
  - Flooding.
- Identifies events or failures that could damage the environment;
- Assesses the likelihood and the potential environmental consequences from accidents at the site; and
- Proposes actions to minimise the potential causes and consequences of accidents.

In the event of an accident, the EA will immediately be notified and informed of the necessary measures implemented to minimise environmental impact of the accident and measures to prevent further possible accidents.

The sites AMP is included in *Annex K.*

Incident Reporting

The reporting of incidents and non-conformities will form a key component of the companies EMS. 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.

Furthermore, the site's EMS 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.

4. EMISSIONS AND THEIR ABATEMENT

4.1 Emissions to Air

Emissions to atmosphere from the plant are via eight main emission points:

- Continuous Emission Points
  - Pyrolysis plant flue stack – 25m height (A1a &A1b – dual flue);
  - Steam Generation Gas boiler flue stack – 25 m height (A2a & A2b – dual flue);
  - Building Extraction System Stack 15m height (A3);
  - CHP Engine stack - 15m height(A5);
- Intermittent / Abnormal Emission Points
  - Emergency flare – 11m high stack (A6); and
  - Emergency Generator 13m high stack (A7).

Additional fugitive emission points to atmosphere are from the following locations:

- Vent 1 (A9): Overpressure release valve for pyrolysis reactors. This would occur rarely in abnormal overpressure situations. Estimated release would be approximately 1,800kg over 2 hours.
- Vent 2 (A8): Oil collection tank breather valve. This emission is estimated to release approximately 100kg per year and is a fugitive emission during normal operation;
- Vent 3 (A10) : Maintenance vent from three tanks during nitrogen purge of syngas within the tank. This release would only occur during maintenance activities and is estimated at 38m^3 per tank;
- Vent 4 (A11): Nitrogen purge vent; and
- Vent 5: Oil Storage tank breather valve (as with Vent 2).

Please refer to the emission point plan provided in *Annex A.*

All emissions from the syngas combustion activities will be in accordance with Chapter IV of the Industrial Emissions Directive (IED) or applicable Waste Incineration BREF BAT-AEL's until such time that EoW is achieved and whereby Article 42 (1) will apply. These are outlined in Table 4.1 below.

Table 4.1 IED Emission Limits / Waste Incineration BREF BAT-AELs – All Syngas Combustion Units

Pollutant	ELV (Referenced to 11% O_2) (mg/Nm^3)
Daily Average	
Total dust	2 – 5*
Total organic carbon (TOC)	<3 – 10*
Hydrogen chloride (HCl)	<2 – 6*
Hydrogen fluoride (HF)	<1*

Sulphur dioxide (SO_2)	5 - 30*
Oxides of nitrogen (NOx)	120*
Carbon monoxide (CO)	50*
Ammonia (NH_3)	2- 10*
Half-Hourly Average	
Total dust	30
Total organic carbon (TOC)	20
Hydrogen chloride (HCl)	60
Hydrogen fluoride (HF)	4
Sulphur dioxide (SO_2)	200
Oxides of nitrogen (NOx)	400
Carbon monoxide (CO)	100
Average over a sample period between 30-Minutes and 8-Hours	
Group 1 metals (a)	0.02*
Group 2 metals (b)	0.05
Group 3 metals (c)	0.3*
Average over a sample period between 6-Hours and 8-Hours	
Dioxins and furans (d)	0.04*

(a) Cadmium (Cd) and Thallium (Tl)

(b) Mercury (Hg)

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

(d) I-TEQ

* Values with a (*) are the more stringent BAT-AELs outlined within the Waste Incineration BREF BAT Conclusions

Emissions from the CHP unit when operated on natural gas during Phase 1 will be in accordance with the Medium Combustion Plant Directive 2015. ELVS are set out in Annex II Part 2 Table 2 of the MCPD as summarised in Table 4.2 below.

Table 4.2 MCPD Annex II Part 2 Table 2 New MCPD ELV's

Pollutant	Type of MCP	Gas Oil	Liquid fuels other than gas oil	Natural Gas	Gaseous fuels other than natural gas
SO_2	Engines & gas turbines	-	120	-	15
NOx	Engines	190	190	95	190
	Gas Turbines	75	75	50	75
Dust	Engines & gas turbines	-	10	-	-

Note: ELV's are defined at a temperature of 273,15 K, a pressure of 101,3 kPa and after correction for the water vapour content of the waste gases and at a standardised O2 content of 6 % for medium combustion plants using solid fuels, 3 %

for medium combustion plants, other than engines and gas turbines, using liquid and gaseous fuels and 15 % for engines and gas turbines

Stack emission parameters for the main emissions are shown in the tables below.

Table 4.3 Stack Emission Parameters – Pyrolysis Heating (Emissions A1a and A1b)

Parameter	Pyrolysis Heating (Emissions A1a and A1b) – Per Unit	
Stack height (m)	25	
Flue exit diameter (m)	0.8	
Temperature of release (ºC)	50	
Moisture content (%v/v)	5 to 13% (a)	
Oxygen content (%v/v dry)	10 to 15% (b)	
Actual flow rate (Am^3/s)	5.14	
Normalised flow rate (Nm^3/s) (c)	4.34	
Emission velocity at flue exit (m/s)	10.2	
Operational hours (h/a)	7,200	
Emissions	**Emission Concentration (mg/Nm^3) (c)**	**Emission Rate (g/s)**
PM_{10}	5	0.0227
TOC	10	0.0454
HCl	6	0.0272
HF	1	0.00454
CO	50	0.227
SO_2	30	0.136
NOx	120	0.545
NH_3	10	0.0454
Group I (Cd, Tl)	0.02	9.1×10^{-5}
Group II (Hg)	0.02	9.1×10^{-5}
Group III (Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V)	0.3	1.4×10^{-3}
Dioxins and Furans	0.06 ng/Nm^3	2.7×10^{-10}
PAHs (as B[a]P)	9×10^{-5}	4.1×10^{-7}
PCBs	3.6×10^{-9}	1.6×10^{-11}

(a) 5% assumed as a worst-case
(b) 10% assumed as a worst-case
(c) Normalised to 273K, 1 atmosphere, dry and 11% O_2

Table 4.4 Stack Emission Parameters – Boilers for Excess Syngas (Emissions A2a and A2b)

