FICHTNER
Consulting Engineers Limited

SUEZ Recycling & Recovery Surrey Ltd

Charlton Lane Eco Park

Review of Operating Techniques

For the purposes of the Review of the Operating techniques listed within the EP, the following documents have been reviewed as follows:

1. Application documents – Supporting information: Sections 1.5 to 2. 9 (inclusive).

The proposed changes to the Operating Techniques (Table S1.2 of the EP) referenced within the Supporting Information are identified within this application. Text has also been updated to reflect the present tense, these changes are not highlighted.

For clarification, the currently permitted capacities, and those proposed within this application are presented in Table 1:

Table 1: Waste processing capacities

Activity	Environmental Permit (tpa)	Proposed capacities (tpa)
Gasification	55,460 (Assumes 44,710 thermally treated and 10,750 rejected from pre-treatment)	94,339 (Assumes 61,320 thermally treated and 33,019 rejected from pre-treatment)
Anaerobic Digestion	40,000	40,000
Community Recycling Centre & Recyclables Bulking Facility	250,000	211,121
Road sweepings	2,660	2,660
TOTAL (Not stated in the EP)	**348,120**	**348,120**

Therefore, this application will not result in an increase in the overall tonnage of waste received/processed at the Facility.

1 Supporting Information

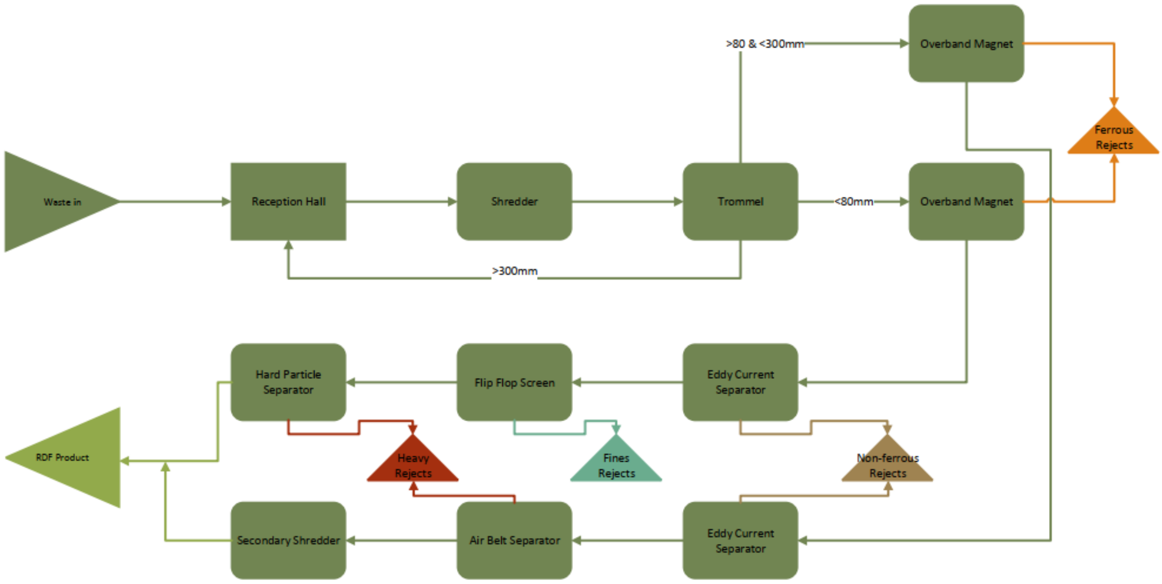
1.5 Summary of Installation Activities - Gasification Plant

1.5.1 Overview

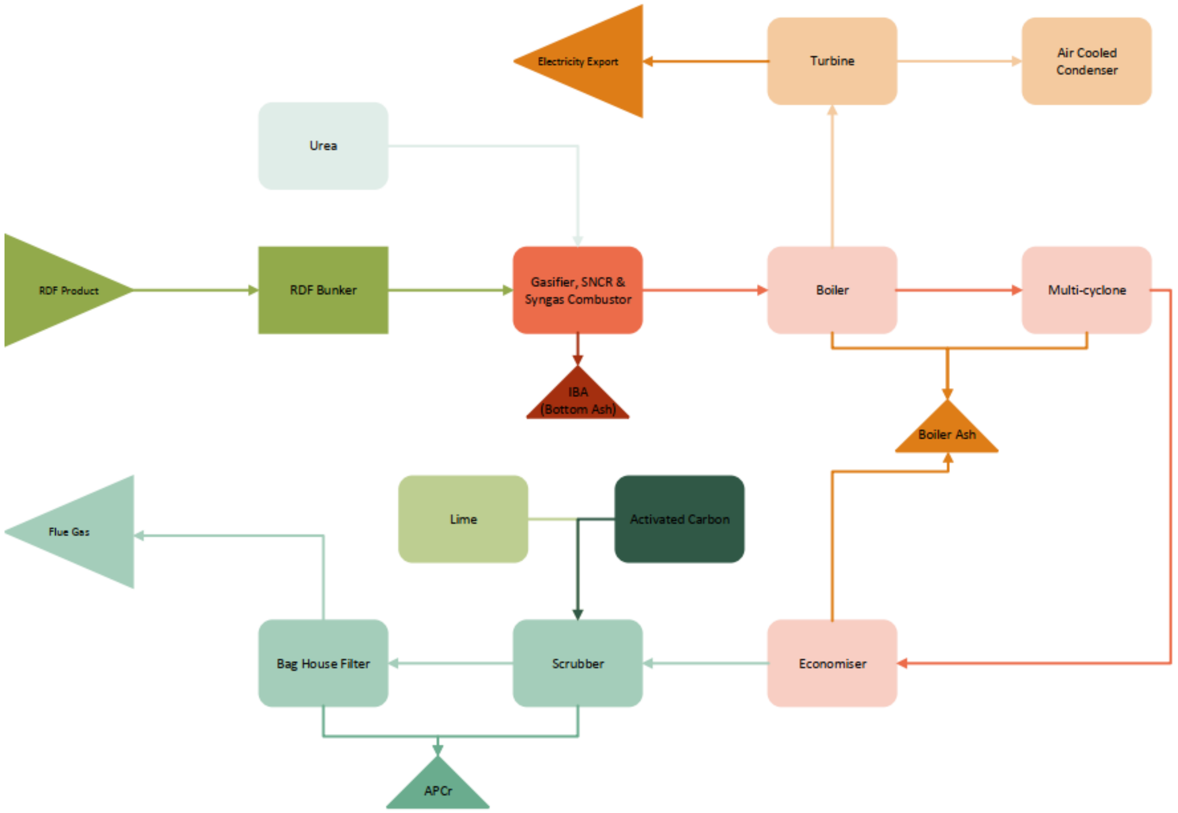
The gasifier includes a pre-treatment line which prepares the residual waste for gasification and recovers recyclates from the incoming residual waste. The pre-treatment equipment which is located within the gasification building removes ferrous metal, non-ferrous metals, aggregates in the form of small stones and glass, as well as large heavy non-combustible material.

The Gasification facility consists of a single stream fluidised bed gasification facility which will process around 61,320 tonnes per annum of refuse derived fuel at its design net calorific value of 10.3 MJ/kg. In total 94,339 tpa of residual waste will be delivered to the gasification building. Of this 94,339 tpa, around 33,020 tpa of material is expected to be recycled or removed from the residual waste stream through the pre-treatment equipment, with the remaining processed materials forming the Refuse Derived Fuel (RDF) feed into the gasification process.

The process for the pre-treatment and gasification processes is illustrated in the simple block diagrams below.



Gasifier Pre-Treatment



Gasifier

1.5.2 Raw Materials

Incoming Waste

Incoming refuse collection and bulk transport vehicles enter the site via Charlton Lane. From there they proceed to the weighbridge, where the quantity of incoming waste is checked and recorded. Vehicle loads are inspected periodically at the weighbridge and reception hall to confirm the nature of the incoming wastes.

The entry/exit into the gasification building is equipped with fast acting roller shutter doors which are kept closed when deliveries not taking place.

Odour and dust is controlled by draught fans located in the gasification building. Some of the extracted air is used as combustion air within the gasification process. The rest of the air is treated by carbon filters before being released. In addition the building contains a dust suppression system; this is a sprinkler type system, which emits a very fine spray to suppress dust. Additives can also be incorporated into the spray to mitigate odours. The building is fitted with a full sprinkler system to protect against fire with water cannons over the waste storage area.

Once within the building the driver tips the load onto the reception area floor and then exits the reception hall via the fast acting door. Materials are manoeuvred into a designated waste reception area using a front-end loader to provide a consistent feedstock to allow the plant to continually run for 24 hours a day, 7 days a week.

The waste reception hall, on the east side of the building, is sized to store approximately 600 tonnes of incoming MSW. This accommodates approximately two days equivalent of waste delivery at the revised rates discussed above. Waste delivery is onto a flat floor and vehicles can deliver towards a push wall from which waste can be moved by use of a wheeled loading shovel to the waste storage area in the north of the reception hall. A grab sorts the waste and feeds the primary shredder of the mechanical pre-treatment line. A separate quarantine bay is provided for segregation of non-conforming wastes.

The pre-treatment line comprises the following treatment processes:

- Primary shredder - open bags, separate the waste and generally reduce the MSW to a workable size.
- Trommel screen - to spilt the waste into size fractions for further processing.
- Ferrous removal by electro-magnet - Removed ferrous material is conveyed to a collection bay.
- Non-ferrous removal by an eddy current separator - Removed non-ferrous material is conveyed to a collection bay.
- A Flip/Flop screen – to separate out fines (aggregates and organics)
- Ballistic Separator - to separate solid waste, depending on its size, density and shape into:
  1. heavyweight fraction; and
  2. light RDF fraction.
- Air belt separator - to separate the different fractions into lightweight and heavyweight fractions.
- Secondary shredder - single-shaft shredder for the secondary granulating of primary shredded material so that it is suitable for gasification within the gasification facility.
- An additional overband magnet removes any remaining ferrous materials from the combined RDF streams.

The pre-treatment line has been designed to operate at a rate of up to 32 tonnes per hour, delivering the refined fuel at a rate of up to 21 tonnes per hour. When combined with the storage element, this provides enough fuel to allow continuous running of the gasifier.

Oversize material separated from the mechanical pre-treatment is returned via conveyor to the north west portion of the tipping hall, close to the tulip grab, to go through the shredder and separation process again.

The RDF bunker, located in the south west corner of the gasification building, consists of a steel walled box with push floor ladders in the bottom to discharge the RDF. RDF output from the mechanical separation is fed by conveyor to a high level above the bunker where it is deposited onto a walking floor. The push floor in turn feeds conveyors to transfer RDF from the bunker to the gasification metering bin in the adjacent gasification hall. The bunker is sized to store approximately 3 days equivalent of RDF production, at densities of 0.2t/m^3 to 0.5t/m^3 depending upon the fill level, which is sufficient to maintain fuel feed for 24 hour operation of the gasification facility.

Fluidised Bed Raw Materials

The fluidised bed comprises a granular bed material. The bed material is either silica sand or crushed refractory clay specifically selected for the process and the operating parameters of the gasifier; and for its resistance to thermal shock and abrasion.

Reagents

Lime for the flue gas cleaning process is stored in one 60 m^3 silo to the west of the gasification building. The lime is delivered by bulk tanker and offloaded pneumatically into the silos with displaced air vented through a reverse pulse jet filter.

The activated carbon is delivered as dry powder in big bags. The activated carbon is discharged from the big bag storage system and transported to the injection point by a pneumatic conveying system.

Urea solution is delivered by road tanker and pumped into a Glass Reinforced Plastic (GRP) double skinned storage tank. The tank is complete with maximum and minimum level switches and leakage detection. From the storage tank, the urea solution is pumped to the mixing and metering module.

Various other water treatment chemicals are delivered in appropriate containers and stored in bunded areas.

A bunded fuel oil tank situated above ground and within the building envelope provides oil for the combustion chamber burners and the AD Boiler. Any offloading spillages are retained within the tank bunding system, which contains 110% of the tank contents.

Various maintenance materials (oils, greases, antifreezes, welding and fire fighting gases etc.) are stored in the appropriate manner.

1.5.3 Gasification Process

Following commissioning and operation of the fluidised bed staged gasifier it has been demonstrated that it has a maximum thermal capacity of 22.0 MWth based on an RDF with a net calorific value of 10.3 MJ/kg and an RDF feed rate of up to 7.7 tph – Maximum Continuous Rating.

The processes within the gasifier can be divided into two zones:

- the gasification zone, in which the RDF is gasified within the fluidised bed; and
- the oxidation zone, in which the syngas and any tars and char are combusted.

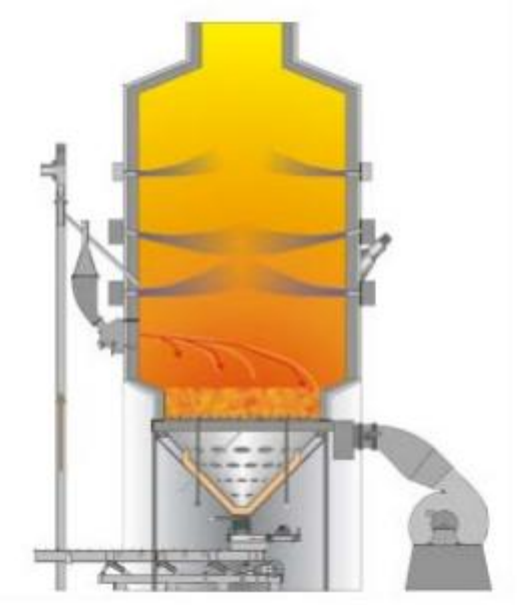


Figure 1: Staged Gasification Design

The fluidised bed comprises a granular bed material and a bed fluidising system.

The fluidised bed material is silica sand or crushed refractory clay specifically selected for the process and the operating parameters of the gasifier; and for its resistance to thermal shock and abrasion.

Air required for fluidisation and gasification enters the fluidised bed vessel through the fluidising air plenum. The air is distributed from the plenum through individual air manifolds and into the fluidising nozzles that extend across the base of the gasifier. These nozzles are spaced to provide a uniform airflow through the bed material to ensure complete fluidisation of the bed.

The air manifolds are fitted with slip sleeve expansion mechanisms and cleanout ports on the end opposite the air plenum and spaced to allow bed and inert material to flow between them. The manifolds have cooling air ports to reduce the temperature of the bed and allow non-combustibles to be drawn out of the system.

The fluidising air system comprises the under-fire air fan, carbon steel ducting, dampers and expansion joints.

The over fire air is delivered into the gasifier through multiple nozzles in the walls of the gasifier above the fluidised bed. Each set of nozzles is supplied with air from a dedicated header and damper assembly giving individual control of the over fire air optimising the thermal oxidation and temperature profile within the gasifier.

The over fire air system comprises the over fire air fan, carbon steel ducting, dampers and expansion joints.

In order to reach the operating temperature, the under-fire air system operates in conjunction with the under-bed pre-heat burner. The under-bed burner is mounted in a refractory lined duct out of the normal air path of the fluidising air and are fired with light fuel oil.

During start up, an over bed burner operates in conjunction with the under-bed burner system, providing the energy to heat the bed material and vapour space. The over bed burner is fired with light fuel oil.

Inert material introduced with the fuel, such as stones or metals, not removed in the pre-treatment process, can lead to occasional agglomeration and clinkering of a portion of the bed media. If allowed to accumulate, this can result in temperature and pressure fluctuations across the bed culminating in de-fluidisation of the bed.

The bed recycle system enables the continuous operation of the fluidised bed process while removing inert material from the bed, reducing downtime, labour and bed media usage.

The bed material, inerts and clinkers flow from the bed into the gasifier drawdown cones, via a bobber system to prevent bridging and reduce the likelihood of blockages. Cooling air from the under-bed fan is distributed through the manifolds to cool the bed material as it flows toward the discharge outlet.

The drawdown cone is complete with a slide gate valve at the bottom discharge. A manually operated isolation slide valve is located above the automatic slide valve and used to isolate the automatic slide gate valve for maintenance.

The bed material, inerts and clinkers are discharged onto a common vibrating screen conveyor. The vibrating screen incorporates a perforated plate to separate inerts and clinkers from the reusable bed material.

The vibrating screen discharges the bed material into the bucket elevator whilst the inerts and clinkers are discharged into a skip for disposal.

The bucket elevator lifts the clean bed material above the active bed for reinjection, thereby maintaining a constant level of bed material in the vessel. A hopper is incorporated into the system near ground level to facilitate manual makeup of the bed material.

A bed material storage silo is provided to store and automate bed material handling for the fluidised bed system. Bed material is diverted from the bucket elevator discharge to the storage silo by a pneumatically operated valve. This allows the vessel to be emptied for inspection or maintenance purposes and also permits the automated refill and makeup to maintain the proper vessel bed material inventory during operation.

An online ash cleaning system is incorporated into the Gasification chamber comprising of 3 Shock Pulse Generator (SPG) units that use a methane and air mix, under controlled conditions, to intermittently detonate and create a shock wave that knocks the ash off the walls in the upper chamber.

The gasifier vessel is complete with all supports, penetrations for overfire air, view ports, SNCR nozzles, access ports, temperature and pressure probes, bed reinjection and fuel in feed. The gasifier includes penetrations for syngas sampling above the bed and below the overfire air injection for periodic sampling of the syngas.

Water tube steam boiler

The design and fabrication of the steam generating system incorporates features based on extensive experience with the gasification and combustion of MSW derived RDF.

The steam boiler generates 17.3 tph of superheated steam at 40 bara and 400°C.

Flue gas from the gasifier enters the steam generator through a vertical tube, natural circulation and evaporative screen section. Wide tube spacing and relatively cool saturated temperatures reduce the potential for ash bridging and provide initial flue gas cooling. Lower flue gas temperatures also reduce fouling of the downstream superheater tubes.

The superheater is split into sections with a mid-stage spray type attemperator to control the outlet steam temperature. A superheater vent valve is provided to maintain steam flow through the superheater during start-up if the downstream equipment is unable to accept start-up steam.

The steam drum is fitted with access manways on each end, internal steam separators, a feedwater distribution grid, chemical feed nozzles, and continuous blowdown nozzles.

Motorised retractable soot blowers and rotary type soot blowers are provided to maintain tube surface cleanliness. The soot blowers are operated from the control room. Ash cleaned from the tubes falls into the ash hopper and is constantly removed by the fly ash handling system.

Access doors are provided for maintenance and inspection purposes. The steam generator casing is gas-tight and factory lined with insulation and refractory.

The economiser, which is used to capture the waste heat from boiler stack gases (flue gas) and transfer it to the boiler feed water, is located in the flue gas ductwork after the multiclone (as described in section 1.5.5) and comprises a single pass, bare tube counter current heat exchanger. The flue gas flows downward so that fly ash entrained in the gas stream is collected at the bottom of the unit. The boiler feedwater flows counter-current or upward to prevent steam bubbles from being trapped. The economiser is fitted with electrically driven rotary soot blowers, operable locally or from the control room. Fly ash cleaned from the tubes falls into the ash hopper and is constantly removed by the fly ash handling system.

