Ellesmere Port WwTW Sludge Treatment Facility

Permit Number EPR/ZP3031LJ

Odour Management Plan

September 2022

Contents

Site Details

Site name:	Ellesmere Port WwTW Sludge Treatment Facility
Site address:	Little Stanney, Nr. Chester, Cheshire, CH2 4HZ
Operator name:	United Utilities Water Limited
Permit number:	EPR/ZP3031LJ
National Grid Reference	SJ 42475 74328

Document Owner

Document owner: Production Manager

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Revision number	Revision authorised by	Date submitted to Environment Agency	Revision owner
Draft for EA review	Production Manager	14.01 2022	
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Who this plan is for:

The OMP will be accessible on the Quality Assurance Sharepoint site and is intended for holders of the following roles:

Production Manager
Environmental Regulatory Advisor
Production Engineer
Digester Safety Controller
Hub Technical Officer
Field Technical Officer
Area Business Manager
Area Production Manager
H&S Business Partner

Incident Response contacts:

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ICC Duty Manager	07713 887302

1. Introduction

1.1. Purpose of the Odour Management Plan

The purpose of this odour management plan (OMP) is to provide guidance to all Operations and Maintenance staff with regard to practices that will minimise the risk of odour emissions being discharged from the Ellesmere Port WwTW Sludge Treatment Facility which could then impact on Customers and the Environment.

This document describes the odour management practices that have been considered as part of the design of the facility and those that must be adhered to during the operation of the treatment plant.

Adherence to the practices indicated within the OMP is vital to ensure that the plant complies with the relevant permit conditions within the (IED) Environmental Permit for the facility which is regulated by the Environment Agency.

This OMP is an operational document that is developed following the identification and review of risk areas for odour release. It details the application of best available techniques (BAT) both in design and operational and appropriate control measures to reduce or minimise the potential impact of odours from the site. It provides detail to allow Operators and Maintenance staff to understand the operational procedures for both normal and abnormal conditions.

This is a 'live' document and will be subject to further review and updating over the operational life of the site.

1.2. Site Description

Ellesmere Port Wastewater Treatment Works (WwTW) is located to the south of Ellesmere Port town, close to the Cheshire Oaks retail and leisure developments. Essar UK's Stanlow Oil Refinery is located to the north east of the site. There is predominately farmland to the east, south and west of the site. The location of receptors is considered in more detail in Section 2.

Sludge arising from the WwTW is treated on site within an 'installation' area that is permitted by the Environment Agency under the Environmental Permitting (England and Wales) Regulations 2016 (the EPR 2016). In addition to indigenous sludge, the facility receives imported sludge from other wastewater treatment works by road tanker. The facility processes three types of sludge:

- Indigenous sludges arising at Ellesmere Port WwTW;
- Imported raw sewage sludge and other sewage related sludges; and
- Imported thickened raw sewage sludge

In addition, the company is in the process of commissioning a Surplus Activated Sludge (SAS) treatment process at the site. Indigenous SAS will be thickened by rotating drum thickening prior to being pumped to the existing thickened raw sludge storage tanks. It will be mixed with indigenous and imported thickened sludge prior to anaerobic digestion treatment.

The sludge treatment process at Ellesmere Port comprises:

- Sludge screening (solids separation);
- Sludge thickening (by gravity belt);
- Pre-treatment of surplus activated sludge by rotating drum thickening (when commissioned);
- Anaerobic digestion (6 No. digesters; 3 thermophilic and 3 mesophilic);
- Sludge dewatering (using three centrifuges); and
- Storage of digestate cake.

The maximum design capacity of the facility is limited by the feed rate to both the gravity belt thickeners (648,240 wet tonnes per year) and to the forthcoming rotating drum thickeners (1,208,880 wet tonnes per year), providing a total maximum treatment capacity of 1,857,120 tonnes per year. Biogas is combusted in two on-site combined heat and power (CHP) engines, generating electricity for the process, and three boilers, generating heat and steam for the process.

The treatment process is automated and operates 24 hours per day, 365 days per year. Indigenous sludge is fed automatically to a receiving wet well and then into the raw sludge storage tanks. Imported sludge is accepted by road tanker 24 hours per day with prior agreement with Bioprocessing and pumped directly into either the raw sludge tanks or thickened sludge tanks.

1.3. Maintenance and Review of the OMP

The OMP is held electronically on the company's Quality Assurance System.