Parameter	Boilers (Emissions A2a and A2b) – Per Unit

Stack height (m)	25	
Flue exit diameter (m)	0.81	
Temperature of release (°C)	180	
Moisture content (%v/v)	5%	
Oxygen content (%v/v dry)	13%	
Actual flow rate (Am^3/s)	7.76	
Normalised flow rate (Nm^3/s) (a)	3.55	
Emission velocity at flue exit (m/s)	10.2	
Operational hours (h/a)	7,200	
Emissions	**Emission Concentration (mg/Nm^3) (a)**	**Emission Rate (g/s)**
PM_{10}	5	0.0177
TOC	10	0.0355
HCl	6	0.0213
HF	1	0.00355
CO	50	0.177
SO_2	30	0.107
NOx	120	0.426
NH_3	10	0.0355
Group I (Cd, Tl)	0.02	7.1×10^{-5}
Group II (Hg)	0.02	7.1×10^{-5}
Group III (Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V)	0.3	1.1×10^{-3}
Dioxins and Furans	0.06 ng/Nm^3	2.1×10^{-10}
PAHs (as B[a]P)	9×10^{-5}	3.2×10^{-7}
PCBs	3.6×10^{-9}	1.3×10^{-11}

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

Table 4.5 Stack Emission Parameters – Ventilation (Emissions A3a and A3b)

Parameter	Ventilation (Emissions A3a and A3b) – Per Unit
Stack height (m)	15
Flue exit diameter (m)	1.51
Temperature of release (°C)	15
Actual flow rate (Am^3/s)	26.9
Normalised flow rate (Nm^3/s) (a)	25.5
Emission velocity at flue exit (m/s)	15.0
Operational hours (h/a)	
Dust (mg/Nm^3)	10 (a)
Dust (g/s)	0.255

(a) Normalised to 273K

Table 4.6 Stack Emission Parameters – Natural Gas Engine (Emission A5)

Parameter	Natural Gas Engine (Emission A5)
Stack height (m)	15
Flue exit diameter (m)	0.4
Temperature of release (°C)	120
Moisture content (%v/v)	10.76
Oxygen content (%v/v dry)	9.98
Actual flow rate (Am^3/s)	2.99
Normalised flow rate (Nm^3/s) (a)	3.43
Emission velocity at flue exit (m/s)	23.8
Operational hours (h/a)	7,500
NOx (mg/Nm^3) (a)	95
NOx (g/s)	0.326
CO (mg/Nm^3) (a)	400
CO (g/s)	1.37

(a) Normalised to 273K, 1 atmosphere, dry and 15% O_2

Table 4.7 Stack Emission Parameters – Flare (Emissions A6a and A6b)

Parameter	Flare (Emission A6a and A6b) – Per Unit		
	Scenario 1	Scenario 2	Scenario 3
Stack height (m)	11	11	11
Flue exit diameter (m)	2.45	2.45	2.45
Temperature of release (°C)	800	800	800
Moisture content (%v/v)	10	10	10
Oxygen content (%v/v dry)	8	8	8
Actual flow rate (Am^3/s)	32.8	14.4	6.1
Normalised flow rate (Nm^3/s) (a)	5.41	2.38	1.01
Emission velocity at flue exit (m/s)	6.95	3.06	1.30
Operational hours (h/a)	6	24	876
NOx (mg/Nm^3) (a)	150		
NOx (g/s) - long-term	0.0167 (b)		
Nox (g/s) - short-term	0.811		
CO (mg/Nm^3) (a)	400		
CO (g/s)	0.270		
VOCs (mg/Nm^3) (a)	10		

VOCs (g/s) - long-term	0.011 (b)
VOCs (g/s) - short-term (g/s)	0.054

(a) Normalised to 273K, 1 atmosphere, dry and 3% O_2

(b) Combined emissions for Scenario 1 for 6 hours, Scenario 2 for 24 hours and Scenario 3 for 876 hours

Table 4.8 Stack Emission Parameters – Emergency Diesel Generator (Emission A7)

Parameter	Emergency Diesel Generator (Emission A7)
Stack height (m)	13
Flue exit diameter (m)	0.25
Temperature of release (°C)	441
Moisture content (%v/v)	0
Oxygen content (%v/v dry)	11.0
Actual flow rate (Am^3/s)	1.69
Normalised flow rate (Nm^3/s) (a)	0.40
Emission velocity at flue exit (m/s)	34.5
Operational hours (h/a)	50
NOx (mg/Nm^3) (a)	2,000
NOx (g/s) - short-term	0.805
NOx (g/s) - long-term	0.00460
CO (mg/Nm^3) (a)	1,000
CO (g/s)	0.403

(a) Normalised to 273K, 1 atmosphere and 5% O_2 (not corrected for moisture)

Detailed dispersion modelling in accordance with the EA H1 methodology has been undertaken to determine the potential air quality and human health impacts associated with the proposed facility. All reports and modelling files associated with the assessment have been included in *Annex D and Annex E*.

4.2 Emissions to Controlled Waters

Uncontaminated clean surface water runoff captured from roof drainage and external roadways / car parking areas will be discharged to the existing surface water drainage system.

With the exception of small volumes of wastewater emissions from the scrubbing and condensing systems, there are no process releases from the process. All process effluents will be contained within a bunded storage vessel and the waste water removed from site by a third-party contractor for offsite disposal.

Under the requirements of the Environmental Permitting Regulations, all storage, processing areas and tanks will be equipped with pollution prevention measures (secondary containment, bunded compounds, controlled storage etc) to ensure that there is no potential for surface water runoff to be contaminated.

There are no releases or discharge points to controlled water from any aspect of the process.

The site surface water drainage system will be protected at all times to ensure that no pollution can be allowed to enter.

4.3 Emissions to Sewer

There are no proposed emissions to sewer, other than domestic foul which will be discharged under consent from Northumbrian Water.

4.4 Emissions to Land

There are no emissions to land arising as a result of the installation.

All operational and storage areas on site are surfaced with impermeable concrete hardstanding.

4.5 Fugitive Emissions

There is a very limited potential for fugitive emission of dust to arise from the storage and handling of the proposed feedstock. All waste feedstocks are unloaded and stored within the enclosed building under negative pressure. There is no external storage or handling of feedstock.

