Yorkshire Water Services Limited

Esholt Sludge Treatment Facility (STF)

Application for Environmental Permit Variation

October 2024 Permit Reference: EPR/ VP3130GZ

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YorkshireWater

Stantec

Sign-off Sheet

Project Name	Environmental Permitting Support
Project No	331001762-100.2101
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FINAL	20/01/2023	FINAL	E Stewart	P. Smith	P. Duncan
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Non-technical Summary

Summary of changes

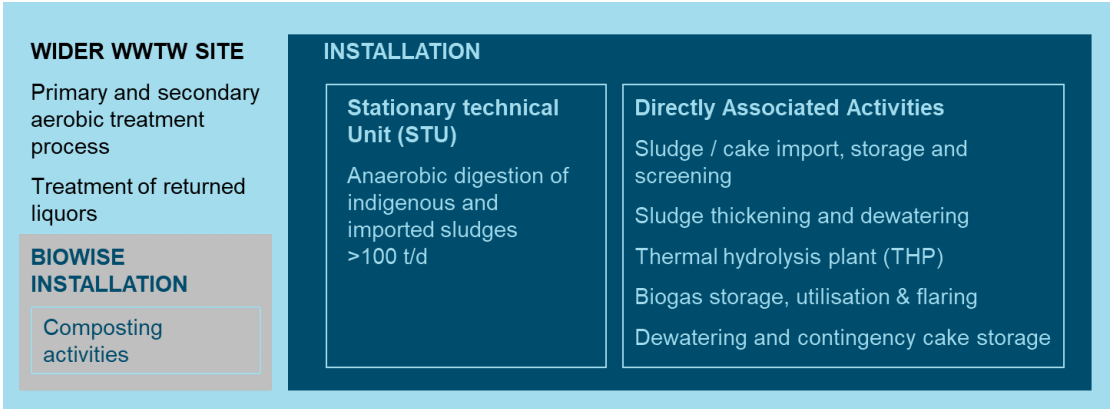
This application is being made due to changes to the Environment Agency (EA) interpretation of the environmental permitting exclusion for Urban Wastewater Activities (under Environmental Permitting (England and Wales) Regulations 2016 (EPR) Schedule 1, Part 2, Chapter 5, Section 5.4). The EA interpretation now requires that anaerobic digestion (AD) plants with a treatment capacity of over 100 tonnes/day (t/d) are classified as installations for the purposes of EPR. Furthermore, it has been determined that, in calculating digestor capacity, there should be no distinction between imported or indigenous sludges.

The Yorkshire Water (YW) Esholt Sludge Treatment Facility (STF), which forms part of the wider Esholt wastewater treatment works (WwTW), exceeds the 100t/d capacity limit and therefore a variation to an existing waste permit (reference number EPR/ VP3130GZ/V004) is required to add Schedule 5.4 Part A(1)b(i) for AD treatment activities. The waste operations permit currently regulates the Combined Heat and Power (CHP) energy centre including cleaning, storage and combustion of biogas in engines, boilers and/or flare as well as the import of sludge from Wastewater Treatment Works (WwTW) for the generation and utilisation of biogas. CHP and sludge intake activities will transition from being permitted waste operations to being DAAs to anaerobic digestion (i.e. DAAs to a Schedule 1 listed activity). The installation boundary will also be extended to include the land occupied by sludge digestion activities, as well as an area of land to the southeast which is used for digested sludge treatment and handling.

This application also includes adoption of Medium Combustion Plant Directive (MCPD) Emission Limit Values for existing combustion plant (including appropriate monitoring provisions) from the relevant phase in date for the plant in question.

The revised permit installation will comprise the following:

Figure 1 Installation schematic



Overview of activities

The Esholt STF treats indigenous sewage sludges arising from sewage treatment processes operated within the wider Esholt WwTW as well as sewage sludges generated by smaller YW WwTW. The principal activities undertaken within the installation includes:

- Sludge reception and screening,
- Undigested sludge thickening and dewatering,
- Thermal Hydrolysis Process (THP)
- Anaerobic digestion,
- Biogas collection and storage (including flaring if operationally necessary),
- Use of biogas (a renewable energy source) to fuel combined heat and power (CHP), generating electricity and heat,
- Operation of steam raising boiler plant for the THP,
- Digested sludge dewatering,
- Raw material storage and use,
- Surface water and process liquor collection and transfer to Esholt WwTW for treatment, and
- Waste storage and transfer off site.

Figure NTS-1 Illustration showing main activity areas

Impact assessment

A detailed assessment of emissions from the process and their potential effects on the environment, including local human and ecological sensitive receptors has been carried out. This is reported in this variation application and concludes that there are no significant negative environmental impacts predicted to arise as a result of activities covered within the scope of this permit variation application; in a number of areas the proposals contained within this variation application will bring about an environmental risk reduction and are considered positive.

A qualitative odour impact assessment has been undertaken. This assessment has concluded that the majority of sensitive receptors are exposed to either a negligible or slight adverse odour effect. Two of the ten sensitive receptors are assessed as being exposed to a moderately adverse effect. YW has not received any odour complaint from these locations. Furthermore, a sniff test odour survey carried out at the boundary of the site in June 2021 did not detect any odour at the boundary closest to these sensitive receptors. However, it is recognised that there is a residual risk arising from odour from any STF process, therefore YW has developed an Odour Management Plan (OMP), which is submitted with this application.

It is recognised that emissions of organic compounds may arise from uncovered sludge sources as well as from the air extraction and dispersion stacks. This includes ammonia, hydrogen sulphide, volatile organic compounds (VOCs) and methane. Measures to reduce these emissions from diffuse and (non-combustion) point sources are proposed.

A noise impact assessment has been undertaken. The risk of noise and vibration at nearby sensitive receptors is predicted to be low; more detailed assessment and further mitigation is not required, nor is a specific noise management plan. Noise will continue to be managed through operational controls and good practice.

A fugitive emissions/bioaerosol risk assessment has been undertaken. This has concluded that further assessment is required at Esholt STF.

All combustion plant emission points are already included within the scope of the existing installation. However, YW is proposing to bring a gas connection onto site to provide mains natural gas for operation of these steam raising boilers. This solution would replace gas oil as the main fuel source for the boilers (with biogas continuing to provide the back-up fuel source). It is also proposed that CHP1 will be converted to natural gas as its sole fuel source. The remaining three CHP engines would continue to operate with biogas as the sole fuel source. An Air Emission Risk Assessment (AERA) utilising atmospheric dispersion modelling has been undertaken to support this proposed change of fuel.

The assessment concludes that, in relation to human health, in both current and future operating scenarios, where impacts are not classified as ‘insignificant’ (i.e. process contribution (PC) less than 1% of the EAL for long-term concentrations or 10% for short-term) the predicted impacts of the installation do not lead to any exceedances of Environmental Assessment Level (EALs) and do not constitute ‘significant pollution’.

In relation to the impact of the installation on ecologically sensitive sites, at all locally designated sites, in both current and future operating scenarios, the predicted PCs from the installation are less than 100% of the applicable annual C_{Le} or C_{Lo}. At the South Pennine Moors SAC the predicted PC's in both scenarios are less than 1% of the applicable CLe or CLe and therefore can be considered 'insignificant'. Therefore, the impacts of the Installation are considered 'insignificant' at all designated ecological sites.

A secondary containment risk assessment has been undertaken to assess whether measures to protect the environment in the event of a failure of containment of primary storage tanks are adequate. Recommendations are made to enhancement containment in some areas.

Site operational controls

The Esholt STF installation is operated in accordance with an Environmental Management System (EMS), which includes controls to minimise point source and fugitive emissions to air, water and land. The YW EMS is certified to ISO14001 and a planned maintenance and inspection programme is in place to optimise the operation of plant.

A leak detection and repair plan is in place to minimise fugitive emissions to air.

An accident management plan has been prepared to assess risks and identify controls associated with accidents and other unplanned events.

Section I: Application Forms

Form A

Form C2

Form C3

Form C6

Form F1 (including letter of authorisation)

Section II: Technical Description

This section of the application provides a Technical Description of the activities to be operated at the site.

The Information provided in this section should be viewed in parallel with:

- Section I: Application Forms
- Section III: Supporting Information

1.1 Introduction and overview

This application is being made due to changes to the Environment Agency (EA) interpretation of the environmental permitting exclusion for Urban Wastewater Activities (under Environmental Permitting (England and Wales) Regulations 2016 (EPR) Schedule 1, Part 2, Chapter 5, Section 5.4). The EA interpretation now requires that anaerobic digestion (AD) plants with a treatment capacity of over 100 tonnes/day (t/d) are classified as installations for the purposes of EPR. Furthermore, it has been determined that, in calculating sludge treatment capacity, there shall be no distinction between imported or indigenous sludges. Therefore, the Yorkshire Water (YW) Esholt Sludge Treatment Facility (STF) exceeds the 100t/d capacity limit, and it has been agreed that a variation to an existing permit is required to add Schedule 5.4 Part A(1)(b)(i) for AD treatment activities.

1.2 Permitting History

YW holds an environmental permit for the Combined Heat and Power (CHP) plant at Esholt; this was issued as a waste operation permit on 7th December 2012 (permit reference number EPR/VP3130GZ/V004). The scope of this permit includes biogas cleaning, storage and combustion in engines, boilers and/or flare. The permit also covers import of sludge from Wastewater Treatment Works (WwTW) for the generation and utilisation of biogas.

This application will vary this CHP permit; CHP and sludge intake activities will transition from being permitted waste operations to being DAAs to anaerobic digestion (i.e. DAAs to a Schedule 1 listed activity). The installation boundary in this area will also be extended to include the land occupied by sludge digestion activities, as well as an area of land to the southeast which is used for digested sludge treatment and handling.

This application also includes adoption of Medium Combustion Plant Directive (MCPD) Emission Limit Values for existing combustion plant (including appropriate monitoring provisions) from the relevant phase in date for the plant in question.

YW holds a completely separate waste operations permit covering sludge conditioning activities (permit reference number DP3192ZP). This permit will remain entirely separate with the intention of surrendering it in the future (the permit cannot currently be surrendered as legacy sludge phyto-conditioning (SPC) material remains on site on the SPC pad to the northwest of the digestion area).

A composting operation is active on an area of land to the south / southwest of the proposed new installation boundary. This permit was established via a partial transfer of permit reference DP3192ZP and is held by a third-party operator (Biowise). This permit will also remain entirely separate from the new STF permit, although it is noted that surface water runoff from the composting operation joins with surface water runoff from the cake pad. Further information is provided in response to Form C3 Q 2 Point Source Emissions to Sewer.

1.3 Description of Site Activities

A summary description of all activities carried out within the Esholt STF, and its relationship to the wider WwTW site, is provided below.

Figure A Installation schematic

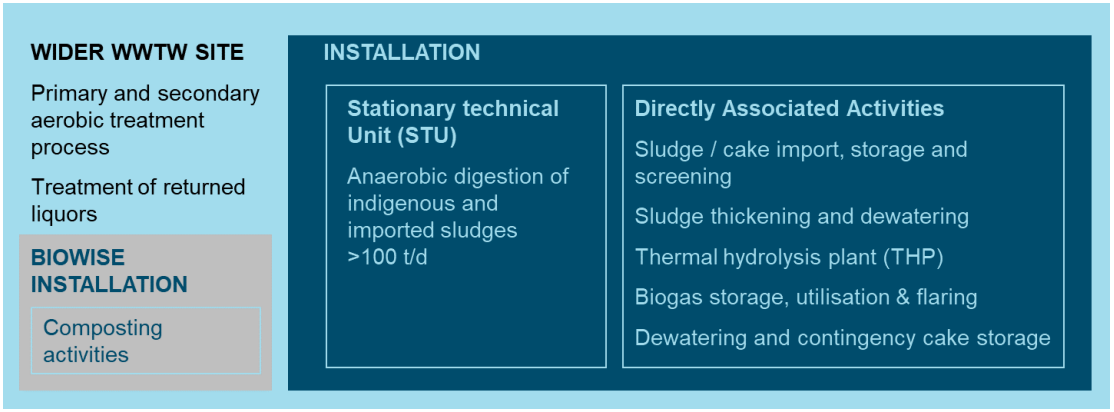


Figure B Installation overview

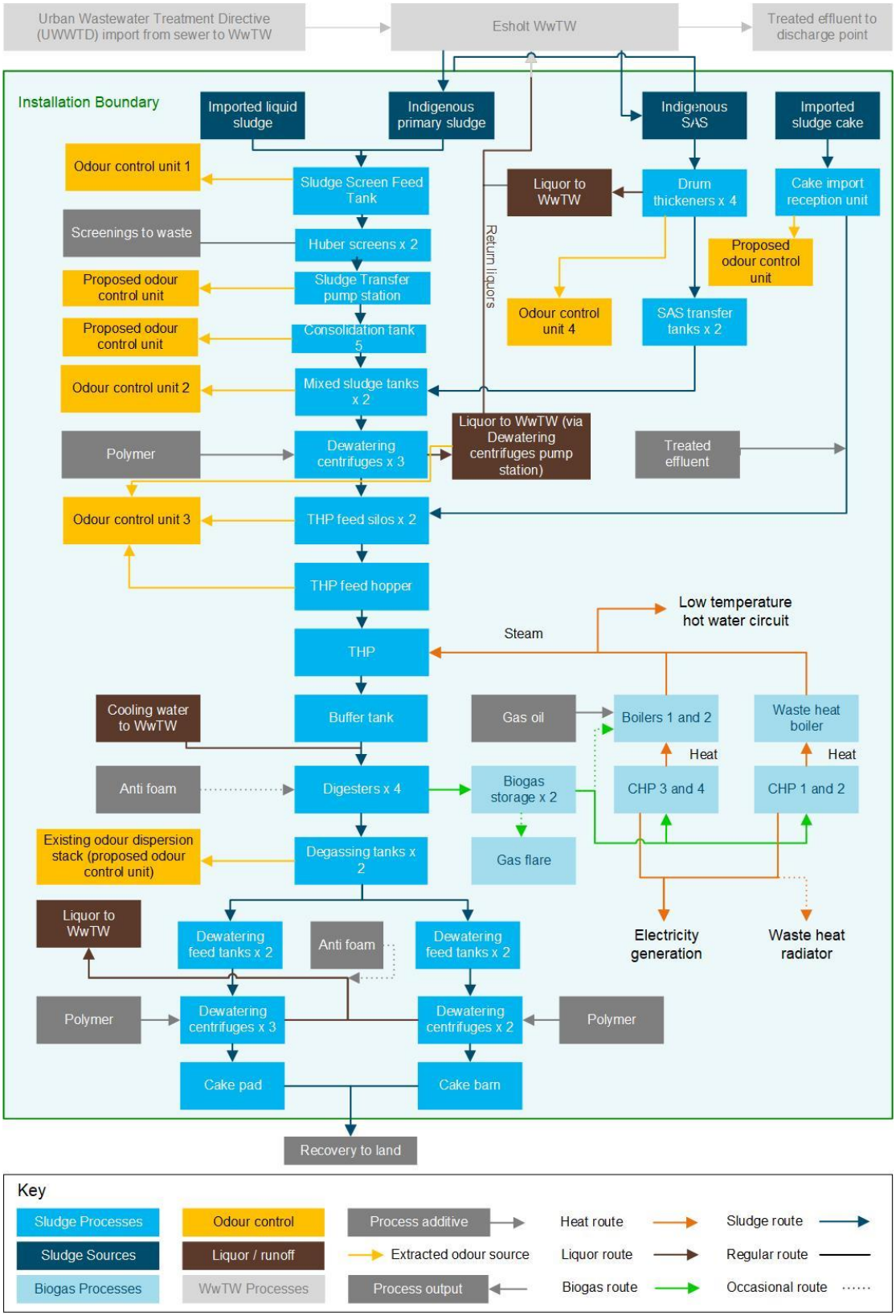


Figure C Installation illustration

1.4 Sludge reception, treatment and handling

Sewage sludges and sludge cake treated within the STF originates from several sources:

- Indigenous sewage sludges, including indigenous primary sludge and indigenous surplus activated sludge (SAS) arising from sewage treatment processes operated within the wider Esholt WwTW are piped directly to the STF.
- Sewage sludges generated by smaller YW sewage works (with lower capacity or capability for treating sludges on-site) are imported to Esholt STF for additional treatment. This may be received in the form of either liquid sludge or sludge cake.

Imported liquid sludge and indigenous primary sludge

Liquid sludge and sludge cake are delivered to the site by tanker / covered tipper lorry, the maximum load typically being 28 tonnes with unloading routinely taking up to 30 minutes. Only appropriately authorised vehicles can discharge at the site. This is controlled using 'WaSP' loggers, valves on the discharge pipework will only open when a driver presents appropriate authentication to the system. The WaSP loggers record the source of the sludge, the time and date of delivery, the total volume discharged and average percentage dry solids of the load.

Figure D Sludge unloading area via WaSP loggers

Imported liquid sludge is delivered to site by tanker. The tanker unloads at the dedicated sludge import area and sludge is pumped (using vehicle mounted pumps) into the sludge screen feed tank (655 m^3 concrete tank) where it is mixed with indigenous primary sludge pumped directly via underground pipework from Esholt WwTW. Headspace air from this tank is routed to a local Odour Control Unit (referred to as OCU 1). This is currently operated as a dispersion only stack. YW is committed to refurbishing and reinstating this OCU to provide effective odour abatement – refer to the proposed improvement programme. The sludge is screened using two Huber enclosed rotating screens. Screenings drop into a skip and are disposed of off-site (see Part III: Form C3, Question 6e for more details of waste streams).

YW is planning to improve sludge screening at Esholt STF. This project will comprise the following:

- Replace existing Rotamat rotating Huber screens with enclosed Huber strain presses. This will occupy approximately the same footprint as the existing screens.
- Addition of a hydrocyclone grit removal system. It is proposed that this additional process stage, to be added between the sludge import screens and Consolidation Tank 5 will be located adjacent to the consolidation tank gallery building within the proposed installation boundary area.

These process changes/additions are designed to improve sludge screening efficiency, provide enhanced fugitive odour emissions control, and in the case of the hydrocyclone, to reduce the potential for downstream process disruption caused by sludge contamination.

After screening, sludge is pumped through a sludge transfer pump station via a sub-surface pipework, to Consolidation Tank 5 (2,500 m^3 uncovered concrete tank) (referred to on site as 'Consol 5') where sludge is blended and mixed using air injection. Two separate new OCUs are proposed for the sludge transfer pump station and Consol 5.

Indigenous SAS

Liquid surplus activated sludge (SAS) is pumped directly from the co-located Esholt WwTW to two SAS storage tanks (2 x 2000 m^3 uncovered concrete tanks). These tanks are air mixed and operate on a fill/draw basis over a 24 hour period.

Sludge from the SAS tanks is transferred to the drum thickener building, via above and below ground pipework. There are four individual drum thickeners (with separate pipes feeding them) located within the building, these are operated manually as and when the process requires.

Liquid polymer is delivered to site either by tanker (bulk delivery) or is delivered in 1 m^3 IBCs. The bulk tanker delivery point is located on the eastern side of the building. Bulk polymer deliveries are transferred into a 10 m^3 bunded GRP bulk storage tank located within the thickener building and from there are transferred to the 3 m^3 bunded GRP polymer prep tank. IBC deliveries directly feed the liquid polymer prep tank. Liquid polymer is diluted with potable water within the 3 m^3 bunded GRP polymer prep tank before being transferred to the adjacent 3 m^3 bunded GRP polymer make up tank. Both the make-up and prep tanks are located within a common bund. A spillage within any of the three polymer tanks would be manually removed from the bunds and disposed of outside of the installation site. From the make up tank the polymer solution is injected into the sludge stream within the flocculation tank (one flocculation tank per pair of drum thickeners) with final treated effluent added as a

'carrier' before being transferred to thickener drums. The polymer encourages separation of water from the sludge as the sludge is rotated in the drum to remove excess liquid. The thickener liquors are returned via the liquor return supernatant pumping station (uncovered below ground sump) to Esholt WwTW for full treatment. The thickened sludge is passed forward to the SAS transfer tanks (see below for further detail).

The drum thickeners are equipped with automatic spray bars which provide continual self-cleaning. The automatic spray bars operate using treated final effluent. A manual jet wash is available for additional cleaning requirements; this system utilises potable water. A full drum cloth clean is also carried out periodically (approximately every 1-2 months, as required).

Air is extracted from the drum thickeners and treated in a carbon filter OCU (referred to hereafter as OCU 4) prior to dispersal via twin dispersal stacks, approximately 7 m high and located to the north end of the SAS thickener building. Ambient air from the building is passively dispersed via louvre vents; ambient building air is not odorous under normal operating conditions due to the direct drum extraction.

The thickened sludge is then transferred to the SAS transfer tanks (2 x 400 m^3 uncovered concrete tanks). Thickened sludge tanks is mixed via pumps.

From the SAS transfer tanks the thickened SAS is then pumped to the mixed sludge tanks where it is mixed with indigenous primary and imported liquid sludges which are pumped from Consol tank 5. There are two covered concrete mixed sludge tanks with a capacity of 1,200 and 1,130 m^3 respectively. The mixed sludge tanks have an air mixing system to prevent settlement and septicity. Air from these tanks is extracted and routed to a local OCU (OCU 2). This is currently operated as a dispersion only stack. YW is committed to refurbishing and reinstating this OCU to provide effective odour abatement – refer to the proposed improvement programme.

Sludge dewatering

From the mixed sludge tanks, sludge is transferred to three dewatering centrifuges. A polymer solution is introduced to the sludge stream to encourage separation of water and sludge within the centrifuges. This polymer is stored as a dry powder within a silo (15 tonne storage capacity) and is mixed with potable water within the polymer mixing tank (25 m^3 capacity) located adjacent to the centrifuges. The liquid centrate is transferred via the dewatering centrifuges pump station and returned for full treatment within Esholt WwTW.

Imported sludge cake

Imported sludge cake is tipped from an enclosed wagon to the dedicated cake import reception unit which is enclosed when tipping operations are not taking place. A proposed new OCU will be installed for the cake import reception unit. Sludge is moved from the sludge cake hopper and is rewetted with final treated effluent (to target ~21% dry solids) and pumped to the Thermal Hydrolysis Process (THP) feed silos (refer to description below for further detail of these process tanks and the THP itself). The sludge cake is rewetted to provide feedstock consistency and mobility. Transfer lines are trace heated and insulated to reduce the risk of freezing and pipe rupture.

Figure E Sludge cake reception facility

Dewatered sludge is passed forward to the THP feed silos (2 no. 210 m^3 steel tanks) where it is combined with re-wetted imported sludge cake. Feedstock from THP feed silos is then transferred to the THP feed hopper (16.2 m^3 steel tank). Headspace air from the THP feed silos and feed hopper is extracted and routed to a local OCU (OCU 3). This is currently operated as a dispersion only stack. YW is committed to refurbishing and reinstating this OCU to provide effective odour abatement – refer to the proposed improvement programme.

Best Available Techniques (BAT) Summary: Sludge reception, treatment & handling

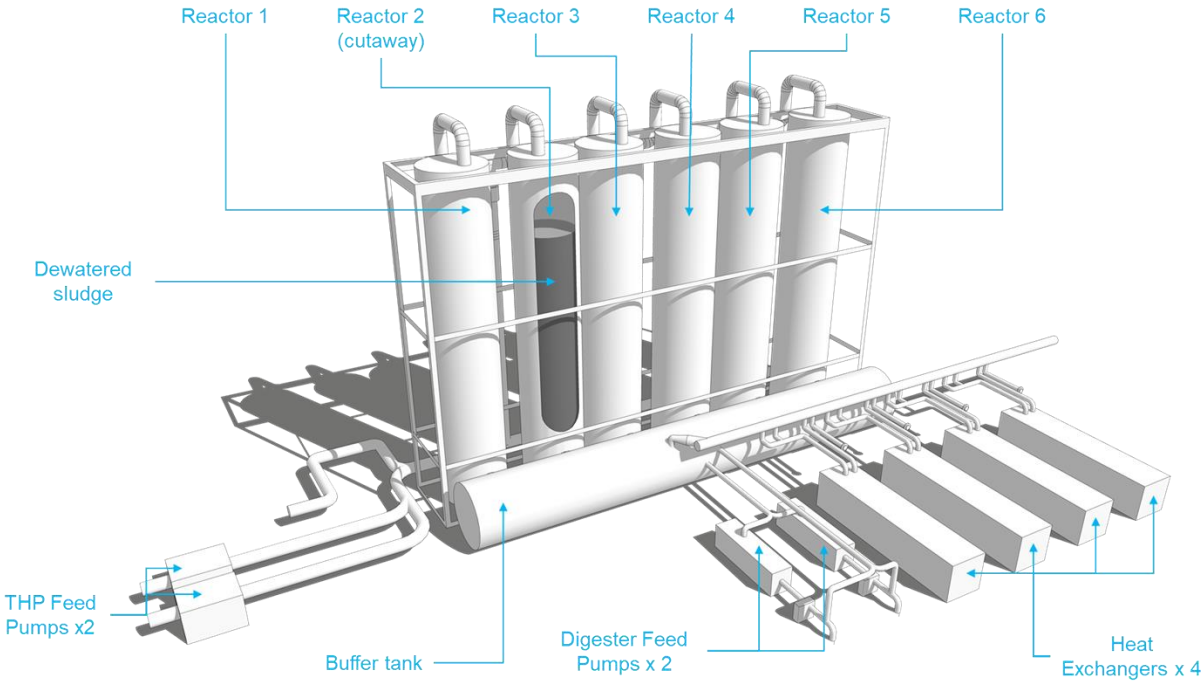
- Controlled unloading processes with tankers contracted via approved supplier(s).
- Trace heating to pipework reduces the risk of loss of containment from pipe fracture on freezing.
- Trace heating is provided to key instrumentation such as tank level gauges to prevent freezing and reduce the risk of false readings.
- In-line dosing of polymer ensures levels are controlled and raw materials used efficiently.
- Tank mixing using air injection to avoid settlement, blockage or gas production.
- PLC controlled plant and largely automated. PLC includes level sensors to reduce risk of tank overtopping, resulting in contamination and potential odour generation.
- YW Environmental Management Procedures (EMPs) are in place covering the import process (refer to Section III, Form C2, Q3d Management Systems).

1.5 Thermal Hydrolysis Plant (THP)

At Esholt STF, thermal hydrolysis technology is used prior to anaerobic digestion to enhance sludge treatment; the process acts to make the sludge more biodegradable, increasing biogas production within the digesters and assisting with pathogen kill in the final product. The THP at Esholt comprises 6 no. 22.7 m^3 reactor vessels, which operate in pairs. Each pair of reactors operates a batch process as follows: a reactor pair is filled with dewatered sludge and heated to around 165 °C using steam generated by boilers (refer to Section 1.7 below). The reactors are held at this temperature for 30 mins and act like a pressure cooker to break down organic matter in the sludge making it more digestible for the microbes in the anaerobic digester. After 30 minutes the steam is flashed out to the next pair of reactors (as a pre-heat stage) and the reactor tanks are emptied. Activity within each pair of reactors is staggered with one pair being filled, one pair undergoing active reaction and the final pair being emptied at any one time. Steam is transferred from one pair of reactors to the next to supplement boiler steam supply and maximise operational efficiencies. The plant is equipped with safety features including pressure relief vents and rupture discs, which operate at a lower pressure to the PRVs, to allow emergency venting of steam and prevent damage to equipment.

The THP achieves 96% pathogen kill, in combination with the normal anaerobic digestion process, this eliminates the need for post-digester liming or cake storage and maturation prior to landspreading.

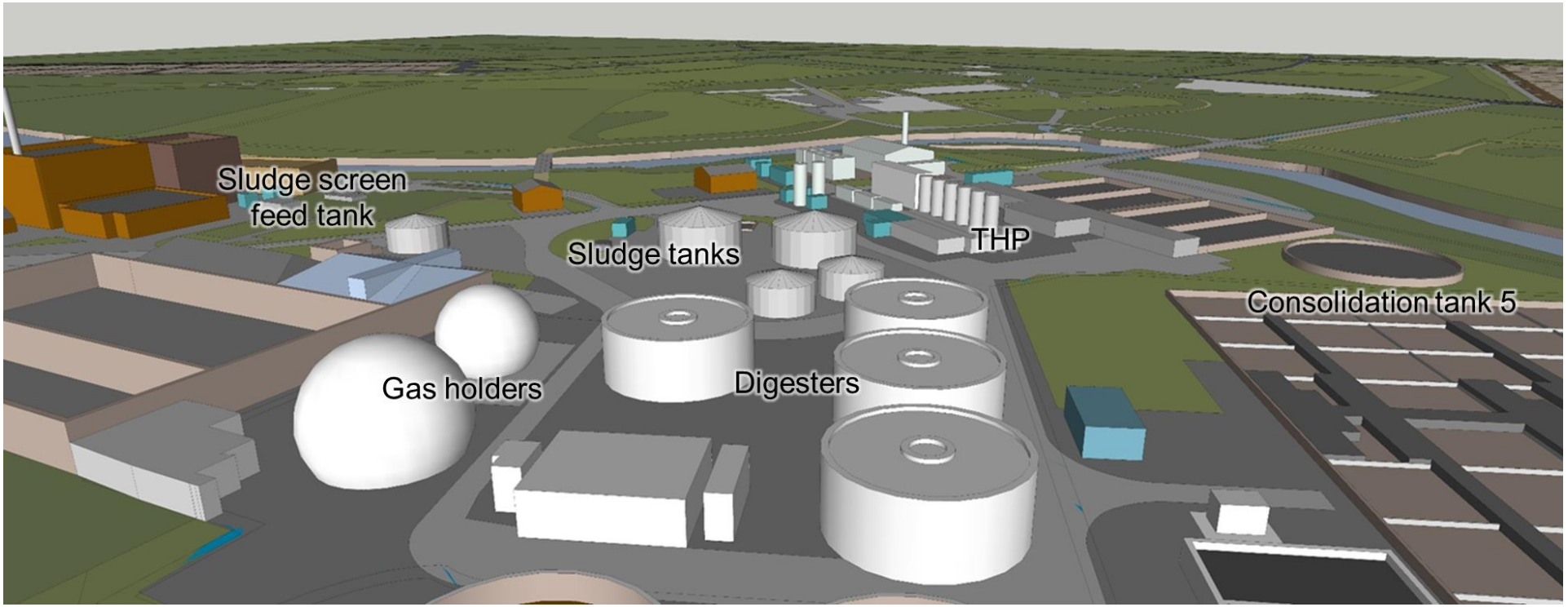
Figure F Thermal Hydrolysis Plant



1.6 Sludge digestion

Following THP, sludge is transferred to a steel buffer tank (39.5 m^3) and from there is passed forward via digester feed lines to the digesters. Heat exchangers are located within the digester feed lines to reduce sludge temperature to the optimal temperature range for mesophilic anaerobic digestion activity (37-43 °C). Cooling water is discharged to the WwTW for treatment. There are 4 no. aluminium-clad and insulated concrete digester tanks located on site, each with a capacity of 3,533 m^3. The anaerobic digesters operate as a continuous process with sludge being continually fed into the base of the digester and treated sludge being displaced from the top. The digesters operate independently of each other, and each have a maximum feed rate of around 106 tonnes / day dry solids (at 10% dry solids) or 1,060 m^3 /day. Digester retention time is determined by the feed rate (which is dependent on other site operations such as the THP) but is typically 10-11 days. The digesters are mixed by gas mixing systems, which utilise biogas from the headspace of each digester; the gas is compressed and then reintroduced using an array of mixing nozzles on the floor of the digester. The digesters do not require any supplementary heating due to the temperature of the sludge being passed forward from the THP.

Figure G AD area configuration



Grit build-up within digesters is a normal feature of operation, the digesters are cleaned out (including accumulated grit) every 10 years as part of the planned periodic inspection which also includes an internal and external inspection of tank integrity and replacement of instrumentation and gas mixing equipment as required. The planned hydrocyclone (to be added between the sludge import screens and Consolidation Tank 5) will help to reduce future grit build up, although internal cleaning will still be required.

An automatic anti-foam dosing system is in place to control digester foaming. This system uses a radar level probe in the digester headspace and compares this to the pressure level sensor at the bottom of the digester to determine the depth of foam. Upon detection of foam, final treated effluent is sprayed into the digester head space through nozzles in the digester roof. If this is not effective in breaking up the foam, a chemical anti-foam is mixed with final treated effluent and dosed into the headspace of the digester via the same spray nozzles. This system includes operator-adjustable dosing setpoints and failsafe systems; if the foam level continues to increase mixing systems are inhibited and if this continues the digester feed will be inhibited. Antifoam is stored in an 1m^3 IBC located on a bunded spill pallet.

Sludge extracted from the digesters is fed to the degassing tanks (2 no. 685 m^3 GRP coated concrete tanks) prior to onward processing. These tanks are equipped with air mixing to introduce oxygen and prevent the anaerobic generation of methane. The tanks are covered, and headspace air is extracted and discharged via a stack, approximately 5 m high. The dispersion stack is proposed to be replaced by a new odour control unit. YW is committed to route this tank air extraction to the biogas system – refer to the proposed improvement programme.