The WwTW Production Manager (PM) is responsible for compliance and review of the OMP, with support from the Process Controllers (PC) and site Environmental Regulatory Advisor (ERA).

The PM is to ensure all operational controls such as SOPs/SSIs/Management of Change are carried out, documented and followed.

The OMP is to be reviewed annually to identify trends in odour complaints and persistent complainers, or sooner if any of the following occur:

- If the Environment Agency or Local Authority EHO conducts an investigation in response to complaints or requests an updated report;
- Regulations or guidelines are updated;
- If an internal audit or post incident review dictates an update; or
- If there are significant changes on site e.g. due to capital spend.

1.4. Odour Management Training

Competence assessments are carried out as part of the UUW appointments procedure, and all staff receive bi-annual performance reviews.

Process Controllers receive externally accredited training to gain competence on treatment process units. All operators receive general training in the maintenance and operation of the OCUs and any additional training as identified through personal development plans.

All staff are required to complete the 'Introduction to Odour Management' course available on the company's Educate website: Introduction to Odour Management eLearning

1.5. Relevant Sector Guidance

This report has been prepared taking due regard to the Environment Agency (EA) Technical Guidance Note H4 Odour Management – How to Comply with Your Environmental Permit (March 2021).

2. Receptors

2.1. Receptor List

The WwTW is situated in a mixed industrial and agricultural area. Receptors within 2km of the installation boundary are detailed in Table 2.1 and shown on Figures 2.1 and 2.2.

To the north the of the installation the area is heavily industrialised with the Stanlow oil refinery complex, waste treatment sites and engineering premises within 2km distance. There is a large retail and leisure complex at Cheshire Oaks, approximately 850m to the west of the installation at its closest point.

The closest residential properties are at Little Stanney (Stoak Grange Farm, approximately 350m to the south, and properties off Church Lane, approximately 640m to the south). Between 1.5 and 2km to the north west there are extensive areas of housing within the Ellesmere Port conurbation at Whitby and Whitby Heath.

There is no recent history of odour complaints at the site (within the last 10 years).