The only external activities on site relate to the Flue Gas Treatment System, Cooling Towers, Waste water Tanks, Oil Storage Tank Farm, Steam Generation Boilers and CHP unit. None of these activities are inherently dusty or odorous, with little potential for fugitive emissions.

Potential fugitive emissions of VOCs from the oil storage tanks are mitigated through use of carbon filters on tank breather vents.

Handling of char is proposed to be undertaken internally ensuring no potential for fugitive emissions from the storage and export of char products.

Additionally, all aspects of the plant are located upon impermeable concrete hardstanding with all tanks within bunds. As such there is no risk to ground, groundwater or surface water in the unlikely event of any spillage.

4.5.1 Odour

Due to the design of the building structure and the fully enclosed processing activities, there is very little potential for offsite odour emissions and impacts to arise from the site. Furthermore, all wastes accepted on site are required to be pre-processed and in accordance with an agreed specification. All waste accepted on site is inspected on arrival to ensure compliance and that it does not have any malodourous properties.

The delivery and reception of waste will not produce any odour emissions.

The pyrolysis process itself has no significant potential for odours as the combustion system thermally oxidises any odorous compounds. Any potentially odorous emissions arising for the storage and processing of wastes within the building are contained within the building.

It is acknowledged that there may be potential for distinctive and characteristic odours arising from the benzene, toluene, ethylbenzene and xylene (BTEX) compounds formed from the condensing of syngas to form pyrolysis oil and its subsequent storage.

Oil purification activities will be undertaken internally, storage of oil is within the external tank farm. The site will implement a number of control measures to manage and minimise any impacts to nearby sensitive receptors. The nearest sensitive receptors are the Premier Inn approximately 130m north of the site.

Although there is very little potential for odour emissions from site due to the control measures, an Odour Management Plan has been produced as part of the sites Environmental Management System. Please refer to *Annex J* for more information.

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

4.5.2 Noise

The design of the installation has taken into account the potential noise impacts on the environment and neighbouring receptors. The site is not located in an area considered to be sensitive to noise.

The processing plant and associated equipment has been designed in accordance with best practice and to ensure that 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 any sensitive receptors.

All noise emissions from the plant are controlled to ensure that they will not create noise nuisance of disturbance. The plant will incorporate a number of noise control measures, such as noise enclosures and stack exhaust attenuators to ensure that all impacts are mitigated.

An Environmental Noise Impact Assessment in accordance with BS 4142:2014+A1:2019 has been undertaken to assess any impacts potentially arising from the facility. The report concludes that the site will have an insignificant impact at nearby receptors with the proposed control measures put in place.

Please refer to *Annex F* for more information.

4.6 Waste / By-Product Generation and Management

Types and Amount of Waste / By-Product

The pyrolysis to oil facility will not inherently produce significant quantities of waste.

The main wastes / by-products produced from the operation of the facility will be:

- Aqueous Effluent; and
- Carbonaceous (bio)char.

Table 4.4 below shows a tabular summary of site wastes.

Table 4.9 Waste / By-Product Summary

Waste / Product	EWC Code	Approx. Quant (tonnes)	Source	R / D Code	Environmental Fate
Aqueous Effluent	19 01 06*	6,270m^3 pa	Gas cleaning and scrubbing	D9 (offsite treatment)	Tankered off site for treatment

Pyrolysis Oil	N/A	84,000 tpa	Converted from waste plastic feedstock	N/A	Product
Char	N/A	12,000 tpa	Converted from waste plastic feedstock	N/A	Product
Ferrous Metal	19 12 02	462 tpa	Shredder (metal wrapping from bales)	R4	Recycled
Aluminium	19 12 03	9 tpa	Shredder	R4	Recycled
General Waste	19 12 12	625 tpa	Shredder	R1	Incineration
WEEE	20 01 36	1 tpa	Business	R5	Recycled

These will be removed from site when required and transferred to an appropriately licensed disposal/recovery facility.

The high carbon biochar has a number of uses in industry. Endolys is currently reviewing the possibility for disposal through sustainable routes by achieving end-of-waste status, however in the meantime the likely end users will be either the construction sector or cement kilns. Until an 'End of Waste' position is achieved, all char will be disposed of as a controlled waste.

5. ENVIRONMENTAL MONITORING

5.1 Emissions to Air

The main emissions from site, as identified in Section 4.1, arise from the pyrolysis flue gas treatment system and steam generation boiler (Emission Point A1 and A2).

The pyrolysis stacks (A1a & A1b) and steam generation boiler (A2) will be fitted with a full MCERTS Continuous Emissions Monitoring System which meets the requirements of BS EN 15259 Air quality – Measurement of Stationary Source Emissions and Environment Agency Technical Guidance Note M2. Any other combustion units utilising syngas (i.e. the CHP unit in Phase 2) will also be fitted with CEMS if the syngas has not yet achieved End of Waste status upon point of it being commissioned.

The CEMS will be IED complaint and monitor HCl, NOx, NH_3, O_2, SO_2, VOC, particulates, H_2O, temperature, pressure and flow.

TOC will be analysed by a Flame Ionisation Detector.

HF will be calculated through the measurement of HCl as a surrogate.

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.

The primary purpose of the CEMS equipment is to provide a 'policeman' to permanently monitor the gas combustion products and to provide feedback to the pyrolysis control system and to ensure that the process remains within its operational control parameters at all times. Given that all combusted synthesis gas is produced by the same sources, monitoring is only required in one single location.

Procedures will be created for monitoring undertaken at the site. These procedures will conform to M1 and M2 guidance and those required by the operator monitoring and assessment scheme and are incorporated into the sites EMS system.

The CEMS will be used such that:

- 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 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.

For all emissions from the CHP unit when operated on natural gas, Endolys will carry out periodic sampling of nitrogen oxide (NOx), and carbon monoxide (CO) in accordance with the Medium Combustion Plant Directive.

All flare usage will be quantified and monitored in accordance with the guidance.

All sampling equipment and associated platforms and sampling ports installed on site meet the requirements of the Environment Agency Technical Guidance Notes M1 and M2 and will be MCERTS approved.