1.5.4 Energy Recovery

The superheated steam from the boiler detailed above is used to drive a steam turbine. The turbine generator arrangement generates electrical power for export to the local electricity distribution network. Air-cooled condensers, located to the north of the Main Gasification Building, is then be used to condense the residual steam from the steam turbine.

1.5.5 Gas Cleaning

The flue gas cleaning system includes a series of stages including:

1. Primary NOx reduction;
2. Primary particulates abatement;
3. Acid gas abatement;
4. Control of heavy metals and dioxins; and
5. Secondary particulate removal.

The cleaned flue gases are discharged to atmosphere through a 49 m stack. This stack is also used to disperse the emissions from the CHP engines associated with the AD plant and the emissions from the odour treatment system. A height of 49 m provides sufficient dispersion to ensure that the development does not result in an unacceptable impact on human health or sensitive environmental receptors. Duty/standby CEMS units would record the contaminants being discharged to the atmosphere from the gasification plant stack.

Primary NOx reduction

Nitrogen oxides can be formed by three mechanisms:

- Thermal NOx;
- Fuel NOx; and
- Prompt NOx.

Thermal NOx formation depends on the temperature and residence time of the reaction products and oxygen levels within the furnace. Fuel NOx depends on the nitrogen content of the fuel; whilst prompt NOx is formed by the reaction of hydrocarbon radicals with atmospheric nitrogen during combustion.

In order to reduce NOx formation during the combustion of the syngas, the system is controlled to give stable temperature and combustion conditions within the oxidation zone of the gasification chamber. The oxidation zone of the gasification chamber operates at temperatures below 1100°C in order to reduce the formation of thermal NOx.

The abatement of oxides of nitrogen (NOx) is achieved by using a selective non-catalytic reduction (SNCR) system. The SNCR system operates by injecting a reducing reagent, urea solution, into the gasifier, which reacts with NOx at temperatures between 900°C and 1000°C. The reaction breaks down the NOx into nitrogen gas and water vapour.

The urea solution is injected into the vapour space of the gasifier through an array of liquid atomising nozzles..

The urea solution is delivered by road tanker and pumped into a GRP double wall storage tank. The tank is complete with max/min level switches and leakage detection. From the storage tank, the urea is pumped to the mixing and metering module.

Primary particulates abatement

During normal operation the flue gas which exits the boiler passes through a multiclone which reduces the level of particulates entering the Economizer. The multiclone dust collector comprises a bank of cyclone tubes. The inlet vanes of each tube impart a rotating motion to the gas, generating a centrifugal force that concentrates particles of entrained dust at the interior walls of the collecting tubes. The particles then fall and discharge from the bottom of the tube. The clean gas exits through the outlet at the top of the collecting tube, whilst the fly ash drops into the hopper and is removed via a double flap airlock. The fly ash from the multiclone is transported by the pneumatic conveying system to the fly ash silo.

Acid gas abatement

Acid gases formed during the gasification process consisting of sulphur dioxide (SO_2) and hydrochloric acid (HCl) are neutralised by the injection of a reagent into the flue gas stream. Hydrated lime is used as the acid gas reagent for acid gas abatement.

The reaction with the acid gases forms calcium sulphite, calcium sulphate and calcium chloride, along with water vapour.

The acid gases react according to the following priority:

- sulphur trioxide;
- hydrogen fluoride;
- hydrogen chloride;
- sulphur dioxide; and
- carbon dioxide.

The hot flue gas is ducted from the outlet of the economiser to the spray dryer. The system comprises a reaction tower; water delivery and spray system; reagent storage and delivery / mixing system.

The hot flue gas flows into the scrubber where it reacts with a spray of water and hydrated lime. The dust like material separated within the fabric filter among reaction salts still contains a certain portion of un-reacted lime.

Hydrated lime is delivered as dry powder by road tanker.

The hydrated lime is fed from the road tanker into the silo via a pneumatic filling pipe.

The exhaust air generated during the filling operation is filtered prior to discharge to atmosphere. The silo is complete with systems to protect against excess pressure and vacuum. The hydrated lime is discharged from the silo via a rotary airlock valve and transported to the milk of lime plant to form the injectable slurry for the scrubber.

The hydrated lime silo has a storage capacity of 60 m^3.

Control of heavy metals and dioxins

Heavy metals are removed from the flue gases by the injection of powdered activated carbon into the flue gas along with effective particulate removal by the bag filters. This is a reliable and well-proven method for reducing mercury concentrations by 90% or more. For other metals, efficient particulate abatement minimizes heavy metal releases to atmosphere.

In addition to controlling the emissions of heavy metals, the powdered activated carbon system is also effective in controlling the release of dioxins to the atmosphere.

The primary method of minimising the generation of dioxins and furans is through the careful control of the combustion conditions within the gasifier. The residence times of the flue gases, along with the temperature and oxygen content in the combustion system so that any dioxins and furans are efficiently destroyed.

The *de novo* synthesis (reformation) of dioxins is minimised by the careful design of the boiler and flue gas system temperature profile.

Any dioxins and furans generated are effectively removed by the injection of powdered activated carbon into the flue gas stream along with effective particulate removal by the fabric filters. This is a reliable and well-proven method for abating emissions of dioxins and heavy metals in waste incineration and gasification facilities in the UK and Europe.

Particulate removal

The bag house removes the fly ash carried over from the combustion process and air pollution control residues (APCR) from the flue gas treatment system.

The bag house comprises four modules – this enables one module to be taken offline for additional cleaning, maintenance and bag replacement. The bag house operates at 140°C.

A dust sensor in the exhaust duct of each filter compartment detects a filter bag failure. In the event of a filter bag failure, the compartment can be isolated from the flue gas path to enable the filter bag to be replaced. The bag house can continue to operate with three compartments at Maximum Continuous Rating.

During normal operation, the build-up of hydrated lime and activated carbon on the filter media enhances the overall performance of the flue gas system by providing residence time for the reagents to react with the acid gases and to improve the removal of heavy metals and dioxins. The bag house is cleaned online by a compressed air pulse jet system.

The pulses of compressed air are initiated automatically based on a time sequence, and/or when the filter pressure differential reaches a set point.

The pulses removes the accumulated cake ash from outside the bags, this ash drops into hoppers located beneath the cells and then is conveyed to the APCR storage silo.

The APCR silo has a storage capacity of 110m^3. During a cold start-up, the bag house is heated by the recirculation of the flue gas, due to the temperature pick-up across the ID fan. The hoppers are insulated and trace heated, where required, to minimize the risk of acid condensation and corrosion.

1.5.6 Ancillary Operations

A fuel oil system serves the gasifier auxiliary burners and the AD plant standby boiler. The fuel oil storage tank is located in a bunded area and includes an interceptor pit and inspection facility. The tank is complete with level indicators and an overfilling protection level switch which close the motorised valves in the filling line. The filling of the fuel oil tank is carried out by road tanker. The tanker hose coupling is located in a bunded area.

The Gasification Facility requires a water supply of approximately 10,000 m^3 per annum. The primary requirement of water is to maintain the water level in the boiler system (steam cycle). Water is primarily sourced from mains water but rainwater harvesting is also used to supply water to the process.

The water is treated in a reverse osmosis plant prior to being used in the boiler. The demineralisation process is undertaken to remove minerals such as calcium from the water in order to prevent salt deposits forming within the boiler chamber and associated pipe work. Such deposits would reduce the efficiency and operating life of the system. Water for fire-fighting is stored in tank(s) with a dedicated pumpset.

In case of failure of the electricity supply, an emergency diesel generator is provided to safely shut down the plant and to provide an emergency supply to the rest of the facility.

1.5.7 Ash Handling

Bottom ash and fly ash are generated within the gasification facility. Bottom ash, which consists of inerts and clinkers, is discharged from the bed recycling system into a skip.

The gasification plant has several points of collection for fly ash and Air Pollution Control residues (APCr):

- Boiler;
- Multiclone;
- Economiser; and
- Bag Filters.

There are two separate ash collection systems:

- System 1: boiler, multiclone and economizer (coarse fly ash); and
- System 2: bag house (APCr).

The ash from each hopper discharges via double flap valves into the ash collection system. Multiple ash drops in close proximity are collected by conveyor system to a single pickup point.

The residue is then transported off-site to suitably permitted waste management facilities via road tanker for disposal or recovery.

1.5.8 Emissions Monitoring

The flue gas is monitored using a continuous emission monitoring system (CEMS). The monitoring has three main objectives.

- to provide data for the efficient and safe plant operation;
- to warn the operator if any emissions deviate from predefined ranges; and
- to provide records of emissions for regulatory compliance.

The CEMS is located in the horizontal section of the stack thereby negating the requirement for a platform and stairway on the stack.

The CEMS monitors and record the following parameters at the stack:

- particulates (PM10);
- sulphur dioxide;
- hydrogen chloride;
- carbon monoxide;
- carbon dioxide;
- ammonia;
- nitrogen oxides (NO & NO2);
- TOCs;
- water vapour;
- oxygen;
- temperature;
- pressure; and
- mass flowrate.

A facility is also be provided to enable flue gas samples to be extracted on a batch basis to enable testing for contaminants that are not continuously monitored, such as HF.

A duplicate CEMS is provided, with one system on-line and the second system in hot standby. In the event of problems with the on-line system, the other system switches online to ensure that monitoring of emissions continues. The system is protected by a dedicated un-interruptible power supply. System hardware, data loggers and analysers are contained in a GRP air-conditioned shelter. The system is MCERTS approved.

1.6 Summary of Installation Activities – CHP/Flare and Anaerobic Digestion

1.6.1 Overview

1.6.1.1 Anaerobic Digestion plant

The plant operates two anaerobic digestion vessels fed with food waste after the removal of undesirable 'contamination' such as plastic, stones, glass etc. Each digester has a design capacity of 128 wet tonnes (at 30% dry solids) per day of organic material, which equates to approximately 40,000 tonnes per annum with the plant operating 24 hours a day, 7 days a week. The plant produces up to 1,276 m^3 per hour biogas with a net calorific value of 22.2 MJ/Nm^3. The biogas is captured from the anaerobic digestion tanks and is piped to a gas holder.

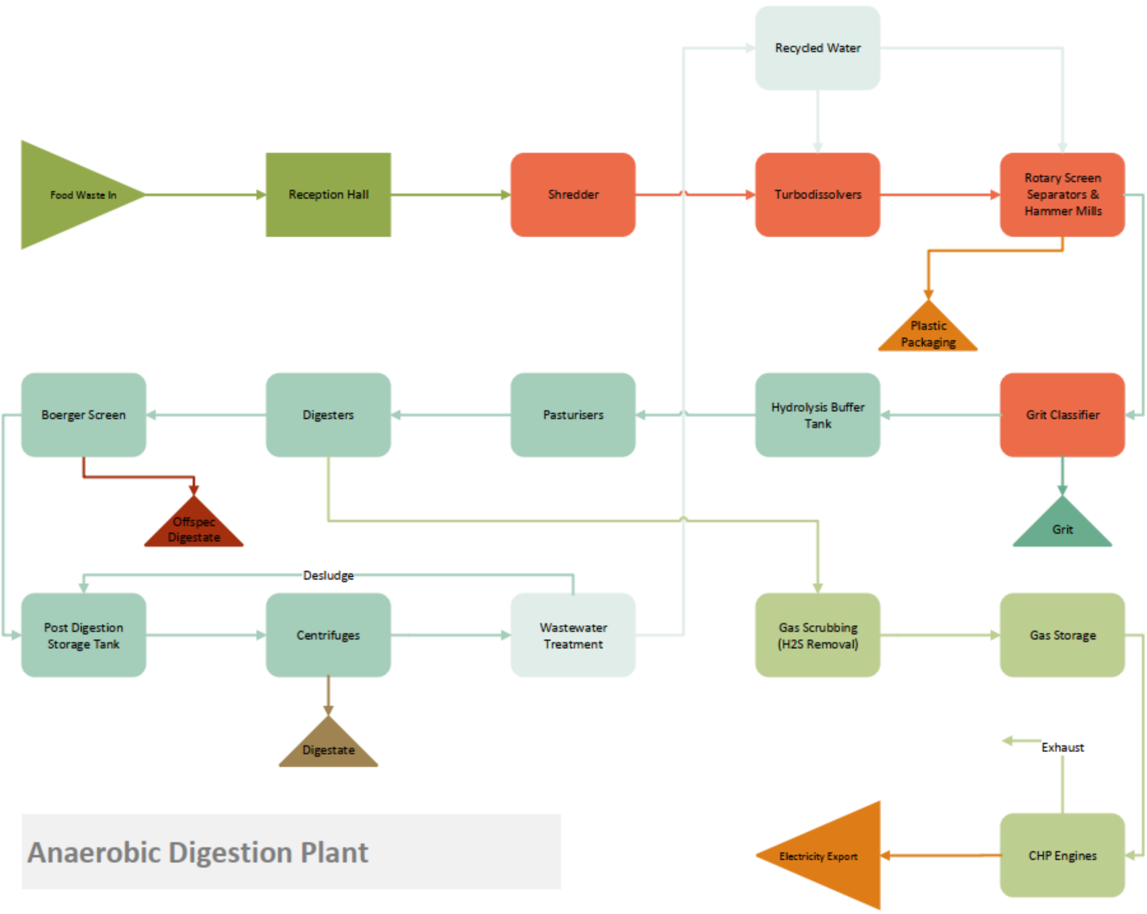
The slurry digestate from the anaerobic digestion process is dewatered in a centrifuge. Up to 16,000 tonnes per annum of digestate cake is transferred offsite to be spread to agricultural land as a soil enhancer. The liquor from the separation process is collected for reuse in the dissolvers, cleaned, part is discharged and the remaining water required made up from fresh water.

1.6.1.2 CHP Plant and Flare

The combined heat and power units consist of two gas engines. The engines convert biogas into heat and power.

The flare stack is designed to operate in the event that more biogas is generated than is used.

The process for the AD Plant, CHP Plant and Flare is illustrated in the simple block diagram below. A larger copy is also included in Annex 1.



1.6.2 Raw Materials

The Anaerobic Digester processes residual food waste from municipal and C&I sources. The AD Plant treats 40,000 tonnes per annum of organic food wastes.

The main AD process building would be split into three main areas: waste reception, waste processing and digestate processing.

1.6.3 Waste Reception

The waste reception area is located in the central third of the building. Vehicles delivering food waste access the site via the weighbridge where vehicles are weighed and logged. Access to the reception area is via fast acting doors operated by staff within the AD facility.

Delivery vehicles reverse into the reception area and the doors are closed whilst waste is deposited. Once the doors are closed the driver tips the load onto the reception area floor and then exits the reception hall via the fast-acting door. The enclosed waste reception building is maintained under positive pressure with an ionised air odour destruction system that pumps ionised air into each hall to destroy potentially odorous compounds within the building.

The reception hall has capacity to hold one day's worth of organic material. This prevents organic material remaining in the reception hall for long periods and hence reduce odour generation.

Upon arrival at the AD area, deliveries of food waste for the AD plant manoeuvre below the canopy to reverse into the reception hall and unload onto a flat floor. Push walls at the rear (east) of the reception hall contain the organic waste prior to feeding the shredder. Waste is moved and fed into the shredder by a wheeled loading shovel. The shredder feeds the process treatment line located within the process hall to the north.

The reception apron below the canopy, the reception hall, and the process hall all fall within the requirements of ABPR (Animal By-Products Regulations 2011). In order to control ABPR material, segregated drainage is provided to these areas. The apron below the canopy has continuous drainage channels around the entire perimeter, which in turn are surrounded by kerbed islands or ramps at vehicle entry / exit points to ensure ABPR wash down is contained. These also reduce water ingress from external areas to minimise the storage capacity and treatment requirements of ABPR material. Wheelwashing is undertaken within the ABPR drainage perimeter to clean exiting vehicles while capturing potential contamination.

Delivered material is handled within the reception hall using a front-end loader. Material is fed into a fixed shredder where it is reduced in size to less than 50mm. Shredded material passes through the shredder to a hopper which in turn feeds an enclosed screw conveyor. The screw conveyor passes through the dividing wall between the reception hall and the processing hall; from this point onwards processing equipment is enclosed to meet health and safety regulations.

Liquid arising from wet materials and shredding is drained via enclosed conduits to the buffer tank feed sump where it is then pumped to the hydrolysis buffer tank for treatment within the Anaerobic Digestion facility. Wash down facilities are provided within the building to clean the floor at the end of each shift. Wash down water is also transferred to the buffer tank.

The maturation hall (south of building), where dewatering takes place, directly fill articulated trailers ready for collection and disposal off-site.

1.6.4 Waste Processing / Separation

The waste separation contains the process equipment designed to separate organic material, (for anaerobic digestion) from unwanted packaging and contamination (e.g. stones, glass) and subsequent liquefaction.

The shredded material is conveyed to one of the waste dissolvers. The dissolvers dilute the incoming organic material with recycled water to form a slurry, whilst leaving packaging and hard inorganic particles unaffected. Material delivered to the waste reception hall has a dry matter concentration of (typically) 20% - 40% by weight; the anaerobic digesters operate with a feed solids concentration of 10-12% by weight. To achieve this, liquid that is extracted during the final dewatering process (liquors) are recycled to the waste dissolvers and mixed with the raw material to achieve 10-12% concentration. Additional water may be added at this stage depending on the concentration of inorganic salts in the recycled liquor. The approximate mains water demand for the AD process would be in the order of 6,000 m^3 per annum.

The mixture of shredded food waste, recycled liquor and water is blended and then discharged to a fine screen. This screen removes contamination larger than the organic slurry. Plastic contamination removed by the screen is de-watered in a hammer mill to recover as much organic slurry as possible and discharged to a skip. This recovered material is not required in the AD process and are transferred to the Gasification facility for disposal.

Material which is denser than the slurry settles in the bottom of the waste dissolvers (stones, glass etc). This material is removed from the dissolvers manually and discharged to waste skips and exported offsite to a suitable waste management facility. Remaining grit is removed downstream of the separation system via a hydrocyclone and classifier unit.

The organic slurry from the waste dissolvers flow from the screens via gravity to the buffer tank feed sump.

1.6.5 Digestion

Slurry from the buffer tank feed sump is pumped to the hydrolysis buffer tank located to the north of the main AD process building.

1.6.5.1 Hydrolysis Buffer Tank

The hydrolysis buffer tank has a working volume of 1,500m^3 and is constructed of glass coated steel. The tank acts as a buffer between the intermittently working reception and processing halls and the continuously operating anaerobic digestion plant. The feed pipe discharges above the 'high top' water level within the tank so that in the event of a pipe failure or leak the tank contents are not released to the environment.

The hydrolysis buffer tank is mixed by an external pump recirculation system to prevent settlement within the tank and is connected to the site odour control system to contain odours.

The hydrolysis tank is fitted with a pressure and vacuum relief valve to protect the roof against excessively high or low pressures, which could occur under abnormal fault conditions. This device is a safety device and should not operate under normal working conditions. However, under abnormal conditions this valve is designed to release to the air.