Best Available Techniques (BAT) Summary: Sludge digestion (*BAT 38*)

- THP increases digestibility of sludge, leading to enhanced biogas production and higher quality digestate. It also removes the need for extended cake maturation or liming to achieve the necessary pathogen target levels.
- Sludge pumps are on inverters for energy efficiency, and typically operate around 75% speed.
- Digested sludge transfer pumps are fitted with vent lines to prevent build-up of potentially explosive biogas.
- Plant operation is largely automated.
- YW procedures are in place covering the digestion process management.
- Monitoring is undertaken to check that the digestion process is healthy and stable. This includes temperature, solids, volatiles, fatty acids and pH, as well as biogas quality (Refer to Section III, Form C2 Q4a for further information on process monitoring).
- Foam levels are actively monitored, and an anti-foam system is used as required.
- Monitoring instrumentation including high level probes and pressure sensors linked to automatic PLC controlled pumps and other equipment to avoid potential loss of containment.
- A risk-based inspection and testing programme for above and below ground vessels, pipes and valves is in place. This incorporates a combination of visual examinations and non-destructive testing (e.g. ultrasonic thickness measurements).

1.7 Biogas storage and use

Biogas generated by the digester is piped to one of two double membrane biogas holders on site, one of these has a capacity of 2,380m^3 and the other a capacity of 1,040m^3. The biogas

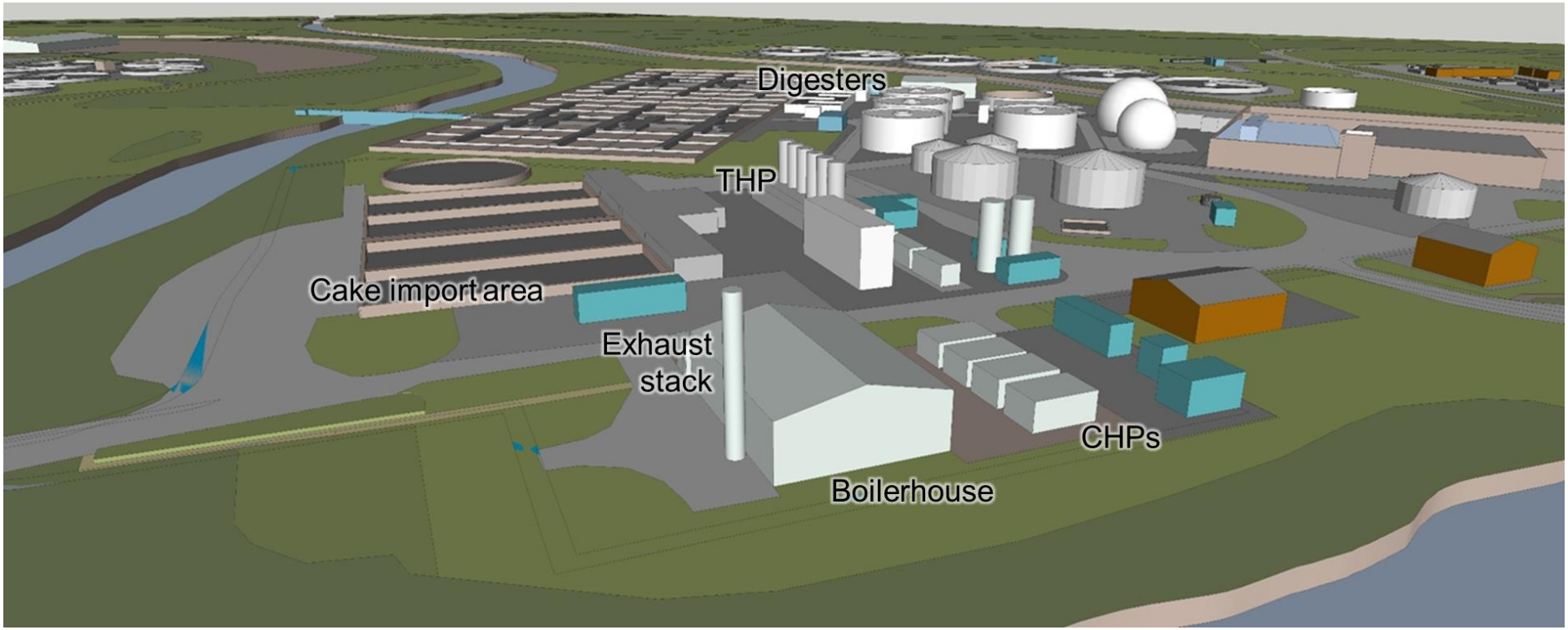
holders provide gas buffering capability in order to allow for fluctuations in gas production. Each gasholder has an ultrasonic level detector to monitor the level of the inner membrane and hence the volume of gas stored. The level detectors are used to control the start and stop of the CHP, composite boilers and waste gas burner. There is a methane gas detector fitted between the two membranes to detect any leaks in the system and alert the plant operators.

Pressure relief valves (PRVs) are located on the inlet biogas pipeline serving each biogas holder as well as outer membrane vent valves on each holder. PRVs are also located at the digesters (2 no. at each digester) and there are 10 PRV's on the THP plant. These valves are an essential safety mechanism and will release gas to atmosphere in the event of a build of pressure preventing damage to equipment. The digester valves are also an 'anti-vacuum' design to prevent tank damage from negative pressures. Additional gas release valves are installed at various points, for instance between the degassing tanks and centrifuge feed tanks. The primary purpose of these is to prevent air-locking within pipework and subsequent loss of pumping.

Excess liquids within the biogas system are removed via condensate traps. These are located at various points in the system including on pipework between the digesters and biogas holders, prior to the waste gas burner, and prior to the CHPs and boilers. These collected liquids are transferred to the WwTW for treatment.

YW propose to install a biogas dehumidifier unit to further enhance condensate removal from pipework prior to the CHP engines. This scheme is subject to further investigation but is likely to comprises a heat exchanger system to cool the biogas and thereby enhance condensate removal.

Figure H CHP compound configuration



Biogas, via a gas booster, is currently used as the sole fuel source for the CHP units operating at Esholt STF; no natural gas or other alternative fuel is available. The CHP facility comprises four reciprocating engine generator sets. Two of these engines (referred to as CHP 1 and 2) have a thermal input of 1.53MW and two (referred to as CHP 3 and 4) have a thermal input of 3.63MW each. The CHPs generate electricity which is used to power essential site processes. Heat from the combustion process is used in waste heat recovery boiler stages, with any excess being discharged using air cooled radiators.

There are two 6.2MW Cochran Low NO_x composite steam raising boilers on site which generate steam for the THP as well as hot water which feeds the low temperature hot water (LTHW) ring main. These composite boilers combine direct firing of gas oil and the capability to receive waste heat from the exhaust gases fed from CHPs 3 and 4. The combined heat input is used for steam raising. The primary fuel for the boiler direct firing stage is currently low sulphur gas oil, with biogas as a backup fuel source. When operating at full capacity the digesters are able to generate sufficient biogas to fuel all four CHPs. The boilers may be fired by biogas in the event that one or more the CHPs is unavailable.

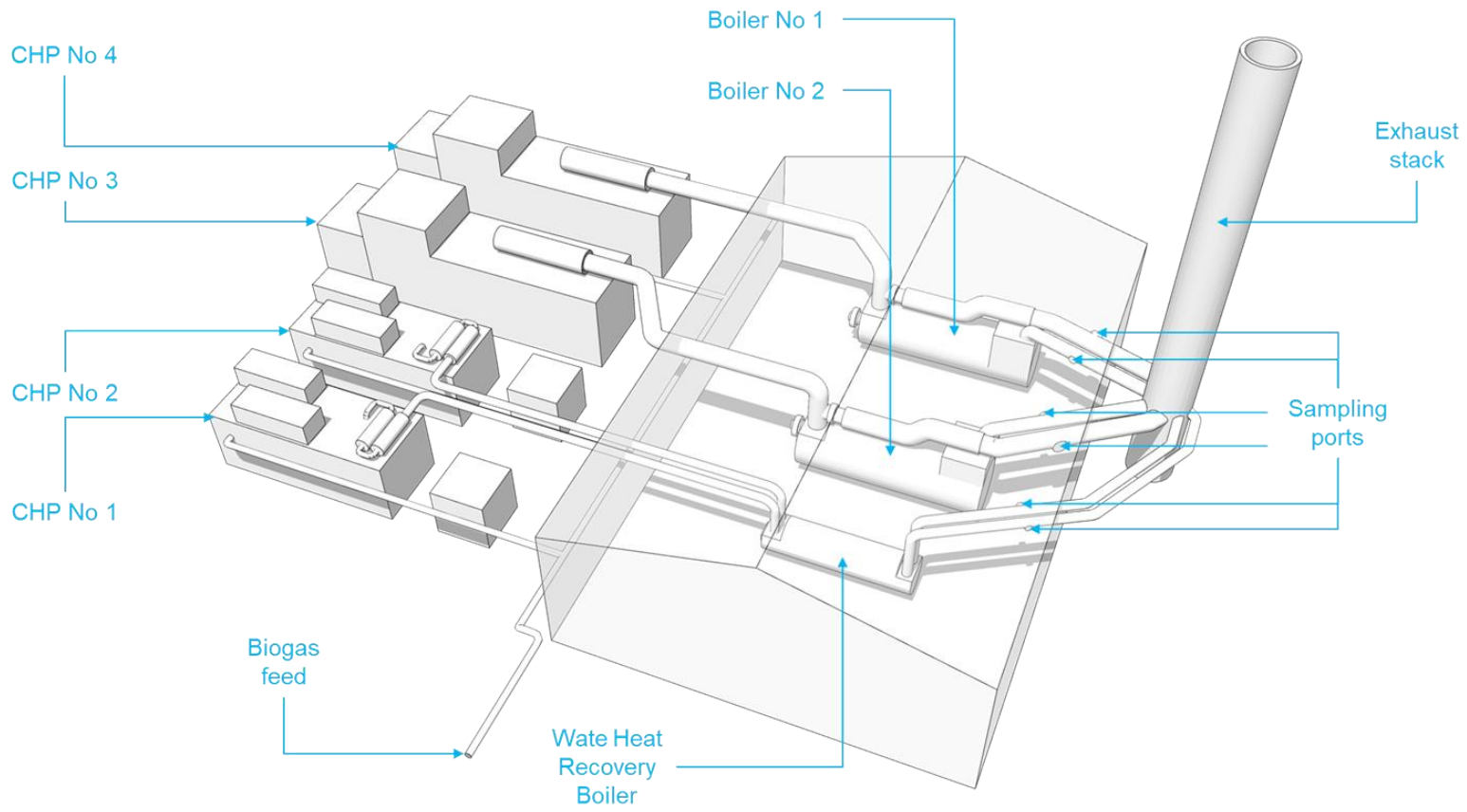
YW is proposing to bring a gas connection onto site to provide mains natural gas for operation of these steam raising boilers. This solution would replace gas oil as the main fuel source for the boilers (with biogas continuing to provide the back-up fuel source). It is also proposed that CHP1 will be converted to natural gas as its sole fuel source. The remaining three CHP engines would continue to operate with biogas as the sole fuel source. Air dispersion modelling has been undertaken to assess emissions following these change – refer to Appendix 7.

Gas oil for the boilers is stored in a 108 m^3 steel tank. This tank includes an integral bund providing secondary containment for the main tank and its fill point. Tertiary containment is provided around the tank filling area in the form of a low roll over bund with drain gully inside. The arrangement is compliant with the Oil Storage Regulations (2001). In addition to the two composite boilers a waste heat recovery (WHR) boiler operates on site. This has no direct firing capacity but recovers heat from CHP 1 and 2 exhaust gases to generate steam for the THP as well as hot water which also feeds the LTHW ring main.

The LTHW ring main receives recovered heat from the engine systems via heat exchangers. This is exported to provide space heating for the adjacent Esholt Hall conference centre owned and operated by YW as well as pre-heating biogas feed to the CHPs. Each engine is fitted with an air-cooled radiator to allow excess heat not required by the LTHW system. This allows the engines to run at full load independently of the demand of the LTHW system and steam generating plant, if necessary.

CHP engine and boiler combustion products are discharged via a 15 m high stack located adjacent to the boilerhouse. Contained within a single windshield are 6 exhaust stacks. These are: CHPs 1 and 2 (via waste heat boiler), CHP 3 and 4 (via or bypassing boiler 1 and 2 economisers) and exhaust stacks for boilers 1 and 2.

Figure I Combustion stack configuration



In periods where biogas generation exceeds CHP engine and boiler capacity (e.g. in the event of multiple plant shutdown/failures) biogas is directed to the waste gas burner. Since there are four CHP engines and two steam boilers with biogas firing capability, flaring rarely occurs. The flare facility comprises a 3,400m³/hr enclosed thermal combustor with 7.5m high exhaust stack and is located at a safe distance from the digesters and other biogas handling and treatment activities. Flare stack operation is automated based on gas level. If the gas level is high then the flare will operate, however utilisation of the gas is preferred over flaring. The flare provides 0.3 second retention time at 1,000 °C.

Figure J Waste gas burner

The areas around the digesters and gas storage and use are classified as a potentially explosive atmosphere, with strict provisions on the control of potential ignition sources in line with requirements of the Dangerous Substances and Explosive Atmospheres Regulations (DSEAR).

Best Available Techniques (BAT) Summary: Biogas utilisation and flares
(*BAT 15 and 16*)Flame arrestors are fitted to the biogas flare system to reduce the risk of fire / explosion.

- Flare burns at 1,000 deg. C with 0.3 second retention time.
- The flare is regularly checked to ensure that it ignites correctly when required and gas flow to the flare is constantly monitored using inline meters.
- Biogas holder provides gas buffering and allowance for fluctuations in gas production.
- Flow meters installed on gas utilisation under PLC control to maximise utilisation efficiency.
- The plant operates under PLC and is largely automated.
- YW procedures are in place covering biogas management.
- Heat is utilised on site in the THP and digestion process, waste heat, via the LTHW circuit serves off-site users.

1.8 Digested sludge treatment, handling and disposal

Digested sludge is pumped from the degassing tanks located adjacent to the anaerobic digesters to the digested sludge dewatering facility via a combination of above and below ground pipes, including a short section crossing the River Aire. The pipe crosses the river alongside the STF access roadway and is located at road level, on the far side and downstream of the road bridge barrier. The height above the river and roadside barrier provides protection for the pipe in the event of serious flooding which may bring large debris down river (refer to Part III, Q 6-5 Accident Management Plan).

There are two separate sets of facilities for digested sludge dewatering. The first of these, which is used preferentially, is known as the sludge export facility. Sludge is transferred from the degassing tanks to two export dewatering feed tanks, each of which is of steel construction and 1,604 m^3 capacity. These tanks are not covered and have air mixing systems to prevent settlement and inhibit generation of methane. Powdered polymer stored within a 25 m^3 storage silo, or liquid polymer stored in IBCs located within a GRP kiosk, is mixed with potable water within a polymer mixing tank. The polymer solution is injected into the sludge stream and taken to one of two export centrifuges where the sludge coagulates and supernatant liquor is removed by centrifugal forces. Dewatered liquor drops from the centrifuges into the export centrate sump and is pumped back to the WwTW for treatment.

The final digested and dewatered sludge cake is transferred via conveyers from the centrifuges up over a push-wall and into the covered sludge cake export barn. The whole area under the conveyer and sludge cake barn is an engineered impermeable surface, with water runoff draining to the WwTW for treatment.

Figure K Export cake barn

In addition to the export dewatering facility there is a second dewatering area, which provides additional capacity for digested sludge treatment and handling. This takes place in what is known as the conditioning area. When the THP/digestion plant are running at full capacity, sludge would typically be diverted to this second dewatering facility for approximately 5-10 minutes in each hour. During these periods, sludge is transferred from the degassing tanks to two conditioning feed tanks, each of which is of concrete construction and have a capacity of 1,200 and 1,130 m^3. These tanks are not covered and have air mixing both to prevent settlement and inhibit generation of methane.

Powdered polymer stored in 750kg bags are suspended over a hopper dosing system which feeds a make-up tank where the powdered polymer is mixed with potable water and transferred to an ageing tank and finally a storage tank. The polymer solution is injected into the sludge stream and taken to one of three centrifuges where the sludge coagulates and supernatant liquor is removed by centrifugal forces. Dewatered liquor drops from the centrifuges into the centrate sump and is pumped back to WwTW for treatment.

The final digested and dewatered sludge cake is transferred via conveyers on to the cake pad. The area under the conveyer and cake pad is an engineered impermeable surface, with water runoff draining the WwTW inlet for treatment.

The digested sludge cake produced by this facility does not require liming or storage to ensure adequate pathogen kill and is suitable for immediate despatch from site to be landspread for agricultural benefit. The THP stage increases destruction of volatile sludge components within the digester, meaning that the final sludge cake has reduced odour generation potential.

Best Available Techniques (BAT Summary)

- Lagging on above ground pipework, including pipework running over the river, provides temperature management to ensure that flow is maintained reducing the risk of viscosity increases or expansion associated with cold temperatures, reducing the risk of pipe fracture and loss of containment.
- Digested sludge transfer pumps are fitted with vent lines to prevent build up potentially explosive biogas.
- Engineered cake pads with leachate and washwater collected for treatment at the WwTW.
- An inspection and testing programme for pipes and valves is in place. This includes biennial surveys using in-pipe crack detection technology.

Section III: Supporting Information

This part of the application provides detailed responses to questions in Section I: Application Forms, where further space is required to provide the necessary information.

Responses are provided only where further information is required, and the questions numbers are as stated in the application forms.

The information provided in this section should be viewed in parallel with:

- Section I: Application Forms
- Section II: Technical Description

Form C2 Supporting Information

2 About your proposed changes

Proposed changes to current activities within this installation are provided in C2: Table 1 below. A full summary of activities it is proposed will be included within this installation are provided in response to Form C3, Table 1a later in this section.

Table C2: 1 - Changes to existing activities

Name	Installation schedule 1 references	Description of the installation activity	Description of waste operation	Description of the mining waste operations	Description of water discharge activity	Description of groundwater activity
Esholt STF	Section 5.4 A(1) (b)(i) Recovery or a mix of recovery and disposal of non-hazardous waste with a capacity exceeding 75 tonnes per day (or 100 tonnes per day if the only waste treatment activity is anaerobic digestion) involving biological treatment	**Addition**: Anaerobic digestion of indigenous and imported UWWT-derived sludges.	None – will be regulated as an installation level permit	N/A	N/A	N/A
		Addition: DAA associated with anaerobic digestion: Treatment of sludge prior to digestion (including reception, bulking, blending, physical handling, screening, dewatering and heat treatment (THP)).	None – will be regulated as an installation level permit	N/A	N/A	N/A
		Addition: DAA associated with anaerobic digestion: Treatment and storage of digested sludge (including physical handling and dewatering) produced at Esholt.	None – will be regulated as an installation level permit	N/A	N/A	N/A
		Adoption of Medium Combustion Plant Directive (MCPD) Emission Limit Values for existing combustion plant (including appropriate monitoring provisions) from the relevant phase in date for the plant in question (refer also to Appendix 12)	None – will be regulated as an installation level permit	N/A	N/A	N/A

Name	Installation schedule 1 references	Description of the installation activity	Description of waste operation	Description of the mining waste operations	Description of water discharge activity	Description of groundwater activity
		None – currently regulated as a waste level permit	**Transition** the following waste activities listed in VP3130GZ to installation level permit (as DAAs): • Import of sludges • Storage and treatment of biogas • Use of biogas as a fuel in combustion plant Incineration of biogas	N/A	N/A	N/A

3 Your ability as an operator

3b Technical ability

YW have relevant technical competence to operate the activities at the site, including those included in this permit variation. Technical management will be provided by David Shaw, Yorkshire Water; his primary and continuing competency assessment certificates can be found in Appendix 2.

The environmental permit numbers and site address for all other waste activities that David Shaw provides technical competence for are provided in Table C2: 3b below.

Table C2: 3b Sites under the technical competence of David Shaw

Permit number	Site address	Postcode
KP3036LW	Lemonroyd STF Fleet Lane Oulton Leeds	LS26 8AB
VP3730GB	Mitchell Laithes (Dewsbury) STF Dewsbury	WF12 9BB
KP3536LL	Neiley STF Newmill Road Brockholes	HD9 7AL
KP3836LT	South Elmsall STF Chapel Lane South Elmsall	WF9 2SW
FB3809MM	Knostrop STF Knowsthorpe Lane Leeds	LS9 0PJ
EPR/CP3897LT	Blackburn Meadows STF Alsing Road Sheffield South Yorkshire	S9 1HF
EPR/WP3030GC	Hull Sludge Treatment Facility Hull Waste Water Treatment Works Hull Road Kingston upon Hull	HU12 8EY

3d Management systems

YW has an established EMS, which is certified to the ISO14001 standard. A copy of the YW ISO14001 certificate is provided as Appendix 3. The EMS forms part of a wider corporate Integrated Management System (IMS) which also incorporates quality management, health and safety management, asset management, organisational resilience and business continuity requirements. The management system follows an asset life cycle approach, from design through to decommissioning.

Corporate level management system processes are in place, which are supplemented by site-specific documented procedures and processes. YW's IMS is structured as shown in Table C2: 3d-1 below.

Table C2: 3d-1 Overall IMS structure

Level 1 - IMS Manual	
	YW's IMS manual is a set of documents including records which describe the scope, policy, objectives and overall management responsibility within YW and specifically addresses the requirements of ISO9001, ISO14001, ISO55001 and ISO45001.
Level 2 - Generic Manuals	
	The level 2 generic manuals detail policies and procedures, concerning the operation and maintenance of systems giving the purpose, scope, responsibilities and operational requirements.
Level 3 - Site Specific Manuals	
	The level 3 site specific manuals detail site specific information and procedures, concerning operations, giving the purpose, scope and responsibilities. Document control procedures are in place to ensure IMS and associated documents and records are identified, controlled, maintained and retained appropriately. Key records maintained in accordance with IMS procedures include training records, internal audit reports, waste transfer and consignment notes, complaint records, risk assessments, legislative records, permits, consents and associated documentation, accident and incident records and monitoring and measurement data.

A summary of the EMS is provided on the following pages, focusing in more detail on how this is applied to the management of sludge treatment operations.

Scope and Policy

The YW EMS has been certified to ISO14001 since 2004. The certified EMS scope covers:

"The management and operation of clean and waste water assets and associated services".

YW's top level commitment to environmental and quality performance can be found in the Quality & Environmental Policy; a copy of the policy is provided as Appendix 4.

Quality and Environmental Policy

Chief Executive of Yorkshire Water Services Ltd approves and is **accountable** for implementation

Responsibility of **all employees** to comply

Covers **all YW activities**, including the Esholt site, and applies to all individuals who are employed by, or carry out work on behalf of YW including contractors, temporary staff and agency workers

Key Roles and Responsibilities

YW has a central team responsible for the implementation of the overall IMS; the YW Bioresources team are responsible for maintaining ongoing compliance and managing the Esholt STF.

YW personnel have role statements which provide details of the responsibilities and accountability of individual roles.

Planning Actions

YW has established appropriate forums and mechanisms for the identification and management of risk, including senior leadership teams and governance groups. Actions are cascaded throughout the organisation as appropriate.

In relation to environmental issues, climate change risk assessments are carried out as well as consideration of extreme weather and climate resilience work. Environmental aspects and impacts have been identified and are recorded using the company's software platform for recording risks (currently the '4Risk' system).

YW is committed to comply with all relevant legislation, regulations and any other requirements to which the organisation subscribes. Legislation is analysed so that its relevance to the activities, aspects, products and services of YW are understood, communicated and applied. Registers of relevant legislation and other requirements are maintained and managed via the Evaluation of Compliance (EoC) process held on SharePoint.

Management requirements that arise from risk assessments and evaluation of compliance processes are taken into account in planning operational control and emergency preparedness procedures.

General Operational Controls (Environmental)

Operational facilities, including the Esholt STF, are managed in accordance with procedures laid down within the EMS. This includes procedures to identify and control environmental issues arising from YW's activities, including specific environmental permit requirements.

Procedures specify environmental best practice requirements, including for example storage of chemicals and oils within a bund (with 110% capacity) which must be maintained in good condition, located inside a building wherever possible, on hardstanding and away from watercourses and site drains. Waste must be segregated appropriately, and waste containers must be located on impermeable hardstanding.

YW has developed a biodiversity policy, underpinned by specific processes and procedures, to deliver programmes of work that aim towards a biodiversity net gain. This policy is applicable to contractors delivering work on behalf of YW.

Maintenance (Planned)

A planned maintenance system is in operation at Esholt STF covering all electrical and mechanical equipment and calibration of instrumentation and control system. A list of all plant items is stored on the Asset Inventory System (AI2) and the frequency, scope and records of planned maintenance and calibration are stored on SAP. Job cards for planned maintenance are produced through the SAP system giving the necessary work instruction. Planned maintenance requirements are initially based on recommendations provided in Operations and Maintenance (O&M manuals).

Total Care Plans (TCPs) are produced for all sites and are reviewed at set intervals. TCP reviews set future planned maintenance frequency, the work to be carried out during the planned maintenance and identifies critical and life expired plant items. This is based on the review of the plant item's history and on condition monitoring results.

An inspection and testing programme for above and below ground vessels, pipes and valves is in place. This programme of work to detect any deterioration or weakness of assets typically incorporates a combination of visual examinations and non-destructive testing (e.g. ultrasonic thickness measurements). The frequency of inspection is in accordance with risk-based requirements, which also varies according to the condition of the asset. A clear process to address any identified defects, with assigned responsibilities, is in place.

In addition to planned maintenance activities described above, a programme of daily, weekly and monthly visual inspections and checks are undertaken. This includes, for instance, visual inspections of general site condition and housekeeping including spills and biogas leaks, checks for abnormal heat, noise and vibration, checking the operation of pumps and monitoring instrumentation, checking calibrations are in date etc. Any abnormal observations are recorded in the site logbook.

Odour checks are carried out in accordance with the Odour Management Plan (see Appendix 10).

The designated Technically Competent Manager (TCM) also undertakes monthly inspections of the site to identify any potential issues and arrange resolution as necessary. These inspections are recorded and the information is retained by YW.

Maintenance of the CHP, boilers and de-watering plant are undertaken by specialist contractors. All activities are closely managed from site to ensure that all YW H&S and environmental policies are met. Regular maintenance of plant such as CHP engine is undertaken in accordance with requirements specified by the equipment manufacturer including routine planned inspections and more in-depth servicing. The frequency of servicing is based on a combination of running hours and condition monitoring data. CHP contractors are on site weekly whilst boiler maintenance normally requires attendance on a quarterly basis. Maintenance contracts include provision for reactive/emergency activities and management of spares.

Processes on site operate continuously, 24-hours per day, 7-days per week, apart from maintenance periods. The plant is designed to operate unattended with process parameters being monitored continuously. Operating logs are stored electronically.

Maintenance (Reactive)

Plant breakdowns are responded to on the basis of a risk assessment matrix (RAM) and prioritised according to consequence of failure and likely time to failure occurring. Amongst other attributes, the RAM takes into account impact to environment, health and safety, cost and flooding.

Site operational staff are responsible for requesting breakdown maintenance and repairs. Any reactive work that achieves a high priority on the RAM is called through to the Engineering Service Desk for progression. These jobs are treated as schedule busters and are progressed accordingly.

Records of all maintenance (planned and reactive) and calibration are retained on the SAP work management system.

Waste Characterisation (Pre-acceptance & Acceptance)

All sludges arriving at Esholt STF are either indigenous primary and secondary sludges from the Esholt WwTW or imported sludge and sludge cake from other YW sites. As a result, the composition of the sludge is very stable, consistent, and is well understood. The volume and source of imports to the site is recorded by WaSP loggers. These also ensure that only appropriately authorised drivers can discharge at the Esholt STF. All sites supplying sludge to Esholt have been reviewed to ensure that the typical sludge they produce is suitable and safe for anaerobic digestion. Sludge production problems are rare, but operators and tanker drivers are trained to identify contaminated sludges at source and stop them being transferred to the digestion site. Spot checks are carried out on imported sludges to ensure they are within acceptable parameters and safe for the digestion process. The Waste Pre-acceptance and Acceptance procedure is included as Appendix 13.

All cake (digested sludge) exported from Esholt has to meet stringent HACCP requirements, including regular sampling to assess safety.

Emergency Preparedness and Response

YW has developed processes to identify, respond to and control emergency situations that may cause adverse environmental consequences. Spill kits are readily accessible at locations where there is a risk of spillage (e.g. delivery, storage and areas of use). Spill control toolbox talks are provided to staff. This includes information about how to prevent and control pollution incidents from accidental spills of oils, fuels, sludge and chemicals.

Contingency plans help minimise potential environmental impacts; this includes emergencies arising from breakdowns, enforced shutdowns, abnormal circumstances such as flooding as well as major fire and spill/loss of containment events. Refer also to the Accident management plan (see Section III; C2, Q6-5) and the Secondary Containment Risk Assessment (Appendix 11).

The YW Business Continuity Plan is in place to define and prioritise critical business functions, details the immediate response requirements for a critical incident and details strategies and actions to be taken to ensure business continuity.

All Bioresources sites, including Esholt, have the capability of remote monitoring and remote operation of key functions. A security guard is present on site 12 hours per day Monday to Friday and CCTV security cameras are located across the site with monitoring provided 24/7 by the YW Service Delivery Centre. All buildings are alarmed and high-risk equipment is provided with secondary fencing for added security.

Monitoring

Process monitoring is undertaken for all key processes on site. This includes monitoring of operational parameters of plant and equipment to ensure it is operating effectively and efficiently. Further details are provided in Section II Technical Description.

Air emissions monitoring, including emissions from the CHP/boiler stack, is undertaken in accordance with permit requirements. Further details are provided in Section III, Form C3, Question 4a. Odour monitoring is described in Appendix 10: Odour Management Plan.

Environmental performance monitoring includes monitoring electricity and gas use, biogas generation, electricity generation, water use and waste arisings. Further details are provided below in Section III, Form C3, Questions 6a, b, c, d and e.

Training, Awareness and Competence

YW maintains processes to ensure that all those working for or on behalf of YW are suitably trained to fulfil their roles efficiently. Assessment of competence and identification of individual training needs is carried out through mutual discussion between the individual and their manager as part of the company performance management process, a fundamental part of which is the competency framework and progression plans which are available for every role in the organisation.

All YW employees receive IMS awareness training, delivered online at induction and periodically thereafter. This includes awareness of the environmental policy and understanding key environmental hazards and risks and the need to comply with IMS requirements.

Staff who work at the Esholt STF receive specific training in the plant's operation and the potential environmental impact of the process as well as health and safety. Plant operators have a detailed understanding of the operational procedures for the site for both normal and abnormal operation. As part of the training, operators will receive specific instructions relating to those aspects of plant operation that have the potential for a negative impact on the environment. Toolbox talks are used to provide information and training to site staff, including information about environmental requirements/activities and legislative and compliance requirements. Training records for programmes and courses managed centrally are held on the company Learning Management System. Records for specific training managed locally at the Esholt site is held by individual managers and/or on the Leaning Management System.

Communication

Communication plans are in place to communicate business performance based on the company's 'Big Goals', company objectives and performance commitments, aligned to the quality, safety, environmental and asset management requirements.

The company intranet, called the Hive, provides regular news updates for YW personnel and holds a wide range of information that employees can access. Other key communication channels include regular corporate newsletters, business unit-specific newsletters, and update sessions and events held by senior business leaders. 'Safeguard' communications are used to issue notifications such as Safety Alerts, Toolbox Talks and Lessons Learned from incident investigations to personnel across the business.

At a Esholt site level environmental information is communicated primarily via toolbox talks and noticeboards.

Contractors

YW has specific procedures in place for the management of contractors regarding health, safety and environmental requirements. This includes procedures to ensure contractors have the required skills and environmental competencies to carry out works at this site. Initially, contractors are assessed by the procurement department for inclusion on the approved supplier list, which includes health and safety and environmental criteria for example, waste documentation such as waste carrier's licence/training certificates. Even when the contractors are on the approved supplier list, they are still further assessed for each specific contracted activity. The contractor is required to submit a risk assessment method statement (RAMS) prior to any commencement of work, identifying how work is to be undertaken and the associated risks. The RAMS must be approved by the Site Manager or an assessor who is competent at reviewing a RAMS, who will also identify any site hazards and issue an Authorisation to Work/Enter the site, following a site induction. When on-site, the contractor must carry this Authorisation to Work at all times. Contractors must also complete a site induction, which remains valid for up to a year, covering health, safety and environmental requirements whilst on site.

Environmental Improvement

Yorkshire Water's IMS objectives are documented with the 'Big Goals' and 'Performance Commitments' which are available and communicated via the company intranet. Planning to achieve IMS objectives is monitored and reported internally (via Performance Zone) and externally (via the Annual Report).

Esholt STF has daily and weekly performance targets including sludge throughput, gas quality, electricity generation and electricity consumption targets. Performance against these targets is reviewed at daily meetings and corrective actions taken as required.

The EMS is subject to a Senior Management Review twice a year to consider environmental performance, objectives and targets and continual improvement.

The Innovations Team at YW undertakes regular monitoring and review of new and innovative technologies and equipment to ensure the business continually improves its operations and activities. This includes consideration of cleaner technologies and improved environmental performance. Sectoral and cross-section benchmarking also takes place as required.

