Aldwarke Sludge Treatment Facility Odour Management Plan

September 2022

YorkshireWater

Stantec

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Contents

1 Introduction

This Odour Management Plan (OMP) for Aldwarke sludge treatment facility (STF) has been developed by Stantec on behalf of Yorkshire Water Services Ltd (YW). YW have developed this OMP as a live working document that forms part of the operational management system of the site. The OMP demonstrates how odours shall be managed and controlled to prevent odour impacts from activities during normal operation and also during abnormal events.

The OMP has been developed to meet the Environment Agency's (EA) H4 Odour Management Guidance.

The OMP has been prepared in support of the permit variation application for Aldwarke STF.

These activities fall under Environmental Permit reference YP3092ZR.

The OMP provides sufficient detail to allow operators and maintenance staff to understand clearly the operational procedures for both normal and abnormal conditions. It is intended to be used as a reference document by operational staff on a day-to-day basis. The OMP includes the following:

- A description of the site and catchment, including sources of odour on the site, and location of sensitive receptors;
- A brief history of received complaints and measures taken to date;
- YW Operation and Management (O and M) procedures for the site, including good housekeeping measures to minimise odour generation and release;
- The mitigation procedures which should be implemented when foreseeable situations that may compromise the ability to prevent and minimise odorous releases occur. These can include both breakdowns and external conditions such as extreme weather;
- An Action Procedure for complaints;
- An odour risk assessment identifying any odorous or potentially odorous areas of the works and immediate and longer-term actions required to eliminate odour complaints; and
- The management and operator training requirements and records with respect to odour.

1.1 Yorkshire Water Odour Management

YW acknowledges that high levels of odour arising from wastewater and sludge treatment are not acceptable and that reasonable measures must be taken to minimise any inconvenience to the general public. YW does not operate under a single defined odour exposure standard. Each site is considered individually taking into account the relevant legislation and local authority's conditions. Site specific factors such as site history with regard to odour complaints, potential future encroachment by residential or business developments, and the presence of particularly odour sensitive receptors within the vicinity of the works / facility are also taken into consideration.

2 Site Information

2.1 Site Location

Aldwarke STF is a treatment works on the north bank of the River Don and located approximately 2.5 km northeast of the town of Rotherham. The residential receptors are located to the north and south beyond the initial surrounding industrial and commercial receptors. The works location is highlighted in Figure 1.

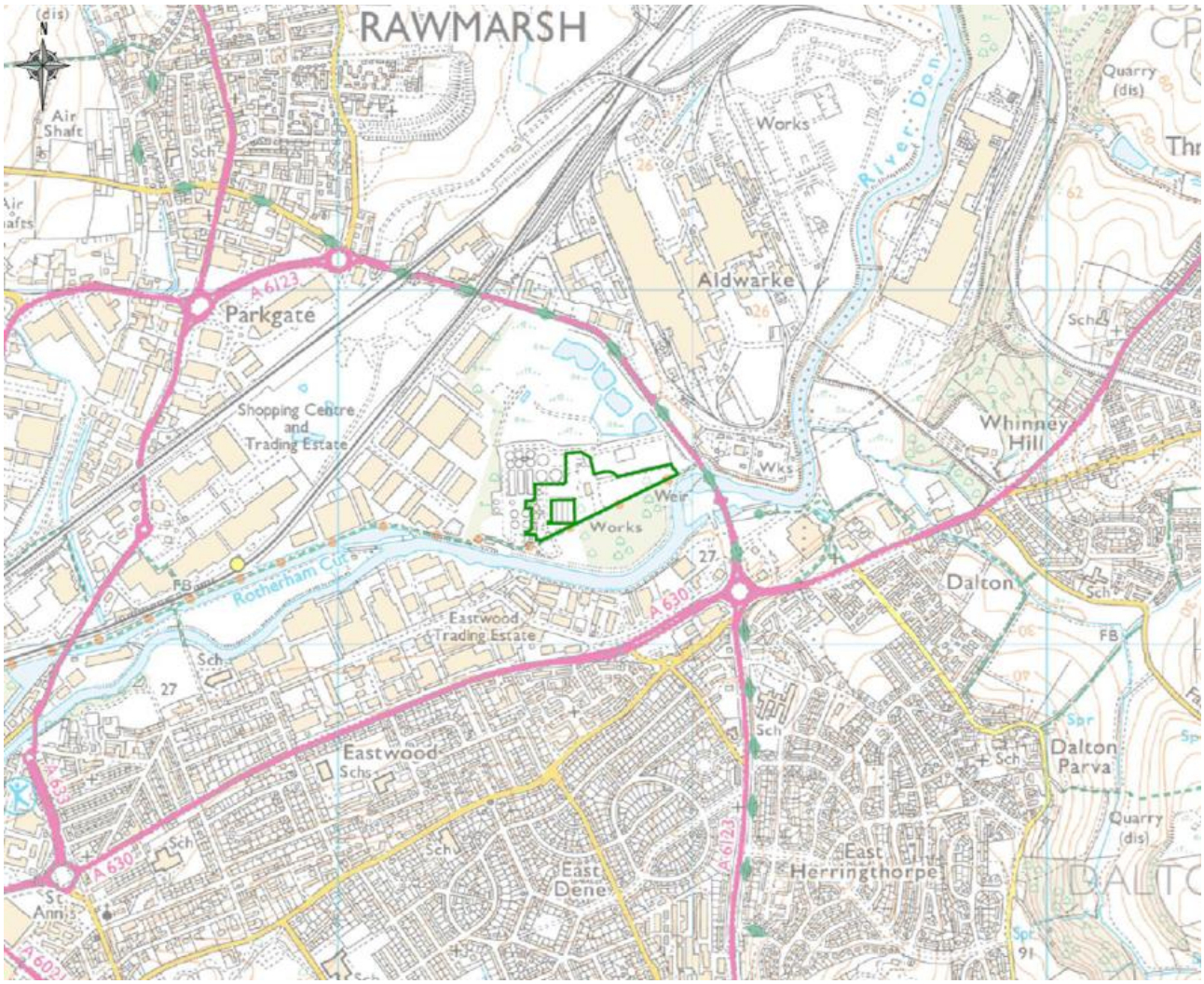


Figure 1 Aldwarke STF Site Location

2.2 Site Receptors

Aldwarke STF is located adjacent to Aldwarke WwTW. The works is located in an area of residential and commercial/industrial use. It is primarily surrounded by industrial areas and adjacent grass land. The industrial areas are located to the north, east and west with mixed industrial and commercial to the south beyond the River Don. The residential receptors are located to the north and south beyond the initial surrounding industrial and commercial receptors.

A summary of the areas of interest and receptors local to the site are highlighted in Figures 2-4, complete with receptor description and sensitivity in Table 1.

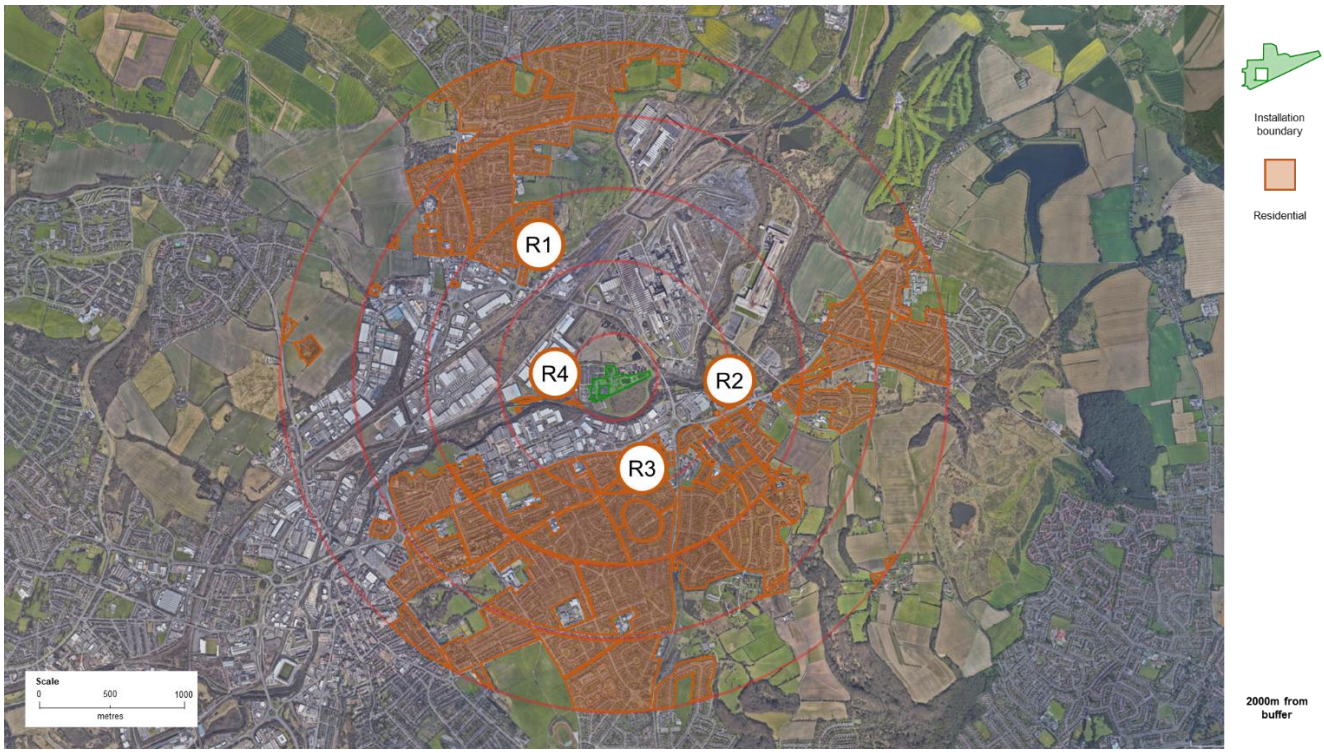


Figure 2 Location of Sensitive Receptors (Residential)

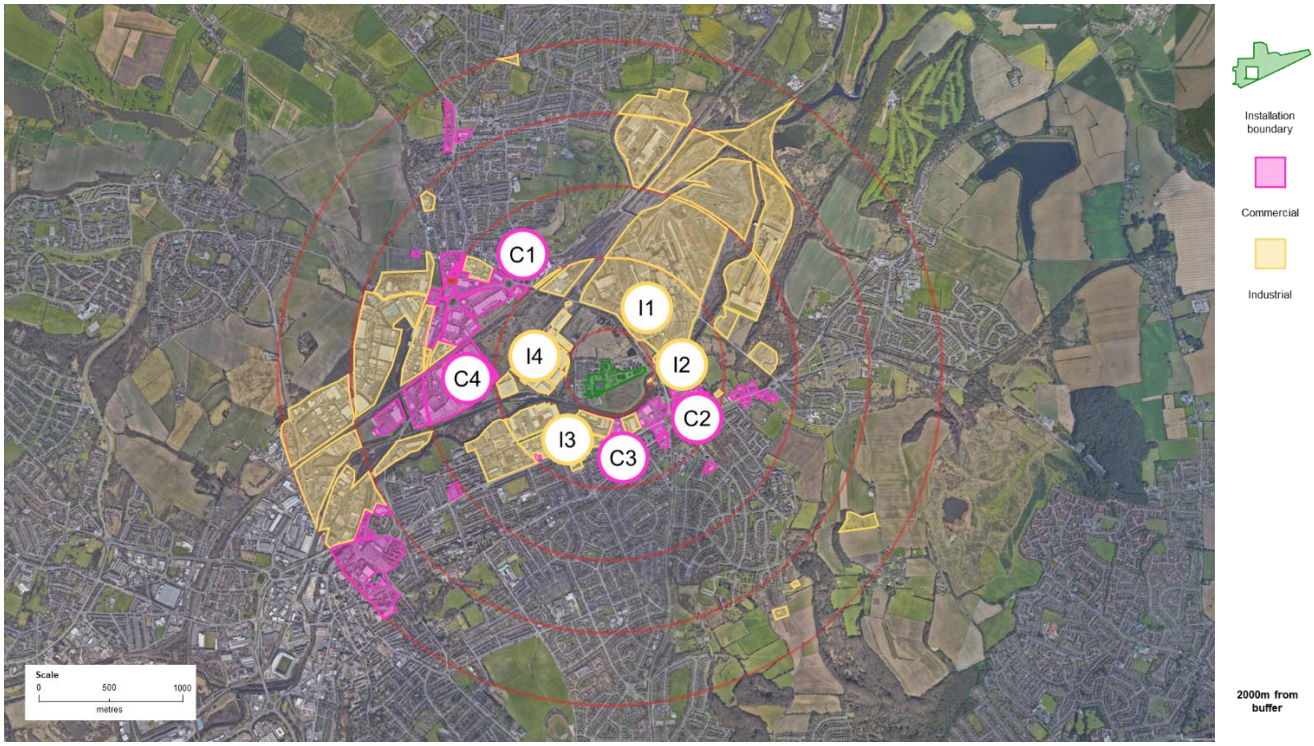


Figure 3 Location of Sensitive Receptors (Commercial / Industrial)

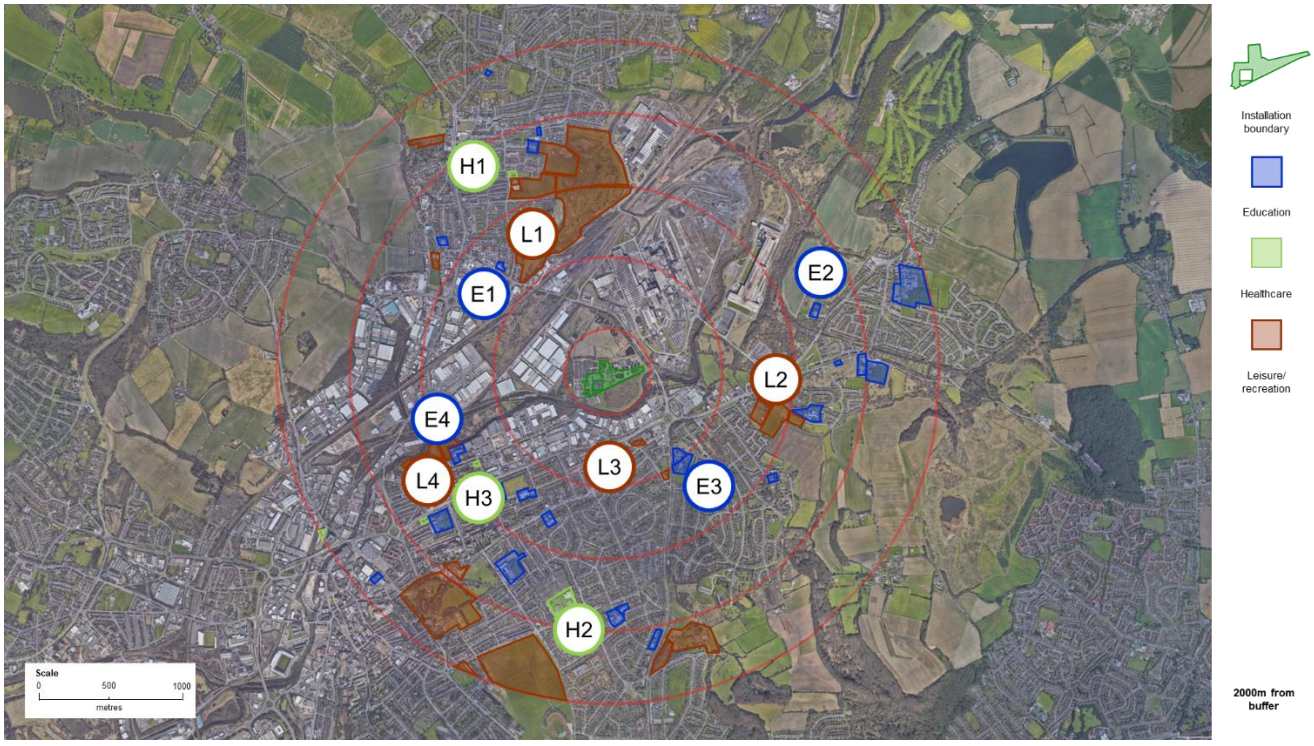


Figure 4 Location of Sensitive Receptors (Education / Leisure)

Table 1 Aldwarke Receptor sensitivities

Receptor Name	Receptor Map Reference	Distance from Site (m)	Receptor Type	Receptor Sensitivity
Residential properties to north	R1	790	Residential	High
Residential properties to east	R2	500	Residential	High
Residential properties to south	R3	390	Residential	High
Residential properties to west	R4	60	Residential	High
Commercial businesses to north	C1	725	Commercial	Medium
Commercial businesses to east	C2	220	Commercial	Medium
Commercial businesses to south	C3	210	Commercial	Medium
Commercial businesses to west	C4	600	Commercial	Medium
Industry to north	I1	270	Industrial	Low
Industry to east	I2	65	Industrial	Low
Industry to south	I3	240	Industrial	Low
Industry to west	I4	140	Industrial	Low
Schools to the north	E1	910	Education	High
Schools to the east	E2	1,225	Education	High
Schools to the south	E3	580	Education	High
Schools to the west	E4	910	Education	High
Leisure/recreation to the north	L1	765	Leisure/recreation	Medium
Leisure/recreation to the east	L2	800	Leisure/recreation	Medium
Leisure/recreation to the south	L3	415	Leisure/recreation	Medium
Leisure/recreation to the west	L4	1,015	Leisure/recreation	Medium
Healthcare to the north	H1	1,395	Healthcare	Medium
Healthcare to the south	H2	1,335	Healthcare	Medium
Healthcare to the west	H3	870	Healthcare	Medium

2.3 Meteorological Conditions

In the UK, the prevailing wind directions are commonly from the west and south-west. The wind direction and speed will impact the dispersion of odour emissions from site. There is currently no wind station on site to measure meteorological conditions.