1.6.5.2 Pasteurisation System

Slurry is pumped from the hydrolysis buffer tank to the pasteurisation plant at a rate of (approximately) 12m^3/hr. Slurry is pumped via a 'pre heat', heat exchanger, which raises the slurry temperature from 30°C to 50°C by recovering heat from the hot pasteurised sludge.

Pasteurisation takes place in 3 parallel tanks each with a maximum volume of 20m^3. At any one time one tank is filling and being heated to 70°C, one tank is holding (batch hold for time temperature pathogen kill) and one tank is emptying. This approach allows a continuous feed in and a continuous feed out whilst providing the 1-hour batch hold at 70°C required by the Animal By-Products Regulations for Category 3 material.

Hot pasteurised sludge is pumped from the pasteurisation plant via a heat recovery exchanger where the temperature is dropped from 70°C to 50°C and to the anaerobic digester.

1.6.5.3 Anaerobic Digester

Pasteurised slurry is injected into the anaerobic digester mixing loop. The anaerobic digesters convert organic material to biogas (methane and carbon dioxide) by the fermentation of organic material in the absence of oxygen. The minimum retention time of the digester is approximately 20 days and biogas is collected within the roof space, which is connected to the biogas system.

The digester is constructed of glass coated steel and is insulated (and clad) to retain temperature. The digester tank is continuously mixed by unconfined sequential gas injection to maintain an active volume >90% and to prevent deposition of solids within the digester.

Digested slurry is displaced by gravity overflow from the digester to the post digestion buffer tank and a high level overflow is included as an additional safety device. Discharge is via a weir box which acts as a siphon break such that the digester cannot be drained in the event of a down-stream pipe fracture.

The digestion tank is fitted with a pressure and vacuum relief valve to protect the roof against excessively high or low pressures, which could occur under abnormal fault conditions. This device is a safety device and should not operate under normal working conditions. However, under abnormal conditions this valve is designed to release biogas to the air.

Iron Chloride is dosed into the anaerobic digester. The addition of iron salts to the digester minimise production of hydrogen sulphide in the biogas.

1.6.5.4 Post Digestion Buffer Tank

The post digestion tank acts as a buffer from the digester to the dewatering stage and also as a means to inhibit further methanogenesis within the slurry. Digested slurry gravitates to the tank from the digester and is then physically pumped to the dewatering press.

The tank is constructed of glass coated steel and is connected to the odour control system. The tank contents are aerated by the injection of air via unconfined mixing pipes in the base of the tank. This aeration is designed to inhibit the anaerobic methane forming bacteria to prevent any further methane production post digestion. This process serves a dual function; firstly stopping the emission of the highly potent greenhouse gas (methane) and secondly ensuring that there are no hazardous areas created downstream from (explosive) methane release.

1.6.5.5 Anaerobic Digestion Bund

The height of the bund has increased, and has been design in accordance with BS EN 1992-3 Liquid Retaining and Containment Structures. The bund sump liquor is tested for pH, and visually inspected, prior to manually operating the pumps to discharge to the surface water system. In the event that the bund sump liquor is out of specification, the sump liquor is recirculated within the anaerobic digestion process.

1.6.5.6 Dewatering

Digested slurry is pumped from the post digestion buffer tank to centrifuges where solids are dewatered to a dry solids concentration of approximately 23%.

The centrifuges are located within the maturation building and digested compost falls by gravity into articulated trailers where it is periodically collected.

Liquor from the centrifuge (water fraction) gravitates to the liquor pumping sump and from here is transferred to the liquor treatment plant.

1.6.5.7 Liquor Treatment Plant

The anaerobic digestion process converts organics to methane and carbon dioxide, but the process also converts nitrogen to ammonia. Part of this ammonia is present in the centrate/liquor from the centrifuge and requires treatment prior to discharge from the site.

The membrane bio reactor (MBR) treats this centrate to remove ammonia, COD and Total Suspended Solids in order to comply with the Trade Effluent Consent (to sewer) and to provide treated effluent for use in the front end separation plant and anaerobic digestion plant.

As the ammonia is converted within the reactor, alkalinity is consumed and caustic soda is dosed into the MBR controlled by a pH probe within the reactor. The caustic soda addition is such that pH is maintained at 7.0 to 8 within the MBR.

1.6.5.8 Treated Liquor Buffer Tank

Within the anaerobic digestion pre-treatment plant incoming waste (which has a dry solids concentration of approximately 30%) is diluted to 10-12% dry solids by the addition of water in the turbodissolvers. The majority of this dilution water is provided by recycled liquors from the downstream process. Some additional make up water is required in order to prevent the build-up of ammonia/potassium/phosphorous salts (in the recycled liquor) from inhibiting the digestion process. To minimise using potable water the plant utilises harvest rainwater from the process building roof.

As the digestion plant operates 24 hours per day 7 days per week and the reception facility on 11 hours per day 5/6 days a week the buffer tank acts as an accumulator for the treated effluent until it is required. The tank is unmixed and open to atmosphere; however, no odour is released from this treated effluent.

The process produces excess water and the discharge from the site (of effluent) is from this location (high level overflow of balance tank). Details of effluent emission from this tank are outlined in the effluent emission schedule. Effluent from the anaerobic digestion plant is passed to further treatment on site before discharge to the environment.

1.6.6 Biogas System

1.6.6.1 Biogas Holder

The biogas holder is a double membrane system with a storage capacity of 2,000m^3. The biogas is stored at ambient temperature.

The biogas holder has 2 primary functions. Firstly, the gasholder is a safety device acting as a volume buffer to the digester and hydrolysis tank. When liquid is pumped out of one of the tanks the gasholder provides biogas to replace the lost volume, hence maintaining system pressure. Similarly when biogas is produced within the digester the gasholder acts as a storage volume preventing an increase in gas pressure.

Secondly the gasholder acts as a buffer for biogas production and use. The combined heat and power plant uses biogas at a fixed rate (approximately 600m^3/hr, based on a 50% methane content), whereas biogas production may vary slightly above and below this figure. The gasholder acts as a buffer to allow the CHP to operate at a constant rate with varying gas production.

The gasholder acts as the pressure regulating device in the gas system. Air is blown into an outside bag which surrounds the inner gasbag. The air outlet is restricted by a regulating valve to create a constant air pressure in the outer bag (20 – 25mbarg), and this in turn pressurises the gas to the same pressure. By maintaining the gas at a positive pressure at all times the risk of oxygen (from air) being drawn into the gas system from a leak or relief valve is eliminated and hence the potential for an explosive mixture of methane and air is eliminated within the process plant.

The gasholder is fitted with a pressure and vacuum relief valve that protects the gasholder against excessively high or low pressures which, could occur under abnormal fault conditions. This device is a safety device and should not operate under normal working conditions, however under abnormal conditions this valve is designed to release biogas to the air. This potential abnormal emission is defined within the air emission schedule provided.

1.6.6.2 Biogas Scrubber

To meet the specified NOx and SOx emissions from the CHP flue gases a ‘biogas scrubbing’ plant is installed in the gas pipe from the gasholder to the CHP units. The scrubber is designed to reduce hydrogen sulphide and ammonia within the biogas to the required level for the CHP engines.

The biogas scrubbing system is biological in nature.

1.6.6.3 Combined Heat and Power Plant

The combined heat and power units consist of two gas engines which have a combined engine use of approximately 600m^3/h based on a 50% methane content. The engines convert biogas into heat and power. Electricity is generated from the combustion of biogas with air and heat is recovered from the cooling jacket, oil lubrication system and flue gas.

Electricity from the CHP engines is exported to the national grid whilst the heat from the process are used within the anaerobic digestion plant to run the pasteurisation process.

1.6.6.4 Flare Stack

The flare stack is designed to operate in the event that more biogas is generated than is used. The flare has the capacity to combust 1000m^3 per hour of biogas. The flare stack is normally only be required to operate when CHP units are not in use for routine maintenance and are unavailable to use the biogas produced by the digester.

The function of the flare stack is to prevent the gasholder from becoming overfull, which would in turn result in over pressurisation of the gas system and release to atmosphere (by the pressure relief valves) of unburnt biogas.

The flare stack is designed to comply with all current standards and is located 6m from any zoned area for safe operation.

1.6.7 Gas Cleaning

There is no flue gas cleaning associated with the CHP Plant and Flare.

1.7 Summary of Waste Operations

1.7.1 Community Recycling Centre

The CRC comprises of :

- areas of hard standing for parking and waste management operations;
- split level recycling skip bays;
- 1 split level green waste bay;
- recycling containers;
- an internal site access road;
- a CRC office; and
- A reuse shop.

Car parking bays are provided within the CRC, of which 30 provide direct access to the split level skips.

The split level recycling skip bays are located to the north and east of the CRC public parking areas. A hard standing area to the north of the skip bays allows for the movement and storage of recycling containers. A separate weighbridge used to weigh the contents of containers from the CRC is located to the north west of the RBF to record weights of recycled materials and ensure no skips are overloaded.

Some wastes from the CRC are transferred to the RBF for bulking.

A site office, including staff welfare facilities, is included in the CRC area.

Access to the CRC is from the main site entrance off Charlton Lane. A dedicated access for vehicles accessing the CRC is signed at the entrance; a separate access lane is provided for vehicles entering the remainder of the site. Upon entering the site, vehicles access the CRC along the dedicated access road.

CRC users proceed along the access road into the CRC where they access a vacant parking bay to enable direct unloading into the containers or park in the designated parking area and walk with their waste to an appropriate container. The containers are clearly signed with the material to be placed within individual containers, e.g. paper and cardboard, metals, wood and glass. The public self select the appropriate container within which material is to be deposited. CRC staff are available to assist members of the public and ensure waste is correctly segregated.

Vehicles leave the CRC via the existing access road and exit the site using the shared access.

1.7.2 Recyclables Bulking Facility (RBF)

The RBF is predicted to handle up to 42,750 tonnes per annum.

The core elements of the RBF are as follows:

- bulking bays;
- bulk storage area;
- storage for containerised recyclates.

Recyclables arrive in either refuse collection vehicles direct from their collection rounds, or in bulk haulage vehicles. Recyclables are also be transferred to the RBF from the CRC. All vehicles weigh in (at the weighbridge) before proceeding to RBF.

Vehicles tip recyclable materials into the appropriately designated bulking bays. Recyclate bulking bays are provided for the following materials: card and mixed papers, glass, cans, plastic bottles, mixed cans & glass & plastics, bulky plastic, bulky waste, wood, inerts, metals, fridges and carpet. The bulking bays are 4m wide by 9m deep and a height of 4m.

There is a bulking bay for residual wastes, where possible recyclables are separated from this material and moved to the appropriate recyclate bay. Residual wastes suitable for processing can be transferred to the gasification facility.

Bulk transport vehicles collecting recyclables are loaded using front end loaders by parking on the hard standing adjacent to the bulking bays.

1.8 Road Sweepings Dewatering Area

In the Road Sweepings Dewatering area, road sweeping vehicles discharge their contents onto a concrete floor. The Road Sweepings Dewatering area is a bulking bay with push-walls and a concrete floor sloping slightly to a drainage system and below ground blind tank. Grit and small particles are prevented from falling into the catch pit and the below ground tank by a grating cover.

Effluent is collected in a below ground 10m^3 tank and is transferred into a vacuum tanker equipped with a gulley sucker attachment, ready to be transferred off-site for treatment.

The grit remaining on the concrete slab is then be bulked up for transfer off-site to a suitably licensed facility.

1.9 Site Wide Issues

1.9.1 Odour Control System

The enclosed waste reception building for the anaerobic digestion plant is maintained under positive pressure with an ionised air odour destruction system that pumps ionised air into each hall to destroy potentially odorous compounds within air within the building.

Air extracted from all waste reception and processing building areas is treated by a carbon-filter-based odour control system. Odour from the maturation hall is pre-treated in an ammonia scrubber prior to the carbon filter.

Treated air from the odour control system is discharged via a common nested stack, 49m in height, located adjacent to the gasification plant.

1.9.2 Weighbridge

The main weighbridge and associated weighbridge office are located on the eastern boundary of the site.

1.9.3 Liquid Effluent and Site Drainage

The existing foul connections at the site continue to be used for the redeveloped Charlton Lane Eco Park. Effluent discharges from the installation comprise effluent from welfare facilities and process effluents.

The process effluents are from the Gasification and CHP Plants. These effluents comprise effluents from boiler water blow down, boiler water treatment, turbine condensate, and wash down from operational areas.

The maximum daily discharge from the installation is up to 400 m^3 and is discharged via a mains sewer under the site's existing Trade Effluent Consent. The discharge consent allows a peak flow of 50 m^3/hour. The trade effluent discharge from the site would be in line with the discharge quality parameters prescribed within the extant discharge consent, refer to Annex 5.

The design for the discharge of uncontaminated surface water drainage involves below-ground attenuation of storm flows in the form of oversized sectional concrete pipe work, with a storage capacity of approximately 700 m^3. Uncontaminated surface water flows are then be pumped to an infiltration basin located to the east of the main developed area.

The infiltration basin comprises a layer of granular material placed over a geotextile membrane which, in turn, overlies the natural Thames gravels. The basal area of the infiltration basin covers 3,000m^2. Uncontaminated surface water flows would soak away into the Thames Gravels. A bentonite clay, or similar, cut off wall would be provided to the north and east of the infiltration basin in order to mitigate any potential risks to groundwater quality.

The infiltration basin includes for a pumping system and buried drainage pipe to allow for excess water to be discharged from the infiltration basin to the Charlton Lane swale. The pumped system allows water to be discharged at a maximum rate of 5 litres / second. There is a cut off device installed in an overflow chamber adjacent to the swale to ensure that flooding does not occur in the event of a blockage of the swale. The swale is located immediately south of the "old" Charlton Lane, which runs immediately outside the site entrance.

Petrol/oil separators are provided at various locations (car parking and vehicle manoeuvring areas) within the installation, and catch pits are incorporated into the drainage design to limit siltation within the system and hence the infiltration basin.

Rainwater is harvested from the process building roofs. Waste water from the administration areas is sent to the sewer currently serving the site for the existing operations.

2 Other Information for Application Form

2.1 Raw materials

2.1.1 Types and amounts of raw materials

The application forms require information on the types and amounts of raw materials which are used. The information requested is shown in the table below.

Table 2: Types and amounts of raw materials

Activity	Material	Storage Capacity		Annual Usage (tonnes per annum unless stated)	Description including any hazard code
		Number of tanks	Tank Capacity (t unless stated)		
S5.1 (A1) (c)	Auxiliary fuel	1	60 m^3	1000 m^3	Low sulphur (<0.1%) gasoil
	Hydrated Lime	1	22	850	powder
	Urea	1	25 m^3	500	50% solution
	Activated carbon	1	3	30	Powdered
	Boiler treatment chemicals		3	10	Corrosion inhibitor, scale inhibitor, biocide, ion exchange resins
Anaerobic Digestion	Ferric Chloride	IBCs	1 m^3	80	20% solution
	Caustic Soda (NaOH)	1	30 m^3	410	32% Solution
	Sulphuric acid	IBCs	1 m^3	30	77% Solution

Table 3: Raw materials and their affect on the environment

Environmental Medium								
Product	**Chemical Composition**	**Typical Quantity**	**Units**	**Air**	**Land**	**Water**	**Impact Potential**	**Comments**
Water	Water	30,000	Cubic meters per year	0	0	0	Low impact	Process water discharge to foul sewer. Water recycled, reused where practicable.
Auxiliary fuel	Low sulphur (<0.1%)	1,500	Cubic meters per year	100	0	0	Low impact	Used for start up . Plant combustion products released to atmosphere after passing through flue gas treatment plant.
Hydrated Lime	$Ca(OH)_2$	250	Tonnes per year	0	100	0	Low impact	Injected hydrated lime is removed with the APC residues at the bag filter and disposed of as hazardous waste at a suitable licensed facility.
Urea	$(NH_2)_2CO$ (40% solution)	500	Tonnes per year	0	100	0	Low impact	Reacts with nitrogen oxides to form nitrogen, oxygen and water vapour. Small quantities of unreacted urea are released to atmosphere at low concentrations, and is continuously monitored.
Activated carbon	C	30	Tonnes per year	0	0	100	Low impact	Injected carbon is removed with the APC residues at the bag filter and disposed of as hazardous waste at a suitably licensed facility.
Boiler treatment chemicals		10		0	0	100	Low impact	Used for regeneration of water treatment plant. Bio-degradable, no bioaccumulation potential and negligible ecotoxicity.
Ferric Chloride	$FeCl_2$	80	Tonnes per year	0	100	0		Used to minimise the generation of hydrogen sulphide in the biogas.

Environmental Medium								
Caustic Soda (NaOH)	NaOH 32% solution, low mercury	410	Tonnes per year	0	0	100	Low impact	Used for pH correction of liquor from anaerobic digestion. Bio-degradable, no bioaccumulation potential and negligible ecotoxicity.
Sulphuric acid	77% Solution	30	Tonnes per year	0	0	100	Low impact	Used for AD ammonia scrubber

Various other materials are required for the operation and maintenance of the plant, including:

1. Hydraulic oils and silicone based oils;
2. Electrical switchgear;
3. Gas emptying and filling equipment;
4. Refrigerant gases for the air conditioning plant;
5. Oxyacetylene, TIG, MIG welding gases;
6. CO_2 / fire fighting foam agents; and
7. Test and calibration gases.

These are supplied to standard specifications offered by main suppliers. All chemicals are handled in accordance with COSHH Regulations as part of the quality assurance procedures and full product data sheets are available on site.

Periodic reviews of all materials used is made in the light of new products and developments. Any significant change of material, where it may have an impact on the environment, are not made without firstly assessing the impact and seeking approval from the Environment Agency.

The Operator maintains a detailed inventory of raw materials used on site and have procedures for the regular review of new developments in raw materials.

2.1.2 Reagent Storage

In order to minimise contamination risk of process or surface water, all liquid chemicals stored on site are kept inside bunded areas or on pallet bunds. In particular, caustic, diesel fuel and urea solution are held in bunded storage tanks. Spillage and leakage are retained in these areas and treated locally.

Lime is delivered to the plant for storage in a silo. Activated carbon is delivered in big bags. Control is achieved through high level control and alarm. The top of the silo is equipped with a vent fitted with a fabric filter. Cleaning of the filter is done automatically with compressed air after the filling operation. The filter is inspected regularly for leaks. Urea solution is delivered to site in road tankers.

The lime and activated carbon are injected via separate injection nozzles. This ensures that the flow rate of each reagent is controlled independently.

2.1.3 Raw Materials Selection

2.1.3.1 Reagent selection

Acid Gas Abatement

There are several reagents available for acid gas abatement. Sodium Hydroxide (NaOH) or hydrated lime ($Ca(OH)_2$) can be used in a wet scrubbing system. Quicklime (CaO) can be used in a semidry FGT system. Sodium bicarbonate ($NaHCO_3$) or hydrated lime can be used in a dry FGT process.

Lime is used as a reagent in the acid gas abatement system. An assessment has been undertaken to determine whether lime represents BAT compared to the use of sodium bicarbonate. For the purposes of this assessment the same assumptions have been applied as per the BAT assessment submitted with the previous EP variation application.