Incidents, non-compliance and complaints

Processes have been developed by YW to identify, respond to and control situations that may cause actual or potential non-conformities. Non-conformities may be identified through internal audits/inspections or may be detected through other means. Incidents are managed in accordance with the Incident Management policy and procedures and Emergency Planning manual. In the event of a significant incident a root cause analysis is conducted. Actions are identified, reported, recorded and communicated to prevent reoccurrence.

Complaints are typically received by YW central Customer Services team, where all complaints are logged on the ICE system. Complaints relevant to Esholt STF are passed on to the Site Manager for further investigation. The Site Manager is responsible for ensuring that any complaint is investigated and, if found to be justified, that work is undertaken to resolve the issue, including liaising with the relevant regulatory bodies where appropriate. The Customer Service Team ensure an appropriate response to the complainant in a timely manner including, if and as appropriate, detailing the reason behind the issue and the actions taken to resolve the matter.

All complaints information is recorded on the ICE system in order that this can be monitored, reviewed and analysed.

Auditing

YW operates an internal audit programme delivered by trained internal auditors or suitably qualified external consultants or contractors. This includes the following:

- IMS auditing/inspections undertaken by the IMS Team.
- Regular combined quality, health and safety and environmental inspections performed at all operational sites, including Esholt STF.
- Assurance and improvement programme to ensure the health, safety, environmental and technical compliance of contractors delivering capital schemes.
- Audits of contractors delivering repair and maintenance activities.

YW is also subject to regular audits by external auditors to ensure continuing adherence to ISO14001 requirements.

Management Review

A formal Management Review of YW's IMS is undertaken and recorded at least once a year. The purpose of these meetings is to ensure the IMS' continuing suitability, adequacy and effectiveness as well as to assess opportunities for improvement and the need for changes to the management system, including the policy and objectives.

Neighbouring operators

The land immediately to the southwest of the conditioning pad is leased by a third party operator (Biowise) for the operation of an open windrow composting (OWC) facility. Whilst there is no technical connection between the Biowise OWC facility and the STF, surface water drainage from the OWC plant passes under the conditioning pad and mixes with surface water runoff from the conditioning pad at the leachate pumping station (located on the edge of the conditioning pad). From here the effluent is transferred to Esholt WwTW for full treatment.

YW and Biowise have communication mechanisms in place including:

- Both parties hold contact details for key operational contacts on the neighbouring site.
- Any accidents and incidents with potential to impact on the other party (e.g. spills, abnormal operational activities/works) will be communicated to the neighbouring site promptly.

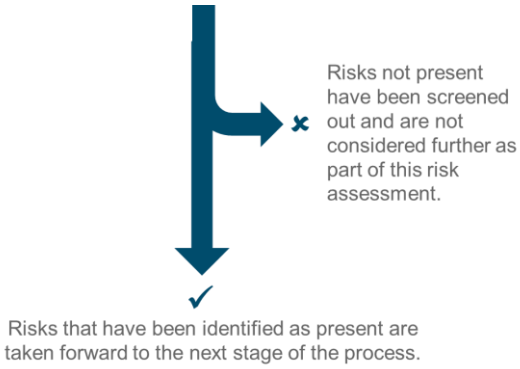
Periodic meetings will be held between Biowise and YW to discuss issues arising, including accidents, incidents, complaints and any other issue of relevance to each environmental permit.

6 Environmental risk assessment

A review of environmental risks associated with activities covered by the scope of this variation application has been carried out. This review follows EA guidance on risk assessments for environmental permits[1] and adopts the approach outlined below:

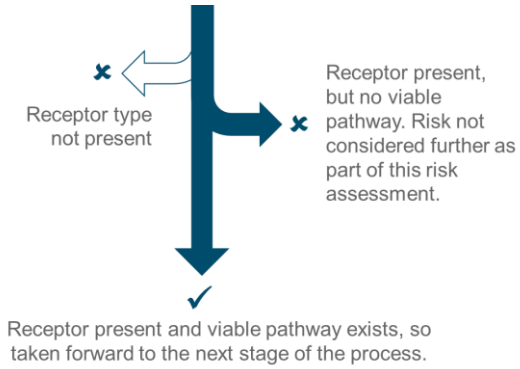
1. Identify and consider risks, and the sources of the risks, and assess whether these require further assessment or can be screened out. Only risks arising from processes that are within scope of this permit variation application have been considered.

⇨**Table C2: 6-1**



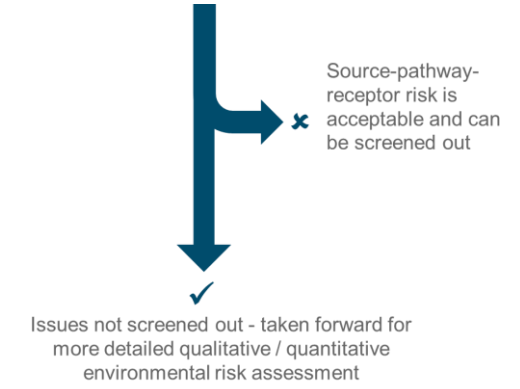
2. Identify and review the receptors (people, animals, property and anything else that could be affected by the hazard) at risk. Within each receptor category, the closest receptor(s) has been identified along with possible pathways to link the receptor to the credible site risks from Stage 1.

⇨**Table C2: 6-2**



3. Assess risks relevant to the specific activity and check they are acceptable and can be screened out –provides a summary of the risk-pathway-receptor assessment.

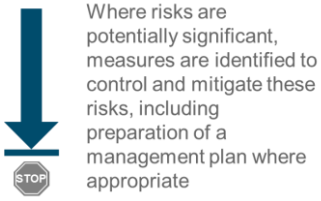
⇨**Table C2: 6-3**



4. Qualitative and quantitative risk assessments for risks which cannot be screened out.

⇨**Q 6-1 to 6-9**

⇨**Appendices 7, 8 and 9**



[1] https://www.gov.uk/guidance/risk-assessments-for-your-environmental-permit (accessed February 2021)

Table C2: 6-1: Identification of Environmental Risks

Identified risk area		Sources on site	Discussion	Identified risk
	Odour	Odour extraction stacks, fugitive releases from tanks, screenings and sludge/cake import, conditioning pad and cake barn	Following sludge import, raw sludge is largely contained to minimise odour generation potential. Displaced air (odour) from most tanks and processing facilities are extracted and dispersed to air via a stack. In addition, there are some unabated odour sources and fugitive emissions. Odour emissions (fugitive) from digested sludge and cake handling facilities are low. YW is committed to improvements to reduce diffuse odour emissions – refer to Proposed Improvement Programme.	✓ Further review
	Point source emissions to air. Emissions deposited from air to land	Odour extraction and dispersion points	Processing of sewage sludges can result in emissions of various compounds with potential human health or ecological impacts. These include Volatile Organic Compounds (VOCs), hydrogen sulphide (H_2S), ammonia, and other organics including mercaptans. Adopting a precautionary approach, these emissions have been further reviewed. These compounds can also be highly odorous; this aspect is considered separately.	✓ Further review
	Noise	Motors, pumps, blowers, compressors, conveyors, vehicle movements, site personnel CHP, Boiler, waste gas burner	Procedures are in place to ensure effective planned maintenance and minimisation of noise and vibration from noise sources associated with sludge treatment and handling facilities. Whilst the CHP, boiler and waste gas burner are already included within the scope of the existing installation, these sources have also been considered for completeness.	✓ Further review
	Fugitive and diffuse emissions	Tanks, pipework and containers used for storage, treatment and digestion of sludge	Anaerobic digestion tanks are fully sealed and biogas is captured and transferred to CHP, boiler and/or flares (see point source emissions to air). Raw and digested sludge is contained in uncovered tanks and has the potential for fugitive emissions, including Volatile Organic Compounds (VOCs), hydrogen sulphide (H_2S), ammonia, methane and other organics including mercaptans. These compounds can also be highly odorous; this aspect is considered separately. Planned maintenance and leak detection and repair programme in place in respect of fugitive emissions. YW is committed to cover tanks in order to reduce diffuse odour emissions – refer to Proposed Improvement Programme.	✓ Further review

Identified risk area		Sources on site	Discussion	Identified risk
	Bioaerosols	Storage and handling of sludge	Raw and digested sludge have a high water content (approx. 60% after thickening). Digested sludge (post THP and digester) have been subject to high temperatures and treatment to kill pathogens and disturbance of cake on the conditioning pad and within the cake barn is minimal, other than initial delivery to the pad and subsequent removal from the pad. Potential for generation of dust and bioaerosols from this source is considered to be low.	✓ Further review
	Accidental Releases	All areas / all activities	Emergency/unplanned events have the potential to result in abnormal emissions of odour, noise of emissions to air, land or water. This includes spillages of potentially contaminative liquids e.g. sludge, chemicals, oils and releases of biogas.	✓ Further review
	Point source emissions to air. Emissions deposited from air to land	CHP, boiler, waste gas burner (flare)	All combustion plant emission points are already included within the scope of the existing installation (permit ref VP3130GZ). A table of point source emissions to air is included in Table C3:2-1. No change to these emissions are proposed for existing / current operations. However, YW is proposing to bring a gas connection onto site to provide mains natural gas for operation of these steam raising boilers. This solution would replace gas oil as the main fuel source for the boilers (with biogas continuing to provide the back-up fuel source). It is also proposed that CHP1 will be converted to natural gas as its sole fuel source. The remaining three CHP engines would continue to operate with biogas as the sole fuel source. An Air Emission Risk Assessment (AERA) utilising atmospheric dispersion modelling has been undertaken to support this proposed change of fuel.	✓ Further review
	Point source emissions to sewer	Surface water run-off, cleaning washwater and liquor from sludge thickening and dewatering facilities	All process liquids, cleaning washwater and most surface water runoff (with the exception of some uncontaminated roof water runoff which is discharged to soakaway) is returned to Esholt WwTW (outside of the scope of this permit application) for treatment prior to discharge to the River Aire.	✓ Further review
	Point source emissions to surface, groundwater and land	None	The only point source emissions to surface water, groundwater or land within the scope of the permit, is the discharge of roofwater runoff from the boiler house and cake barn via emission points W1, W2 and W3. These discharges comprise only clean rainwater runoff and therefore no further assessment is required. All process liquids and all other surface water runoff is returned to Esholt WwTW for treatment prior to discharge to the River Aire. Risks associated with accidents and other planned incidents are considered separately.	✗ Not considered further

Identified risk area		Sources on site	Discussion	Identified risk
	Visible plumes	CHP, Boiler, waste gas burner	The nature of the combustion sources is such that plume moisture levels will be low and thus in normal operations, and for the majority of weather conditions, plume visibility is expected to be very low. Excess steam is occasionally released from the THP, but this is occasional and localised. CHP, Boiler and waste gas burner are already included within the scope of the existing installation and no changes are proposed. No further assessment is required.	✘ Not considered further
	Adapting to climate change	All areas / all activities	Required only for new bespoke permit applications.	✘ Not considered further
	Litter	Storage and handling of sludge in open air	The nature of waste treated on site does not result in litter.	✘ Not considered further
	Vermin and Pests	Storage and handling of sludge in open air	The activities within the installation do not give rise to significant pest or vermin issues.	✘ Not considered further
	Dust	Storage and handling of sludge in open air	The facility handles wet wastes which do not result in dusts.	✘ Not considered further
	Global warming potential	CHP, Boiler, waste gas burner	All combustion plant emission points are already included within the scope of the existing installation, the biogas fuel is renewable. Further energy information is provided in a detailed response to Q6 of Form C3.	✘ Not considered further

Table C2: 6-2: Identification of sensitive receptors and pathways

Receptor type	Receptor description and distance[2]	Pathway	Possible pathway from source							
			Odour	Air (non combustion)[3]	Air (combustion)[3]	Noise	Fugitive / diffuse	Bioaerosol	Accidental releases	Sewer
Human										
Residential housing - North	Digester area: Nearest residential properties located approximately 160m to the north (adjacent to Esholt Hall). Digested sludge area: Nearest residential property located approximately 450m to the north.	Airborne	✓	✓	✓	✓	✓	✓	✓	✗
Residential housing – East	Digester area: Nearest residential property located approximately 315m to the northeast and 900m to the southeast. Digested sludge area: Nearest residential property located approximately 450m to the east.	Airborne	✓	✓	✓	✓	✓	✗	✓	✗
Residential housing – South	Digester area: Nearest residential property located approximately 820m to the south. Digested sludge area: Nearest residential property located approximately 450m to the south.	Airborne	✓	✓	✓	✓	✓	✗	✓	✗
Residential housing – West	Digester area: Nearest residential property located approximately 650m to the southwest. Digested sludge area: Nearest residential property located approximately 770m to the west.	Airborne	✓	✓	✓	✓	✓	✗	✓	✗

2 Note that nearest receptors have been identified separately from each of the two main areas on site: the digester area (including sludge reception, screening and handling, THP and digester, CHP/boilers and biogas storage and handling) and the digested sludge area (including digested sludge dewatering and sludge storage and handling).
3 Note that these sources are present at the digester area only.

Receptor type	Receptor description and distance[2]	Pathway	Possible pathway from source							
			Odour	Air (non combustion)[3]	Air (combustion)[3]	Noise	Fugitive / diffuse	Bioaerosol	Accidental releases	Sewer
Public amenity areas including public footpath / cycleway	National Cycle Network route crosses YW land directly to the West, but outside of, the installation boundary. The surrounding land use is generally wooded, with footpaths and is likely to provide local ecological and amenity interest.	Airborne	✓	✓	✓	✓	✓	✓	✓	✗
Schools	There are 10 schools within approximately 2km of the site, and 2 sites within 1km. The nearest of these is 785m to the southeast of the digested sludge area.	Airborne	✓	✓	✓	✓	✓	✗	✓	✗
Hospitals	There are no hospitals within 2 km of the site. There is 1 hospital approximately 5 km from the site.	Airborne	✗	✗	✗	✗	✗	✗	✗	✗
Industrial / commercial sites	YW-owned Esholt Hall is located approximately 140m to the northeast of the digester area. Home Farm Industrial Park (comprising a number of office units) is located approximately 315m to the northeast of the digester area.	Airborne	✓	✓	✓	✓	✓	✓	✓	✗
Ecological										
Habitat sites – statutory designations	There is one internationally designated site within 10km of the installation (a SAC/SPA) and one nationally designated site within 2km; this is a SSSI designated for geological reasons.	Airborne	✗	✗	✓	✗	✗	✗	✓	✗
Habitat sites – local sites and non statutory designations	The surrounding land use is generally wooded, with footpaths and is likely to provide local ecological interest.	Airborne Surface water Groundwater	✗	✓	✓	✗	✓	✗	✓	✓

Receptor type	Receptor description and distance[2]	Pathway	Possible pathway from source							
			Odour	Air (non combustion)[3]	Air (combustion)[3]	Noise	Fugitive / diffuse	Bioaerosol	Accidental releases	Sewer
Protected species	Possible presence of protected species on or off site.	Airborne Surface water Groundwater	✘	✓	✓	✘	✓	✘	✓	✘
Environment – Other										
Global atmosphere	Local, regional and global atmosphere.	Airborne	✘	✓	✓	✘	✓	✘	✓	✘
Local atmosphere	Local atmosphere. Site is not located within an AQMA.	Airborne	✘	✓	✓	✘	✓	✘	✓	✘
Ground / groundwater	Underlying groundwater classed as a Secondary A aquifer; groundwater vulnerability classed as medium-high. Groundwater source protection zone located 1.2km to the northeast	Unmade ground / infiltration / percolation	✘	✘	✘	✘	✘	✘	✓	✓
Surface water	River Aire directly adjacent to installation boundary. Likely hydraulic continuity between underlying groundwater and river.	Overland runoff / infiltration / percolation	✘	✘	✘	✘	✘	✘	✓	✓

Table C2:6-3: Assess risks: screening assessment

Table C2.6-3 below sets out the screening assessment for environmental risks.

Source	⇨	Pathway	⇨	Receptor	Discussion	Further assessment required?
Odour	⇨	Airborne	⇨	Residential housing – north, east, south, west Public amenity areas including public footpath/cycleway Schools Industrial /commercial sites	There are a number of odour sources on site include sludge intake and screening, uncovered tanks, dewatering centrifuges, dewatering liquor handling and temporary sludge cake storage. Whilst many odour sources are covered, with odour extraction and dispersion to atmosphere, there are residual odour risks and therefore further assessment is required.	**Yes – odour impact assessment is summarised in response to Q 6-2 below. Full assessment is included as Appendix 8.**
Point source emissions to air from vent stacks – ammonia / H_2S / other organics	⇨	Airborne	⇨	Residential housing – north, east, south, west Public amenity areas including public footpath/cycleway Schools Industrial /commercial sites Habitat sites – local sites and non-statutory designations Protected species Global atmosphere Local atmosphere	Off gases and vapours collected from tank headspace and displacement air can contain substances potentially harmful to human health (e.g. H_2S) and also substances which can contribute to nutrification of habitat sites (ammonia) potential. Odour extraction and dispersion serves as the primary control for these emissions.	**Yes – a review of emissions of substances from point sources (excluding odour and combustion) is summarised in response to Q 6-3 below.**

Source	⇨	Pathway	⇨	Receptor	Discussion	Further assessment required?
Point source emissions to air from fuel combustion	⇨	Airborne	⇨	Residential housing – north, east, south, west Public amenity areas including public footpath/cycleway Schools Industrial /commercial sites Habitat sites – statutory designations Habitat sites – local sites and non-statutory designations Protected species Global atmosphere Local atmosphere	Biogas generated by the digesters is used as the sole fuel source for the CHPs. The CHPs generate electricity for use on site and waste heat is used to provide supplementary heat for the boilers. In periods when the CHPs are not available then the boilers may be fired using biogas (biogas is a back-up fuel supply for the boilers). Any excess biogas which cannot be used by either the CHPs or boilers is sent to the waste gas burner (flare). An air quality impact assessment, including air dispersion modelling is therefore required in order to assess the significance of emissions to air from the process on potentially sensitive receptors, against relevant air quality standards and assessment levels.	**Yes – air quality impact assessment is summarised in response to Q 6-4 below. Full assessment is included as Appendix 7.**
Noise	⇨	Airborne	⇨	Residential housing – north, east, south, west Public amenity areas including public footpath/cycleway Schools Industrial /commercial sites	There are fixed and mobile noise sources within the installation. Whilst these are not considered to represent a significant contribution to off-site noise levels, there remains some potential to affect the identified off-site receptors and therefore further assessment is required.	**Yes – qualitative risk assessment is summarised in response to Q 6-5 below. Full assessment is included as Appendix 9**

Source	⇨	Pathway	⇨	Receptor	Discussion	Further assessment required?
Fugitive / diffuse emissions – ammonia / H2S / methane / other organics	⇨	Airborne	⇨	Residential housing – north, east, south, west Public amenity areas including public footpath/cycleway Schools Industrial /commercial sites Habitat sites – local sites and non-statutory designations Protected species Global atmosphere Local atmosphere	It is recognised that this a potentially significant issue in the sector, a leak detection and repair plan is in place covering the installation.	**Yes – a review of diffuse emissions (excluding odour) is summarised in response to Q 6-3 below. In relation to fugitive emissions, proposed BAT controls include a leak detection and repair plan – Refer to Form C3 Q3b and Appendix 14**
Bioaerosols	⇨	Airborne	⇨	Residential housing – north Public amenity areas including public footpath/cycleway. Industrial/commercial sites	The majority of residential neighbours are located outside of screening range (250m) for a static receptor location. Relevant sensitive exposure locations are those where there is potential for exposure over an extended period. Whilst EA guidance does not consider AD as a significant source it is recognised that there are some potential low-level sources within the installation (e.g. uncovered tanks and cake pad). As a precautionary principle a risk assessment has been undertaken.	**Yes – risk assessment is provided in response to Q6-6 below.**

Source	⇨	Pathway	⇨	Receptor	Discussion	Further assessment required?
Accidental Releases	⇨	Airborne Overland runoff / infiltration / percolation	⇨	Residential housing – north, east, south, west Public amenity areas including public footpath/cycleway Schools Industrial /commercial sites Habitat sites – statutory designations Habitat sites – local sites and non-statutory designations Protected species Global atmosphere Local atmosphere Ground/groundwater Surface water	Pollution prevention infrastructure, operational control and management techniques (including as part of the EMS) are in place to prevent accidents and other unplanned events with environmental consequences, or, in the event that these do occur to minimise or mitigate the environmental impacts.	**Yes – accident management plan is provided in response to Q6-7 below**
Point source emissions to sewer	⇨	Release to River Aire via WwTW	⇨	Habitat sites – local sites and non-statutory designations Ground/groundwater Surface water	All process liquids, cleaning washwater and surface water runoff is returned to Esholt WwTW (outside of the scope of this permit application) for full treatment prior to discharge to the River Aire.	**Yes - YW is committed to undertaking a period of monitoring in order to characterise the liquors returned to the WwTW. Further detail is provided in response to Q 6-8 below.**

Q 6-1 Habitats risk assessment requirements

There is one European designated habitat site (South Pennine Moors SAC and SPA) within 10km of the installation, approximately 5.2km to the north-west of the site. There is one nationally designated conservation site within 2km of the installation, Yeadon Brickworks and Railway Cutting SSSI which is located approximately 1.5km of the site; this is cited as a site of geological interest.

Impacts on designated habitat sites are considered as part of the air quality risk assessment (see Appendix 7 and summary provided in Q6-4 below). Due to the nature and scale of activities undertaken and the distance from the installation, permitted activities at Esholt will not impact on any of the designated sites identified.

Q 6-2 Summary of the Odour Impact Assessment

A qualitative odour risk assessment has been undertaken for Esholt STF considering twenty-eight process activities across two separate areas on site and potential odour effect on ten receptors. The assessment has been based on a Source-Pathway-Receptor approach and is primarily based upon professional judgement.

The risk assessment has indicated that two of the sensitive receptors considered are potentially exposed to a moderate adverse odour effect with the remaining eight receptors potentially exposed to either a slight adverse or negligible adverse odour effect. The two receptors exposed to a moderate adverse odour effect are Esholt Hall and Home Farm Industrial Park, located to the north-east of the site with both receptors representing residential receptors. YW has not received any odour complaints from these locations. Furthermore, a sniff test odour survey carried out at the boundary of the site in June 2021 (see Appendix B of Appendix 8) did not detect any odour at the boundary closest to these sensitive receptors.

All sensitive receptors to the south of the STF are considered to have a negligible odour effect, attributed to the receptor distance from the site and subsequent ineffective odour pathway. Sniff testing from the odour survey highlighted that whilst cake odours were observed local to the cake pad, these were secondary to the odours coming from the compost area. No cake odours were observed downwind of the cake pad supporting the theory that if the process is healthy and sludge cake stockpiling is managed effectively, this would not be considered a future risk of odour at surrounding receptors.

For the overall site, it is considered that Esholt STF does not have an adverse odour effect on its surrounding receptors. However, based on the significant number of odour complaints received by the local environmental health officer, these complaints need to be investigated and determined if the STF is a contributing factor or if emissions are attributed to another source. Appropriate levels of monitoring of the STF should be undertaken to ensure a healthy process is maintained and that there is no deterioration in odour emissions from the site

Notwithstanding the findings of this assessment, YW is committed to meeting BAT requirements and to further reducing odour and other diffuse emissions from uncovered tanks and unabated odour dispersion stacks – refer to Q6-3 below and proposed improvement programme.

Q 6-3 Review of emissions of substances from diffuse and point sources (excluding odour and combustion)

It is recognised that emissions of organic compounds may arise from uncovered sludge sources (including uncovered tanks and the cake pad) as well as from the air extraction and dispersion stacks. This includes ammonia, hydrogen sulphide, volatile organic compounds (VOCs) and methane. Odour is considered separately (refer to Appendix 10 – Odour Management Plan). Furthermore, it is noted that BAT conclusion 14d specifies that diffuse emissions should be contained, collected and treated. Table C2: 6-4 summarises the emissions mitigation measures currently in place and proposals for further mitigation, where required.

Table C2: 6-4: Review of diffuse and point source emissions

Sludge source	Existing emissions controls	BAT assessment
Sludge screens	Sludge screens are covered / contained. Residence time and hours of operation of the intake sludge screens is limited (each delivery is processed within approximately 15 mins; approximately 10 deliveries per day) and therefore emissions are not considered to be significant.	No further mitigation is proposed due to small footprint and short term / intermittent nature of emissions from this source.
Screenings skips	Skips are not covered but are emptied regularly.	No further mitigation is proposed due to small footprint of this source.
Sludge screen feed tank	Tank is covered, extracted and dispersed – see below for comments in relation to the dispersal stack.	BAT in place – see below for comments in relation to the OCU.
Odour dispersion stack for sludge screen feed tank (OCU 1)	OCU is no longer operational and is currently acting as a dispersion stack.	YW will refurbish / reinstate this OCU to ensure effective treatment of odours from this source. Refer to proposed improvement programme.
Consolation tank 5	Tank is not covered.	YW will install a fixed tank cover and extract and treat odour in a new OCU. Refer to proposed improvement programme.
Mixed sludge tanks (2 no.)	Tank is covered, extracted and dispersed – see below for comments in relation to the dispersal stack.	BAT in place – see below for comments in relation to the OCU.
Odour dispersion stack for mixed sludge tanks (OCU 2)	OCU is no longer operational and is currently acting as a dispersion stack.	YW will refurbish / reinstate this OCU to ensure effective treatment of odours from this source. Refer to proposed improvement programme.
Sludge cake reception storage vessels	Cake reception containers are covered and passively vented to air.	YW will connect the sludge cake reception storage vessels to an existing OCU (OCU 3). Refer to proposed improvement programme.
SAS thickeners	Thickener units are enclosed and located within a building. Air from thickener units is extracted and treated in a single stage carbon filter.	BAT in place – see below for comments in relation to the OCU.
OCU 4 (SAS thickeners)	Carbon filter	Single stage OCU in operation and no operational issues are reported. However, no monitoring data is currently available. An assessment of the effectiveness of this OCU will be carried out. YW will undertake any refurbishment work that may be required in order to ensure effective OCU operation.
SAS transfer tanks (2 no.)	Tanks are not covered. SAS has inherently lower emissions generation potential. Monitoring data collected at other YW sites (uncovered SAS storage tanks/sump at Caldervale, Sandall and Mitchell Laithes) is provided below: H2S: 0.005 – 0.035 ppm (10 samples collected in total) Ammonia: <0.1 ppm at all three sites (10 samples collected in total)	YW commit to • Undertake emission monitoring at these tanks (as minimum this will include H_2S, ammonia, TVOCs and methane). The purpose of the monitoring is to confirm that emissions from these SAS tanks are consistent with low emissions measured at other YW sites.

Sludge source	Existing emissions controls		BAT assessment
	TVOC	<0.1 ppm at all three sites (10 samples collected in total)	• Assuming low emissions can be confirmed, cover these tanks with floating plastic balls. Refer to proposed improvement programme.
Thickener liquor sump	Sump is not covered.		YW will install a fixed tank cover and extract and treat odour in an existing OCU (OCU 4). Refer to proposed improvement programme.
Dewatering centrifuges for raw sludge	Centrifuge units are enclosed and located within a cabin.		No further mitigation is proposed due to small footprint of this source.
Centrate pumping station – raw sludge centrifuges	Sump is not covered.		YW will install a fixed cover and extract and treat odour in an existing OCU (OCU 3)
THP feed silos	Tank is covered, extracted and dispersed – see below for comments in relation to the dispersal stack.		BAT in place – see below for comments in relation to the OCU.
THP hopper	Tank is covered, extracted and dispersed – see below for comments in relation to the dispersal stack.		BAT in place – see below for comments in relation to the OCU.
Odour control unit for Dewatering centrifuges liquor return, THP feed silos and THP hopper (OCU 3)	OCU is no longer operational and is currently acting as a dispersion stack.		YW will refurbish / reinstate this OCU to ensure effective treatment of odours from this source. Refer to proposed improvement programme.
Degassing tanks	Tank is covered, extracted and dispersed – see below for comments in relation to the dispersal stack.		BAT in place – see below for comments in relation to the air extraction and dispersion stack.
Dispersion stack for degassing tanks	No OCU or other air treatment / abatement in place.		Existing tank air extraction to be routed to biogas system. Biogas from these tanks to be collected and utilised. Refer to proposed improvement programme.
Dewatering feed tanks (4 no.)	Tanks are not covered.		It is noted that digested sludge sources are inherently lower emissions generation potential and that these tanks are located a significant distance from the biogas system.
Dewatering centrifuges for digested sludge (5 no. in 2 locations)	Centrifuge units are enclosed and located within a cabin.		No further mitigation is proposed due to small footprint of this source and inherently lower emissions generation potential of digested sludge sources.
Liquor pumping station – Export centrate sump	Sump is not covered.		YW will install a fixed cover for this sump. It is noted that digested sludge sources have inherently lower emissions generation potential and therefore no emissions treatment is required.
Leachate pumping station	Sump is not covered.		YW will install a fixed cover for this sump. It is noted that digested sludge sources have inherently lower emissions generation potential and therefore no emissions treatment is required.

Sludge source	Existing emissions controls	BAT assessment
Liquor balancing tanks (digested sludge liquor) (2 no.)	Tanks are not covered.	It is noted that digested sludge sources are inherently lower emissions generation potential

Q 6-4 Summary of the Air Emissions Risk Assessment

All combustion plant emission points are already included within the scope of the existing installation. A table of point source emissions to air is included in Table C3:2-1. No changes to these emissions are proposed for existing / current operations. However, YW is proposing to bring a gas connection onto site to provide mains natural gas for operation of these steam raising boilers. This solution would replace gas oil as the main fuel source for the boilers (with biogas continuing to provide the back-up fuel source). It is also proposed that CHP1 will be converted to natural gas as its sole fuel source. The remaining three CHP engines would continue to operate with biogas as the sole fuel source. An Air Emission Risk Assessment (AERA) utilising atmospheric dispersion modelling has been undertaken to support this proposed change of fuel.

The AERA report (included in full as Appendix 7) outlines the approach, methodology and results in full. A number of worst-case assumptions were used to ensure a conservative assessment, including continuous operation of the boilers and CHPs (which is not a typical real world operating scenario). The results of the assessment have been interpreted in accordance with the requirements of the EA to identify if impacts represent 'significant pollution' as required by the EA to determine an EP application. The AERA has been undertaken in accordance with relevant legislation, policy and guidance.

Emissions of NOx (in the form of nitrogen dioxide (NO_2)) and SO_2 were assessed against the relevant Air Quality Standards for NO_2 and SO_2 for the protection of human health. An assessment was also carried against the relevant Critical Levels (C_{Le}) for NOx and SO_2, and Critical Loads (C_{Lo}) for nitrogen and acid deposition which are designed for the protection of designated ecological sites.

The assessment concludes that, in relation to human health, in both current and future operating scenarios, where impacts are not classified as 'insignificant' (i.e. process contribution (PC) less than 1% of the EAL for long-term concentrations or 10% for short-term) the predicted impacts of the installation do not lead to any exceedances of Environmental Assessment Level (EALs) and do not constitute 'significant pollution'.

In relation to the impact of the installation on ecologically sensitive sites, at all locally designated sites, in both current and future operating scenarios, the predicted PCs from the installation are less than 100% of the applicable annual C_{Le} or C_{Lo}. At the South Pennine Moors SAC the predicted PC's in both scenarios are less than 1% of the applicable CLe or CLe and therefore can be considered 'insignificant'. Therefore, the impacts of the Installation are considered 'insignificant' at all designated ecological sites.

Q 6-5 Summary of the Noise Impact Assessment

Potential sources of noise resulting from the activities proposed in this variation application, have been identified and assessed in Table C2: 6-5. Further detail is provided in Appendix 9. For scoring mechanism refer to Q 6-9.