Table 5.1 Monitoring Frequency

Emission Point	Parameter	Monitoring Frequency	Methodology
A1a/b & A2a/b	• Oxides of nitrogen (NO and NO_2 expressed as NO_2) • Nitrous oxide (N_2O) • Particulate Matter • Hydrogen Chloride • Carbon Monoxide • Sulphur Dioxide • Ammonia • Total Organic Carbon	Continuous daily average and ½ hour average for all parameters	MCERTS certified CEMS equipment
A1a/b & A2a/b	• Cadmium and thallium and their compounds (total) • Mercury and its compounds • Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds (total) • Hydrogen Fluoride • Dioxin / Furans • Dioxin like PCB's • Specific Individual PAH's	Quarterly	EA Monitoring Guidance M1/M2 compliant extractive sampling
A5	• Oxides of nitrogen (NO and NO_2 expressed as NO_2); • Carbon Monoxide	Periodically	Medium Combustion Plant Directive.

5.2 Emissions to Controlled Waters

There will be no direct process emissions to controlled waters arising from the installation.

Therefore, no monitoring is required.

5.3 Emissions to Sewer

There will be no emissions to sewer other than domestic, therefore no monitoring is required.

5.4 Emissions to Land

There are no process emissions to land arising from the facility, therefore no monitoring is required.

6. BEST AVAILABLE TECHNIQUES AND APPROPRIATE MEASURES APPRAISAL

A review of the Environment Agency (EA) Appropriate Measures Guidance and Best Available Techniques (BAT) requirements has been undertaken and the proposed installation does not directly align with any of the EA Guidance / BREF guidance documents.

A review has been conducted against the Non Hazardous and Inert Waste: Appropriate Measures for Permitted Facility guidance due to seeming the most appropriate. This review is provided in Table 6.1. A review has also been completed against the relevant BAT conclusions in the Waste Incineration BREF as requested by the enhanced pre-application advice, however it is important to note that the process is not considered incineration, and the majority of the conclusions are not applicable. This is provided in Table 6.2.

Table 6.3 also provides a review against the applicable sections of the Refining of Mineral Oil and Gas BREF, as requested during enhanced pre-application advice.

Table 6.1 Non-Hazardous and Inert Waste: Appropriate Measures for Permitted Facilities

Appropriate measures reference	Appropriate measures	Justification
1. When appropriate measures apply		
1.1 Who this guidance is for	This guidance applies to permitted waste management facilities – full details provided within the appropriate measures guidance.	The proposed installation does not directly align with any of the published EA guidance/ BREF guidance documents and therefore this guidance has been adopted as most appropriate.
1.2 Assessing appropriate measures for your site	-	-
1.3 Implementing appropriate measures at new and existing facilities	-	-
1.4 Site design and suitability	Consideration to the potential impacts of climate change when selecting a site, especially flood risk, drought, extreme temperature and extreme weather events.	The application and proposed operations on site have considered the potential impacts of climate change. An Environmental and Climate Change Risk Assessment has been conducted to identify, mitigate and assess the risks posed to the facility from climate change, as well as the risk the facility could pose to the environment and human health. The Environmental and Climate Change Risk Assessment is included in *Annex C – Environmental and Climate Change Risk Assessment*.
2. General Management Appropriate Measures		

2.1 Management System	You must have an up to date written management system, and activities at your facility must follow it. Your management system must incorporate the features detailed within the appropriate measures guidance.	The site shall be operated in accordance with corporate standards and procedures as part of an Environmental Management System (EMS). The system will be designed to meet the requirements of ISO 14001:2015. Section 3.5 above details the aspects of the EMS on site.
2.2 Staff Competence	Staff competence in accordance with the aspects detailed within the appropriate measures guidance.	This condition has been met. All personnel working at the facility will be trained and overseen by the technology developer and manufacturing team. All personnel, irrespective of discipline will be trained in necessary sections of Endolys' operational procedures and management plans. All staff working for and on behalf of the site will be suitably trained and competent (e.g. professional maintenance engineers, electricians, equipment operators etc). All personnel working on site will be trained in the necessary sections of the EMS and associated procedures. 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. The operator will maintain written operation instructions for all plant and monitoring equipment present on site.
2.3 Accident Management Plan	As part of your written management system you must have a plan for dealing with incidents or accidents that could results in pollution, including near misses. The accident management plan must identify and assess the risks the facility poses to human health and the environment. Particular areas to consider are detailed within the appropriate measures guidance.	This condition has been met. Endolys operate in accordance with an Accident Management Plan (AMP) which is included in *Annex L - Accident Management Plan.* Section 3.8 above details the key aspects of the AMP and overview of incident reporting.
2.4 Contingency Plan and Procedures	Implement a contingency plan in accordance with the appropriate measures guidance.	This condition will be met. Endolys will implement a contingency plan with associated procedures in accordance with the appropriate measures guidance.
2.5 Facility Decommissioning		This condition will be met. Facility decommissioning will be implemented within the company's EMS.
3. Waste pre-acceptance, acceptance and tracking		
3.1 Waste pre-acceptance	Implement waste pre-acceptance procedures in accordance with the appropriate measures guidance.	This condition has been met. Prior to processing, all wastes accepted on site will be subjected to stringent waste pre-acceptance and acceptance criteria in accordance with the sites EMS and associated waste procedures.

3.2 Waste acceptance	Implement waste acceptance procedures in accordance with the appropriate measures guidance.	This condition has been met. Prior to processing, all wastes accepted on site will be subjected to stringent waste pre-acceptance and acceptance criteria in accordance with the sites EMS and associated waste procedures.
3.3 Quarantine	Quarantine requirements in accordance with the aspects detailed within the appropriate measures guidance.	This condition has been met. The site will benefit from a quarantine area. The quarantine area is in accordance with the Fire Prevention Plan requirements for site.
3.4 Waste tracking	Waste tracking in accordance with the appropriate measures guidance.	This condition has been met. All waste entering and leaving the site will be tracked in accordance with the sites EMS and associated waste procedures.
4. Waste Storage		
Waste storage	Appropriate measures for waste storage at a regulated facility permitted to store, treat or transfer (or both) non-hazardous and inert waste. Waste storage in line with the requirements detailed within the appropriate measures guidance.	This condition has been met. Incoming waste will be accepted on site in baled form and unloaded and stored internally within the Reception Hall & Storage Area. The storage of waste plastic film will be carried out in line with the appropriate measures requirements.
4.1 Segregation	Different types of waste should be segregated if contamination would inhibit the recovery of waste.	This condition has been met. The site will only accept pre-processed non-hazardous waste in baled form and unloaded and stored internally within the main processing building. Waste feedstock is homogeneous in nature. There is no risk of contamination.
5. Waste treatment		
Waste treatment	Waste treatment in accordance with the requirements detailed within the appropriate measures guidance.	This condition has been met. Prior to arriving on site all incoming waste will undergo waste pre-acceptance and acceptance checks and rejection procedures if required. Waste treatment will be conducted in accordance with the sites EMS and associated operating procedures which will detail waste treatment activities, processes and abatement and control equipment.
5.1 Soils and inert waste	N/A	N/A
5.2 Waste treatment outputs, including fines	N/A	N/A