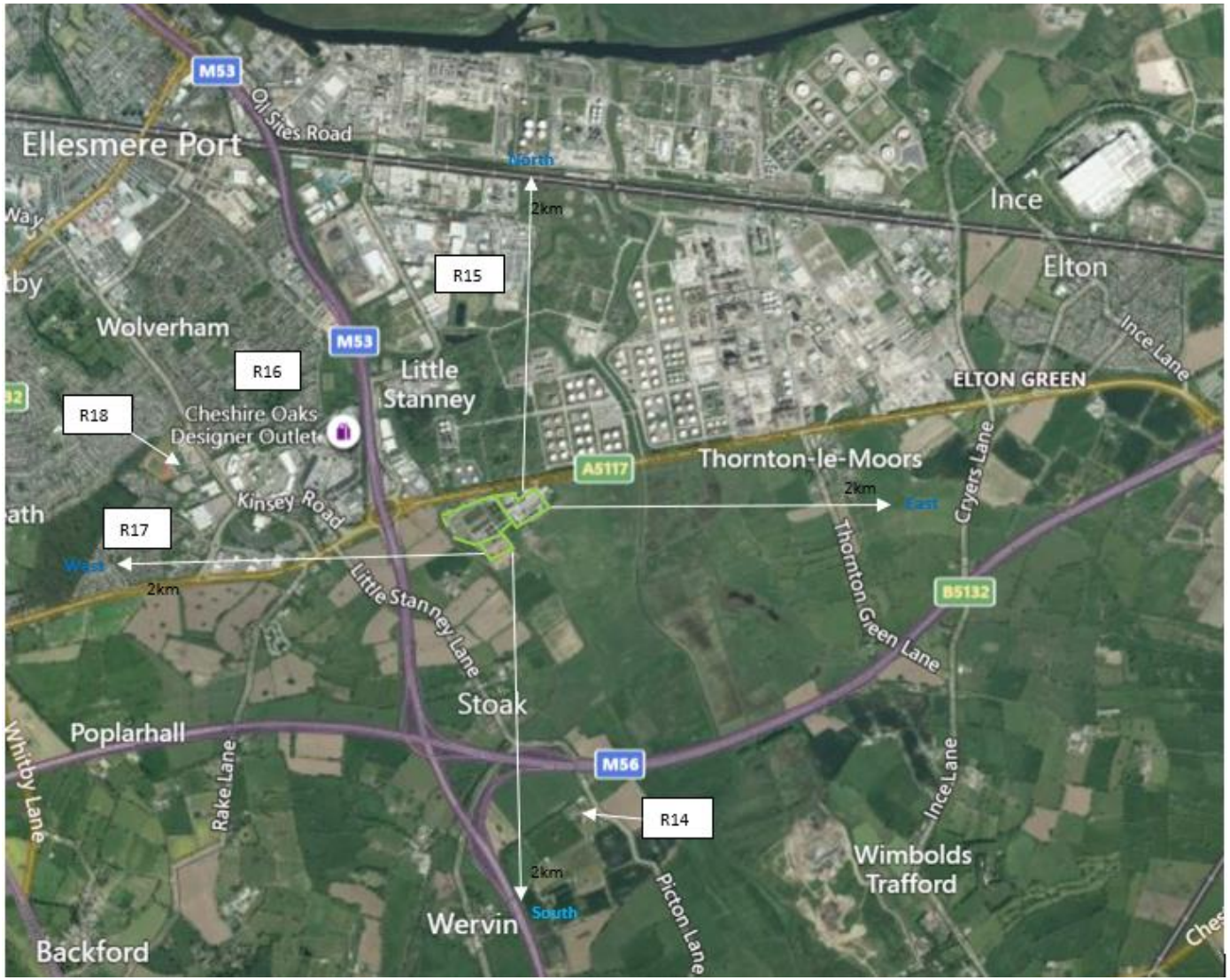
Table 2.1. Receptor List

Receptor	Description	Closest distance from Installation boundary (m)	Direction from the site	Sensitivity to odour
R1	Essar Oil Refinery	270	NNE	Low
R2	Stoak Grange Farm, Little Stanney Lane	350	SW	Moderate
R3	Commercial properties (car showrooms) off Stanney Mill Lane	450	WNW	Moderate
R4	Residential properties off Church Lane, Little Stanney	640	S	High
R5	Residential properties at Little Stanney village	775	SSW	High
R6	Cheshire Oaks Retail Park	850	W	Moderate
R7	Old Hall Farm Public House and Restaurant	940	W	Moderate
R8	Residential properties off Stanney Lane	1,000	WSW	High
R9	Residential properties at Hylton Court, Ellesmere Port	1,200	NW	High

Receptor	Description	Closest distance from Installation boundary (m)	Direction from the site	Sensitivity to odour
R10	Caravan and motorhome campsite	1,300	SW	High
R11	Residential properties at Yates Road and Park Road, Thornton-Le-Moor	1,500	E	High
R12	Residential properties at Thornton-Le-Moor village	1,600	E	High
R13	Farm Park and Café, Thornton-Le-Moor village	1,600	ENE	Moderate
R14	Farm and residential properties off Picton Lane	1,600	SSE	Moderate to High
R15	Waste recycling facilities	1,600	N	Low
R16	Residential properties off Rochester Drive	1,700	NW	High
R17	Residential properties off Stanney Woods Avenue	1,800	W	High
R18	Sports centres with outdoor sports facilities	1,850	WNW	Moderate

Figure 2.1 Map of site location and receptors within 1.5km

Figure 2.2 Map of site location and receptors within 2km



2.2. Wind Rose and Source of Weather Data

Liverpool John Lennon Airport is the closest available weather station to the site, located approximately 8km to the north. Wind rose data from 2011-2020 for the station is provided in Appendix A. The wind rose data shows that the site experiences strong prevailing north-westerly winds, predominantly in excess of 10 knots, meaning any odorous emissions released from site are likely to be dispersed to the south east of the works. Winds blowing from the south east are also common, typically of lower intensity (3-6 knots speed), which would disperse any odours to the north east.

The Ellesmere Port Sludge Treatment Facility and surrounding area has a relatively flat topography with few natural barriers to wind movement.

Live data on wind speed and direction can be obtained from numerous websites, including the Met Office and Windfinder websites.

- Met Office: https://www.metoffice.gov.uk/weather/forecast/gcmzrjhdw#?date=2021-12-21
- Windfinder: https://www.windfinder.com/#11/53.3655/-2.8098/2021-12-01T21:00Z

Past data on wind speed and direction can be obtained from the following website for Liverpool Airport, which can be helpful in establishing the general wind direction and strength if investigating an odour complaint where there has been a delay in receiving notification from the complainant:

Weather for Liverpool, England, United Kingdom (timeanddate.com)

3. Sources of Odour and Site Processes

3.1. Odorous Materials Entering and Leaving Site

Only one waste type is treated at the site, i.e. sludges from the treatment of urban wastewater (EWC 19 08 05).