Table C2:6-5: Noise risk assessment

Hazard	Receptor	Pathway	Risk Management Techniques	Probability of Exposure	Consequence	Overall Risk
Noise: CHP	Residential / Place of Worship / Commercial	Airborne	The equipment is containerised in a high performance acoustically treated enclosure and designed for external applications. Good maintenance of plant to ensure that excessive noise levels are not generated, under Operations & Maintenance contract. Regular checks of noise mitigation measures fitted to items of plant. Where repair or replacement is required, the plant will, where possible, be taken out of service until repair or replacement of parts has been undertaken.	Unlikely - The risk management actions will prevent significant impact at nearest receptors	Mild – Minor nuisance impacts	Low
Noise: CHP and Boiler Exhausts			Enclosure mounted high performance exhaust silencer with elevated stack vent point. Good maintenance of plant to ensure that excessive noise levels are not generated, under Operations & Maintenance contract. Regular checks of noise mitigation measures fitted to items of plant. Where repair or replacement is required, the plant will, where possible, be taken out of service until repair or replacement of parts has been undertaken.	Unlikely - The risk management actions will prevent significant impact at nearest receptors	Mild – Minor nuisance impacts	Low
Noise: Digesters (Gas Mix Compressors)			Compressors on the gas mixing are potentially noisy but are located in acoustic enclosures and/or have integrated acoustic controls. Good maintenance of plant to ensure that excessive noise levels are not generated, under Operations & Maintenance contract. Regular checks of noise mitigation measures fitted to items of plant. Where repair or replacement is required, the plant will, where possible, be taken out of service until repair or replacement of parts has been undertaken.	Unlikely - The risk management actions will prevent significant impact at nearest receptors	Mild – Minor nuisance impacts	Low
Noise: Fans on air cooled radiators			Fans of a low noise specification and subject to regular checks and maintenance. Good maintenance of plant to ensure that excessive noise levels are not generated from equipment breakdown or wear and tear (e.g. fan motor bearing failure), under Operations & Maintenance contract.	Unlikely - The risk management actions will prevent significant impact at nearest receptors	Mild – Minor nuisance impacts	Low
Noise: Waste Gas Burner			Waste gas burner operates only when CHPs are unavailable. Good maintenance of plant to ensure that excessive noise levels are not generated from equipment breakdown or wear and tear (e.g. fan motor bearing failure), under Operations & Maintenance contract.	Unlikely - The risk management actions will prevent significant impact at nearest receptors	Mild – Minor nuisance impacts	Low
Noise: Vehicular movements around site			Vehicles will be screened from receptors for the majority of their operations. Due to the layout of this area, vehicle movements would be transient and typically associated with passing movements only.	Unlikely - The risk management actions will prevent significant impact at nearest receptors	Mild – Minor nuisance impacts	Low
Noise: Air Mix Compressors			Good maintenance of plant to ensure that excessive noise levels are not generated, under Operations & Maintenance contract. Regular checks of noise mitigation measures fitted to items of plant. Where repair or replacement is required, the plant will, where possible, be taken out of service until repair or replacement of parts has been undertaken.	Unlikely - The risk management actions will prevent significant impact at nearest receptors	Mild – Minor nuisance impacts	Low
Noise: THP			Potential for noise from steam venting. Occurs intermittently. Good maintenance of plant to ensure that excessive noise levels are not generated, under Operations & Maintenance contract. Regular checks of noise mitigation measures fitted to items of plant. Where repair or replacement is required, the plant will, where possible, be taken out of service until repair or replacement of parts has been undertaken.	Unlikely - The risk management actions will prevent significant impact at nearest receptors	Mild – Minor nuisance impacts	Low

Q 6-6 Bioaerosol risk assessment

Bioaerosols are defined as micro-organisms suspended in the air and can include bacteria, fungi and viruses, or parts of living organisms, such as spores and plant pollen. Bioaerosols are usually smaller than 10µm in diameter and can cause human health impacts such as allergic responses and inflammation. Bioaerosols are naturally present in the air, but they are also associated with organic waste treatment processes including composting, mechanical biological treatment, and potentially some aspects of anaerobic digestion (AD) which are widely used in the UK.

There is minimal regulatory guidance available for assessing bioaerosol emissions from AD facilities. Regulatory Position Statement 031[4], states that bioaerosol concerns would normally be associated with composting activities, and in particular:

'Operations…likely to result in the uncontrolled release of high levels of bioaerosols' are defined as including '*the shredding of waste and the turning of waste in the sanitisation, stabilisation and maturation stages of composting where these operations are not contained or are not subject to exhaust ventilation and scrubbing/filtering'*.

These activities do not take place at Esholt STF. Furthermore, Environment Agency guidance (2012)[5] states that:

"We do not consider that bioaerosols from anaerobic digestion are a serious concern.

However, the most recent guidance[6] requires that biological waste treatment facilities provide a site-specific bioaerosol risk assessment if there are sensitive receptors within 250m of activities, regardless of the specific processes carried out at a site. It is noted that the consensus from various studies is that bioaerosols from composting activities decline rapidly within the first 100 metres from a site and generally decline to background levels within 250m[7]. Technical Guidance Note M9[8] states that receptors located more than 250m away should be discounted as they are not likely to be affected.

The nearest residential housing is located approximately 160m to the north of the digester area, adjacent to, and within the grounds of YW-owned Esholt Hall. Esholt Hall itself is noted as a potential industrial/commercial receptor location. The building has previously been used as a conference centre and is now being redeveloped for use as a YW staff training academy. Risks associated with industrial/commercial receptors are likely to be less significant due to the relatively shorter duration of exposure (i.e. on the basis of approximately 8 hour/day, 5 days / week working pattern, or less in the case of visitors to these sites). The prevailing wind direction is towards the west[9], further reducing potential to impact on these locations. The Biowise process operations have not been considered as a receptor, as they form part of the multi-operator installation. In any event, Biowise undertake bioaerosol monitoring in line with TGN M9 monitoring guidance. There are no other residential or industrial/commercial receptors within 250m of the installation boundary.

A precautionary approach has been taken within this application and consideration has been given to the potential for impact from bioaerosols as a result of activities at Esholt STF. This review follows a source-pathway-receptor model to evaluate risk, giving consideration to the characteristics of the waste material, plant design and the operational controls in place to mitigate the risks from bioaerosols. This is summarised in Table C2: 6-5 overleaf.

[4] Environment Agency. 2011. Composting and potential health effects from bioaerosols: our interim guidance for permit applicants. Regulatory Position Statement 031.
[5] Environment Agency. 2012. Guidance for developments requiring planning permission and environmental permits.
[6] Environment Agency, consultation draft July 2020, Appropriate measures for the biological treatment of waste.
[7] Environment Agency. 2011. Composting and potential health effects from bioaerosols: our interim guidance for permit applicants. Regulatory Position Statement 031.
[8] Environment Agency TGN M9 'Environmental Monitoring of Bioaerosols at Regulated Facilities', July 2018,
[9] Based on meteorological data 2007-2011 from the Bingley No. 2 weather station, located approximately 11km to the southwest of the site. This meteorological data set was used in the 2012 air quality impact assessment.

Table C2: 6-6: Review of potential bioaerosol sources and associated risk

Source	Source controls	Pathway	Receptors	Overall risk
Raw sludge reception	Sludge is enclosed throughout; sludge is pumped from tankers or via pipelines to receiving enclosed storage tanks. Displaced air is extracted and dispersed to atmosphere (see separate entry below). Unloading activities occur infrequently. The distance between this source and the nearest residential receptor is >250m.	None	**Digester area receptors:** Residential housing located approximately 160m to the north of the digester area installation boundary, but at greater distance from individual sources. Esholt Hall (currently being redeveloped for use as a YW staff training academy) located approximately 140m to the north of the digester area installation boundary, but at greater distance from individual sources. There are no other residential or industrial/commercial receptors, and no schools or hospitals within 250m of bioaerosol sources.	No risk present – sludge is fully enclosed
Sludge cake reception facility	Unloading activities occur infrequently and are of short duration. Cake is delivered by covered wagon. Cake reception tank is covered when tipping is not taking place. Material disturbance is short lived during tipping operations only. Sludge cake is wet, does not produce dust and is not readily susceptible to airborne dispersion. The distance between this source and the nearest residential receptor is approximately 215m, which combined with the infrequent nature of tipping, makes this source low risk.	Airborne dispersion		Low
Sludge reception - screenings skip	Screenings are not subject to regular disturbance and are stored in relatively small quantities (2 x skips). Screenings are wet, do not produce dust and are not readily susceptible to airborne dispersion. The distance between this source and the nearest residential receptor is >250m.			Low
Sludge handling – screening, dewatering, THP and digestion	Sludge is fully enclosed within tanks or pipework at all times. Displaced air is extracted and dispersed to atmosphere (see separate entry below).	None		No risk present – sludge is fully enclosed
Consolidation tank 5 (uncovered)	Sludge is liquid in nature, does not produce dust and is not readily susceptible to airborne dispersion. Consolidation tank 5 is located to the south of the digester area and therefore at a greater distance from the receptors identified to the north of the site. The distance between this source and the receptors is >250m and therefore the receptor is unlikely to be affected.	Airborne dispersion		Low
			Digester area receptors:	Low

Source	Source controls	Pathway	Receptors	Overall risk
Thickener OCU (OCU 4)	Sludge is enclosed within thickeners or pipework at all times. Displaced air is extracted and treated by a carbon filter prior to released to atmosphere.		Residential housing located approximately 160m to the north of the digester area installation boundary, but at greater distance from individual sources. Esholt Hall (currently being redeveloped for use as a YW staff training academy) located approximately 140m to the north of the digester area installation boundary, but at greater distance from individual sources. There are no other residential or industrial/commercial receptors, and no schools or hospitals within 250m of bioaerosol sources.	Very low
Odour control units x 4	Sludge is liquid in nature, does not produce dust and is not readily susceptible to airborne dispersion. The distance between these sources and the nearest residential receptor is >250m other than OCU3 (THP feed silos) which is approximately 235m. Overall, any effects are likely to be not significant. YW is committed to undertaking improvements to existing OCUs to ensure effective operation (refer to proposed improvement programme). OCUs will be subject to monitoring programme and planned maintenance to ensure effective operation.			Low
Emergency scenario – bio-gas venting	As the sludge digestion process is a wet process, biogas is unlikely to contain significant concentrations of bioaerosols. Venting events infrequent and short-lived.			Very low
Emergency scenario – Sludge spillage	Sludge is wet, does not produce dust and is not readily susceptible to airborne dispersion. Events occur infrequently and in almost all cases will involve small quantities of sludge. Major/catastrophic loss is highly unlikely to occur. Emergency response procedures are in place to ensure such incidents are responded to promptly and spilt material is cleaned up.			Very low
Digested sludge dewatering feed tanks (uncovered) x 4	Sludge is wet, does not produce dust and is not readily susceptible to airborne dispersion. Sludge contained within the dewatering feed tanks has been processed at high temperature via THP and AD achieving high levels of pathogen kill. Bioaerosols generation potential is therefore very low.	Airborne dispersion	**Digested sludge area receptors:** There are no residential housing, schools or hospitals, or industrial/commercial	Very low

Source	Source controls	Pathway	Receptors	Overall risk
Digested sludge dewatering centrifuges	Digested sludge has been processed at high temperature via THP and AD achieving high levels of pathogen kill. Bioaerosol generation potential is therefore very low. Sludge cake is wet (approximately 25% solids content), does not produce dust and is not readily susceptible to airborne dispersion.		receptors within 250m of bioaerosol sources associated with the digested sludge area.	Very low
Digested sludge cake handling cake pad	Digested sludge has been processed at high temperature via THP and AD achieving high levels of pathogen kill. Bioaerosol generation potential is therefore very low. Sludge cake is wet (approximately 25% solids content), does not produce dust and is not readily susceptible to airborne dispersion. The cake is delivered to the cake pad and is then left undisturbed until moving to the cake barn or removal from site.	Airborne dispersion		Very low
Digested sludge cake handling– cake barn	Digested sludge has been processed at high temperature via THP and AD achieving high levels of pathogen kill. Bioaerosol generation potential is therefore very low. Sludge cake is wet (approximately 25% solids content), does not produce dust and is not readily susceptible to airborne dispersion. The cake is delivered to the cake barn and is then left undisturbed until removal from site. The cake barn roof and half height walls further reduce susceptibility to airborne dispersion.			Very low
Vehicle tracking of materials around on the cake pad and roads, which could dry out and disperse	Regular washdown and wetting in order to reduce dust and keep pad area clean.			Very low
Emergency scenario – Sludge cake spillage	Sludge is wet (approximately 25% solids content), does not produce dust and is not readily susceptible to airborne dispersion. Events occur infrequently and in almost all cases will involve small quantities of sludge. Major/catastrophic loss is highly unlikely to occur. Emergency response procedures are in place to ensure such incidents are responded to promptly and spilt material is cleaned up.			Very low

Bioaerosol monitoring

As there are a small number of residential and workplace receptors within 250m of the installation boundary, YW has undertaken quantitative bioaerosols monitoring in accordance with Technical Guidance Note M9 'Environmental Monitoring of Bioaerosols at Regulated Facilities'. This monitoring exercise was carried out by Element Materials Technology Environmental UK Ltd on 22nd and 23rd August 2022. Sampling was undertaken at nine locations on site, with three parallel samples collected per location. The median concentration of total bacteria and of *Aspergillus fumigatus* in the three parallel samples collected were found to be below the guidance limit (1000 and 500 CFU/m^3 respectively) at seven of the sampling locations. At two locations the median concentration of total bacteria exceeded the guidance limit. The median recorded concentrations were 1,500 and 1,750 CFU/m^3 of total bacteria at locations SP5 and SP7 respectively. At no location did the median concentration of *Aspergillus fumigatus* exceed the guidance limit. It is noted that one location (SP5) is adjacent to the large activated sludge plant (ASP) associated with the Esholt STW. As ASPs are vigorously aerated, a bioaerosol contribution from this source (outside of the permit boundary) is possible.

Bioaerosol Risk Assessment - conclusions

The bioaerosol risk assessment undertaken concludes that the Esholt STF installation is not considered to be a significant source of bioaerosols and the likelihood of bioaerosols causing negative impacts at nearby receptors is low or very low. This is due to:

- All potential bioaerosol sources at Esholt STF are wet, do not produce dust and are not readily susceptible to airborne dispersion.
- All potential receptors are located greater than 250m from the installation boundary other than the residential housing and training centre, which form part of the YW-owned Esholt Hall complex; these buildings are located approximately 140-160m from the installation boundary. However, this location is at a greater distance from potential bioaerosol sources; in most cases the distance is greater than 250m (where below this, other factors such as frequency of use and forced air dispersion limit the potential for negative effects).
- The consensus of studies is that bioaerosols decline to background levels within 250m and guidance states that receptors located more than 250m away should be discounted as they are not likely to be affected.
- Digested sludge has been processed at high temperature via THP and AD achieving high levels of pathogen kill. Bioaerosol generation potential from digested sludge source is therefore very low.

Notwithstanding the findings of the risk assessment, exceedances of the guidance limit for total bacteria were detected at two out of nine locations sampled during bioaerosol monitoring. Therefore, it is proposed that further monitoring and assessment is undertaken to better understand this data and to assess the likely source(s) and any mitigation measures that may be necessary. This further work will comprise:

- Two further monitoring exercises (6 monthly bioaerosol monitoring over 12 months).
- Data analysis to establish any trends in terms of location and operational activities being undertaken on site.
- Review of site activities to identify appropriate mitigation measures. It is noted that YW already proposes mitigation measures including tank covering and OCU refurbishment, in order to comply with BAT requirements, and that these will contribute to a reduction in bioaerosol risks.

The monitoring data and findings of the data analysis and recommendations for improvements (e.g. mitigation measures and/or further monitoring) will be reported to the Environment Agency within 18 months.

Q 6-7 Accident Management Plan

The potential for accidental releases resulting from the activities proposed in this variation application are identified and assessed in Table C2: 6-7 below. This includes a summary of measures in place to manage/reduce accident risks. Refer to Q 6-9 for the scoring mechanism.

Table C2: 6-7: Potential accidental releases and associated risk

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk (after preventative controls)		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Environmental Consequence**	**What is the overall risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs – who is responsible for what?**	**How likely is this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains?**
Site Wide - general						
Flooding leading to damage to site processes and/or mobilisation of polluting materials	Ground / groundwater / surface waters	Floodwaters / Infiltration	**Preventative controls** • Flood risk review undertaken. Parts of the STF installation lie within Flood Zone 2 (land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding), and parts lie within Flood Zone 1 (Land having a 1 in 100 or greater annual probability of river flooding). • The site is built on a gradient. Major process tanks are constructed significantly above river level. • Materials are stored in appropriately sealed containers (preferably bulk or semi-bulk), or proprietary secondary containment cabinets, such that the risk of contents being mobilised or containers being washed away in a flood event is low. • Vulnerable Asset Protection Plan specifically details flooding actions including how river levels should be monitored and what actions are required. • **In the event of an incident/accident** • Initiate site emergency plan. • Remove mobile fuel/ chemical sources away from flood risk, if appropriate and safe to do so.	Likely	Medium	Moderate risk

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk (after preventative controls)		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Environmental Consequence**	**What is the overall risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs – who is responsible for what?**	**How likely is this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains?**
Flooding due to drain blockages and/or excessive rainfall causing localised on-site surface water flooding leading to damage to site processes and/or mobilisation of polluting materials	Ground / groundwater / surface waters	Floodwaters / Infiltration	**Preventative controls** • Drains are monitored for blockages and cleaned as required. • Materials are stored in appropriately sealed containers (preferably bulk or semi-bulk), or proprietary secondary containment cabinets, such that the risk of contents being mobilised or containers being washed away in a flood event is low. • Vulnerable Asset Protection Plan specifically details flooding actions. • Planned maintenance / inspection of site drainage systems. **In the event of an incident/accident** • Initiate site emergency plan. • Remove mobile fuel/ chemical sources away from flood risk, if appropriate and safe to do so.	Unlikely	Mild	Low risk

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk (after preventative controls)		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Environmental Consequence**	**What is the overall risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs – who is responsible for what?**	**How likely is this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains?**
Fire	Nearby human receptors Local air quality and global climate impacts Ground / groundwater / surface waters	Air Overland runoff / infiltration / drainage systems	**Preventative controls** • Regular maintenance of equipment; LDAR programme in place. • Fire alarms are fitted in CHP cabinets and boiler house • DSEAR assessment has been completed for site and only appropriate ATEX rated equipment may be used in high risk areas. • Access controls in place for digester compound and portable gas monitor use required when inside compound. • Site does not treat combustible wastes. Sludge is wet. • Gas slam shut valves on biogas feeds to the CHP / boilers. • Gas and fire detection in the boiler house and CHP enclosure, and other key AD plant areas. • Gas oil tank is located outside of the boiler house and CHP compound. • Lightning protection provided for biogas storage. **In the event of an incident/accident** • Follow site emergency procedure. • Hydrants connected to a final effluent supply can be used by the fire service. • Excess biogas created by the site will be burnt through the flare.	Highly unlikely	Severe	Low risk

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk (after preventative controls)		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Environmental Consequence**	**What is the overall risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs – who is responsible for what?**	**How likely is this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains?**
Failure to contain firewater following fire / explosion event leading to localised on site surface water flooding leading to damage to site processes and/or mobilisation of polluting materials	Ground / groundwater / surface waters	Floodwaters / Infiltration	**Preventative controls** • Site drainage collects and returns surface/yard water to WwTW for treatment (with the exception of roofwater from two buildings) (see Figure 5). • Site drainage systems, hardstanding, sumps, storm tanks etc will minimise flow of firewater to receptors. **In the event of an incident/accident** • Initiate site emergency procedure.	Highly unlikely	Medium	Low risk
Excessively low temperatures leading to blockages or damage to pipework, valves or equipment and unplanned release of gas with fire / explosions risks and/or release of potentially polluting liquids	Nearby human receptors Local air quality and global climate impacts Ground / groundwater / surface waters	Air Overland runoff / infiltration / drainage systems	**Preventative controls** • 'Winterisation' procedures. • Bunding provided to environmentally critical plant and equipment. • Current YW technical standards include trace heating for vulnerable pipework. **In the event of an incident/accident** • Isolate systems as appropriate and initiate fire, spill and emergency response procedures, cleaning up spill and disposal of wastes appropriately. • Carry out repairs (as required).	Unlikely	Mild	Low risk

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk (after preventative controls)		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Environmental Consequence**	**What is the overall risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs – who is responsible for what?**	**How likely is this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains?**
Generalised or localised power failure leading to failure of pumps / control systems and escape of sludge and/or biogas	Nearby human receptors Local air quality and global climate impacts Ground / groundwater / surface waters	Air Overland runoff / infiltration / drainage systems	**Preventative controls** • Site has a dual power supply to minimise risk of power failure. • Process for recovering from power failure has been planned and recorded. • In the event of power failure, sludge transfers will stop but this will not affect security of containment e.g., tanks will not overflow. **In the event of an incident/accident** • Halt sludge imports to site. • Confirm backup power supply is online. • Confirm that all systems are operating normally.	Unlikely	Mild	Low risk
Vandalism / site security failure leading to unplanned release of gas with fire / explosions risks and/or release of potentially polluting liquids (chemicals, oils, sludges)	Nearby human receptors Local air quality and global climate impacts Ground / groundwater / surface waters	Air Overland runoff / infiltration / drainage systems	**Preventative controls** • High level of security on site with 24 hr security monitoring, secure entry gate systems and locked cabs and control units. • In addition to perimeter fencing around site, key digestion equipment sits within a separate fenced area. • Storage containers bunded. **In the event of an incident/accident** • Isolate systems as appropriate and initiate fire, spill and emergency response procedures, cleaning up spill and disposal of wastes appropriately. • Carry out repairs (as required). • Review security measures on site.	Highly unlikely	Mild	Negligible risk

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk (after preventative controls)		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Environmental Consequence**	**What is the overall risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs – who is responsible for what?**	**How likely is this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains?**
Failure of chemical or oil containment due to deterioration of storage containers, pipework or valves leading to spillage	Ground / groundwater / surface waters	Overland runoff / infiltration / drainage systems	**Preventative controls** • All oil storage (including gas oil fuel) and waste oil storage tanks are fully bunded (using either fixed or mobile bunds). • Joints external to containment minimised and fully welded. • Tank and pipework inspections undertaken as part of routine maintenance. • Operational procedures for refilling oil and chemical storage tanks. Spill kit to be available at tanks. • Any oil spilt around engines during maintenance will be cleaned up and disposed of appropriately. **In the event of an incident/accident** • Isolate systems as appropriate and initiate spill response procedure, cleaning up spill and disposal of wastes appropriately. • Carry out repairs (as required). • Review systems to prevent recurrence.	Unlikely	Mild	Low risk
Failure of chemical or oil containment during delivery	Ground / groundwater / surface waters	Overland runoff / infiltration / drainage systems	**Preventative controls** • Delivery procedures inc. supervision by site staff, check on space available in receiving tank. • Storage containers bunded. • Chemical/oil storage only in area surrounded by hardstanding with all drainage directed to WwTW. **In the event of an incident/accident** • Follow incident plan.	Unlikely	Mild	Low risk

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk (after preventative controls)		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Environmental Consequence**	**What is the overall risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs – who is responsible for what?**	**How likely is this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains?**
Vehicle impact leading to loss of pressurised gas and explosion / fire risk or loss of liquid containment (chemicals, oils, sludges)	Nearby human receptors Contribution to local air pollution and global warming Ground / groundwater / surface waters	Air	**Preventative controls** • Site speed limits in place to reduce chance and consequence of collision. • Tanker discharge point and access to this area are controlled by manned security point at main site entrance. • Key areas including sludge cake reception area have barriers to prevent collision with equipment. • Key digestion assets including digestion tanks are set back from road and surrounded by a fence. • Site drainage will capture spills related to pipe failure. **In the event of an incident/accident** • Isolate systems as appropriate and initiate fire, spill and emergency response procedures, cleaning up spill and disposal of wastes appropriately. • Carry out repairs (as required)	Highly unlikely	Medium	Low risk
Excessive noise from plant or equipment e.g., due to equipment deterioration or failure	Nearby human receptors	Air	**Preventative controls** • Procurement controls mean plant are selected to comply with relevant noise limits. • Regular maintenance completed to ensure equipment operates within normal noise parameters. • Acoustic enclosures / controls on some noise generating plan (e.g. compressors) • Sensitive receptors not located within close proximity to the site. Refer to Table C2:6-2 for summary of sensitive receptors. **In the event of an incident/accident** • Investigate cause and implement preventive measures, which may include system maintenance interventions.	Unlikely	Mild	Low risk

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk (after preventative controls)		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Environmental Consequence**	**What is the overall risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs – who is responsible for what?**	**How likely is this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains?**
THP						
Excessive gas pressure in vessels causing pipework/tank rupture	Nearby human receptors Ground / groundwater / surface waters	Air Overland runoff / infiltration / drainage systems	**Preventative controls** • Operators are trained to operate site within design parameters. • Process has automated processes in place to prevent dangerous occurrences. • Alarms alert operators if a hazardous situation is developing. **In the event of an incident/accident** • Pressure relief valves are fitted to tanks to protect against damage from excess pressure.	Unlikely	Medium	Moderate/Low risk
Site wide - sludge pipework, tanks, valves						
Spillage of sludge during transfer / handling activities	Ground / groundwater / surface waters	Overland runoff / infiltration / drainage systems	**Preventative controls** • Staff training on system operation. • Hardstanding in key/high risk areas. • Site drainage returns surface runoff to WwTW. **In the event of an incident/accident** • Isolate systems as appropriate and initiate spill response procedure, cleaning up spill and disposal of wastes appropriately.	Likely	Minor / negligible	Low risk

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk (after preventative controls)		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Environmental Consequence**	**What is the overall risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs – who is responsible for what?**	**How likely is this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains?**
Failure (cracks, splitting) of underground pipework (e.g. fuel, chemicals, sludge, site drains)	Ground / groundwater / surface waters	Infiltration	**Preventative controls** • Existing underground pipework will be periodically surveyed using in-pipe crack detection technology. • Where new pipework at the site has to be underground, the containment provision will be risk assessed and appropriate design specification implemented, which may include secondary containment and leak detection. **In the event of an incident/accident** • Damaged pipe will be isolated. • Spill management procedure will be followed. • Repairs to damaged pipework will be arranged.	Unlikely	Medium	Moderate/Low risk
Minor failure of sludge storage tanks / digester tanks e.g., tank overtopping, pipework leaks	Ground / groundwater / surface waters	Overland runoff / infiltration / drainage systems	**Preventative controls** • High level probes to prevent overfilling of tanks, overflow pipework is in place as a failsafe. • Trace heating is provided to tank level gauges to prevent freezing and reduce the risk of false readings. • Site is monitored on a daily basis. • Infrastructure maintenance and inspections. • Protective measures as for sludge spillage. • Site drainage returns to WwTW for safe processing. • Refer to Appendix 11 for details of secondary containment risk assessment. **In the event of an incident/accident** • Isolate systems as appropriate and initiate spill response procedure, cleaning up spill and disposal of wastes appropriately. • Arrange repairs.	Likely	Minor / negligible	Minor risk

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk (after preventative controls)		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Environmental Consequence**	**What is the overall risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs – who is responsible for what?**	**How likely is this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains?**
Major failure of digester or other sludge storage tank or associated pipework leading to large scale sludge loss/spillage	Ground / groundwater / surface waters	Overland runoff / infiltration / drainage systems	**Preventative controls** • Design and construction of assets is governed by relevant YW technical standards to ensure it is fit for purpose. • Infrastructure maintenance and inspections. • Existing and planned bunding/secondary containment (Refer to Appendix 11 secondary containment risk assessment). • Site drainage returns to WwTW for safe processing. **In the event of an incident/accident** • Cancel all sludge deliveries to site. • Isolate systems as appropriate and initiate spill response procedure, cleaning up spill and disposal of wastes appropriately.	Highly unlikely	Severe	Moderate/Low risk

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk (after preventative controls)		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Environmental Consequence**	**What is the overall risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs – who is responsible for what?**	**How likely is this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains?**
Biogas pipework, valves, vents						
Failure of biogas pipework, valves and biogas holder (corrosion, cracks, material defects etc) leading to **minor** release of biogas and slight fire / explosion risk	Nearby human receptors Local air quality and global climate impacts	Air	**Preventative controls** • Design and construction of pipework is governed by relevant YW technical standards to ensure it is fit for purpose. • Most biogas pipework operates at low pressures. • Pipework/gas holders protected from excessive pressure by pressure relief valves. • Pipework is above ground where possible to facilitate inspection and maintenance. • Maintenance schedule defined as part of LDAR strategy at site. • Requirements around use of ATEX rated equipment control risk of leak leading to fire/explosion. **In the event of an incident/accident** • Consider need to isolate pipework. • Consider need to initiate emergency response procedures. Arrange repair to affected asset.	Unlikely	Minor / negligible	Negligible risk

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk (after preventative controls)		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Environmental Consequence**	**What is the overall risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs – who is responsible for what?**	**How likely is this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains?**
Failure of biogas pipework, valves and biogas holder (corrosion, cracks, material defects etc) leading to **major** release of biogas and fire/ explosion risk	Nearby human receptors Local air quality and global climate impacts	Air	**Preventative controls** • Design and construction of pipework is governed by relevant YW technical standards to ensure it is fit for purpose. • Most biogas pipework operates at low pressures. Pipework/gas holders protected from excessive pressure by pressure relief valves. • Pipework is above ground where possible to facilitate inspection and maintenance. • Maintenance schedule defined as part of LDAR strategy at site. • Standard operational H&S requires staff to wear personal gas monitors at all times, these will detect large scale leakage from pipes. • Requirements around use of ATEX rated equipment control risk of leak leading to fire/explosion. **In the event of an incident/accident** • Immediately follow safety control mechanisms in place to isolate pipework / equipment. • Consider need to initiate emergency response procedures.	Highly Unlikely	Medium	Low risk

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk (after preventative controls)		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Environmental Consequence**	**What is the overall risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs – who is responsible for what?**	**How likely is this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains?**
Breakdown or other damage to on site gas consumers e.g. CHP/boilers leading to disposal of biogas without energy recovery	Nearby human receptors Local air quality and global climate impacts	Air	**Preventative controls** • Site is designed to minimise risk of uncontrolled release to air. • Operational and maintenance controls in place to ensure reliability of equipment and minimise requirement to send biogas to flare. • There are four CHP engines and two steam boilers with biogas firing capability, therefore flaring rarely occurs. **In the event of an incident/accident** • Any remaining capacity on on-site gas storage will fill. • Once gas storage is full flare will operate, ensuring proper combustion of biogas. • If flare fails, gas will vent through PRVs to prevent damage to site gas system.	Unlikely	Mild	Low risk

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk (after preventative controls)		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Environmental Consequence**	**What is the overall risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs – who is responsible for what?**	**How likely is this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains?**
Failure of flare leading to release of unburnt biogas to atmosphere	Nearby human receptors Local air quality and global climate impacts	Air	**Preventative controls** • Flare only used as backup in event of problems elsewhere on site. • Flare selected to give minimum 0.3s retention at 1,000C ensuring full combustion of biogas. • Operational and maintenance controls in place to minimise requirement to send biogas to flare. • Flare has control system that ensures ignition e.g., flame detection. • Maintenance programme in place to ensure that flare is always in good operational condition. **In the event of an incident/accident** • Raise urgent maintenance request for repairs to flare. • If flare fails, valve will automatically shut down flow of gas to flare. • Once all site gas containment is full, pressure will release through PRVs to prevent damage to equipment and uncontrolled release of biogas.	Unlikely	Mild	Low risk
Incorrect setting or damage to emergency pressure relief valves leads to premature release of gas or valve fails to reseat after release leading to uncontrolled release of biogas to atmosphere	Local air quality and global climate impacts	Air	**Preventative controls** • Inspection and maintenance of PRVs carried out on a routine basis to ensure they are set and operate correctly. • Checks on PRVs part of normal operational routine. • Over-pressure alarms in control system will alert site staff to incidents that could trigger PRV release. **In the event of an incident/accident** • Follow management procedures to ensure that the valves are re-seated/pressure setting adjusted rapidly and without putting staff at risk.	Unlikely	Minor / negligible	Negligible risk

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk (after preventative controls)		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Environmental Consequence**	**What is the overall risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs – who is responsible for what?**	**How likely is this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains?**
Digester foaming blocks gas lines, leading to release of biogas and/or foam through PRVs	Local air quality and global climate impacts	Air	**Preventative controls** • Feed rate to digesters is controlled to prevent organic overloading. • Digester mixing is regularly assessed as part of operational checks to ensure that it is functioning effectively. • Feedstock assessment ensures that nature and quality of feedstock is understood. • Anti-foam system is fitted to digesters to control foaming. **In the event of an incident/accident** • Follow site procedures for dealing with foaming. • Investigate cause and implement preventive measures. • Ensure that PRVs are not blocked with foam and operating correctly to protect tanks. • Ensure PRVs reseat once pressure in headspace returns to normal levels.	Unlikely	Mild	Low risk
Spillage / loss of containment of liquids	Ground / groundwater / surface waters	Overland runoff / infiltration / drainage systems	**Preventative controls** • Checks on condensate traps and valves are part of regular operational routine. • Condensate runs to site drainage for treatment. • Digester operation is controlled to minimise risk of foaming, which could lead to blockages on condensate system. **In the event of an incident/accident** • Clear up any spills. • Ensure all valves are operating correctly.	Unlikely	Minor / negligible	Negligible risk

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk (after preventative controls)		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Environmental Consequence**	**What is the overall risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs – who is responsible for what?**	**How likely is this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains?**
Sludge treatment processes						
Import of sludge which does not meet waste acceptance criteria leading to disruption to sludge treatment processes	Ground	Spread to land as part of disposal	**Preventative controls** • YW control all sites supplying sludge. Only sewage sludge is imported to Esholt STF, this has a consistent composition and comes from carefully controlled treatment processes. • Prior to initial acceptance of sludge from a new YW site, a screening assessment will be completed to confirm it is safe and stable. • JRP- WaSP system records the dry solids, volume and origin of every import brought to site. • Site operators and tanker drivers are trained to identify problem sludges and divert them to alternative sites for treatment. **In the event of an incident/accident** • Digester health will be investigated to understand cause of problem and best route to resolution. • Digestate being removed from digesters will be subject to enhanced monitoring to ensure that there is no environmental risk. Note this is also a HACCP requirement. • Where relevant the Environment Agency will be alerted that a problem has occurred. • The root cause of the problem will be investigated and procedures updated so that the incident cannot recur.	Unlikely	Minor / negligible	Negligible risk