5.3 Waste treatment for landfill	N/A	N/A
6. Emissions control		
6.1 Enclosure within buildings	Activities to be undertaken within a building as potential mitigation should be conducted in line with the appropriate measures guidance.	This condition will be met. All processing and storage of waste is undertaken internally within an enclosed building.
6.2 Point source emissions to air (channelled emissions)	Point source emissions to air to be undertaken in accordance with the requirements detailed within the appropriate measures guidance.	This condition has been met. An Air Quality Assessment has been undertaken and is included in *Annex D & E – AQA and HHRA.*
6.3 Fugitive emissions to air	The site must implement appropriate measures to prevent and minimise fugitive emissions to air, including dust, mud and litter, odour and noise and vibrations. Additional requirements are detailed within the appropriate measures guidance.	This condition has been met. Fugitive emissions to air have been screened out within the Environmental and Climate Change Risk Assessment provided in *Annex C – Environmental and Climate Change Risk Assessment.* All wastes accepted on site will be subjected to stringent waste pre-acceptance, acceptance and rejection criteria in accordance with the sites EMS and associated waste procedures.
6.4 Point source emissions to water (including sewer)	The site must identity the main chemical constituents of the facilities point source emission of water and sewer as part of an inventory of emissions. Additional requirements are detailed within the appropriate measures guidance.	This condition has been met. There will be no emissions to controlled waters arising from the installation. Uncontaminated clean surface water runoff captured from roof drainage and external roadways / car parking areas will be discharged to the existing surface water drainage system. With the exception of small volumes of wastewater emissions from the scrubbing and condensing systems, there are no process releases from the process. All process effluents will be contained within a bunded storage vessel and the waste water removed from site by a third-party contractor for offsite disposal. There will be no emissions to sewer with the exception of domestic foul flows.
6.5 Fugitive emissions to land and water	You must use appropriate measures to control potential fugitive emissions and make sure that they do not cause pollution. The sites design should be designed in consideration with the appropriate measures guidance.	This condition has been met. There will be no fugitive emissions to land and water arising from the installation. All waste feedstock will be stored within the enclosed building fitted with extraction and kept under negative pressure. All storage tanks associated with the process are installed with secondary containment and are designed to comply with EA and CIRIA guidance.
6.6 Pests	You must manage waste in a way that prevents pests and in accordance with the appropriate measures guidance.	This condition has been met. Pests are unlikely to become an issue on site. Monitoring for evidence of pests will be included during the daily site perimeter inspection. However, if a problem does develop, reasonable measures will be taken to use commercially available products and services to control pests.

7. Emission monitoring and limits		
7.1 Emissions to air	The facilities emissions inventory must include relevant characteristic of emissions to air as detailed within the appropriate measures guidance. Consideration must be given to fugitive emissions to air and the potential to cause pollution to sensitive receptors.	This condition will be met. The site will have a detailed emissions inventory detailing all the required monitoring in line with the site permit.
7.2 Medium Combustion Plant Directive	Operate in accordance with the points detailed within the appropriate measures guidance.	This condition has been met. The natural gas CHP unit will be monitored in accordance with the Environment Agency Guidance 'Monitoring Stack Emissions: MCPs and Specified Generators) as detailed within Section 5.
7.3 Emissions to water and sewer	The facilities emissions inventory must include relevant characteristics of point source emissions to water or sewer and key process parameters as those detailed within the appropriate measures guidance.	N/A – there are no point source emissions to water or sewer arising from the installation.
8. Process efficiency and appropriate measures		
8.1 Energy Efficiency (Installations only)	Create and implement an energy efficiency plan at your facility and undertake the requirements detailed within the appropriate measures guidance.	This condition will be met. Endolys will have an energy efficiency plan in place which will be regularly reviewed and integrated within the company's EMS.
8.2 Raw Materials (Installations only)	Operate in accordance with the requirements detailed within the appropriate measures guidance.	This condition will be met. A list of raw materials will be maintained on site.
8.3 Water use (Installations only)	Operate in accordance with the requirements detailed within the appropriate measures guidance.	This condition will be met. Water use and optimisation measures will be implemented on site, regularly reviewed and operated in accordance with the sites EMS.
9. Waste Minimisation, recovery and disposal		
9.0 Waste minimisation, recovery and disposal	Implementation of a residues management plan and additional requirements detailed within the appropriate measures guidance.	This condition has been met. A Residuals Management Plan will be implemented on site.

Table 6.2 Waste Incineration BREF BAT Conclusions

BAT Ref	BAT Conclusion	Comment
Environmental Management Systems		
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.	The site shall be operated in accordance with corporate standards and procedures as part of an Environmental Management System (EMS). The system will be designed to meet the requirements of ISO 14001:2015. Section 3.5 above details the aspects of the EMS on site.
Monitoring		
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.	N/A – the plant is not considered an incineration plant. However the efficiency of the plant will be regularly monitored by Endolys.
BAT 3	BAT is to monitor key process parameters relevant for emissions to air and water including those given in Guidance.	N/A – all process monitoring will take place as detailed within Section 4 of this document. There will be no point source emissions to water arising from the installation. There will be no bottom ash treatment carried out on site.
BAT 4	BAT is to monitor channelled emissions to air with at least the following 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.	N/A – all emissions monitoring will take place as detailed within Section 5 of this document.
BAT 5	BAT is to appropriately monitor channelled emissions to air from the incineration plant during Other Than Normal Operating Conditions (OTNOC).	N/A – the plant is not considered an incineration plant.
BAT 6	BAT is to monitor emissions to water from FGC and/or bottom ash treatment with at least the frequency given in the guidance 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.	N/A – there are small volumes of wastewater emissions from the scrubbing and condensing systems however this is removed from site by a third-party contractor for offsite disposal. There will be no bottom ash produced or treated at site .
BAT 7	BAT is to monitor the content of unburnt substances in slags and bottom ashes (LOI & TOC) at the incineration plant at least every 3 months and in accordance with EN standards.	N/A – not applicable to the site. Char will be monitored in accordance with the site permit.

