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**GENT FAIRHEAD & CO. LIMITED
RIVENHALL IWMF
ODOUR MANAGEMENT PLAN**

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1 INTRODUCTION

The purpose of this document is to detail the provisions which have been taken into account during the design phase of the Rivenhall Integrated Waste Management Facility (IWMF) (the facility) to manage the risk of the operation of the installation leading to an odour nuisance to the public.

As required by Environment Agency Guidance Note: How to Comply with your Environmental Permit, it is acknowledged that Odour Management Plans are mandatory when applying for a permit for an anaerobic digestion (AD) facility and a mechanical biological treatment (MBT) facility, such as those proposed for the facility. This report identifies the odour management controls included in the design for the facility. However, it should be noted that this report will be subject to review following completion of detailed design of the facility. It is proposed that a Pre-operational Improvement Condition is included which requires the Odour Management Plan to be approved by the Environment Agency (EA) prior to commencement of operation of the various waste treatment processes.

The facility has been designed in accordance with the requirements of the current odour management guidance, including the following:

- Sector Guidance Note IPPC S5.06: Guidance for the Recovery and Disposal of Hazardous and Non Hazardous Waste, Environment Agency;
- Guidance Note H4: Odour Management, Environment Agency;
- An industry guide for the prevention and control of odours at biowaste processing facilities, The Composting Association; and
- Odour Guidance for Local Authorities, DEFRA, March 2010.

Under the Pre-Operational Improvement Condition it is proposed that prior to commissioning the Rivenhall IWMF, a detailed odour management plan will be submitted to the Environment Agency for approval. The Odour Management Plan will include full details of odour control, odour prevention and odour management protocols associated with the IWMF operation and the routine monitoring and intervention measures that will be applied around the site, and details of off-site waste source supply controls, in line with the EMS plan.

2 SITE LOCATION AND DESCRIPTION

2.1 The Rivenhall IWMF

Gent Fairhead & Co Limited is proposing to construct and operate the facility. The facility will be located at the former Rivenhall Airfield site.

2.2 The Site

The Site is located on the southeastern edge of a former World War II airfield known as Rivenhall Airfield between the villages of Bradwell (northwest 2.6 km), Silver End (southwest 1.1 km), Rivenhall (south 2.3 km), Coggeshall (northeast 2.8 km) and Kelvedon (southeast 3.4 km).

Access to the site will be provided via a private access road from the existing A120.

The former airfield and its immediate surroundings are on a plateau above the River Blackwater. This plateau is currently being excavated and, therefore, under the current planning permissions, most of the former airfield will become a restored 'bowl' for continued agricultural use. The airfield was previously open and exposed and had been used predominantly for agricultural purposes, although extensive sand and gravel extraction and restoration has been undertaken at the Site.

The nearest residential properties within 1 km of the Site are: The Lodge, Allshotts Farm, Bumby Hall, Sheepcotes Farm, Green Pastures Bungalow, Goslings Cottage, Goslings Barn, Goslings Farm, Deeks Cottage, Heron's Farm, Deeks Cottage, Haywards, and Park Gate Farm Cottages.

2.3 Summary of Site Operations

There will be six principal activities to the Rivenhall IWMF, (1) Combined Heat and Power (CHP) Plant; (2) Materials Recycling Facility (MRF); (3) anaerobic digestion (AD) facility; (4) Mechanical Biological Treatment (MBT) facility; (5) A De-inked Paper Pulp Production Facility (Pulp plant); and (6) Wastewater treatment plant (WWTP). The capacities of the treatment processes are as follows:

- (1) The CHP plant will have a maximum design capacity to process up to 595,000 tonnes per annum of non-hazardous Solid Recovered Fuel (SRF)¹ and Refuse Derived Fuel (RDF), herein referred to as RDF;
- (2) The MRF will have a maximum design capacity to process 300,000 tonnes per annum of direct waste and treated waste materials from the MBT to recover recyclates for transfer off-site, with the residual material being transferred to the CHP facility;
- (3) The AD plant will be designed to process up to 30,000 tonnes per annum of food and organic waste, with the resultant biogas being combusted in a CHP engine;
- (4) The MBT Plant will have a maximum design capacity to process 170,000 tonnes per annum of waste to produce a non-hazardous RDF, which will be fed into the MRF to recover recyclates prior to treatment as a fuel within the CHP plant;
- (5) The Pulp plant will have a maximum design capacity to process 170,000 tonnes per annum of waste paper to produce approximately 85,500 tonnes per annum of recycled and reusable paper pulp; and
- (6) The Wastewater Treatment Plant will have a maximum design capacity of 550,000 m³ per annum of wastewater from the installation.

¹ The planning permissions states as an *Informative* "reference to Solid Recovered Fuel (SRF) for the purposes of this planning permission is considered to be the same as Refuse Derived Fuel (RDF)."

These principal activities will consist of a combination of installation activities (as defined in the Environmental Permitting Regulations) and directly associated activities. In submitting this application it is regarded that the following activities are being applied for, as presented in the Table below:

Type of Activity	Schedule 1 Activity		Description of Activity
Installation	Section 5.1 Part A1, b)	CHP Facility (Line 1)	Incineration of non-hazardous waste with a capacity of greater than 3 tonnes per hour
Installation	Section 5.1 Part A1, b)	CHP Facility (Line 2)	Incineration of non-hazardous waste with a capacity of greater than 3 tonnes per hour
Installation	Section 6.1 Part A1, a)	Pulp plant	Processing of waste paper to produce a recycled paper pulp and a sludge which is suitable to be applied to land as a soil conditioner.
Waste operation		AD facility	The anaerobic digestion of organic waste to produce a biogas which is subsequently combusted in a biogas engine, and a digestate which is suitable to be applied to land as a soil conditioner.
Directly Associated Activities			
Directly Associated Activities		MRF	Processing of residual waste to recover recyclates and produce a fuel which is suitable for combustion within the CHP Plant; and the processing of treated materials from the MBT to recover recyclates and refine the fuel which is suitable for combustion within the CHP Plant
Directly Associated Activities		MBT	The biodrying of incoming waste to reduce the moisture content of the waste to produce a fuel which is suitable for combustion within the CHP Plant. Material which has been treated within the MBT will enter the MRF for the recovery of recyclates and final refinement prior to transfer to the CHP.
Directly Associated Activities		Wastewater Treatment	The treatment and storage of process effluents from the installation prior to re-use within the installation (effluent from the Pulp plant).

As shown in the application forms (Part B1), the anaerobic digestion plant is being applied for as a separate standard rules EP, reference SR2012 No12.

2.3.1 MRF

The purpose of the MRF is to identify and recover recyclates from incoming untreated Municipal Solid Wastes (MSW) and Commercial & Industrial (C&I) wastes, from the shredded and biologically dried output from the MBT plant, and if possible and appropriate to recover further recyclates from incoming refuse derived fuel (RDF) (or solid recovered fuel (SRF)). As the predominant output by volume from the MRF will be RDF destined for the CHP plant, the MRF is deemed to be an RDF manufacturing and/or refinement process. All RDF manufactured at the installation will be transferred to the CHP plant.

The MRF is designed to both mechanically and manually sort recyclable materials from the incoming waste. The identification and separation processes are achieved initially through a mechanical process and subsequently through a manual process for final quality control.

The MRF processing facility is divided into two lines:

- (1) Line 1 is for processing the material that comes from the MBT bio-drying vessels.
- (2) Line 2 is for processing material that generally comes direct into the facility having undergone no or minimal pre-treatment by way of recyclate removal.

The MRF has been designed and will be operated by one of the UK's most experienced waste recycling plant providers and operators. The design philosophy has taken account of the current market availability of wastes for recycling.

The Rivenhall IWMF will be operated to be commercially complimentary to the facilities of local and county-wide commercial waste operators, providing additional recycling facilities that will enhance further recovery of recyclates beyond that which has already been achieved.

2.3.1.1 Line 1 (from MBT output)

Line 1 is for processing the material that has been pre-treated in the MBT bio-drying vessels.

Following treatment, the bio-dried wastes within the MBT vessels will be picked up by the wheeled front-end loader and tipped into a metering feed hopper at the head of Line 1. The hopper acts as both a reception point for the waste and a way of systematically feeding the waste at a steady state into the treatment process.

Once the materials have passed through the hopper, they pass by conveyor into the trommel, a rotary screening drum that separates materials of different sizes based on its settings of hole sizes. As material passes through the drum, any material that is smaller than the holes in the drum at that point will drop out, thus providing effective separation. The first holes will be set to 50mm, and any material less than 50mm will fall through and be conveyed directly to the temporary storage or holding bay at the end of the line as RDF.

The retained material continues to pass through the trommel over separation holes set at 150mm, and any material less than 150mm will fall through into a hopper feeding a transverse conveyor beneath the trommel. This fraction size of between >50mm <150mm will include the bulk of the metals and plastic bottles. The transverse conveyor will take this material to the ballistic separator shared with Line 2 (outlined in section 2.3.1.2).

The remaining materials will pass out of the end of the trommel underneath an over band magnet to remove any remaining ferrous material and the residual material will be dropped into the RDF bunker.

2.3.1.2 Line 2

Line 2 is for processing material that generally comes direct into the facility having undergone no or minimal off-site pre-treatment by way of recyclate removal. In addition, it will process the 50 mm to 150 mm fraction separated out from Line 1.

Following deposition by the delivery vehicle, a wheeled loading shovel will handle the incoming waste, either initially storing it temporarily in the daily holding bunker, or feeding it directly into the feed hopper at the head of the Line 2. Waste placed into the feed hopper drops onto a shredder that will shred the waste into 300mm particles. This ensures that the waste passes through the process in a uniformed size and that the RDF produced at the end of the line is in accordance with the fuel requirements for combustion within the CHP Plant.

All of the shredded material will then pass along a conveyor into the trommel where the initial separation holes will be set at 50mm. All of the material less than 50mm material will drop through the holes and be conveyed to the RDF bay ready for dispatch.

The remaining material will pass along the trommel to where the next separation holes are set at 150mm. All of the >50mm <150mm will fall through the trommel at this stage and onto a ballistic separator. At this point, the >50mm <150mm material from Line 1 will also be fed in parallel to this ballistic separator

The function of the ballistic separator is to separate out the principal recyclates in 2D and 3D formats. This is achieved by passing the waste materials over a series of parallel inclined rotating plates formed of angled metal paddles. This action enables the 2D flat and flexible materials such as paper and plastic film to rise up the incline but any 3D rigid or rolling materials such as plastic bottles and metal cans will roll back down the incline. Fine items fall through a sieve mesh.

From the ballistic separator, the 2D or flat >50mm<150mm material is conveyed to the RDF dispatch bay. The 3D or non-flat >50mm<150mm material will pass along a conveyor via an over-band magnet and eddy separator to an optical sorter where all of the plastic bottles can be identified. The optical sorter works by reading the different polymer types, colours and shapes. Once these have been identified, an electronic signal is sent to an air jet that expels the bottle as it passes over the jet of air. These materials will be ejected into holding cages ready for baling.

The >150 mm material that had not dropped out of the trommel for conveyance to the ballistic separator continues on to the end of the trommel where it is fed onto a conveyor under an over-band magnet for ferrous extraction and then into a picking cabin. In the picking cabin, operatives will take out the larger recyclables such as paper and rigid plastics. These will be dropped into appropriate holding cages or bunkers beneath the picking station ready for baling.

Following the end of the picking line, the remaining material continues on the conveyor and over a non-ferrous separator to extract non-ferrous metals and under a final over-band magnet to extract any remaining ferrous metals. The ferrous and non-ferrous fractions will be dropped into a holding cage or bunker ready for baling for transfer off-site to a licensed waste management facility.

All remaining materials will be fed by conveyor to drop into the RDF dispatch bay.

2.3.1.3 Recyclate dispatch

The materials that have been separated out for recycling such as paper, card, plastic bottles and metals will be mechanically transferred from each holding cage, on a separate basis, and conveyed to the baler attached to Line 2. The area between the baler and the RDF bunker will be used for the storage of bales (by clamp truck) of the various recyclates awaiting transfer off-site.

Vehicles collecting recyclates material heading for the end market (flat bed bulkers) will collect the bales during day-time operational hours.

2.3.2 MBT

The purpose of the MBT Facility is to receive collected municipal or commercial wastes that require some pre-treatment in order to remove moisture and recyclates (in combination with the adjacent MRF) and to manufacture a RDF suitable for energy recovery in the CHP plant. The MBT may also be employed when appropriate to biologically dry and moisture condition incoming RDF prior to energy recovery in the CHP plant.

The MBT process is designed to take in organic-rich materials that are treated in a series of enclosed vessels. The vessels include individual floor and roof systems that provide for air to be forced through the waste to facilitate the process of biological drying.

The MBT process is modular with each vessel being rectangle in shape. The MBT process is designed for the treatment of up to approximately 170,000 tonnes per annum of waste through the process utilising eight lines with two vessels in each line. The waste will be loaded into each vessel by a front-end loading shovel.

The MBT facility will receive waste between 0700 to 1830 hours Monday to Friday and 0700 to 1300 hours on Saturdays. The facility will be operated to ensure that the quantity of wastes that will be delivered each day will be less than the capacity available in the MBT bio-drying vessels (allowing for the proposed quantity of material that will be removed that day to be processed in the MRF).

The waste will remain in the vessels for a minimum of 7 days enabling the biological process to occur, during which time the waste will lose up to 12% moisture content. This enables easier extraction of recyclables, particularly plastics and metals, within the mechanical processes in the MRF.

2.3.2.1 MBT Operation

Following deposition by the delivery vehicle, a wheeled loading shovel will handle the incoming waste.

In the event that the incoming waste has not undergone any initial shredding at the customer's collection or transfer facility, there will be a mobile shredder available in the tipping hall to ensure that all material placed into the MBT vessels is shredded to an appropriate size to be determined during operations; in the order of 150 mm to 300 mm.

The mobile shredder will not necessarily shred all wastes, only selected wastes. In addition, it will "cut" wastes to a size of 300 mm.

The wheeled loading shovel will pick up the waste from the tipping floor or holding bay, pass it through the mobile shredder as required, and place it into one of the MBT vessels as soon as possible after it has arrived at the Installation. The waste reception area will be cleared of waste and cleaned at the end of each working day.

The maximum period of time in which incoming waste would be held in the reception area awaiting processing would be approximately half the working day, equivalent to 6 hours or 360 minutes. However, most waste delivered to the MBT facility will be processed within one or two hours of the delivery occurring, depending on the 'availability' of the mobile shredder and the MBT vessels when the waste is tipped.

The design of the MBT Vessels is modular and there will be up to 16 vessels installed and in operation. The vessels are made from 3 walls of concrete with a fixed or retractable PVC roof. Approximate dimensions of each vessel are 6.5m internal width, 18m length and 4m internal height. There is a removable metal door at the front. During loading, the metal door is removed and the retractable part of the roof rolled back. The waste will be placed to a height of approximately 3m and initially compacted with the loading shovel.

Each vessel will be designed to hold up to approximately 200 tonnes of waste. When the vessel is full, the door is replaced (using the loading shovel) and, if appropriate, the roof is rolled back over the top of the vessel. The vessel will be effectively sealed at this stage. This minimises the potential for vermin, helps to maintain the heat within the vessel and contains odours or dust during the biological drying process.

A strict regime of temperature and moisture content monitoring will be undertaken for a period of seven days whilst the waste is being treated within the vessel. When the waste has achieved the appropriate moisture content, the vessel will be emptied by a wheeled loading machine and transferred directly through to the MRF feed hopper for further processing.

Depending upon the nature of the waste, and on the output from similar previous practices in the MRF, the operator may decide that there are insufficient recyclates that can be recovered by sending the MBT output through the MRF. If this is the case, the material that exits the MBT, now classified as 'RDF', will be loaded direct onto in-house dump-trucks which will transport the RDF direct to the CHP plant.

2.3.2.2 MBT Process – Temperature and Moisture Content Controls

The MBT is very similar to an in-vessel composting system. These are normally sited outdoors, but in the case of the Rivenhall IWMF, will be contained inside another building as there is no need or intention to create a compost output from the MBT plant. It will be used only for the manufacture of RDF for use in the CHP plant and to enhance the recovery of certain recyclates.