Table 4: Acid Gas Abatement BAT Assessment

Item	Unit	$NaHCO_3$	$Ca(OH)_2$
Mass of reagent required	kg/h	109	67
Mass of residue generated	kg/h	84	85
Cost of reagent	£/tonne	£155	£94
Cost of residue disposal	£/tonne	£150	£125
Overall Cost	£	32.5	20.5
Ratio of costs		1.58	1.00
Please note, the above costs are dated 2013.			

In summary, there is a small environmental benefit for using sodium bicarbonate, in that the mass of residues produced is slightly smaller. However, there are a number of significant disadvantages:

- The sodium bicarbonate residue has a higher leaching ability than lime-based residue, and therefore may require additional treatment prior to disposal, making it more expensive to dispose of;
- The reaction temperature for sodium bicarbonate doesn't match as well with the optimum adsorption temperature for activated carbon, which are dosed at the same time as the acid gas reagent; and
- The costs of sodium hydroxide are approximately 50% higher than using a lime system.

Taking this into consideration, the use of lime is considered to represent BAT for this facility.

NOx Abatement

The NOx Abatement system is operated with 40% urea solution.

The Sector Guidance on Waste Incineration considers all options as representing BAT for NOx abatement. It was proposed to use Urea solution for the NOx Abatement system, because the climate change impacts of ammonia solution outweigh the handling and storage issues associated with the use of urea.

2.1.3.2 Auxiliary Fuel

The auxiliary fuel for the gasification facility is fuel oil. This is brought in by tanker, loaded/unloaded via a sealed pipe system, and stored in an above ground bunded storage tank.

As stated in Article 50 (4) of the IED:

> *Each combustion chamber of a waste incineration plant shall be equipped with at least one auxiliary burner. This burner shall be switched on automatically when the temperature of the combustion gases after the last injection of combustion air falls below the temperatures set out in paragraph 2. It shall also be used during plant start-up and shut-down operations in order to ensure that those temperatures are maintained at all times during these operations and as long as unburned waste is in the combustion chamber.*
>
> *The auxiliary burner shall not be fed with fuels which can cause higher emissions than those resulting from the burning of gas oil as defined in Article 2(2) of Council Directive 1999/32/EC of 26 April 1999 relating to a reduction in the sulphur content of certain liquid fuels (1) OJL121, 11.5.1999, p.13. liquefied gas or natural gas.*

Therefore as identified by the requirements of IED the only available fuels that can be used for auxiliary firing are those which can cause no higher emissions than those resulting from the burning of gas oil. Therefore the available fuels for auxiliary firing are as follows:

1. Natural gas;
2. Liquefied gas (LPG); or
3. Gasoil.

Auxiliary burner firing on a well managed waste combustion plant is only required intermittently, i.e. during start-up, shutdown and when the temperature in the combustion chamber falls to 850°C.

Natural gas can be used for auxiliary firing and is safer to handle than LPG. As stated previously, auxiliary firing is only required intermittently. When firing this requires large volumes of gas, which would be needed to be supplied from a high-pressure gas main. The installation of a high-pressure gas main to supply gas for auxiliary firing to the Charlton Lane Eco Park would be very expensive.

LPG is a flammable mixture of hydrocarbon gases. It is a readily available product, and can be used for auxiliary firing. As LPG turns gaseous under ambient temperature and pressure, it is required to be stored in purpose built pressure vessels. If there was a fire within the site, there would be a significant explosion risk from the combustion of flammable gases stored under pressure.

A fuel oil tank can be easily installed at the Charlton Lane Eco Park. Whilst it is acknowledged that fuel oil is classed as flammable, it does not pose the same type of safety risks as those associated with the storage of LPG. The combustion of fuel oil leads to emissions of sulphur dioxide, but these emissions are minimised as far as reasonably practicable through the use of low sulphur fuel oil.

Therefore, low sulphur light fuel oil is used for auxiliary firing for the gasifier.

The fuel oil system serves the gasifier auxiliary burners and the AD plant standby boiler.

The use of fuel oil for auxiliary firing and a standby boiler for the AD facility is considered to represent BAT.

2.1.4 Incoming Waste Management

2.1.4.1 Incoming Waste Handling

The existing Charlton Lane installation has procedures for pre-acceptance and acceptance procedures for waste, waste storage, and specific activities for waste treatment. The revised procedures comply with the Indicative BAT requirements in the Sector Guidance Note, including:

- Maintaining a high standard of housekeeping in all areas and provide and maintaining suitable equipment to clean up spilled materials.
- Loading and unloading of vehicles in designated areas provided with impermeable hard standing. These areas have appropriate falls to the process water drainage system.
- Fire fighting measures are designed by consultation with the Local Fire Officers, with particular attention paid to the waste storage area.
- Delivery and reception of waste is controlled by a management system that identifies all risks associated with the reception of waste and shall comply with all legislative requirements, including statutory documentation.
- Incoming waste is :
  - delivered in covered vehicles or containers; and
  - unloaded into the enclosed reception area.

- Design of equipment, buildings and handling procedures ensures there is insignificant dispersal of litter.
- Inspection procedures are employed to ensure that any wastes which would prevent the gasifier from operating in compliance with its permit are segregated and placed in a designated storage area pending removal.
- Further inspection take place by the operators during vehicle tipping and waste mixing.
- To minimise odour:
  - self-closing doors are provided for any potentially odorous indoor areas.
  - waste is stored inside the gasification building to prevent odour release and keeping external doors closed where possible.
  - during shutdown, doors limits odour spread while still allowing vehicle access. Misting sprays can be used to reduce odour from the waste storage area. The plant employs waste storage management procedures wastes are removed from the storage area on a first in, first out basis so as not to exceed the maximum storage time of 4 days.
  - procedures are in place to divert waste away from the site during shut downs if odour management is not effective.

2.1.4.2 Waste to be Gasified

The plant is used to recover energy from MSW and C&I waste, with European Waste Catalogue Codes as follows:

Table 5: Waste To Be Processed in the Gasifier

EWC Code	Description of Waste
WASTES FROM AGRICULTURE, HORTICULTURE, AQUACULTURE, FORESTRY, HUNTING AND FISHING, FOOD PREPARATION AND PROCESSING	
Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing	
02 01 02	ABPR Category 1 - Animal-tissue waste
02 01 03	plant-tissue waste
02 01 04	waste plastics (except packaging)
02 01 06	ABPR Category 1 - Animal faeces, urine and manure (including spoiled straw), effluent, collected separately and treated off-site
02 01 07	wastes from forestry
02 01 09	agrochemical waste other than those mentioned in 02 01 08
wastes from the preparation and processing of meat, fish and other foods of animal origin	
02 02 02	ABPR Category 1 - Animal-tissue waste
02 02 03	ABPR Category 1 - Materials unsuitable for consumption or processing
Wastes from fruit, vegetables, cereals, edible oils, cocoa, coffee, tea and tobacco preparation and processing; conserve production; yeast and yeast extract production, molasses preparation and fermentation	
02 03 04	materials unsuitable for consumption or processing
02 05 Wastes from the dairy products industry	
02 05 01	materials unsuitable for consumption or processing
wastes from the baking and confectionery industry	

EWC Code	Description of Waste
02 06 01	materials unsuitable for consumption or processing
02 06 02	wastes from preserving agents
WASTES FROM WOOD PROCESSING AND THE PRODUCTION OF PANELS AND FURNITURE, PULP, PAPER AND CARDBOARD	
wastes from wood processing and the production of panels and furniture	
03 01 01	waste bark and cork
03 01 05	sawdust, shavings, cuttings, wood, particle board and veneer other than those mentioned in 03 01 04
wastes from pulp, paper and cardboard production and processing	
03 03 01	waste bark and wood
03 03 07	mechanically separated rejects from pulping of waste paper and cardboard
03 03 08	wastes from sorting of paper and cardboard destined for recycling
03 03 10	fibre rejects, fibre-, filler- and coating-sludges from mechanical separation
WASTES FROM ORGANIC CHEMICAL PROCESSES	
wastes from the MFSU of plastics, synthetic rubber and man-made fibres	
07 02 13	waste plastic
WASTE PACKAGING; ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED	
packaging (including separately collected municipal packaging waste)	
15 01 01	paper and cardboard packaging
15 01 02	plastic packaging
15 01 03	wooden packaging
15 01 05	composite packaging
15 01 06	mixed packaging
15 01 09	textile packaging
absorbents, filter materials, wiping cloths and protective clothing	
15 02 03	absorbents, filter materials, wiping cloths and protective clothing other than those mentioned in 15 02 02
WASTES NOT OTHERWISE SPECIFIED IN THE LIST	
16 01 19	Plastic
CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)	
wood, glass and plastic	
17 02 01	Wood
17 02 03	Plastic
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	

EWC Code	Description of Waste
wastes from physico/chemical treatments of waste (including dechromatation, decyanidation, neutralisation)	
19 02 03	premixed wastes composed only of non-hazardous wastes
19 02 10	combustible wastes other than those mentioned in 19 02 08 and 19 02 09
wastes from aerobic treatment of solid wastes	
19 05 01	non-composted fraction of municipal and similar wastes
19 05 02	non-composted fraction of animal and vegetable waste
19 05 03	off-specification compost
wastes from anaerobic treatment of waste	
19 06 04	digestate from anaerobic treatment of municipal waste
19 06 06	digestate from anaerobic treatment of animal and vegetable waste
wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletizing) not otherwise specified	
19 12 01	paper and cardboard
19 12 04	plastic and rubber
19 12 07	wood other than that mentioned in 19 12 06
19 12 08	Textiles
19 12 10	combustible waste (refuse derived fuel)
19 12 12	other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11
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 01	paper and cardboard
20 01 02	Glass
20 01 08	biodegradable kitchen and canteen waste
20 01 10	Clothes
20 01 11	Textiles
20 01 25	edible oil and fat
20 01 28	paint, inks, adhesives and resins other than those mentioned in 20 01 27
20 01 30	detergents other than those mentioned in 20 01 29
20 01 32	medicines other than those mentioned in 20 01 31
20 01 36	discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35
20 01 38	wood other than that mentioned in 20 01 37
20 01 39	Plastics
20 01 40	Metals
20 01 41	wastes from chimney sweeping

EWC Code	Description of Waste
20 02	*garden and park wastes (including cemetery waste)*
20 02 01	biodegradable waste
20 02 02	soil and stones
20 02 03	other non-biodegradable wastes
20 03	*other municipal wastes*
20 03 01	mixed municipal waste
20 03 02	waste from markets
20 03 03	street-cleaning residues
20 03 04	septic tank sludge
20 03 06	waste from sewage cleaning
20 03 07	bulky waste

The waste is delivered from the local area in Refuse Collection Vehicles (RCVs) and by Bulk Transfer Vehicles.

The Gasification facility will receive around 94,339 tpa of waste for pre-treatment which following processing will supply a single stream fluidised bed gasifier with 61,320 tonnes per annum of refuse derived fuel with a net calorific value of 10.3 MJ/kg.

The other factor that affect total fuel input capacity are the hours of operation. In some years, the plant may not need to be shut down for as long a period, so that the fuel input capacity increases.

Checks are made on the paperwork accompanying each delivery to ensure that only waste for which the plant has been designed are accepted.

For waste delivered in Refuse Collection Vehicles (RCVs) from the daily household waste collection rounds and bulk transfer vehicles from transfer stations, it is not practical to inspect this waste before it is tipped into the waste storage area, since it is compressed in the vehicles. The waste is observed by the tipping hall operator as it is tipped and by the front-end loader as it is mixed. Unacceptable waste is removed from the waste storage for further inspection and quarantine.

Commercial and industrial waste, loads are routinely spot checked. Any unacceptable waste is rejected and stored in a designated area in the tipping hall with contained drainage. The Environmental Management System (EMS) include procedures to control the inspection, storage and onward disposal of unacceptable waste. Certain wastes require specific action for safe storage and handling. The EMS also contains procedures for controlling the blending of waste types to avoid mixing of incompatible wastes.

2.1.4.3 Gasifier - Waste Pretreatment & Waste Feed

The gasifier is protected from harmful elements in the MSW by a pre-treatment line. The pre-treatment line processes the waste removing the harmful elements but providing the opportunity to remove additional recyclate streams from the incoming MSW.

The pre-treatment line has an operational design capacity of 28 tonnes per hour, delivering the refined fuel at a rate of 18.2 tonnes per hour. When combined with the storage element, this provides enough fuel to allow continuous running of the gasification facility.

The pre-treatment equipment removes ferrous metal, non-ferrous metals, dense plastic, aggregates in the form of small stones and glass, as well as large heavy non-combustible material.

The pre-treatment equipment comprises the following treatment processes:

- Primary shredder - open bags, separate the waste and generally reduce the MSW to a workable size.
- Trommel screen - to spilt the waste into size fractions for further processing.
- Ferrous removal by electro-magnet - Removed ferrous material is conveyed to a collection skip.
- Non-ferrous removal by an eddy current separator - Removed non-ferrous material is conveyed to a collection skip.
- Flip Flop Screen - to separate fines (stones, sand and organic matter, etc.).
- Air belt & Hard Particle separators - input material to separate the different fractions into lightweight and heavyweight fractions.
- Secondary Shredder - single-shaft shredder for the secondary granulating of primary shredded material so that it is suitable for processing within the gasification facility.

The residual waste following pre-treatment is discharged into a conveyor which discharges the RDF into an above ground bunker. This has a storage capacity of approximately four days. The RDF is be transferred by conveyor to the gasifier metering bin.

The waste feed automatically shutdowns if a high temperature is detected in the plug screw feeder or high pressure detected in the gasifier as required to comply with the requirements of the IED.

2.1.4.4 Waste to be Processed in the Anaerobic Digester

The Anaerobic Digestion plant processes wastes with European Waste Catalogue Codes. The list of wastes presented in the table below have been selected as the Anaerobic Digestion process is regarded as being appropriate for treatment for these waste types.

Table 6: Waste to Be Processed through Anaerobic Digestion

EWC Code	Description of Waste
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 01	sludges from washing and cleaning
02 01 02	animal-tissue waste
02 01 03	plant-tissue waste
02 01 06	animal faeces, urine and manure (including spoiled straw), effluent, collected separately and treated off-site
02 01 07	wastes from forestry
02 01 99	residues from commercial mushroom cultivation
02 02	*wastes from the preparation and processing of meat, fish and other foods of animal origin*
02 02 01	sludges from washing and cleaning – process water, – food washing waste
02 02 02	animal tissue waste – Category 3 ABP including blood, animal flesh, fish processing waste, fish carcasses, poultry waste
02 02 03	materials unsuitable for consumption or processing
02 02 04	sludges from on-site effluent treatment

EWC Code	Description of Waste
02 02 99	non specified* – sludges from gelatine production – animal gut contents
02 03	*wastes from fruit, vegetables, cereals, edible oils, cocoa, coffee, tea and tobacco preparation and processing; conserve production; yeast and yeast extract production, molasses preparation and fermentation*
02 03 02	sludges from washing, cleaning peeling, centrifuging and separation – coffee, mushroom compost, food processing waste, food washing waste, tobacco
02 03 04	biodegradable materials unsuitable for consumption or processing (other than those containing dangerous substances)
02 03 05	effluent from the processes referred to in sources of waste
02 03 99	non specified* – sludge from production of edible fats and oils – seasoning residues, molasses residues – residues from production of potato, corn or rice starch
02 04	*wastes from sugar processing*
02 04 03	sludges from on-site effluent treatment – biological sludge
02 04 99	*other biodegradable wastes*
02 05	*wastes from the dairy products industry*
02 05 01	biodegradable materials unsuitable for consumption or processing (other than those containing dangerous substances) – solid and liquid dairy products, milk, food processing wastes, yoghurt, whey
02 05 02	sludges from on-site effluent treatment
02 06	*wastes from the baking and confectionery industry*
02 06 01	materials unsuitable for consumption or processing
02 06 03	sludges from on-site effluent treatment
02 07	*wastes from the production of alcoholic and non-alcoholic beverages (except coffee, tea and cocoa)*
02 07 01	wastes from washing, cleaning and mechanical reduction of raw materials
02 07 02	wastes from spirits distillation
02 07 04	materials unsuitable for consumption or processing
02 07 99	spent grains, hops and whisky filter sheets/ cloths.
03	WASTES FROM WOOD PROCESSING AND THE PRODUCTION OF PANELS AND FURNITURE, PULP, PAPER AND CARDBOARD
03 03	*wastes from pulp, paper and cardboard production and processing*
03 03 02	green liquor sludge (from recovery of cooking liquor)
03 03 08	wastes from sorting of paper and cardboard destined for recycling
03 03 10	fibre rejects, fibre-, filler- and coating-sludges from mechanical separation
04	WASTES FROM THE LEATHER, FUR AND TEXTILE INDUSTRIES
04 01	*wastes from the leather and fur industry*
04 01 01	fleshings and lime split wastes
04 01 05	tanning liquor free of chromium
04 01 07	sludges, in particular from on-site effluent treatment free of chromium

EWC Code	Description of Waste
04 02	waste from the textile industry
04 02 01	organic matter from natural products, e.g. grease, wax
07	WASTES FROM ORGANIC CHEMICAL PROCESSES
07 02	wastes from the manufacture, formulation, supply and use of plastics, synthetic rubber and man-made fibres
07 02 13	waste plastic - must conform to BS EN 13432
19	WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE
19 05	wastes from aerobic treatment of solid wastes
19 05 01	non-composted fraction of municipal and similar wastes
19 05 02	non-composted fraction of animal and vegetable waste
19 05 03	off-specification compost
19 06	wastes from anaerobic treatment of waste
19 06 03	liquor from anaerobic treatment of municipal waste
19 06 04	digestate from anaerobic treatment of municipal waste
19 06 05	liquor from anaerobic treatment of animal and vegetable waste
19 06 06	digestate from anaerobic treatment of animal and vegetable waste
20	MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS
20 01	*separately collected fractions (except 15 01)*
20 01 08	biodegradable kitchen and canteen waste
20 01 25	edible oil and fat
20 01 38	wood other than that mentioned in 20 01 37
20 02	*garden and park wastes (including cemetery waste)*
20 02 01	biodegradable waste
20 03	*other municipal wastes*
20 03 01	mixed municipal waste – separately collected biowastes
20 03 02	wastes from markets - markets – allowed only if source segregated biodegradable fractions e.g plant material, fruit and vegetable

2.1.4.5 Anaerobic Digestor - Waste Handling

Residual food waste from municipal and C&I sources is delivered from the local area in suitable Collection Vehicles and by Bulk Transfer Vehicles. The AD Plant treats 40,000 tonnes per annum of food waste.

Checks are made on the paperwork accompanying each delivery to ensure that only waste for which the plant has been designed are accepted.

For waste delivered in suitable Collection Vehicles from the daily household waste collection rounds and bulk transfer vehicles from transfer stations, it is not practical to inspect this waste before it is tipped into the waste storage area, since it is compressed in the vehicles. The waste is observed by the tipping hall operator as it is tipped and by the front end loader as it is mixed. Unacceptable waste is removed from the waste storage for further inspection and quarantine.