Doncaster Sheffield airport meteorological station is 22km east of the site. There is also a meteorological station in Sheffield city centre, closer to the works. As both meteorological stations are representative of the local area, Doncaster Sheffield airport has been selected for use due to a complete data set for use in odour assessments being captured at this location. The meteorological data included below consist of 1-hourly average data suitable for use in atmosphere dispersion modelling software.

The meteorological data from Doncaster Sheffield airport meteorological station has been incorporated into the site's odour risk assessment whereby wind direction and frequency are used to determine the "pathway effectiveness" from source to receptor. Data for 2019 has been adopted for the odour risk assessment as there would be no variability in pathway risk scoring when using a different year. It is more critical for the risk assessment to determine a representative meteorological station location that met. year. The met. year should be updated within every 5 years to ensure the prevailing wind direction and wind speeds are still representative.

Wind direction and speed is also included as part of the on-site sniff testing however, this is based on short-term variations and recorded at the time of assessment (see Section 5.1 Sniff Testing). The wind rose plot for Doncaster Sheffield airport is included in Figure 5.

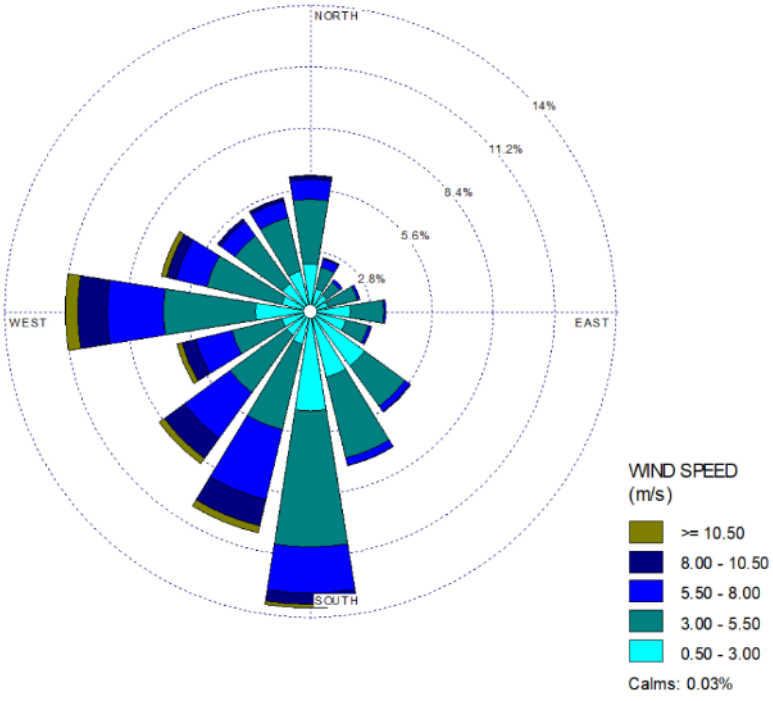


Figure 5 Doncaster Sheffield Airport Wind Rose Plot (2019)

2.4 Process Description

Sludge reception, treatment and handling

Aldwarke STF treats the following sewage sludges:

- Indigenous primary sludges and surplus activated sludge (SAS) arising from sewage treatment processes operating within the wider Aldwarke WwTW that are piped directly to the STF.
- Liquid sludges generated by other YW Wastewater Treatment Works (WwTW) (with lower capacity or capability for treating sludges on-site) that are imported to Aldwarke STF for additional treatment.

Imported liquid sludge is delivered to site by tanker, which would normally unload at the sludge import area. The maximum load is typically 28 tonnes with unloading taking up to 30 minutes. Only appropriately authorised vehicles can discharge at the site. This is controlled using a 'WaSP' logger; valves on the discharge pipework will only open when a driver presents appropriate authentication to the system. The WaSP logger records the source of the sludge, the time and date of delivery, the total volume discharged and average percentage dry solids of the load.

The existing (but currently unused) sludge import facility comprises two Huber ROTAMAT enclosed rotating screens to screen the sludge prior to transfer to a covered, below ground concrete sump of approximately 80 m^3. Screenings drop into a skip and are disposed of off-site (see Part III: Form B3, Question 6e for more details of waste streams). Imported sludge is then passed forward to the thickener feed tanks (see below for more details).

The existing STF sludge import facility is currently not being used due to operational problems. However, there is a programme of works planned to upgrade the STF import facility, either via refurbishment of the existing facility or replacement with a new sludge import facility. The new facility would perform the same function as the existing and would comprise a new sludge screen feed tank with connections for imported and indigenous primary sludge, pipework to bring indigenous primary sludge to this tank, a new import discharge facility with WaSP system, flow meter and other monitoring equipment and pipework. The existing ROTAMAT sludge screens would be refurbished and retained.

There are waste acceptance procedures that deal with the trade waste that is being treated through the WwTW. Some traders may also be subject to trade effluent consents. With regard to the potential for septic sludge imports to be received into the STF, a pre-acceptance process is in place to ensure that it is only received at sites that are capable of processing it without impacting the process (Refer to 'Waste Characterisation (Pre-acceptance & Acceptance' in 3d Management systems, Form B2).

Indigenous primary sludge and surplus SAS from the wider Aldwarke WwTW is pumped via below ground pipework into the thickener feeds tanks (2 no. 1,493 m^3 open topped steel tanks). The liquid sludge is mechanically mixed; the tanks operate in parallel fill mode or operate in fill / draw mode i.e. one fills whilst the other empties.

Liquid sludge from the thickener feed tanks is then transferred to either the gravity belt thickener (GBT) building or drum thickener building via below ground pipeline. Forward feed of sludge to the drum thickeners and GBT is controlled via SCADA and each thickener unit can operate either individually or in any combination.

Gravity Belt Thickener

Within the GBT building, potable water is mixed with powdered polymer (stored in 25 kg bags) within the polymer make up tank (approximate capacity 1.5 m^3 steel tank), before transfer to a dosing tank (approximate capacity 1.5 m^3 steel tank). Both polymer tanks are located on a metal grid above a secondary containment sump within the GBT building. The polymer solution is dosed into the sludge stream and fed into the GBT (1 no.). From here the sludge migrates down the moving, porous belt where excess liquid is able to drain away, leaving the thickened sludge on the belt. Thickened sludge is then scraped from the belt and collected in the thickened sludge hopper. Sludge is typically thickened to 5-7% solids.

The GBT is continually cleaned using automatic spray bars. In addition, cold water cleaning using a pressure washer is undertaken as required. This system operates using potable water and wash water leaves via the liquor route.

Air extracted from the GBT unit is discharged to atmosphere via a vent stack (approximately 6 m in height) adjacent to the north west side of the GBT building (referred to as Air extraction and dispersion stack 1). Ambient air from the building is passively vented via louvres in the wall without odour treatment; ambient building air is not odorous under normal operating conditions due to the direct GBT extraction.

The resulting thickener liquor is transferred to the return liquor sump (covered, underground sump approximately 80 m^3 capacity located adjacent to the sludge import facility). From this sump, liquors are pumped back to the WwTW for full treatment.

Drum Thickeners

From the thickener feed tanks sludge is pumped via underground pipework to the drum thickener building. Liquid polymer is normally delivered to the thickener building in 1,000 litre IBCs, or alternatively may be delivered in bulk. The polymer intake point is located outside the thickener building; polymer is transferred for storage to a bulk storage tank (approximately 5 m^3 capacity), is mixed with final effluent and transferred to the adjacent holding tank (approximately 2.5 m^3 capacity). Both tanks are GRP and located on a metal grid over a secondary containment concrete sump inside the building. The polymer solution is injected into the sludge stream before being introduced to the thickener drums (2 No.). The polymer encourages separation of water from the sludge as the sludge is rotated in the drum to remove excess liquid. The thickener liquor is transferred to the liquor return sump where it is mixed with the GBT thickener liquor (underground sump approximate 80 m^3 capacity located adjacent to the sludge import facility) prior to transfer back to the WwTW for full treatment.

The drum thickeners are equipped with automatic spray bars which provide frequent short cleans. The automatic spray bars operate using treated final effluent. A manual jet wash is also available for additional cleaning requirements; this system utilises potable water and has a dedicated extraction system for the diesel engine fumes which are vented outside the building.

Air extracted from each of the drum thickener units is discharged to atmosphere via a dispersion stack (approximately 5 m high) located adjacent to the north of the drum thickener building (referred to as Air extraction and dispersion stack 2). Ambient air from the building is passively vented via louvres in the wall without odour treatment; ambient building air is not odorous under normal operating conditions due to the direct drum extraction.

Sludge digestion

The thickened sludge is transferred from the GBT and drum thickener buildings via above and below ground pipework into two digester feed tanks (2 no. open topped 500 m^3 concrete tanks). Sludge within the digester feed tanks is mechanically mixed. The tanks operate in alternate fill and draw mode.

Sludge is pumped from the digester feed tanks to the anaerobic digesters (2 no. 3,167 m^3 concrete tanks, approximately 347 m^3 of each tank's storage capacity is below ground). The anaerobic digesters operate as a continuous process with sludge being added at the bottom, with one tank feeding on the hour every hour and the other on the half hour every hour. Treated sludge is displaced out of the top of the digester, via the outlet pipe, by sludge being fed into the bottom of the digester. The digesters are capable of feeding at up to 475 m^3/day combined at 6% dry solids giving a 12-day retention time as required by Hazard Analysis and Critical Control Points (HACCP) controls. The digesters are mechanically mixed.

A water circuit filled with potable water is heated to around 70°C by the CHPs and/or boilers; this heats the digesters using tube-in-tube, counter-current heat exchangers ensuring optimum conditions for digester microbial activity. Sludge from the digesters is continually recirculated around the heat exchangers using 2 no. (duty/standby) recirculation pumps per digester. Valves are manually balanced to moderate the amount of hot water that passes into the heat exchanger, depending on the heat demand of the digesters.

Grit build up within digesters is a normal feature of operation; the digesters are cleaned out (including accumulated grit) approximately 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.

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, antifoam is automatically dosed into the sludge mixing pumps. This system includes operator-adjustable dosing setpoints; if the foam level continues to increase the digester feed will be inhibited. Antifoam is stored in an IBC within a dedicated cabinet with two dosing pumps to dose into the digesters as required.

Sludge extracted from the digesters is transferred via below ground pipeline and the interceptor pumping station to the centrifuge feed tanks (see below for further information).

The digesters are due to undergo a major refurbishment by 2024 including improvements to the recirculation system and heat exchangers as well as installing impermeable surfacing to the area around the digesters. It is also proposed that a new sludge transfer tank will be installed adjacent to the digesters to receive sludge and a new transfer pumping station will be installed to transfer sludge to the centrifuge feed tanks.

Biogas storage and use

Biogas generated by the digesters is piped via a common biogas discharge line to the biogas holder (200 m^3 working volume) and from there to the CHPs, boiler plant and/or waste gas burner (flare). The biogas holder provides gas buffering capability in order to allow for fluctuations in gas production.

Excess liquids within the biogas are removed via condensate traps on the biogas system. There are five condensate traps in total; one from the digesters to the biogas holder, one from the biogas holder to CHP1, one from the biogas holder to a condensate trap pit where one serves the boilers and CHP2 and one serves the gas burner. The collected liquids are transferred to the WwTW for treatment.

On leaving the gas holder, the biogas passes to the CHP engines and boilers via gas boosters (one booster for each CHP/boiler), which increase the pressure of the biogas prior to use.

Pressure relief valves are located on the roof of each digester (two per digester) and a further one is located at the biogas holder. These valves provide an essential safety mechanism and will release gas to atmosphere in the event of a build of pressure preventing damage to equipment e.g. the gas holder. The valves are also an 'anti-vacuum' design to prevent tank damage from negative pressures.

Biogas is used as the fuel source for the site CHPs. The CHP facility comprises two reciprocating engine generator sets which generate electricity which is used to power essential site processes. Heat from the combustion process is used to maintain the required temperature in the anaerobic digesters, with any excess being discharged using air cooled radiators. CHP 1, located adjacent to the north of the digesters has a thermal input of approximately 875 kW and an electrical output of 307 kW. CHP 2 located to the north of the boiler house has a thermal input of approximately 470 kW and an electrical output of 165 kW.

The CHP are located within dedicated enclosures. Engine combustion products are discharged via 5 m high (approximately) stacks above the building roof.

Two dual fuel boilers, located in the boiler house, are used to provide an alternative heat source for the digesters in the event that the CHPs are unavailable or supplementary heat is required. The boilers are fired by biogas with gas oil available as a backup fuel source. Gas oil is stored within an integrally bunded steel tank of 9,717 litres capacity located to the north of the boiler house. Feed lines to the boiler house are located above ground.

Boilers 1 and 2 are identical and have a thermal input of approximately 765 kW and a thermal output of 650 kW. Combustion products from the boilers are discharged via stacks through the roof of the boiler house. The stacks for both boilers extend approximately 2.5 m above the building roof which itself is approximately 4.5 m high.

In periods where the CHP engines and boiler are unavailable, or biogas generation exceeds combustion capacity, biogas is directed to the waste gas burner (464 m^3/hr maximum capacity) which has a stack height of 5 m. This burner, although a purpose-built closed flare system, is not capable of achieving a minimum of 1,000°C with 0.3 seconds retention time at this temperature. Flare stack operation is automated based on gas level within the biogas holder. If the gas level is high then the flare will operate, however utilisation of the gas is preferred over flaring.

The areas around the digesters and gas storage 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). The flare facility is located at a safe distance from the digesters and other biogas handling and treatment activities.

A project is currently being developed to upgrade some of the existing biogas assets. It is proposed that a like for like replacement scheme will be undertaken with the existing biogas holder, condensate traps, pipework and flare stack being decommissioned / demolished and new facilities that meet BAT requirements will be installed.

Digested sludge treatment, handling and disposal

Digested sludge is transferred via below ground pipes and the interceptor pumping station to two centrifuge feed tanks (1 x uncovered 700 m^3 steel/GRP tank (No. 2) and 1 x uncovered 700 m^3concrete tank (No. 1)). In these tanks the digestate is mechanically mixed, to prevent settlement. The tanks operate as a fill/draw pair. From these tanks the digestate is piped to the centrifuge building, which contains one centrifuge. Within the adjacent polymer room, powdered polymer is dropped from a 700 kg bag into a hopper and then mixed with potable water in a *c.* 5 m^3 polymer blend tank prior to being pumped to an adjacent *c.* 5 m^3 polymer transfer tank where the polymer solution is held prior to use. The digested sludge is mixed with the polymer solution and then passed to the dewatering centrifuge where the sludge coagulates and supernatant liquor is removed by centrifugal forces. The liquor drops from the centrifuge into a wet well and is then pumped to the return liquor balance tank (steel, covered, 1,186 m^3 capacity) located near the WwTW inlet. From here liquors are transferred to the WwTW for full treatment.