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk (after preventative controls)		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Environmental Consequence**	**What is the overall risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs – who is responsible for what?**	**How likely is this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains?**
Failure/blockage of sludge screening facility leading to spillage and excess odour emissions	Ground Air	Overland runoff / infiltration / drainage systems Odour to air	**Preventative controls** • Design and construction controls ensure equipment is correctly specified for task. • Maintenance to ensure reliable operation of equipment. • Imports are from YW sites which gives control over content. • Hardstanding around import facility prevents spills travelling to land. • Site drainage will collect spills and return to WwTW for treatment. **In the event of an incident/accident** • Stop imports. • Clean up spill. • Unblock screens.	Likely	Minor / negligible	Low risk
Sludge contamination leading to inhibition of microbial activity / process disruption and insufficient digestion	Ground	Spread to land as part of disposal	**Preventative controls** • Management controls to identify potentially problematic sludges at source. • All sludge imports are from YW sites where sludge characteristics are very stable. • Contamination levels would need to be very severe to significantly impact digestion processes due to the very large digester volume. **In the event of an incident/accident** • Assess digester content to decide best route to normal digester health. • Sample cake prior to export from site to confirm it is safe to spread to land. • Review acceptance procedures.	Highly Unlikely	Medium	Low risk

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk (after preventative controls)		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Environmental Consequence**	**What is the overall risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs – who is responsible for what?**	**How likely is this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains?**
Excessive feeding of digester leads to reduced retention time and failure to meet pathogen kill requirements	Ground / groundwater / surface waters	Spread to land as part of disposal	**Preventative controls** • THP prior to digestion achieves high pathogen kill and improves sludge digestibility. • Staff training • Digesters have a maximum feed interlock ensuring that a set daily feed volume cannot be exceeded. This limit has been calculated to ensure digester stability and environmental safety. • HACCP monitoring. **In the event of an incident/accident** • Turn off digester feed. • Stop additional sludge imports until normal operational situation returns.	Highly Unlikely	Medium	Low risk
Failure of dewatering process leading to discharge to cake pad of cake with high water content	Ground / groundwater / surface waters	Overland runoff / infiltration / drainage systems	**Preventative controls** • Liquid runoff from sludge cake pad collected and directed to WwTW for treatment. System has large storage and handling capacity. **In the event of an incident/accident** • Switch off centrifuge and identify cause of problem.	Unlikely	Minor/negligible	Negligible risk

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk (after preventative controls)		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Environmental Consequence**	**What is the overall risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs – who is responsible for what?**	**How likely is this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains?**
Temporary cessation of land spreading e.g. due to extreme weather conditions, leading to build up of digested sludge cake	Local air quality and global climate impacts	Air	**Preventative controls** • Esholt cake storage is normally within a covered barn, which under normal circumstances, has spare capacity. If this becomes full, a cake storage pad is available to hold excess production. • Additional storage is available at nearby Yorkshire Water sites. **In the event of an incident/accident** • Monitor available storage in cake barn and reduce/stop sludge imports as required. • Divert sludge imports to alternative YW sites for storage.	Likely	Minor/negligible	Low risk
Very warm weather leading to increase in odour generation from sludge cake	Local air quality	Air	**Preventative controls** • Only likely to happen during a prolonged of extreme weather event. • Sludge cake secondary maturation or lime addition not required at this site due to THP. Cake is normally removed from site promptly. **In the event of an incident/accident** • Initial response would be to review operating times and avoid cake generation during problematic weather events, considering both temperature and wind. • If this was not sufficient, YW would look to remove cake from site and store elsewhere.	Likely	Minor/negligible	Low risk
Odour extraction and dispersal						

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk (after preventative controls)		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Environmental Consequence**	**What is the overall risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs – who is responsible for what?**	**How likely is this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains?**
Failure of components within extraction and dispersal systems leading to reduced dispersion of odorous emissions to air	Nearby human receptors Local air quality and global climate impacts	Air	**Preventative controls** • Regular operational checks on systems (e.g. fan operation). • Inspection and maintenance schedule to ensure reliability of extraction system. **In the event of an incident/accident** • Follow operational procedures to minimise generation of emissions until system is repaired.	Unlikely	Mild	Low risk
CHPs, Boilers and other gas consumers						
Excessive emissions to air from boilers and CHP e.g., due to equipment failure, poor performance or malfunction leading to incomplete or inefficient combustion	Nearby human receptors Local air quality and global climate impacts	Air	**Preventative controls** • Planned preventative maintenance in place for equipment to ensure assets continue to meet original specification on emissions. • Site operational knowledge supported through contracts with specialist providers. • Regular emissions monitoring timetable in operation to confirm required performance level is maintained. **In the event of an incident/accident** • Investigate cause and implement preventive measures, which may include system maintenance interventions.	Unlikely	Mild	Low risk

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk (after preventative controls)		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Environmental Consequence**	**What is the overall risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs – who is responsible for what?**	**How likely is this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains?**
Pipe Bridge						
Rupture due to impact	Surface waters	Air	**Preventative controls** • Pipes are attached to the downstream side of road bridge. This is of a substantial concrete construction. • The river is not navigable by boats, no risk of impact from river traffic. • Site flood protection plan dictates that process is stopped once river level reaches pre-determined level. Pumps will not be actively moving sludge across bridge in high water situations. **In the event of an incident/accident** • Pressure sensors will automatically stop pumps moving flow over pipe bridge.	Highly Unlikely	Medium	Low risk
Rupture due to freezing	Surface waters	Air	**Preventative controls** • Insulation fitted to pipes. • Trace heating fitted to all pipes at risk of freezing including sludge, wash water and potable water. • **In the event of an incident/accident** • Pressure sensors will automatically stop pumps moving flow over pipe bridge.	Unlikely	Mild	Low risk

What harm can be caused and who can be harmed			Managing the risk	Assessing the risk (after preventative controls)		
Hazard	**Receptor**	**Pathway**	**Risk management**	**Probability of exposure**	**Environmental Consequence**	**What is the overall risk?**
What has the potential to cause harm?	**What is at risk? What do I wish to protect?**	**How can the hazard get to the receptor?**	**What measures will you take to reduce the risk? If it occurs – who is responsible for what?**	**How likely is this contact?**	**What is the harm that can be caused?**	**What is the risk that still remains?**
Rupture due to pressure	Surface waters	Air	**Preventative controls** • Air release valves fitted to pipework. • Pumps that have potential to generate high pressures e.g. progressive cavity pumps will be fitted with high pressure cut out sensors. • Maintenance and inspection regime to confirm integrity of pipes. **In the event of an incident/accident** • Pressure sensors will automatically stop pumps moving flow over pipe bridge.	Highly unlikely	Medium	Low risk

Q 6-8 Assessment of point source emissions to sewer

All liquor from raw and digested sludge thickening and dewatering processes, condensate (e.g. from biogas handling), cleaning / washdown effluent and all surface water runoff (with the exception of roofwater from two buildings) is collected and discharged via underground drainage systems to Esholt WwTW for full treatment prior to discharge to the River Aire. This position has been managed for a long period within YW without a requirement for a formal discharge consent between YW STF and YW WwTW. The WwTW treats effluent from off site and from the STF and has consent limits in place covering all outputs. Therefore, there has been no requirement to separately characterise or assess the outputs from the STF, or any effects of these on receiving waters, separately from the wider WwTW. As such there is no such information available at this time.

YW is committed to undertaking a period of monitoring in order to characterise the liquors returned to the WwTW. The programme of monitoring is identified in Table C2: 6-8 and C2: 6-9 below. Samples will be taken manually from suitable location(s) upstream of the liquor return point to the WwTW inlet and will be submitted to a laboratory facility that can test to the appropriate standard. Sampling and chemical analysis will be undertaken in line with EA guidance: 'Surface water pollution risk assessment for your environmental permit - GOV.UK (www.gov.uk)'. Analysis will be carried out at a UKAS (17025) accredited laboratory and those undertaking the sampling and analysis will be by accredited to MCERTs.

It is proposed this sampling will be carried out for a period of 12 months. The data will be used to undertake an environmental impact assessment in accordance with Environment Agency guidance. The findings of the monitoring, analysis and impact assessment will be provided to the Environment Agency within 18 months of permit issue. Any requirements for ongoing monitoring will be established after this has been completed.

Table C2: 6-8 – Proposed analytical suite: Esholt return liquors characterisation programme - BAT 3 and BAT 7 requirements

Substance / Parameter	BAT-AEL	Waste Treatment Process to which the BAT-AEL applies	Monitoring Frequency	Monitoring Standard
Flow (m^3/day)	N/A	N/A	Monthly for 12 months	MCERTS
Chemical oxygen demand (COD)	N/A	Treatment of water-based liquid waste	Monthly for 12 months	BS ISO 15705
Biological oxygen demand (BOD)	N/A	N/A	Monthly for 12 months	BS EN 1899-1 and -2
Zahn-Wellens test	N/A	N/A	Monthly for 12 months	N/A
Total organic carbon (TOC)	N/A	Treatment of water-based liquid waste	Monthly for 12 months	EN 1484
pH	N/A	N/A	Monthly for 12 months	BS ISO 10523
Total suspended solids (TSS)	N/A	Treatment of water-based liquid waste	Monthly for 12 months	EN 872
Conductivity	N/A	N/A	Monthly for 12 months	ISO 7888 / BS EN 27888
Temperature	N/A	N/A	Monthly for 12 months	Calibrated probe
Total nitrogen	N/A	Treatment of water-based liquid waste	Monthly for 12 months	EN 12260, EN ISO 11905-1
Total phosphorus	N/A	Treatment of water-based liquid waste	Monthly for 12 months	Various EN standards available (i.e. EN ISO 15681-1 and -

Substance / Parameter	BAT-AEL	Waste Treatment Process to which the BAT-AEL applies	Monitoring Frequency	Monitoring Standard
				2, EN ISO 6878, EN ISO 11885)
Adsorbable organically bound halogens (AOX)	0.2 – 1 mg/l	Treatment of water-based liquid waste	Monthly for 12 months	EN ISO 9562
Benzene, toluene, ethylbenzene, xylene (BTEX)	N/A	Treatment of water-based liquid waste	Monthly for 12 months	EN ISO 15680
Free cyanide (CN-)	0.02 – 0.1 mg/l	Treatment of water-based liquid waste	Monthly for 12 months	Various EN standards available (i.e. EN ISO 14403-1 and -2)
Hydrocarbon oil index (HOI)	0.5 – 10 mg/l	Treatment of water-based liquid waste	Monthly for 12 months	EN ISO 9377-2
PFOA	N/A	All waste treatments	Monthly for 12 months	No EN standard available
PFOS	N/A	All waste treatments	Monthly for 12 months	No EN standard available
Phenol index	N/A	Treatment of water-based liquid waste	Monthly for 12 months	EN ISO 14402
Arsenic (expressed as As)	0.01 – 0.1mg/l	Treatment of water-based liquid waste	Monthly for 12 months	Various EN standards available (e.g. EN ISO 11885, EN ISO 17294-2, EN ISO 15586)
Cadmium (expressed as Cd)	0.01 – 0.1mg/l		Monthly for 12 months	
Chromium (expressed as Cr)	0.01 – 0.3mg/l		Monthly for 12 months	
Copper (expressed as Cu)	0.05 - 0.5mg/l		Monthly for 12 months	
Lead (expressed as Pb)	0.05 -0.3mg/l		Monthly for 12 months	
Nickel (expressed as Ni)	0.05 – 1mg/l		Monthly for 12 months	
Zinc (expressed as Zn)	0.1 – 2mg/l		Monthly for 12 months	
Manganese (Mn)	N/A		Monthly for 12 months	
Hexavalent chromium (Cr(VI))	0.01 – 0.1mg/l	Treatment of water-based liquid waste	Monthly for 12 months	Various EN standards available (i.e. EN ISO 10304-3, EN ISO 23913)
Mercury (expressed as Hg)	1 – 10 ug/l	Treatment of water-based liquid waste	Monthly for 12 months	Various EN standards available (i.e. EN ISO 17852, EN ISO 12846)

Table C2: 6-8 – Proposed analytical suite: Esholt return liquors characterisation programme - freshwater specific pollutants, priority hazardous substances, priority substances and other pollutants

Substance / Parameter	Monitoring Frequency	Monitoring Standard
1,1,1-trichloroethane	Monthly for 12 months	Chemical analysis by UKAS accredited laboratory with an appropriate minimum reporting value (MRV) (usually 10% of the EQS)
1,1,2-trichloroethane	Monthly for 12 months	
1,2-dichloro-ethane	Monthly for 12 months	
2,4-dichlorophenol	Monthly for 12 months	
2,4-dichlorophenoxyacetic acid (2,4-D)	Monthly for 12 months	
2-chlorophenol	Monthly for 12 months	
3,4-dichloroaniline	Monthly for 12 months	
3-chlorophenol 4-chlorophenol (total or individual monochlorophenols)	Monthly for 12 months	
4-chloro-3-methylphenol	Monthly for 12 months	
Abamectin	Monthly for 12 months	
Aclonifen	Monthly for 12 months	
Alachlor	Monthly for 12 months	
Ammonia (un-ionised)	Monthly for 12 months	
Anthracene	Monthly for 12 months	
Arsenic	Monthly for 12 months	
Atrazine	Monthly for 12 months	
Azinphos-methyl dissolved)	Monthly for 12 months	
Bentazone	Monthly for 12 months	
Benzene	Monthly for 12 months	
Benzo(a)-pyrene (BaP)	Monthly for 12 months	
Benzo(b)-fluor-anthene	Monthly for 12 months	
Benzo(g,h,i)-perylene	Monthly for 12 months	
Benzo(k)-fluor-anthene	Monthly for 12 months	
Benzyl butyl phthalate	Monthly for 12 months	
Bifenox (Methyl 5-(2,4-dichlorophenoxy)-2-nitrobenzoate)	Monthly for 12 months	Chemical analysis by UKAS accredited laboratory with an appropriate minimum reporting value (MRV) (usually 10% of the EQS)
Biphenyl	Monthly for 12 months	
Boron	Monthly for 12 months	
Brominated diphenylether - total PBDE (or congener) numbers 28, 47, 99, 100, 153 and 154	Monthly for 12 months	
Bromine (total residual oxidant)	Monthly for 12 months	
Bromoxynil	Monthly for 12 months	
C10-13 chloroalkanes	Monthly for 12 months	
Cadmium and its compounds (dissolved)	Monthly for 12 months	
Carbendazim	Monthly for 12 months	
Carbon tetrachloride	Monthly for 12 months	
Chlorfenvinphos	Monthly for 12 months	

Substance / Parameter	Monitoring Frequency	Monitoring Standard
Chloride	Monthly for 12 months	
Chlorine (total residual oxidant)	Monthly for 12 months	
Chloronitro toluenes	Monthly for 12 months	
Chlorothalonil	Monthly for 12 months	
Chlorotoluron	Monthly for 12 months	
Chlorpropham	Monthly for 12 months	
Chlorpyrifos (chlorpyrifos-ethyl)	Monthly for 12 months	
Chromium (III) (dissolved)	Monthly for 12 months	
Chromium (VI) (dissolved)	Monthly for 12 months	
Cobalt (dissolved)	Monthly for 12 months	
Copper (dissolved)	Monthly for 12 months	
Coumaphos	Monthly for 12 months	
Cyanide	Monthly for 12 months	
Cybutryne	Monthly for 12 months	
Cyclodiene pesticides - total aldrin, dieldrin, endrin and isodrin	Monthly for 12 months	
Cyfluthrin	Monthly for 12 months	
Cypermethrin	Monthly for 12 months	
DDT total	Monthly for 12 months	
Demetons	Monthly for 12 months	
Di(2-ethylhexyl)-phthalate (DEHP)	Monthly for 12 months	
Diazinon (sheep dip)	Monthly for 12 months	
Dibutyl phthalate	Monthly for 12 months	
Dichlorobenzene (total dichlorobenzene isomers)	Monthly for 12 months	
Dichloro-methane	Monthly for 12 months	
Dichlorvos	Monthly for 12 months	
Dicofol	Monthly for 12 months	
Diethyl phthalate	Monthly for 12 months	
Diflubenzuron	Monthly for 12 months	
Dimethoate	Monthly for 12 months	Chemical analysis by UKAS accredited laboratory with an appropriate minimum reporting value (MRV) (usually 10% of the EQS)
Dimethyl phthalate	Monthly for 12 months	
Dioctyl phthalate	Monthly for 12 months	
Dioxins and dioxin-like compounds	Monthly for 12 months	
Diuron	Monthly for 12 months	
Doramectin	Monthly for 12 months	
EDTA	Monthly for 12 months	
Endosulphan	Monthly for 12 months	
Fenchlorphos	Monthly for 12 months	
Fenitrothion	Monthly for 12 months	
Flucofuron	Monthly for 12 months	
Fluoranthene	Monthly for 12 months	

Substance / Parameter	Monitoring Frequency	Monitoring Standard
Fluoride - (dissolved)	Monthly for 12 months	
Formaldehyde	Monthly for 12 months	
Glyphosate	Monthly for 12 months	
Heptachlor & heptachlor epoxide	Monthly for 12 months	
Hexabromocyclo-dodecane (HBCDD)	Monthly for 12 months	
Hexachloro-benzene	Monthly for 12 months	
Hexachloro-butadiene	Monthly for 12 months	
Hexachloro-cyclohexane	Monthly for 12 months	
Hydrogen sulphide	Monthly for 12 months	
Indeno(1,2,3-cd)-pyrene (see PAHs below for AA and biota EQS)	Monthly for 12 months	
Ioxynil	Monthly for 12 months	
Iron (dissolved)	Monthly for 12 months	
Isoproturon	Monthly for 12 months	
Ivermectin	Monthly for 12 months	
Lead and its compounds - (dissolved)	Monthly for 12 months	
Linuron	Monthly for 12 months	
Malachite green	Monthly for 12 months	
Malathion	Monthly for 12 months	
Mancozeb	Monthly for 12 months	
Maneb	Monthly for 12 months	
Manganese	Monthly for 12 months	
MCPA (pH level higher than 7)	Monthly for 12 months	
MCPA (pH level less than 7)	Monthly for 12 months	
Mecoprop	Monthly for 12 months	
Mercury and its compounds - (dissolved)	Monthly for 12 months	
Methiocarb	Monthly for 12 months	
Mevinphos	Monthly for 12 months	
Naphthalene	Monthly for 12 months	
Nickel and its compounds - (dissolved)	Monthly for 12 months	Chemical analysis by UKAS accredited laboratory with an appropriate minimum reporting value (MRV) (usually 10% of the EQS)
Nitrilotriacetic acid (NTA)	Monthly for 12 months	
Nonylphenol (4-nonylphenol)	Monthly for 12 months	
Octylphenol (4-(1,1',3,3'-tetramethyl-butyl)-phenol)	Monthly for 12 months	
Omethoate	Monthly for 12 months	
Para-para-DDT	Monthly for 12 months	
PCSDs	Monthly for 12 months	
Pendimethalin	Monthly for 12 months	
Pentachloro-benzene	Monthly for 12 months	
Pentachloro-phenol	Monthly for 12 months	
Perfluorooctane sulfonic acid and its salts (PFOS)	Monthly for 12 months	

Substance / Parameter	Monitoring Frequency	Monitoring Standard
Permethrin	Monthly for 12 months	
pH	Monthly for 12 months	
Phenol	Monthly for 12 months	
Pirimicarb	Monthly for 12 months	
Pirimiphos-methyl	Monthly for 12 months	
Polyaromatic hydrocarbons (PAH) - Benzo(a)-pyrene (BaP), Benzo(b)-fluor-anthene, Benzo(k)-fluor-anthene, Benzo(g,h,i)-perylene and Indeno(1,2,3-cd)-pyrene	Monthly for 12 months	
Prochloraz	Monthly for 12 months	
Propetamphos	Monthly for 12 months	
Propyzamide	Monthly for 12 months	
Quinoxyfen	Monthly for 12 months	
Silver - (dissolved)	Monthly for 12 months	
Simazine	Monthly for 12 months	
Styrene	Monthly for 12 months	
Sulcofuron	Monthly for 12 months	
Sulphate	Monthly for 12 months	
Tecnazene - total	Monthly for 12 months	
Terbutryn	Monthly for 12 months	
Tetrachloroethane	Monthly for 12 months	
Tetrachloro-ethylene	Monthly for 12 months	
Thiabendazole	Monthly for 12 months	
Tin (inorganic) (total)	Monthly for 12 months	
Toluene	Monthly for 12 months	
Total anions	Monthly for 12 months	
Triallate	Monthly for 12 months	
Triazaphos	Monthly for 12 months	
Tributyl phosphate	Monthly for 12 months	
Tributyltin compounds (tributyltin-cation)	Monthly for 12 months	Chemical analysis by UKAS accredited laboratory with an appropriate minimum reporting value (MRV) (usually 10% of the EQS)
Trichloro-benzenes	Monthly for 12 months	
Trichloro-ethylene	Monthly for 12 months	
Tricholoro-methane (chloroform)	Monthly for 12 months	
Triclosan	Monthly for 12 months	
Trifluralin	Monthly for 12 months	
Triphenyltin and derivatives	Monthly for 12 months	
Vanadium	Monthly for 12 months	
Xylene	Monthly for 12 months	
Zinc - (dissolved)	Monthly for 12 months	

Q 6-9 Risk assessment methodology

The risk assessment methodology employed for the noise impact assessment (Q 6-5) and accident management plan (Q 6-7) is summarised in Tables C2 6-9 to 6-12 below.

The overall risk rating for each of the identified risk scenarios is determined on the basis of the probability of the scenario occurring (the probability/likelihood score) and the environmental consequence(s) if the scenario were to occur (the consequence score). The probability and consequence categories used in this methodology are provided in Tables C2: 6-9 and 6-10 below.

Table C2: 6-9: Classification of Consequences

Classification	Definition
Severe	• Acute risks to human health • Short-term risk of pollution of sensitive water resource (e.g. major spillage into controlled waters) • Impact on controlled waters e.g. large-scale pollution or very high levels of contamination • Catastrophic damage to buildings or property (e.g. explosion causing building collapse) • Ecological system effects – irreversible adverse changes to a protected location. Immediate risks
Medium	• Chronic risks to human health • Pollution of sensitive water resources (e.g. leaching of contaminants into controlled waters) • Ecological system effects – substantial adverse changes to a protected location • Significant damage to buildings, structures and services (e.g. damage rendering a building unsafe to occupy, such as foundation damage)
Mild	• Non-permanent health effects to human health • Pollution of non-sensitive water resources (e.g. pollution of non-classified groundwater) • Damage to buildings, structures and services (e.g. damage rendering a building unsafe to occupy, such as foundation damage) • Substantial damage to non-sensitive environments (unprotected ecosystems e.g. crops)
Minor/Negligible	• Non-permanent health effects to human health (easily prevented by appropriate use of PPE) • Minor pollution to non-sensitive water resources • Minor damage to non-sensitive environments (unprotected ecosystems e.g. crops) • Easily repairable effects of damage to buildings, structures, services or the environment (e.g. discoloration of concrete, loss of plants in a landscaping scene)

Table C2: 6-10: Classification of probability / Likelihood

Classification	Definition
High Likelihood	An event is very likely to occur in the short term, and is almost inevitable over the long term OR there is evidence at the receptor of harm or pollution
Likely	It is probable that an event will occur. It is not inevitable, but possible in the short term and likely over the long term
Unlikely	Circumstances are possible under which an event could occur. It is by no means certain that even over a longer period such an event would take place, and less likely in the short term
Highly Unlikely	Probability is so low that it is close to zero; It is improbable that an event would occur even in the very long term

Table C2: 6-11 below provides the matrix used to identify the overall risk category using these consequence and probability categories.

Table C2: 6-11: Risk Matrix and Terminology Used for Risk Assessments

		Consequence			
		Severe	**Medium**	**Mild**	**Minor/Negligible**
Probability (Likelihood)	**High Likelihood**	Very high risk	High risk	Moderate risk	Moderate/Low risk
	Likely	High risk	Moderate risk	Moderate/Low risk	Low risk
	Unlikely	Moderate risk	Moderate/Low risk	Low risk	Negligible risk
	Highly Unlikely	Moderate/Low risk	Low risk	Negligible risk	Negligible risk

The overall risk categories are described in Table C2: 6-12 below.

Table C2: 6-12: Description of Risk Categories

Term	Description
Very high risk	Severe harm to a receptor may already be occurring OR a high likelihood that severe harm will arise to a receptor, unless immediate remedial action works / mitigation measures are undertaken.
High risk	Harm is likely to arise to a receptor, and is likely to be severe, unless appropriate remedial actions / mitigation measures are undertaken. Remedial works may be required in the short term, but likely to be required over the long term.
Moderate risk	Possible that harm could arise to a receptor but low likelihood that such harm would be severe. Harm is likely to be medium. Some remedial works may be required in the long term.
Moderate / low risk	Possible that harm could arise to a receptor, but where a combination of likelihood and consequence results in a risk that is above low, but is not of sufficient concern to be classified as medium. It can be driven by cases where there is an acute risk which carries a severe consequence, but where the exposure is unlikely.
Low risk	Possible that harm could arise to a receptor. Such harm would at worse normally be mild.
Negligible risk	Low likelihood that harm could arise to a receptor. Such harm unlikely to be any worse than mild.

Form C3 Supporting Information

1 What activities are you applying to vary?

Activities to be included within this installation are provided in Table C3: 1a-1 below. A summary of the activities to be removed from, and added to, the permit is provided above in C2: Table 1 above in response to Form C2, Question 2.

Table C3: 1a-1 – Types of activities

Installation name	Schedule 1 references	Description of the Activity	Activity Capacity	Annex I (D codes) and Annex II (R codes) and descriptions	Hazardous waste treatment capacity	Non-hazardous waste treatment capacity
Esholt STF	Section 5.4 A(1) (b)(i)	**Anaerobic digestion** of indigenous and imported UWWT-derived sludges: Recovery or a mix of recovery and disposal of non-hazardous waste with a capacity exceeding 75 tonnes per day (or 100 tonnes per day if the only waste treatment activity is anaerobic digestion) involving biological treatment	>100 tonnes per day	R3: recycling/ reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes)	N/A	AD treatment is limited to 1,178m^3/d. Refer to Appendix 12 for supporting calculations spreadsheet.

Directly Associated Activities (including description)	
Import and treatment of sludges prior to digestion, including screening, mixing, thickening, dewatering and thermal hydrolysis	R3: Recycling/reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes)
Treatment of digested sludge (including physical handling and dewatering) before being recycled to agriculture.	R3: Recycling/reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes)
Storage and treatment of biogas	R13: Storage of wastes pending any of the operations numbered R1 to R12 (excluding temporary storage, pending collection, on the site where it is produced) D15 Storage pending any of the operations numbered D1 to D14 (excluding temporary storage, pending collection, on the site where it is produced)
Use of biogas as a fuel	R1: Use principally as a fuel to generate energy
Incineration of biogas	D10: Incineration on land
Raw material (non-waste) **storage**	No applicable waste codes
Surface water collection, including **temporary storage**	No applicable waste codes
Collection and treatment of odorous gases	No applicable waste codes

Total storage capacity (tonnes)	Sludge storage capacity within STF vessels provided in Table 1a-2 overleaf.
Annual throughput (tonnes each year)[10]	**Indigenous primary sludge:** 555,104 tonnes per year (at the minimum 2.4% dry solids) **Indigenous SAS:** 1,330,500 tonnes per year (at the minimum 0.4% dry solids) **Liquid sludge (imported):** 339,273 tonnes per year (at the minimum 2.2% dry solids) **Sludge cake (imported):** 25,948 tonnes (at 21% dry solids) Total:2,250,825t

10 Figures presented here as tonnes per year assume a 1:1 ratio of m3 to tonnes in all cases.

Table 1a-2 – Storage capacities

Vessel	Nominal capacity (m^3)
Liquid import tank (1)	655
Consolation tank 5 (1)	2,500
SAS storage tanks (2)	2,000 each
SAS transfer tanks (2)	400 each
Mixed sludge tanks (2)	1,200 and 1,130
THP feed silos (2)	210 each
THP hopper (1)	16.2
Buffer tank (1)	39.5
Degassing tanks (2)	685 each
Export dewatering feed tanks (2)	1,604 each
Dewatering feed tanks (2)	1,200 and 1,130
Conditioning pad and cake barn	
A maximum storage capacity has been estimated on the basis of available space on the conditioning pad and in the cake barn, taking account of typical sizes and heights of material stockpiles. This is necessarily an estimate. On this basis a figure of 5,500 tonnes has been derived. Under normal circumstances the amount of cake stored will be significantly below this quantity.	

Table C3: 1b-1 – Types of waste accepted - Imported and Indigenous wastes to the sludge AD process (digesters)

Waste Code	Description of the waste
19	Wastes from waste management facilities, off-site waste water treatment plants and the preparation of water intended for human consumption and water for industrial use
19 02	Wastes from physico/chemical treatments of waste (including dechromatation, decyanidation, neutralisation)
19 02 06	Sludges from physico/chemical treatment other than those mentioned in 19 02 05, specifically sewage sludge
19 06	Wastes from anaerobic treatment of waste
19 06 06	Digestate from anaerobic treatment of animal and vegetable waste
19 08	Wastes from waste water treatment plants not otherwise specified
19 08 05	Sludges from treatment of urban waste water

2 Point source emissions to air, water and land

A full inventory of emission points is provided in Table C3: 2-1 below and illustrated in Section IV, Figure 3. Proposals for monitoring emissions to air are provided in Table C3: 4a-1.

Refer also to Appendix 12 Medium Combustion Plant Directive requirements for details of Emission Limit Values (ELVs) for emissions to air from boilers and CHP engines following phase in of MCP Directive controls, in accordance with applicable timescales.

Table C3:2-1: Emissions Inventory to air

New / Existing	Emission Point Ref	Source	Location	Emissions parameter	Quantity / unit		Techniques to minimise emissions
Existing plant – emission points unchanged, currently within permit VP3130GZ	A1 (previously N.A1)	CHP 3 engine exhaust	Energy centre	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	500[11]	mgNm	Low NOx combustion controls
				Sulphur dioxide (SO_2)	<350[12]	mgNm	Sludge management techniques
				Carbon monoxide (CO)	1,400[11]	mgNm	Engine servicing and maintenance
				Total VOCs (as carbon)	1,000[11]	mgNm	Engine servicing and maintenance
	A2 (previously N.A2)	Boiler 1 exhaust (gas oil)	Energy centre	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	500[11]	mgNm	Low NOx burners
				Sulphur dioxide (SO_2)	<350[12]	mgNm	Ultra low sulphur gas oil
				Carbon monoxide (CO)	1,400[11]	mgNm	Boiler servicing and maintenance
				Total VOCs (as carbon)	1,000[11]	mgNm	Boiler servicing and maintenance
		Boiler 1 exhaust (biogas)		Oxides of nitrogen (NO and NO_2 expressed as NO_2)	500[11]	mgNm	Low NOx burners
				Sulphur dioxide (SO_2)	<350[12]	mgNm	Sludge management techniques
				Carbon monoxide (CO)	1,400[11]	mgNm	Boiler servicing and maintenance
				Total VOCs (as carbon)	1,000[11]	mgNm	Boiler servicing and maintenance
	A3 (previously N.A3)	CHP 4 engine exhaust	Energy centre	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	500[11]	mgNm	Low NOx combustion controls
				Sulphur dioxide (SO_2)	<350[12]	mgNm	Sludge management techniques
				Carbon monoxide (CO)	1,400[11]	mgNm	Engine servicing and maintenance
				Total VOCs (as carbon)	1,000[11]	mgNm	Engine servicing and maintenance
	A4 (previously N.A4)	Boiler 2 exhaust (gas oil)	Energy centre	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	500[11]	mgNm	Low NOx burners
				Sulphur dioxide (SO_2)	<350[12]	mgNm	Ultra low sulphur gas oil
				Carbon monoxide (CO)	1,400[11]	mgNm	Boiler servicing and maintenance
				Total VOCs (as carbon)	1,000[11]	mgNm	Boiler servicing and maintenance
		Boiler 2 exhaust (biogas)	Energy centre	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	500[11]	mgNm	Low NOx burners
				Sulphur dioxide (SO_2)	<350[12]	mgNm	Sludge management techniques
				Carbon monoxide (CO)	1,400[11]	mgNm	Boiler servicing and maintenance
				Total VOCs (as carbon)	1,000[11]	mgNm	Boiler servicing and maintenance

[11] Emission limit taken from existing permit VP3130GZ/V004 using reference conditions 273 degrees Kelvin, 101.3kPa, dry gas, 5% O_2.
[12] Representative ELV taken from other YW biogas combustion permit conditions using reference conditions: 273 degrees Kelvin, 101.3kPa, dry gas, 5% O_2.