Within the MBT the temperature inside the waste for optimum biological drying conditions is likely to be in the region of 50 to 60°C, but there are no statutory limitations to adhere to. There will be no external heat supplied or drawn into the vessels. The effective self-composting process ensures that the material in the vessels warms up naturally without requiring any external heating sources to provide heat into the vessels.

In order to assist in bio-drying control, and to confirm when the wastes have reached appropriate moisture contents, a number of 2 metre long temperature probes will be inserted through the roofs of the vessels. Each vessel will have a large fan at the back to constantly blow through air and to keep the wastes aerated. Adjustments will be made in air circulation to maintain temperatures at appropriate levels.

Air within the MBT vessels is circulated for an anticipated 75% of the cycle time. A valve on the inlet air side of the fan units will control replenishment volumes of air as needed to control temperatures and moisture. The capacity of the stainless steel fan units is circa 1.5 m³/sec which in turn is controlled by a speed reducer. The air flow is distributed at ground level through patented air rails which have proven themselves to stay clear and remain unblocked for a service interval of at least 6 months. The oxygen enriched air percolates through the waste and is then sucked back into the fan via pipework mounted on the inside of each vessel roof. There are virtually no emissions from the MBT vessels whilst in this phase of operation.

As the air used within the vessels is fed into and re-circulated on a closed (contained) loop system, the short retention time (up to a maximum of 2 weeks) mitigates the potential creation of an anaerobic environment. Temperature controls will enable the operator to ensure that such anaerobic conditions are not reached.

It is anticipated that moisture modification through the MBT process will be in the order of 10% to 12% reduction over the first week with a maximum potential moisture reduction of 15% over 2 weeks. Moisture modification results in approximately 75% leachate generation and 25% loss to air.

2.3.2.3 MBT Drainage

The enclosed MBT vessels are within the main buildings ("the Western Hangar").

The floor of the MBT area within the MBT Plant will be graded internally for appropriate wastewater control within each vessel and, separately, within the trafficked areas of the remainder of the MBT. The initial tipping area and short-term waste bunkers will be individually drained. The design allows for all surfaces to be regularly washed down and kept clean using fresh water from the Upper Lagoon.

The building floor beneath each MBT vessel is sloped lengthwise from the waste access/entrance door towards the central aisle between the two banks of MBT vessels. At the end of each floor, a 150 mm wide by 150 mm deep leachate collection drain will run transversely across the MBT vessel floor will collect any leachate and feed it into the collection drains. Wastewater or leachate produced through the bio-drying process will be used as a pre-seeded source of process water to support the adjacent AD operation.

2.3.2.4 MBT Air and Dust Control

The closed loop air circulation system within each MBT vessel essentially uses the waste as a biofilter; air is drawn from within the IWMF building through the individual roof of each vessel. Hence, the MBT vessel is held at a negative pressure, which mitigates against the potential for fugitive emissions. In any case, these would not be direct to the external air and the positive ventilation system within the IWMF buildings will collect and treat air emissions arising from the MBT's operation.

The air temperature within each MBT vessel will be maintained at or around 50 to 60°C.

Standard air changes within the MBT building will maintain a good working environment. Any emissions from the process are only released into the building when the vessel front doors are opened following treatment, i.e. as the RDF is removed using the wheeled loading shovel.

Within the MBT area, standard air changes through a positive ventilation system will be required, whereby air is drawn into the building via the front louvres in the building and sucked through dust filters and an ozone system with carbon filters providing final polishing in order to exhaust clean air to the surrounding atmosphere. Carbon filters will require replacement on a regular basis as required by the particular manufacturer's requirements, expected to be in the region of every 4 to 6 months.

Due to the hard-surface nature of all buildings and roads within the IWMF, the trafficking by modern road vehicles, and the naturally damp nature of the waste materials being handled, it is not expected that dust will be created in high quantities in the MBT plant. Nevertheless, as with all operational areas of the IWMF, good operational husbandry will be instigated in accordance with the recent HSE guidance relating to the control and mitigation of dust.

Leachate from the MBT process is prevented from entering the air circulation process through a unique and patented system of air circulation, which ensures leachate is efficiently collected without entering air rails at the base of each MBT vessel. This system has been well-proven at Waterbeach in Cambridgeshire and at a number of other facilities in Scotland.

The air rails run lengthwise on the building floor beneath the vessels and between the access door and the central separation aisle (where the leachate is collected and the air blowers are located). There will be at least four air rails per vessel.

The air rails are fixed directly onto the surface of the concrete floor beneath the vessels. The end of the air rails near the waste access/entrance door has a reinforced lip to deflect the bucket of the wheeled loader that then runs along the top of the rails to avoid damage.

The rail consists of one inverted galvanised "U" top section mounted over another reinforced galvanised "U" bottom section bolted into the concrete floor. The air is blown through the bottom section and exits via a series of 12 mm holes drilled at 300 mm centres in the vertical sides of the bottom U Section. Because of the positive fall of the bi-drying floor allowing leachate to run freely towards the leachate collection drain, and the continuous positive air pressure inside the air circulation duct, which essentially "squeezes" through the tight fitting of one "U" section clamped over another, this system has proven to be effective in passing air through the waste in the vessels while never becoming clogged with leachate or debris.

The top "U" section is fabricated in 2.5 metre lengths with hidden quick fixings and can be easily removed if required for maintenance or in the unlikely event of clogging by debris.

There will be no external heat supplied or drawn into the MBT vessels. The effective self-composting process ensures that the material in the MBT vessels warm up naturally without requiring any external heating sources to provide heat into the vessels.

2.3.3 Anaerobic Digestion (AD) Plant

The anaerobic digestion (AD) process will comprise a wet pre-treatment and anaerobic digestion system. This is considered to be a proven technology for the proposed waste feedstock, which will comprise separately collected municipal or commercial food wastes and/or other green wastes, herein referred to as mixed organic waste.

2.3.3.1 AD Waste Reception and Mechanical Pre-sorting

Mixed organic waste is delivered to the site and deposited into the AD reception area, where it is taken on a collecting screw conveyor and transferred to the pulpers.

2.3.3.2 Hydromechanical pre-treatment

The hydromechanical pre-treatment consists of two steps:

- dissolution and defibring of the digestible organics into an organic suspension and removal of coarse impurities in a waste pulper; and
- removal of fine impurities in a grit removal system.

2.3.3.3 Waste pulper

Pulping is performed to facilitate three objectives:

- disintegration of organic waste to enhance the subsequent digestion process;
- removal of non-biodegradable contaminants as a "heavy" fraction (stones, large bones, batteries and metallic objects); and
- removal of non-biodegradable contaminants as a "light" fraction (textiles, wood, plastic film, string etc.).

In the waste pulper, process water is added to the waste, which produces a suspension with a water content of approximately 90% (w/w), so that it is able to be pumped and mixed.

The waste pulper is operated in a batch-mode. The batch-mode consists of the following operation steps:

- charging of the pulper;
- dissolving process (defibration of the biowaste);
- pumping out of the biowaste suspension;
- filling with process water;
- heavy fraction discharge; and
- light fraction removal.

The charging of the waste pulper is automated. Once the optimal concentration of solids in the pulper has been reached, the charging with waste is automatically stopped.

The waste pulper is equipped with a special turbine. When it rotates, fluidic forces defibrate, suspend and partly dissolve the digestible organic fraction contained in the waste. Biologically non-degradable substances, such as plastics, textiles, metals, glass etc. are not damaged in the process. These contaminants are separated at the end of the treatment cycle.

After the dissolving process the waste-suspension is extracted through a sieve plate with a perforation limit of 10 mm at the bottom of each pulper by means of a centrifugal pump. The pulp will have a dry solids content of approximately 10 % (w/w).

Before the discharge of the contaminants the pulper is filled with process water. The contaminants retained in the pulper are now separated from the mixture of process water and contaminants on the basis of their different sedimentation characteristics.

At the bottom of the pulper the heavy fraction (glass, sand, stones, batteries, metals etc.) sediments and is removed by means of a trap system from the mixture of process water and contaminants. Before discharge it is rinsed with process water to minimize the remaining content of residual organic substances. With a dewatering screw conveyor, the purified heavy fraction is further cleaned of fine organic particles, then dewatered and transferred to a container.

The light fraction (plastics, textiles, composite materials as well as the hardly or non-digestible organic fraction, e.g. wood etc.) floats in the suspension or rises to its surface. After the separation of the heavy fraction, a gate valve is opened and the light fraction and suspension flushes into the receptacle of the LRS screw. The LRS screw removes and transports the light fraction to a light fraction press to reduce the moisture content. The dewatered light fraction is taken to a container by a conveyor belt. The resulting press water, as well as the excess water at the screw rake, is collected in a drainage system and carried back into the process with a pump.

Processing time of each batch-cycle depends very much on the type of waste and its composition. It is assumed that the cycle time is approximately 60 min for the waste pulper with screw rake.

2.3.3.4 AD Grit Removal System

The pulp withdrawn from the pulper still has a content of heavy fraction particles up to a size of the screen perforation (grit).

First the pulp is pumped into a surge tank. The pulp is withdrawn out of the coned point of the surge tank and is pumped through a grit removal system. The grit removal system mainly consists of a hydrocyclone, a classifying pipe, and a gritbox. Caused by centrifugal forces in the hydrocyclone a sludge enriched with grit is discharged as underflow into the classifying pipe and sediments downwards into the gritbox by occurring a reduction of the content of discharged organics due to a weak counterflow with upstream water. The gritbox is emptied automatically depending on demand.

The pulp is circulated through the grit removal system several times to ensure that all grit is removed from the waste. On completion of the grit removal cycle, the recirculation is stopped and the de-gritted pulp is pumped to the suspension buffer.

2.3.3.5 AD Suspension Buffer

To obtain proper mixing, air from the tank headspace is led after extraction of its condensate buffer to the air compressor suspension buffer, where it is compressed and injected back to the suspension buffer via a central gas lance system at the bottom of the tank. This induces a proper mixing of the tank contents.

Bacterial hydrolysis will commence and consume oxygen, so a certain level of oxygen must be maintained in the injected air, by permitting a very carefully controlled rate of fresh air to the compressor suction, which will suppress the formation of methane and odourous compounds.

The suspension buffer is connected to the waste air treatment system in order to avoid possible bad odours.

2.3.3.6 AD Digester

The pulp is pumped from the suspension buffer to the digesters, where the biogas production will take place. The digester is fed with the means of a digester feeding pump. The feeding process of the digester will be automatic and semi-continuous. It will be fed throughout a twenty-four hour day, seven days a week, for short periods and in frequent intervals by the use of pumps, optimal for the transport of low flowing suspensions containing solids. High liquid level in the digester outlet sump inhibits the digester feed pump.

Part of the biogas produced in the digester is led to one gas compressor per digester where it is compressed and pushed back into the digester via a central gas lance system at the bottom of the digester. The biogas creates bubbles while leaving the gas lances and it increases the water level at the top of the digester. Thus, a significant volume of liquid is displaced which creates a high velocity current in the central part of the digester up to the surface. It continues horizontally towards the perimeter of the digester, moves down close to the wall region to the bottom and then back to the digester's centre. This effect has the capability of mixing all the digester's volume. The high surface velocities avoid the formation of a 'crust' on the surface of the digester.

The temperature of the digester is monitored. The biological process operates at mesospheric temperature conditions, i.e. between 36°C and 38°C, which gives higher operating and disposal safety within the process. A constant temperature will be maintained in the digester by the external recirculation heat exchanger system provided for each digester.

The retention time for the waste will be approximately 18 days, during which the organic dry matter in the digesters will be converted to biogas.

The digested pulp (digestate) is automatically pumped from the digesters to the dewatering station under level control.

Digestate storage tanks will be equipped with appropriate pressure control systems including pressure sensors and pressure relief valves to protect against both pressure and vacuum. Data from the pressure control system and sensors will be fed the AD control room. Pressure within the digesters will be monitored and managed to prevent build up or vacuum conditions developing. In the unlikely event of pressure build up, the pressure release valves will allow the tanks to vent through control pipes to a pressure control gasometer.

Whilst the AD plant is subject to detailed design, it is expected that any significant pressure variations will result in an alarm notifying the operator. It is understood that the pressure release valves (for over and under pressure protection) would not commonly be connected to the alarm system on AD facilities and are manual 'dumb' systems (spring loaded, weighted disc or burst disc).

The digester monitoring philosophy will be developed at the detailed design stage, to comply with the conditions of the standard rules permit (SR2012 No.12). Since the standard rules do provide specific requirements for monitoring techniques or frequency, the following notes are merely indicative.

Chemical assays (alkalinity, ammonia, dry solids and volatile solids, VFA, C:N ratio, OLR, pH) will be performed in accordance with standard techniques. Under normal operation the monitoring frequency will be weekly or greater as required, for example during start-up and stabilisation of the digesters.

On-line measurements of, temperature, biogas pressure, H₂S and biogas flow rate are likely to be included for process control. Data will be measured by instruments fitted to various parts of the plant. Data will be logged automatically and reviewed daily by the operators via a computerised user interface. High level indications will link to alarms. The instruments will be maintained in accordance with good operating practise and the manufacturer's instructions. Safety critical outputs will be linked to alarms and verified by offline measurements at suitable intervals, where practical.

The primary means of preventing foam will be maintaining good control of all the basic digester parameters, particularly temperature, pH, mixing efficiency, alkalinity and organic loading rate (OLR). The operators will be suitably skilled and trained. Daily visual checks will be performed via viewing window(s) in the top(s) the digester(s) and by monitoring digestate for signs of foam. Further foam control systems (such as anti-foam dosing) may be implemented if deemed necessary through detailed design.

2.3.3.7 Sanitation

In accordance with the requirement of PAS 110, the following conditions will be achieved within the anaerobic digestion sanitation process:

- temperature of 70 °C;
- time during which the material is kept at this temperature of 1 hour; and
- maximum particle size of 12 mm.

To achieve the conditions, there are three isolated sanitation tanks of 30 m³ each. While one tank is being loaded and heated up to 70°C, in the second tank the required temperature is being maintained for over 1 hour and finally the third tank is being emptied during this time. This allows for a continuous feeding of the digesters. The third requirement, the 12 mm particle size, will be maintained by the 12 mm sieve on the bottom of the pulper.

2.3.3.8 AD Biogas Cleaning and Combustion

Hydrogen sulphide (H₂S) needs to be removed from the biogas produced, in order to avoid corrosion and to reduce sulphur concentrations in the emissions when the biogas is combusted. An external biological desulphurisation will be used to achieve the required values for the valorisation of the biogas in biogas units.

The outgoing biogas is conducted over a condensate trap, which is filled with gravel. In it, the water is partially separated from the biogas. In addition, the gravel heap also serves to retain possibly entrained solid components such as foam particles.

This biogas will be combusted in two biogas gas engines, with a combined electrical output of approximately 1MW. The configuration of biogas engines will be determined during detailed design. However, it is assumed that two engines will be sized to 2 x 50% of maximum capacity. Therefore, when the maximum capacity of the feedstock is being treated in the front end of the process and maximum biogas production is being realised, both engines will operate at full capacity. If less feedstock is being treated in the front end of the process, biogas production will be lower and one engine will operate while the other is in standby mode.

An automatic gas flare will be used to combust the biogas during periods of plant shutdown or excess biogas production. The flare will be designed to achieve a minimum temperature of 1,000 °C and 0.3 seconds retention time at this temperature. The high temperature flare will burn the biogas and prevent uncontrolled release (and release of odour) into the atmosphere. On-line measurements of, temperature, biogas pressure, H₂S and biogas flow rate will be monitored and controlled by the site management team.

2.3.3.9 AD Dewatering

The solid-liquid separation will be used to separate the digestate into a thin liquid fraction with low total solids content and a solid fraction with high total solids content.

The digestate is continuously pumped at a controlled rate from the digesters to dewatering centrifuges.

Prior to entering the centrifuges, if required, the pulp will be conditioned by the addition of polyelectrolyte solution.

The dewatering unit will be operated continuously, to ensure a constant discharge of the digester and maintain the level in the digesters.

The dewatered digestate is placed on a covered conveyor belt and is transported to a small storage area, which bridges the weekend production. From here it is transported with a front loader to the storage prior to transfer off-site.