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 accepted on site.
General Environmental and Combustion Performance		
BAT 9	In order to improve the overall environmental performance of the incineration plant by waste stream management, BAT is to use all of the techniques (a) to (c) given below, and, where relevant, also techniques (d), (e) and (f).	Endolys will operate stringent waste pre-acceptance and acceptance procedures which will form part of the companies EMS. 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.
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	N/A – there is no bottom ash treatment proposed 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 9c) including, depending on the risk posed by the incoming waste, the elements given in the guidance.	Waste deliveries will be monitored in accordance with the waste acceptance procedures. This will include: ▪ 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). ▪ Due to the type of waste accepted on site, site radioactivity detection will not be provided.
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.	The site benefits from impermeable hardstanding and a sealed drainage system. Periodic verification of impermeable surfaces will be incorporated into the sites planned preventative maintenance and inspection schedules. No waste will be accepted on site unless there is the capacity to do so.
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 waste will be accepted on site in accordance with an agreed specification. When ready for processing, the feedstock will be pre-treated via screening and separation equipment and agglomerated to form plastic pellets. The plant will be controlled using a digital control system (DCS) linked to a SCADA system.
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, as and when needed and practicable, based on the characterisation and control of the waste (see BAT 11).	The plant will be controlled using a digital control system (DCS) linked to a SCADA system.
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 system and water treatment plant are appropriately designed for the facility, will be operated within the design range and maintained to ensure optimal availability.
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.	N/A – OTNOC is not a requirement for this type of facility.
Energy Efficiency		
BAT 19 – BAT 20	Energy efficiency BAT conclusions.	N/A – heat will be recovered as far as possible by the system with flue gas recirculated. Energy efficiency will be optimised during the operation of the plant.
Emissions to Air		
BAT 21 – BAT 31	Emissions to air BAT conclusions.	N/A – all emissions to air will be monitored as detailed within Section 5 of this document.
Emissions to Water		
BAT 32 – BAT 34	Emissions to water BAT conclusions.	N/A – there are no point source emissions to water arising from the installation.
Material Efficiency		

BAT 35 – BAT 36	Material efficiency BAT conclusions.	N/A – there is no treatment of slags and bottom ashes on site.
Noise		
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.	The site has undertaken a Noise Impact Assessment which is provided within *Annex F*. Operational measures for the reduction of noise on site include: ▪ Improved inspection and maintenance of equipment; ▪ Closing of doors and windows of enclosed areas, if possible; ▪ Operation of equipment by experienced staff; ▪ Avoidance of noisy activities at night, if possible; ▪ Provisions for noise control during maintenance activities; ▪ Attenuation fitted to equipment where required.

Table 6.3 Refining of Mineral Oil & Gas BREF BAT Conclusions

BAT Ref	BAT Conclusion	Comment
Environmental Management Systems		
BAT 1	In order to improve the overall environmental performance, BAT is to implement an environmental management system (EMS) that incorporates the features provided within the BREF document.	The site shall be operated in accordance with corporate standards and procedures as part of an Environmental Management System (EMS). The system will be designed to meet the requirements of ISO 14001:2015. Section 3.5 above details the aspects of the EMS on site.
Energy Efficiency		
BAT 2	In order to use energy efficiently, BAT is to use an appropriate combination of the techniques given in the guidance including design techniques, process control and maintenance techniques and energy efficient production techniques.	The plant utilises design techniques such as heat and power recovery and heat integration where applicable, in addition to process optimisation, use of energy benchmarking and use of CHPs.
Solid Material Storage & Handling		
BAT 3	In order to prevent or, where that is not practicable, to reduce dust emissions from the storage and handling of dusty materials, BAT is to use one or a combination of the techniques given in the guidance. :	Incoming feedstocks (waste plastic film) are not inherently dusty materials. Char produced has the potential to be dusty. As such it is cooled in an enclosed multistage system prior to storage internally in a sealed hopper pending export.
Monitoring		

BAT 4	BAT is to monitor emissions to air by using the monitoring techniques and with at least the following 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.	N/A – all emissions monitoring will take place as detailed within Section 5 of this document.
BAT 5	BAT is to monitor the relevant process parameters linked to pollutant emissions, at catalytic cracking and combustion units by using appropriate techniques and with at least the frequency given below	N/A – all emissions monitoring will take place as detailed within Section 5 of this document.
BAT 6	BAT is to monitor diffuse VOC emissions to air from the entire site by using all of the following techniques: (i) sniffing methods associated with correlation curves for key equipment; (ii) optical gas imaging techniques; (iii) calculations of chronic emissions based on emissions factors periodically (e.g. once every two years) validated by measurements.	The site will implement appropriate monitoring of VOC emissions to atmosphere, proportionate to the oil separation and storage activities. All tanks will be fitted with carbon filters to abate emissions from breather vents.
BAT 7	In order to prevent or reduce emissions to air, BAT is to operate the acid gas removal units, sulphur recovery units and all other waste gas treatment systems with a high availability and at optimal capacity.	The site will ensure this BAT is met through operational control and the implementation of special procedures in periods of abnormal operation such as during start up and shut down.
BAT 8	In order to prevent and reduce ammonia (NH_3) emissions to air when applying selective catalytic reduction (SCR) or selective non- catalytic reduction (SNCR) techniques, BAT is to maintain suitable operating conditions of the SCR or SNCR waste gas treatment systems, with the aim of limiting emissions of unreacted NH_3 . BAT-AEL: NH_3 <5 - 15mg/Nm^3 (monthly average)	This BAT requirement will be met. All combustion of syngas will meet Chapter IV IED ELV's and Waste Incineration BREF BAT-AELs namely NH_3 2 – 10 mg/Nm^3 daily average.
BAT 9	In order to prevent and reduce emissions to air when using a sour water steam stripping unit, BAT is to route the acid off-gases from this unit to an SRU or any equivalent gas treatment system	N/A – no sour water stream stripping unit proposed onsite.
BAT 10	BAT is to monitor emissions to water by using the monitoring techniques with at least the frequency given in the guidance 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.	N/A – there are no process emissions to controlled water associated with the installation.
Emissions to Water		
BAT 11 – BAT 13	Emissions to water BAT conclusions.	N/A – there are no point source emissions to water arising from the installation.
Waste Generation & Management		