Commercial and industrial waste is routinely spot checked, and any unacceptable waste is rejected and stored in a designated area in the tipping hall with contained drainage. The Environmental Management System (EMS) includes procedures to control the inspection, storage and onward disposal of unacceptable waste. Certain wastes require specific action for safe storage and handling. The EMS includes procedures for controlling the blending of waste types to avoid mixing of incompatible wastes.

The Charlton Lane installation has procedures for pre-acceptance and acceptance procedures for waste, waste storage, and specific activities for waste treatment.

The revised procedures comply with the Indicative BAT requirements in the Sector Guidance Note, including:

- Maintaining a high standard of housekeeping in all areas and provide and maintaining suitable equipment to clean up spilled materials.
- Loading and unloading of vehicles in designated areas provided with impermeable hard standing. These areas have appropriate falls to the process water drainage system.
- Fire fighting measures are designed by consultation with the Local Fire Officers, with particular attention paid to the waste storage area.
- Delivery and reception of waste is controlled by a management system that identifies all risks associated with the reception of waste and shall comply with all legislative requirements, including statutory documentation.
- Incoming waste is:
  - delivered in covered vehicles or containers; and
  - unloaded into the enclosed reception area.
- Design of equipment, buildings and handling procedures ensures there is insignificant dispersal of litter.
- Inspection procedures are employed to ensure that any wastes which would prevent the anaerobic digestion process from operating in compliance with its permit are segregated and placed in a designated storage area pending removal.
- Further inspection takes place by the plant operatives during vehicle tipping and waste mixing.
- To minimise odour:
  - self-closing doors are provided for any potentially odorous indoor areas.
  - waste is stored inside the anaerobic digestion building to prevent odour release.
  - during shutdown, the doors limit odour spread while still allowing vehicle access. Misting sprays can be used to reduce odour from the waste storage area. The plant employs waste storage management procedures and good mixing to avoid the development of anaerobic conditions.
  - procedures are in place to divert waste away from the site during shut downs if odour management is not effective.

2.1.4.6 Waste to be Received in the Waste Operations

The Waste Operations (Community Recycling Centre, Recyclables Bulking Facility and Road Sweeping Bulking Facility) process/receive wastes with following European Waste Catalogue Codes.

Table 7: Waste to be received at the Community Recycling Centre and Recyclables Bulking Facility

EWC Code	Description of Waste
03	WASTES FROM WOOD PROCESSING AND THE PRODUCTION OF PANELS AND FURNITURE, PULP, PAPER AND CARDBOARD
03 01	Wastes from wood processing and the production of panels and furniture
03 01 01	waste bark and cork
03 01 05	sawdust, shavings, cuttings, wood, particle board and veneer other than those mentioned in 03 01 04
09	WASTES FROM THE PHOTOGRAPHIC INDUSTRY
09 01	Wastes from the photographic industry
09 01 11*	single-use cameras containing batteries included in 16 06 01, 16 06 02 or 16 06 03
09 01 12	single-use cameras containing batteries other than those mentioned in 09 01 11
13	OIL WASTES AND WASTES OF LIQUID FUELS
13 02	Waste engine, gear and lubricating oils
13 02 04*	mineral-based non chlorinated engine, gear and lubricating oils
13 02 05*	mineral-based non chlorinated engine, gear and lubricating oils
13 02 06*	synthetic engine, gear and lubricating oils
13 02 07*	readily biodegradable engine, gear and lubricating oils
13 02 08*	other engine, gear and lubricating oil
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 01	paper and cardboard packaging
15 01 02	plastic packaging
15 01 03	wooden packaging
15 01 04	metallic packaging
15 01 05	composite packaging
15 01 06	mixed packaging (packaging waste associated with incoming weee only)
15 01 07	glass packaging
15 01 09	textile 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 03	end-of-life-tyres
16 01 07*	oil filters
16 02	Wastes from electrical and electronic equipment

EWC Code	Description of Waste
16 02 09*	transformers and capacitors containing pcbs
16 02 10*	discarded equipment capacitors containing or contaminated by pcbs other than those mentioned in 16 02 09
16 02 11*	discarded equipment capacitors containing chlorofluorocarbons, hcfc, hfc
16 02 12*	discarded equipment capacitors containing free asbestos
16 02 13*	discarded equipment containing hazardous components other than those mentioned in 16 02 09 to 16 02 12
16 02 14	discarded equipment other than those mentioned in 16 02 09 to 16 02 13
16 02 15*	hazardous components removed from discarded equipment
16 02 16	components removed from discarded equipment other than those mentioned in 16 02 15
16 05	gases in pressure containers and discarded chemicals
16 05 05	gases in pressure containers other than those mentioned in 16 05 04
16 06	Batteries and accumulators
16 06 01*	lead acid
16 06 02*	Ni-Cd batteries
16 06 03*	mercury-containing batteries
16 06 04	alkaline batteries (except 16 06 03)
16 06 05	other batteries and accumulators
17	CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)
17 01	Concrete, bricks, tiles and ceramics
17 01 01	concrete
17 01 02	bricks
17 01 03	tiles and ceramics
17 01 07	mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06
17 02	Wood, glass and plastic
17 02 01	wood
17 02 02	glass
17 02 03	plastic
17 04	Metals (including their alloys)
17 04 01	copper, bronze, brass
17 04 02	aluminium
17 04 03	lead
17 04 04	zinc
17 04 05	iron and steel
17 04 06	tin

EWC Code	Description of Waste
17 04 07	mixed metals
17 04 11	cables other than those mentioned in 17 04 10
17 05	Soil (including excavated soil from contaminated sites), stones and dredging spoil
17 05 04	soil and stones other than those mentioned in 17 05 03
17 05 06	dredging spoil other than those mentioned in 17 05 05
17 06	Insulation materials and asbestos-containing construction materials
17 06 04	insulation materials other than those mentioned in 17 06 01 and 17 06 03
17 06 05*	construction materials containing asbestos
17 08	Gypsum-based construction material
17 08 02	gypsum-based construction materials other than those mentioned in 17 08 01
17 09	Other construction and demolition wastes
17 09 04	mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03
19	WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION/INDUSTRIAL USE
19 12	Wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified
19 12 01	paper and cardboard
19 12 02	ferrous metal
19 12 03	non-ferrous metal
19 12 04	plastic and rubber
19 12 05	glass
19 12 07	wood other than that mentioned in 19 12 06
19 12 09	minerals (for example sand, stones)
19 12 12	other wastes (including mixture of materials) from mechanical treatment of waste other than those mentioned in 19 12 11
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 01	paper and cardboard
20 01 02	glass
20 01 08	biodegradable kitchen and canteen waste
20 01 10	clothes
20 01 11	textiles
20 01 13*	solvent

EWC Code	Description of Waste
20 01 14*	acids
20 01 15*	alkalines
20 01 17*	photochemicals
20 01 19*	pesticides
20 01 21*	fluorescent tubes and other mercury containing waste
20 01 23*	discarded equipment containing chlorofluorocarbons
20 01 25	edible oil and fat
20 01 26*	oil and fat other than those mentioned in 20 01 25
20 01 27*	paint, inks, adhesives and resins containing dangerous substances
20 01 28	paint, inks, adhesives and resins other than those mentioned in 20 01 27
20 01 29*	detergents containing dangerous substances
20 01 30	detergents other than those mentioned in 20 01 29
20 01 33*	batteries and accumulators included in 16 06 01, 16 06 02 or 16 06 03 and unsorted batteries and accumulators containing these batteries
20 01 34	batteries and accumulators other than those mentioned in 20 01 33
20 01 35*	discarded electrical and electronic equipment other than those mentioned in 20 01 21 and 20 01 23 containing hazardous components
20 01 36	discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35
20 01 37*	wood containing dangerous substances
20 01 38	wood other than that mentioned in 20 01 37
20 01 39	plastics
20 01 40	metals
20 01 41	wastes from chimney sweeping
20 02	Garden and park wastes (including cemetery waste)
20 02 01	biodegradable waste
20 02 02	soil and stones
20 02 03	other non-biodegradable wastes
20 03	Other municipal wastes
20 03 01	mixed municipal waste
20 03 02	waste from markets
20 03 03	street-cleaning residues
20 03 07	bulky waste

Table 8: Wastes to be received at the Road Sweeping Bulking Facility

EWC Code	Description of Waste
20	MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS
20 03	Other municipal wastes
20 03 03	street-cleaning residues

2.1.4.7 Waste Operations - Waste Handling

The Charlton Lane installation has procedures for pre-acceptance and acceptance procedures for waste, waste storage and specific activities for waste treatment.

2.1.5 Waste Minimisation Audit (Minimising the Use of Raw Materials)

A number of specific techniques are employed to minimise the production of residues. All of these techniques meet the Indicative BAT requirements from the Sector Guidance Note on Waste Incineration.

2.1.5.1 Gasification Plant Waste Minimisation

Feedstock Homogeneity

Fluidised beds operate better with a homogeneous feedstock. The pre-treatment of the incoming waste ensures that a homogeneous feedstock is delivered to the fluidised bed.

Preventing Agglomeration and Clinkering

Any inert material introduced with the fuel, such as stones or metals not removed in the pre-treatment process, can lead to occasional agglomeration and clinkering of a portion of the bed media. This can result in temperature and pressure fluctuations across the bed culminating in de-fluidisation of the bed.

The bed recycle system enables the continuous operation of the fluidised bed process while removing inert material from the bed, reducing downtime, labour and bed media usage.

The bed material, inerts and clinkers are discharged onto a common vibrating screen conveyor. The vibrating screen incorporates a perforated plate to separate inerts and clinkers from the reusable bed material.

The vibrating screen discharges the bed material into the bucket elevator whilst the inerts and clinkers are discharged into a skip for disposal.

The bucket elevator lifts the clean bed material above the active bed for reinjection, thereby maintaining a constant level of bed material in the vessel. A hopper is incorporated into the system near ground level to facilitate manual makeup of the bed material.

Fluidised Bed Material Maintenance

A bed material storage silo is provided to store and automate bed material handling for the fluidised bed system. Bed material is diverted from the bucket elevator discharge to the storage silo by a pneumatically operated valve. This allows the vessel to be emptied for inspection or maintenance purposes and also permits the automated refill and makeup to maintain the proper vessel bed material inventory during operation.

Gasification Zone Conditions

Gasification Zone conditions are optimised in order to minimise the quantity of residues arising for further disposal. Burnout in the chamber reduces the TOC content of the bottom ash to less than 3% by optimising waste feed rate and combustion air flows.

Dioxin Controls

As identified within the Environment Agency sector guidance for the Incineration of Waste EPR5.01, there are a number of BAT design considerations required for the boiler. The boiler has been designed to minimise the formation of dioxins and furans as follows:

- Slow rates of combustion gas cooling are avoided via boiler design to ensure the residence time is minimised in the critical cooling section and avoid slow rates of combustion gas cooling to minimise the potential for *de-novo* formation of dioxins and furans.
- The gas residence time in the critical temperature range are minimised by ensuring high gas velocities exist in these sections.
- The boiler design includes the following design features for minimisation of dioxins:

The plant design has focused on ensuring wherever possible that dioxin control is achieved though design prevention as opposed to subsequent abatement.

Transfer surfaces are above the minimum of 170 °C subject to other reaction considerations.

Computational Fluidised Dynamics (CFD) has been applied to the design to demonstrate that gas velocities are in a range that negates the formation of stagnant pockets / low velocities.

Minimising the volume access in the critical cooling sections ensures high gas velocities.

Boundary layers of slow moving gas are prevented along boiler surfaces via design and a regular maintenance schedule to remove the build-up of any deposits that may have occurred.

Flue Gas Treatment Control

Close control of the flue gas treatment system minimises the use of reagents and hence minimise the residues produced. The locations of the urea injection system have been optimised to maximise NOx abatement.

The plant preventative maintenance regime includes regular checks and calibration of the lime dosing system to ensure optimum operation. Back-up feed systems are provided to ensure that there is no interruption in the lime dosing. The bag filter is designed to build up a filter cake of unreacted lime, which acts as a buffer during any minor interruptions in dosing.

2.1.5.2 Anaerobic Digestion Plant Waste Minimisation

Feed composition

A high separation efficiency is achieved in the mechanical treatment process so that the feed to the digester is high in biodegradable content which minimises the generation of digestate sludge. By separating out the non-biodegradable content, it increases the agricultural value of the digestate.

Feed homogeneity

Good mixing of the feed with the digestate before entering the digester ensures the waste is fully inoculated with bacteria, which improves the rate of digestion and minimise sludge production.

Residence time

The waste feed and sludge extraction rates for the anaerobic digesters are controlled so that the residence time of slurry within the digester is at least 20 days. This optimises biogas production from the waste.

Digester conditions

The digester is operated with a high solids content which reduces the volume of sludge produced as less water is contained in the sludge. The digester is controlled to operate under optimal conditions for bacterial growth to ensure the waste is fully digested and therefore less sludge is produced.

Washdown Water Use

To ensure the efficient use of wash down water to reduce water discharges from the remainder of the site, SUEZ would propose to adopt water minimisation techniques for cleaning and washing down which include:

- Vacuuming, scraping, or mopping in preference to hosing down; and
- Use of trigger controls on all hoses and washing equipment.

As stated within section 1.6.3, wash down facilities are provided within the Anaerobic Digestion Reception Hall to clean the floor at the end of each shift. This washdown water is transferred to the buffer tank and treated within the AD process.

Wash down water is not expected to be re-used nor is it expected to be a significant water consumption activity. It is estimated that the quantity of water used for washing down is approximately 0.01 m^3/hr, or 0.6% of the total annual water usage for the Eco Park.

2.1.5.3 CHP Plant and Flare Waste Minimisation

Periodic maintenance is undertaken on the CHP Plant and Flare to ensure that they are operating appropriately.

2.1.6 Water Use

2.1.6.1 Overview

The main uses of water at the plant are to make-up the water for the boiler and dilute food waste into the AD. The following key points should be noted:

- The water system has been designed with the key objective of minimal consumption of potable water.
- Most of the steam produced is recycled as condensate. The remainder is lost as blowdown to prevent build-up of sludge and chemicals.
- Lost condensate is replaced with demineralised water.
- All waste water from the process is exported to sewer via a Trade Effluent Consent issued by Thames Water.
- The facility has completely separate foul sewer systems and storm water systems (surface drainage).

2.1.6.2 Potable and Amenity Water

Water for supplies for the offices and mess facilities come from a potable water supply. The quantity of this water is small compared to the other water uses on site.

Rainwater is harvested from the process building roofs and collected in the process water tank for use within the waste treatment activities at the Facility.

Wastewater from the administration areas is sent to the sewer currently serving the site for the existing operations.

2.1.6.3 Gasification Unit Process Water

The primary requirement of water is to maintain the water level in the boiler system (steam cycle). Water would be primarily sourced from mains water but rainwater harvesting is also used to supply water to the process.

Water usage is further minimised by the use of trigger controls on all wash hoses.

Mains water is treated in a reverse osmosis plant (located on the plant and covered by this EP application) to produce quality feed water for the boilers. This type of system has a number of advantages over an ion-exchange demineralised water plant and is considered to represent BAT:

- regeneration is continuous so that de-ionised water is always available;
- there is no acid / alkali chemical dosing, meaning that there are no storage and handling issues associated with the storage of reagents; and
- there is no requirement to treat the bed regeneration water in an effluent treatment plant prior to discharge to drain - the membrane reject water can be used as grey water for washdown.

Liquid effluents from boiler water blowdown and effluents from the boiler water treatment process is fed to below ground sewers. The discharge from the Gasification facility is discharged via the mains sewer under a Trade Effluent Discharge Consent (Ref: Annex 5). These effluents comply with the emission limits presented in the discharge consent.

2.1.6.4 Anaerobic Digestion Unit Process Water

Material delivered to the waste reception hall has a dry matter concentration of (typically) 20% - 40% by weight; the anaerobic digesters operate with a feed solids concentration of 10% by weight.

To achieve this, liquid extracted during the final dewatering process (liquors) is recycled to the turbodissolvers and mixed with the raw material to achieve 10% concentration. Additional recycled water may be added at this stage depending on the concentration of inorganic salts in the recycled liquor.

2.2 Emissions

2.2.1 Emissions to Air

There are seven point source emission points for emissions to air.

The emission points to air which are applicable to the facility are presented in the table below:

Proposed Emission Points

Emission Point Reference	Source
A1	Gasification Facility
A4	CHP Gas Engine 1
A5	CHP Gas Engine 2
A6	Flare
A7	Odour control system flue 1
A8	Odour control system flue 2
A9	MBR Aeration tank vent

The full list of proposed emission limits for atmospheric emissions is shown in the table below. This includes the information requested in Table 2 of Application Form Part B3.

Proposed Emission Limits Values (ELV's)

Parameter	Units	Half Hour Average	Daily Average	Periodic Limit	10-minute Average
Gasification Plant A1 [1]					
Particulate matter	mg/Nm^3	30	10	-	-
VOCs as Total Organic Carbon (TOC)	mg/Nm^3	20	10	-	-
Hydrogen chloride	mg/Nm^3	60	10	-	-
Carbon monoxide	mg/Nm^3	100	50	-	150
Sulphur dioxide	mg/Nm^3	200	50	-	-
Oxides of nitrogen (NO and NO_2 expressed as NO_2)	mg/Nm^3	400	100	-	-
Hydrogen fluoride	mg/Nm^3	-	-	2	-
Cadmium & thallium and their compounds (total)	mg/Nm^3	-	-	0.05	-
Mercury and its compounds	mg/Nm^3	-	-	0.05	-
Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds (total)	mg/Nm^3	-	-	0.5	-
Dioxins & furans ITEQ	ng/Nm^3	-	-	0.1	-
CHP Plant - A4 and A5 [2]					
Oxides of nitrogen (NO and NO_2 expressed as NO_2)	mg/Nm^3	-	-	300	-
Carbon monoxide	mg/Nm^3	-	-	1400	-

Parameter	Units	Half Hour Average	Daily Average	Periodic Limit	10-minute Average
Sulphur dioxide	mg/Nm^3	-	-	350	-
Total VOC's	mg/Nm^3	-	-	1000	-
Flare - A6 [3]					
Oxides of nitrogen (NO and NO_2 expressed as NO_2)	mg/Nm^3	-	-	150	-
Carbon monoxide	mg/Nm^3	-	-	50	-
Sulphur dioxide	mg/Nm^3	-	-	395	-
Total VOC's	mg/Nm^3	-	-	10	-
Note: 1. Emission limits are the expressed with a concentration in dry air at a temperature of 273K, at a pressure of 101.3 kPa and with an oxygen content of 11% dry. 2. Emission limits are the expressed with a concentration in dry air at a temperature of 273K, at a pressure of 101.3 kPa and with an oxygen content of 5% dry. 3. Emission limits are the expressed with a concentration in dry air at a temperature of 273K, at a pressure of 101.3 kPa and with an oxygen content of 3% dry.					

2.2.2 Fugitive Emissions to Air

Gasification

Odour and dust is controlled by draught fans located in the reception hall that extract air for use within the gasification process; this results in a slight negative pressure within the tipping hall preventing odours, dust or litter from escaping the building.