Sludge cake handling arrangements are currently being altered; the final digested and dewatered sludge cake will be dropped directly from the centrifuge onto a trailer prior to being transferred by tractor/trailer to the sludge cake pad. The cake pad is an engineered impermeable surface, with water runoff collected in drains running along edges of the pad. These liquids are pumped back to the WwTW (via the return liquor wet well (adjacent to the cake pad) and liquor balance tank) for full treatment.

Sludge cake is moved by mechanical loaders into storage rows on the cake pad area. There is no lime addition at Aldwarke; instead, cake is stored in piles according to age and is left for further pathogen reduction according to the Critical Limit in the HACCP plan. The maximum storage capacity of the cake pads is approximately 2,800 m^3; although less than this is stored under normal operating conditions (normally up to approximately 1,500 m^3). Once treatment is complete, sludge cake is removed from site and landspread in accordance with legislative requirements. Samples of digested, matured cake are taken every 3 months and analysed for metals and pathogens to ensure HACCP standards are being met.

A project is currently being developed to upgrade the digested sludge dewatering facilities including installation of a new raised dewatering system sized on the basis of peak digester throughput. The new facility would drop sludge cake directly on to the engineered cake pad. The existing centrifuge would be retained to provide back-up dewatering capacity.

The cake pad also serves certain contingency functions, for both operations at Aldwarke and to wider strategic regional sewage infrastructure operated by YW. The cake pad may, under exceptional circumstances (such as the failure of assets or non-availability of normal disposal routes on a temporary basis) be used for storage of treated digestate produced at other YW sites, before being recycled to agriculture. Similarly, other contingency measures could require, under exceptional circumstances such as failure of assets, the interim storage of thickened or dewatered sludge on the cake pad, where that sludge originates from another YW site (or from Aldwarke operations), before that material then undergoes AD treatment in the STF at Aldwarke, or if necessary is removed for further treatment at an alternative AD facility. It is recognised that such operations are abnormal and would require initiation of site contingency operating procedures, with the intention of minimising any potential short term adverse environmental effects and returning to normal operations as soon as practicable.

The process flow diagram for the site is highlighted in Figure 6. The location of key site activities is shown in Figure 7 below.

Figure 6 Aldwarke STF Process Flow Diagram

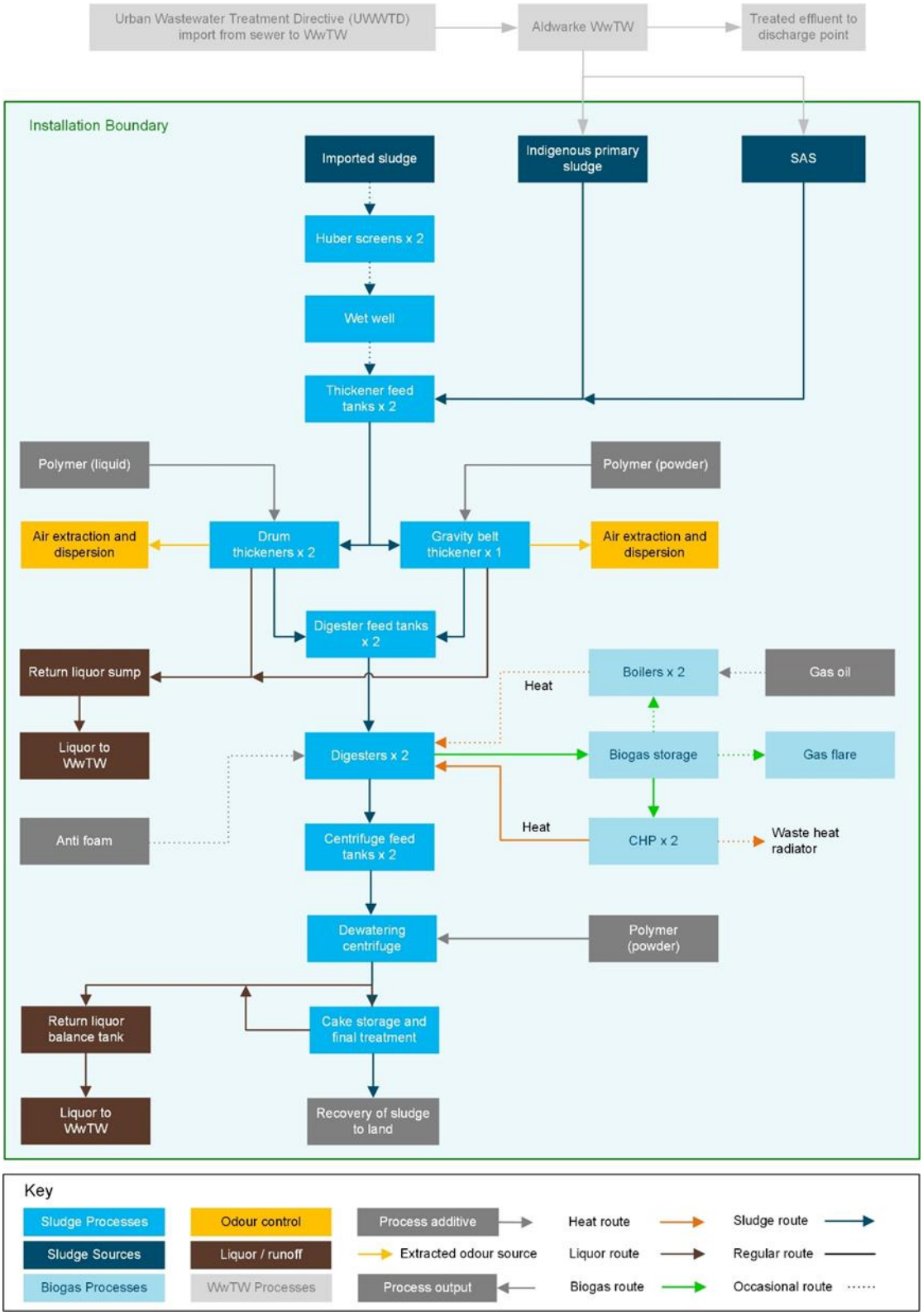
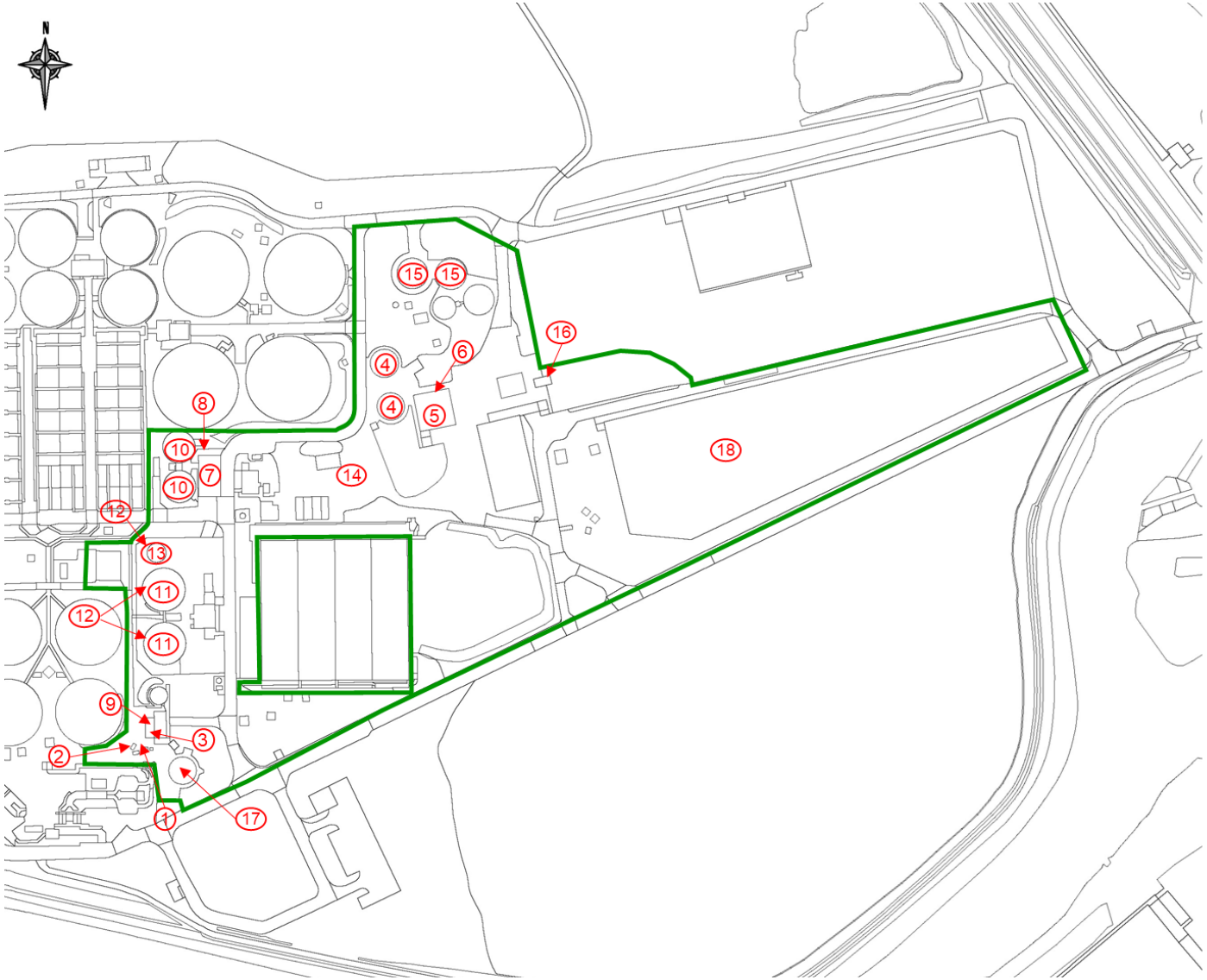


Figure 7 Aldwarke STF Source Locations



Key

Installation boundary

Source locations

1	Sludge Screens
2	Sludge Screenings Skip
3	Sludge Wet Well
4	Thickener Feed Tanks
5	Drum Thickeners
6	Drum Thickener Ventilation Stack
7	GBT
8	GBT Ventilation Stack
9	Return Liquor Sump
10	Digester Feed Tanks
11	Digesters
12	Biogas Relief Valves
13	Biogas Holder
14	Flare
15	Centrifuge Feed Tanks
16	Dewatering Centrifuge
17	Return Liquor Balance Tank
18	Cake Storage Pad

Type of waste accepted at Aldwarke STF, and their odour characteristics are summarised in Tables 2 and 3 below.

Table 2 Types of Waste Accepted and Restrictions - 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

Table 3 Types of Waste Accepted and Restrictions – for dewatering / storage only

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 02 06	Sludges from physico/chemical treatment other than those mentioned in 19 02 05, specifically sewage sludge conditioned with sanitised green waste.
19 02 06	Sludges from physico/chemical treatment other than those mentioned in 19 02 05, specifically sewage sludge conditioned with wood waste.
19 02 06	Sludges from physico/chemical treatment other than those mentioned in 19 02 05, specifically sludge phyto conditioned.
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

2.5 Process Odour Sources

The odour potential of a source can be broken down into three key considerations:

- How inherently odorous the compounds present are.
- The unpleasantness of the odour.
- The magnitude of the odour release.

When trying to determine the offensiveness of an odour source, site-specific odour sampling should be considered in the first instance. In the absence of source odour emission data, the assessment criteria will consider the Environment Agency's Horizontal Guidance Note (H4). H4 looks to categorise how offensive odours are with sources/processes/activities that are considered 'most offensive' odours include septic effluent or sludge and biological landfill odours. All raw sludge treatment processes would be considered to have a high odour offensiveness unless source-specific odour sampling is undertaken demonstrating a low level of odorous compounds. Processes containing the below material are considered to represent a high odour offensiveness:

- Indigenous sludge
- Sludge imports (liquid and solid)
- Sludge liquors

Processes containing the below material are considered to represent a medium odour offensiveness:

- Rags and screenings
- Digested sludge
- Digested sludge liquors
- Digested sludge cake (stored)

No processes on an STF are considered to store material that represents a low odour offensiveness unless supported by source-specific odour sampling.

The unpleasantness of an odour can be used in defining the source odour offensiveness. This is typically achieved through source material hedonic tone assessments, however; these types of assessments are not typically available for a site without source-specific sampling.

The risk source odour potential critical risk scoring for odour offensiveness and mitigation / control adopted is summarised in Table 4.

Table 4 Source Odour Potential Risk Scoring

Source	Risk Rating		
	High	Medium	Low
Odour Offensiveness	Very odorous compounds (H2S, Mercaptans) with low odour threshold. Unpleasant odour - "Most Offensive". Unpleasant hedonic tone. Large, permitted process / Surface Area.	Compounds involved are moderately odorous. Unpleasantness - process classed in H4 as "Moderately Offensive" or where odours have neutral or slightly unpleasant hedonic tone. Smaller permitted process / Surface Area.	Compounds involved are only mildly offensive. Unpleasantness - process classed in H4 as "Less Offensive". Neutral to positive hedonic tone.
Mitigation / Control	Open air operation with no containment. Reliance solely on good management techniques and best practice.	Some mitigation measures in place but significant residual odour remains.	Effective mitigation measures in place (e.g. BAT, BPM) leading to little or no residual odour.

Table 5 displays the site sludge odour sources, with an inventory of material, quality, and storage capacity, and goes on to explore the odour offensiveness and emission risk. The location of each odour source (asset ID) is shown on Figure 7 above.

Table 5 Aldwarke STF Sludge Inventory of odorous materials

Source	Asset ID	Source Type	Storage Capacity (m^3)	Average retention time	Frequency of Operation	Odour Description	Hedonic Tone	Odour Offensiveness	Mitigation Measures	Emission Release Type	Emission Risk
Sludge Screens	1	Imports	N/A	N/A	Intermittent Daily	Septic sludge, sulphide	Unpleasant	High	Covered	Fugitive	Medium
Sludge Screenings Skip	2	Sludge Screenings	N/A	N/A	Continuous	Septic sludge, sulphide	Unpleasant	Medium	Open to atmosphere	Diffuse	Medium
Sludge Wet Well	3	Imports	80	30 minutes	Continuous	Septic sludge, sulphide	Unpleasant	High	Covered	Fugitive	Medium
Thickener Feed Tanks	4	Indigenous, Imports	2 x 1,493	24 hours	Continuous	Septic sludge, sulphide	Unpleasant	High	Open to atmosphere	Diffuse	High
Drum Thickeners	5	Indigenous, Imports	N/A	N/A	Intermittent Daily	Septic sludge, sulphide	Unpleasant	High	Covered and extracted to an odour dispersion stack	Fugitive	Low
Drum Thickener Ventilation Stack	6	Indigenous, Imports	N/A	N/A	Intermittent Daily	Septic sludge, sulphide	Unpleasant	High	Extraction and dispersion to atmosphere	Point	High
GBT	7	Indigenous, Imports	N/A	N/A	Intermittent Daily	Septic sludge, sulphide	Unpleasant	High	Covered and extracted to an odour dispersion stack	Fugitive	Low
GBT Ventilation Stack	8	Indigenous, Imports	N/A	N/A	Intermittent Daily	Septic sludge, sulphide	Unpleasant	High	Extraction and dispersion to atmosphere	Point	High
Return Liquor Sump	9	Sludge Liquors	80	N/A	Continuous	Septic sludge, sulphide	Unpleasant	High	Covered	Fugitive	Medium
Digester Feed Tanks	10	Indigenous, Imports	2 x 500	24 hours	Continuous	Septic sludge, sulphide	Unpleasant	High	Open to atmosphere	Diffuse	High
Digesters	11	Indigenous, Imports	2 x 3,167	12 days	Continuous	Biogas, Methane/ sulphide	Unpleasant	High	Covered and extracted to biogas storage Full containment of biogas is a critical safety consideration	Abnormal - fugitive only as biogas is collected for use on site.	Low

Source	Asset ID	Source Type	Storage Capacity (m^3)	Average retention time	Frequency of Operation	Odour Description	Hedonic Tone	Odour Offensiveness	Mitigation Measures	Emission Release Type	Emission Risk
Biogas Relief Valves	12	Digested Sludge	N/A	N/A	Emergency operation	Biogas, Methane/ sulphide	Unpleasant	High	Critical process safety requirement. Operates only as required under abnormal process conditions	Point	Low
Biogas Holder	13	Biogas	200	2 hours	Continuous	Biogas	Unpleasant	High	Enclosed vessel. Full containment of biogas is a critical safety consideration	Abnormal - fugitive only as biogas is collected for use on site.	Low
Flare	14	Combusted biogas	N/A	N/A	Emergency Operation	Combustion	Acceptable	Low	Biogas is combusted	Point	Low
Centrifuge Feed Tanks	15	Digested	2 x 700	48 hours	Continuous	Digested sludge / Earthy	Acceptable	Medium	Open to atmosphere	Diffuse	High
Dewatering Centrifuge	16	Digested	N/A	N/A	Intermittent Daily	Digested sludge / Earthy	Acceptable	Medium	Covered and within a building	Diffuse	Medium
Return Liquor Balance Tank	17	Digested Liquors	1,186	24 hours	Continuous	Digested sludge / Earthy	Acceptable	High	Open to atmosphere	Diffuse	Medium
Cake Storage Pad	18	Digested	2,800	6-8 weeks	Continuous	Digested sludge / Earthy	Acceptable	Medium	Open to atmosphere	Diffuse	High

3 Odour Critical Plant Operation

3.1 Odour Critical Sources

Given the control measures that are in place during operation of the facility, these contributions (if any) are unlikely to increase the odour impact on the receptors outside of the site boundary.