New / Existing	Emission Point Ref	Source	Location	Emissions parameter	Quantity / unit		Techniques to minimise emissions
Existing plant – emission points unchanged, currently within permit VP3130GZ	A5 (previously N.A5)	CHP 1 engine exhaust (exhaust via unfired waste heat boiler)	Energy centre	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	500[11]	mgNm	Low NOx combustion controls
				Sulphur dioxide (SO_2)	<350[12]	mgNm	Sludge management techniques
				Carbon monoxide (CO)	1,400[11]	mgNm	Engine servicing and maintenance
				Total VOCs (as carbon)	1,000[11]	mgNm	Engine servicing and maintenance
	A6 (previously N.A6)	CHP 2 engine exhaust (exhaust via unfired waste heat boiler)	Energy centre	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	500[11]	mgNm	Low NOx combustion controls
				Sulphur dioxide (SO_2)	<350[12]	mgNm	Sludge management techniques
				Carbon monoxide (CO)	1,400[11]	mgNm	Engine servicing and maintenance
				Total VOCs (as carbon)	1,000[11]	mgNm	Engine servicing and maintenance
	A7 (previously N.A7)	Waste gas burner	Adjacent to digester compound	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	150[13]	mgNm	None - abnormal use only
				Carbon monoxide (CO)	50[13]	mgNm	None - abnormal use only
				SO_2	Not quantified[14]		None - abnormal use only. Sludge management techniques
				Total VOCs (as carbon)	10[13]	mgNm	Flame temperature and residence
	A8 (previously N.A8)	Biogas holder 1 (emergency pressure relief valve)	Adjacent to digester compound	Biogas	Not quantified – emergency use only[14]		None - emergency use only
	A9 (previously N.A9)	Biogas holder 2 (emergency pressure relief valve)	Adjacent to digester compound	Biogas	Not quantified – emergency use only		None - emergency use only
New emissions points	A10	Odour control unit 1 (Sludge screen feed tank)	Liquid import tank	H_2S	Not quantified		Sludge management techniques. OCU to be refurbished and reinstated - refer to proposed improvement programme.
				NH_3	Not quantified		
				Mercaptans	Not quantified		
				Dimethyl sulphide	Not quantified		
	A11		Mixed sludge tanks	H_2S	Not quantified		
				NH_3	Not quantified		

[13] Emission limit taken from existing permit VP3130GZ/V004 using reference conditions 273 degrees Kelvin, 101.3kPa, dry gas, 3% O_2.
[14] No ELV for these determinands proposed in permit. No appropriate reference limit value identified.

New / Existing	Emission Point Ref	Source	Location	Emissions parameter	Quantity / unit	Techniques to minimise emissions
		Odour control unit 2 (Mixed sludge tanks)		Mercaptans	Not quantified	Sludge management techniques. OCU to be refurbished and reinstated - refer to proposed improvement programme.
				Dimethyl sulphide	Not quantified	
New emissions points	A12	Odour control unit 3	Dewatering centrifuges pump station, THP feed silos, and THP feed hopper	H_2S	Not quantified	Sludge management techniques. OCU to be refurbished and reinstated - refer to proposed improvement programme.
				NH_3	Not quantified	
				Mercaptans	Not quantified	
				Dimethyl sulphide	Not quantified	
	A13	Odour control unit 4	Drum thickeners	H_2S	Not quantified	Single stage carbon filter OCU in operation and no operational issues are reported. However, no monitoring data is currently available. An assessment of the effectiveness of this OCU will be carried out. YW will undertake any refurbishment work that may be required in order to ensure effective OCU operation. Refer to proposed improvement programme.
				NH_3	Not quantified	
				Mercaptans	Not quantified	
				Dimethyl sulphide	Not quantified	
	A14	Degassing tanks odour dispersion stack	Degassing tanks	H_2S	Not quantified	A single stage carbon filter OCU is proposed to replaced the existing dispersion stack. However, no monitoring data is currently available. An assessment of the effectiveness of this OCU will be carried out. YW will undertake any refurbishment work that may be required in order to ensure effective OCU operation. Refer to proposed improvement programme.
				NH_3	Not quantified	
				Mercaptans	Not quantified	
				Dimethyl sulphide	Not quantified	
	A15	Proposed odour control unit	Screen sludge transfer pump station	H_2S	Not quantified	A single stage carbon filter OCU is proposed to be installed. However, no monitoring data is currently available.
				NH_3	Not quantified	
				Mercaptans	Not quantified	
				Dimethyl sulphide	Not quantified	

New / Existing	Emission Point Ref	Source	Location	Emissions parameter	Quantity / unit	Techniques to minimise emissions
						An assessment of the effectiveness of this OCU will be carried out. YW will undertake any refurbishment work that may be required in order to ensure effective OCU operation. Refer to proposed improvement programme.
	A16	Proposed odour control unit	Cake import reception unit	H_2S	Not quantified	A single stage carbon filter OCU is proposed to be installed. However, no monitoring data is currently available. An assessment of the effectiveness of this OCU will be carried out. YW will undertake any refurbishment work that may be required in order to ensure effective OCU operation. Refer to proposed improvement programme.
				NH_3	Not quantified	
				Mercaptans	Not quantified	
				Dimethyl sulphide	Not quantified	
	A17	Proposed odour control unit	Consolidation tank	H_2S	Not quantified	A single stage carbon filter OCU is proposed to be installed. However, no monitoring data is currently available. An assessment of the effectiveness of this OCU will be carried out. YW will undertake any refurbishment work that may be required in order to ensure effective OCU operation. Refer to proposed improvement programme.
				NH_3	Not quantified	
				Mercaptans	Not quantified	
				Dimethyl sulphide	Not quantified	
	N/A	PRVs - biogas	Digesters and locations on biogas pipelines	Biogas	Not quantified – emergency use only	None - emergency use only
	N/A	PRVs – THP	THP pressure relief valve	Off gases from THP process	Not quantified – emergency use only	None - emergency use only

Emissions to sewer and water

All process liquor and surface water runoff, other than some uncontaminated roof water, is collected and discharged via underground drainage systems to Esholt WwTW for full treatment prior to discharge to the River Aire. Process liquor emissions comprise liquor from raw and digested sludge dewatering processes, condensate e.g. from biogas handling, cleaning washwater and surface water runoff. Discharge points are shown on Figure 3. Key sources are as follows:

- Discharge point S1 comprises surface water runoff and cleaning wash water from local site areas as well as boiler blowdown and biogas condensate.
- Discharge point S1 will also contain surface water run off from the proposed new secondary containment improvements of a new drainage network to a new pumping station with use of consol tank 1 as storage before return to the WwTW inlet.
- Surface water runoff, cleaning wash water, thickener liquors and centrate are discharged to Esholt WwTW via emission point S2
- Liquor from the dewatering centrifuges, cleaning wash water and surface water runoff is discharged to Esholt WwTW via local emission points S3.
- Surface water runoff from the conditioning pad is combined with surface water runoff from the adjacent Biowise composting plant at the leachate pumping and is transferred to Esholt WwTW for full treatment via emission point S1 (refer to Figure 4).
- Uncontaminated roof water from the boiler house and the export barn are discharged to infiltration basins via local emission points W1, W2 and W3.

A copy of the site drainage plan is provided as Figure 4. Site drainage is also shown, overlain on site surfacing, in Figure 5.

Esholt WwTW treats effluent from off site and from the STF and has consent limits in place covering all outputs. There has been no requirement to separately characterise or assess the outputs from the STF, or any effects of these on receiving waters, separately from the wider WwTW. As such no monitoring data is available at this time.

YW is committed to undertake a 12-month programme of monitoring of process liquors returned to the WwTW to characterise the emissions – refer to Form C2 Q6-8 for details of the proposed monitoring programme.

Table C3: 2-2 – Emissions to sewer and water

Emission Point Ref.	Source	Parameter	Expected Emissions	
			Quantity	Unit
W1	Roof water runoff	Volume	Variable ~ dependent on rainfall	
W2	Roof water runoff	Volume	Variable ~ dependent on rainfall	
W3	Roof water runoff	Volume	Variable ~ dependent on rainfall	
S1	Washwaters Surface water runoff (including cake pad) Condensate Boiler blowdown Surface water runoff from the adjacent composting plant	Suspended solids Biological Oxygen Demand (BOD) Ammonia Volume	Not yet quantified. Characterisation of emissions will be undertaken in line with BAT – refer to information provided in response to Form C2 Q6-8 for more details.	
S2	Washwaters Surface water runoff Thickener liquors (SAS) Dewatering liquor (raw sludge)	Suspended solids Biological Oxygen Demand (BOD) Ammonia Volume	Not yet quantified. Characterisation of emissions will be undertaken in line with BAT – refer to information provided in response to Form C2 Q6-8 for more details.	
S3	Washwaters Surface water runoff Dewatering liquor (digested sludge)	Suspended solids Biological Oxygen Demand (BOD) Ammonia Volume	Not yet quantified. Characterisation of emissions will be undertaken in line with BAT – refer to information provided in response to Form C2 Q6-8 for more details.	

3 Operating techniques

3a1 Does your permit (in Table 1.2 Operating Techniques or similar table in the permit) have references to any of your own documents or parts of documents submitted as part of a previous application for this site?

Table S1.2 of the current permit (VP3130GZ /V004) includes reference to documents which are superseded, or are supplemented, by documents contained within this permit variation application. This is summarised in Table C3: 3a1 below.

Table C3: 3a1 – Superseded Documents

Permit ref	Existing document reference (taken from Table 1.2 Operating Techniques)	Reason no longer valid	New document reference
VP3130GZ	Burning of biogas: Environmental risk assessment (EPR-H1) submitted in response to Section 2.7 of Part 2C of the application form	**Supplementary** information provided in this variation application	This risk assessment remains relevant. However, this is supplemented by additional information included within this application: • Response to Form C3, Q 6 Environmental Risk Assessment
VP3130GZ	Import of sewage sludge: Environmental risk assessment (EPR-H1) submitted in response to Section 2.7 of Part 2C of the application form	**Supplementary** information provided in this variation application	This risk assessment remains relevant. However, this is supplemented by additional information included within this application: • Response to Form C3, Q 6 Environmental Risk Assessment
VP3130GZ	Supporting information for Environmental Permit (Substantial Variation) submitted in response to Question 2b - Changes or additions to existing activities, Part C2 of the application form. 2.4.2 Facility Boundary, 2.4.3 Process Flow Diagram. Details submitted in response to Question 5a of Part C2 of the application form	**Superseded** by information provided in this variation application	• Section II: Technical Description • Response to Form C2, Q2 About your proposed changes • Response to Form C3, Q1 What activities are you applying to vary? • Figure 2 Installation Layout
VP3130GZ	Revised site plan	**Superseded** by information provided in this variation application	• Figure 2 Installation Layout • Figure 3 Principal Emissions points • Figure 4 Drainage plan
VP3130GZ	Proposed lists of waste types	**Superseded** by information provided in this variation application	• Response to Form C3, Q1 Types of Waste Accepted

3b General requirements

Fugitive emissions management plan – Leak Detection and Repair (LDAR) programme

YW has a defined maintenance plan for biogas pipework at Esholt STF – this is included as Appendix 14. This includes regular visual inspections, as well as more detailed investigations such as use of a methane detecting camera to identify leaks. Any leaks identified are assigned a priority for repair, the priority recognises potential as both an environmental and safety hazard. Key section headings in the LDAR management procedure (which forms part of the EMS) include:

- Introduction, scope, responsibilities, assurance.
- LDAR considerations including summary of equipment, techniques and approaches.
- Site specific LDAR plan:
  - STF Tanks (Anaerobic Digesters);
  - Pressure Relief Valves;
  - Biogas pipework from AD to biogas treatment and storage;
  - Biogas storage ;
  - Pipework from biogas treatment to flare stack and engine;
  - Biogas Engine;
  - Boilers
  - Flare Stack;

The majority of biogas pipework is within a secure area to reduce the risk of physical damage. A DSEAR review of the site has been completed and installed equipment is appropriate for the zone in which it is installed.

Best Available Techniques: Reducing diffuse (fugitive) emissions to air (*BAT 14*)

The design and operation of Esholt STF ensures diffuse (fugitive) emissions to air are minimised. This includes the following measures:

- Raw sludge and sludge cake is largely contained with displaced air from tanks piped to an odour control unit for treatment prior to release to atmosphere.
- H_2S levels are monitored in the biogas and are recorded.
- Emissions of odour and organic compounds from digested material (post THP/AD) is very low. Refer to the odour impact assessment and odour management plan (Appendices 8 and 10, respectively) for more details.
- All pipework design is subject to Water Industry Mechanical and Electrical Specifications (WIMES), which ensures correct material selection, corrosion prevention and valve type.
- Regular inspections of tanks and pipework undertaken in line with the LDAR programme.
- Biogas pipework largely above-ground, allowing easy inspection/leakage detection.
- Sludge and sludge cake is wet at all times and therefore potential for generation of dust is very limited. This is not an issue of concern (see bioaerosol risk assessment, Section 6).
- Traffic speed limits of 10pm are enforced on site.

3c Types and amounts of raw materials

Table C3: 3c-1 – Types and amounts of raw materials

Description of raw material	Use	Maximum storage capacity	Annual throughput[15]	Main hazards	Alternative
Polymer (liquid)	Coagulant used for raw sludge thickening	10 m^3 bulk storage tank plus IBC storage (~5 m^3)	~90,000 kgs	Polluting to watercourses in the event of a spillage/loss	No viable alternative
Polymer (powder)	Coagulant used for digested sludge thickening	55 m^3	~75,051 kgs	Polluting to watercourses in the event of a spillage/loss	No viable alternative
Antifoam	Digester antifoaming agent	IBC storage (~5 m^3)	<5 m^3	Polluting to watercourses in the event of a spillage/loss	No viable alternative
Sodium hydroxide [NaOH]	Boiler treatment chemical	220 litres	<220 litres	Polluting to watercourses in the event of a spillage/loss	No viable alternative
Oxygen scavenger [Sodium bisulphite + Cobalt catalyst]	Boiler treatment chemical	220 litres	<220 litres	Polluting to watercourses in the event of a spillage/loss	No viable alternative
Corrosion inhibitor [Amine based]	Boiler treatment chemical	220 litres	<220 litres	Polluting to watercourses in the event of a spillage/loss	No viable alternative
Sodium chloride (NaCl)	Boiler water softener	100 kgs	<100 kgs	Polluting to watercourses in the event of a spillage/loss	No viable alternative
Glycol	Antifreeze	2 m^3	<2 m^3	Polluting to watercourses in the event of a spillage/loss	No viable alternative
Lubrication oil	Equipment lubricant	1 m^3	2,800 litres	Polluting to watercourses in the event of a spillage/loss	No viable alternative

[15] Raw materials data is provided on the basis of a combination of 2020 data, where available, and estimates based on typical storage volumes at this and other YW STF sites.

Description of raw material	Use	Maximum storage capacity	Annual throughput[15]	Main hazards	Alternative
Propane	Boiler starter fuel	1,410 kgs	1,000 kgs approximately	Potential impact on local and global atmosphere	No viable alternative
Diesel	Fuel for mechanical loaders	2,500 litres	29,105 litres [16]	Polluting to watercourses in the event of a spillage/loss	No viable alternative
Gas oil	Boiler fuel	108,000 litres	1,643,893 litres	Polluting to watercourses in the event of a spillage/loss	No viable alternative

4 Monitoring

4a Describe the measures you use for monitoring emissions

Proposals for monitoring point source emissions to air and sewer are shown in Table C3: 4a-1.

Refer also to Appendix 12 Medium Combustion Plant Directive requirements for details of monitoring proposals for emissions to air from boilers and CHP engines following phase in of MCP Directive controls, in accordance with applicable timescales.

Table C3: 4a-1 Proposed emissions monitoring requirements

Emission point	Grid ref.	Parameter	Monitoring technique	Monitoring frequency
Emissions to air				
A1 (previously N.A1) CHP 3	418749, 439544	NOx (NO and NO_2 expressed as NO_2)	Extractive emissions testing in line with TGN M1 and BS EN 14792	Annual
		CO	Extractive emissions testing in line with TGN M1 and BS EN 15058	Annual
		Sulphur dioxide (SO_2)	Extractive emissions testing in line with TGN M1 and EN 14791	Annual
		Total VOCs	Extractive emissions testing in line with TGN M1 and EN 12619:2013	Annual
A2 (previously N.A2) Boiler 1	418749, 439544	NOx (NO and NO_2 expressed as NO_2)	Extractive emissions testing in line with TGN M1 and BS EN 14792	Annual
		CO	Extractive emissions testing in line with TGN M1 and BS EN 15058	Annual

[16] Annual throughput data includes use outside of installation boundary (within the wider Esholt WwTW)

Emission point	Grid ref.	Parameter	Monitoring technique	Monitoring frequency
		Sulphur dioxide (SO_2)	Extractive emissions testing in line with TGN M1 and EN 14791	Annual
		Total VOCs	Extractive emissions testing in line with TGN M1 and EN 12619:2013	Annual
A3 (previously N.A3) CHP 4	418749, 439544	NOx (NO and NO_2 expressed as NO_2)	Extractive emissions testing in line with TGN M1 and BS EN 14792	Annual
		CO	Extractive emissions testing in line with TGN M1 and BS EN 15058	Annual
		Sulphur dioxide (SO_2)	Extractive emissions testing in line with TGN M1 and EN 14791	Annual
		Total VOCs	Extractive emissions testing in line with TGN M1 and EN 12619:2013	Annual
A4 (previously N.A4) Boiler 2	418749, 439544	NOx (NO and NO_2 expressed as NO_2)	Extractive emissions testing in line with TGN M1 and BS EN 14792	Annual
		CO	Extractive emissions testing in line with TGN M1 and BS EN 15058	Annual
		Sulphur dioxide (SO_2)	Extractive emissions testing in line with TGN M1 and EN 14791	Annual
		Total VOCs	Extractive emissions testing in line with TGN M1 and EN 12619:2013	Annual
A5 (previously N.A5) CHP 1	418749, 439544	NOx (NO and NO_2 expressed as NO_2)	Extractive emissions testing in line with TGN M1 and BS EN 14792	Annual
		CO	Extractive emissions testing in line with TGN M1 and BS EN 15058	Annual
		Sulphur dioxide (SO_2)	Extractive emissions testing in line with TGN M1 and EN 14791	Annual
		Total VOCs	Extractive emissions testing in line with TGN M1 and EN 12619:2013	Annual
A6 (previously N.A6) CHP 2	418749, 439544	NOx (NO and NO_2 expressed as NO_2)	Extractive emissions testing in line with TGN M1 and BS EN 14792	Annual
		CO	Extractive emissions testing in line with TGN M1 and BS EN 15058	Annual
		Sulphur dioxide (SO_2)	Extractive emissions testing in line with TGN M1 and EN 14791	Annual

Emission point	Grid ref.	Parameter	Monitoring technique	Monitoring frequency
		Total VOCs	Extractive emissions testing in line with TGN M1 and EN 12619:2013	Annual
A7 (previously N.A7) Waste gas burner	418536, 439417	NOx (NO and NO_2 expressed as NO_2)	Extractive emissions testing in line with TGN M1 and BS EN 14792	Annual (only required if operational for more than 876 hours in a year)
		CO	Extractive emissions testing in line with TGN M1 and BS EN 15058	Annual (only required if operational for more than 876 hours in a year)
		Total VOCs	Extractive emissions testing in line with TGN M1 and EN 12619:2013	Annual (only required if operational for more than 876 hours in a year)
A8 (previously N.A8) Waste gas burner	418566, 439441	No monitoring of this source is required under current permit VP3130GZ/V004 and none is proposed.		
A9 (previously N.A9) Waste gas burner	418572, 439445	No monitoring of this source is required under current permit VP3130GZ/V004 and none is proposed.		
A10 Odour control unit 1 (Sludge screen feed tank)	418579, 439515	YW is committed to refurbishing the existing OCU at this emission point. Monitoring will be carried out in accordance with BAT 8 and the Esholt STF Odour Management Plan (refer to Appendix 10 for more details).		
A11 Odour control unit 2 (Mixed sludge tanks)	418619, 439484	YW is committed to refurbishing the existing OCU at this emission point. Monitoring will be carried out in accordance with BAT 8 and the Esholt STF Odour Management Plan (refer to Appendix 10 for more details).		
A12 Odour control unit 3 (Dewatering centrifuges pump station, THP feed silos, and THP feed hopper)	418708, 439501	YW is committed to refurbishing the existing OCU at this emission point. Monitoring will be carried out in accordance with BAT 8 and the Esholt STF Odour Management Plan (refer to Appendix 10 for more details).		

Emission point	Grid ref.	Parameter	Monitoring technique	Monitoring frequency
A13 Odour control unit 4 (Drum thickeners)	418537, 439347	YW is committed to complete an assessment of the effectiveness of this OCU. Monitoring will be carried out in accordance with BAT 8 and the Esholt STF Odour Management Plan (refer to Appendix 10 for more details).		
A14 Degassing tanks odour dispersion stack (Proposed to be replaced by odour control unit)	418652, 439449	YW is committed to covering the degassing tanks and routing gases to the biogas system / relevant assets. Therefore, it is proposed that this emission point will be removed.		
A15 Proposed odour control unit (Screen sludge transfer pump station)	418629, 439510	Monitoring will be carried out in accordance with BAT 8 and the Esholt STF Odour Management Plan (refer to Appendix 10 for more details).		
A16 Odour control unit (Cake import reception unit)	418760, 439490	Monitoring will be carried out in accordance with BAT 8 and the Esholt STF Odour Management Plan (refer to Appendix 10 for more details).		
A17 Odour control unit (Consolidation tank)	418703, 439426	Monitoring will be carried out in accordance with BAT 8 and the Esholt STF Odour Management Plan (refer to Appendix 10 for more details).		
PRVs – Biogas	Various	No emissions monitoring proposed due to nature of release point as an essential safety mechanism with very occasional and short duration use.		
PRVs - THP	Various	No emissions monitoring proposed due to nature of release point as an essential safety mechanism with very occasional and short duration use.		
Emissions to sewer				
S1	418193, 440273	No monitoring data is currently available. YW is committed to undertake a period of monitoring in order to fully characterise the liquors returned to the WwTW – refer to Q 6-8 Assessment of point source emissions to sewer for more details. Any ongoing monitoring requirements will be established after this initial monitoring, and subsequent analysis and assessment, has been completed.		
S2	418603, 439372			
S3	418857, 439189			
Emissions to ground				
W1	419142, 438895	No specific monitoring programme proposed. Discharge of clean roof water only.		
W2	419098, 438862			
W3	418762, 439546			

Selected process monitoring parameters are illustrated in Table C3: 4a-2. The site is operated under full PLC SCADA control with data logging and interrogation of key parameters to maintain safe, efficient and low emissions operation.

Table C3: 4a-2 Key process monitoring provisions

Emission point / description	Parameter	Monitoring approach	Monitoring frequency
Sludge intake	Intake volume	SCADA	Continuous during unloading operations
	% dry solids	SCADA	Continuous during unloading operations
CHP (A1, A3, A5, A6)	Operating hours	SCADA	Continuous data logging
	Electricity generated	SCADA	Continuous data logging
	Load required / actual (%)	SCADA	Continuous data logging
	Biogas flow / pressure to CHP	SCADA	Continuous data logging
	Heat circuit temperatures (deg. C)	SCADA	Continuous data logging
Boilers (A2, A4)	Load required / actual (%)	SCADA	Continuous data logging
	Biogas / natural gas flow / pressure to boiler	SCADA	Continuous data logging
	Heat circuit temperatures (deg. C)	SCADA	Continuous data logging
	Heat circuit flow	SCADA	Continuous data logging
Flare compound (A7)	Biogas to flare (m^3)	SCADA	Continuous data logging
	Run hours	SCADA	Continuous data logging
OCUs 1,2 ,3 ,4 (A10, A11, A12, A13)	Operational status	SCADA	Indication
Proposed Future OCUs (A14, A15, A16, A17)	Operational status	SCADA	Indication
Biogas storage (A8, A9)	Gas level (%)	SCADA	Continuous data logging
	Gas pressure (mb)	SCADA	Continuous data logging
	Methane %	SCADA	Continuous data logging
THP	Temperature (deg. C)	SCADA	Continuous data logging
	Pressure	SCADA	Continuous data logging
Digesters	Volume	SCADA	Continuous data logging
	Volatile Fatty Acids (VFAs)	Manual	Periodic
	Alkalinity	Manual	Periodic
	Process temperature	SCADA	Continuous data logging
	% solids (intake)	SCADA	Continuous data logging
	Retention (hours)	SCADA	Continuous data logging
	Temperature	SCADA	Continuous data logging
	H_2S (ppm)	SCADA	Continuous data logging
Centrifuges	Dry solids (%)	SCADA	Continuous data logging
	Flow	SCADA	Continuous data logging

4b Point source emissions to air only

The proposed sampling locations and facilities are assessed in Table C3: 4b-1, based on the requirements and recommendations provided in BS EN 15259 and Environment Agency M1[17]. The most recent MCERTS accredited stack emission test[18] carried out at the site reported:

"The sampling location meets all the requirements specified in EA Guidance Note M1 and EN 15259, and therefore there are no improvement recommendations."

Table 4b-1: BS EN 15259 / TGN M1 Assessment - Sampling Requirements

M1 Characteristic	BS EN 15259 relevant clauses	Requirement	Commentary
Sample plane location	6.2	As far downstream or upstream from any disturbance, which could produce a change in direction of flow (e.g. bends, fans).	Sampling ports are installed on a straight section of stack, substantially downstream and upstream of 90 degree bends where horizontal hot gas ductworks exits the boilers or enters the windshield. A constant cross-sectional area is present within the flues.
	6.2	In a section of duct with constant shape and cross-sectional area.	
	6.2	Recommend five hydraulic diameters* upstream and two hydraulic diameters downstream (or five hydraulic diameters from the top of the stack)	
Sample plane orientation	6.2	Installation of sample plane in vertical stacks is preferred to horizontal ducts	The sampling plane is horizontal due to the boiler house and stack configuration.

[17] Environment Agency Technical Guidance Note (Monitoring) M1 (2010), now superseded by online resource 'Guidance: Monitoring stack emissions: measurement locations'

[18] Element Materials Technology (2021), Job Reference Number EMT00508

M1 Characteristic	BS EN 15259 relevant clauses	Requirement	Commentary
Exploratory survey	6.2	It is advised that an exploratory velocity traverse is carried out before committing to installation	The ports are installed and reported as compliant. Due to the narrow diameter, homogeneity testing in line with the requirements set out in BS EN 15259 is not required, as per guidance[19].
Flow criteria	6.2	Angle of gas flow less than 15° to duct axis.	The recent monitoring exercise reports no deviations to the required standards.
	6.2	No local negative flow.	
	6.2	Minimum velocity (a differential pressure of 5Pa, which equates to 3 ms-1).	
	6.2	Ratio of the highest to lowest gas velocity less than 3:1.	
Measurement ports	6.2	Planned at detailed design stage because retrofitting can be expensive (for example ducts may have protective linings).	The number, location and type of measurement ports were designed having regard to TGN M1; the recent monitoring exercise reports no deviations to the required standards.
	6.2	Allows access to sample points.	A temporary sampling platform is installed which allows compliant sampling from all ports
	Annex A	It is recommended that for small stacks (less than 0.7m diameter) a socket of 75mm is acceptable.	Sample ports are sized appropriately to the equipment to be used for monitoring. The ports are accessible via the platform for maintenance.

[19] Method Implementation Document for EN 15259:2007, Environment Agency, v3, May 2019

M1 Characteristic	BS EN 15259 relevant clauses	Requirement	Commentary
	-	The port socket must not project into the gas stream.	The recent monitoring exercise reports no deviations to the required standards.
	Annex B	Additional ports may be required to allow access for measurement of other quantities (for example velocity and water vapour)	N/A
	6.2	Additional ports for CEMS (if applicable)	No CEMS is installed or proposed – not applicable.
	-	The operator must maintain the ports in good condition and free them up prior to work being undertaken	The ports are accessible
Identification	6.2	Clearly identified and labelled measurement section	The ports are clearly identifiable.
Load bearing capacity	6.2	Permanent and temporary working platforms must have a load bearing capacity sufficient to fulfil the measurement objective	A temporary working platform is provided when required; the structure is designed for appropriate loading for all sampling and maintenance activities.
Position and working space	6.2	Sufficient working area to manipulate probe and operate the measuring instruments, without equipment overhanging guardrails	A suitable temporary working platform is provided, which facilitates manipulation of probes and operation of measuring instruments.
	6.2	A sufficient depth of the working area is given by the internal diameter or depth of the duct and the wall thickness plus 1.5 m	

M1 Characteristic	BS EN 15259 relevant clauses	Requirement	Commentary
	6.2	If two opposite measurement ports are installed for one measurement line, a correspondingly smaller working area is required	N/A
	6.2	Its recommended that vertical ducts have a working height from the platform to the ports of 1.2 to 1.5m	A temporary working platform is provided when required; the structure is designed for appropriate loading for all sampling and maintenance activities.
	-	Removable chains or self-closing gates at the platform to prevent workers falling through access hatches or ladders.	Safe access is provided, including fall protection.
Fall prevention	-	Upper handrails at a minimum of 950mm (910mm allowed for old handrails). Gaps in rail no bigger than 470mm. Toe boards required	Fixed guard rails are reported to be provided on the temporary platform (at 0.5m and 1m); vertical base boards are also provided (Elements, 2021)
	-	Consider installing personal protection systems on vertical ladders	
Access	6.3	Easy and safe access available	Temporary access provisions are reported by the MCERTS contractors as ‘safe’ and ‘easy’
	-	Consider installing work restraint systems on vertical ladders	
Power supply	6.3	Single phase 110V electrical power of a suitable current provided by a suitable number of sockets at the platform	Adequate and safe electrical supply provisions are made.

M1 Characteristic	BS EN 15259 relevant clauses	Requirement	Commentary
Lifting equipment	6.3	Lifting systems for raising and lowering of equipment, where access to the sampling platform is by vertical, or steeply inclined, ladders or stairs	Not applicable
	-	Lifting systems (for example, hoists) and attachments (for example, eyes) must be inspected and maintained by a competent person	
	-	Installation of a support structure for securing portable lifting systems (handrails are not usually suitable for supporting lifting systems)	
Monorails	-	Consider sampling monorails above the sampling ports to enable certain designs of sampling train to be suspended.	Not applicable
Exposure to gas	6.3	Avoid areas of sources which emit unexpectedly, for example rupture discs, overpressure valves and steam discharges.	Compliant
Exposure to stack gas	6.3	Avoid areas of significant positive pressure.	Monitoring takes place internally, but the building has adequate natural (passive) ventilation.
Awareness	6.3	Consider how stack emission monitoring personnel are informed of operating faults that may endanger them?	All monitoring works would be under a permit to work scheme, which includes a detailed Risk Assessment and Method Statement (RAMS).
Ventilation	-	Well ventilated.	Monitoring takes place internally, but the building has adequate natural (passive) ventilation.

M1 Characteristic	BS EN 15259 relevant clauses	Requirement	Commentary
Heat and dust	6.3	Protection of the working area from heat and dust.	No dust sources within working space. Twin walled flue design (internal flues with windshield), no specific personnel protection required for heat above normal safe site working conditions.
Weather protection	6.3	Protective measures (for example, weather protection and heating to ensure conditions are appropriate for personnel and equipment).	Internal sampling
Lighting	-	Artificial lighting or facilities for temporary lighting.	Internal sampling, area and task lighting as required.

6 Resource efficiency and climate change

6a Describe the basic measures for improving how energy efficient your activities are

YW consumption and generation data is collated and stored within a web-based energy database. This enables the business to produce bespoke reports as required by internal stakeholders.

Monthly energy consumption hubs are held to review ongoing energy use and performance. These are supported with discussions regarding how asset operation can be modified, or capital intervention made, to reduce energy use. This is further supported by YW requirements under the Energy Saving Opportunity Scheme (ESOS) compliance programme. YW conducts energy surveys that are discussed with the site operational teams. The findings of the surveys are collated into a final report and presented to senior management.

YW have published performance commitments in relation to the amount of biogas that is derived from the sludge processed. The higher the efficiency of biogas production the greater the potential for electricity generation. There is a daily generation hub that seeks to identify any generation issues and rectify them promptly.

Overall annual energy and carbon performance is publicly shared via the company annual report as part of the Streamlined Energy and Carbon Reporting (SECR) requirements.

Energy is monitored and managed on a regular basis through the Energy and Recycling Team. Energy consumption and energy generation reports are run and reviewed regularly and are recorded on YW's Performance Zone. YW also participates in a number of mandatory and voluntary carbon reporting schemes. YW sets itself targets for energy consumption and energy generation at both a strategic and operational level. YW has dedicated teams which focus on:

- Maximising renewable energy generation; and
- Implementing strategic and site-specific energy efficiency projects.

Table C3: 6a-1 below describes the measures taken on site to minimise energy use.