BAT 14	In order to prevent or, where that is not practicable, to reduce waste generation, BAT is to adopt and implement a waste management plan that, in order of priority, ensures that waste is prepared for reuse, recycling, recovery or disposal.	Endolys will implement a Residues / Waste Management Plan onsite as part of its EMS.
BAT 15	In order to reduce the amount of sludge to be treated or disposed of, BAT is to use one or a combination of the techniques given below i) sludge pretreatment ii) reuse of sludge in process units	There will be minimal sludge produced during settlement within the tanks. This sludge will be periodically dewatered with the oil recycled to the facility and the remainder removed offsite for treatment by a third party contractor. Due to the very small volumes of sludge anticipated, it is not considered proportionate to implement either sludge pretreatment or reuse of sludge into to the design of the facility and the above is considered BAT for the Endolys process.
BAT 16	In order to reduce the generation of spent solid catalyst waste, BAT is to use one or a combination of the techniques given below. i) Spent solid catalyst management ii) Removal of catalyst from slurry decant oil	Any catalysts used onsite will be safely removed and handled by qualified contractors for recovery offsite.
Noise		
BAT 17	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.	The site has undertaken a Noise Impact Assessment which is provided within *Annex F*. Operational measures for the reduction of noise on site include: ▪ Improved inspection and maintenance of equipment; ▪ Closing of doors and windows of enclosed areas, if possible; ▪ Operation of equipment by experienced staff; ▪ Avoidance of noisy activities at night, if possible; ▪ Provisions for noise control during maintenance activities; ▪ Attenuation fitted to plant where required.
BAT conclusions for integrated refinery management		
BAT 18	In order to prevent or reduce diffuse VOC emissions, BAT is to apply the techniques given below: Techniques related to plant design i) limiting the number of potential emission sources ii) maximising inherent process containment features iii) selecting high integrity equipment iv) facilitating monitoring and maintenance activities by ensuring access to potentially leaking components Techniques related to plant installation and commissioning i) well-defined procedures for construction and assembly ii) robust commissioning and hand-over procedures to ensure that the plant is installed in line with the design requirements	Although the plant is not technically a refinery there is a general applicability for the parts of the process related to oil separation and storage. Endolys will ensure that the techniques provided by the guidance are implemented onsite.

	Techniques related to plant operation i) Use of a risk-based leak detection and repair (LDAR) programme in order to identify leaking components, and to repair these leaks	
BAT conclusions for the alkylation process		
BAT 19 – BAT 21	Alkylation BAT conclusions	N/A – there is no alkylation process onsite
BAT conclusions for base oil production processes		
BAT 22	Base oil production BAT conclusions	N/A – this is not a base oil production process
BAT conclusions for the bitumen production process		
BAT 23	Bitumen production BAT conclusions	N/A – there is no bitumen production proposed as part of the Endolys process
BAT conclusions for the fluid catalytic cracking process		
BAT 24 – BAT 27	Fluid catalytic cracking BAT conclusions	N/A – there is no fluid catalytic cracking proposed as part of the Endolys process
BAT conclusions for the catalytic reforming process		
BAT 28	Catalytic reforming BAT conclusions	N/A – there is no catalytic reforming proposed as part of the Endolys process
BAT conclusions for the coking process		
BAT 29 – BAT 32	Coking BAT conclusions	N/A – this is not relevant to the Endolys process
BAT conclusions for the desalting process		
BAT 33	Desalting BAT conclusions	N/A – this is not relevant to the Endolys process
BAT conclusions for the combustion units		
BAT 34 - 37	Combustion Unit BAT conclusions	N/A – all combustion units on site will be subject to BAT relating to other processes. All units combusting syngas will be subject to Chapter IV IED requirements and Waste Incineration BREF BAT-AELS, whilst the natural gas CHP unit will be subject to MCPD requirements.

BAT conclusions for the etherification process		
BAT 38 – BAT 39	Etherification BAT conclusions	N/A – this is not relevant to the Endolys process
BAT conclusions for the isomerisation process		
BAT 40	Isomerisation BAT conclusions	N/A – this is not relevant to the Endolys process
BAT conclusions for natural gas refineries		
BAT 41 – BAT 43	Natural gas refinery BAT conclusions	N/A – the Endolys process is not a natural gas refinery
BAT conclusions for the distillation process		
BAT 44 - 46	Distillation BAT conclusions	N/A – this is not relevant to the Endolys process
BAT conclusions for the products treatment process		
BAT 47 - 47	Product Treatment BAT conclusions.	N/A – this is not relevant to the Endolys process
BAT conclusions for storage and handling processes		
BAT 49	In order to reduce VOC emissions to air from the storage of volatile liquid hydrocarbon compounds, BAT is to use floating roof storage tanks equipped with high efficiency seals or a fixed roof tank connected to a vapour recovery system.	The storage tanks at the Endolys site are of fixed roof design connected to a vapour recovery system.
BAT 50	In order to reduce VOC emissions to air from the storage of volatile liquid hydrocarbon compounds, BAT is to use one or a combination of the techniques given below: i) Manual oil tank cleaning ii) Use of a closed loop system .	The storage of oil will be undertaken in external dedicated tanks. These will have carbon filters fitted to breather vents to reduce the emission of VOCs from storage.
BAT 51	In order to prevent or reduce emissions to soil and groundwater from the storage of liquid hydrocarbon compounds, BAT is to use one or a combination of the techniques given below. i) Maintenance programme including corrosion monitoring, prevention and control; ii) Double bottomed tanks	Endolys will apply a combination of applicable techniques given in the guidance, including a dedicated maintenance programme and siting the tank farm within an appropriately sized bund.