The liquid fraction (centrate) is discharged into a small tank and from here it is pumped to the process water tank.

2.3.3.10 AD Digestate Storage Tanks

The remaining digestate, which has not been sent for dewatering, will be pumped to the two Digestate Storage Tanks. The tanks will be equipped with quick coupling systems for the removal of the liquid digestate for its transfer off-site.

2.3.3.11 AD Exhaust Air Collection and Treatment

The AD operating area has been compartmentalised to limit the total volume of air that requires treatment via a biofilter and/or need to be collected and changed through the building's overall ventilation system. This defines areas of 'clean' or 'dirty' air (i.e. 'clean' being air that naturally circulates around contained AD operating systems within an internal environment that requires little or no treatment prior to ventilation; and 'dirty' being areas of the building where waste and digestate, delivery or collection, requires air treatment to mitigate fugitive emissions). By controlling and containing the environment(s) within the AD area it is possible to minimise and mitigate the overall ventilation, air treatment and air changes that are required inside the building.

The AD waste reception and digestate offtake areas require 2 to 3 air changes per hour and are treated through a sealed/contained biofilter located above the 'dirty' area. The treated air from the biofilter will be released via a dedicated flue within the main stack without any 'additional' treatment.

Given the enclosed and contained nature of the AD processes, the remainder of the AD area 'clean' will require 2 to 3 air changes per day. Air within the enclosed process areas of the building will be treated through standard air changes through the integrated ventilation system. Dust and carbon filters are used to exhaust clean air that can be used in other process areas – carbon filters will require replacement on a 4 to 6 month basis.

The environment within the AD halls will be held under negative pressure to control, manage and mitigate the potential for odorous emissions. Doors to the AD area shall remain closed except for those short periods of waste delivery or removal of the reject containers.

2.3.4 CHP

The CHP facility will combust waste comprising predominantly RDF from off-site satellite waste treatment facilities, some RDF produced by the on-site MRF and MBT, and some biological residues from the WWTP. The CHP plant will produce electrical power for use in the CHP plant and other on-site process with excess exported to the local distribution network. Heat will be exported as steam and hot water to on-site processes and for space heating.

The CHP facility will consist of two combustion lines. The thermal capacity of each boiler will be 92 MWth giving a total thermal capacity of the CHP facility of 184 MWth.

The CHP facility will be able to generate up to 50 MWe. With the AD plant in operation and generating 1 MWe, the CHP plant will be limited to 49 MWe as the total site generation is limited to 50 MWe. Normal export is expected to be around 28 MWe, after providing power to the other facilities on site.

The maximum capacity of the CHP facility is 595,000 tonnes per annum.

The CHP facility will be designed to accept RDF within an NCV design range of circa 7-13 MJ/kg. Fluctuations in the delivered NCV may lead to variations in the waste throughput, but this will not exceed 595,000 tonnes per annum of incoming waste.

An indicative process schematic for the CHP plant is presented within Figure 1. A larger version is included in Annex 1.

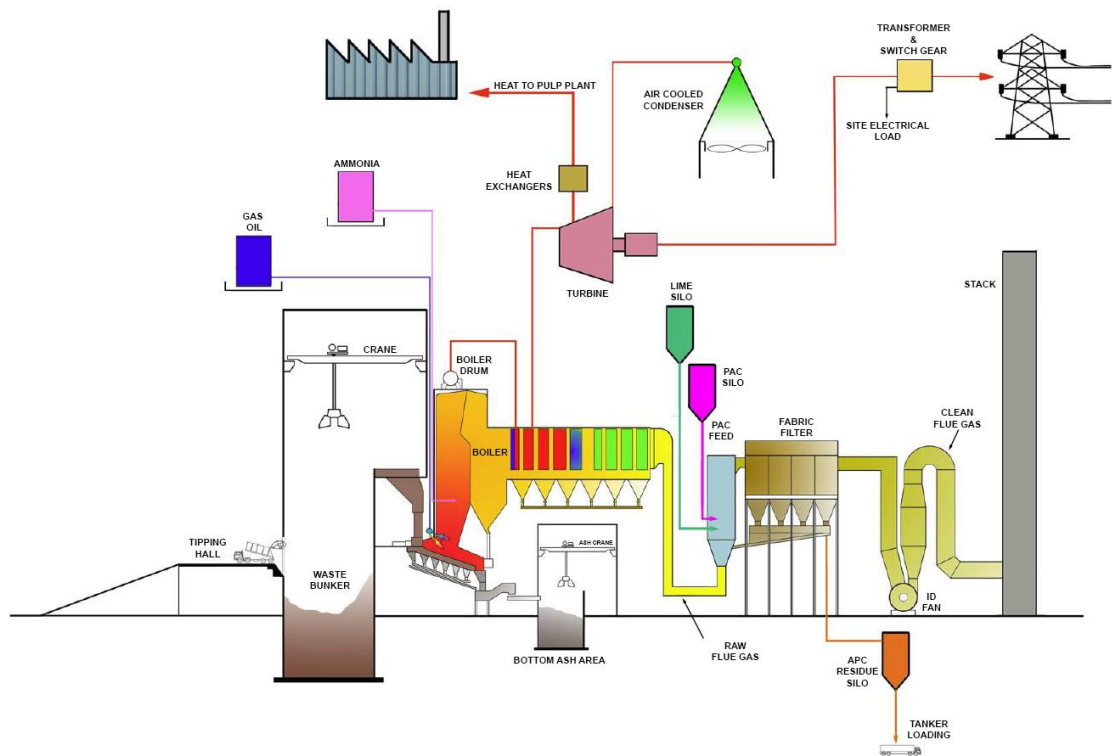


Figure 1 – Indicative CHP Plant Schematic

2.3.4.1 RDF Reception

The RDF storage bunker will have a storage capacity of approximately 8,000 tonnes, which is equivalent to up to 5 days RDF storage capacity. RDF will be stacked by the overhead crane. There will also be some additional storage within the Installation for RDF at the MRF and MBT plants.

The RDF reception area will be a fully enclosed building, maintained under slight negative pressure by the buildings ventilation system to minimise the risk of odours, dust or litter from escaping from the building. Combustion air for the CHP is drawn from the tipping hall and bunker. The vehicles will tip into the bunker from which a grab will transfer RDF to the feed hoppers for the combustion lines.

The grab will also be used to mix the RDF and remove any unsuitable or non-combustible items identified by the operations staff. These items will then be quarantined prior to transfer off-site for disposal at a suitably licensed facility.

Sludge residues from the WWTP will be transferred by site vehicle and tipped into the bunker.

2.3.4.2 Raw materials

The CHP facility will use a variety of raw materials during the combustion and processing of the RDF.

Aqueous ammonia solution will be delivered in sealed tankers and off-loaded via a standard hose connection into a tank with suitable secondary containment. Displaced air will be vented back into the tanker via a filter. In addition the tank will be fitted with an emergency pressure valve which will discharge to atmosphere via a filter.

All liquid chemicals used by the CHP facility will be stored in controlled areas, with secondary containment facilities providing containment for a volume of 110% of the biggest storage container or 25% of the total capacity, whichever is the greater.

Lime and activated carbon will be delivered to the CHP facility in powder tankers and transferred to separate dedicated storage silos. Both the lime and activated carbon will be transported pneumatically from the delivery vehicle to the correct storage silo.

Silos will be fitted with high level alarms. The top of the silos will be equipped with a vent fitted with a fabric filter. Cleaning of the filter will be done automatically with compressed air after the filling operation. Filters will be inspected regularly for leaks.

2.3.4.3 Combustion process

The two stream combustion unit, a moving grate design, will ensure continuous mixing of the fuel and hence promote good combustion. In each stream, as the fuel enters the furnace it will pass through a drying zone, a combustion zone and a burnout zone. Primary combustion air will be extracted from within the fuel storage bunker and fed in below the fuel through the grate to promote good combustion. This will maintain the bunker and tipping hall at negative pressure hence mitigating odour release from the storage of waste within the bunker.

Secondary combustion air will be injected above the grate where it provides for good mixing and combustion control. Ammonia solution, using an enhanced Non-Selective Catalytic Conversion (SNCR) system, will be injected into the combustion chamber to react with the oxides of nitrogen, chemically reducing them to nitrogen and water.

Auxiliary low NO_x burners operating on fuel oil will be fitted for start-up sequencing and to maintain temperatures above 850°C for 2 seconds. The oxygen concentration and temperature will be carefully controlled to ensure complete combustion and minimise dioxin emissions.

Bottom ash from the grate will be transported by the grate to the bottom of the hearth and into a water-filled quench pit. A conveyor will then lift the wet ash to the ash storage area in the main tipping hall. The bottom ash tipping hall will be within the confines of the building.

It is intended that the ash would be transferred to a suitably licensed waste management facility where it will be processed to produce a substitute aggregate material. If a suitable recovery facility is not available to accept the residue, it may be transferred for disposal in an off-site landfill.

Prior to transfer off-site, bottom ash will be periodically sampled in accordance with the Environment Agency's ash sampling protocol.

A proportion of clean flue gas downstream of the flue gas treatment plant will be recirculated back into the furnace to improve boiler efficiency, reduce NO_x and flue gas volume to the stack. The proportion of recirculated flue gas will depend on the calorific value of the waste and the thermal load at which the incinerator is operated, but is normally expected to be in the range 10 – 20%.

2.3.4.4 Energy recovery

Hot gases from the fuel combustion will pass through a series of heat exchangers and superheaters and finally through a two stage economiser. The first stage of the economiser will be used to preheat feedwater before it is supplied to the boiler and the second stage will be used to heat up condensate and will ensure that the flue gas temperature is the optimum temperature for reaction with lime. The design of the boilers, following a computerised fluid dynamics assessment, will ensure that the flue gas temperature is quickly reduced through the critical temperature range to minimise the risk of dioxin reformation.

The steam will be fed to a steam turbine which will be used to generate electricity. Steam will be condensed using air cooled condensers.

Steam will be extracted from the steam turbine at various pressures. This will be used to supply heat for internal processes (e.g. deaeration and condensate preheating), plume abatement at the stack and external processes at the Pulp plant (drying, process heating and space heating) and the WWTP (evaporation, effluent cooling and space heating). Steam pressures will be selected to optimise electrical output and overall plant efficiency. Total heat export from the CHP facility (including plume abatement but excluding internal heat uses at the CHP plant) will normally be in the range 20 – 40 MWth depending on external ambient conditions. External ambient conditions (predominantly temperature) will affect the heat demand for space heating in the Pulp plant and WWTP, and plume abatement at the CHP plant.

Most of the steam supplied to the Pulp plant will be returned as condensate to the CHP plant for re-use in the water-steam cycle. This will minimise the consumption of potable water used for the production of demineralised water for the boiler.

2.3.4.5 Gas cleaning

Flue gases pass from the boiler to the gas cleaning equipment. The flue gases will enter a reaction chamber where lime reacts with and neutralises the acid gases. Activated carbon will be injected into the duct preceding the bag filter to adsorb (primarily) dioxins, other volatile organic compounds (VOCs), mercury and other trace metals. The lime injection rate will be controlled by upstream measurement of hydrogen chloride (HCl) thus optimising the efficiency of gas scrubbing and reagent usage.

Nitrogen oxides (NO_x) abatement will be achieved by the use of an enhanced selective non-catalytic reduction (SNCR). The SNCR is based on the injection of ammonia solution into the furnace chambers to significantly reduce NO_x emissions to lower concentrations than a 'typical' SNCR system. The SNCR system has been designed with the injection of ammonia solution at multiple points within the combustion chamber, coupled with infra-red pyrometers and integrated algorithms to allow more precise delivery of reagent. NO_x will also be controlled using flue gas recirculation, see 2.3.4.3.

Bag filters will be used to remove the fine ash plus reacted and excess lime and carbon from the flue gases. The build-up of the latter two on the surface of the filter bags enhances the performance of the system. Reverse pulses of compressed air will be used to remove the accumulated particulate from the bags. These Air Pollution Control residues (APCr) will fall into a collection hopper. Some of the residues will be recirculated back into the process to minimise reagent consumption. The spent residues are conveyed to a dedicated APCr storage silo. The APCr will be collected by sealed tankers and taken to a licensed waste treatment facility.

The bag filters will be fitted with burst bag detection. The burst bag detection system will be a pulse-jet sequencer unit. The system will use a dust sensor within the unit, which is independent of the particulate monitor within the stack, to identify if a bag filter within each row of bags has burst. Where it is identified that a bag has burst, the row will be able to be isolated to allow the damaged bag to be replaced without shutting down the CHP Plant.

The cleaned gas will then discharge to atmosphere via a stack, with an approximate height of 55 m above the existing ground level which is equivalent to a stack height of 75m from the base of the stack.

2.3.4.6 Ancillary Equipment

Demineralised water is required to compensate for boiler blowdown losses.

Demineralised water will be provided from an on-site water treatment plant.

A standby generation system, which will be fired using gas oil, will be installed to provide sufficient electrical power to safely shut down the CHP facility and other site processes in the event that the electrical grid connection is lost and the turbine is off line and unable to provide electricity to site processes. The standby diesel generators will have a thermal input of approximately 5MWth.

The CHP air cooled condensers will provide a source of cooling to condense the steam generated by the thermal treatment processes, and any auxiliary cooling requirements such as air compressors.

Steam from the exhaust of the steam turbine will be condensed in an air-cooled condenser and return to the water-steam cycle. Smaller forced-air coolers will provide cooling for other equipment, e.g. turbine generator and oil systems.

2.3.4.7 Liquid effluent and site drainage

The CHP facility is designed for zero discharge of wastewater. Rain water and waste water from boiler drains, blowdown and the demineralised water treatment plant will be stored and use for quenching boiler bottom ash.

2.3.4.8 Emissions monitoring

Emissions from the stack will be monitored using continuous emissions monitoring systems (CEMS) for: particulates, carbon monoxide (CO), ammonia (NH₃), sulphur dioxide (SO₂), hydrogen chloride (HCl), oxygen (O₂), nitrogen oxides (NO_x) and Volatile Organic Compounds (VOCs).

In addition to the continuous monitoring, periodic sampling and measurement will be undertaken for hydrogen fluoride (HF), nitrous oxide (N₂O), cadmium (Cd), thallium (Tl), mercury (Hg), antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni), vanadium (V), dioxins and furans and dioxins like PCBs.

Periodic measurements will be carried out four times in the first year of operation and twice per year thereafter.

The CHP Facility will include a dedicated duty CEMS for each line and a stand-by CEMS which will ensure that there is continuous monitoring data available even if there is a problem with a duty CEMS system.

2.3.5 Pulp Plant

The Pulp plant would be capable of recycling up to 170,000 tpa of recovered printing and writing paper and card, to produce 85,500 tpa of recycled paper pulp which will be transported off-site and used to predominantly manufacture printing and writing paper, white surface packaging and some tissue.

The Pulp plant has been designed and configured to produce recycled pulp suitable for use in the manufacture of writing or printing paper. To achieve this, the quality and purity of the paper and card feedstock imported to the Site must comply with a recognised specification. This would provide the Pulp plant with raw materials suitable for the washing, cleaning, bleaching, mixing and drying operations required to produce the recycled pulp.

Grades (defined by EN643) within High Grade RCP, specifically sorted office papers (SOP/SOW) and White Letter which are largely post-consumer and uncoated papers, and Multigrade (printer waste) which are largely pre-consumer, will be sourced as a feedstock for the Pulp plant.

The proposed specification of the paper and card suitable for treatment within the Pulp plant is defined by EN643.

- EN 643 Group 1: Mixed papers; OCC Packaging; Old News; and Pams.

- EN643 Group 2: Unsold News; Printed, mechanical pulp; Sorted office; Printed, colours, wood-free; Carbonless; and, PE coated.
- EN643 Group 3: Printed lightly, heavily; and, Printed white, coloured.
- EN643 Group 4: Kraft Papers; and Sacks.
- EN643 Group 5: Special Papers; and Liquid packaging board.

Based on the above feedstock, the Pulp plant would prepare a feedstock comprising 75% Sorted Office Paper (SOP), 15% Multigrade and 10% White Letter.