Table C3: 6a-1 – Energy efficiency measures

Operating and maintenance	**Documented measures in place**	
Regular testing and maintenance of biogas systems for leaks, seals, and condensate traps	Yes	Maintenance/servicing undertaken by qualified technicians and registered organisations. Records are maintained on site.
Operation of motors and drives	Yes	Regular inspections/lubrication & maintenance undertaken by qualified technicians and specialist contractors. Records are retained.
Compressed air systems	Yes	On-going leak detection and repair programme undertaken by qualified technicians.
Hot water systems	Yes	Digester system monitored constantly and inspected and tested regularly by an operator and recorded.
Lubrication to avoid high friction losses	Yes	Technicians and specialist contractors carry out regular lubrication, including CHP engine oil change, and records are maintained.
Boiler maintenance e.g. optimising excess air	Yes	Carried out as per legislative requirements and YW procedures.
Physical measures	Documented measures in place	
Sufficient insulation of heated vessels and pipework	Yes	Inspection and housekeeping to check condition of insulation; repair or replacement carried out as necessary
Provision of sealing and containment methods to maintain temperature	Yes	Anaerobic digesters are enclosed.
Other appropriate measures	Yes	Daily operational inspections are conducted to check for aspects such as leaking tanks and pipework
Building services	Documented measures in place	
Energy efficient lighting is in place	Yes	There are limited building service requirements on site, energy efficient options are provided where readily available, and when equipment comes up for renewal
Space heating	Yes	
Hot water	Yes	
Temperature control	Yes	
Ventilation	Yes	
Draft proofing	Yes	
BAT conclusions for energy recovery	Documented measures in place	
Heat recovery (please specify where from and add more lines if appropriate)	Yes	Heat recovered from CHP engines via boiler economisers used for steam raising for THP operations as well as feeding the low temperature hot water (LTHW) ring main. This is exported to provide space heating for the adjacent Esholt Hall owned and operated by YW as well as pre-heating biogas feed to the CHPs.

Heat exchangers (explain where fitted and add more lines if appropriate)	Yes	Heat exchangers are used in the CHP engine and boiler economisers. The LTHW ring main is fed from the boilers and also receives heat from the engine jacket and oil cooling systems through plate heat exchangers. This is exported to provide space heating for the adjacent Esholt Hall (owned and operated by YW) as well as pre-heating biogas feed to the CHPs.
Re-use of spent cooling water	N/A	
Minimisation of water use and re-circulating water systems for energy saving	Yes	Preference is given to the use of final treated effluent rather than mains water where water quality demand allows.
Good insulation	Yes	All boilers, anaerobic digesters and pipework are insulated
Plant layout to reduce pumping distances	Yes	Where existing layout allows

6b Provide a breakdown of any changes to the energy your activities use up and create

The main site energy sources are electricity from the public supply, gas oil (used to fire boilers 1 and 2 only) and biogas generated by the anaerobic digesters which is combusted in the CHP engine to generate electricity. Heat is also recovered from the CHP and used in the two composite boilers and waste heat boiler to generate steam for the THP and hot water for the LTHW ring main. The LTHW ring main in term provides space heating for the adjacent Esholt Hall as well as pre-heating biogas feed to the CHPs. Biogas is also used as back-up fuel supply for the composite boilers.

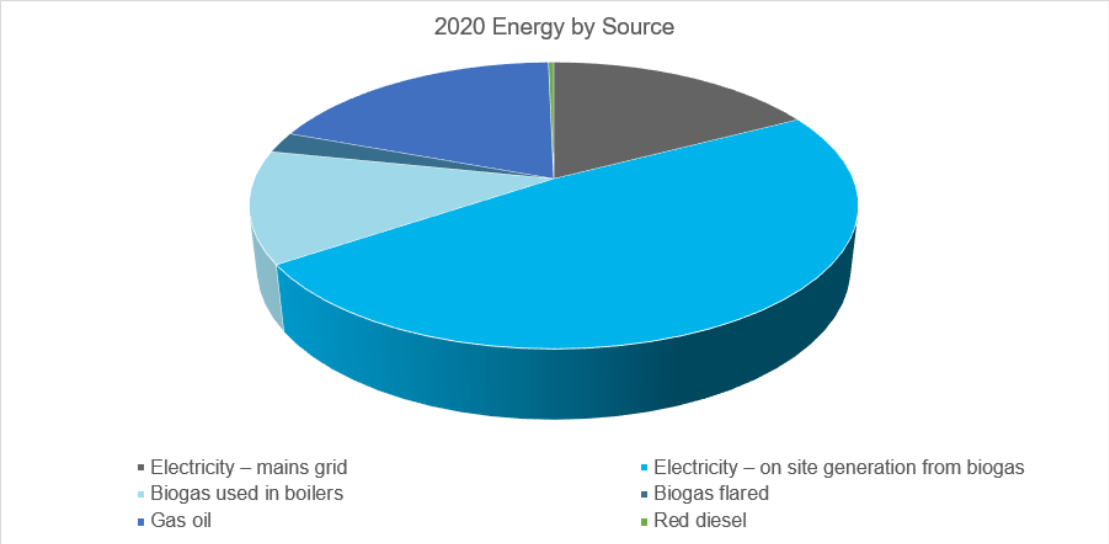
Table C3: 6b-1 shows the energy balance for the site. Electricity generated on site is used to power site equipment. There is currently no facility to export any excess to the national grid. To maintain control of energy consumption, and improve it where possible, electricity and fuel consumption is reported and reviewed on a regular basis.

YW is currently investigating the option of bringing a gas connection onto site to provide mains gas for operation of these steam raising boilers. This solution would replace gas oil as the main fuel source.

Table C3: 6b-1 – Typical annual energy use

Energy Source	Energy Consumption MWh [20]		
	Delivered	Primary	% of total (primary)
Electricity – mains grid [21]	6,697	16,074	17.3
Electricity – on site generation from biogas [22][23]	15,017	44,809	48.3
Biogas used in Boilers[24]	11,739	11,739	12.6
Biogas flared[24]	2,211	2,211	2.4
Gas oil used in boilers [25]	17,665	17,665	19.0
Diesel [26]	313	313	0.3

Figure C3: 6b-1 – 2020 energy by source



[20] Using 2020 data
[21] Electricity imported includes the use for the whole site not just the permitted activities due to metering arrangements.
[22] Delivered value is recorded electricity generation (net of exported value of 231MWh).
[23] Primary value is calculated from measured biogas used in the CHP, measured average biogas methane content of 63% and the calorific value of methane 37.706 MJ per m3 (OFGEM 2016 / ISO 6976:1995).
[24] Figures derived from measured biogas use, measured average biogas methane content of 63% and the calorific value of methane 37.706 MJ per m3 (OFGEM 2016 / ISO 6976:1995).
[25] Gas oil is the primary fuel source for the steam raising boilers (with biogas as back-up fuel). 1,643,893 litres consumption, energy derived using DUKES 2019 calorific values of fuels.
[26] A small amount of road diesel is used in off-road vehicles e.g. cake handling on pad. 29,100 litres consumption, energy derived using DUKES 2019 calorific values of fuels.

Global warming potential (GWP)

The CHPs are operated as renewable energy generation plant; therefore there are no direct emissions of carbon dioxide (a greenhouse gas) resulting from the combustion of biogas in the CHPs. However, there are direct CO_2 emissions as a result of combustion of gas oil in the two composite boilers. There are also indirect emissions of CO_2 resulting from the use of imported electricity. At present, due to metering arrangements, it is not possible to apportion electricity usage to just the permitted activities within the installation, therefore site wide (Esholt WwTW) usage is reported in this section. The CO_2 equivalent (CO_2e) emissions for the plant are set out in Table C3: 6b-2, together with overall GWP calculation.

There will be some losses of biogas (methane) from the plant (a substance with a high global warming potential, at least 21 times higher than CO_2), resulting from unquantified fugitive losses from the biogas system (see LDAR programme). These have not been included in the GWP calculation as no data is available.

Table C3:6b-2 – Global warming potential

Substance	Energy source	Energy Consumption in 2020– Primary (MWh)	CO_2 emission factor (T/MWh) [27]	Mass CO_2 released (tonnes/yr)	Global warming potential	Overall Global Warming Potential (TCO_2 / yr) [28] [29]
Carbon dioxide	Electricity (mains) imported	16,074	0.166	2,668	1	2,668
	Biogas	66,177	0	0	0	0
	Gas oil	17,665	0.25	4,416	1	4,416
	Diesel	313	0.25	78	1	78
Total GWP						7,163

6c Have you entered into, or will you enter into, a climate change levy agreement?

No, the activities are not eligible to take part in the CCL Scheme.

The production and use of biogas to produce heat (which is used in the process) and electricity used on site, is the single greatest measure which allows the site to minimise its use of fossil fuels and maximise the use of energy, whilst recovering biological wastes. Biogas may be used in any of the four CHP or two composite boilers on site and therefore biogas flaring is rarely required.

[27] Factors from https://www.gov.uk/guidance/assess-the-impact-of-air-emissions-on-global-warming
[28] These calculations do not consider the CO_2 equivalent amount which is avoided through the avoidance of releasing methane which has a much higher GWP than CO_2
[29] Does not include fugitive losses of methane, which are considered low and are not quantified (see LDAR)

6d Explain and justify the raw and other materials, other substances and water that you will use

Information related to raw materials use and selection is provided above in response to Q3c.

Water minimisation

Water use within the installation is not significant due to the nature of operations/activities undertaken within the installation. Water is used in small quantities for domestic use within control buildings and is also used as make up fluid for chemicals (polymer), for sludge dewatering processes, as boiler feed water and for some cleaning activities i.e. sludge intake screens, thickener drums, washdown in some areas.

Measures are in place to ensure that water is used only where necessary and preference is given to the use of final treated effluent rather than mains water. The primary water users are listed below, along with the source of water.

Table C3:6d-1 – Water use

Use	Source
Domestic use within control / welfare building	Mains potable water
General cleaning/hosing of external hardstanding surfaces	Final treated effluent and potable for internal cleaning activities
Sludge import screen washing (automated)	Final treated effluent and potable
Imported sludge cake re-wetting	Final treated effluent
Mixing with liquid polymer for sludge thickening and dewatering processes	Mains potable water used for product make-up. Final effluent is used as the carrier water during dosing.
Digester anti-foam washwater spray	Final treated effluent
Boiler feed water	Mains potable water

6e Describe how you avoid producing waste in line with Council Directive 2008/98/EC on waste

Waste Minimisation

The site is designed and operated as a waste recovery plant and as such minimises waste generation from its own operations. Other than sludge cake, generation of waste is generally minimal and, largely limited to packaging or scrap materials associated with engineering projects. Where practical materials are transported to site and stored in bulk or containers are returned to the supplier.

A summary of waste generated as a result of activities undertaken within the Esholt STF is provided in Table C3 6e-1 below.

Table C3 6e-1 – Waste streams

Waste Type	Nature of material	Storage arrangements	Treatment / disposal method	Annual production (tonnes)[30]
Sludge screenings	Non-hazardous	Stored within a skip prior to collection by approved waste contractor	Landfill	450
Waste oil	Hazardous	Stored within bunded container prior to collection by approved waste contractor	Recycle	1.9
General waste	Non-hazardous	Stored within a dedicated container prior to collection by approved waste contractor	Recycle or energy from waste	10
Metals	Non-hazardous	Stored within a skip prior to collection by approved waste contractor	Recycle	5
Mixed recycling	Non-hazardous	Stored within a dedicated container prior to collection by approved waste contractor	Recycle (or if contaminated may be energy from waste)	1.2
Wood	Non-hazardous	Stored within a skip prior to collection by approved waste contractor	Recycle (or if contaminated may be energy from waste)	4
Empty IBCs	Hazardous	Stored in a dedicated container prior to collection by approved waste contractor	Recycle	0.3

[30] Waste data is estimated on the basis of waste arisings data for Esholt WwTW as a whole and from waste data for comparable YW STF sites.

Waste Type	Nature of material	Storage arrangements	Treatment / disposal method	Annual production (tonnes)[30]
Oil contaminated absorbents	Hazardous	Stored in a dedicated container prior to collection by approved waste contractor	Recycle	0.2
Oil filters	Hazardous	Stored in a dedicated container prior to collection by approved waste contractor	Recycle	0.1

Best Available Techniques: Waste storage, handling and transfer (*BAT 4 and 5*)

IMS procedures specify appropriate measures to ensure compliance with applicable legislation and to control and minimise pollution risks. Controls to minimise environmental risks associated with waste storage, handling and transfer include:

- Waste materials are stored on site for the shortest practicable period of time, in suitable, fit for purpose containers located on areas of hardstanding and away from sensitive receptors such as the River Aire. Waste containers are clearly labelled with their intended contents and container storage capacities are not permitted to be exceeded. Site housekeeping inspections are undertaken to ensure these standards are maintained.
- Very limited quantities of hazardous waste are generated by site activities. This is limited to items such as batteries, aerosols, waste oil and fluorescent tubes. Hazardous waste is always stored in secure containers, away from sensitive receptors and segregated from other waste types.
- Procedures are in place to ensure waste 'duty of care' requirements are met including ensuring that waste is only removed from site by contractors properly licenced and approved for use and accompanied by a fully completed waste transfer or hazardous waste consignment note. Waste transfer and consignment note records are retained electronically or as paper copies on site. Effective implementation of these procedures is supported by training for YW personnel as appropriate.
- Controls are in place to prevent pollution as a result of sludge storage and handling. Following reception on site, sludge is fully contained within tanks and pipework until it is deposited, as digested sludge cake on the cake pad. Surface water runoff from the cake pad is fully contained and is discharged back to Esholt WwTW for treatment. Sludge storage and handling areas are located away from sensitive receptors such as the River Aire.

Form C6 Supporting Information

3 How much do you want to discharge?

3b, c, d and f

All liquor from raw and digested sludge thickening and dewatering processes, condensate (e.g. from biogas handling), cleaning / washdown effluent and all surface water runoff, other than roof water from two buildings on site, is collected and discharged via underground drainage systems to the Esholt WwTW for full treatment prior to discharge to the River Aire.

YW do not currently undertake any routine monitoring of this discharge. It is noted that these discharges include surface water runoff from hardstanding areas within the installation, including the cake pad and therefore discharges will vary according to rainfall.

Calculations have been used to estimate the volume of effluent returned to Esholt WwTW. These values have been provided for indicative purposes and not for the purpose of deriving any permit conditions at this time. The estimated figures presented have been calculated as follows:

Figure C6: 3-1 – Process return calculation

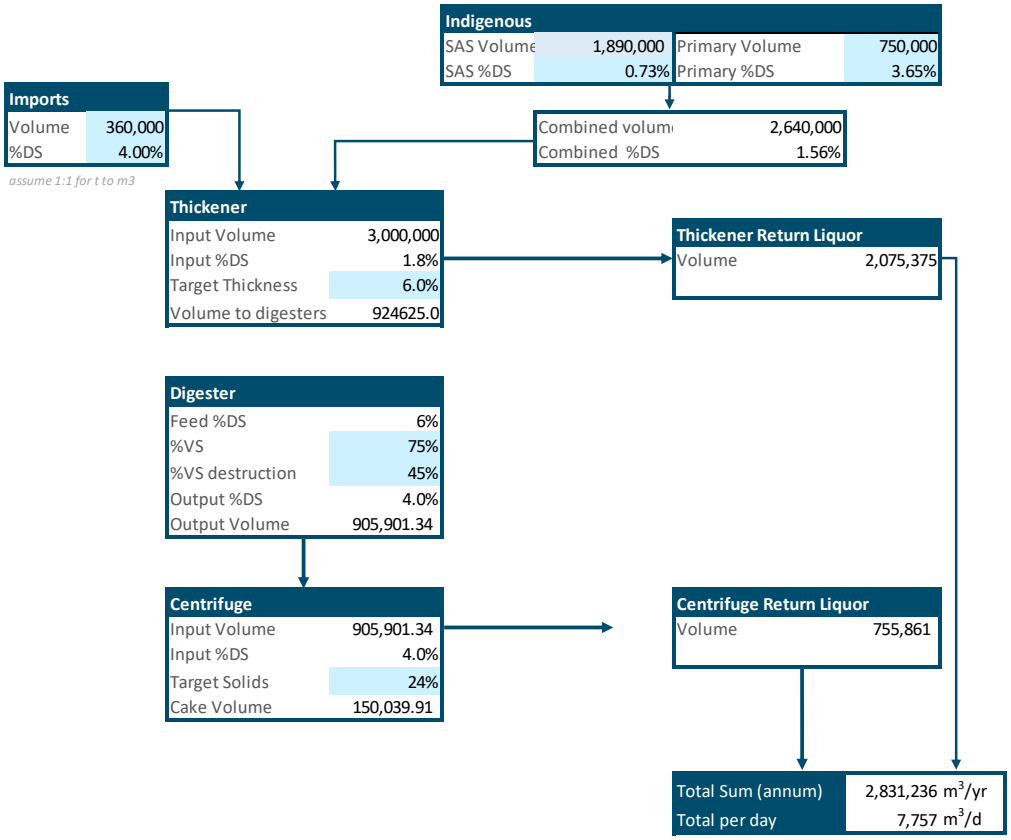


Figure C6: 3-2 – Rainfall plus process return calculation

Main AD area	1,000	m^2
Dewatering Area	810	m^2
Cake pad surface area	455	m^2
Average Rainfall (annum)	1000	mm

Source: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/regional-climates/north-east-england_-climate---met-office.pdf

Source: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/regional-climates/north-east-england_-climate---met-office.pdf

Highest monthly rainfall (mm)	92	mm
Daily rainfall (mm) (averaged)	3.07	mm
Cake pad surface area	455.00	m^2

Expected cake pad runoff (annum)	2,265,000	Litres	≈	6.21 M^3/d
Estimated cake pad runoff per day (based on highest monthly rainfall data)	1,395.33	l/d		
Highest run off (cubic metres per day)	1.40	m^3/d		
+				
Process returns	7757	m^3/d		
=				
Sum worst case cake pad run off and process returns	**7758.21**	**m^3/d**		

5a, b2 Should your discharge be made to the foul sewer?

Form C6 directs YW to answer questions 5a and 5b2. These questions cannot be answered by YW as the STF is co-located on site with the WwTW. These questions appear to be directed at applicants who wish to discharge to surface water or groundwater, which does not apply to YW (all effluent/contaminated water is returned to the WwTW).

No further information is therefore provided in relation to these specific questions.

6a, b, c How will the effluent be treated?

All liquor from raw and digested sludge thickening and dewatering processes, condensate (e.g. from biogas handling), cleaning / washdown effluent and all surface water runoff, other than roof water from two buildings on site, is collected and discharged via underground drainage systems to the co-located Esholt WwTW for full treatment prior to discharge to the River Aire. YW do not undertake effluent treatment within the STF installation boundary.

7b, c, d, e, f, g What will be in the effluent?

All liquor from raw and digested sludge thickening and dewatering processes, condensate (e.g. from biogas handling), cleaning / washdown effluent and all surface water runoff, other than roof water from two buildings on site, is collected and discharged via underground drainage systems to the Esholt WwTW for full treatment prior to discharge to the River Aire. This position has been managed for a long period within YW without a requirement for a formal discharge consent between the YW STF and the YW WwTW. The WwTW treats effluent from off site and from the STF, and has consent limits in place covering all outputs. Therefore, there has been no requirement to separately characterise or assess the outputs from the STF, or any effects of these on receiving waters, separately from the wider WwTW. As such there is no such information available at this time.

YW is committed to undertake a period of monitoring in order to characterise the liquors returned to the WwTW. The programme of monitoring is identified in response to Form C2, Q6-8. Samples will be taken manually from a suitable location(s) upstream of the WwTW inlet, and will be submitted to a laboratory facility that can test to the appropriate standard. It is proposed this sampling will be carried out for a period of 12 months. The data will be used to complete an environmental impact assessment in accordance with Environment Agency guidance. The findings of the monitoring, analysis and impact assessment will be provided to the Environment Agency within 18 months of permit issue (refer to Proposed Improvement Programme below).

8d, e, f Environmental risk assessments and modelling

Refer to information provided above in response to question 7.

9a, b, d, e, f, h, i Monitoring arrangements

YW do not currently undertake any routine monitoring of effluent discharged to the co-located Esholt WwTW. There is no flow monitoring and sampling equipment currently in place or proposed at this time. The grid reference of emission points and proposed sampling points for S1, S2 and S3 (refer to Figure 3) are as follows:

Table C6: 9-1 – Location of emissions and sampling points

Emission Point Ref	Location	
	Emission point	Proposed sampling point
S1	418193, 440273	418193, 440273
S2	418603, 439372	418608 439363
S3	418857, 439189	418857 439189
N/A – sampling point for waste water emissions from the adjacent composting operation	N/A	418959 439030

10a, b, c Where will the effluent discharge to

Form C6 directs YW to answer questions 10a, b and c. These questions cannot be answered by YW as there is no option that applies to discharges from the installation. These questions appear to be directed at applicants who wish to discharge treated effluent to the receiving environment, which does not apply to YW (all effluent/contaminated water is returned to the WwTW).

No further information is therefore provided in relation to these specific questions.

Proposed Improvement Programme

IP Ref.	Related Section	Requirement	Time from receiving permit
1	Q6-3	Implement measures to reduce emissions and odour from diffuse and (non-combustion) point sources (refer to the summary of emissions abatement proposals provided in the table below).	End of 2024
2	C2: Q6-6	Undertake further bioaerosol monitoring and assessment.	18 months
3	C2: Q6-8	Complete return liquors monitoring programme followed by data analysis and assessment.	18 months
4	Appendix 11 (Containment Risk Assessment)	Engineering feasibility assessments and detailed design in respect of identified containment enhancements.	End of 2024

Summary of emissions abatement proposals

Sludge source	Proposed emissions abatement
Odour dispersion stack for sludge screen feed tank (OCU 1)	YW will refurbish / reinstate this OCU to ensure effective treatment of odours from this source.
Consolation tank 5	YW will install a fixed tank cover and extract and treat odour in a new OCU.
Odour dispersion stack for mixed sludge tanks (OCU 2)	YW will refurbish / reinstate this OCU to ensure effective treatment of odours from this source.
Sludge cake reception storage vessels	YW will connect the sludge cake reception storage vessels to an existing OCU (OCU 3).
SAS storage tanks (2 no.)	YW commit to • Undertake emission monitoring at these tanks (as minimum this will include H2S, ammonia, TVOCs and methane). The purpose of the monitoring is to confirm that emissions from these SAS tanks are consistent with low emissions measured at other YW sites. • Assuming low emissions can be confirmed, cover these tanks with floating plastic balls.
OCU 4 (SAS thickeners)	Single stage OCU in operation and no operational issues are reported. However, no monitoring data is currently available. An assessment of the effectiveness of this OCU will be carried out. YW will undertake any refurbishment work that may be required in order to ensure effective OCU operation.
SAS transfer tanks (2 no.)	YW commit to • Undertake emission monitoring at these tanks (as minimum this will include H2S, ammonia, TVOCs and methane). The purpose of the monitoring is to confirm that emissions from these SAS tanks are consistent with low emissions measured at other YW sites. • Assuming low emissions can be confirmed, cover these tanks with floating plastic balls.
Thickener liquor sump	YW will install a fixed tank cover and extract and treat odour in an existing OCU (OCU 4). Refer to proposed improvement programme.

Sludge source	Proposed emissions abatement
Centrate pumping station – raw sludge centrifuges	YW will install a fixed cover and extract and treat odour in an existing OCU (OCU 3).
Odour dispersion stack for THP feed silos and THP hopper (OCU 3)	YW will refurbish / reinstate this OCU to ensure effective treatment of odours from this source. .
Dispersion stack for degassing tanks	Existing tank air extraction to be routed to biogas system. Biogas from these tanks to be collected and utilised.
Dewatering feed tanks (4 no.)	Cover tanks with floating plastic balls. It is noted that digested sludge sources are inherently lower emissions generation potential and that these tanks are located a significant distance from the biogas system.
Liquor pumping station – Export centrate sump	YW will install a fixed cover for this sump. It is noted that digested sludge sources have inherently lower emissions generation potential and therefore no emissions treatment is required.
Leachate pumping station	YW will install a fixed cover for this sump. It is noted that digested sludge sources have inherently lower emissions generation potential and therefore no emissions treatment is required.
Liquor balancing tanks (digested sludge liquor) (2 no.)	Cover tanks with floating plastic balls. It is noted that digested sludge sources are inherently lower emissions generation potential

Section IV: Figures

Figure 1 Site Location Plan

Figure 2 Site Layout Plan

Figure 3 Principal emission points

Figure 4 Drainage Plan

Figure 5 Drainage and Surfacing

Section V: Appendices

Appendix 1 Relevant Offences

Form C2 / Q3a Have you, or any other relevant person, been convicted of any relevant offence?

Yorkshire Water Services Ltd Relevant Prosecutions Record

Huddersfield Magistrates' Court 9 February 2011

On the above date YW pleaded guilty to breach of Section 85 (1) and (3) of the Water Resources Act 1991.

This incident relates to the Heaton Lodge site which partially treats sewage and then transports this treated sewage to the Cooper Bridge site.

On 9 August 2009 at approximately 4.10pm, an Environment Agency officer found a discharge to the River Don from the Heaton Lodge site. This was reported to YWS at 4.47pm but an off-duty YW colleague had already noted the discharge and reported it proactively 30 minutes earlier. An operator attended site at 4.30pm and identified the cause of the discharge to be a burst from a cracked rising main on the Heaton Lodge site.

The sludge pumps were immediately isolated, stopping the discharge some 30 – 40 minutes after it had first been noted by the off duty YW operator and the matter was escalated to senior management to inform them of the incident in line with the usual process.

YW offered to clean up the affected area but were informed by the EA officer that no clean-up was necessary. Service partners for YW attended on 10 August to locate the exact position of the main burst which was caused by excessive pressure thought to have been due to a blockage. The discharge from the main occurred in the area where it goes under the river. The area around the main was also bunded to contain any future spillages pending confirmation of the structural condition of the main. Visual inspections of the pipe work were maintained for a number of weeks following this incident as part of the site visits that are routinely undertaken.

Repairs were completed by 12 August when sludge transfer and full operations returned. The length of damaged pipe, 20m, was replaced and 75 metres of the main were jetted and CCTV was also carried out to ensure there were no other defects in the main. The total cost of the works was £16,800.

Since the incident, the main had been pressure tested to ensure the integrity of the main – no further incidents have occurred since August 2009 and the further testing did not establish any need for further repair works. The volumes and pressures pumped in this main were reduced following the incident due to a change in the process of transporting the sludge.

The evidence from the EA covered the potential effect, and the actual chemistry/biology however there's no indication that this incident affected the watercourse in terms of its flora and fauna. There was no fish kill. In fact, YWS offered to clean up the watercourse on the day of the incident and were informed that this was not necessary.

The watercourse recovered rapidly. There was no evidence put forward by the EA to suggest that the effect was medium or long term, supported by the EA's contention that a clean-up was not required.

There was no evidence that the recreational use around the discharge point had been adversely affected. The Magistrates accepted that there had been no "flaunting of the law" by the Company. They noted that there was no significant damage to flora or fauna and that the watercourse recovered rapidly. On the issue of culpability, they accepted that the Company did not deliberately break the law and they further noted that the Company did not achieve any economic gain through the commission of this offence.

YWS was fined £10,000 and ordered to pay the EA's costs of £1,164.34.

Huddersfield Magistrates' Court 9 February 2011

On the above date YW pleaded guilty to breach of Section 85 (1) and (3) of the Water Resources Act 1991. This incident occurred on what is known as the Deighton site. This site receives crude sewage and undertakes preliminary treatment in the form of screening of any debris. The main in question transports this treated sludge to the Calder Valley incinerator, at the time of this incident.

At 7.45pm on 9 September 2009, a call was received from the EA that there had been a report of sewage from a local resident and it is noted what the EA state this resident said when reporting this issue. I would ask the Court to be mindful of the terminology used and place the appropriate reliance on this when considering what the customer may or may not have meant by this comment as there is no further evidence with regard to this statement and it clearly could not relate to actual measured flow. RTS which is the alarm system used by Yorkshire Water on its assets was checked immediately for any alarms but none were found.

An operator attended site at 8.30pm and was unable to safely locate the discharge as daylight was fading and for health and safety reasons, the operator ceased his investigation. Service partners for YW had previously been isolating the pumps on a daily basis as the pumps were being commissioned and therefore these pumps were only running between the hours of 7.30am – 6.00pm at the time of this incident. On 9 September, the pumps had been turned off when the operator attended so there was not a discharge left to continue by the operator leaving site.

On the morning of 10 September, the pumps were set running again at 9.05am. The exact point of the discharge which had proved difficult to find due to the excess of overgrowth on the wall was then located. An EA officer was on site and aware that the pumps had been set to run again and at 10.15am witnessed the discharge point. The pumps were immediately stopped.

On 10 September at 11.30am, service partners for YW began the repairs to the main which resulted in a 4m length being replaced. The repairs were made difficult by the presence of a large tree adjacent to the burst. This is believed to have been a contributing factor to the cause of the burst as the tree had displaced the main. CCTV operations were also undertaken on the main, 100m to establish its overall condition with no defects found.

All sludge was tankered from site and any debris observed in the river was completely removed by YW operations. The main was subsequently flushed with treated final effluent

and a full CCTV survey was undertaken with no defects identified, the main was found to be in good condition and was brought back into service on 12 September.

Following this incident, the tree and its roots were completely removed to avoid any repeat incident once YW were aware of the contribution of this tree to this incident. The entire length of the main has been cleaned out and a pressure monitor has been placed on the main so that in future, if the pressure rises due to a blockage or any problem, the pumps will cease pumping to avoid a burst. The monitor is alarmed to notify YW of a problem. Together with the cost of the repair works immediately after the incident and the further cleaning works, a total of approximately £375k has been spent on this main.

The evidence from the EA covers the potential effect, and the actual chemistry/biology however there's no indication that this incident affected the watercourse in terms of its flora and fauna.

There was no fish kill. YWS offered to clean up the watercourse and carried out these operations immediately with the agreement of the EA. No further actions were requested by the EA following their further investigations.

There was no evidence put forward by the EA to suggest that the effect was medium or long term. There was no evidence that the recreational use around the discharge point has been adversely affected. They noted that this was a Category 1 offence. It was however noted that there was no significant permanent damage to the flora or fauna. In respect of culpability, there was no deliberate pollution to the watercourse and no economic gain. They had considered all the environmental credentials and investment for the company and they also noted the significant investment in this main since the incident had occurred.

YWS was fined £12,000 and ordered to pay the EA's costs of £1,897.93.

Scarborough Magistrates' Court 6 May 2011

YWS was prosecuted for an offence that on or before 26 April 2010 it did cause a water discharge, namely the entry of waste into the Runswick Beck, Runswick Bay other than in accordance with an environmental permit contrary to Regulations 12 (1) (b) and 38 1 (a) of the Environmental Permitting (England and Wales) Regulations. This was the first offence to be prosecuted under the new regulations.

At 4:26pm on 26 April, YWS was contacted by the EA via Loop informing it of potential pollution incident at Runswick Beck. YWS was directly informed by Loop at 4.40pm and a job was raised for the standby operator who was on site for 5:05pm (some 40 minutes after the first contact).

The operator confirmed that the detention tank on site was full and the overflow was active. The pumps appeared to be running but they were failing to keep on top of the flow. No alarms had been received from the site as it was established that the ultrasonic head that records levels in the tank was inoperable as it had been removed from the tank and placed on top of the tank. The reasons for this were unknown as was both the identity of the person who removed the ultrasonic head and when this was done.

The tank was pumped down by the operator by putting both pumps on hand. The site was not designed to operate using both pumps and was on a duty standby arrangement, however, to try to solve the problem both pumps were in use. At 6:45pm, approximately two hours from the report of the incident by the EA, the discharge was stopped. The operator later noted a discharge from the rising main at Hinderwell and believed the rising main to be blocked which would have had the effect of reducing the SPS's capacity to pump in any event. As the operator had stopped the discharge, before he left site, he checked the watercourse and beach for any signs of debris. He found no such debris as the detention tank has a screened overflow.

A high-level flow was placed in the tank as a temporary indicator for any future high levels. The operator confirmed to the EA that he had stopped the discharge. The EA informed YWS that it would be attending the following day to take samples and requested a clean-up of the beck.

A job was raised for Lumsden and Carroll to clean up Runswick Beck but it did seem that the vegetation in the Beck had contained the majority of the flow. No debris was found. In agreement with the EA, only the top 20 metres of the Beck were cleaned for health and safety reasons. Investigations into YWS's own assets on 27 April established that the detention tank was full of sewage debris. The STRATE pump unit was also cleaned out.

On 28 April, the STRATE tank was cleaned out and its controls were also checked by an electrician. A large quantity of silt was found in the unit and the pumping propellers were also found to be worn. The detention tank had been cleaned out two years prior to this in accordance with our accepted process. It was cleaned out on 29 April and impellors were ordered which had to be delivered from Germany.

The rising main was found to have two of the three air valves clogged with fat and the third valve was found to be damaged – all of which were cleaned and replaced. Approximately £6k in costs was incurred in both the clean-up operation and repair and replacement of the relevant assets. Following the incident, the site was visited every other day, with daily monitoring of RTS.

Sample results taken by the EA showed a significant impact at the point of discharge. Sample results 300 metres downstream of the discharge point on 26 April, showed a lesser impact. Samples taken from the same place 300 metres downstream on 27 April showed a greatly reduced impact suggesting that the watercourse had improved significantly within 24 hours of the incident. The site now has an updated maintenance plan and the telemetry has been fully tested.

The Magistrates made the following comments: "We have listened very carefully to all that has been said today regarding this unfortunate incident at Runswick Bay. We have acknowledged that Yorkshire Water did respond exceedingly quickly. In our view, a response time of 25 minutes is exceptional. We have also noted the early guilty plea and given maximum credit for this."