The Gasification building contains a dust suppression system, consisting of a sprinkler type system which emits a very fine spray to suppress dust. Additives can be incorporated into the spray to mitigate odours.

Anaerobic Digestion Process Building

Access to the reception area is via fast acting doors operated by staff within the AD facility. Delivery vehicles reverse into the reception area and the doors remain closed whilst waste is deposited. Odours are treated in situ by an ionised air system, which maintains the enclosed waste reception building under positive pressure with potentially odorous compounds being destroyed within the building.

Air extracted from the Anaerobic Digestion Process Building and Gasification Building is pressurised before being passed through a carbon filter system contained within the Odour Control Facility. The carbon filters remove odours and particulate elements ensuring dust and odour are not released into the surrounding atmosphere. Having passed through the carbon filters the treated air would be discharged to the atmosphere the main stack (emission points A7 and A8).

The exhaust gases from the MBR Aeration tank are discharged to atmosphere via a vent at the top of the tank (emission point A9).

Biogas Handling

The gasholder is a safety device acting as a volume buffer to the digester and hydrolysis tank. When liquid is pumped out of the digestate tanks the gasholder provides biogas to replace the lost volume hence maintaining system pressure. Similarly when biogas is produced within the digester tanks the gasholder acts as a storage volume for this gas, hence preventing an increase in gas pressure.

2.2.3 Emissions to Water

There are no process emissions to water from the Facility.

Surface water run-off is discharged to groundwater through an infiltration basin which drains into the Thames Gravels. The infiltration basin includes for a pumping system and buried drainage pipe to allow for excess water to be discharged from the infiltration basin to the Charlton Lane swale. The pumped system allows water to be discharged at a maximum rate of 5 litres / second. There is a cut off device installed in an overflow chamber adjacent to the swale to ensure that flooding does not occur in the event of a blockage of the swale. The swale is located immediately south of the "old" Charlton Lane, which runs immediately outside the site entrance.

Petrol/oil separators and catch pits are incorporated into the drainage design to limit siltation within the system and hence the infiltration basin.

2.2.4 Emissions to Sewer

Under normal operation the following effluent streams are discharged to sewer:

- Liquor from the AD facility;
- Boiler blowdown and other liquid effluent from the Gasification Plant;
- Wastewaters from the demineralisation water treatment plant;
- Wash down waters from operational areas.

Emissions to sewer are regulated though an existing Trade Effluent Consent issued by Thames Water. A Trade Effluent Consent was granted by Thames Water on the 7 March 2013, and was subsequently varied on 12 June 2019 to reflect a change in the SUEZ company name . This includes emission concentrations for the installation as presented in the following table.

Table 9: Emissions Parameters for Discharges to Sewer

Parameter	Units	Daily Average
pH		6 to 11
Temperature	°C	43.3
Maximum volume	m^3/day	400
Maximum volume	m^3/hour	50
Maximum volume	l/second	13.89
Suspended Solids	mg/l	500
COD	mg/l	2000
Saponifiable Material	mg/l	300
Unsaponifiable Material	mg/l	50
Sulphide	mg/l	1
Ammoniacal Nitrogen	mg/l	70

Parameter	Units	Daily Average
Sulphate	mg/l	1800
Settleable Solids	mg/l	500
Total Phosphorus	mg/l	13
Rapidly Settleable Solids	mg/l	100

2.2.5 Contaminated water

The gasification facility is supplied with fuel oil on an as needs basis with no provision for other flammable fuels except propane gas in bottles. All chemicals are stored in an appropriate manner incorporating the use of bunding and other measures (such as acid and alkali resistant coatings) to ensure appropriate containment. The potential for accidents, and associated environmental impacts, is therefore limited.

Adequate quantities of spillage absorbent materials are made available onsite, at an easily accessible location(s), where liquids are stored. A site drainage plan, including the locations of foul and surface water drains and interceptors are made available onsite, where practicable.

The fuel oil storage tank is located in a bunded area and include an interceptor pit and inspection facility. The tank includes level indicators and an overfilling protection level switch which close the motorised valves in the filling line. The filling of the tank is carried out by road tanker. The tanker hose coupling is also located in a bunded area.

In the event of a fire, all fire water is collected in the site drainage system. The drainage system is be fitted with an emergency shut-off, which automatically shutdown the drainage pumping system in the event of a fire alarm. This prevents any water discharges from leaving the installation. In accordance with the requirements of the EA's FPP Guidance, if required by the EA, SUEZ will implement an approved FPP which complies with the EA's requirements.

All spillages, no matter how minor, are reported to site management and a record of the incident is made. The relevant authorities (EA/Health and Safety Executive) are informed if spillages/leaks are significant.

The effectiveness of the Emergency Plan for spillages is subject to Management Review and are reviewed following any major spillages and revised as appropriate.

2.3 Monitoring Methods

2.3.1 Emissions Monitoring

Sampling and analysis of all pollutants including dioxins and furans is carried out to CEN or equivalent standards (e.g. ISO, national, or international standards). This ensures the provision of data of an equivalent scientific quality.

The plant is equipped with modern monitoring and data logging devices to enable checks to be made of process efficiency.

The purpose of monitoring has three main objectives.

1. To provide the information necessary for efficient and safe plant operation;
2. To warn the operator if any emissions deviate from predefined ranges; and

3. To provide records of emissions and events for the purposes of demonstrating regulatory compliance.

2.3.1.1 Monitoring Emissions to Air

Gasification Process

The following parameters are monitored and recorded continuously using a Continuous Emissions Monitoring Systems (CEMS):

- dust;
- sulphur dioxide;
- hydrogen chloride;
- carbon monoxide;
- carbon dioxide;
- ammonia;
- nitrogen oxides (NO & NO2);
- TOCs;
- water vapour;
- oxygen;
- temperature;
- pressure; and
- mass flowrate.

A facility is provided to enable flue gas samples to be extracted on a batch basis to enable testing for contaminants that are not continuously monitored, such as HF.

A duplicate CEMS is provided, with one system on-line and the second system in hot standby. In the event of problems with the on-line system, the other system switches online to ensure that monitoring of emissions continues. The system is protected by a dedicated un-interruptible power supply. System hardware, data loggers and analysers are contained in a GRP air-conditioned shelter. The system is MCERTS approved.

The methods and standards used for emissions monitoring are in compliance with guidance note EPR 5.01 and the IED. In particular, the CEMS equipment is certified to the MCERTS standard and has certified ranges which are no greater than 1.5 times the relevant daily average emission limit.

Emissions are monitored using the following CEMS systems:

- HCl, CO, SO_2, NOx (NO+ NO_2) and NH_3 is measured by an FTIR type multi-gas analyser;
- VOC is measured by a FID type analyser;
- Particulate matter is measured by an opacimeter; and
- O_2 is monitored by a zirconium probe.

The frequency of periodic measurements complies with the IED as a minimum. The flue gas sampling techniques and the sampling platform comply with Environment Agency Technical Guidance Notes M1 and M2.

Reliability

Annex 6, Part 8 of the IED allows a valid daily average to be obtained only if no more than 5 half-hourly averages during the day are discarded due to malfunction or maintenance of the continuous measurement system. The IED also requires that no more than 10 daily averages are discarded per year.

These reliability requirements have been met by selecting MCERTS certified equipment.

Calibration is carried out at regular intervals as recommended by the manufacturer and by the requirements of BS EN14181. Regular servicing and maintenance is carried out under a service contract with the equipment supplier. The CEMs is supplied with remote access to allow service engineers to provide remote diagnostics.

There is one CEMS and one stand-by CEMS in 'hot stand-by', if required. The back-up system ensures that there is continuous monitoring data available even if there is a problem with the duty CEMS systems. The system is protected by a dedicated un-interruptible power supply.

Start-up and Shutdown

The emission limit values under the IED do not apply during start-up and shutdown. Therefore, a signal would be sent from the main plant control system to the CEMS package to indicate when the plant is operational and thermally processing waste. The averages would only be calculated when this signal was sent, but raw monitoring data would be retained for inspection.

Start-up ends when all the following conditions are met:

- The oxidation zone of the gasification chamber is up to operational temperature (850°C)
- Exhaust gas O_2 is less than 15% (wet measurement); and
- RDF Feed Plug Screw slide valve is open.

Shutdown begins when any of the following conditions are met

- RDF Feed Plug Screw slide valve is closed The oxidation zone of the gasification chamber operational temperature drops below 850°C
- Exhaust gas O_2 is equal to or above 15% (wet measurement).

CHP engine

The Environment Agency Standard Rules Permit - SR2010No15 – sets a standard requirement for annual monitoring for the following pollutants:

- Oxides of nitrogen (NO and NO_2 expressed as NO_2)[2]
- Carbon monoxide
- Sulphur dioxide
- Total volatile organic compounds including methane

It is proposed to undertake periodic monitoring of emissions to air for the pollutants listed above, as per the standard rules permit. However, it is proposed for the first year of operation to undertake the monitoring on a quarterly basis. This would be reviewed after the first year of operation and changed to annual as per the Standard Rules Permit - SR2010No15.

The flue gas sampling techniques and the sampling platform complies with Environment Agency Technical Guidance Notes M1 and M2.

Flare

The Environmental Permit includes emission limits for the flare. As stated in the permit, periodic monitoring is '*required only if the flare operates from more than 876 hours in the year*'.

2.3.1.2 Monitoring Emissions to Land

Disposal of residues to land complies with all relevant legislation. In particular the bottom ash complies with the IED criterion of Loss on Ignition less than 5%. Compliance with the LOI criterion has been demonstrated during commissioning and is checked at periodic intervals in accordance with the requirements of the EP. Testing for LOI is conducted by an independent laboratory.

2.3.1.3 Monitoring Emissions to Water

There are no process water discharge to water.

2.3.1.4 Monitoring Emissions to Sewer

There is a Trade Effluent Consent in place, which includes sampling and monitoring requirements, refer to Annex 5.

2.3.2 Monitoring of Process Variables

2.3.2.1 Monitoring of Process Variables – Gasification

The following process variables have particular potential to influence emissions:

- Waste throughput is recorded to enable comparison with the design throughput. As a minimum, daily and annual throughput is recorded;
- Combustion temperature is monitored at a suitable position to demonstrate compliance with the requirement for a residence time of 2 seconds at a temperature of at least 850°C;
- The oxygen concentration is measured at the outlet from the boiler; and,
- The differential pressure across the bag filters is measured, in order to optimise the performance of the cleaning system and to detect bag failures.

Additionally, water use is monitored and recorded regularly at various points throughout the process to help highlight any abnormal usage. This is achieved by monitoring the incoming mains water, the demineralised water plant, and the boiler water makeup.

2.3.2.2 Monitoring of Process Variables – Anaerobic Digestion

The volumetric flow through the anaerobic digestion process is monitored via a flow-meter located on the slurry feed line to the digesters.

Within the treatment stages of the anaerobic digestion process there is monitoring of various elements of the process:

Front End Facility:

- Flow-meter on turbo-dissolvers recycled water feed pipe work;
- Flow-meter on turbo-dissolvers potable water feed pipe work; and,
- Level transmitter on turbo-dissolvers.

Hydrolysis / Buffer Tank:

- Level transmitter on buffer tank feed sump; and,
- Level transmitter on hydrolysis/ buffer tank.

Pasteurisation Plant:

- Pressure transmitter on hydrolysis/ buffer tank
- Temperature transmitters on pasteurisation plant heat exchanger units
- Temperature transmitters (triple validation on each tank) on pasteurisation tanks
- Flow-meter on digesters feed line

Anaerobic Digesters:

- Temperature transmitters on digester heat exchanger;
- Level transmitter on digester tanks;
- Pressure transmitter on digester tanks;
- Temperature transmitter on digester tanks;
- Gas flow-meter on digester off take gas pipe work;
- Gas flow-meter on gas boosters and CHP feed line;
- Gas holder standard instrumentation (level transmitter + CH4 detector); and,
- Gas flow-meter on flare stack feed line.

Liquor Treatment Plant:

- Pressure transmitter on liquor treatment plant chemical storage tank;
- Level transmitter on liquor treatment plant chemical storage tank bund;
- Level transmitter on liquor treatment plant tank; and,
- pH & DO on liquor treatment plant tank.

Dewatering:

- Flow-meter on dewatering feed line.

2.4 Technology Selection

2.4.1 Combustion Technology

2.4.1.1 Introduction and scope

This section lists and explores the alternatives considered by SUEZ when considering the appropriate technology to be employed at the installation.

As detailed in the original application, the selected technology for the treatment of waste at the Charlton Lane Eco Park is gasification. The aim of this assessment is to consider the different gasification technologies which are being marketed in the UK. These are as follows:

1. Gasification or pyrolysis with the syngas being cleaned and used to generate electricity in a gas engine or gas turbine. This is the technology which was proposed in the original EP application.
2. Close-coupled gasification or pyrolysis, where the waste is converted to a syngas by partial oxidation (gasification) or by the application of heat in the absence of oxygen (pyrolysis) and the resulting syngas is combusted in a secondary chamber with the hot flue gases used to provide energy for steam generation.
3. Plasma gasification, where a high temperature electric arc is either used to break down the waste into a syngas, or is used to break down the syngas from a conventional gasification plant. The resultant syngas is then used to generate electricity in a gas engine or gas turbine.

Each of these technologies is considered below.

2.4.1.2 Conventional Gasification and Pyrolysis

In gasification, the waste is heated in the presence of some air, but insufficient air to achieve full combustion. This leads to the production of a synthetic fuel gas, or syngas, which can then be used to generate electricity.

In pyrolysis, the waste is heated in the absence of air, leading to the production of a syngas with a higher calorific value than from gasification. However, the process normally requires some form of external heat source, which may be the combustion of part of the syngas.

The primary benefits which are claimed for gasification and pyrolysis are higher efficiency and lower emissions than conventional combustion and close-coupled gasification.

The higher efficiency is based on the use of gas engines or gas turbines, which are more efficient at generating electricity from syngas than a conventional steam turbine is at generating electricity from steam. However, the energy used to convert waste into syngas and to clean up the syngas so that it can be used in the gas engine tends to erode this advantage, so that the overall efficiency of a gasification or pyrolysis plant tends to be similar to the overall efficiency of a conventional combustion plant.

It is true that gasification plants operate well below the emission limits specified in the IED, but this is also true for close-coupled gasification.

While there are a number of suppliers offering various gasification and pyrolysis technologies in the UK, and while environmental permits have been granted for such plants, there is still limited operational experience. In particular, no developer of gasification and/or pyrolysis processes has yet managed successfully to demonstrate at a commercial scale the combination of municipal waste gasification or pyrolysis with a gas engine or gas turbine. This is because the gasification or pyrolysis process produces tars in the syngas, which need to be removed before the syngas can be used in a gas engine.

2.4.1.3 Close-coupled gasification

This is the technology which is being proposed for the Charlton Lane gasification facility. The advantage of this system is that it is based on more proven technology than the other gasification options, as there are a number of full-scale operational plant in Europe and North America and the combustion of syngas to generate steam is simpler than using syngas in a gas engine or turbine, as discussed in section 2.4.1.2.

The proposed plant achieves all of the requirements of the IED.

2.4.1.4 Plasma Gasification

Plasma gasification uses a high temperature electric arc furnace to break down the components of the waste feedstock into a residue which is presented as a vitrified solid and low molecular weight gases. This produces a fuel gas which then has to be cleaned of sulphur and chlorine gases but which contains very little condensable tars. It is these condensable tars which have proved difficult to deal with in attempts to produce a synthetic gas from waste suitable for use in a gas turbine or gas engine.

While the use of plasma gasification to make a syngas has been demonstrated in Japan and the USA, although not on municipal waste, the use of this syngas to generate electricity in a gas engine has not been demonstrated at commercial scale. In addition, the power consumption is very high, due to the use of high temperature and the need to make oxygen for the process.

An alternative approach is to use a fluidised bed gasifier to generate the fuel gas and then a plasma arc furnace to break down the gases into low molecular weight components. The electricity required within the process is therefore significantly less than that required by a straight plasma arc process, although the overall efficiency of the process remains similar to that of conventional combustion. However, this process has a limited capacity and is yet to be proven in commercial operation.

2.4.1.5 Selection of the preferred technology

Close-coupled gasification has been selected for this project because it is a more proven process which the applicant expects to offer a dependable long term waste management solution for the management of MSW from Surrey. The process complies with all legislative requirements.

2.4.2 NOx Reduction

NOx levels are controlled by a combination of primary (SNCR) and secondary (SCR) NOx abatement.

2.4.2.1 NOx Abatement

The SNCR system operates by injecting a reducing reagent, urea solution, into the gasifier, which reacts with NOx at temperatures between 900°C and 1000°C. The reaction breaks down the NOx into nitrogen gas and water vapour.

The urea solution is injected into the vapour space of the gasifier through an array of liquid atomising nozzles.

2.4.2.2 Conclusions

SNCR is a widely utilised NOx abatement technology for waste incineration and gasification facilities. For this installation, the use of SNCR is required to achieve the low emission limits for NOx to ensure that the impact on the local area is acceptable.

Taking the above into consideration, the proposed NOx abatement technology is considered to represent BAT.

2.4.2.3 Flue Gas Recirculation (FGR)

The installation employs flue gas recirculation. It is intrinsic to the design. The recirculation of a proportion of the flue gases into the gasification zone to modify the temperature and oxygen levels within the bed.

It is important to emphasise that FGR itself does not reduce NOx emissions to the levels required by IED and so it would not alleviate the need for secondary abatement, as detailed in section 2.4.2.4.

It is important to understand that FGR is not a bolt-on abatement technique. The recirculation of a proportion of the flue gases into the combustion chamber to replace some of the secondary air, changes the operation of the plant in various ways, by changing the temperature balance and increasing turbulence. This requires the boiler to be designed to ensure that the air distribution remains even. However, the gasification zone and boiler has been designed and optimised to use FGR in this case.

2.4.2.4 Conclusion

The proposed SNCR abatement system is considered to represent BAT for the Charlton Lane facility.

The system can achieve the required low concentrations of NOx to minimise the impact upon the AQMA, as demonstrated in the Air Quality Assessment, included in Annex 2.

2.4.3 Acid Gas Abatement System

It is recognised that there are currently three technologies widely available for acid gas treatment on municipal waste incineration plants in the UK:

1. Wet scrubbing, involving the mixing of the flue gases with an alkaline solution of sodium hydroxide or hydrated lime. This has a good abatement performance, but it consumes large quantities of water, produces large quantities of liquid effluent which require treatment and has high capital and operating costs. It is mainly used in the UK for hazardous waste incineration plants where high and varying levels of acid gases in the flue gases require the buffering capacity and additional abatement performance of a wet scrubbing system.
2. Semi-dry, involving the injection of urea solution into the flue gases in the form of a spray of fine droplets. The acid gases are absorbed into the aqueous phase on the surface of the droplets and react with the urea. The fine droplets evaporate as the flue gases pass through the system, cooling the gas. This means that less energy can be extracted from the flue gases in the boiler, making the steam cycle less efficient. The urea and reaction products are collected on a bag filter, where further reaction can take place.
3. Dry, involving the injection of dry lime into the flue gases as a powder. The lime is collected on a bag filter to form a cake and most of the reaction between the acid gases and the bicarbonate takes place as the flue gases pass through the filter cake. In its basic form, the dry system consumes more urea than the semi-dry system. However, this can be improved by recirculating the flue gas treatment residues, which contain some unreacted lime and reinjecting this into the flue gases.