Management of releases includes reducing turbulence, containment and dispersion. Where odorous gasses are finally released, controlling the height of release through a stack or the timing of releases through management of activities can influence dispersion before there is an impact on people. Potential on site odour releases associated with Aldwarke STF are given in Table 6 below.

Table 6 Aldwarke STF Odour Critical Sources (operational controls)

Asset	Asset ID	Potential Odour Source	Odour Control Measures	Odour Risk	Mitigation Trigger	Mitigation Measures	Timescale	Responsible Person
Sludge Screens and skips	1&2	Sludge Screenings	Regular throughput maintained, replacement of full skips, no excess storage of screenings.	Unlikely given control measures in place	Screenings spill local to skip. Increase in complaint frequency / odour sniff test identifies sludge screenings off-site.	Early removal / replacement of skip	Within 5 working days of incident	Product and Process Engineer
Sludge Wet Well	3	Liquid sludge	Wet Well covered without extraction. Inspection hatches kept closed. Regular throughput is maintained	Unlikely given control measures in place	Increase in complaint frequency / odour sniff test identifies sludge odours off-site.	Dose sludge with odour control chemical	Within 5 working days of incident	Product and Process Engineer
Thickener Feed Tanks	4	Liquid sludge	Tank is uncovered. Risk assessment and odour plan in place before cleaning of any tank	Likely given lack of control measures in place.	Increase in complaint frequency / odour sniff test identifies sludge odours off-site.	Dose sludge with odour control chemical	Within 5 working days of incident	Product and Process Engineer
Drum Thickeners	5&6	Liquid sludge	Sludge thickeners are enclosed, and air extracted to atmosphere. Building doors are kept closed, except when access is required. Duty / Standby extraction fan to be available. Prevent increase of fugitive emissions risk from covered processes.	Likely even with the control measures in place	Failure of extraction fans & increase in complaint frequency / odour sniff test identifies sludge odours off-site.	Dose sludge with odour control chemical	Within 5 working days of incident	Product and Process Engineer
						Standby extraction fan to be in service. Investigate cause of limited extraction.	Support from supplier to be arranged at next availability	Product and Process Engineer

Asset	Asset ID	Potential Odour Source	Odour Control Measures	Odour Risk	Mitigation Trigger	Mitigation Measures	Timescale	Responsible Person
Gravity Belt Thickeners	7&8	Liquid sludge	Sludge thickeners are enclosed, and air extracted to atmosphere. Building doors are kept closed, except when access is required. Duty / Standby extraction fan to be available. Prevent increase of fugitive emissions risk from covered processes.	Likely even with the control measures in place	Failure of extraction fans & increase in complaint frequency / odour sniff test identifies sludge odours off-site.	Dose sludge with odour control chemical	Within 5 working days of incident	Product and Process Engineer
						Standby extraction fan to be in service. Investigate cause of limited extraction.	Support from supplier to be arranged at next availability	Product and Process Engineer
Return liquor sump	9	Sludge liquors	Sump covered without extraction and small footprint. Inspection hatches kept closed. Regular throughput is maintained	Unlikely given control measures in place	Increase in complaint frequency / odour sniff test identifies digested liquor odours off-site.	Investigate thickener performance and schedule reactive maintenance	Same day as incident	Product and Process Engineer
						Dose sludge with odour control chemical	Within 5 working days of incident	Product and Process Engineer
Digester Feed Tanks	10	Liquid sludge	Tank is uncovered. Risk assessment and odour plan in place before cleaning of any tank	Likely given lack of control measures in place.	Increase in complaint frequency / odour sniff test identifies sludge odours off-site.	Dose sludge with odour control chemical	Within 5 working days of incident	Product and Process Engineer
Digester	11	Liquid sludge / biogas	Tank is covered and biogas extracted. Risk assessment and odour plan in place before cleaning of any tank.	Unlikely given control measures in place	Loss of digester performance (see Table 14 for monitoring parameters)	Investigate digester performance and schedule reactive maintenance.	Same day as incident	Product and Process Engineer

Asset	Asset ID	Potential Odour Source	Odour Control Measures	Odour Risk	Mitigation Trigger	Mitigation Measures	Timescale	Responsible Person
Biogas Safety Valves	12	Biogas	Planned maintenance on equipment. Monitoring of digester / biogas pressures. Flare available to burn excess gas.	Unlikely given the control measures in place. Critical safety system.	Prolonged / frequent use of safety valve.	Failures are investigated and reactive maintenance undertaken.	Same day as incident	Product and Process Engineer
Biogas Holder	13	Biogas	Planned maintenance on equipment. Monitoring of pressures. Flare available to burn excess gas.	Unlikely given the control measures in place. Critical safety system.	Prolonged / frequent use of safety valves.	Failures are investigated and reactive maintenance undertaken.	Same day as incident	Product and Process Engineer
Flare	14	Biogas	Planned maintenance on equipment.	Unlikely given the control measures in place. Critical safety system.	Prolonged / frequent use of flare.	Failures are investigated and reactive	Same day as incident	Product and Process Engineer
Centrifuge Feed Tanks	15	Liquid digested sludge	Risk assessment and odour plan in place before cleaning of any tank	Reduced risk due to lower odour potential from digested sludge	Increase in complaint frequency / odour sniff test identifies sludge cake storage odours off-site.	Investigate digester performance and schedule reactive maintenance.	Same day as incident	Product and Process Engineer
						Dose sludge with odour control chemical	Within 5 working days of incident	Product and Process Engineer
Dewatering Centrifuge	16	Digested sludge cake	Centrifuge is contained asset	Unlikely given control measures in place. Reduced risk due to lower odour potential from digested sludge.	Increase in complaint frequency / odour sniff test identifies sludge cake storage odours off-site.	Check digester performance.	Same week as incident	Product and Process Engineer

Asset	Asset ID	Potential Odour Source	Odour Control Measures	Odour Risk	Mitigation Trigger	Mitigation Measures	Timescale	Responsible Person
Return Liquor Balance Tank	17	Sludge liquors	Tank is uncovered. Risk assessment and odour plan in place before cleaning of any tank Reduced risk due to lower odour potential from digested sludge liquor	Unlikely given control measures in place. Reduced risk due to lower odour potential from digested sludge liquor.	Increase in complaint frequency / odour sniff test identifies digested liquor odours off-site.	Investigate centrifuge performance and schedule reactive maintenance	Same day as incident	Product and Process Engineer
						Dose sludge with odour control chemical	Within 5 working days of incident	Product and Process Engineer
Sludge Cake Storage	18	Digested sludge cake	Cake handling is minimised (cake is moved only during transfer from conveyor to trailer, when unloaded from the trailer onto the cake pad, and when loaded onto the export wagon) to minimise disturbance and odour release.	Unlikely given control measures in place. Reduced risk due to lower odour potential from digested sludge.	Increase in complaint frequency / odour sniff test identifies sludge cake storage odours off-site.	Restrict process and reduce storage volumes.	Same week as incident	Centrifuge unit operator
						Ensure cake is removed from site for disposal at the earliest opportunity.	Arrange for compliant cake to be removed from site same week	Centrifuge unit operator
						Root cause analysis and resolution.	Immediately	Product and Process Engineer
Sludge cake export	18	Digested sludge cake	Cover the wagon before leaving site	Unlikely given control measures in place. Reduced risk due to lower odour potential from digested sludge.	Wagon uncovered when leaving site	Ensure wagon is covered before leaving site	Immediately	Wagon Driver

4 Odour Impact

4.1 Odour Dispersion Model

An odour dispersion model has not been developed for Aldwarke STF as part of this OMP.

Odour dispersion modelling including site specific olfactometric surveys shall be undertaken in the event of increased frequency of odour complaints or operational changes with a perceived increase in odour impact risk.

Any odour sampling shall be undertaken in accordance with EN standards (e.g. dynamic olfactometry according to EN 13725 in order to determine the odour concentration or EN 16841-1 or -2 in order to determine the odour exposure).

4.2 Odour Survey Results

An odour survey has been undertaken on selected processes as part of the qualitative odour risk assessment. The odour survey was undertaken during April 2022 to assess the odour emissions from the uncovered and treated emission source. Table 7 includes a summary of the survey results.

Table 7 Aldwarke STF Odour Survey Results

Source	Odour Concentration	Odour Emission Rate	Hydrogen Sulphide	Ammonia
	(ou_E/m^3)	($ou_E/m^2/s$)	(ppm)	(ppm)
Fresh Digested Cake	739	7.7	0.007	3.8
Stored Digested Cake	189	2.0	0.006	0.6
Thickener Feed Tank	1,384	14.0	0.410	< 0.1
Digester Feed Tank	945	10.0	0.140	< 0.1
Centrifuge Feed Tank	530	5.5	0.010	0.5
Liquor Return Sump[1]	226	2.3	0.007	1.5
Thickener vent stack	258,886	67,633	31.8	<0.1
GBT vent stack[2]	258,886	81,290	31.8	<0.1

As part of the odour survey, monitoring and sniff tests were undertaken at eleven locations surrounding and within to the STF operational area. The odour description for the majority of the samples was ‘no odour’ however, there were samples where odour was described as either ‘faint’, ‘slight’, ‘moderate’ or

[1] Monitoring at the return liquor balance tank was not possible due to the significant height of this tank. The tank is covered. Therefore sampling was undertaken at the (covered) centrate wet well located adjacent to the cake pad, which directly feeds the return liquor balance tanks and therefore is assumed to have the same characteristics.

[2] Note that monitoring at GBT vent stack was not possible as the GBTs were not operational at the time of the sampling visit (due to maintenance work being carried out). Data for the drum thickener vent has been used as both thickener facilities draw from the same feed tank and therefore have the same characteristics.

'strong'. The monitoring identified four locations within the STF where hydrogen sulphide was found to be above the detection threshold (highest 0.019 ppm hydrogen sulphide, south of the thickener building). Three locations where hydrogen sulphide was detected above this threshold are local to the sludge thickening tanks or thickener buildings with the fourth local to the liquor balance tank. It is noted that this latter sample location is between the liquor balance tank and the inlet for the main WwTW. Therefore, it is likely that odour from the WwTW inlet is contributing to the odour detected at this location (the odour at this location was described as 'odour from the inlet works'). Hydrogen sulphide detected at other locations is likely due to emissions associated with thickened sludge. It is noted that YW is committed to installing OCUs to mitigate emissions from these sources (refer to Proposed Permit Improvement Conditions).

4.3 Qualitative Odour Risk Assessment

A qualitative odour risk assessment of Aldwarke STF has been undertaken by Stantec to determine the odour impact risk at sensitive receptors local to the works. The assessment relies on subjective professional judgement but uses the generic guidance methodologies provided and referenced in documents such as the Institute of Air Quality Managements (IAQM) Guidance on the Assessment of Odour for Planning, the Scottish Environmental Protection Agency (SEPA) Odour Guidance 2010, the Environment Agency's Horizontal Guidance Note H1 Environmental Risk Assessments for Permits, and Annex A of H1 – Amenity & accident risk from installations and waste activities.

These guidelines use the Source-Pathway-Receptor concept in which it evaluates the relationship between source(s) of odour, the pathway or transmission route by which exposure may occur at a given receptor(s) who may be affected/impacted.

How well a qualitative odour risk assessment predicts the odour impact for a scenario is dependent on how well the Source-Pathway-Receptor approach can be assessed and scored. This type of assessment is based on subjective judgement and therefore, robust assessment criteria are required. Where subjective judgement for a criterion could be considered broad, sub-criteria have been determined to provide a more detailed judgement.

The odour offensiveness of the sludge assets have adopted the risk ratings included in Table 4. The pathway from source to receptor considers the distance, local terrain and meteorological conditions, as highlighted in Section 2.3.

The sensitive receptors considered in the assessment are documented in Figure 8 and Table 8.

Figure 8 Aldwarke STF Odour Risk Assessment Sensitive Receptor Locations

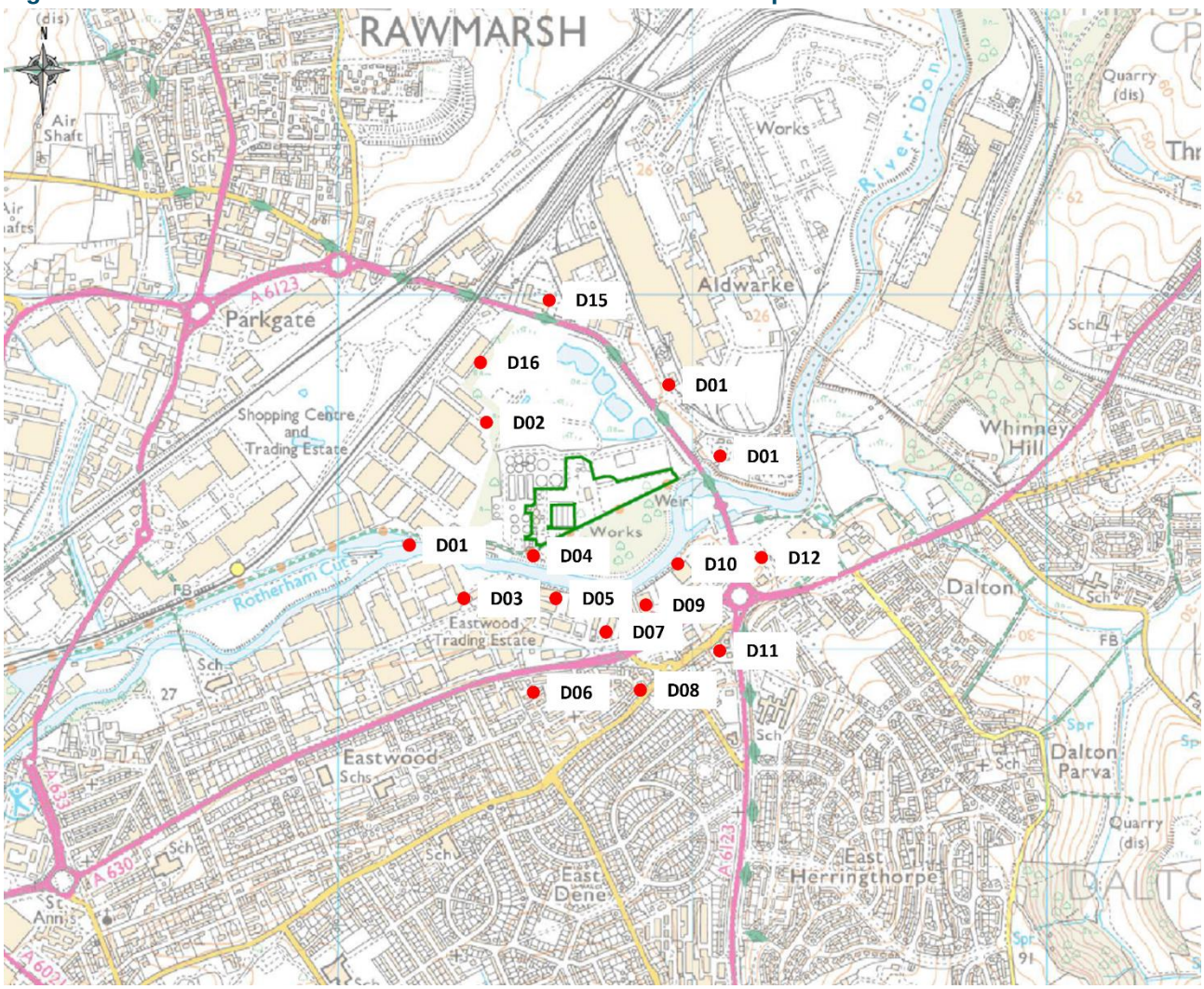


Table 8 Aldwarke STF Odour Risk Assessment Sensitive Receptors

Receptor Name	Receptor ID	Receptor Type	Distance to Site (m)	Receptor Sensitivity
Canal Boat Docking Area	D01	Residential / Boat Docking	355	High
Packaging Supply Shop	D02	Industrial	237	Low
Logistics Warehouse	D03	Industrial	226	Low
Waterside Cottages	D04	Residential	105	High
Freight Forwarding Service	D05	Industrial	125	Low
Ashwell Grove	D06	Residential	356	High
Car Restoration Service	D07	Commercial	240	Medium
Oak Meadows	D08	Residential	421	High
Manufacturer	D09	Manufacturing	269	Low

Receptor Name	Receptor ID	Receptor Type	Distance to Site (m)	Receptor Sensitivity
Retail Park	D10	Commercial	272	Medium
Doncaster Rd	D11	Residential	411	High
Supermarket	D12	Commercial	304	Medium
Electrical Sub-station	D13	Industry	113	Low
Steel Fabricator	D14	Industry	209	Low
Steel Fabricator (Offices)	D15	Offices	416	Medium
Insulation Materials Shop	D16	Manufacturing/ Warehouse	381	Low

4.4 Results

The results of the qualitative odour risk assessment are summarised in Table 9.