2.05 Sorted Office Papers

Paper, as typically generated by offices, shredded or unshredded, printed, may contain coloured papers, with a minimum 60 % wood-free paper, free of carbon and principally free from carbonless copy paper (ccp)/no carbon required (NCR), less than 10 % unbleached fibres including manila envelopes and file covers, less than 5 % newspapers and packaging.

2.13 Multigrade

A blend of coloured and white letters, coloured wood-free magazines and other wood-free papers and shavings. Free from newsprint but 10 % of other wood containing papers are permitted. May contain 2% paper with plastic layer.

3.05 White Letter

Sorted white wood-free writing papers, originating from office records, free from cash books, carbon paper and non-water soluble adhesives.

In summary, the above is the technical specification for what is generally referred to as high grade 'mixed office waste' in the industry and the Pulp plant will be capable of processing this wide range of types of waste papers including high quality graphics paper, photocopying paper, printing and writing etc.

2.3.5.1 Design of waste paper de-inking plants

The four key quality parameters that influence the design of waste paper de-inking plants are:

- (1) ink removal;
- (2) "Stickies";
- (3) brightness; and
- (4) ash.

Ink Removal

The quality of ink and dirt removal is measured using a parameter called dirt or speck count: this refers to the number and size of black or coloured spots that are visible to the human eye on the finished paper.

Ink is applied to paper to create an image, either graphic or character. The type of ink and the way it is applied varies. This variability creates a problem in deciding which process should be selected to separate the ink material from the fibre and remove it from the system whilst at the same time retaining as much fibre as possible.

Laser printers produce their image using a powdered ink that is a material bound with a plastic fixative that is melted onto to the paper surface. This has been a problem for a number of earlier designs of de-inking plant because the images are very difficult to release from the cellulose fibre that forms the paper. The proposed plant incorporates equipment and technologies that will remove (or render invisible to the human eye) any residues from laser printing on the fibres.

Virgin pulp fibres do not contain ink particles.

“Stickies”

The term “Stickie” evolved from the papermaking process to describe blobs of sticky material that adhere to and contaminate the papermaking fabrics on which paper is made. If the paper making fabrics were contaminated the paper maker would have to stop the paper making machine and spend time cleaning the fabric or cut the fabric off.

The “Stickie” materials are contained in the waste paper as a variety of adhesives and plastics used in book bindings, self-seal envelopes, self-adhesive labels, and other office applications. Stringent quality control of the incoming waste paper would minimise the inclusion of the other contraries such as plastics and metal staples.

Brightness

Consumers like to have bright products because it suggests clean, sterile, healthy, modern, etc. and consequently a large amount of effort and cost is incurred to make things look “bright”.

Brightness is measured using a number of techniques but generally they work on the principle of shining light onto the product and measuring the quantity of reflected rays; the higher the brightness the larger number of reflected rays.

The Pulp plant would incorporate a modern two stage brightening process incorporating oxidative and reductive chemical processes to increase the brightness of the final product in order to approach the brightness achieved with virgin pulp.

Ash

Ash is a term used by the paper makers to describe how much non-fibre material is in the product. The measurement is made from the complete combustion of a sample of the paper in a ceramic furnace by measuring the ash that is left after the paper has burned.

Ash is typically made up of minerals such as China Clays used in the production of the paper.

There are other parameters that are important to the paper makers but not largely influenced by the de-ink plant design. These parameters are the average fibre length and the ability of water to flow through the fibres which can affect the quality of the final product. These parameters are generally inherited from the waste paper fed into the de-inking plant.

2.3.5.2 Pulp plant process overview

A simplified process flow diagram for the Pulp plant is presented below.

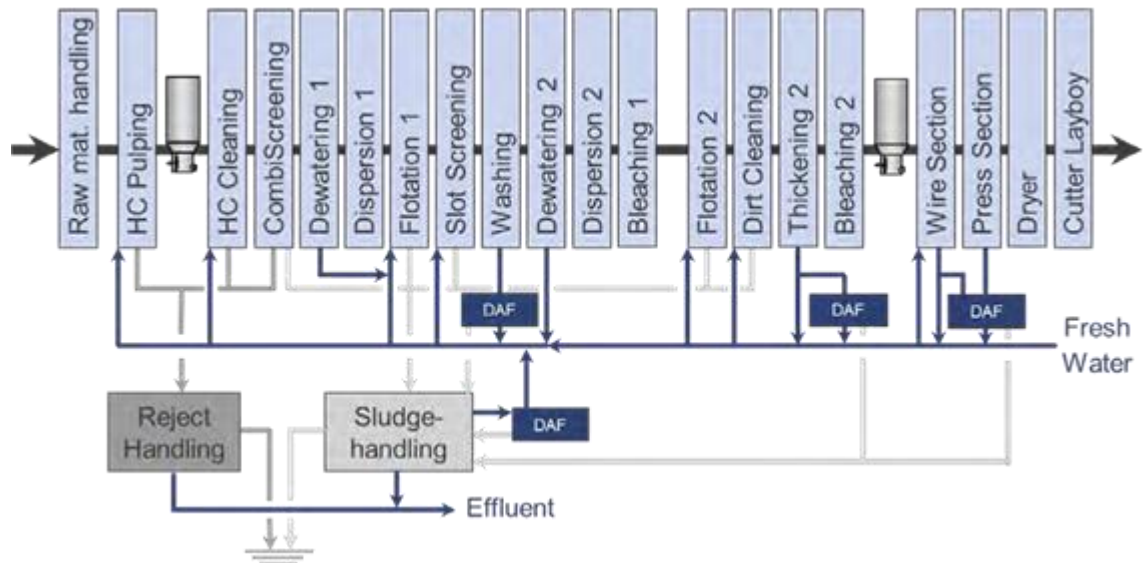


Figure 2 – Pulp Process Flow Diagram

2.3.5.3 Paper reception and pre-sorting

High grade mixed office waste paper and other high grade waste papers would be delivered to the installation and unloaded in the reception hall. Paper will typically be delivered in baled form, but the reception hall can also receive paper in loose form i.e. delivered within ejector trailers. Forklifts with debaling equipment and front end loaders would transfer the paper feedstock to a feeding hopper that would evenly distribute the paper onto a feed conveyor. At this point the paper feedstock to the Pulp plant would be joined with paper recovered from the mixed dry recyclable and/or similar pre-sorted or separated mixed commercial wastes MRF.

2.3.5.4 Pulping

Waste paper would be fed by conveyor into the pulper.

Water is heated to a temperature of approximately 80°C using a direct steam inductor and added to the pulper under flow control. The amount of water added is determined by the desired pulping consistency (i.e. ratio of water to solid matter). Typically, the likely paper feed would be approximately 90% solids whereas the ideal pulping consistency is 15% to ensure maximum fibre to fibre contact is achieved in order to loosen the ink from the paper fibres.

Additives would be applied to raise the pH to approximately 10 to create the right conditions for the fibres to swell and soften.

At the end of the pulping cycle, the fibrous mixture or 'stock' from the pulper would pass through a perforated screen. The fibrous mixture will be diluted to 5% consistency before being pumped to the high consistency cleaner.

The un-pulpable contaminants, (i.e. plastic covers, large staples and pieces of metal that have not been previously removed) are screened out and discharged on to a conveyor and fed to a standing open ro-ro container. The Ro-Ro container would be transported by the on-site truck to feed the rejected materials either into the MRF for further screening, separation and recovery or into the CHP bunker to be mixed with the incoming RDF feedstock and used within the CHP plant.

2.3.5.5 High consistency cleaner

The high consistency cleaners are designed to remove small heavy contaminants such as glass, stones, staples, paper clips etc. from the paper fibre stock using a centrifuge. These contaminants are periodically removed and discharged into a chute where any water is removed and collected for recirculation.

Processing rejects consist of clips, metals, plastics, stickies (i.e. staples and metal bindings used in the production of publications, and plastic films and glues that are used as paper coatings in the production of high grade brochures or journals which will collectively make up approximately 50% of the rejects) and fibres (i.e. fibres that drop out of the pulping process which will make up the remaining 50% of the rejects).

The contaminants are sent back into the MRF for further screening, separation and recovery or mixed with the RDF feedstock and used within the CHP plant. The processing rejects are expected to have an approximate calorific value of up to 40 MJ/kg. Any metals which are not recovered within the MRF will subsequently be recovered from the IBA from the CHP Plant.

The remaining feedstock (pulp) within the high consistency cleaners is then fed into a coarse screening system.

2.3.5.6 Coarse screening

The coarse screening system would screen and remove from the feedstock plastic and other flat contaminants larger than 2 mm in diameter, whilst minimising the loss of the pulp fibre. Rejected materials from the coarse screening process would be recirculated and fed back into the high consistency cleaners.

Coarse screening is a three stage process comprising two primary coarse screens (one would be operational whilst the other would be on standby), one secondary coarse screen and one tertiary coarse screen.

Materials passing through the three stage coarse screening process would be fed into the pre-screening system.

2.3.5.7 Pre-screening

The pre-screening system would remove spherical and cuboid debris (i.e. glue, melted plastic and latex based sticky materials) from the pulp together with other contaminants larger than 0.18 mm in size. Rejected materials from the pre-screening process would be discharged to a sludge silo for further treatment.

Pre-screening is a three stage process comprising one primary screen, one secondary screen and one tertiary screen, all fitted with slotted screening baskets.

Materials passing through the three stage pre-screening process would be fed into the main floatation system.

2.3.5.8 Main floatation

The main floatation system removes ink, ash and other hydrophilic contaminants using surfactant and soap based chemicals whilst minimising fibre loss.

Main floatation consists of a two stage washing system comprising one primary floatation cell with six chambers and a secondary floatation cell with four chambers.

The materials from the pre-screening system are diluted down to 1.2% solids and pumped into the first (of six) chambers in the primary floatation cell through a distribution system designed to prevent turbulent flow. Each chamber would be fitted with a specially designed air distributor to liberate entrained air from the mixture in the form of bubbles.

The chemical reaction which takes place within the primary floatation cell would attract small particles of ink to the surface of the chamber in the form of bubbles. The bubbles create a foam on the surface of the primary floatation cell. Water levels within each primary floatation cell would be continuously monitored to allow the foam to overflow into a collecting chamber.

The primary floatation cells are operated on a sequence of batch processes, whereby, once the pulp has been washed in one chamber, it is pumped into the next chamber where the washing process starts again. After passing through all six chambers the cleaned pulp feedstock is fed into the low consistency primary forward cleaning system.

The foam from the primary floatation cells would contain inert materials and some pulp fibres. This would be collected in a chamber, sprayed with water and diluted into a slurry and pumped into the secondary floatation system.

The secondary floatation process is identical to that taking place in the primary floatation cells. However, the resultant foam is collected and discharged as a slurry to the sludge silo for further treatment.

2.3.5.9 Low consistency forward cleaning

The low consistency forward cleaning system uses four cone shaped centrifuges to separate cellulose fibres (paper fibres) from the de-inked pulp.

The forces that act within the centrifuge direct the materials that have a specific density higher than that of cellulous fibre to the internal wall of the centrifuge and rejected through a nozzle at the bottom. These residues would be collected and fed into the next centrifuge.

Cellulose fibres and other lightweight materials that are discharged through the top of the first centrifuge would be transferred to the fine screening system. It should be noted that materials discharged through the top of any other centrifuge would be recirculated through the system to ensure consistency and purity of the cellulose fibre recovered by the low consistency forward cleaning system.

The residues from the low consistency forward cleaning system would be collected and discharged as a slurry to the sludge silo for further treatment.

2.3.5.10 Fine screening

The fine screening system uses four filter screens to remove spherical and cuboid debris (i.e. any remaining glue, melted plastic and latex based sticky materials) from the de-inked pulp larger than 0.15 mm in size. Rejected materials from the fine screening process would be discharged to a sludge silo for further treatment.

Fine screening is a four stage process comprising two primary fine screens, one secondary fine screen and one tertiary fine screen all fitted with slotted screening baskets.

Materials passing through the four stage fine screening process would be fed into the thick washing system.

2.3.5.11 Thick washing

The thick washing system is designed to wash fillers, ash and fines from the de-inked pulp. The washed fibres would be pumped or transported by screw conveyors into the dispersing system.

The water used within the thick washer (containing the fillers, ash and fines) would be pumped to a washer filtrate storage tank. Following filtration the water collected from the storage tank would be pumped to the first loop water clarification system.

2.3.5.12 Dispersing

The dispersing system is used to develop the fibre quality. The disperser would loosen the brittle plastic based inks found on laser printed paper and resin or varnish based inks that are found on specialist publications such as quality publications, brochures and reports.

Steam is used to heat the disperser and chemicals are added to bleach colours from the fibres. Some of the steam will be lost from the process in the dispersers.

Once treated within the disperser the pulp is pumped into a post floatation system.

2.3.5.13 First loop water clarification

The first loop water clarification system would be used to aerate and clarify the water discharged from the thick washer. Aeration would cause solid particles to float to the surface, where they are collected and pumped to the sludge silo for further treatment. The clarified water resulting from the first loop water clarification system would be reused within the Pulp plant.

2.3.5.14 Post floatation

The post floatation system works in a similar manner to that of the primary floatation system to remove and loosen ink using surfactant and soap based chemicals whilst minimising fibre loss. However, the post floatation process would use one primary floatation cell with four chambers and a secondary floatation cell with three chambers.

After passing through all four chambers within the primary floatation cell, the cleaned pulp feedstock is fed into the low consistency high and low cleaning system, and foam from the secondary floatation cells would be collected and discharged as a slurry to the sludge silo for further treatment.

2.3.5.15 Low consistency high and low density cleaning

The low consistency high and low density cleaning system uses a further bank of two cone shaped centrifuges (operating in forward and reverse) to separate long and short cellulose fibres from the de-inked pulp.

Materials passing through the centrifuges would be fed into the disc thickener, whilst the residues would be collected and discharged as a slurry to the sludge silo for further treatment.

2.3.5.16 Disc thickener

The disk thickener is a multi disc filter unit which would be used to remove water from remaining pulp slurry by collecting the cellulose fibres from the solution over a very fine mesh.

Once fed into the disc thickener, the pulp slurry would rotate slowly causing the fibres to accumulate on the surface of the filter discs whilst the remaining water filters through the filter mesh. The dewatered fibres would be removed and discharged into a chute at a consistency of approximately 10% solids. The fibres are then pumped to the second stage dispersing system.

Water that filters through the disc thickener is collected and pumped to the second loop clarifier for clarification and use for dilution.

2.3.5.17 Second stage dispersing

The second stage dispersing system works in a similar manner to that of the dispersing system to further develop the quality of the fibre. The second stage disperser would loosen the remaining inks, resins and varnishes from the fibre.

Steam is used to heat the second stage disperser and additives applied to bleach the fibres. Some of the steam will be lost from the process in the dispersers.

Once treated within the second stage disperser the thickened fibrous pulp would be transported by a conveyor into reductive bleaching tower.

2.3.5.18 Second loop water clarification

The second loop water clarification system would be used to aerate and clarify the water discharged from the disc thickener. Aeration would cause solid particles to float to the surface which are collected and pumped to the sludge silo for further treatment. The clarified water resulting from the second loop water clarification system would be recirculated and reused within Pulp plant.

2.3.5.19 Reductive bleaching

The reductive bleaching system comprises a specially designed down-flow tower. The thickened fibrous pulp would be fed by the screw conveyor into a rotating distributor at the top of the bleaching tower and rotated using an electric motor. The distributor creates an even distribution of fibrous pulp within the tower to create a plug flow. As the pulp progresses down the tower bleaching chemicals are added to develop the brightness of the fibre.

As the pulp reaches the bottom of the tower the fibres are removed and fed into the final floatation system.

2.3.5.20 Final floatation

The final floatation system works in a similar manner to that of the primary and post floatation systems to remove and loosen any remaining ink. The final floatation process would use one primary floatation cell with four chambers and a secondary floatation cell with three chambers.

After passing through all four chambers within the final floatation cell the cleaned pulp feedstock is fed into the final disc thickener, and foam from secondary floatation cells would be collected and discharged as a slurry to the sludge silo for further treatment.

2.3.5.21 Final disc thickener

The final disc thickener works in a similar manner to that of the disc thickener system and comprises a multi disc filter unit which would be used to remove water from remaining fibrous pulp.