As stated in the Environment Agency Guidance EPR 5.01, semi-dry and dry scrubbing systems are regarded as being appropriate for Municipal Waste Incinerators. Wet scrubbing techniques have therefore been excluded from this assessment.

The two systems abate the same mass of acid gas emissions and generate the same quantity of residues requiring disposal/recovery. The semi-dry system has a slightly higher global warming potential due to reduced power generation; however, it also has a lower annualised operating cost.

The semi-dry option benefits from medium reaction rates which mean that a shorter residence time is required in comparison with a dry system.

Due to the lower annualised operating cost and higher reaction rates for the abatement of acid gases, SUEZ considers that the semi-dry system is considered to represent BAT for the Facility.

2.4.4 Particulate Abatement

The installation uses a two stage system for the abatement of particulates:

- Primary Particulate Abatement consists of a multiclone; and
- Secondary Particulate Abatement consists of a multi-compartment fabric filter.

2.4.4.1 Primary Particulate Abatement

The installation employs a multiclone which acts as a primary particulate abatement system to reduce the level of particulates entering the selective catalytic reduction unit (see section 2.4.2). The multiclone dust collector comprising a bank of cyclone tubes and is located on the exit of the boiler. The inlet vanes of each tube imparts a rotating motion to the gas generating a centrifugal force that concentrates particles of entrained dust at the interior walls of the collecting tubes. The particles then fall and be discharged from the bottom of the tube. The clean gas exits through the outlet at the top of the collecting tube, whilst the fly ash drops into the hopper and is removed via a rotary valve airlock.

2.4.4.2 Secondary Particulate Control

The multi-compartment fabric filter is used to remove fly ash carried over from the combustion process; reaction products from the flue gas treatment system, along with excess lime and contaminated activated carbon.

During operation, the build-up of lime and activated carbon on the filter media enhances the overall performance of the flue gas system by providing residence time for the reagents to react with the acid gases and to improve the removal of heavy metals and dioxins.

2.4.4.3 Conclusions

There are a number of alternative technologies available for the abatement of particulates, but none offer the performance of the fabric filter:

1. Fabric filters are a proven technology and used in a wide range of applications. The use of fabric filters with multiple compartments allows individual bag filters to be isolated in case of individual bag filter failure.
2. Wet scrubbers are not capable of meeting the same emission limits as fabric filters.
3. Electrostatic precipitators are also not capable of abating particulates to the same level as fabric filters. They could be used to reduce the particulate loading on the fabric filters and so increase the acid gas reaction efficiency and reduce lime residue production, but the benefit is marginal and would not justify the additional expenditure, the consequent increase in power consumption and significant increase in the foot-print of the facility.
4. Ceramic Filters have not been proven for this type of plant and are regarded as being more suited to high temperature filtration.

The two stage system is considered to represent BAT. The fabric filters polish the flue gases prior to release to the environment to comply with the emission limits for particulates required by the IED.

2.4.5 Anaerobic Digestion

Slurry from the buffer tank feed sump is pumped to the hydrolysis buffer tank located to the north of the main AD process building. The hydrolysis buffer tank has a working volume of 1,500m^3 and constructed of glass coated steel.

The hydrolysis feed tank acts as a buffer between the intermittently working reception and processing halls and the continuously operating anaerobic digestion plant. The hydrolysis buffer tank is mixed by an external pump recirculation system to prevent settlement within the tank and is connected to the gas system to contain odours.

Slurry is pumped from the hydrolysis buffer tank to ensure an even feed to the pasteurisation plant. Pasteurisation takes place in 3 parallel tanks each with a maximum volume of 20m^3. At any one time one tank is filling and being heated to 70°C, one tank is holding (1hr residence time for temperature pathogen kill) and one tank is being emptying. This allows a continuous feed in and a continuous feed out whilst providing the 1 hour batch hold at 70°C, in accordance with the Animal By-Products Regulations.

Pasteurised slurry is then pumped to the anaerobic digesters. Two 3,000m^3 anaerobic digester tanks convert organic material to biogas through fermentation of organic material in the absence of oxygen.

The digester tank is continuously mixed by unconfined sequential gas injection to maintain an active volume >90% and to prevent deposition of solids within the digester.

The post digestion storage tank acts as a buffer from the digester to the dewatering stage and also as a means to inhibit further production of methane within the slurry. The tank contents are aerated by the injection of air via unconfined mixing pipes in the base of the tank. This aeration is designed to inhibit the anaerobic methane forming bacteria to prevent any further methane production post digestion. The displaced gas/vapour from this tank is captured in the site odour control system.

The digested slurry is pumped from the post digestion storage tank to the centrifuge where solids are dewatered to a dry solids concentration of approximately 23%.

2.4.5.1 Digestion type

It is proposed that the organic fraction of source segregated waste are processed using anaerobic digestion. Aerobic digestion is an alternative which is less sensitive to process conditions such as pH, temperature and sulphur compounds. However, anaerobic digestion is able to break down more complex compounds in the waste and has the significant advantage that the majority of the chemical energy in the waste is released as methane which can be burned to generate electricity and heat.

2.4.5.2 Digester conditions

Batch or Continuous

As identified in the BREF - “Waste Treatment Industries” anaerobic digestion can be undertaken as a batch or continuous process. Continuous processes do not suffer from odour problems when emptying vessels, unlike batch vessels. Bio-gas production from batch plants is inherently intermittent and it is therefore more difficult to achieve a continuous biogas supply to the electricity generating engines. Continuous processes benefit from consistent and more controllable gas production which reduces the gas storage volume required and improves the efficiency of the gas engines. Continuous processing also requires less operational input and intervention.

Wet or Dry

As identified in the BREF - “Waste Treatment Industries” anaerobic digestion can be undertaken in either dry or wet conditions. In a wet system, solid wastes is slurried and fermented by hydrolytic and fermentative bacteria to release volatile fatty acids which are then converted to biogas in a high rate industrial waste water anaerobic digester. Wet systems are favourable for the digestion of source segregated organic waste and wet organic waste from food processors.

As the anaerobic digestion process is proposed to treat residual food waste from municipal and C&I sources, it is regarded that the proposed wet system represent BAT as detailed in the BREF - “Waste Treatment Industries”.

Retention Time

The minimum retention time of the digesters is approximately 20 days and biogas is collected within the roof space, which is connected to the biogas system. The longer the retention time of the slurry in the digester, the greater the extent of biodegradation and subsequently a better quality digestate, the greater the production of biogas. Having a 20 day retention time ensures that the material is mature, free from pathogenic bacteria and seeds and also the digestate generates lower odour emissions.

Temperature

The operating temperature of an anaerobic digester is determined by the type of microorganism to be employed to digest the waste. The two most common systems are mesophilic (37-41°C) or thermophilic (48-55°C). The anaerobic digester is operated at 40°C which is in the mesophilic region.

Mesophilic systems tend to be more stable than Thermophilic systems. The mechanical pre-treatment of the feed and the continuous design of the digester ensures conditions remain constant and the bacterial system remains stable. As mesophilic systems do not require any additional heating, all of the gas produced can be used to generate electricity from the biogas which is produced in the Anaerobic Digestion process.

It is regarded that the proposed mesophilic process represents BAT as detailed in the BREF - “Waste Treatment Industries”.

2.4.5.3 Conclusions

The anaerobic digestion process allows the treatment of the organic fraction of food wastes. Due to the reasons detailed above the proposed operating techniques are regarded as achieving BAT as detailed in the BREF - “Waste Treatment Industries”.

2.4.6 Biogas Combustion plant

2.4.6.1 Combustion technology

Gas engine

The energy from the biogas produced by the anaerobic digestion plant is recovered as electricity by using it to fuel two gas engines. An alternative to using a gas engine would be to use the gas to fire a steam boiler and utilise the steam produced to generate electricity in a steam turbine. At the proposed rate of gas production from the AD plant, direct use of the biogas in a gas engine is a more efficient means of generating electricity than using a boiler and steam turbine. The use a gas engine to combust the biogas to generate electricity is therefore regarded as representing BAT.

Spark Ignition

The engines are spark ignition engines. Spark ignition engines are regarded as being a low Nitrogen Dioxide technology. The use of Spark ignition engines is therefore regarded as representing BAT.

2.4.6.2 Combustion conditions

Flare

As required by the BREF – Waste Treatment Industries, when flaring biogas, the outlet temperature of the flue-gas is at least 900°C and the residence time 0.3 sec.

2.4.6.3 Emissions Abatement

Sulphur dioxide

The combustion sector guidance note states that for small scale plant (<20MW$_{th}$), the use of low sulphur fuels (<1.2%S) is sufficient in the consideration of BAT.

Ferric Chloride is dosed into the anaerobic digester. The addition of iron salts to the digester minimise the generation of hydrogen sulphide in the biogas. The digester is designed to have a maximum H_2S content of less than 800 ppm.

A biogas scrubber is also used to reduce H_2S and NH_3 content of the biogas.

This technique is regarded as representing BAT for minimising the sulphur content of the fuel and is therefore regarded as an appropriate technique for the abatement of sulphur dioxide emissions.

NOx Reduction

NOx emissions within the gas engines is controlled through lean burn techniques. These measures control NOx levels in the exhaust gases to below 300mg/m^3, which is significantly lower than the 500mg/m^3 which is required by the Environment Agency Landfill Gas technical guidance note (LFTGN 08).

It is not regarded that SCR or SNCR techniques would represent BAT for this combustion process.

Particulates

The combustion of biogas is not considered to lead to emissions of particulates. As stated within Environment Agency Guidance Note EPR 1.01, gas fired plant does not generally require particulate control. As the engines are new, additional abatement control is not required.

It is therefore regarded that the technology selection is an appropriate technique for the minimisation of particulate emissions and represents BAT.

Carbon Monoxide

As stated within Environment Agency Guidance Note EPR 1.01, it is acknowledged that when low NOx combustion techniques are applied there is a trade-off in increased CO emissions. It is therefore regarded that the technique selected is appropriate technique for the minimisation of Carbon Monoxide emissions and represents BAT.

Volatile Organic Compounds (VOC's)

As stated within Environment Agency Guidance Note EPR 1.01, it is acknowledged that VOC emissions indicate poor controlled combustion conditions. Good combustion techniques are employed to minimise emissions of VOC's from the installation.

It is therefore regarded that the technique selected is appropriate technique for the minimisation of VOC emissions and represents BAT.

The controls detailed above are regarded as representing BAT for the installation.

2.4.7 Steam Condenser

The plant operates an Air Cooled Condenser (ACC) to condense the steam output from the turbine to allow return of the condensate to the boiler. The two main alternatives to an ACC are a water cooled condenser or an evaporative condenser and all are considered in Sector Guidance Note EPR 5.01 as potential BAT solutions. The former uses a recirculating water supply to condense the steam and the latter uses water which is evaporated directly from the condenser surface and lost to the atmosphere to provide the required cooling.

The main advantage of both of these water based systems is that they provide improved cooling and are not susceptible to condenser efficiency fluctuation with changing air temperature. High air temperatures in the summer with an Air Cooled Condenser can result in insufficient condensing power and subsequently reduce the efficiency of the generating turbine. Another advantage of a water cooled condensing system is the reduction in noise in comparison to the noise generated by the fans in an air cooled condenser system.

The disadvantage of the water cooled systems is the significant volume of water required. There is no local abstraction point so this would lead to significant potable water use. Chemical additives are also needed which means there would be a significant effluent flow to the sewer.

In winter there is a risk of freezing, and maintenance costs are high due to the wet nature of the technology. In the case of evaporative condensers there is also the significant potential for release of water vapour plumes.

The ACC is designed and guaranteed by the technology supplier with enough additional capacity to maintain turbine efficiency during the summer.

An air cooled condenser is therefore considered to represent BAT for this facility.

2.5 Specific Information required by the Industrial Emissions Directive (2010/75/EU)

This section contains information on how the plant is designed, equipped and run to make sure it meets the requirements of Chapter IV of the Industrial Emissions Directive (2010/75/EU).

2.5.1 Requirements

Legislative Obligations – Industrial Emissions Directive (2010/75/EU)

1. The design of the oxidation zone ensures that all gases resulting from the combustion of waste are maintained at or above 850ºC for at least 2 seconds;
2. Sufficient oxygen levels are maintained to ensure good combustion in the oxidation zone.
3. Auxiliary burners, fired with fuel oil are used to automatically maintain furnace conditions, which are controlled by the combustion control system.
4. Measures are included to minimise the amount and harmfulness of residues formed from the combustion process. The bottom ash from the combustion process will not exceed 5% LOI.
5. Urea solution is injected into the combustion chamber to reduce NOx emissions.

Gasification Zone

In the Gasification Phase, the waste in the gasification zone is thermally decomposed in an oxygen deficient atmosphere to produce a syngas.

Oxidation Chamber

Combustion of the syngas from the gasification zone occurs in the oxidation chamber.

Supplementary Burners and Fuels

Additional combustion air is supplied through an injection ring. Auxiliary burners are included but mostly are only required to operate during start-up and shutdown. The auxiliary burners also operate when the temperature within the oxidation chamber drops below 850°C. The auxiliary burners are controlled by the combustion control systems.

The burners are a low NOx design and the auxiliary fuel used is low sulphur fuel oil.

2.5.1.1 Validation of Combustion Conditions

The gasification facility is designed to provide a residence time, after the last injection of combustion air, of more than two seconds at a temperature of at least 850°C.

It was also demonstrated during commissioning that the Plant can achieve complete combustion by measuring concentrations of carbon monoxide, volatile organic compounds and dioxins in the flue gases and the LOI conditions of the bottom ash.

During the operations, the temperature at the 2 seconds residence time point is monitored to ensure that it remains above 850°C. The location of the temperature probes has been selected using the results of the plug flow model procedure undertaken during commissioning.

Urea is injected into the combustion gases at a temperature of between 850 and 1100°C.

Sufficient nozzles are provided to distribute the urea correctly across the entire cross section of the radiation zone.

2.5.1.2 Measuring Oxygen Levels

The oxygen concentration at the boiler exit is monitored and controlled to ensure that there is always adequate oxygen for complete combustion of combustible gases. Oxygen concentrations are controlled by regulating combustion airflows and waste feed rate.

2.5.1.3 Combustion Control

The plant is controlled from the Central Control Room. A modern control system, incorporating the latest advances in control and instrumentation technology, which is used to control operations, optimising the process relative to efficient syngas and heat release, good burn-out and minimum particle carry-over. The system controls and/or monitors the main features of the plant operation including, but not limited to the following:

- waste feed rate;
- SNCR system;
- flue gas oxygen concentration at the boiler exit;
- flue gas composition at the stack;
- gasification and oxidation processes, and operating temperatures;
- boiler feed pumps and feed water control;
- steam flow at the boiler outlet;
- steam outlet temperature;
- boiler drum level control;
- flue gas control;
- power generation; and
- steam turbine exhaust pressure.

The response times for instrumentation and control devices are designed to be fast enough to ensure efficient control of the process.

2.5.1.4 Waste Charging

The gasification plant meets the indicative BAT requirements outlined in the Incinerator Sector Guidance Note for waste charging and the specific requirements of the IED:

- The combustion control and feeding system are fully in line with the requirements of the IED. The conditions within the combustor is continually monitored to ensure that optimal conditions are maintained and that the emission limits are not exceeded. Auxiliary burners fired with fuel oil are installed and are used to maintain the temperature in the oxidation chamber.
- Waste is not charged when the temperature in the oxidation zone falls below 850°C, both during start-up and during operation.
- Waste is not charged if the emissions to atmosphere are in excess of an emission limit value due to disturbance or failures of the abatement equipment.
- The gasification of the waste is controlled using temperature measurements. Premature combustion of the waste is prevented through the use of process control to ensure gasification within the fluidised bed.

2.5.2 Unavoidable Stoppages

The table below lists unavoidable stoppages, disturbances and failures of the abatement plant or continuous emission monitoring system during which plant operation will continue. The table shows the maximum anticipated frequency of these events. It is highly unlikely that all of these events could occur at their maximum anticipated frequencies.

Table 10: Unavoidable Stoppages

Event	Mitigation	Action Required	Incident Duration	Anticipated Maximum Frequency
Combustion air fan(s) failure	Maintenance Two fans	Initial turndown Emergency shutdown initiated	Max 4 hrs or until combustion stopped	Once every 3 years
Filter bag leak	Maintenance	Isolation of filter compartment	30 min until filter compartment isolated	Once a year
Failure of lime dosing system	Stand-by reagent blower; filter cake on bag filter acting as buffer	Start stand by blower	-	Twice a year
Failure of urea water system	Stand-by dosing pump	Start stand by pump	-	Twice a year
Failure of activated carbon dosing system	Stand-by reagent blower / detection by flow indicator	Start stand by blower	-	Twice a year
Loss of electricity grid connection	Plant capable of working in island mode; if not possible, emergency generator to supply power for	If island mode and diesel generator fail, emergency shutdown initiated	Max 4 hrs or until combustion stopped	Once every 10 years

Event	Mitigation	Action Required	Incident Duration	Anticipated Maximum Frequency
	controlled shutdown			
Failure of emission monitoring equipment	Redundant equipment is installed; maintenance	Start stand by CEMS	-	Twice a year
Burner not starting as needed when 2 second temperature drops below 850C	Maintenance of burner Weekly test of burner	Initial turndown Emergency shutdown initiated	Max 4 hrs or until combustion stopped	Once every 10 years
Failure of ID Fan	Maintenance ; bearings vibration monitoring	Emergency shutdown initiated	10 min until combustion stopped	once every 5 years

2.6 Energy Efficiency

2.6.1 General

Electricity is generated by way of a steam turbine which is driven through the combustion of a synthesis gas 'syngas', electricity is also generated from a gas engine driven through the combustion of methane produced by the anaerobic digestion of food waste. The steam from the boilers supply a steam turbine generator to generate electricity.

The facility supplies electricity to the local electricity grid via a power transformer which increases the voltage to the appropriate level.

In case of failure of the electricity supply, an emergency diesel generator is provided to safely shut down the plant and to provide an emergency supply to the rest of the facility.

In considering the energy efficiency of the facility, due account has been taken of the requirements of the Environment Agency's Horizontal Guidance Note H2 on Energy Efficiency and the BREF.

2.6.1.1 Gasification Energy Efficiency

The gasification process generates up to 3.65MWe from 61,320 tonnes per annum of waste following pre-treatment, assuming 8,760 hours continuous operation. As stated within the Environment Agency Guidance Note – The Incineration of Waste (EPR5.01), the benchmark for the generation of electricity from municipal waste incineration is 5-9 MW per 100,000 tonnes.

Applying the criteria stated within the EA guidance, the gasification plant generates approximately 6 MW per 100,000 tonnes of waste. It is therefore regarded that the gasification plant meets the EA benchmarks for recovery of electricity.