Table 9 Aldwarke STF Odour Risk Assessment Results

Receptor ID	Receptor Type	Source Odour Potential	Pathway Effectiveness	Odour Exposure	Receptor Sensitivity	Likely Odour Effect
D01	Residential / Boat Docking	Medium	Ineffective Pathway	Negligible Risk	High	Negligible Effect
D02	Industrial	Medium	Moderately Effective Pathway	Low Risk	Low	Negligible Effect
D03	Industrial	Medium	Moderately Effective Pathway	Low Risk	Low	Negligible Effect
D04	Residential	Medium	Moderately Effective Pathway	Low Risk	High	Slight Adverse Effect
D05	Industrial	Medium	Moderately Effective Pathway	Low Risk	Low	Negligible Effect
D06	Residential	Medium	Moderately Effective Pathway	Low Risk	High	Slight Adverse Effect
D07	Commercial	Medium	Moderately Effective Pathway	Low Risk	Medium	Negligible Effect
D08	Residential	Medium	Moderately Effective Pathway	Low Risk	High	Slight Adverse Effect
D09	Manufacturing	Medium	Moderately Effective Pathway	Low Risk	Low	Negligible Effect

Receptor ID	Receptor Type	Source Odour Potential	Pathway Effectiveness	Odour Exposure	Receptor Sensitivity	Likely Odour Effect
D10	Commercial	Medium	Moderately Effective Pathway	Low Risk	Medium	Negligible Effect
D11	Residential	Medium	Moderately Effective Pathway	Low Risk	High	Slight Adverse Effect
D12	Commercial	Medium	Moderately Effective Pathway	Low Risk	Medium	Negligible Effect
D13	Industry	Medium	Moderately Effective Pathway	Low Risk	Low	Negligible Effect
D14	Industry	Medium	Moderately Effective Pathway	Low Risk	Low	Negligible Effect
D15	Offices	Medium	Moderately Effective Pathway	Low Risk	Medium	Negligible Effect
D16	Manufacturing/ Warehouse	Medium	Moderately Effective Pathway	Low Risk	Low	Negligible Effect

The qualitative odour risk assessment for Aldwarke STF has indicated that all considered sensitive receptors are exposed to either a negligible or slight adverse odour effect indicating no receptors are exposed to a moderately adverse odour effect or worse.

The qualitative odour risk assessment for Aldwarke STF has indicated that all considered sensitive receptors are exposed to either a negligible or slight adverse odour effect indicating no receptor is exposed to a moderately adverse odour effect or worse and that the odour effect of the site is considered not significant.

The YW complaints log recorded no odour complaints over the last five years for the site as a whole (i.e. the YW Aldwarke WwTW and STF).

Of the considered BAT conclusions associated with emissions to air, specifically 14d and 34, a number of sources have been identified as not complying with certain BAT conclusions.

Some of the processes are open to atmosphere, such as the thickener feed tanks, digester feed tanks, centrifuge feed tanks and cake pad. Whilst these processes do not utilise the techniques specifically described in the BAT conclusions; the assessment has not identified a significant risk of odour impact at surrounding receptors from the works. This is supported by the lack of odour complaints and only two “strong” odours detected associated with the sludge thickening process and no “unpleasant” odours associated with the uncovered processes detectable at the STF operational area during the odour survey sniff testing. It is considered that although these processes do not adopt the specified measures in BAT 14d, they do not have an odour impact on surrounding receptors to the level to warrant odour mitigation; as such the alternative measures in place are adequate.

For the overall site, it is considered that Aldwarke STF does not have an adverse odour effect on its surrounding receptors and therefore the odour effect can be considered not significant. As such, no additional odour mitigation is required above the existing measures already observed on site.

4.5 BAT Conclusions

BAT Conclusion 14d

BAT Conclusion 14 is associated with the appropriate combination of techniques to prevent or reduce diffuse emissions to air. BAT Section 14d is associated with the "containment, collection and treatment of diffuse emissions" and includes techniques such as:

- Storing, treating, and handling waste and materials that may generate diffuse emissions in enclosed buildings and/or enclosed equipment (e.g., conveyor belts);
- Maintaining the enclosed equipment or buildings under adequate negative pressure;
- Collecting and directing emissions to an appropriate abatement system via an air extraction system and/or air suction systems close to the emission sources.

An assessment of STF processes has been undertaken against BAT 14d in Table 10 to review current site measures and compliance.

Table 10 BAT 14d Containment, Collection and Treatment of Diffuse Emissions

Source	Containment, Collection and Diffuse Emissions	BAT Compliance	Compliance Restrictions
2 No. Sludge Screens	Sludge screens contained process without foul air extraction. Sludge screens, although of a proprietary enclosed design, do not facilitate creating a negative pressure environment.	Enclosed process, but without extraction and abatement of process air. Small size of source, intermittent use. Adequate measures considered to be in operation.	None
Sludge Screening Skip	Skips open to atmosphere with no containment or treatment of emissions.	Area subject to regular inspection and management, source not considered to contribute to off-site odour nuisance potential. Adequate measures considered to be in operation.	None
Sludge intake wet well	Wet well is covered processes without foul air extraction. Chamber will not hold a negative pressure.	Area subject to regular inspection and management, source not considered to contribute to off-site odour nuisance potential. No further mitigation proposed as wet well not currently in use. The need for emissions abatement will be assessed as part of the planned intake facility refurbishment / replacement scheme	None

Source	Containment, Collection and Diffuse Emissions	BAT Compliance	Compliance Restrictions
2 No. Thickener Feed Tanks	Tank open to atmosphere with no containment or treatment of emissions.	Odour management techniques in use rather than specific BAT containment measures. YW will undertake an options appraisal of measures to cover undigested sludge tanks (i.e. thickener feed tanks and digester feed tanks). Refer to proposed improvement programme.	None
2 No. Drum Thickeners	Thickeners of a proprietary design with odours extracted to ventilation stack. Assumed to hold a negative pressure.	Source is enclosed. Area subject to regular inspection and management, source not considered to contribute to off-site odour nuisance potential. Adequate measures considered to be in operation.	None
Drum Thickener Ventilation Stack	Air extraction and dispersion via a 5m high stack. No odour treatment.	Forced extraction via 5m high stack to assist dispersion of odours. YW will install an OCU at this stack. Refer to proposed improvement programme.	N/A
1 No. GBT	GBTs of a proprietary design with odours extracted to ventilation stack. Assumed to hold a negative pressure.	Source is enclosed. Area subject to regular inspection and management, source not considered to contribute to off-site odour nuisance potential. Adequate measures considered to be in operation.	None
GBT Ventilation Stack	Air extraction and dispersion via a 6m high stack. No odour treatment.	Forced extraction via 6m high stack to assist dispersion of odours. YW will install an OCU at this stack. Refer to proposed improvement programme.	N/A
Return Liquor Sump	Sump is covered processes without foul air extraction. Sump will not hold a negative pressure.	Area subject to regular inspection and management, source not considered to contribute to off-site odour nuisance potential. Sump is covered and small footprint. Adequate measures considered to be in operation.	None
2 No. Digester Feed Tanks	Tank open to atmosphere with no containment or treatment of emissions.	Odour management techniques in use rather than specific BAT containment measures. YW will undertake an options appraisal of measures to cover undigested sludge tanks (i.e. thickener feed tanks and digester feed tanks). Refer to proposed improvement programme.	None

Source	Containment, Collection and Diffuse Emissions	BAT Compliance	Compliance Restrictions
2 No. Centrifuge Feed Tanks	Tank open to atmosphere with no containment or treatment of emissions.	Tank contains digested sludge only which is inherently less odorous. No sensitive receptors in close proximity. Adequate measures considered to be in operation as supported by odour measurements and impact assessment	None
Dewatering Centrifuge	Centrifuges, although of a proprietary enclosed design, do not facilitate creating a negative pressure environment.	Source is enclosed. Area subject to regular inspection and management. Digested sludge source which is inherently less odorous and not considered to contribute to off-site odour nuisance potential. Adequate measures considered to be in operation.	None
Return Liquor Balance Tank	Tank is covered processes without foul air extraction. Tank will not hold a negative pressure.	Odour management techniques in use rather than specific BAT containment measures. Tank contains liquor arising from digested sludge sources which is inherently less odorous. Adequate measures considered to be in operation as supported by odour measurements and impact assessment.	None
Cake Storage	Cake Pad open to atmosphere with no containment or treatment of emissions.	Odour management techniques in use rather than specific BAT containment measures. Digested sludge only, which is inherently less odorous, during normal operating conditions. Adequate measures considered to be in operation, as supported by odour measurements and impact assessment.	The use of enclosed equipment or buildings is constrained by the volume of cake stored.

Of the sources on site, the screening skips, thickener feed tanks, digester feed tanks, centrifuge feed tanks and cake storage area do not adopt the specific conclusions outlined in BAT 14d. The sludge screens, sludge wet well, drum thickeners, GBT, return liquor sump, dewatering centrifuge and return liquor balance tank would be considered to be partially compliant due to being contained processes. Whilst these processes are only partially compliant, the sludge screens, sludge wet well, return liquor sump, drum thickener, GBT and dewatering centrifuge occupy a small source footprint and are not likely to contribute to significant odour emissions or impact on surrounding receptors.

Specific BAT measures within 14d are not in use on the centrifuge feed tanks. However, the odour survey indicates that the digested sludge emissions have a low emission rate, more akin to secondary treated wastewater than indigenous sludge emissions. As activated sludge plants and final tanks are typically uncovered wastewater treatment processes, argument could be made that as the dewatering feed tanks are more akin to these process emissions, that these tanks could remain uncovered, presenting a low risk of odour impact on surrounding receptors.

The cake pad is not covered and does not utilise specific measures outlined in BAT 14d. The cake pad odour emissions are more akin to secondary treated wastewater than indigenous sludge emissions. Covering the cake pad would require a significantly sized building with air extraction / ventilation, odour treatment and dispersion to atmosphere. Given the infrequent nature of odour complaints, the risk of odour impact from this area would be limited and does not warrant additional mitigation measures beyond adherence to measures established in the odour management plan and limiting cake double handling. These measures are considered adequate and equivalent to the specified provisions in BAT 14d.

BAT Conclusion 34

BAT 34 is associated with the treatment of channeled emissions to air and identifies the accepted techniques and associated emission levels (BAT-AELs). The BAT-AELs for channeled emissions are included in Table 11.

Table 11 BAT 34 BAT Associated Emission Levels for Channelled Emissions

Parameter	Unit	BAT-AEL (Average over the sampling period)	Waste Treatment Process
Ammonia (NH_3)	Mg/Nm^3	0.3 - 20	All biological treatments of waste
Odour Concentration	ou_E/m^3	200 – 1,000	

To note, whilst the BAT-AEL for odour concentration is reported as a range, clarification has been provided that the upper range of 1,000 ou_E/m^3 is an accepted performance limit. As part of the odour survey, the ventilation stacks were sampled and identified to have a stack outlet concentration in excess of the BAT-AEL of 1,000 ou_E/m^3. Although odour complaints have not been received at Aldwarke, survey data has indicated that emissions from 2 no. thickener air extraction stacks are high and therefore OCU(s) will be installed to treat these emissions. Refer to proposed improvement programme.

4.6 Odour Improvement Plan

The identified odour improvements for the site are detailed in Table 12.

Table 12 Odour Improvement Pan

Action No.	Source ID	Source	Odour Risk	Improvement Plan	Timescale
1	4	Thickener Feed Tanks	Uncovered undigested sludge	Undertake an options appraisal of measures to cover undigested sludge tanks (i.e. thickener feed tanks and digester feed tanks). This includes an engineering assessment of the viability of retrofitting a fixed roof and undertaking trials of floating media (either balls or plastic plates) as an alternative approach to tank covering for existing uncovered tanks. Proposals to cover undigested sludge tanks at Aldwarke will be developed once these investigations and trials have been completed.	6 months- completion of tank covering trials and report findings and submit proposals for tank covering at Aldwarke 18 months – to implement tank cover solution
2	10	Digester Feed Tanks	Uncovered undigested sludge		
3	5, 6	Thickener Vent Stack	Untreated channeled emissions	Installation of new OCU to treat odours from sludge thickeners	By 2025 (end of AMP period)
4	7, 8	GBT Vent Stack	Untreated channeled emissions	Installation of new OCU to treat odours from GBTs	By 2025 (end of AMP period)

5 Monitoring and Control of Odours

All monitoring should clearly relate to the assessment of odour control and complete records must be kept in an auditable format. The only way to determine whether the processes on site are under control, and to keep them under control, is to carry out appropriate monitoring.

As far as possible, Aldwarke STF is operated to minimise odour generation and release. As long as the treatment process satisfies the normal design criteria, odour should be minimal. To minimise odour nuisance, it is important to ensure that Aldwarke STF is operating at its optimum. Covers and hatches should always be replaced to maintain the integrity of enclosures provided to collect odorous air.

5.1 Sniff Testing

Sniff testing is recognised by Yorkshire Water as a useful technique to build up a picture of the impact the odour has on the surrounding environment over time. Sniff testing shall be used to support profiling site odour impact, investigate odour complaints and to introduce temporary odour mitigation measures.

Sniff testing shall be undertaken on site on a weekly basis by site operational staff. It is accepted that operational staff may not be ideal for sniff testing of site odours as they have adapted to odours from the site. However, this will provide a baseline for routine observations. The weekly operator sniff tests shall assess the site boundary and focus on the detection of any odours that could potentially be leaving site.

Monthly sniff tests shall be carried out by non-site-based staff (Technically Competent Manager) who are not adapted to site odours. The monthly sniff test shall be carried out at additional test locations local to source to profile the location of any fugitive emission sources. For Aldwarke STF, due to a lack of odour complaints and the majority of assets having odour mitigation, the routine sniff-testing shall be site based only.

In the event of odour complaints being received, site operators shall undertake a sniff test including off-site sniff testing local to the complaint location(s). In the occurrence of a significant odour event or repeated complaints, a third-party shall be engaged for an additional odour investigation including on and off-site sniff testing.

A third-party odour sniff test is scheduled to be undertaken twice a year for comparison with Yorkshire Water (operator and monthly tester) observations. The third-party sniff test shall include both on and off-site locations based on surrounding sensitive receptors and complaint locations. The off-site locations shall be reviewed prior to any third-party testing to ensure any recent changes to sensitive receptors are considered.

The location of weekly and monthly on-site sniff testing locations has been included in Figures 9 and 10 respectively. Routine off-site locations have not been included due to a lack of odour contacts. In the event that odour complaint frequency increase, off-site locations shall be incorporated into the routine sniff testing.