The dewatered fibres would be removed and discharged into a chute at a consistency of approximately 8% solids. The fibres are then pumped into a storage tower and fed into the pulp drying and baling system.

2.3.5.22 Final pulp drying and baling

The final stage of the process would be the dewatering, drying and baling of the recycled fibrous pulp.

The pulp drying and dewatering system will comprise a four stage process whereby the recycled pulp is fed into a headbox under pressure from the storage tower and passed through a parallel opening (slice) onto the forming section.

Within the forming section, the pulp is fed onto a continuous moving mesh belt. Here the pulp is dewatered by gravity and vacuum suction to 55% solid content. From here the web of wet pulp is conveyed via a pick up roll into the press section.

Within the press section, the web of pulp is squeezed under pressure through two rollers to further dewater and prepare the dewatered pulp (which is in a sheeted form) for the final stage of the drying process.

The web of pulp moves from the press section into the dryer section where it is dried by warm air convection as it passes through three vertical stages: intense drying at high temperature, high air speed and high air pressure; high evaporation drying at a medium temperature, medium air speed and medium air pressure; and, finally, exit drying at low temperature, low air speed and low air pressure.

At the end of the exit drying stage the web of pulp is at 87% to 90% solid content. The dried and recycled pulp sheet is passed from the exit dryer and baled either for temporary storage within the pulp store or direct to the vehicle loading bay for export from the installation.

2.3.5.23 Sludge drying

Sludge (principally China Clay and small pulp fibre) produced by the pulping process will be dried prior to export from site to be used as a soil improvement material.

The sludge will be fed through a screw press and steam-heated tube dryer to reduce its moisture content from 50% to 35%. Water arising from the sludge drying process will be fed to the WWTP for treatment, recirculation and reuse. The sludge comprises inert materials, therefore, and will be free from odour. The sludge drying operation takes place within the confines of the Pulp plant building under standard ventilation control measures.

By reducing the moisture content of the sludge, vehicle movements associated with its collection and export from site will be minimized, and increase its reuse as a soil improvement material.

2.3.6 Wastewater Treatment Plant (WWTP)

The wastewater treatment plant (WWTP) will consist of the following seven treatment stages:

- (1) course and fine screens;
- (2) roughing and polishing dissolved air floatation (DAF);
- (3) lime soda softening;
- (4) sand filtration;
- (5) membrane treatment – reverse osmosis;
- (6) DAF and precipitator sludge collection; and
- (7) dewatering.

2.3.6.1 Coarse and fine screens

The course and fine screens will remove larger particles including 'Stickies' that are troublesome in downstream process plant and can interfere with flotation and settlement.

Collected screenings will be removed from the screen face by a wiper screw auger and will be deposited in an adjacent wheelie bin. In the event of failure of one unit, the entire flow can be accommodated and the level of treatment maintained by the remaining packaged screening unit.

2.3.6.2 Roughing and polishing dissolved air floatation (DAF)

The incoming effluent will have total suspended solids of up to 710 mg/l and a temperature of up to 50°C. The high temperature reduces the solubility of oxygen in water and therefore limits the amount of air that can be saturated in the air dissolving tube. This combined with a high incoming suspended solids leads to a less than ideal solids/air bubble ratio and less than ideal separation performance.

Therefore there is a second stage of polishing DAFs. The bulk of the suspended solids removal will take place in the roughing DAFs with the polishing DAFs operating at a much improved solids/air bubble ratio and providing an overall much improved separation performance.

The double DAF arrangement will allow for operation of each stage at differing pH which will be optimised to improve silica and organics separation.

Each stage of DAF is provided with a rapid mix weir for the addition of ferric chloride and flocculation tanks with a retention time of approx. 20 minutes and the facility for the addition of polyelectrolyte. This will encourage finer particles and colloidal organic matter to agglomerate and form larger and more easily separable floc that will be floated and removed. Depending on the precise composition of the organic matter and the percentage that is in colloidal form rather than fully dissolved, useful reductions in chemical oxygen demand (COD) can be achieved.

Therefore the design of the DAFs is optimised to achieve the maximum physiochemical separation possible which is intrinsically the lowest cost form of treatment.

2.3.6.3 Lime soda softening

After the roughing and polishing DAF plant where ferric chloride coagulant will be dosed, the effluent will be dosed with hydrated lime which will be supplemented with additional ferric chloride to further aid reduction in the de-inking solids and to improve the mobility of settled carbonate sludge.

2.3.6.4 Sand filtration

Clarified water from the lime soda softening precipitators will be subject to sand filtration to remove any solids carry-over. A bank of four pressure down-flow filters will capture any suspended solids in the sand media bed. On increase in head-loss, each filter will in turn be subject to an air, air and water, and water only backwash.

Solids removed will be returned to the calamity / balance tank where they will be pumped to the DAFs for solids separation.

The combination of double DAF, lime soda softening and filtration will remove as much of the residual ink, and greatly reduce the scaling and fouling potential of the pre-treated effluent. Only organic matter in particulate form that is able to float or settle will be removed and therefore soluble organic matter and its associated COD will be unaffected.

The pre-treatment plant will generate an effluent that has much reduced fouling potential on the membrane separation plant where bulk removal of soluble COD and dissolved salts will take place.

2.3.6.5 Membrane treatment – reverse osmosis

Four stages of reverse osmosis (RO) will be used to achieve the water quality requirements.

The product / permeate from each stage becomes the feed to the following stage, and the quality of the permeate progressively improves such that by the final fourth stage the desired treatment objectives are comfortably achieved.

The concentrate or reject from each stage is passed back to the feed of the preceding stage such that eventually all the concentrate / reject is amalgamated as a single discharge from the first stage.

Stage-one: High shear oscillating RO

The first stage is a high shear oscillating RO membrane plant.

Shear waves produced on the membrane surface keep the colloidal material in suspension, thereby minimizing fouling and prevent precipitating salts from accumulating on the membrane surface as scale. As a result, high throughput and water recoveries above that of a conventional membrane system can be achieved.

The device employs torsional oscillation at a rate of 50 times per second (50 Hertz) at the membrane surface to inhibit diffusion polarization of suspended colloids. The suspended colloids are held in suspension, where a tangential cross flow washes them away.

The high frequency oscillations impart a shear to the surface of the membrane to mitigate fouling and scaling. The membrane module houses a stack of flat membrane sheets (filter pack) in a plate and frame-type configuration.

It is possible to vary both frequency and amplitude to get the surface clean from suspended particulates and colloids. The sinusoidal shear waves of the membranes push the incoming particles from the surfaces and back into the bulk phase, resulting in a membrane surface clear for filtration.

The system consists of four components: a driving system that generates the oscillations, a membrane module, a torsion spring that transfers the oscillations to the membrane module, and an oscillation control system.

The high shear oscillating membrane system is not limited by the solubility of minerals or the presence of suspended solids. It can be used in the same applications as crystallizers or brine concentrators and is capable of high recoveries (up to 90%).

Stage two/three/four: Conventional spiral wound RO systems

The second, third and fourth stages comprise conventional RO treatment mounted horizontally in pressure vessels and arranged on skids.

2.3.6.6 Treated effluent storage and pumping

Treated permeate from the final stage of the RO system is discharge via a hydrophore vessel and official sampling point into 3 treated water tanks constructed in concrete. The total volume provides for a residence time of over 1.5 days at the design flow rate of 85 m³/h.

Cleaned and treated water will be recirculated and reused within the Pulp plant to provide a zero liquid discharge (or closed loop) waste water treatment system.

2.3.6.7 RO reject evaporator

The reject from the RO process will be transferred to the WWTP evaporator.

Condensate or product from the system is liberated steam which has been condensed from wastewater vapour and recovered through mechanical vapour recompression.

Solid rejects/sludge arising from the evaporator will be mixed with the RDF within the CHP plant.

2.3.6.8 DAF and precipitator sludge collection & dewatering

Floated sludge from the roughing and polishing DAFs is collected in a sludge sump and is pumped to the common inlet of a filter press.

Sludge from each precipitator is pumped directly to a gravity thickening tank. The sludge settles into a hopper at the base of the gravity thickening tank. The clear supernatant will overflow and flow via gravity to the calamity / balancing tanks where it is recycled back into the main treatment plant flow.

Settled sludge that has collected at the base of the gravity thickening tank is pumped directly to a filter press. DAF sludge will be blended in line for co-pressing with the precipitator sludge.

The filter press is a conventional plate and frame type with a pneumatic power 'squeeze cycle' which will ensure a high quality and consistently dry cake is produced with approx. 30% dry solids content. If required, a polyelectrolyte will be dosed to flocculate the incoming solids and improve the filtration of the sludge.

Solid rejects/sludge arising from the WWTP process will be mixed with RDF within the CHP plant.

2.3.7 Ancillary Activities

2.3.7.1 Building Ventilation

The building ventilation system will provide abatement of odours from each of the waste treatment processes.

- (1) CHP plant bunker and tipping hall;
- (2) Pulp plant;
- (3) AD plant; and
- (4) MRF and MBT plant.

CHP plant and tipping hall

The waste bunker and tipping hall will be maintained at a negative pressure. In maintaining negative pressure in the bunker it will prevent odour escaping from the waste bunker area.

Air from the waste bunker will be extracted from the bunker area and fed in below the fuel through the grate in the CHP Plant to promote good combustion. The high temperatures within the combustion chamber will destroy any odours within the air.

Pulp plant

The process area within the Pulp plant which may generate odours is the sludge area. Air from the sludge area will be ventilated to the bunker within the CHP plant. On this basis, this area will be maintained at a negative pressure.

AD plant

The AD plant has been compartmentalised into 'clean' or 'dirty' air (i.e. 'clean' being air that naturally circulates around contained systems within an internal environment that requires little or no treatment prior to ventilation; or, 'dirty' being areas of the building where waste and digestate, delivery or collection, requires air treatment to mitigate fugitive emissions). Therefore, the building ventilation systems will only be required to 'manage' the odorous air from the 'dirty' areas.

Air from 'clean' areas will be treated through the building ventilation system, with carbon and dust filters removing dust and any odours from the air prior to release to atmosphere via louvres in the building.

Air from the 'dirty' areas will be extracted and treated within a biofilter. The treated air from the biofilter will then be released via the site stack.

MRF and MBT plant

The closed loop air circulation system within each MBT vessel essentially uses the waste as a biofilter; air is drawn from the building through the individual roof of each vessel. Hence, the vessel is contained at a negative pressure, which mitigates against the potential for fugitive emissions. In any case, these would not be direct to the external air and the mechanical ventilation system in the building will take care of such emissions as described below.

The air temperature within each vessel will be maintained between 50 to 60°C.

Standard air changes within the MBT building will maintain a good working environment. Any emissions from the process are only released into the waste processing area when the vessel front doors are opened following treatment – i.e. as the RDF is removed using the wheeled loading shovel.

Within the MBT area, standard air changes through a positive ventilation system will be required, whereby air is drawn into the building via the front louvres in the building and sucked through dust filters and an ozone system with carbon filters providing final polishing in order to exhaust clean air to the surrounding atmosphere. Carbon filters will require replacement on a regular basis as required by the particular manufacturer's requirements, expected to be in the region of every 4 to 6 months.

In terms of dust control, this is not expected to be a difficult operational concern. Due to the hard-surface nature of all buildings and roads with in the IWMF, the trafficking by modern road vehicles, and the naturally damp nature of the waste materials being handled, it is not expected that dust will be created in high quantities in the MBT plant. Nevertheless, as with all operational areas within the installation, good operational husbandry will be instigated in accordance with the recent HSE guidance relating to the control and mitigation of dust ("Construction Dust: Inspection & Enforcement Guidelines 2014" HSE).

2.3.7.2 Auxiliary Power

Back-up diesel generators will be available to safely shut down the different waste treatment facilities in case of loss of grid connection for the installation.

2.3.7.3 Water Abstraction

Abstraction of water from the River Blackwater is covered by a separate abstraction licence (AN/037/0031/001/R01), which was granted by the EA on 9 March 2016. The abstraction from the River Blackwater will be used to maintain the supply of process water within the on-site New Field lagoon system, to supply the IWMF's closed loop process water system.

Upper and New Field lagoons will be used to manage and control the water required by the IWMF. Upper lagoon will provide the day-to-day water required by the IWMF and the larger New Field lagoon will provide additional storage of water resulting from permitted abstraction of water from the River Blackwater, or from water returned from the IWMF process. For the purposes of this application Upper Lagoon is the only lagoon proposed within this application.

Abstraction Licence Serial No: AN/037/0031/001/R01 includes the following constraints on the abstraction of water from the River Blackwater:

- Water abstraction at NGR TL 8343 2223 from a pumping sump with two pumps with a combined capacity of not more than 100l/sec, which will be used for filling reservoirs for the subsequent purpose of process water for waste treatment, processing and recycling;
- The maximum quantity of water to be abstracted up to:
 - o 360m³/hr;
 - o 8,640m³/d; and

- o 250,000m³/yr.
- No abstraction of water is permitted when the flow in the River Blackwater (as gauged by the Agency) at Appleford Bridge gauging station (NGR TL 845 158) is equal or less than 1,309l/sec (1.309m³s⁻¹).
- No abstraction of water can take place until the Licence holder has provided a storage facility, capable of storing at least 250,000m³ of water which is constructed or lined so that it remains impermeable. (i.e. New Field Lagoon)

Upper Lagoon will have a storage capacity of approximately 25,000 m³ with a water level 32mAOD.

In accordance with the site planning permission Upper Lagoon will be constructed below surrounding ground levels and within areas of previous quarry working. The side slopes of Upper Lagoon will be constructed largely within in-situ London Clay (Permeability <10⁻¹⁰ m/s) and backfilled Boulder Clay. The slopes will be shaped to a maximum gradient of 1V:3H. Upper Lagoon will be constructed wholly within in-situ London Clay, constructed at a gradient of 1V:3H.

Prior to filling the Upper Lagoon the side slopes will be proof rolled to seal the clay subgrade.

2.3.7.4 Site Drainage

Site drainage plans, as approved by Essex County Council, are presented in Annex 1 of the EP application.

Water which is abstracted from the River Blackwater will be pumped into the on-site storage lagoon. The lagoon will provide a storage facility for water to be used within the process.

Uncontaminated surface water run-off from building roofs and areas of hardstanding will be discharged into the lagoon.

3 REVIEW OF POTENTIAL SOURCES, PATHWAYS AND RECEPTORS

The issue of sources, pathways, and receptors has been covered in the Air Dispersion Modelling Assessment, submitted within Annex 5 of the Environmental Permit Application.

3.1 Odour Sources

An odour is the organoleptic attribute perceptible by the olfactory organ on sniffing certain volatile substances. It is a property of odorous substances that make them perceptible to our sense of smell. The term odour refers to the stimuli from a chemical compound that is volatilised in air. Odour is our perception of that sensation and we interpret what the odour means. Odours may be perceived as pleasant or unpleasant. The main concern with odour is its ability to cause a response in individuals that is considered to be objectionable or offensive.

Odours have the potential to trigger strong reactions for good reason. Pleasant odours can provide enjoyment and prompt responses such as those associated with appetite. Equally, unpleasant odours can be useful indicators to protect us from harm such as the ingestion of rotten food. These protective mechanisms are learnt throughout our lives. Whilst there is often agreement about what constitutes pleasant and unpleasant odours, there is a wide variation between individuals as to what is deemed unacceptable and what affects our quality of life.

An odorant is a substance which stimulates a human olfactory system so that an odour is perceived. Odorants may be a single chemical but more typically are a complex mixture of compounds and can also be associated with fine particulates. This complex mix often makes reliable "chemical" analysis or measurement at source difficult.

Typically, odours are detected at very low concentrations of chemicals and compounds in air. The human nose is very sensitive with on average over 5 million scent receptors. Humans can detect concentrations as low as a few parts per billion (ppb), or less in air.

The potential point source releases of odour from the facility are:

- the main stack which emits combustion gases from the CHP plant; the biogas gas engines; and ventilation air from the pulp plant and AD plants; and
- the biogas flare.