	iii) Impervious membrane liners iv) Sufficient tank farm bund containment	
BAT 52	In order to prevent or reduce VOC emissions to air from loading and unloading operations of volatile liquid hydrocarbon compounds, BAT is to use one or a combination of the techniques given below to achieve a recovery rate of at least 95 %: . Vapour recovery by: (i) Condensation (ii) Absorption (iii) Adsorption (iv) Membrane separation (v) Hybrid systems BAT-AELS for non-methane Voc and benzene emission from loading and unloading operations of volatile liquid hydrocarbon compounds are as follows: NMVOC – 0.15 – 10 g/Nm^3 Benzene - <1 mg/Nm^3 Both expressed as hourly averages	The pyrolysis oil will contain a significant proportion of high boiling components and as such, emissions of VOCs from loading activities will be minimal. As such, none of the techniques given in the guidance will be implemented.
BAT conclusions for visbreaking and other thermal processes		
BAT 53	Visbreaking BAT conclusions	N/A – this is not relevant to the Endolys process
BAT conclusions for waste gas sulphur treatment		
BAT 54	Waste gas sulphur treatment BAT conclusions	N/A – this is not relevant to the Endolys process
BAT conclusions for flares		
BAT 55	In order to prevent emissions to air from flares, BAT is to use flaring only for safety reasons or for non-routine operational conditions (e.g. start-ups, shutdown).	Endolys will only utilise the flare in emergency or abnormal operating conditions in accordance with BAT
BAT 56	In order to reduce emissions to air from flares when flaring is unavoidable, BAT is to use the techniques given below.: i) Correct plant design ii) Plant management iii) Correct flaring devices design iv) Monitoring and reporting	Endolys have designed the plant in accordance with BAT and will ensure monitoring and reporting of flare usage is appropriately undertaken
BAT conclusions for integrated emission management		

BAT 57	In order to achieve an overall reduction of NO X emissions to air from combustion units and fluid catalytic cracking (FCC) units, BAT is to use an integrated emission management technique as an alternative to applying BAT 24 and BAT 34	N/A - all emissions abatement and management techniques will be in line with the waste incineration BREF BAT conclusions and Chapter IV of the IED.
BAT 58	In order to achieve an overall reduction of SO 2 emissions to air from combustion units, fluid catalytic cracking (FCC) units and waste gas sulphur recovery units, BAT is to use an integrated emission management technique as an alternative to applying BAT 26, BAT 36 and BAT 54.	N/A - all emissions abatement and management techniques will be in line with the waste incineration BREF BAT conclusions and Chapter IV of the IED.

7. IMPACT TO THE ENVIRONMENT

7.1 Impacts to Air

Detailed air quality modelling using the UK ADMS dispersion model has been undertaken to predict the impacts associated with stack emissions from the proposed facility.

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 has been used as an input to the UK Atmospheric Dispersion Modelling System (ADMS) dispersion model.

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

Predicted ground level concentrations are compared with relevant air quality standards for the protection of health and critical levels/ loads for the protection of sensitive ecosystems and vegetation.

7.1.2 Sensitive Human Health Receptors

The location of the discrete sensitive receptors selected for the assessment is presented in Table 7.1.

Table 7.1 Human Health Receptors

ID	Receptor	Type	Easting	Northing
R1	Business Park	Commercial	432226	513483
R2	Pioneer Court	Commercial	432231	513620
R3	Morton Park Hotel	Residential/leisure	432236	513823
R4	Offices	Commercial	432041	513849
R5	Driving Test Centre	Commercial	431858	513561
R6	Farmhouse	Residential	432123	513204
R7	Morton Grange Farm	Residential	432908	513668
R8	Aeolian House	Residential	432797	513999
R9	Woodlands Hospital	Hospital	432144	513972
R10	Travelodge	Residential/leisure	431748	513937
R11	Yarm Road	Residential	431286	514092
R12	Recreation Ground	Leisure	431305	513832
R13	Estoril Road	Residential	431132	513958
R14	School	Educational	430787	513874
R15	Warren Close	Residential	431171	513515

R16	Firthmoor Academy	Educational	430966	513417

The report concludes that there is no significant impact at nearby human receptors caused by the Installation.

Please refer to the Air Quality Assessment and Human Health Risk Assessment provided in *Annex D and Annex E* for more information.

7.1.3 Sensitive Habitat Sites

The Environment Agency's Risk Assessment Guidance[1] 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 2 km 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.

However, the habitat screening for MCP installations is 5 km for European sites and 2 km for SSSI. There are no European sites within 5 or 10 km.

Habitat receptor designations and locations relevant to the assessment are presented in Table 7.2. There is 1 SSSI within 2 km and there are 2 LNR's within 2 km of the facility site.

1 https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit
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	Assumed Primary Habitat	Eastings	Northings
H1. Maidenvale Fishing & Nature Reserve LNR/LWS	Neutral grassland	431299	513532
H2. Brankin Moor LNR/LWS	Woodland	430258	512907
H3. Hunger Hill Farm LWS	Woodland	433006	512789
H4. Red Hall LWS	Neutral grassland	431884	515287

The report concludes that there is no significant impact to nearby habitat receptors as a result of the operation of the Installation.

Please refer to the Air Quality Assessment provided in *Annex D* for more information.

7.2 Impacts to Controlled Waters

There will be no impact to controlled waters arising from this installation.

All process effluents are tankered off site for treatment and disposal.

7.3 Impacts to Sewer

There will be no impact to sewer arising from this installation.

7.4 Impacts to Land

There will be no impact to land arising from this installation.

7.5 Fugitive Emissions, Noise and Odour

All emissions of noise, dust and odour are minimised and controlled at source to ensure that there are no potential offsite impacts. Across site, all emissions of noise, dust and odour will be subject to operational management and monitoring plant to ensure that none of the nearby offsite receptors are adversely impacted.

APPENDICES

APPENDIX A SITE PLANS AND FIGURES

APPENDIX B TECHNICAL DETAILS

APPENDIX C ENVIRONMENTAL RISK ASSESSMENT

APPENDIX D AIR QUALITY ASSESSMENT

APPENDIX E HUMAN HEALTH RISK ASSESSMENT

APPENDIX F NOISE IMPACT ASSESSMENT

APPENDIX G APPLICATION SITE CONDITION REPORT

APPENDIX H ENVIRONMENTAL MANAGEMENT SYSTEM SUMMARY

APPENDIX I FIRE PREVENTION PLAN

APPENDIX J ODOUR MANAGEMENT PLAN

APPENDIX K ACCIDENT MANAGEMENT PLAN

APPENDIX L MCPD CHECKLIST

APPENDIX M DIRECTORS DETAILS