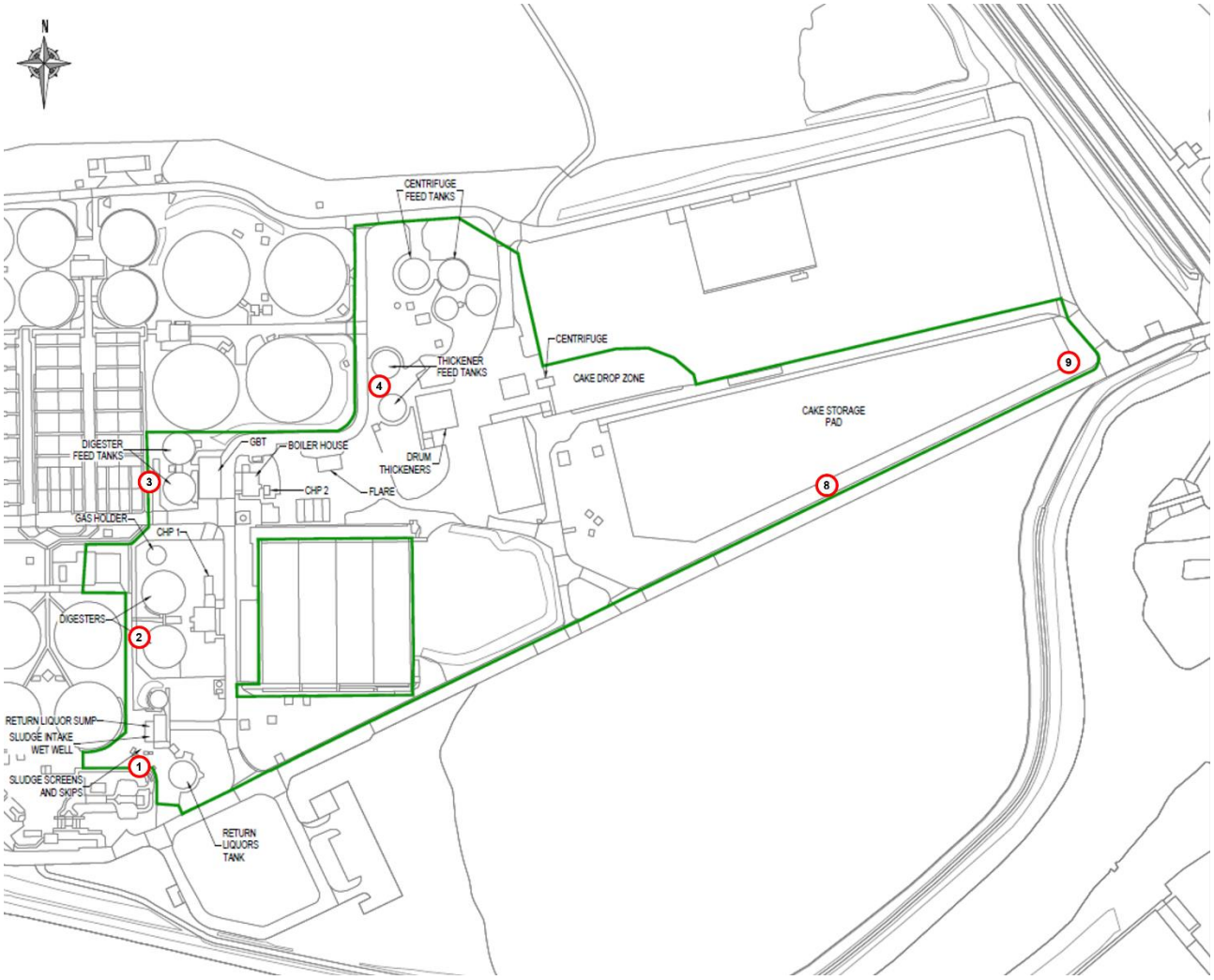


Figure 9 Aldwarke STF Weekly On-Site Sniff Testing Locations

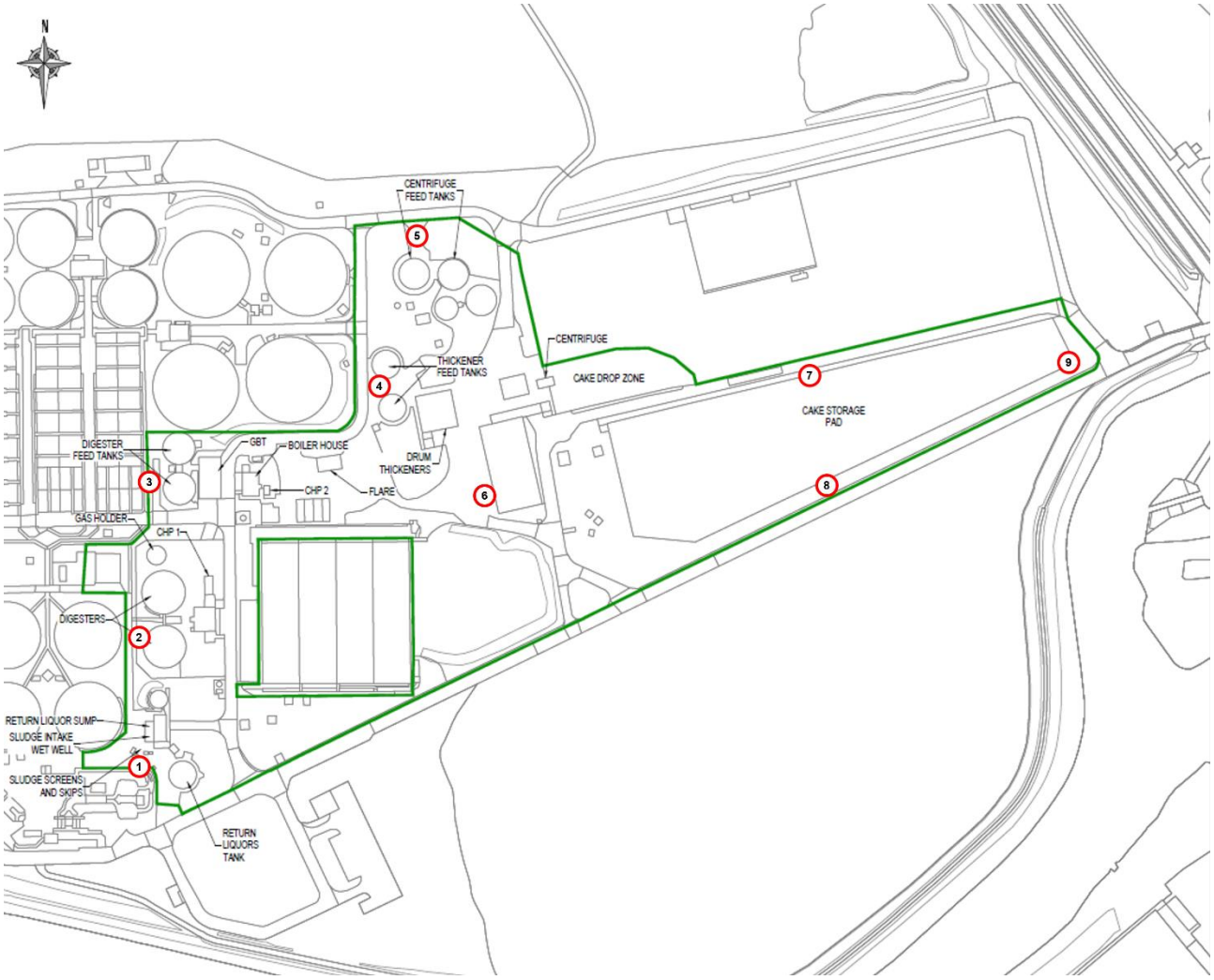


Figure 10 Aldwarke STF Monthly On-Site Sniff Testing Locations

5.2 Imports/Exports

The Site Operating Procedures include instructions on how sludge must be imported. The YW Safe Loading & Discharging of Sludge Road Tankers is available in Appendix 5. Tankers shall be filled and emptied in a way that minimises odour discharge.

5.3 Sludge Treatment and Disposal

Raw or co-settled sludges always smell objectionable, but the odour becomes stronger during storage, as anaerobic decomposition occurs, leading to high concentrations of malodorous compounds in sludges and sludge liquors. Digested sludges are less odorous, particularly after they have cooled. To minimise the generation of odours, where possible, fresh sludge shall be processed and sent to digestion as quickly as possible before further treatment and removal from site. Raw sludges stored upstream of digestion would never be stored for more than 2 days in normal plant operation.

5.4 Sludge Thickening and Storage

Accumulation of sludge in the system can cause increased odour release in storage tanks, as well as from sludges and liquors when thickening takes place. To minimise odours from the Aldwarke STF, the works should be operated as follows:

- Minimise retention prior to thickening, dewatering or digestion;
- Prevention of sludge accumulation in off-line tanks; and
- Proactive identification of potential problems and tankering of sludges to other sites with odour abatement.

5.5 Anaerobic Digestion

The digestion process breaks down a wide range of odorous compounds, which may be released if care is not taken to avoid turbulence of the sludge after digestion. Odour problems may be caused by:

- Saline intrusion (or industrial wastes) leading to elevated sulphate concentrations of raw sludge, giving a greater sulphide potential;
- Emissions of biogas resulting in significant odour problems; and
- Incomplete digestion leading to odour release from secondary digestion tanks.

Suggested remedial measures include:

- Check seals and valves to prevent the release of biogas;
- Ensure gas handling system is balanced and that pressure relief valves do not operate prematurely;
- Ensure all excess gas is flared and that flare stack ignition is immediate and reliable;
- Addition of iron salts or other chemicals to precipitate or inhibit the formation of sulphide.

There are odour checklists for both YW Operators and Team Leaders in Appendix 2.

5.6 Site Operation and Management Procedures

- All operating practices should be compliant with the site O&M manuals. The Integrated Management System (IMS) developed by YW to cover Environmental, Health & Safety and Quality elements of all aspects of YW activities will also apply.
- The IMS identifies the environmental aspects and impacts of all YW plants, including the facility at Aldwarke. The facility will operate under the IMS which shall include:

- Quality management procedures for operational aspects, for example: preventative electrical and mechanical maintenance, safe working procedures, accident / incident response and emergencies;
- Specialist contractors shall be employed by YW to undertake any non-routine or specialised maintenance tasks;
- Use of only YW approved contractors. YW maintain an approved contractors list which is used for appointment of all YW contractors. This requires contractors to achieve a high level of environmental competence / performance. YWS Framework Contractors are required to operate an EMS in accordance with ISO 14001;
- Preparation/issue of risk assessments and method statements by all contractors before starting work. These risk assessments and method statements will include consideration of odour and measures in place to control odour releases. These are prepared as part of the 'hand - over' and 'hand – back' certificate or 'permit to work'; and
- Regular environmental and quality audits to be carried out. These shall include a review of potential odour and identify any additional control measures which may be required.

5.6.1 Procedures for Operation Plant

All operating practices should be compliant with the site O&M manuals, YW company practice and the OMP.

5.6.2 Routine Inspection and Recording

Visual inspection of facility processes will be carried out on regular basis as part of staff duties. If abnormal odour is witnessed, YW staff shall record details in the Odour Log Spreadsheet of the observation and immediately investigate. During any such recording carried out as part of this OMP, it is important to document any potential contribution from other off-site sources of potential odour nuisance located outside of the facility boundary. An odour monitoring record sheet to be used in the event of site odours is included in Appendix 3.

5.6.3 Maintenance by Engineering Reliability Staff

Engineering Reliability staff (Mechanical Fitters, Electricians and ICA Technicians) carry out routine maintenance of plant and equipment. This includes odour abatement equipment.

Routine maintenance requirements are included within YW's Work Management System (WMS) task lists for the site and are forwarded to members of this team via their Toughbook. Feedback on planned maintenance carried out is recorded in WMS by the Engineering Reliability staff member via their Toughbook and transferred to SAP for storage.

5.6.4 Reporting Faults and Identifying Maintenance Needs

For faults requiring immediate attention, the Product and Process Engineer raises a SAP notification and calls it through to the Scheduling & Planning Team. If it meets a high priority according to the Risk Assessment Matrix (RAM), it will be attended as a scheduling buster for the relevant YW Engineer to attend site.

For less urgent faults the Product and Process Engineer raises a SAP notification. It will be converted into a SAP job and picked up by the Scheduling & Planning Team and progressed accordingly. If at any time the situation changes, and the job becomes more urgent, the Product and Process Engineer (PPE) would re-prioritise the SAP job in line with the RAM and call through to the Scheduling & Planning Team.

Routine maintenance requirements are fed to YW's maintenance team via SAP.

5.7 Changing Dispersion Conditions

Site activities that could lead to increased site emissions will be avoided when there are poor dispersion conditions or during sensitive periods (hot days, when people are more around). If not possible to be avoided, additional monitoring in the form of sniff testing and monitoring of site performance shall be undertaken. In the event that site activities lead to an increase in off-site odours or customer complaints, the activity shall be rescheduled / undertaken during low-risk times / weather conditions.

Table 13 Aldwarke STF Changing Dispersion Risk

Asset	Changing Dispersion Condition	Mitigation Trigger	Mitigation Action	Time scale	Responsible Person
Screening skip	Hot Days, School Holidays (summer)	Temperature - >26°C and significant odour complaints	Increase frequency of skip export from site	Forecast in advance – 5-day weather forecast	Product and Process Engineer
Sludge cake export	Hot Days, School Holidays (summer)	Temperature - >26°C and significant odour complaints	Cake export between 8am to 6pm only	Forecast in advance – 5-day weather forecast	Product and Process Engineer

6 Emergency and Incident Response

This section addresses the issue of appropriate response to odour incidents caused by process failure or equipment breakdown. These emergency procedures include the:

- Foreseeable situation that may compromise the ability to prevent and minimise odorous releases from the process;
- Actions to be taken to minimise the impact; and
- Person responsible for initiating the action.

Where abnormally high odour levels are observed – indicating odour pollution a PPE will be required to take appropriate contingency measures. These measures should include:

- Investigating the odour incident and its cause(s);
- Bringing the process back under control; and
- Minimising exposure or annoyance effects.

Table 14 below summarises incident / emergency control measures in place. The YW odour emergency contact details for Aldwarke STF are available in Appendix 1.

Table 14 Aldwarke STF Incident/Emergency Control Measures

Failure/Abnormal Situation	Potential Odour Source	Potential Impact	Mitigation Measures	Actions to be Taken	Timescale for Rectification	Responsible Person
Liquid sludge import spillage	Liquid sludge	Medium – low volume spillage likely to go directly to drain which returns to the WwTW for treatment.	Pipework and tanks undergo regular inspections. Planned maintenance on equipment	Stop source of spill and immediately wash down area.	Immediate	Tanker Driver
				Arrange repair.	Job to be raised and promoted on same working day or next	Site Operator
				Record spillage and actions taken in site diary.	Same day as incident	Site Operator
Sludge cake spillage	Sludge Cake	Medium to High depending on volume of spill	Regular inspection and planned maintenance	Stop source of spill and immediately wash down area.	Immediate	Tanker Driver
				Arrange repair.	Job to be raised and promoted on same working day or next	Site Operator
				Record spillage and actions taken in site diary.	Same day as incident	Site Operator
				If there is likely to be any offsite impact inform manager and technically competent manager immediately.	Same day as incident	Site Operator
Contingency storage of raw/indigenous sludge on cake pad	Raw/Indigenous sludge cake	High	Regular inspection and planned maintenance	Arrange repair	Job to be raised and promoted on same working day or next. Work to be prioritised. Raw sludge cake to be processed through the digester as priority.	Site Operator
High pressure conditions in digesters	Release from Pressure Relief Valve	Medium - Biogas would be vented at high pressure to aid dispersion	Gas pressure is regulated and monitored	Diversion of biogas to Waste Gas Burner	Immediate	Site Operator
				Investigate likely sources of high pressure in the digester and resolve (e.g. blocked outlet)	Immediate	Site Operator

Failure/Abnormal Situation	Potential Odour Source	Potential Impact	Mitigation Measures	Actions to be Taken	Timescale for Rectification	Responsible Person
Loss of Biogas containment	Leaks from gas holder membrane or release from pressure relief valves	Medium	Double gas holder membrane system with gas pressure between the membranes regulated and monitored. Methane detectors operated with alarms to alert operators of any leakage between membranes.	Diversion of biogas to CHP plant or Waste Gas Burner. Inspection maintenance and repairs of gas holder as appropriate	Immediate	Site Operator
				Record details and Actions taken in site diary	Immediate	Site Operator
Staff unavailability	Risk of increase to site odours due to limited operational resources	Low	Staff replacement	Operator replacement from another site Remote monitoring from Control Room / off-site / another site	Same day / For next working day	Product and Process Engineer / Site Manager
Asset Fire	Risk of increase to site odours due to limited access and inability to operate assets	Medium	Regular inspection and planned maintenance	Remote monitoring from Control Room / off-site / another site	Immediate	Product and Process Engineer
Very high rainfall	Flooding	Low	Increased monitoring of media and sludge storage	Check the performance of the Odour Control Unit when water levels drop and replace media as required (if media has been flooded it may need replacing)	Site operator to investigate on same working day. Support from OCU supplier to be arranged for next availability	Product and Process Engineer

7 Inspection/Monitoring/Maintenance Schedules and Records

7.1 Inspection/Monitoring/Maintenance Schedules for Odour Abatement Equipment

Proactive maintenance tasks are included within SAP task lists for each site and are forwarded to the Product and Process Engineer and Operator via their Toughbook for completion.