Identified possible sources of fugitive emissions of odour are:

- waste delivery vehicles;
- the MRF waste reception and process;
- the MBT waste reception and process;
- the AD process, in three sections:
 - (1) waste reception;
 - (2) AD process; and
 - (3) digestate storage;
- biogas storage;
- the CHP waste bunker;
- the ash storage area;
- the Pulp plant sludge storage area; and
- the WWTP.

3.2 Pathways

Odours emitted from the sources identified are emitted to air and have the potential to be conveyed to nearby receptors via transfer through the air.

The extent to which odour is detectable downwind and the intensity and character of such odours is dependent upon the following factors:

- The nature and magnitude of odorous emissions released from the source.
- Wind direction and wind speed.
- Atmospheric turbulence (vertical and horizontal) and the level of dilution and dispersion odours undergo as they travels downwind.

All of these factors can exhibit substantial variation over time.

3.3 Receptors

3.3.1 Sensitive Receptors

The identification of potentially sensitive receptors has been conducted on the basis that the level of exposure to odours that is likely to generate annoyance in residential premises (i.e. people's homes) tends to be considerably lower than the levels which may generate annoyance at commercial premises where higher tolerance to odour exposure can generally be expected.

The general approach to the Air Dispersion Modelling was to evaluate the highest predicted process contribution to ground level concentrations. In addition, the predicted process contribution at a number of sensitive receptors was evaluated. These sensitive receptors, and their location in relation to the installation boundary, are presented in Table 1, and shown on a plan in Appendix B.

ID	Receptor Name	Location		Distance from the Site Boundary (m)
		X	Y	
D1	Sheepcotes Farm (Hanger No.1)	581564.6	220328.3	425
D2	Wayfarers Site	582557.4	220185.4	170
D3	Allshot's Farm (Scrap Yard)	582892.6	220458.3	322
D4	Haywards	583235.7	221162.6	975
D5	Hérons Farm	582443.0	221378.3	694
D6	Gosling's Farm	581426.9	221380.9	889
D7	Curd Hall Farm	583261.7	221708.3	1374
D8	Church (adjacent to Bradwell Hall)	581832.3	222157.9	1511
D9	Bradwell Hall	581837.5	222319.1	1677
D10	Rolphs Farmhouse	580675.8	220512.8	1236
D11	Silver End / Bower Hall / Fossil Hall	581286.5	219730.6	1024
D12	Rivenhall Pl/Hall	581860.9	219104.3	1235
D13	Parkgate Farm / Watchpall Cottages	582336.5	219195.2	1045
D14	Ford Farm / Rivenhall Cottage	582697.7	218597.5	1689
D15	Porter's Farm	583391.6	219242.0	1427
D16	Unknown Building 1	583131.7	219462.9	1093
D17	Bumby Hall / The Lodge / Polish Site (Light Industry)	582947.2	220115.2	483
D18	Footpath 8, Receptor 1 (East of Site)	582660.7	220977.1	130
D19	Footpath 8, Receptor 2 (East of Site)	582597.0	220688.5	184

Table 1 – Sensitive Receptors

ID	Receptor Name	Location		Distance from the Site Boundary (m)
		X	Y	
D20	Footpath 8, Receptor 3 (East of Site)	582609.1	220564.0	134
D21	Footpath 8, Receptor 4 (East of Site)	582627.3	220497.2	95
D22	Footpath 8, Receptor 5 (East of Site)	582590.9	220415.2	19
D23	Footpath 8, Receptor 6 (East of Site)	582761.0	220217.8	276
D24	Footpath 8, Receptor 7 (East of Site)	583016.1	220026.5	592
D25	Footpath 35, Receptor 1 (North of Site)	582861.2	220843.4	489
D26	Footpath 35, Receptor 2 (North of Site)	582454.2	221013.5	348
D27	Footpath 35, Receptor 3 (North of Site)	582032.1	221162.3	504
D28	Footpath 31, Receptor 1 (North west of Site)	581877.2	220958.8	325
D29	Footpath 31, Receptor 2 (North west of Site)	581740.6	220764.5	212
D30	Footpath 31, Receptor 3 (North west of Site)	581379.2	220548.8	532
D31	Footpath 7, Receptor 1 (South east of Site)	582505.9	220117.6	193
D32	Footpath 7, Receptor 2 (South east of Site)	582757.9	220066.0	388
D33	Footpath 7, Receptor 3 (South east of Site)	582967.5	219959.7	606
D34	Footpath 7, Receptor 4 (South east of Site)	583167.9	220372.7	597
D35	Footpath 7, Receptor 5 (South east of Site)	583301.5	220725.0	790
D36	Elephant House (Street Sweepings)	582368.7	220189.0	55
D37	Green Pastures Bungalow	581249.9	221176.1	853
D38	Deeks Cottage	582873.4	221255.1	779
D39	Woodhouse Farm	582583.9	220617.9	155
D40	Gosling Cottage / Barn	581508.4	221305.5	782
D41	Felix Hall / The Clock House / Park Farm	584578.8	219574.9	2177
D42	Glazenwood House	579980.5	222134.8	2443
D43	Bradwell Hall	580570.6	222802.9	2549
D44	Perry Green Farm	580899.7	221973.3	1677
D45	The Granary / Porter Farm / Rook Hall	584106.2	218964.5	2097
D46	Grange Farm	584888.0	222222.0	2922
D47	Coggeshall	585070.0	222839.0	3453

4 ODOUR MANAGEMENT AND CONTROL MEASURES

It should be noted that the IWMF is subject to detailed design. Where design information is available, it has been included within this plan. Following completion of detailed design, additional information in relation to the control measures to be implemented on-site will be incorporated into this plan.

Prior to commissioning of the different waste treatment processes, a commissioning plan will be submitted to the EA for approval. The commissioning plan will include the measures to be taken to prove performance of the abatement measures detailed in this section. The commissioning plan will include but not be limited to:

- (1) Confirmation of the management and contractual arrangements which will define the age(s) of the waste materials imported into the site.
- (2) Further details associated with volumes of waste that will be imported into each waste reception area, the storage times and details of storage capacity of the various reception areas or bunkers will be supplied on completion of the detailed design. The detailed design information will also be used to support the development of the final Odour Management Plan.
- (3) The development of a waste acceptance criteria that limits the odour of waste received at the site; this will be supplemented by random monitoring of suppliers and odour monitoring of the materials proposed for export into the site at the point of origin.
- (4) Odour parameters, odour ranges, monitoring protocols and intervention trigger levels being established within the commissioning plan.
- (5) Design and management of ventilation systems.
- (6) Extent of building enclosure and management of the operation of access doors.
- (7) Management of emergency situations.

4.1 Monitoring

Routine olfactory inspection of the site will be conducted during operational hours by trained operators. During the inspection a walk-around of the installation boundary, as identified in Appendix A, will be conducted and observations made concerning the type and nature of any odours detected, including the likely source. This monitoring will be recorded and incorporated into the site management arrangements.

If it is deemed that excessive odour is detected at the installation boundary, then the source of the odour will be investigated. Once the source and cause of the odour has been identified, appropriate mitigation measures to abate the odour will be implemented.

4.2 Control Measures

All waste recovery, recycling and treatment operations within the installation will take place within environmentally controlled buildings. This design and operational control feature will result in all potential odorous environments being held under negative air pressure, thereby minimising the potential for odour from the installation. Where appropriate, management systems will be developed to ensure that 'unacceptable' odorous wastes are not delivered to the facility and, if they are, that suitable systems are in place to ensure that the load is either rejected, or, quarantined within the IWMF building before being transported from site.

4.2.1 Receipt and Management of Wastes

All deliveries of waste to the IWMF will be in enclosed vehicles. All wastes delivered to the facility will be delivered in bulk waste vehicles and will be transferred from waste transfer stations where it will have been bulked for processing within the facility.

Wastes for treatment within the facility will be managed prior to delivery through management contracts with waste suppliers. Agreements will be in place with a limited number of waste contractors to ensure that the wastes received are suitable for treatment within the facility. Waste which is delivered to the IWMF will only be accepted if it is in accordance with the waste acceptance procedures for the facility.

Upon arrival at the IWMF all deliveries of waste will be inspected at the gatehouse. This initial check will ensure it is in accordance with the description of the waste and confirm that the IWMF is permitted to receive the waste. If the waste is identified as being odorous it will not be accepted at the site and will be rejected.

If the waste is permitted to be received, it will be directed to the relevant treatment process to receive the waste within the IWMF building.

Upon arrival at the waste treatment process, the delivery/unloading of the waste will be within a waste reception area which is dedicated to the waste treatment process. Delivery/unloading of waste will be supervised by site operatives. If the waste is identified as being odorous/unacceptable it will be quarantined within the Facility prior to being returned to the waste producer. Steps will be taken to investigate the reason for malodorous materials being imported into the site with the waste supplier, and appropriate action taken to prevent a reoccurrence. The provenance and age of the waste supplied to the IWMF will be monitored and managed to minimise the risk of malodorous materials being imported to the site.

Anaerobic conditions can lead to the generation of odorous air within waste reception areas. Incoming waste which is delivered to the treatment process will be stored in the waste reception area for the minimum period of time – the length of time will be dependent on the process – to prevent the formation of anaerobic conditions within waste reception areas.

The continuous 24-hour nature of the waste processing operations within the facility will result in minimising the temporary storage of wastes within reception areas. Reception areas will be cleared and cleaned during normal night time operations.

Prior to periods of planned maintenance, all quantity of waste stored in waste reception and storage areas will be 'run-down' so that they do not contain significant quantities of potentially odorous material during planned shutdown periods.

To allow for periods of extended unplanned shutdown, procedures will be in place to divert incoming wastes, paper and fuel away from the facility.

The arrangements for the storage of wastes are detailed in the followings sections. It should be noted that there will be no external storage of potentially odorous waste associated with the operation of the IWMF.

The waste materials received and treated within the IWMF will come for a variety of sources and will comprise materials that are a day old, to materials that have been subject to pre-treatment, processing and recovery operations within other satellite facilities, potentially up to 7 to 14 days old dependant on retention time and treatment. The commercial contracts relating to the export and receipt of these wastes will limit the potential for malodorous materials being imported into the site.

4.2.1.1 MRF

Incoming waste

The incoming waste storage facility within the MRF is the day holding bunker (floor tipping bay). The day holding bunker has a storage capacity of approximately 200 tonnes. The day holding bunker will be emptied on a daily basis, as all waste which is delivered to the MRF will be processed. Therefore, the waste will be stored within the MRF day holding bunker for a maximum period of up to 16 hours. However, most waste delivered to the MRF will be processed within one or two hours of the delivery occurring.

Recyclates

Recyclates which are recovered within the MRF will be baled and stored in the MRF Recyclates Storage area prior to transfer off-site to a suitably licenced.

RDF Output

The RDF output will be stored in the RDF Bay within the MRF. The RDF Bay will have a maximum storage capacity of 500 tonnes. The RDF will be transferred from the RDF bay to the CHP plant bunker on a daily basis. Therefore, the RDF will be stored within the RDF Bunker and CHP bunker for a maximum period of up to 24-hours, however during operation of the MRF, the RDF output is not expected to be stored in the RDF Bay for longer than 16 hours.

4.2.1.2 MBT

Incoming Waste

Incoming waste to the MBT facility will be delivered into a day holding bunker for storage of incoming waste. This is located adjacent to the MBT vessels. The day holding bunker will have capacity for approximately 200 tonnes of waste, and will be emptied at the end of each day.

The MBT facility will receive waste from 0700 to 1830 hrs Monday to Friday and 0700 to 1300 hrs Saturdays. The facility will be operated to ensure that the quantity of wastes that will be delivered each day will be less than the capacity available in the MBT bio-drying vessels (allowing for the proposed quantity of material that will be removed that day to be processed in the MRF).

The maximum period of time which incoming waste would be held in the reception area, or day holding bunker, awaiting processing would be approximately half the working day, equivalent to 6 hours or 360 minutes. However, most waste delivered to the MBT facility will be processed within one or two hours of the delivery occurring, depending on the 'availability' of the mobile shredder and the MBT vessels when the waste is tipped.

Bio-dried Waste

There will be 16 vessels installed within the MBT facility. Each vessel is designed to hold up to 200 tonnes of waste. Therefore, there would be a maximum of up to 3,200 tonnes of waste being processed within the MBT facility at any one time.

The vessels will have concrete walls on three sides and a retractable roof which can be pulled back to allow loading/unloading of the vessels.

The incoming waste will be processed within the MBT vessels for at least one week and a maximum of 14 days (two weeks).

Upon completion of processing the waste within the biodrying tunnels, it will be unloaded from the tunnels and transported by wheeled loader directly into the MRF reception hopper for further processing as part of the MRF operation. There will be no other storage of bio-dried waste within the MBT building apart from within the MBT vessels.

4.2.1.3 Anaerobic Digestion (AD) Plant

Incoming Organic Waste

The waste reception bunker within the AD Plant has been designed with a maximum waste storage capacity of approximately 150 tonnes.

The bunker is equipped with two parallel screw conveyors for the discharge of the organic waste. The bunker is V-shaped with a slight inclination. The walls of the AD reception bunker are equipped with rinsing devices to avoid material to be adhered on the walls. The waste is collected in a collecting screw conveyor. This screw conveyor is equipped with a sieve and a pump sump for the leachate, which is pumped to the pulper sump. The waste is further transported to the pulpers by a screw conveyor system.

Allowing for the processing capacity of the plant, the incoming waste will be stored in the AD reception area for a maximum period of 2 days.

Digestate

The dried digestate output from the AD process will be stored within the Digestate Offtake area prior to transfer off-site. The Digestate Offtake area will be an area of hardstanding with concrete push walls. The dried digestate will be loaded into vehicles for transport off-site.

The digestate storage area will be designed for the storage of up to 3 days of dried digestate from the AD process.

4.2.1.4 CHP

Incoming Waste

Allowing for the design capacity of the CHP Plant, it is estimated that the maximum period of time which waste will remain in the CHP bunker will be approximately 4 to 5 days. Therefore, the maximum capacity of the bunker is approximately 8,000 tonnes. If there is an extended unforeseen shutdown of the CHP Plant, waste will be back loaded from the CHP bunker and transferred off-site to a suitably licenced waste management facility.

IBA

Due to the high temperatures, any organic substances within the waste will have been destroyed within the waste incineration process. Therefore, it is not anticipated that the IBA will be odorous and will be managed within the confines of the IWMF building within the IBA tipping hall.

The Ash Hall will have capacity for the storage of 1,750 tonnes of IBA, equivalent to four days production of IBA with both incinerator streams operating continuously at full load.

APCr

Due to the high temperatures, any organic substances within the waste will have been destroyed at the high temperatures within the waste incineration process. Furthermore, the ammonia dosed in the SNCR NOX abatement system will have reacted within the combustion process prior to the bag filters. Therefore, it is not anticipated that the APCr will be odorous and the residues will be held within sealed silos.

APCr will be stored within two APCr silos each of capacity 200m³, equivalent to approximately five days storage at full load operation of both incineration streams

4.2.1.5 Pulp Plant

RCP Area (Incoming)

The waste reception area within the Pulp Plant for incoming waste paper and card bales known as "Recovered Paper" (or "RCP") has been designed with a maximum waste storage capacity of 8,450 tonnes.

The RCP storage area has been designed for the storage of approximately 24 days production of MDIP.

The RCP will be delivered by road and stored in the area shown as 'A9 Recovered Waste Paper Storage (RCP)' on Drawing 213033-100, refer to Appendix A of the Fire Prevention Plan. Delivered RCP bales will have typical dimensions of 1.4m long x 1.1m wide x 1.1m high. Stacking is considered safe up to a height of five bales giving a maximum height of 5.5 metres. (Note: The Environment Agency's Pete McGillivray has confirmed that the storage requirements relating to pile separation distances in the Environment Agency's guidance 'Fire prevention plans' Version 2, March 2015 only applies to external storage of wastes.). However, the storage volume is based on a minimum of 6 metres distance between piles, which is considered to be good practice.

RCP will be processed on a 'first-in, first-out' basis. A complete rotation of stock within the RCP area is expected to occur approximately 15 to 20 times per annum.

De-inking Sludge

Sludge from the de-inking process will be stored in the De-inking Sludge Storage area. This is a concrete storage bunker of approximate area 560m² with full-height concrete walls.