YWS was fined £7,500 fine and ordered to pay the EA's costs of £1,581.67.

Rotherham Magistrates' Court 10 June 2011

YWS was prosecuted for an offence that on or before 24 April 2010 it did cause a water discharge, namely the entry of waste into the Blackwater Dyke, Aldwarke Lane, Rotherham other than in accordance with an environmental permit contrary to Regulations 12 (1) (b) and 38 1 (a) of the Environmental Permitting (England and Wales) Regulations.

At 11:05am on 26 April, YWS was informed via the EA of a discharge to Blackwater Dyke. YWS operatives were on site at Aldwarke Lane SPS at 12:30pm and found that both pumps at the site were inoperative. Pump no 1 was found to be blocked and the fuses had blown at pump no 2.

A job was immediately raised for an electrician and fitter to attend site. In the interim, straw bales were delivered to site and placed at the confluence of the Dyke and River Don to prevent solids moving into the River Don. Pump No 1 was lifted, unblocked and restored to normal operation on the same afternoon but pump no 2 was found to be burnt out so was removed from the wet well. The pumping station operated on a duty/standby basis and therefore one pump was capable of dealing with the flows.

The site was monitored overnight by standby operatives to ensure the pumping station continued to operate satisfactorily using one pump. No further issues were noted. On 27 April, a replacement pump no 2 was delivered but was not immediately fitted due to wet well restrictions. The site was monitored again overnight. Pump No 2 was installed on 28 April. On 30 April, the EA requested a clean-up of the Dyke and a recycler/vactor unit was requested which removed the surface liquids from the Dyke. No further works were required by the EA.

Aldwarke Lane SPS was monitored by telemetry, however, a telemetry failure was identified on 9 December 2009 which was not rectified until 28 April 2010. The pumping station was visited on a monthly basis prior to the incident and the last visit prior to the incident being on 1 April. The EA did not take any samples of the Dyke nor did it produce any photographs. There was therefore no evidence of the impact on the Dyke.

An employee of the EA witnessed this incident on Saturday 24 April whilst in the area socially. For reasons which had not been explained in his statement or elsewhere, he did not report this incident to any party until two days later on 26 April.

The Magistrates made the following comments: "We have been hearing a case prosecuted by the Environment Agency against Yorkshire Water. We have taken into account the statement from the Environment Agency that the breakdown of the telemetry had no bearing on the subsequent breakdown of the pumps. However, telemetry would have given an early indication of the problem and should not have taken 5 months to repair. We do however appreciate that Yorkshire Water took early action on being informed by the Environment Agency. We would have fined the company £5,000 but give maximum credit for the early guilty plea".

YWS was fined £3,750 fine and ordered to pay the EA's costs of £835.38.

Wakefield Magistrates' Court 18 July 2011

YW was prosecuted for an offence that on or before 7 April 2010 it did cause the entry of polluting matter, namely sewage waste, into the un-named tributary of the River Don to the North of Pugneys Country Park in the district of Wakefield, a controlled water, other than in accordance with a discharge consent contrary to section 85 (1) and 85 (6) of the Water Resources Act 1991.

On 7 April at 11.38am, YWS were informed of a discharge to the tributary by the EA. An operator was sent to site and noted a problem with the Denby Dale Road CSO. Around 1.5 tonnes of fat, rags, silt and grit were removed from the CSO chamber. At the time of the incident, the CSO telemetry data was not visible due to a fault with the alarm points. Data recovered since the incident indicates that the CSO began to discharge to the site detention tank on 11 February 2010 and ceased on 7 April 2010. The flow was being returned to sewer and there is no recorded data to indicate when the discharge to the watercourse may have commenced.

On the day of the incident, a bund was created using straw bales to prevent solid material reaching the River Don. A litter pick around the CSO outfall was also carried out. On 9 April, fat was again found to be accumulating in the CSO chamber which became partially blocked again. This blockage was cleared on the same day and the asset was proactively checked over the weekend and the watercourse also monitored.

On 12 April, the CSO and continuation sewer were completely cleansed by high pressure jetting. One storm pump was also found to be blocked, this blockage was also cleared that day. During that week, the CSO telemetry was also repaired and modified to make graphical data visible and a supplementary "pollution incident" alarm was created. On 13 April, YWS met with the EA and agreed to bund off the dyke upstream of the overflow and that the site would be monitored daily.

Since this incident, potential sources of the fact have been investigated but have not identified a source. All of these businesses who could be the potential source of the fat have been contacted to inform them of the problem and provide guidance on the correct disposal method. A cyclical monthly inspection of the asset has been raised to help identify any future accumulations of fat. This involves checking the CSO itself and a visual check of the outfall.

Prior to the incident, the Detention Tank was inspected on a routine visit on 2 March with no faults found. The pumping station was visited on 11 March which found a partial blockage in the CSO caused by fats which was removed during the same visit. The CSO itself receives a 3-monthly inspection – YWS guidance is that it should be every 6 months so the asset was already being visited more frequently.

The EA took two sets of samples on 8 April and 16 April. The former sample was taken from the point where the drain emerges from culvert into an open ditch. This sample does demonstrate an impact on the watercourse. The second sample taken by the outfall itself some 9 days after the incident was reported, show significantly lower levels for all of the components tested on 8 April. A number of photographs have also been provided.

YWS was fined £10,500 and ordered to pay the EA's costs of £2,324.67.

Calderdale Magistrates' Court 4 January 2012

On 4 January 2012 YWS pleaded guilty to an offence that on or before 1 April 2011 it failed to comply with Schedule 1, Conditions 11 (a) and 9 (a) (iii) of an environmental permit for waste water treatment and discharge, number WRA7510 in that the levels of biochemical oxygen demand and suspended solids discharged from the works were in excess of the permitted maximum amounts allowed under the said permit and caused pollution of the River Don contrary to Regulations 12 (1) (a) and 38 (2) of the Environmental Permitting (England and Wales) Regulations 2010 and Section 2 of the Pollution Prevention and Control Act 1999. The levels of BOD were 3.6mg/l over the levels normally permitted to be discharged to the watercourse being 73.6 mg/l rather than 70 mg/l or under.

The works in question suffered greatly as a result of the intense winter of 2010/11. The weather had affected a great deal of authorities and the public alike. By way of background, during this period maintenance work in the area, including this sewage treatment works, increased by 374% in January and 240% in February. The impact on the Copley works was severe. A number of assets were affected at the works which resulted in the increase in the levels of sludge being held back for treatment which resulted in the breach of the permit. It can be described almost as a domino effect on preceding treatment assets caused by the winter which then impacted the operation of the centrifuges which were required to operate consistently in a manner for which they are not designed.

A centrifuge is a large drum which is motorised and spins very fast like a washing machine. Wet sludge enters the drum and is spun such that the water is removed and the thickened sludge is passed forward as a cake. It is one part of the overall treatment process at the works.

At the works, there are two centrifuges and the design is for them to operate on what is known as a duty/standby basis. The importance of that is that only one centrifuge is ever required to operate. The standby is there to be called into operation should a problem arise with the duty asset.

The centrifuges are maintained on a 6-monthly basis by a specialist contractor and were last inspected on 3 February 2011 and in July 2010 prior to that. An issue was identified with one of the centrifuges which in turn led to its removal for repair on 10 February leaving one still in situ which is still within the design capacity.

The remaining centrifuge continued to operate at a lower continuous level of operation. It is important to note that this asset did not fail. However, as it was struggling to maintain required levels, a decision was made to bring in a further centrifuge unit which eventually ran on a 24-hour basis, 7 days a week. This arrived on site on 2 April. The levels of BOD on 10 March were 136mg/l. By 1 April 2011, YW had reduced the level of BOD by 50% to 73.6mg/l, 3.6mg/l over the permitted levels of discharge i.e. the levels which are set by the EA that can be safely discharged without any impact. Therefore, clearly the activity by YW had made a significant impact to the BOD levels.

This incident came to the prosecution's attention as a result of self-reporting by YW, there was no attempt to conceal the events on site nor any potential impact on the watercourse. YW were proactive in their communication to the EA to ensure there was full visibility of what was occurring on site. The EA attendance on site was solely in response to the YW contact.

There was no evidence from the EA of any impact on the watercourse other than the sample results provided and some photographic evidence. The sample results show that the levels of BOD were 3.6mg/l over the levels normally permitted to be discharged to the watercourse. It was submitted therefore that taking this into account, the impact on the watercourse was minimal given the close proximity of the final sample result to what is allowed to be safely discharged in all normal circumstances. Any impact in any event was short term if at all.

There was no fish kill nor is there any evidence submitted by the EA of any damage to flora/fauna or impact on recreational or amenity value.

The Yorkshire Water response was timely and effective with costs of approximately £60k being incurred as an immediate and subsequent consequence of the incident. Since the incident occurred, a full root cause analysis was undertaken resulting in a full review of the maintenance procedures to equipment upstream as it were of the centrifuge assets. Those assets were already on an appropriate system of inspection and maintenance which was adhered to prior to this incident. A further new action is a robust two-phase escalation process to reinforce monitoring levels on site in terms of sludge levels which now instigate new actions within the company. A new team leader has also been brought to the site to give more focus to these sorts of issues.

Yorkshire Water self-reported this incident to the EA and fully cooperated with them under interview. Yorkshire Water now has an understanding as to the impact of such a severe winter event which had not previously been seen for in excess of 30 years.

A fine of £5,000 was imposed against a maximum of £50,000. Costs were also awarded to the EA in the sum of £1,593.98.

Bradford Magistrates' Court 20 March 2012

On 20 March 2012 YWS pleaded guilty to 3 offences all contrary to Regulation 38(2) of the Environmental Permitting (England and Wales) Regulations 2010 as follows:

1. Between 17 April and 3 June 2011 at Copley Sewage Treatment Works there was a failure to comply with the permit in that the works were not operated in accordance with that permit through the storage of sludge in external areas.
2. Between 1 April and 24 June 2011 at South Elmsall Sewage Treatment Works there was a failure to comply with the permit in that sludge originating from Copley works and Wheldale works was stored and treated at the site.
3. Between 1 April and 24 June 2011 at South Elmsall Works there was a failure to comply with the permit through the storage of sludge in external areas for more than 2 days and was not stored in sludge skips.

The works at Copley suffered greatly as a result of the intense winter of 2010/11 which affected a great deal of authorities and the public alike.

By way of background, during this period maintenance work in the area, including this sewage treatment works, increased by 374% in January and 240% in February of 2011. The impact on the Copley works was severe. A number of assets were affected at the works which resulted in the increase in the levels of sludge being held back for treatment which resulted in a discharge outside of the permit for Copley. The Company having seen this discharge occur wished to take all measures to repeat a discharge to the watercourse outside of permitted levels.

There were 3 offences before the court relating to permits at 2 sites Copley and South Elmsall sewage treatment works (STW). The background to all 3 offences is as described above. As a result of the issues being seen on site against the backdrop of the situation referred to, a Company Response Management Team (CRMT) was set up on 5 April to make risk based assessments and decisions on the process to be undertaken to deal with the sludge storage. Both sites have permits to regulate the storage of sludge, at Copley, there is an internal storage area and at South Elmsall, the sludge is permitted to be stored externally in skips for no more than 2 days. The offences were not financially motivated. The Company having set up a CRMT which consists of senior management and operators alike, considered all options for the storage of this sludge. The usual process would have been to send the sludge to the Calder Valley incinerator. This incinerator was undergoing its annual programme of planned maintenance between 1-18 April. This is done on an annual basis with no previous impact on operations.

The other appropriate option was another site which due to potential employee risk, had been temporarily closed down pending works to remove that risk.

The final potential option, other than that taken, was to take this matter to landfill. As an environmental option, due to this not being a particularly environmentally friendly option against all others, the decision was taken not to do so. Therefore, the option to store this substance elsewhere or indeed to use alternative containers was not appropriate or indeed a viable option. In all the circumstances, considering availability and indeed environmental impact, the decision taken was the only decision available so it certainly was not a decision taken without full consideration and assessment of the company's responsibilities both with regards to its regulatory duties but also its duties to the environment.

Offence 1:

The internal storage area was full to capacity by 14 April. The decision was made to store the overflow externally which could be safely stored on areas which were considered appropriate to avoid any external impact via drainage or ground impact. Bales of hay were also placed around the stored substance to protect against any issues in the event of rainfall and to protect against seepage outside of these areas. As soon as the incinerator was available, the sludge was removed from site starting from 23 April and completely removed by 3 June with the vast majority having been removed by 27 May.

Offence 2:

This relates to the transporting of sludge from Copley and Wheldale STW to South Elmsall STW. The sludge was only stored on site but no treatment actually took place. In respect of this offence, during the Environment Agency's (EA) own visit report of 11 May 2011, it was deemed that this was "a non-compliance which has no potential environmental impact". The sludge was transported from Wheldale to South Elmsall from 1 April to ensure as much storage was available at Copley as possible.

Offence 3:

It is permitted to store sludge externally at South Elmsall although it is accepted that this should be carried out by virtue of the use of skips and for no more than 2 days. The background explained above explains the duration and it is estimated that approximately 38 skips would have been required for this storage. As the company was continually making arrangements for transporting of this sludge appropriately and it was not known where 38 skips could have been obtained from, the option was taken to store the substance on the ground which was protected from any escape from the site whether by virtue of drains or ground contamination.

The removal of sludge from Copley was prioritised but as soon as possible with complete removal in accordance with the date on the summons.

The context of these incidents was to be considered amongst Yorkshire Water's regional operations. The issues explained on these sites due to the winter and its longstanding impact were felt regionally. Had the Company been in a position to consider any other options, it would have done so but was heavily constricted by events occurring which were caused by issues outside its control.

Effect on environment

There is no evidence from the EA of any impact on the environment save for reference to complaints of odour which the company does not seek to disregard or indeed argue against the impact. The EA's own guidance on incident classification for odour for significant effects is in summary, odour offensive and persistent enough to cause significant effect on human senses… which lead to some disturbance and significantly more intrusive than normal background and potentially with a significant effect on amenity value. There were two odour complaints on 3 May for South Elmsall over the period of external storage for the duration between 1 April to 24 June. There were 6 complaints from the same two customers over the period of external storage for Copley between 17 April and 3 June.

It was submitted that the odour complaints did not fall within this classification and therefore the incidents should be considered against the EA's own guidance of what constitutes a significant impact.

Further the considered actions taken by Yorkshire Water with regard to actual storage areas were to avoid an impact to the environment via a discharge to a watercourse or otherwise as previously seen.

The response by Yorkshire Water

It was submitted that the Yorkshire Water response was as timely and effective as possible in all the circumstances considering the options available in respect of the shut down for planned and unplanned reasons, of the usual process sites. Costs of approximately £55k were incurred as an immediate and subsequent consequence of the incident. Since these incidents occurred, the level of resource focused on audits and compliance has been increased with further training to be provided for responsible managers and teams.

Yorkshire Water now has an understanding as to the impact of such a severe winter event and the impact this had on assets and resulting operations such as the storage of sludge.

Following the EA's visit on 5 May, an action plan was agreed with them for South Elmsall in which Yorkshire Water confirmed that no additional material would be added to that already in placer and it was fully communicated that all of the cake would be removed by 4 July. There was no requirement by the EA at that stage to remove this material any quicker.

For the Copley site, from 10 May, the Company was in contact with the EA regarding its plans for removal of the sludge from the site. To this extent, in respect of both sites, from 5 May onwards, Yorkshire Water was in regular communication informing them of their plans and next steps.

A fine of £17,000 was imposed per offence against a maximum of £50,000. Costs were also awarded to the EA in the sum of £3,935.70.

Huddersfield Magistrates' Court 25 September 2012

On 25 September 2012 YWS pleaded guilty to one offence contrary to Regulations 12 and 38 (2) of the Environment Permitting (England and Wales) Regulations 2010 as follows:

That on or before 14th June 2011 at Huddersfield (Upper Brighouse) Sewage Treatment Works, Yorkshire Water Services Limited did fail to comply with an Environmental Permit, namely conditions 9 and 10 of Schedule 7 of the conditions of consent to discharge number WRA7409 in that a standby pump was not present.

Upper Brighouse is part of a complex of waste water treatment works which treats effluent from Huddersfield town and the surrounding area. Upper Brighouse is subject to conditions contained within permit number WRA7409. In particular, the discharge of settled sewage in an emergency is subject to conditions set out in Schedule 7 to permit WRA7409. Conditions 9 and 10 provide:-

> "9. The duty pump(s) shall be maintained in good working order, and at least one standby pump shall be provided and maintained.
>
> 10. Standby pump(s) shall automatically activate should the duty pump(s) become inoperative for reasons other than power failure. The pumping station shall be maintained so that the pump shall automatically reactivate as soon as is practical after the power is restored after interruption to the supply".

Conditions 9 and 10 relate to an interstage pumping station at Upper Brighouse. There are three pumps available within the pumping station. Pump A acts as a duty pump which pumps flows forward to treatment, pump B is used intermittently to assist the duty pump at times of high flow following heavy rainfall and pump C acts as the standby pump.

At the end of October 2010 pump A failed and could not be repaired in situ. The pump was removed and sent to the manufacturer for assessment. A decision was taken at that time, based on an assessment of operational risk not to source an alternative pump as pump B was capable of pumping flows to treatment and that pump C (formerly the standby pump) could be used as the assist pump. The permit does not, in any event, specify that an assist pump has to be provided. At the end of January 2011 the manufacturer (Hydrosteel) confirmed that the pump was capable of being repaired and gave a lead time for the work of approximately 3 weeks. As there had been no operational difficulties with the pumping arrangements at Upper Brighouse, the decision not to source a temporary third pump was not reviewed.

As with most large organisations, YWS operates a dedicated work and job scheduling system (SAP). The system has been in place for approximately 10 years and is used to schedule and allocate individual jobs. Each job is given its own individual SAP number but there is no overall unique number given to the whole life of a problem or a piece of work, so that a job such as the removal, repair and reinstatement of a pump is not given a single unique SAP reference number which allows it to be traced and remain "visible" until completed in its entirety. Instead, the current operation of the SAP system breaks jobs down into individual stages with each stage having to be separately scheduled and being capable of being completed without there being visibility for the whole job.

The repaired pump was returned to site at the beginning of March and a job raised for its installation. Throughout this period, there were no operational difficulties with the pumping arrangements and again, the decision to use two pumps was not reviewed. A pump was installed at the interstage pumping station in early May however, that pump that was not correctly rated and had to be removed. On 14th June prior to the correct pump (the repaired pump A) being installed, pump B developed an electrical fault which meant that although it was running and showing on the monitoring system as running, it was not actually pumping. At the same time, pump C which was acting as the assist pump, developed a mechanical failure. The failure of pumps B and C resulted in a discharge of settled storm sewage into the River Don. That discharge was permitted under the terms of condition 3 of Schedule 7 to consent number WRA7409.

Effect on the Environment

There was no impact on the environment as a result of this offence.

Response by Yorkshire Water

YWS had, prior to the instigation of the prosecution, identified limitations within its current organisational working practices and structures and the current use of the SAP system for allocating and assigning jobs. A review and a programme for change (Operating for Excellence) commenced in 2011 and aims to ensure across all of YWS's business and operational functions that there are effective systems and processes in place, so that there is greater clarity and visibility as to how, when and why decisions are taken and work programmed. One of the issues to be taken into account in considering the criticality of a particular asset will be ensuring full permit compliance can be achieved and maintained. The Operating for Excellence project, which commenced in September 2011, is now in its pilot phase. In relation to Engineering & Reliability, one of the outcomes identified to date, is the need for there to be a central engineering reliability hub to allow improvements in the way that workflows are managed within operational teams including scheduling, planning and procurement.

The Magistrates made no comment when imposing the fine and costs award, save for confirming that the company had been given credit for an early guilty plea. A fine of £1,200.00 was imposed against a maximum of £50,000.00. Costs were also awarded to the Environment Agency in the sum of £913.42.

01 October 2013

Beverley magistrates' court in connection with an offence contrary to Regulation 12 and 38 of the EPR 2010 on 12 October 2011 at Beverley Waste Water Treatment Works, Beverley.

Fine - £4,000.
Costs - £1,248.70.

01 October 2013

Beverley magistrates' court in connection with an offence contrary to Regulation 12 and 38 of the EPR 2010 on 18 April 2012 at Beverley Waste Water Treatment Works.

20 February 2014

Wakefield magistrates' court in connection with an offence contrary to Regulation 12 and 38 of the EPR on 06 March 2013 at Wash Dyke, Pontefract (Sowgate Lane SPS).

19 January 2016 – Shay Lane Pumping Station

Shay Lane pumping station Single offence of causing a water discharge activity contrary to Regulation 12 and 38 of the EPR 2010 05 October 2013.

Negligent Harm 2 £600,000 £24,000.

28 April 2016 – Naburn WWTW

3 charges of contravening Regulations 12 and 38 EPR 2010:

1. Discharge of polluted water from Naburn WwTW into the River Ouse on 23 August 2013.

2. Failure to provide and maintain at least one standby pump at Naburn WwTW between March and October 2013.

3. Failure to provide and maintain at least one standby pump at Naburn WwTW between 17 August and 29 September 2014 See under "Offence(s).

Charges 1 and 2 - high degree of negligence.

Charge 3 – Reckless.

Charges 1 and 2 – Harm 3.

Charge 3 – Harm 4 Charges 1 and 2 - £500,000.

Charge 3 - £600,000.

17 August 2016 – Sherwood CSO

Single offence of causing a water discharge activity contrary to Regulation 12 and 38 of the EPR 2010 12 April 2013.

Negligent Harm 2 £350,000 £30,000.

13 July 2017 – Hinderwell WWTW

Single offence of causing a water discharge activity contrary to Regulation 12 and 38 of the EPR in July 2015.

Culpability – Reckless.
Harm – 2.
Fine - £600,000.

27 November 2017 – Sandy Lane (aka Belle Vue) Pumping Station, Doncaster

Single offence of causing a water discharge activity contrary to Regulation 12 and 38 of the EPR in 24 / 25 April 2014.

Culpability – Negligent.
Harm – 3.
Fine - £45,000.

8 September 2021 – Potteric Carr Nature Reserve (Balby STW)

Sheffield magistrates' court in connection with two offences on 28 March 2017 at Mother Drain at Potteric Carr Nature Reserve (Balby STW). Yorkshire Water pleaded guilty to a water discharge activity contrary to Reg 12 and 38 of the EPR and a breach of condition of the environmental permit. A fine of £150,000 was imposed against offence 1.

28 January 2022 – Dale Road SPS

Leeds Crown Court in connection with one offence on 3-9 November 2017 at Dale Road SPS. Yorkshire Water pleaded guilty and a fine of £233,000 was imposed.

18 July 2022 – Bradford Beck (George Street Detention Tank)

Leeds Magistrates' Court in connection with three offences between September 2017 and June 2019. Yorkshire Water pleaded guilty and a fine of £1,600,750.00 and £22,112.79 in costs was imposed.

Appendix 2 Technical Competence

Appendix 3 ISO14001 Certificate

Appendix 4 Quality and Environmental Policy

Appendix 5 Site Condition Report

Appendix 6 BAT Assessment

Appendix 7 Air Quality Risk Assessment

Appendix 8 Odour Impact Assessment

Appendix 9 Noise Impact Assessment

Appendix 10 Odour Management Plan

Appendix 11 Secondary Containment Risk Assessment

Appendix 12 Medium Combustion Plant Directive Requirements

Form C2.5 Appendix 1 Specific questions for the MCP / SG

Medium Combustion Plant checklist

MCP Site specific identifier	Bradford Esholt MCP CHP No. 1 (Guascor 200125)	
Grid reference of the location of the MCP	Easting	Northing
	418715	439542
Rated thermal input (MW)	1.53	
Type of MCP	Combined Heat and Power (CHP), not designated as Specified Generator	
Type of fuels used	Biogas	
Date of first operation	01/03/2009	
Sector of activity (NACE code)	3700	
Expected number of annual operating hours of the MCP	8424 (this figure is assuming 2 weeks downtime for maintenance)	
Average load in use (%)	100% (this can vary depending on site electricity demand and bio-gas availability)	
Where the option of an exemption…	N/A	
Stack height (m)	15	
Distance to nearest human receptor (m)	200 m	
Distance to nearest ecological receptor (m)	2km	

MCP Site specific identifier	Bradford Esholt MCP CHP No. 2 (Guascor 200126)	
Grid reference of the location of the MCP	Easting	Northing
	418715	439542
Rated thermal input (MW)	1.53	
Type of MCP	Combined Heat and Power (CHP), not designated as Specified Generator	
Type of fuels used	Biogas	
Date of first operation	12/03/2010	
Sector of activity (NACE code)	3700	
Expected number of annual operating hours of the MCP	8424 (this figure is assuming 2 weeks downtime for maintenance)	
Average load in use (%)	100% (this can vary depending on site electricity demand and bio-gas availability)	
Where the option of an exemption…	N/A	
Stack height (m)	15	
Distance to nearest human receptor (m)	200 m	
Distance to nearest ecological receptor (m)	2km	

MCP Site specific identifier	Bradford Esholt MCP CHP No. 3 (TCG 2020V16)	
Grid reference of the location of the MCP	Easting	Northing
	418715	439542
Rated thermal input (MW)	3.63	
Type of MCP	Combined Heat and Power (CHP), not designated as Specified Generator	
Type of fuels used	Biogas	
Date of first operation	18/11/2013	
Sector of activity (NACE code)	3700	
Expected number of annual operating hours of the MCP	8424 (this figure is assuming 2 weeks downtime for maintenance)	
Average load in use (%)	100% (this can vary depending on site electricity demand and bio-gas availability)	
Where the option of an exemption…	N/A	
Stack height (m)	15	
Distance to nearest human receptor (m)	200 m	
Distance to nearest ecological receptor (m)	2km	

MCP Site specific identifier	Bradford Esholt MCP CHP No. 4 (TCG 2020V16)	
Grid reference of the location of the MCP	Easting	Northing
	418715	439542
Rated thermal input (MW)	3.63	
Type of MCP	Combined Heat and Power (CHP), not designated as Specified Generator	
Type of fuels used	Biogas	
Date of first operation	18/11/2013	
Sector of activity (NACE code)	3700	
Expected number of annual operating hours of the MCP	8424 (this figure is assuming 2 weeks downtime for maintenance)	
Average load in use (%)	100% (this can vary depending on site electricity demand and bio-gas availability)	
Where the option of an exemption…	N/A	
Stack height (m)	15	
Distance to nearest human receptor (m)	200 m	
Distance to nearest ecological receptor (m)	2km	

MCP Site specific identifier	Bradford Esholt MCP Boiler 1 (Cochran)	
Grid reference of the location of the MCP	Easting	Northing
	418732	439537
Rated thermal input (MW)	6.2	
Type of MCP	Boiler	
Type of fuels used	Gas oil (primary), Biogas (back up)	
Date of first operation	03.01.2014	
Sector of activity (NACE code)	3700	
Expected number of annual operating hours of the MCP	8,424 (this figure is assuming 2 weeks downtime for maintenance)	
Average load in use (%)	100% (this depends on site demand)	
Where the option of an exemption…	N/A	
Stack height (m)	15	
Distance to nearest human receptor (m)	200 m	
Distance to nearest ecological receptor (m)	2km	

MCP Site specific identifier	Bradford Esholt MCP Boiler 2 (Cochran)	
Grid reference of the location of the MCP	Easting	Northing
	418732	439537
Rated thermal input (MW)	6.2	
Type of MCP	Boiler	
Type of fuels used	Gas oil (primary), Biogas (back up)	
Date of first operation	04.01.2014	
Sector of activity (NACE code)	3700	
Expected number of annual operating hours of the MCP	8,424 (this figure is assuming 2 weeks downtime for maintenance)	
Average load in use (%)	100% (This depends on site demand)	
Where the option of an exemption…	N/A	
Stack height (m)	15	
Distance to nearest human receptor (m)	200 m	
Distance to nearest ecological receptor (m)	2km	

Appendix 2 Emission Limit Values

To apply from 1 January 2025

New / Existing	Emission Point Ref	Source	Location	Emissions parameter	Quantity / unit[31]		Techniques to minimise emissions
Existing plant	A2	Boiler No. 1 (Gas oil or Natural Gas)	Energy Centre	NOx	200	Mg/Nm^3	Low NOx burner
	A4	Boiler No. 2 (Gas oil or Natural Gas)	Energy Centre	NOx	200	Mg/Nm^3	Low NOx burner
	A2	Boiler No. 1 (Biogas)	Energy Centre	NOx	250	Mg/Nm^3	Low NOx burner
				SO_2	170	Mg/Nm^3	Sludge management techniques
	A4	Boiler No. 2 (Biogas)	Energy Centre	NOx	250	Mg/Nm^3	Low NOx burner
				SO_2	170	Mg/Nm^3	Sludge management techniques

[31] CHP ELV applies at 15% O2

To apply from 1 January 2030

New / Existing	Emission Point Ref	Source	Location	Emissions parameter	Quantity / unit[32]		Techniques to minimise emissions
Existing plant	A5	CHP 1 (Biogas)	Energy Centre	NOx	190	Mg/Nm^3	Low NOx Combustion Control
				SO_2	60	Mg/Nm^3	Sludge management techniques
	A6	CHP 2 (Biogas)	Energy Centre	NOx	190	Mg/Nm^3	Low NOx Combustion Control
				SO_2	60	Mg/Nm^3	Sludge management techniques
	A1	CHP 3 (Biogas)	Energy Centre	NOx	190	Mg/Nm^3	Low NOx Combustion Control
				SO_2	60	Mg/Nm^3	Sludge management techniques
	A3	CHP 4 (Biogas)	Energy Centre	NOx	190	Mg/Nm^3	Low NOx Combustion Control
				SO_2	60	Mg/Nm^3	Sludge management techniques
	A5	CHP 1 (Natural gas)	Energy Centre	NOx	190	Mg/Nm^3	Low NOx Combustion Control
	A6	CHP 2 (Natural gas)	Energy Centre	NOx	190	Mg/Nm^3	Low NOx Combustion Control
	A1	CHP 3 (Natural gas)	Energy Centre	NOx	190	Mg/Nm^3	Low NOx Combustion Control
	A3	CHP 4 (Natural gas)	Energy Centre	NOx	190	Mg/Nm^3	Low NOx Combustion Control

[32]. Boiler ELV applies at 3% O2

Monitoring

Describe the measures you use for monitoring emissions

MCP Proposed emissions monitoring requirements

Monitoring will be undertaken within 4 months of the date of MCPD phase-in and will continue with the frequency indicated below.

Emission point	Parameter	Monitoring technique	Monitoring frequency
Emissions to air			
A1 (previously N.A1) CHP 3	NOx (NO and NO_2 expressed as NO_2)	Extractive emissions testing in line with TGN M1 and BS EN 14792	Every 3 years
	Sulphur dioxide (SO_2)	Extractive emissions testing in line with TGN M1 and EN 14791	Every 3 years
	Carbon monoxide (CO)	Extractive emissions testing in line with TGN M1 and EN 15058	Every 3 years
A2 (previously N.A2) Boiler 1	NOx (NO and NO_2 expressed as NO_2)	Extractive emissions testing in line with TGN M1 and BS EN 14792	Every 3 years
	Sulphur dioxide (SO_2)	Extractive emissions testing in line with TGN M1 and EN 14791	Every 3 years
	Carbon monoxide (CO)	Extractive emissions testing in line with TGN M1 and EN 15058	Every 3 years
A3 (previously N.A3) CHP 4	NOx (NO and NO_2 expressed as NO_2)	Extractive emissions testing in line with TGN M1 and BS EN 14792	Every 3 years
	Sulphur dioxide (SO_2)	Extractive emissions testing in line with TGN M1 and EN 14791	Every 3 years
	Carbon monoxide (CO)	Extractive emissions testing in line with TGN M1 and EN 15058	Every 3 years
A4 (previously N.A4) Boiler 2	NOx (NO and NO_2 expressed as NO_2)	Extractive emissions testing in line with TGN M1 and BS EN 14792	Every 3 years
	Sulphur dioxide (SO_2)	Extractive emissions testing in line with TGN M1 and EN 14791	Every 3 years
	Carbon monoxide (CO)	Extractive emissions testing in line with TGN M1 and EN 15058	Every 3 years
A5 (previously N.A5) CHP 1	NOx (NO and NO_2 expressed as NO_2)	Extractive emissions testing in line with TGN M1 and BS EN 14792	Every 3 years
	Sulphur dioxide (SO_2)	Extractive emissions testing in line with TGN M1 and EN 14791	Every 3 years
	Carbon monoxide (CO)	Extractive emissions testing in line with TGN M1 and EN 15058	Every 3 years
A6 (previously N.A6) CHP 2	NOx (NO and NO_2 expressed as NO_2)	Extractive emissions testing in line with TGN M1 and BS EN 14792	Every 3 years
	Sulphur dioxide (SO_2)	Extractive emissions testing in line with TGN M1 and EN 14791	Every 3 years
	Carbon monoxide (CO)	Extractive emissions testing in line with TGN M1 and EN 15058	Every 3 years

Appendix 13 Waste Pre-acceptance and Acceptance Procedure

Appendix 14 Leak Detection and Repair (LDAR) Plan

Appendix 15 STF Processing Capacity Calculations

Appendix 16 Materials Safety Data Sheets