Feedback on maintenance of odour abatement equipment and pipework is recorded in SAP by the Product and Process Engineer or Operator via their Toughbook. YW maintenance staff also provide feedback on work carried out by them.

7.2 Key Process Monitoring

The site is operated under a full PLC SCADA control with data logging and interrogation of key parameters to maintain safe, efficient, and low emissions operation. Table 15 includes the key process monitoring provisions for processes associated with emissions to air.

Table 15 Key Process Monitoring Provisions

Emission point / description	Parameter	Monitoring approach	Monitoring frequency
Sludge intake	Intake volume	JRP/WaSP	Continuous during unloading operations
	% dry solids	JRP/WaSP	Continuous during unloading operations
CHPs (A1 and A2)	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 (A3 and A4)	Load required / actual (%)	SCADA	Continuous data logging
	Biogas 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 (A5)	Biogas to flare (m^3)	SCADA	Continuous data logging
Biogas storage	Gas level (%)	SCADA	Continuous data logging
	Gas pressure (mb)	SCADA	Continuous data logging
	Methane %	SCADA	Continuous data logging

Emission point / description	Parameter	Monitoring approach	Monitoring frequency
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
	Foam level	SCADA	Continuous data logging
Thickeners (drum and gravity belt)	Dry solids (%) – inlet and outlet	SCADA	Continuous data logging
	Flow – inlet and outlet	SCADA	Continuous data logging
Centrifuge	Dry solids (%) - inlet	SCADA	Periodic
	Dry solids (%) - outlet	Manual	Periodic
	Flow (m^3/hr) at inlet	SCADA	Continuous data logging

8 Customer Communications

8.1 External Complaints

External odour complaints are received by Loop, which is the external company YW uses for all customer contacts. The call handler will work with the caller to understand the source of the issue. They will explore where the caller experienced the odour, whether it is a repeat or a singular issue, when and where it's most noticeable, what site the odour may be coming from, a description of the smell and if it's the first time it's been noticed. Loop record all complaints on the ICE system and contact the appropriate site owner, via the YW Control Room, to manage the complaint. The complaint will be passed to the Site Manager within 30 minutes or next working day if out of hours. The issue will be dealt with as a matter of priority. ICE is a computer program used to record and manage customer contact. The complainant may or may not request feedback of the cause and resolution of the issue. The odour contact form is included in Appendix 7.

When a complaint has been received, Site will undertake an investigation using the Site Checklist and record details of the investigation in the Odour Investigation Form (Appendix 8).

Odour complaints will be investigated at this site on the same working day (where practicable) and ideally within 2 working days of being aware of the issue. The investigation must not be carried out any later than 5 working days after being aware of the issue.

The Technical Optimiser should then put a note in the site diary and odour diary to record the complaint and inform the TCM and Site Manager of their findings.

Any actions will be resolved as a matter of priority. If immediate resolution of the odour issue can't be carried out, and where reasonably practicable, mitigation measures will be undertaken. Actions will be recorded on the investigation form. Feedback of the issue and the actions undertaken will be sent to the Customer Case Manager to communicate to the Complainant (if requested).

In the event of multiple complaints, and / or the potential for multiple complaints to occur, the Duty Manager will be informed and an incident response will be instigated.

8.2 Internal Complaints

If the PPE or any YW staff identify an abnormal odour release, the PPE will undertake an investigation using the Operator Site Checklist and complete any actions the investigation suggests. The PPE should then put a note in the site diary and the odour site dairy and inform the Technical Optimiser and Site Manager of their findings.

The odour complaint process is included in Appendix 6.

8.3 Community Engagement

Customers are at the heart of what we do at Yorkshire Water. In the event of an odour issue affecting multiple customers within the community, Yorkshire Water's communication team will decide the level of response that is required. This could include, but not be restricted to, stakeholder liaison (communication through local councillors, MPs and affected businesses), local media liaison and/or community meetings to discuss the issues and actions that will be undertaken to rectify the issue. Customer engagement events would be held if the odour severity dictated this level of response. Customers may be encouraged to keep an odour diary to record when odour is perceived to be a greater issue.

9 Training

9.1 Training Requirement

The training requirements for key staff at Aldwarke STF are displayed in Table 16 below.

Table 16 Aldwarke STF Training Requirements

Post	Training Requirement
Product and Process Site Manager	• Awareness of the responsibilities for avoiding odour nuisance. • Monitoring / maintenance of odour abatement equipment. • Odour control procedures during start-up / shut down. • Procedures for abnormal conditions. • Requirements of the OMP and Environmental Permit.
Product and Process Engineer / Operator	• Awareness of the responsibilities for avoiding odour nuisance. • Monitoring / maintenance of odour abatement equipment. • Odour control procedures during start-up / shut down. • Procedures for abnormal conditions. • Requirements of the OMP and Environmental Permit.
Sampler	• Awareness of responsibilities for avoiding odour nuisance and reporting. • Monitoring of odour abatement equipment.

9.2 Training Received

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 Aldwarke 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 Aldwarke site is held by individual managers and/or on the Leaning Management System.

Appendices

Appendix 1 Emergency Contacts

Table 17 Aldwarke STF Contacts

Area	Contact
Sheffield Council	0114 273 4567
Odour Abatement Systems Suppliers	ERG Odour Control
OCU Maintenance Provider	Greenacre Environmental Systems Limited
Aldwarke STF Odour related Yorkshire Water Contacts	Adam Broughton - 07790616873 Site Optimiser: John Bullivant - 07790617692

Appendix 2 Odour Checklist

CHECKLIST FOR SITE ODOUR INVESTIGATION

AREA OF WORKS	POTENTIAL PROBLEM		FOLLOW UP ACTION REQUIRED
ODOUR MANAGEMENT PLAN (OMP)	· Does the site have an OMP?	YES / NO	
	· Is the site operated according to the OMP?	YES / NO	Inform Treatment Team Leader
SITE - GENERAL	· Are all covers in place?	YES / NO	Replace covers and close hatches as required
	· Are all access hatches closed?	YES / NO	
INLET WORKS	· Is the crude sewage black and / or smelly?	YES / NO	Inform Treatment Team Leader
Screening	· Are there any spilled screenings?	YES / NO	Clean up spills
	· Are the compacted screenings clean?	YES / NO	Inform Treatment Team Leader if screenings are not clean
Grit Removal	· Is there any spilled grit?	YES / NO	Clean up spills
	· Is the grit clean?	YES / NO	Inform Treatment Team Leader if grit is not clean
Screening and Grit Skips	· Do the screenings skips smell?	YES / NO	Inform Treatment Team Leader
	· Do the grit skips smell?	YES / NO	Inform Treatment Team Leader
	· Are the screenings skips too full?	YES / NO	Empty skips as needed
	· Are the grit skips too full?	YES / NO	Empty skips as needed
Storm Tanks	· Have the storm tanks been left full following a storm?	YES / NO	Empty and clean out tanks as needed
	· Is there any sludge left in the bottom of the tanks?	YES / NO	
PRIMARY TANKS	· Are the tanks black and / or smelly?	YES / NO	Inform Treatment Team Leader
	· Are the tanks gassing?	YES / NO	
	· Is there excess scum on the surface?	YES / NO	
BIOLOGICAL FILTRATION	· Are the aeration vents blocked?	YES / NO	Inform Treatment Team Leader
	· Is there any ponding?	YES / NO	
ACTIVATED SLUDGE	· Do the dissolved oxygen levels in the aeration lanes match the setpoint(s)?	YES / NO	Adjust dissolved oxygen levels as required
	· Do the MLSS fall within the tramlines for the site?	YES / NO	Increase / decrease RAS rate as needed
FINAL TANKS	· Are the tanks black and / or smelly?	YES / NO	Inform Treatment Team Leader
	· Are the tanks gassing?	YES / NO	
	· Is there excess scum on the surface	YES / NO	
TERTIARY TREATMENT	· Any there any site specific issues?	YES / NO	Inform Treatment Team Leader
SLUDGE TREATMENT	· Are there any sludge spills?	YES / NO	Clean up spills
Imports and Exports	· Does the tanker filling and emptying process cause significant release of odour?	YES / NO	Inform Treatment Team Leader
Sludge Thickening and Storage	· Are all covers are in place?	YES / NO	Replace covers and close hatches as required
	· Are all access hatches closed?	YES / NO	
	· Are the doors to sludge treatment buildings / sludge cake stores kept closed?	YES / NO	Close doors as required
Anaerobic Digestion	· Is all excess gas flared?	YES / NO	Inform Treatment Team Leader
	· Is flare stack ignition immediate and reliable?	YES / NO	
	· Are the whesso valves / PRVs operating prematurely?	YES / NO	
	· Are the seals on the condensate traps intact?	YES / NO	
ODOUR ABATEMENT	· Is there any detectable odour downwind of the stack?	YES / NO	Inform Treatment Team Leader
	· Is the fan(s) working?	YES / NO	Arrange for fan to be repaired
GENERAL	· Are there any outstanding actions from a previous investigation?	YES / NO	Complete actions

NAME: _____ **DATE:** _____

CHECKLIST FOR SITE ODOUR INVESTIGATION
PRODUCT + PROCESS OPTIMISER / TREATMENT TEAM LEADER

AREA OF WORKS	POTENTIAL PROBLEM		FOLLOW UP ACTION REQUIRED
ODOUR MANAGEMENT PLAN (OMP)	· Does the site have an OMP?	YES / NO	
	· If the site is not operated according to the OMP	YES / NO	Make changes to site operation to minimise odour production and release
SITE - GENERAL	· Are all covers in place?	YES / NO	Replace covers and close hatches as required
	· Are all access hatches closed?	YES / NO	
INLET WORKS	· If the crude sewage black and / or smelly	YES / NO	Check incoming sewage for septicity (in conjunction with Operations Support team) Contact Industrial Waste to check for potential septic discharges
Screening	· Are there any spilled screenings?	YES / NO	Clean up spills
	· If the compacted screenings are not clean	YES / NO	Optimise operation of screenings handling equipment
Grit Removal	· Is there any spilled grit?	YES / NO	Clean up spills
	· If the grit is not clean	YES / NO	Optimise operation of grit handling equipment
Screening and Grit Skips	· If the screenings skips smell	YES / NO	Check that screenings are clean and free from organic material; optimise screenings handling equipment if needed Empty skip(s)
	· If the grit skips smell	YES / NO	Check that grit is clean and free from organic material; optimise grit cleaning system if needed Empty skip(s)
	· Are the screenings skips too full?	YES / NO	Empty skips as needed
	· Are the grit skips too full?	YES / NO	Empty skips as needed
Storm Tanks	· Have the storm tanks been left full following a storm?	YES / NO	Empty and clean out tanks as needed
	· Is there any sludge left in the bottom of the tanks?	YES / NO	
PRIMARY TANKS	· If the tanks are black and / or smelly	YES / NO	Check inlet for septicity: Check levels of sludge in the tank and increase desludge rate if needed
	· OR If the tanks are gassing	YES / NO	
	· If there is excess scum on the surface	YES / NO	Remove excess scum
BIOLOGICAL FILTRATION	· If the aeration vents are blocked	YES / NO	Unblock aeration vents
	· If there is ponding	YES / NO	Consider increasing flushing rate and / or forking media
ACTIVATED SLUDGE	· Do the dissolved oxygen levels in the aeration lanes match the setpoint(s)?	YES / NO	Adjust dissolved oxygen levels as required
	· Do the MLSS fall within the tramlines for the site?	YES / NO	Increase / decrease RAS rate as needed
FINAL TANKS	· If the tanks are black and / or smelly	YES / NO	Check inlet of tanks for septicity: Check levels of sludge in the tank and increase desludge rate if needed
	· OR If the tanks are gassing	YES / NO	
	· If there is excess scum on the surface	YES / NO	Remove excess scum
TERTIARY TREATMENT	· If there are any site specific issues	YES / NO	Investigate and rectify
SLUDGE TREATMENT	· Are there any sludge spills?	YES / NO	Clean up spills
Imports and Exports	· If the tanker filling and emptying process causes significant release of odour	YES / NO	Investigate whether the process can be modified to reduce odour emissions Consider changing timing of tanker operations to reduce nuisance potential
Sludge Thickening and Storage	· Are all covers are in place?	YES / NO	Replace covers and close hatches as required
	· Are all access hatches closed?	YES / NO	
	· Are the doors to sludge treatment buildings / sludge cake stores kept closed?	YES / NO	Close doors as required
Anaerobic Digestion	· If all excess gas is not flared	YES / NO	Contact ER to investigate
	· If flare stack ignitionis not immediate and reliable	YES / NO	Contact ER to investigate
	· If the whesso valves / PRVs operate prematurely	YES / NO	Contact ER to investigate
	· If the seals on the condensate traps leak or are damaged	YES / NO	Contact ER to investigate
ODOUR ABATEMENT	· If there is any detectable odour downwind of the stack	YES / NO	Check OCU using additional checklist
	· Is the fan(s) working?	YES / NO	Arrange for fan to be repaired
GENERAL	· If there are any outstanding actions from a previous investigation	YES / NO	Complete actions

NAME: _____ **DATE:** _____

Appendix 3 Odour Monitoring Record Sheet

Odour Monitoring Record Sheet

Sheet No:

				METEROLOGICAL CONDITIONS							ODOUR[1]		SOURCE		SITE STATUS	CORRECTIVE ACTION	
Date	Location	Time	Staff Name	Weather Temp	General air quality	General air stability	Wind Strength	Wind Direction	Bar Pressure	cloud cover	Intensity 0-6	Offensiveness / Nature	Source within facility	External source	Facility Activities	Action required	Action implemented

[1] *Intensity: 0 No odour, 1 Very faint odour, 2 Faint odour, 3 Distinct odour, 4 Strong odour 5, Very strong odour, 6 Extremely strong odour

Appendix 4 Sniff Testing Record Sheet

Test by		Start Time	
Date		End Time	
Weather Condition		Temperature	
Wind Strength		Wind Direction	

Location No. / Name	Nearest Receptor Sensitivity	Intensity	What does it smell like?	Frequency of odour?	Is the source evident?	Other comments / observations
1. Return Liquor Balance Tank	Low / Medium / High	0 No odour 1 Very faint 2 Faint odour 3 Distinct odour 4 Strong odour 5 Very strong odour 6 Extremely strong odour.		Constant / Intermittent	Yes / No Source area / name to be provide. Might be that maintenance work if occurring and you can detect increased odours due to that activity, or call smell cake import wagon etc	Are there odours detected from other sources? Farm / Landfill / other industry etc
2. Digesters						
3. Digester Feed Tanks						
4. Thickener Feed Tanks						
5. Centrifuge Feed Tanks						
6. Thickener / Centrifuge Buildings						
7. Cake Pad - North						
8. Cake pad - South						
9. Cake Pad - East						

Appendix 5 Safe Loading and Discharge of Sludge Road Tankers

Occupational Health & Safety Management System

Safe Working Procedure SWP 007

Safe Loading & Discharging of Sludge Road Tankers

Document Control Ref:	SWP 007
Document Location:	OH&S Database / Safe Working Procedures
Document Custodian:	OH&S Department
Review Period:	5 Years

Revision History

Issue	Date	Reviewed By	Amendment Details
1	31/12/2013	D. Ross	New document
2	13/02/2015	D. Ross	Clauses 2.10, 2.21, 2.25, 3.3, 3.4, 3.5, 3.15
3	12/10/2016	S. Ross, C. Birkenshaw, M. Blanchard, J. Pell	Updated to reflect current practice
4	30/10/2018	J. Pell, M Blanchard	Updated gas monitor requirements & reviewed document

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The following notes are for your guidance. For further information, or if in doubt, contact your line manager / Safety Advisor who will give further help or advice.