In addition, if it is assumed that the gasification plant is available for 8,760 hours per annum, thus allowing for periods of start-up or shutdown, the gasification plant generates 32,000 MWh. Thus the gasification plant generates approximately 0.52 MWh/tonne of waste. This is slightly higher that the benchmark range of 0.415 - 0.644 MWh/tonne of waste for electricity production per tonne of MSW, as presented in the BREF.

The gasification plant (excluding pre-treatment processes) has a parasitic load of 0.7MW. If it is assumed that the gasification plant is available for 8,760 hours per annum, then the gasification plant consumes 6,132 MWh. Therefore, the specific energy consumption of the gasification facility is 100 kWh/te. The benchmark comparison stated in the Waste Incineration BREF is 150 kWh/te. Therefore, the gasification plant compares favourably with the benchmark stated in the BREF.

2.6.1.2 Anaerobic Digestion Energy Efficiency

The AD facility generates up to 2.4 MWe from the processing of 40,000 tonnes of food waste and other organic wastes. The parasitic load of the AD facility is 1.15MWe (daytime) and 0.82 MWe (night-time). Assuming the AD facility operates for 8,500 hours per annum the AD/CHP Plant generates approximately 20,400 MWh of power. Assuming the operational availability is equally apportioned between daytime and night-time, the AD facility has a parasitic load of approximately 8,400 MWh per annum. This equates to a parasitic load of 210 kWh/te. The benchmark comparison stated in the Waste Industries BREF is 50 - 55 kWh/te of MSW.

When comparing the specific energy consumption of the AD/CHP Plant with the benchmark energy consumption, it must be noted that it is not stated whether the benchmark energy consumption includes any pre-treatment or post-treatment of the waste. The calculations for the Charlton Lane AD plant has included waste reception and preparation, the AD process and post-treatment activities (dewatering), and the liquor treatment plant.

The proposed system requires all organic materials to be prepared for biological treatment in the anaerobic digestion by shredding and the pre-treating. These are both energy intensive processes, but create a consistently sized feedstock to aid in the generation of biogas. Following treatment in the AD plant, the digestate is dewatered using centrifuges prior to transfer off-site for land spreading.

As stated in the Waste Industries BREF:

"Estimates concerning the utilisation of electricity by the plant vary a great deal. In rural AD plants, approximately 20 % of the electricity produced in the process is required for the plant operation, while urban plants may utilise 2/3 of the electricity produced."

As stated previously the AD facility generates 20,400 MWh of power with a parasitic load of approximately 8,400 MWh per annum. This implies that approximately 41% of the power produced in the process is consumed as parasitic load. The feedstock for the AD facility is organic and food waste sourced from municipal and C&I sources. This type of feedstock is believed to be more representative of an urban AD plant. The Charlton Lane AD plant is therefore regarded as being significantly more efficient than the urban plants referred to within the BREF.

2.6.1.3 Energy Efficiency Summary

It is concluded that the installation achieves both the BAT Incineration Sector Guidance Note and BREF for Waste Incineration benchmark levels for energy efficiency.

2.6.2 Basic Energy Requirements

It is estimated that in total the installation generates up to 6MW of electricity. Electricity would be generated by way of a steam turbine which would be driven through the combustion of a synthesis gas 'syngas', this would contribute approximately 3.6 MW. Electricity would also be generated from a gas engine driven through the combustion of methane produced by the anaerobic digestion of food waste, this would contribute up to 2.4 MW. The photovoltaic cells would generate up to 0.16MW of electricity.

The facility has been designed with careful attention being paid to all normal energy efficiency design features, such as high efficiency motors, high standards of cladding and insulation etc.

The plant is designed to achieve a high thermal efficiency. In particular:

- The boilers are equipped with economisers and super-heaters to optimise thermal cycle efficiency without prejudicing boiler tube life, having regard for the nature of the waste that is being combusted;
- Unnecessary releases of steam and hot water are avoided, to avoid the loss of boiler water treatment chemicals and the heat contained within the steam and water;
- Steady operation is maintained where necessary by using auxiliary fuel firing;
- Boiler heat exchange surfaces are cleaned on a regular basis to ensure efficient heat recovery; and
- Flue gases from the gasification chamber are fed to the boiler, which is designed to cool the flue gas and recover the heat as superheated steam for use in the steam turbine.

2.6.2.1 Operating and Maintenance Procedures

The O&M procedures includes the following aspects:

- Good maintenance and housekeeping techniques and regimes across the whole plant;
- Plant Condition Monitoring carried out on a regular basis, to ensure, amongst other things, that motors are operating efficiently, insulation and cladding are not damaged and that there are no significant leaks; and
- Operators trained in energy awareness and encouraged to identify opportunities for energy efficiency improvements.

2.6.2.2 Energy Efficiency Measures

An energy efficiency plan is built into the operation and maintenance procedures of the plant ensuring maximum, practical, sustainable, safe and controllable electricity generation. This plan is reviewed periodically as part of the ISO:14001 review process.

During normal operation, procedures are reviewed and amended, where necessary, to include improvements in efficiency as and when proven new equipment and operating techniques become available. These are assessed on the implementation cost compared with the anticipated benefits.

2.6.3 Further Energy Efficiency Requirements

The plant is not subject to a Climate Change Levy agreement, although the electricity generated is partially exempt from the levy.

Under the IED, heat should be recovered as far as practicable. In order to demonstrate this, it should be noted that the boiler operates with superheated steam at a minimum pressure of around 40 bar and a temperature of at least 400°C. Higher steam temperatures would potentially lead to more corrosion of the superheater tubes.

2.6.4 Energy Efficiency and Waste Operations

It is not regarded that there are any requirements for Energy Efficiency associated with the Waste Operations.

2.7 Waste Recovery and Disposal

2.7.1 Installation Activities

The residue streams arising from the installation are:

1. Ash from the gasification process;
2. Ferrous and non-ferrous metals;
3. APC residue and fine ash particles;
4. Digestate Cake;
5. Fines;
6. Hard particles / residues; and
7. Residues from dewatering of road sweepings.

As described below, the waste recovery and disposal techniques are in accordance with the indicative BAT requirements. The wastes generated are summarised in Table 11.

2.7.1.1 Ash from the Gasification Process

Boiler ash, and multiclone ash are conveyed to the ash silo for storage prior to transfer off-site to a suitably licensed waste management facility. The ash from the gasification process are not combined with the Air Pollution Control residues.

Gasifier bottom ash is removed by skip to the reception hall and periodically loaded onto lorries for downstream processing.

2.7.1.2 Ferrous and non-ferrous metals from pre-treatment

Ferrous and non-ferrous metals are extracted from the incoming waste in the pre-treatment process. Metals are transferred off-site to a suitably licensed facility for recovery.

2.7.1.3 Air Pollution Control residues (APCr)

These residues result from the cleaning of the flue gases prior to release to air. The gasification system utilises lime and consequently the residues are caustic due to the lime use and also contain heavy metals, and other hazardous substances removed from the gases. Approximately 3% of input material remains as APCR.

APCR is classified as hazardous (due to its elevated pH) and requires specialist landfill disposal or treatment. The options are:

- Treatment via a chemical process which enables the material to go to non-hazardous landfill;
- Stabilisation which renders the material suitable for hazardous landfill;

- Deep mine storage where bagged material is simply stored without further intervention (this is not suitable for silo stored material); and,
- Vitrification.

2.7.1.4 Digestate Cake

The sludge residue from anaerobic digestion is dewatered in the centrifuges where solids are dewatered to a dry solids concentration of approximately 23%. Digested material falls by gravity into trailers. The installation produces up to 16,000 tonnes per annum of digestate cake which is transferred offsite to be spread to agricultural land as a soil enhancer.

2.7.1.5 Non-combustibles

Fines and hard particles/heavy residues are not suitable for the gasification process. Therefore they are extracted from the incoming residual waste within the pre-treatment facility and dispatched to suitably permitted facilities.

2.7.1.6 Residues from Dewatering Road Sweepings

Grit and residues from dewatering of road sweepings is bulked up for transfer off-site to a suitably licensed facility.

Table 11: Key Waste Streams

Source/ Material	**Properties of Waste**	**Storage location/ volume stored**	**Future annual quantity of waste produced (approximate)**	**Disposal Route and Transport Method**
Boiler Ash/Multiclone Ash	This ash is relatively inert, classified as non-hazardous.	Silos	2,000 t	Either sent to nearby landfill or sent to an ash recycling facility for further use as a secondary aggregate. A small fraction may be unsuitable for reuse and landfilled. Transport occurs by road vehicles.
Gasifier Bottom Ash	Bottom ash		3,000 t	Either sent to nearby landfill or sent to an ash recycling facility for further use as a secondary aggregate. A small fraction may be unsuitable for reuse and landfilled. Transport occurs by road vehicles.
Ferrous metal	From pre-treatment		1,500 t	Ferrous metals are separated from the waste and recycled. Transport occurs by road vehicles.

Source/ Material	Properties of Waste	Storage location/ volume stored	Future annual quantity of waste produced (approximate)	Disposal Route and Transport Method
Non-Ferrous metal	From pre-treatment		610 t	Non-ferrous metals are separated from the waste and recycled. Transport occurs by road vehicles.
Fly Ash / APCR	Fly Ash from boiler and air pollution control residues, may contain some unreacted lime.	APCR silo. Capacity of 65m^3.	3,000 t	Recycled or disposed of in a licensed site for hazardous waste. Transport occurs by road vehicle.
Digestate	Following dewatering within the AD facility	AD facility.	7,000 t	Transferred off-site to a suitably licensed disposal/recovery facility. Transport occurs by road vehicle.
Contaminated aggregate (Fines)	From pre-treatment		19,000 t	Transferred off-site to a suitably licensed disposal/recovery facility. Transport occurs by road vehicle.
Hard particles / residue	From pre-treatment		12,500 t	Transferred off-site to a suitably licensed disposal/recovery facility. Transport occurs by road vehicle.
Road Sweepings following dewatering	From dewatering of road sweepings	Road Sweepings Dewatering Area	2,660 t	Transferred off-site to a suitably licensed

Source/ Material	Properties of Waste	Storage location/ volume stored	Future annual quantity of waste produced (approximate)	Disposal Route and Transport Method
				disposal/recovery facility. Transport occurs by road vehicle.

2.7.2 Waste Operations

2.7.2.1 Community Recycling Centre Wastes

Wastes from the Community Recycling Centre are either transferred off-site to a recycling facility or an appropriate bay within the RBF for bulking.

Full containers are transported by HGV to the weighbridge to the north of the RBF, from here the containers are either be transported directly to a recycling facility or their loads are transferred into the appropriate bay within the RBF for bulking prior to onwards transport to a recycling facility or other waste management facility.

2.7.2.2 RBF Wastes

Recyclable materials are stored in designated bulking bays, total annual tonnage not exceeding 42,750 tonnes. Recyclate bulking bays are provided for the following materials:

- Mixed cardboard and paper;
- Glass
- Cans
- Plastic bottles
- Mixed glass, cans & plastics;
- Mixed Bulky waste;
- Organic wastes;
- Residual/Mixed Municipal Waste;
- Timber;
- Inerts;
- Metals;
- Fridges; and,
- Carpet.

Recyclables are loaded onto bulk transport vehicles to a recycling facility or other waste management site. The vehicles are loaded using front end loaders, on an area of hard standing adjacent to the bulking bays.

2.8 Management

2.8.1 Introduction

SUEZ Surrey demonstrates environmental and social responsibility by operating all facilities and services to the highest environmental, health and safety and professional standards. The Charlton Lane Eco Park facility is designed and constructed following the latest international and national regulations, standards and guidance.

As part of its ongoing commitment to sustainable and responsible development and to regulatory compliance, SUEZ Surrey have developed and implemented a documented Integrated Management System (IMS). The IMS has been certified to the requirements of the BS EN ISO 14001:2015 Environmental Management System Standard.

2.8.2 Management Systems

2.8.2.1 Scope and Structure

The scope of SUEZ's certification to ISO 14001 is for:

- the collection, transport, sorting, separation, recycling and recovery, treatment and disposal of controlled waste including household, municipal, commercial and industrial waste (including hazardous and difficult waste);
- the operation of materials recycling facilities, household waste recycling facilities, composting plants, wood processing facilities, transfer stations including security shredding operations, energy from waste plants, landfill sites, gas utilisation plants, logistic depots, vehicle workshops and associated procurement functions

Documented procedures detail specifically how activities are controlled and managed. SUEZ Surrey's existing procedures for accident management comply with the requirements set out in Agency guidance "Risk assessments for your environmental permit".

2.8.2.2 General Requirements

The objectives and scope of the EMS ensure that SUEZ Surrey meets the requirements by:

- identifying, documenting and implementing standard procedures for use throughout the company;
- determining a procedural hierarchy with regard to the sequence and interaction of the relevant processes;
- giving adequate responsibility, authority and resources to management necessary to support the operation of the EMS;
- obtaining reliable products and services that satisfy customer requirements;
- establishing criteria to assess the effectiveness of the procedures;
- monitoring, measuring and analysing the procedures for their effectiveness; and
- implementing actions necessary to achieve planned results and continual improvements of these processes.

2.8.3 Personnel

Operation and maintenance of the plant is undertaken by the applicant's own staff, with sufficient contracts in place for service and maintenance of key items of plant. Sufficient numbers of staff, in various grades, are provided to manage, operate and maintain the plant on a continuous basis, 7 days per week throughout the year. The plant is managed, operated and maintained by experienced managers, boiler operators and maintenance staff.

Staff breakdown by operational areas:

- Weighbridge – 2 people
- CRC – 10 people
- Recycling Bulking Facility – 8 people
- Gasification Facility – 30 people
- Anaerobic Digestion Facility – 5 people
- Management, Office and Visitor Centre – 17 people

The key environmental management responsibilities are allocated as described below:

- The **Plant Manager** has overall responsibility for management of the site and compliance with the operating permit. He or she are also responsible for waste management and scheduling. The general manager is required to have extensive experience relevant to his responsibilities.
- The **Operations Managers** have day-to-day responsibility for the operation of the plant, to ensure that the plant is operated in accordance with the permit and that the environmental impact of the plant's operations is minimised. In this context, he or she are responsible for designing and implementing operating procedures which incorporate environmental aspects.
- The **Environment and Industrial Risk (EIR) Manager** is responsible for the management of the Environmental Management System, for the monitoring of authorised releases and for interaction with the Environment Agency.
- The **National Environment and Industrial Risk (EIR) Manager** is responsible for the development and management of the Environmental Management System.
- The **Maintenance Manager** is responsible for the management of maintenance activities, for maintenance planning and for ensuring that the plant continues to operate in accordance with its design.

2.8.4 Competence, Training and Awareness

Through documented procedures, SUEZ Surrey aims to ensure that any persons performing tasks for it or on its behalf that have the potential to cause significant impact on the environment or quality of service defined by SUEZ Surrey are competent on the basis of appropriate education, training or experience, and retain associated records.

SUEZ Surrey has established and maintains procedures to make employees aware of:

- the importance of conformity with the environment and quality policies and procedures and with the requirements of the EMS;
- potentially significant environmental aspects associated with their work;
- their roles and responsibilities in achieving conformity with the requirements of the EMS, including emergency preparedness and response requirements;
- the relevance and importance of their activities and how they contribute to the achievement of the environmental and quality objectives; and
- the potential consequences of the departure from specified procedures.

SUEZ Surrey complies with industry standards or codes of practice for training (e.g. WAMITAB), where they exist.

2.8.4.1 Competence

Minimum role competency requirements are identified by the Line Manager and/or the HR Department and satisfied through the recruitment process. All roles are documented with the specific job requirements defined in "Principal Responsibilities" and "Key Job Elements".

2.8.4.2 Induction and Awareness

Staff induction programmes are location-specific and include, as a minimum, the induction of the following:

- the Environmental Policy; and,
- Environmental Awareness Training.

2.8.4.3 Training

Ongoing staff training needs are identified and progress monitored by line management as part of the employee appraisal system. Once identified, the training needs of employees is addressed in a number of ways, including:

- on-the-job training;
- coaching and mentoring;
- internal training and development events; and
- external training courses/ events.

Training records are maintained. SITA Surrey complies with industry standards or codes of practice for training (e.g. WAMITAB), where they exist.

2.8.5 Maintenance

SUEZ has developed and operates a documented preventative maintenance system, which is used to identify, record and collate all information relating to the maintenance of the facility. Preventative maintenance associated with the facility are undertaken in accordance with the technology provider's recommendations.

2.9 Closure

2.9.1 Introduction

The facility is designed for an operational life of over 25 years but its actual operational lifetime is dependent on a number of factors including:

- The continued supply of waste fuels; and
- The development of alternative methods competing for the same waste fuels.

When the facility has reached the end of its operational life, it may be adapted for an alternative use or demolished as part of a redevelopment scheme and the site cleared and left in a fit-for-use condition.

2.9.2 General

At the end of the economic life of the plant, the development site and buildings may be converted to other uses or form part of an appropriate landscape restoration plan. The responsibility for this may well rest with other parties if the facility is sold. However, SUEZ Surrey recognises the need to ensure that the design, the operation and the maintenance procedures facilitate decommissioning in a safe manner without risk of pollution, contamination or excessive disturbance to noise, dust, odour, ground and water courses.

To achieve this aim, a site closure plan has been prepared. The closure plan includes the information listed below

2.9.3 Site Closure Plan

The site closure plan includes for the following measures to be implemented to ensure the objective of safe and clean decommissioning of the Facility.

2.9.3.1 General Requirements

- Underground tanks and pipe work to be avoided except for supply and discharge utilities such as mains water, sewerage lines and gas supply;
- Safe removal of all chemical and hazardous materials;
- Adequate provision for drainage, vessel cleaning and dismantling of pipe work;
- Disassembly and containment procedures for insulation, materials handling equipment, material extraction equipment, fabric filters and other filtration equipment without significant leakage, spillage, dust or hazard;
- The use of recyclable materials where possible;
- Methodology for the removal/decommissioning of components and structures to minimise the exposure of noise, disturbance, dust and odours and for the protection of surface and groundwater; and
- Soil sampling and testing of sensitive areas to ensure the minimum disturbance (sensitive areas to be selected with reference to the initial site report).

2.9.3.2 Specific Details

- A list of recyclable materials/components and current potential outlet sources;
- A list of materials/components not suitable for recycle and potential outlet sources;
- A list of materials to go to landfill with current recognised analysis, where appropriate;
- A list of all chemicals and hazardous materials, location and current containment methods; and
- A Bill of Materials detailing total known quantities of items throughout the site such as:
- Steelwork;
- Plastics;
- Cables;
- Concrete and Civils Materials;
- Oils;
- Chemicals;
- Consumables;
- Contained Water and Effluents; and
- Bottom Ash and APC Residues.

2.9.3.3 Disposal Routes

Each of the items listed within the Bill of Materials will have a recognised or special route for disposal identified; e.g. Landfill by a licensed contractor, disposal by high sided, fully sheeted road vehicle or for sale to a scrap metal dealer, disposal by skip/fully enclosed container, dealer to collect and disposal by container.