Production of sludge under normal operation is expected to be 260 tonnes/day at a maximum moisture content of approximately 50%. The sludge will be dewatered prior to export from site. The sludge will be loaded by wheel loader into skips or bulk trailers for transfer off site to a facility which has a contract for the off-take of the sludge. All road transportation will utilise enclosed vehicles/trailers. The sludge will be spread on land as a soil conditioner.

The de-inking sludge storage bunker has been designed for the storage of approximately five days sludge production.

MDIP

The final product pulp that is produced in the plant is known as "Market De-Inked Pulp" (or "MDIP") and this is in the form of dried board which is stored in bales for subsequent transportation offsite to paper and tissue mills. It is not anticipated that MDIP will be odorous.

MDIP bales will be stored in the Market De-Inked Pulp area prior to transfer off-site to a licenced facility. The storage area is shown as 'A10 MDIP Storage' on drawing 213033-100. The whole of the area will be covered by Maximum storage will be approximately 11,500 tonnes.

MDIP will be processed on a 'first-in, first-out' basis. A complete rotation of stock within the MDIP area is expected to occur approximately 15 to 20 times per annum.

The MDIP storage area has been designed for the storage of approximately 33 days production of MDIP.

4.2.2 Waste Water Treatment Plant (WWTP)

WWTP sludges

Sludges from the WWTP processes will be dewatered to a sludge cake. The normal production rate of sludge will be approximately 30 tonnes per day. The sludge cake will be loaded into skips and transferred to the CHP plant on a daily basis.

4.2.3 Point Source Odorous Emissions

The point source odorous emissions from the facility will be from the following sources:

- the CHP plant;
- the AD biogas engine;
- ventilation air from the pulp plant;
- ventilation air from the AD plant;

- the AD biogas flare; and
- ventilation from other process areas.

4.2.3.1 CHP

Emissions from the CHP plant will be released from flues located within the main stack.

Odorous air from the waste reception and waste storage areas within the CHP Plant will be used as combustion air in the CHP plant. The Industrial Emissions Directive (IED) requires that any combustion gases passing through an EfW plant must experience a temperature of 850°C or more for at least two seconds. Due to the high temperature experienced by the gases, most odorous chemicals would be destroyed. Any surviving odorous chemicals may become trapped on the bag filters.

The flue gases from the waste incineration process will pass through a flue gas treatment (FGT) system, which includes bag filters to reduce the particulate content of the flue gas.

Ammonia solution is introduced into the furnace as part of the FGT process, which converts into ammonia during the process, and there may be some occasional "ammonia slip" during operation. However, this is covered by the Air Dispersion Modelling, and has been shown to be within air pollution emission limits, which are far lower than the limits that would be required for odour control.

The release of the flue gases from the main stack will assist with dispersion of the flue gases. Taking this into consideration, there will not be any malodorous air from the CHP Plant that will be detectable at sensitive receptors.

4.2.3.2 AD Biogas engines

Combustion gases from the combustion of biogas within the biogas engines will be released via a flue located within the main stack.

A biological desulphurisation unit will be used to remove sulphur from the biogas prior to combustion within the biogas engines. The high temperatures experienced by the gases in the engines will destroy odorous chemicals before the gases are sent up the stack.

Furthermore, the release of the flue gases from the main stack will assist with dispersion of the flue gases. Taking this into consideration, there will not be any malodorous air from the AD biogas engines that will be detectable at sensitive receptors.

4.2.3.3 Ventilation air from the AD plant

The AD operating area has been compartmentalised (inside the building) to limit the total volume of air that requires treatment via a biofilter and/or collected and changed through the buildings overall ventilation system. This defines areas of 'clean' or 'dirty' air (i.e. 'clean' being air that naturally circulates around contained AD operating systems within an internal environment that requires little or no treatment prior to ventilation; or, 'dirty' being areas of the building where waste and digestate, delivery or collection, requires air treatment to mitigate fugitive emissions). By controlling and containing the environment(s) within the AD area it is possible to minimise and mitigate the overall ventilation, air treatment and air changes that are required inside the building.

The AD waste reception and digestate offtake areas require 2 to 3 air changes per hour and is treated through a sealed/contained biofilter located above the 'dirty' area and released via the stack. The AD waste reception and digestate offtake areas will have a total volume of 24,500 m³. The biofilter is designed with a flow rate of approximately 61,500 m³/hour, which is equivalent to 2.5 air changes per hour. Design calculations for the design of the biofilter are presented within Appendix D. It should be noted that the calculations provided are indicative, and are subject to further design of the AD plant. It is expected that the biofilter will have an odour removal efficiency of 85-95%, however this will be subject to detailed design.

GFC would propose that a pre-operational condition is included within the EP which required confirmation of the design of the biofilter for the AD plant up to 6 months prior to commencement of commissioning of the biofilter.

Furthermore, during the commissioning phase of the building services, the odour control systems for the AD plant will be verified against the design requirements. Approval of the ventilation systems will be included within the commissioning plan for the installation, and the results will be included with the Commissioning Report submitted to the EA following commissioning of the AD plant.

Given the enclosed and contained nature of the AD processes, the remainder of the AD area 'clean' will require 2 to 3 air changes per day. Air within the enclosed process areas of the building will be treated through standard air changes through the integrated ventilation system. Dust and carbon filters are used to exhaust clean air that can be used in other process areas – carbon filters will require replacement on a 4 to 6 month basis.

The environment within the AD halls will be held under negative pressure to control, manage and mitigate the potential for odorous emissions. Doors to the AD area shall remain closed except for those short periods of waste delivery or removal of the reject containers.

4.2.3.4 Ventilation air from the Pulp plant

Air handling units (AHUs) will draw external ambient air into the Pulp Plant for use as ventilation air. The air will be heated in the using waste heat from the pulp plant processes and heat from low pressure steam extracted from the steam turbine at the CHP Plant. (The low pressure steam is heat hot water which will be circulated in a closed loop between the CHP Plant, Pulp Plant and WWTP. The hot water carries the heat to the AHUs). The heated ventilation air will absorb moisture given off from processes in the pulp plant. This will prevent condensation and provide a comfortable working environment for personnel.

4.2.3.5 Biogas flare

The biogas flare will not cause any odour issues for the same reason as was explained for the biogas engines in Section 4.2.3.2.

4.2.3.6 Ventilation air from the MRF and MBT Areas

The MRF and MBT facilities will be compartmentalised from the other waste treatment processes. Ventilation air from the MBT and MRF process areas will be released via the mechanical ventilation systems within the IWMF.

The mechanical ventilation systems have been designed with an assumed extraction rate of 2.5 air changes per hour.

The mechanical ventilation system for the MRF and MBT areas will utilise a combination of fabric filters to abate particulates; and ozone systems to abate odorous emissions. The fabric filters and the ozone systems will be supplemented by a further polishing stage which will use carbon filters prior to release of the abated air via louvres in the walls of the building.

Design calculations confirm the volumes of air to be treated within the mechanical ventilation systems are presented within Appendix E. Details of the extraction rates and design of the mechanical ventilation system will be subject to detailed design of the MRF and MBT waste treatment processes.

4.2.3.7 Ventilation from other process areas

Air from process areas within the IWMF which are not expected to contain odours will be released by the buildings mechanical ventilation system. This air will be extracted from the process areas, and treated using a combination of fabric filters and carbon filters. The treated ventilation air will be exhausted via louvres in the walls of the building.

4.2.4 Fugitive Odorous Emissions

4.2.4.1 Waste Delivery Vehicles

All waste will be delivered to the Installation in covered and enclosed vehicles, which will contain any fugitive emissions within the delivery vehicles. Wastes will not be unloaded until the delivery vehicles are within the IWMF building, and the vehicles are in the dedicated waste treatment areas.

4.2.4.2 MRF waste reception and process

The MRF waste reception and process is located inside an enclosed area kept under negative pressure. Air extracted from the MRF area will be treated via ozone systems and carbon filters and particulate filters to remove odour to a significantly low level.

All doors to the waste reception hall will be kept shut during unloading and loading operations and at all times when waste access is not required.

4.2.4.3 MBT waste reception and process

The MBT waste reception and process is located inside an enclosed area kept under negative pressure.

All doors to the waste reception hall will be kept shut during unloading and loading operations and at all times when waste access is not required.

The closed loop air circulation system within each MBT vessel uses the waste as a biofilter; air is drawn from within the building through the individual roof of each MBT vessel. Hence, the MBT vessel is held at a negative pressure, which mitigates against the potential for fugitive emissions. In any case, these would not be direct to the external air and the mechanical ventilation system within the building will collect and treat odorous emissions arising from the operation of the MBT facility.

The air temperature within each MBT vessel will be maintained at or around 50 to 60°C.

Standard air changes within the MBT building will maintain a good working environment. Any emissions from the process will only be released into the building when the MBT vessel doors are opened following treatment, i.e. as the bio-dried waste is removed using the wheeled loading shovel.

Carbon filters will require replacement on a regular basis as required by the particular manufacturer's requirements, expected to be in the region of every 4 to 6 months.

4.2.4.4 Biogas storage

Biogas will be stored in an air-tight gas bag, which will prevent the biogas from being released. This will prevent potential fugitive release of biogas.

4.2.4.5 CHP waste bunker

An induced draught (ID) fan will be used to maintain the waste bunker at negative pressure. This will ensure that no odours are able to escape the building. Air from the CHP bunker will be drawn into the combustion process.

The CHP facility operators will employ bunker management procedures (mixing and periodic emptying and cleaning) to avoid the development of anaerobic conditions in the waste bunker, which could generate further odorous emissions.

During periods of planned maintenance for the CHP plant, one stream will be shut down at a time. This will ensure that the waste bunker is maintained at negative pressure to combust any odorous air within the waste bunker area.

If one stream is forced into an unplanned shutdown, the other stream is able to continue incinerating waste. The ID fan of the one running stream will be able to create a negative pressure within the bunker prevent odorous releases.

It is unlikely that both CHP streams would be shutdown simultaneously for long periods of time (longer than a week). For short periods when both streams are down, the doors of the waste chutes within the waste reception area will be closed to contain any odour. However, if both streams are down for longer periods, the bunker will be emptied by unloading the material into refuse vehicles and transferred off-site to a suitably licensed waste management facility and incoming waste will be diverted at source to an alternative treatment facility.

4.2.4.6 Ash storage area

Incinerator bottom ash (IBA) is the product of incineration of RDF. This means that it will have reached a temperature of 850°C or higher during combustion for at least two seconds, and that it will have a Loss on Ignition (LOI) of less than 5% or a Total Organic Carbon of less than 3%, as required by the IED. Therefore no organic or putrescible solid material would be present within the IBA. Consequently there will be no odour from the ash storage area and will be managed within the confines of the IWMF building within the IBA tipping hall.

4.2.4.7 Sludge storage area

The sludge storage area will contain the following residues from the Pulp plant:

- Spherical and cuboid debris (i.e. glue, melted plastic and latex based sticky materials) together with other contaminants larger than 0.18 mm in size from the pre-screening, and spherical and cuboid debris larger than 0.15mm from the fine screening systems.
- Foam made up of small ink particles from the secondary floatation process of the main, post and final floatation systems.
- The high density material residues separated in the centrifuges in the low consistency forward cleaning system.
- Floating solid particles removed from the de-inked pulp from the first loop and second loop water clarifications after aeration.
- Residues from low consistency high and low density cleaning system.

The sludge storage area has potential for malodorous air, and will therefore be enclosed and maintained under negative pressure. Air extracted from the sludge area will be vented to the CHP waste bunker. Air in the waste bunker is induced into the furnace where it is used as primary combustion air. As explained previously in Section 4.2.3.1, the high temperatures reached in the furnace mean that odours are destroyed in the furnace.

If there is a planned shutdown of both stream of the CHP, the paper pulping plant will be required to shutdown prior to the CHP shutdown.

If one CHP stream is forced into an unplanned shutdown, the other stream is able to provide the negative pressure to extract from the pulp plant into the CHP bunker and prevent odour releases.

If both streams of the CHP plant are required to enter into an unplanned shutdown, the Pulp storage area will be contained and any odour generating material will be transferred offsite to a suitably licenced waste management facility.

4.2.4.8 WWTP

The WWTP will process all process effluents generated by the installation. The WWTP uses a reverse osmosis technology which will prevent any potential fugitive emissions of odour. The WWTP process takes place inside air tight vessels preventing any odorous materials that enter the WWTP from releasing their odour.

Sludge produced by the waste water treatment process will be dewatered prior to transfer off-site to be spread to land as a soil conditioner.

5 ODOUR MONITORING

A programme of odour monitoring will be undertaken at the IWMF. This will include the following monitoring regime:

- (8) Sniff testing at the perimeter of the IWMF site; and
- (9) Wind direction and wind speed.

5.1 Sniff Testing

Sniff testing will be undertaken around the perimeter of the IWMF. Where odours at the perimeter of the IWMF are identified this will be reported to the site management team. An investigation on the source and root cause of the odours will be undertaken as detailed in section 7.1.

5.1.1 Competent Individuals

In order to ensure repeatability of the results four individuals will be trained. This will allow the monitoring to continue if one individual is away or unavailable. Furthermore, as colds, sinusitis or sore throats can affect the sense of smell, having two or more trained individuals will allow the monitoring to continue in the event of illness. However, if all individuals are suffering from illness etc then this fact should be clearly recorded on the odour monitoring forms.

The number of trained individuals should not exceed four people in order to maintain the consistency of the results.

It is important that these individuals do not spend or have not spent significant time in waste processing areas, as the *testers* sense of smell must not have become accustomed to the odours arising.

The individuals undertaking the monitoring should avoid strong foods or drinks (including coffee) for at least half an hour before conducting the monitoring. Furthermore, strongly scented toiletries and the use of deodorisers within vehicles will be avoided.

5.1.2 Monitoring Locations

The locations of proposed odour monitoring will be presented in Appendix C. The locations will be identified taking into any accessibility constraints following completion of detailed design of the IWMF.

5.1.3 Monitoring Frequency

In order to generate a detailed odour record for the Installation it is envisaged that monitoring is carried out once a day during the Winter months (October – March) and twice a day during the Summer months (April – September). This will ensure a detailed data set is obtained all year round, furthermore, during the warm summer months the monitoring is increased as the risk of odour generation is higher.

It is also envisaged that the proposed monitoring is carried out if a complaint is received in order to identify and record the odours present at the time of the complaint, refer to section 7.

The proposed strategy should be flexible; therefore, the monitoring should not be conducted at a set time of day. Instead the monitoring should be conducted when there is a high risk of odour generation, i.e. during times where there are waste deliveries to the site or residues being transferred from the site, and not when there is relatively no risk of odour generation, i.e. outside operational hours/no wind.

5.1.4 Data Collection and Recording

Before starting the monitoring route the individual should record all pertinent details, such as date, time, weather conditions and activities being carried out on the composting site. This has been summarised within a suggested monitoring template contained within section 4.4.9 below.

In order to quantify the odour at a specific level the Intensity and the Offensiveness are recorded. These are based on a 1 to 5 and a 1 to 4 scale respectively. The proposed levels for the two scales are shown below:

Scale	Intensity Rating
1	No detectable odour
2	Faint Odour (barely detectable, need to stand still and inhale facing into the wind)
3	Moderate Odour (odour easily detectable while walking and breathing normally)
4	Strong Odour
5	Very Strong Odour (probably causing nausea)

Scale	Offensiveness Rating
1	No detectable odour
2	Potentially Offensive
3	Moderately Offensive
4	Very Offensive

As well as recording the odour Intensity and Offensiveness, general comments on the odour will also be recorded, such as persistence, transience and potential source etc.

5.1.5 Action Limits

It is envisaged that if monitoring locations score a 2 or higher for Intensity or score a 2 or higher for Offensiveness, then a more detailed investigation into the activities being undertaken and the root cause of the odour is undertaken. This will attempt to identify the source of the odour and suggest possible ways to improve operations at the IWMF to prevent odour being generated from on-site activities.

5.2 Wind direction and wind speed

An anemometer will be installed at the site to record the wind direction and speed. The anemometer will be used to provide data to inform investigations into any odour complaints.

6 ABNORMAL EVENTS

Table 1 shows possible abnormal events, and planned responses in the event of these occurrences.