Minimum Number of Persons Required: 1	**Major Hazards:** • Hydrogen sulphide • Slips, trips and falls • Manual Handling • Stored energy • Pressure systems • Noise • Falls from height
Essential Safety Equipment Required: • Personal gas monitor • Safety footwear • Hand protection • Hi-Vis jacket/vest • Eye protection • Head protection (hard hat) • Hearing protection • First aid kit (Include. Eyewash) • Task lighting	
Training and/or Documentation required: • Please see Section 6 – Further Guidance.	

1. Introduction

1.1 Sludge tanker 'barrels' are classed as pressure vessels and are subject to annual examination by a competent person. Only fully trained YW personnel, or authorised persons who understand how all the controls pressure relief valves etc. function, may operate this equipment.

Note: Do not use pressure vessels that you are not familiar with or have not been trained on and seek advice and support.

1.2 Pressurised vessels are potentially hazardous under working conditions, and daily checks should be made of the satisfactory operation of safety critical devices such as the Pressure Relief Valve. Follow the detailed supplier's instructions regarding operator's daily checks.

1.3 Sewage and sewage sludge are substances that are potentially hazardous to health. Avoid skin contact, ingestion and inhalation of aerosols. Always wear your personal protective equipment and follow good hygiene practices.

1.4 Experience has shown that during the operation of a vacuum tanker, hydrogen sulphide can be vented from the tanker barrel. The use of suitable portable gas monitors is therefore a mandatory requirement at all times whilst on-site.

1.5 Avoid leaving pressure vessels containing sludge parked overnight. (Where this cannot be avoided ensure that the vessels are adequately vented by the means of leaving the vent valve open).

1.6 Follow designated traffic routes, one way systems etc. and comply with site speed restrictions.

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Safe Loading & Discharging of Sludge Road Tankers

Task

2. Loading the Tanker (Vacuum Transfer)

2.1 On arrival on site, check that your personal gas monitor is turned on – has been calibrated (in a clean air environment) - and is worn on your person at all times whilst on-site (near your breathing zone).

2.2 Complete a 360º check of the tanker/loading area. Consider the environment around you – hazard identification, wind direction, vehicle movements, people in close proximity to the vehicle e.g. operators/contractors etc. Ensure all inlet and outlet valves are closed and then open the vent breaker valve before removing the end-cap.

2.3 Where practicable attach sufficient 'vent bagging' to the compressor exhaust extension pipe to vent any hydrogen sulphide away from the work area to ensure a safe working area is provided. Also consider the positioning or repositioning of your vehicle to reduce the potential of H2S in the working zone.

Note: Ensure that any gases being vented away from the tanker are not creating additional hazards to other people or processes and are not likely to enter a confined space.

2.4 If loading from a hose already connected to sludge holding tank, check hose for weight kick and gently lift (hose may possibly still have liquid left in it). Never assume any hose is sound - check for splits and excessive wear. Also check that couplings are in good condition and the correct sealing ring is in place before using the tanker hose. If the tanker hose is found to have faults, the tanker hose must never be used and be disposed of correctly.

2.5 Connect the hose between the tanker inlet valve and the loading point. Check that all connections are correctly fitted and all air taps are closed.

Note: The use of gloves in couplings is an unacceptable practice – do not use to create a seal in the bauer coupling.

2.6 Ensure that the changeover valves are in the vacuum/suck position.

2.7 Open the travel valve (if not automatic where fitted).

2.8 Once connections to vehicle and sludge tanks are made and vehicle power take off (PTO) is engaged if applicable, the driver should carefully monitor the loading operation. This may be achieved by standing in a safe location outside of the vehicle, observing the loading procedure.

Note: Keep clear of the exhaust area when loading and venting the barrel.

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2.9 Yorkshire Water vehicles predominantly use a hydraulic pack. If using a donkey engine, do not engage the PTO as this will damage the hydraulic pack.

2.10 Start the vacuum pump and check that vacuum starts to develop.

2.11 Monitor the dial gauge to ensure the vacuum develops.

2.12 Open inlet valve on tanker.

2.13 If loading from sludge tank open outlet valve on loading point slowly.

2.14 Look and listen for air or product leaks.

2.15 On tankers fitted with sight glass, check isolation valves are open.

2.16 Feel the hose for sludge going through it and check the sight glass when loading for sludge rising in the barrel.

2.17 You may not always get a full load on the first attempt.

2.18 If this happens, vent the barrel and ensure the dump tank is empty and then re-start vacuum pump and check that vacuum starts to develop.

2.19 Monitor the dial gauge to ensure the vacuum develops.

2.20 When tanker is nearly full (sight glass and dial gauge) close the valve on sludge tank and then open the air release valve to enable the tanker hose to be emptied safely on completion of loading.
Note: Sight glasses should be clearly marked to the correct level for vehicle weight.

2.21 Close inlet valve on tanker.

2.22 Turn off vacuum pump and vent tank.

2.23 Disconnect tanker hose and put away in a safe place ensuring site is left in a clean and safe state.

2.24 Connect end cap and ensure relevant valves, such as vent valves, are closed before moving vehicle.

2.25 In addition to the vacuum loading of tankers, barrels may also be loaded by external pumping. Please refer to the pump loading safe working procedure.

2.26 Complete a 360° walk-around check of the vehicle, equipment and immediate work area.

Note: At sites where there are no fixed tanker points, sludge (or sewage), may have to be drawn directly from an asset which is not a sludge holding tank. Ensure that steps are taken to minimise risk by using the correct tools, considerations are made for working at height, avoid confined spaces and other hazards. If in any doubt about the safety of the operation, consult your line manager.

3 Discharging the Tanker (Pressure)

3.1 Yorkshire Water vehicles predominantly use a hydraulic pack. If using a donkey engine, do not engage the PTO as this will damage the hydraulic pack.

3.2 On arrival on site, check that your personal gas monitor is turned on – has been calibrated (in a clean air environment) - and is worn on your person at all times whilst on-site (near your breathing zone).

3.3 Complete a 360º check of the tanker/loading area. Consider the environment around you – hazard identification, wind direction, vehicle movements, people in close proximity to the vehicle e.g. operators/contractors etc. Ensure all inlet and outlet valves are closed and then open the vent breaker valve before removing the end-cap.

3.4 Open air tap on barrel before removing end cap.

3.5 If discharging from a tanker hose already connected to sludge holding tank, check hose for weight, kick and gently lift (it is possible that the hose may still have liquid left in it). Never assume any tanker hose is sound - check for splits and excessive wear. Also check that couplings are in good condition and the correct sealing ring is in place before using the hose.

3.6 Connect hose between the tanker outlet valve and the off-loading point. Check that all connections are correctly fitted and all air taps are closed.

Note 1: Ensure that tanker hoses are securely connected before operating the V5, rotork valves or manual valves at the off-loading point.

Note 2: The use of gloves in couplings is an unacceptable practice – do not use to create a seal in the bauer coupling.

3.7 Ensure that the discharge point rotork or manual operating valve is fully open before opening the tanker rear outlet valve.

3.8 Open the outlet valve on tanker.

3.9 Ensure that the changeover valves are in the pressure/blow position.

3.10 Open travel valve (if fitted and not automatic).

3.11 Start pump.

3.12 Monitor the Dial Gauge for pressure.

3.13 Feel the hose for sludge going through and where possible visually check the V5 machine or sight glass to make certain liquid is discharging (no blockages).

3.14 Where ever possible it's always better to turn the pump off before the last of the sludge is discharged as this helps to reduce odour, prevent the bagging from bouncing and H2S.

3.15 Be aware that when discharging under pressure the load can be "discharged" with significant force and sludge can spray over a wide area, especially in windy conditions.

3.16 If discharging to a level below the barrel outlet, the preferred method is by gravity as it is a safer but possibly slower operation. Ensure that you have left the pipe work clear of the product.

3.17 Close tanker outlet valve (and ensure any manual/rotork valves at the discharge point are left closed).

3.18 Turn off pump and vent tank in a suitable location to prevent H2S exposure to all parties.

3.19 Open air tap and release remaining air pressure within the tanker hose slowly.

3.20 Disconnect tanker hose and replace end cap.

3.21 Store the tanker hose in a safe place.

3.22 Clean out dump tank and clean up any spillages.

3.23 Ensure all valves are in the correct position. Connect end cap and ensure relevant valves, such as vent valves, are closed before moving vehicle.

3.24 Complete a 360° walk-around check of the vehicle, equipment and immediate work area.

4 Action in the Event of a Gas Monitor Alarm

4.1 The gas monitor is designed to alarm at any reading above 10 parts per million of hydrogen sulphide with a pre warning at 5ppm.

4.2 If an alarm is activated, the driver must immediately shut down the load/discharge operation and walk away from the vehicle. This will remove you from the immediate gas hazard as detected by the monitor.

4.4 Advise any person in the local area that there is hydrogen sulphide present and ask them to leave the area until you give the all clear.

4.5 Check your gas monitor – the reading will start to decrease as you move out of the gaseous atmosphere.

4.6 Periodically check the reading of the monitor, when the reading has dropped to a safe level and press the reset button on the monitor. Walk back towards the working area, checking gas levels.

4.7 If the alarm sounds again, repeat the above process.

4.8 Once the alarm indicates it is safe at the vehicle controls – re-start the load/unload process.

4.9 All gas monitor alarms over 10ppm must be reported as 'Near Misses'.

4.10 The alarm will indicate the presence of hydrogen sulphide and you must follow the SWP if the alarm sounds.

4.11 Multiple alarm activations may occur at a site during a load/unload. If this occurs for a prolonged period stop work at this site and seek immediate advice from your line manager.

4.12 Time Weighted Average alarm means that you should inform your line manager and stop working with sludge for the day when using a gas monitor.

5 Incident and Hazard Reporting

5.1 Report all Accidents to your line manager immediately and complete an accident report on Safeguard.

5.2 Report all Near Misses using the YW incident reporting system on Safeguard.

5.3 Report all Hazards using the YW Hazard Reporting System on Safeguard.

5.4 Report any vehicle defects promptly in accordance with the YW Fleet defect reporting procedures.

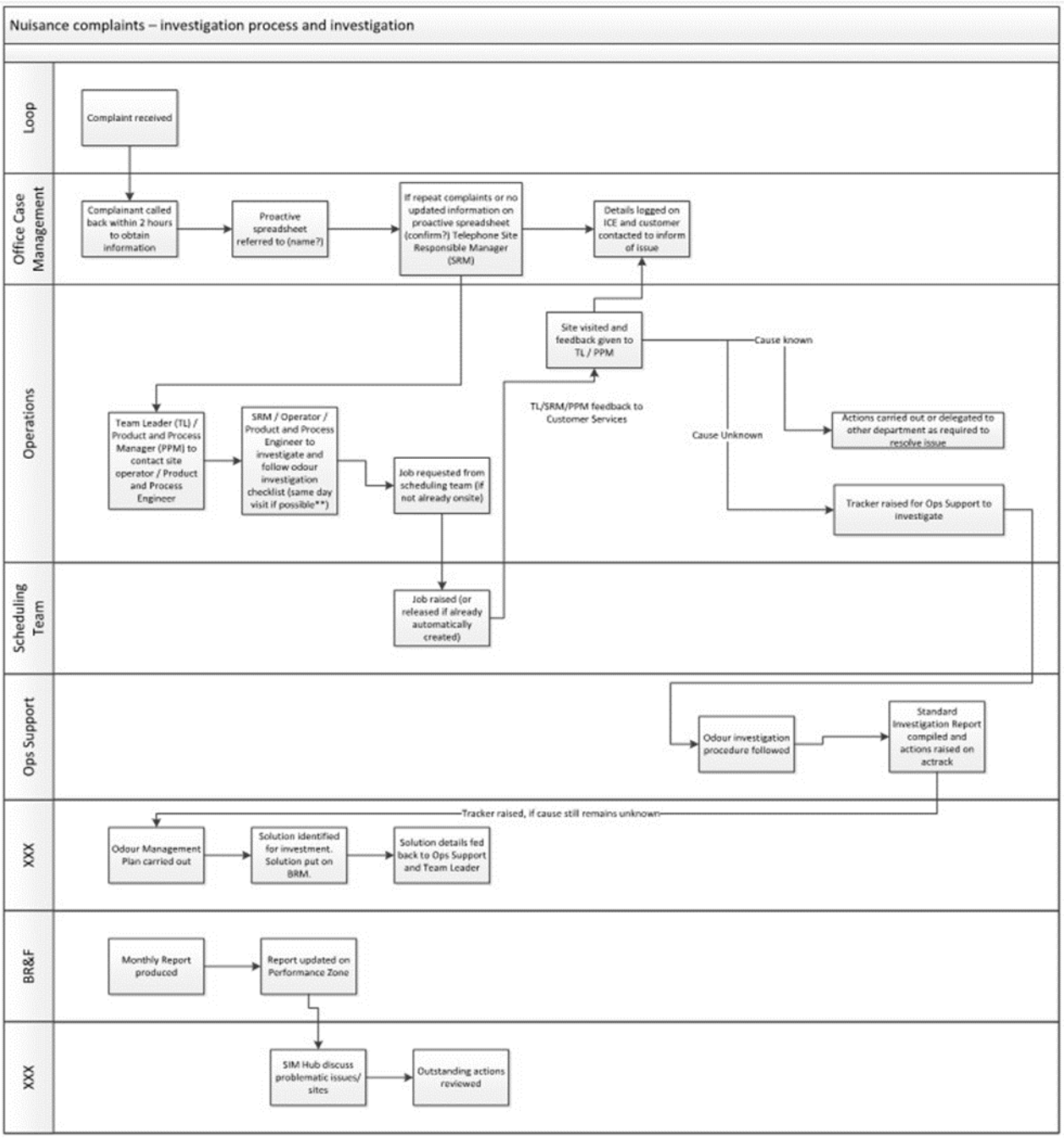
6 Further Guidance

Management Procedures / Safe Working Procedures / Technical Specifications (held on Safeguard) that are also relevant include:

- SWP 053 – Personal Safety & Security
- SWP 078 – Safe Use of Mobile Phones
- MP 05 – Lone Work
- MP 34 – Manual Handling

REMEMBER: IF IN DOUBT - ASK YOUR LINE MANAGER / SAFETY ADVISOR

Appendix 6 Odour Complaint Process



*Where sites have a conditioning pad, the site responsible manager should be made aware of issue first
** The site should be visited within the same working day if possible and no less than 3 working days. If >5 complaints received site should be visited no later than next working day.

Appendix 7 STF Odour Complaint Form

Loop handle customer complaints being reported to Yorkshire Water. The call handler will work with the complainant to try and locate the odour. Loop uses a software system called ICE to record the issue. If the issue is believed to be arising from a sewage works, the call handler will work through the following forms to pinpoint the issue.

Customer's details (name and address, if provided)	
When did the odour occur	
Time when the odour occurred	
Where was the location of the odour	
Is the odour happening now or was it in the past	
Does the customer know what is causing the smell	
What is a description of the odour (sewage / drains / eggy / sweet composting)	
Is this the first time the odour has been noticed	
Where is the odour at its worst (inside/outside house/boundary)	
Any other comment	

Appendix 8 Odour Investigation Form

The following investigation form will be used by Operational staff in the event of an odour complaint being received.

Date of odour complaint	
Time of odour (if known)	
Name of YW colleague investigating issue	
Postcode where the issue was identified (if known)	
Weather at the time of odour complaint (including temperature)	
Wind Direction (from onsite wind monitor) and strength (no wind, light, gusty, heavy)	
Description of smell from Complainant (if known)	
Is this linked with other complaints	
Do you know what asset is causing the issue	
Can the asset be identified through sniff testing (follow sniff testing monitoring programme in the odour management plan)	
Can the issue be resolved immediately	
If no, what actions are needed to resolve the issue	
If the issue is going to take >2 days to resolve, can the issue be mitigated to reduce the odour effect	
Does the odour management plan need updating to discuss the cause/action/mitigation	
Date when resolved	