Table 1 – Abnormal Events and Response Measures				
Event	Location	Likely effect	Response measures	Timescales for response
Severely odorous wastes received	MRF and MBT reception areas	Increase in odour within MBT/MRF building while severely odorous waste is present, any fugitive emissions would become more serious.	<p>Treatment of this waste will be prioritised to reduce the duration of time in stored within the tipping area.</p> <p>Direct transfer to the CHP Plant for incineration will be considered.</p> <p>Additional deliveries of waste from the waste producer may be suspended.</p> <p>If appropriate, transfer the waste to a dedicated quarantine area, and reject odorous waste which does not comply with the waste acceptance procedures.</p> <p>Review whether the implemented measures have been successful</p>	Immediate
Failure of the MRF and MBT ventilation system through particle filters, the ozone system and carbon filters	MRF	Increase in odour within MRF areas, which would increase concentrations of fugitive odour emissions.	<p>Maintenance engineers would be sent to rectify the failure.</p> <p>Operations would be suspended until the problem is rectified.</p>	Immediate
	MBT	Increase in odour within MBT area, which would increase concentrations of fugitive odour emissions.	<p>Maintenance engineers would be sent to rectify the failure.</p> <p>Deliveries would be suspended until the problem is rectified.</p> <p>The doors and roofs to the MBT vessels provide a seal which would be maintained to reduce odour releases.</p>	Immediate

Table 1 – Abnormal Events and Response Measures

Event	Location	Likely effect	Response measures	Timescales for response
Failure of the AD ventilation system through biofilters	AD and digestate storage	Increase in odour within AD area, which would increase concentrations of fugitive odour emissions.	Maintenance engineers would be sent to rectify the failure. Operations would be suspended until the problem is rectified.	Immediate
Failure of an EfW ID fan	CHP	Increase odours within the Tipping Hall and reception areas.	Maintenance engineers sent to rectify the failure. One line will continue to operate maintaining the Tipping Hall and reception areas under negative pressure.	Immediate
Failure of both EfW ID fans	CHP	Increase odours within the Tipping Hall and reception areas.	Maintenance engineers sent to rectify the failure.	Immediate
			CHP and Pulp Plant operations would be suspended until the problem is rectified.	One day
			Waste will be unloaded from the CHP waste bunker. Pulp sludge will be removed from the pulp plant sludge storage.	One week
Failure of the pulp plant sludge storage ventilation system	Pulp plant	Increase odours within the pulp plant sludge storage.	Maintenance engineers sent to rectify the failure. The pulp plant would be contained to prevent odours from being released from the storage area.	Immediate
Development of anaerobic conditions in waste storage areas	MRF tipping area	Increase odours within the MRF tipping area and reception areas.	Wastes will be removed on a first-in, first-out principle and the waste will be regularly mixed to avoid the development of anaerobic conditions.	Ongoing
	MBT tipping area	Increase odours within the MBT tipping area and reception areas.	Wastes will be removed on a first-in, first-out principle and the waste will be regularly mixed to avoid the development of anaerobic conditions.	Ongoing

Table 1 – Abnormal Events and Response Measures				
Event	Location	Likely effect	Response measures	Timescales for response
	AD tipping area	Increase odours within the AD tipping area and reception areas.	Wastes will be removed on a first-in, first-out principle and the waste will be regularly mixed to avoid the development of anaerobic conditions.	Ongoing
	EfW waste bunker	Increase odours within the MT Tipping Hall and reception areas.	Wastes will be removed on a first-in, first-out principle and the waste will be regularly mixed to avoid the development of anaerobic conditions.	Ongoing
Leak of sludge from WWTP	WWTP	Localised increase in odour specific to the leak point	Maintenance engineers sent to rectify the leak.	Immediate
Plant breakdown	Any location	Risk of increased impact from any area of site where normal operations are affected during and after the breakdown	A supply of critical spares will be maintained on site. The site will employ maintenance engineers to enact any repairs.	Immediate
			If spares or engineers are not available, the relevant operations and their predecessors in the process will be suspended if necessary to prevent significant increase in odour emissions	Immediate

In all instances where waste treatment processes are required to be suspended, the receipt of waste at the facility will be prevented or the waste will be diverted to one of the waste treatment processes within the facility. If there are no alternative waste treatment processes operating or available on the IWMF site, incoming waste will be stopped and diverted to alternative waste treatment facilities elsewhere by instructing waste suppliers to implement the planned contingency arrangements.

6.1.1 Emergency Planning

6.1.2 Abnormal meteorological conditions

Abnormal meteorological conditions such as low wind strength, low pressure, high temperatures may promote elevated levels of odour either on the site or at nearby sensitive receptors. A wind direction towards sensitive receptors may increase odour levels. Conversely very low wind strength and temperature inversions may minimise dispersion and potentially create a build-up of odour. High temperatures may also increase emissions.

Contingency mitigation measures will be developed as part of the detailed design, construction and commissioning of the facility. This will include an emergency plan for flooding and the procedures to be implemented in case of flooding at the facility.

6.1.3 Staffing Issues

Human error and accidents may cause elevated levels of odour to be created either through the stopping or breakdown of the process or the failure of control equipment. Contingency mitigation measures will be developed as part of the detailed design, construction and commissioning of the facility. This will include procedures to be implemented in case of staffing issues at the facility.

6.1.4 Unplanned Odorous Events

If at any time it is necessary to undertake temporary actions that are likely to cause elevated levels of odour, Gent Fairhead & Co Limited (or its designated responsible person) will contact the Environment Agency and any other interested parties before such actions are taken to inform them of the operations being undertaken and that the elevated levels of odour will be of a temporary nature. Where practicable, such actions will only proceed when the prevailing wind direction can be demonstrated to be away from sensitive receptors.

7 ODOUR ACTION PLANS/CONTINGENCIES

7.1 Odour Complaint Investigation

The following actions will be taken on receipt of an external odour complaint or the identification of odour at the site boundary.

- Any complaints received at the site will be logged in the sites incident reporting system. The Environment Agency will be informed as soon as possible after a complaint has been received.
- The site management will be given the details of the odour complaint as soon as possible, including the location, nature, time, and date of the complaint.
- If complaints are received, a "sniff test" will be conducted by suitably trained personnel in the area from which the complaint is received. In order to assess the presence of any odours, and the odour characteristics and intensity. Where possible, the likely cause of the odour will be identified.
- For all complaints, reference will be made to the site activities at the time of the complaints, and further onsite investigations will be conducted to determine whether any abnormal operation are (or were) occurring. The following key potential causes of abnormal odour emissions will be investigated:
 - (1) Is the waste arriving in appropriate vehicles?
 - (2) Are there any unusual characteristics evident in the waste on site (composition, age, condition etc.)?
 - (3) Are operations in 'normal operation'?
 - (4) Are the extraction and ventilation systems (through the stack; the biogas flare; the induced draught through the CHP Plant; and building ventilation) working properly?
 - (5) Are there any unusual activities taking place off site?
- Once the cause of the odour has been established, appropriate actions will be immediately implemented (see Section 7.2), and actions devised to prevent a reoccurrence of the incident.
- Feedback will be given to all complainants on the findings of any investigations if they are known, and a summary will be provided of any remedial measures taken to rectify odour problems and ensure that the problem has been suitably resolved. The complainant will be asked if the perceived problem is still occurring to measure any improvement achieved.
- Gent Fairhead and Co Limited will submit a short factual report to the Environment Agency detailing:
 - (1) the complaint(s) received;
 - (2) the investigations conducted;
 - (3) the findings of those investigations;
 - (4) whether the complaint was substantiated;
 - (5) any remedial measures implemented; and
 - (6) any ongoing improvement actions to be implemented.
- Records of all complaints, subsequent investigations, and remedial actions will be retained on site for a minimum of five years. The site management will ensure that records are readily retrievable, and maintained as fit for retention. As applicable, records will be stored in accordance with the Data Protection Act 1998.

7.2 Action plans

In the event that an odour complaint is proven to be justified and attributable to operations undertaken at the facility, or a 'non-conformance' occurs, a defined action plan will be implemented. The following odour 'non conformances' have been identified for the site:

- abnormal odour emissions occur;
- significant odour is detected onsite that is believed to pose a risk of offsite odour impact; and
- significant site odour is detected off-site during the "sniff testing" exercise.

In the event that any of the above occurs, the following actions shall be taken:

- If not previously undertaken, a walk-around of the entire site and a review of the activities undertaken at the facility will be conducted in order to identify the likely cause(s) of the odour.
- Upon identification of the likely odour source(s), appropriate corrective and preventative measures will be identified and implemented, depending on the outcome of the investigations. The measures will consider, but not be limited to the following.
 - (1) Suspension of receipt of highly odorous waste in the relevant waste reception areas and the closure of all doors until excessively odorous wastes are processed or removed from site.
 - (2) Suspension of future receipt of the odorous waste stream until confirmed acceptable.
 - (3) Review of the effectiveness of waste acceptance, reception and handling procedures to avoid the formation of anaerobic conditions in waste storage areas.
 - (4) Review of all process parameters (temperature, moisture, oxygen availability) to ensure all composting/maturation processes are under control. Implementation of corrective actions to restore parameters to desired levels.
 - (5) In the case where anaerobic conditions occur within the MBT process and excessive odours are generated, the aeration rate will be increased, and odorous materials will be removed from site or returned to the MBT tipping area for reprocessing if necessary.

Details of any odour 'non-conformances' including the nature of the incident, results of investigations, action taken and any required amendments to the OMP will be made available to the Environment Agency on request.

8 LIAISON & DOCUMENT REVIEW

8.1 Liaison

As required by the third Schedule of the Section 106 Agreement, Gent Fairhead and Co Limited has developed an IWMF Site Liaison Group.

The IWMF Site Liaison Group is intended to give interested parties an opportunity to discuss any matters arising from the operation of the facility. The Group comprises representatives of Essex County Council, Braintree District Council, the Environment Agency, Rivenhall, Silver End, Bradwell, Coggeshall, Kelvedon and Feering Parish Councils, and the local Community Group

The IWMF Site Liaison Group will meet periodically and will be used to disseminate information relating to the operation of the IWMF to interested stakeholders. The Group will offer the opportunity to review and address local environmental concerns associated with the operation of the IWMF operations.

Gent Fairhead and Co Limited will report to the IWMF Site Liaison Group on the findings and preventative actions of any investigations into odour complaints received.

8.2 Review requirement and timescale

The odour management plan will be formally reviewed by Gent Fairhead and Co Limited initially six months after the commencement of operations, and from then on an annual basis to ensure that the controls described are effective and reflect best available techniques. In addition the OMP will be reviewed following any relevant changes in site operations or procedures that are likely to have implications from an odour generation/impact perspective.

Any required changes to the conditions set out within this document shall be formally agreed with the Environment Agency prior to their implementation.

Appendix A – Installation Boundary Drawing

Appendix B – Plan of Odour Sensitive Receptors

Appendix C – Proposed Odour Monitoring Locations

[To be developed following detailed design]

Appendix D - Design Calculations for the AD Plant Ventilation Systems

The heating and ventilation systems within the IWMF will be designed in accordance with the latest CIBSE guidance. 'CIBSE Guide B: Heating, ventilating, air conditioning and refrigeration' Table 1.5 within the guidance presents recommended allowances for air infiltration, in terms of air changes per hour, for selected building types. Whilst it does not present recommended allowances for waste treatment facilities, such as the AD waste reception area, it makes the recommendations for building/room types which are considered to be representative of this area, as follows:

Building/room type	Air infiltration allowance - air changes/hour
Factories - 3000 m ³ to 10,000 m ³	0.5 to 1.0
Factories - over 10,000 m ³	0.25 to 0.75
Warehouses - working and packing areas	0.5
Warehouses - storage areas	0.2

The ventilation system for the AD reception area has been designed to ensure that negative pressure is retained in the AD plant.

The air abatement system has been designed with the following assumptions:

Building Volumes

The volume of the AD plant which will require treatment within the biofilter has been calculated as follows (i.e. excluding the area of tanks which will be separated off from the process area):

$$\begin{aligned}
 \text{Floor Area} &= 2,900 \text{ m}^2 \\
 \text{Average Height} &= 10.5\text{m} \\
 \text{Volume of air to be treated} \\
 &= \text{Floor Area} \times \text{Average Height} \\
 &= 2,900 \times 10.5 \\
 &= 30,450 \text{ m}^3
 \end{aligned}$$

Volume of Process Equipment and Waste

The process equipment and waste being stored within the facility will occupy a volume of the void. For the purposes of the calculation it has been assumed that process equipment and waste will occupy 20% of the building volume.

$$\begin{aligned}
 \text{Volume of the process equipment and waste} \\
 &= \text{Total Building Volume} \times \text{percentage volume of process equipment and waste} \\
 &= 30,450 \times 20\% \\
 &= 6,090 \text{ m}^3
 \end{aligned}$$

Volume of Air to be Treated

On the basis that 20% of the building will be occupied by the process equipment and waste, the total volume of air to be extracted will be:

$$\begin{aligned}
 \text{Total volume of air to be extracted} \\
 &= \text{Volume of building} - \text{Volume of Process Equipment and Waste} \\
 &= 30,450 \text{ m}^3 - 6,090 \text{ m}^3
 \end{aligned}$$

$$= 24,360 \text{ m}^3$$

Odour Extraction System Design

As presented in the air quality assessment, the air extraction system has been designed with the following requirements:

Volumetric Flow – 61,500 m³/hour (17.08 m³/sec)

Number of Air Changes

On the basis of the design of the odour extraction system, as presented, the number of air changes per hour can be calculated as follows:

Number of Air Changes per hour

$$\begin{aligned} &= \text{Volumetric Flow of the Odour Extraction} / \text{Volume of Air to be Extracted} \\ &= 61,500 / 24,360 \\ &= 2.5 \text{ Air changes per hour} \end{aligned}$$

Taking into consideration the requirement of CIBSE Guide B for buildings with a capacity of > 10,000m³, an air change rate of 2.5 air changes per hour is considered suitable to ensure that fugitive emissions are prevented / minimised.

Appendix E - Design Calculations for the MBT and MRF Mechanical Ventilation Systems

The dimensions of the MBT and MRF areas are presented in the following table:

Table 2 - Dimensions of Waste Processing Areas				
Process Area	Height (m)⁽¹⁾	Width (m)	Length (m)	Volume ⁽²⁾
MRF	21.75	42	101.5	92,720 m³
MBT (Area 1)	21.38	56	101.5	121,524 m³
MBT (Area 2)	21.38	49	21.5	22,523 m³
MBT (Area 1 and 2)				144,039 m³
Note:				
(1) The height has been calculated from the average elevation within the process area.				
(2) These are the maximum volumes of air which would be required without allowance for any compartmentalisation of the waste processing areas which would reduce the volumes of air requiring treatment.				

As stated within the EP application documents submitted, the air extraction system has been designed with an assumed 2.5 air changes per hour. Taking this into consideration, the approximate volumes of air to be extracted from each of the process areas are as follows:

- MRF – $(92,720 \times 2.5) = 231,800 \text{ m}^3/\text{hour}$
- MBT – $(144,039 \times 2.5) = 360,100 \text{ m}^3/\text{hour}$

As explained within the EP application, air from these areas will be treated within the mechanical ventilation systems for these areas, and released via the louvres within these areas.

Appendix F - Odour Assessment Report

Installation		Date	
Weather		Wind (strength / direction)	
Temperature (°C)		Pressure (mbar if known)	
Ground Conditions		Cloud Cover	
General Air Quality		Time: Start	
		Time: Finish	
Activity on Site			

Plan attached showing location & extent of odour YES / NO

Complaint Received? YES / NO

If **YES** complete the following:

Date & time complaint received		Number of complaints which may relate to the same source	
Location of complaint			
Grid Reference (if not a property)		Time odour noticed and duration	

Additional Comments:

Action Required:

Signed:

Date:

Test Location & Time	Intensity (1 – 5)	Offensiveness (1 – 4)	“Dilution to Threshold” Ratio	Comments: (including persistence, transience, potential source)

Note: The “Dilution to Threshold” Ratio is obtained from the Nasal Ranger and is only required if an odour is detectable, i.e. a 2 or higher for Intensity.



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