Waste accepted at the facility is limited to sewage sludges arising from UUW facilities only (indigenous and imported) where inputs are either sewerage or rigorously controlled trade effluent, both of which are strictly monitored either into the sewer network or at the wastewater treatment works.

All movements of sludge wastes within UUW are planned and tracked using planning software (Podfather) and assessed in advance in accordance with a Biosolids Assurance Scheme (BAS) source material risk assessment. Whilst there will be some minor variation in the composition of the sludges, due to the different composition of sewerage flows into the works producing the sludges and seasonal variability in those flows, the anaerobic digestion process easily manages these variables with no significant impact upon the process or the outputs. The effect of incoming waste on the biological process is monitored via process controls set out in the HACCP Plan.

Indigenous sludge is pumped from a wet well at the WwTW to one of two unthickened raw sludge tanks (Tank 1 or Tank 2). In addition, indigenous sludge can be held in two raw sludge holding tanks (Tanks 3 and 4). Imported raw sludges from other wastewater treatment works arrive by road tanker and are off-loaded and pumped directly into either of the raw sludge tanks (1 or 2). All of the sludge reception tanks are enclosed.

Thickened sludge from other UUW works arrives via tanker and is pumped into the thickened sludge storage tank No.1, which is also an enclosed tank.

Digested sludge is dewatered using three centrifuges housed within a building. The sludge cake produced falls into transport trailers located on the ground floor level of the building, where it is stored prior to collection and removal from site for agricultural land spreading. The total volume of cake stored at any time is 165 tonnes and the maximum retention time is 5 days.

Contingency storage for cake is available at an external storage area. Due to the size of the cake pad and the need for continuous operation of sludge production, a maximum of five loads can be stored before being removed. The usual turnaround time for this is five days. However, notwithstanding the bay is emptied each week.

3.2. Overview of Odorous Processes and Emissions

A process flow diagram for the sludge treatment operation is contained in Appendix B.

Unscreened sludge is pumped to the sludge screen, where sludge screenings are collected in an open skip. From here the screened sludge passes to the Gravity Belt Thickening (GBT) feed sump. There are two screens operating as duty/standby.

From the screening unit and feed sump, sludge is pumped into two GBTs for thickening, which are housed within a building. Polymer make up tanks are located underneath the GBTs. Polymer is made up from

powder stored in a silo outside the GBT building mixed with water. Polymer make up and feed to the GBTs is controlled automatically. Final effluent is used to wash out the GBTs. Thickened sludge from the GBTs is passed to the thickened sludge reception tanks. Filtrate is returned to the inlet of the WwTW via a covered sump. The thickened sludge is stored in three covered, partially submerged tanks.

From Spring 2023, the Ellesmere Port facility will also treat surplus activated sludge (SAS). SAS will be thickened using three rotating drum thickeners (duty/assist/standby). The treatment process includes an enclosed buffer tank for the storage of pre-thickened sludge and an enclosed thickened SAS storage tank. Thickened SAS will be mixed with indigenous and imported thickened sludge prior to treatment by digestion. Filtrate from the thickening process will be collected and pumped to the flow for full treatment via existing GBT filtrate pipework.

Thickened sludge is pumped to one of three Thermophilic Aerobic Digesters (TAD) where it is held at 54˚C for 45 minutes. From the TAD vessels, sludge is batch fed into one of three Mesophilic Anaerobic Digesters (MAD) tanks. These are fixed roof digesters, mixed by gas compressors. Digestion takes place at a minimum temperature of 29.7^{o}C, with a minimum retention time of 12 days.

Hydraulic retention time (HRT) is continuously monitored using instrumentation installed on the digestion plant. The HRT is the ratio of vessel volume (m^3) / sludge feed rate (m^3/day). This is the time taken for anaerobic digestion to complete efficiently. The feed rate to the MAD tanks is a critical control point (CCP) defined by the HACCP Plan.

All treated sludge from the digestion process is stored in an enclosed digested sludge tank. From here, the digested sludge is pumped to a buffer tank located next to the centrifuge building. Sludge is dewatered using three centrifuges located within the building. Dry polymer is mixed with water and supplied to the centrifuges via a tank housed in the building.

Centrate from the dewatering process gravitates to a buffer tank and from there it is then pumped to the centrate tank and then to the head of the works for discharge back to treatment.

Biogas generated in the digestion process is stored in a single gasholder, from where it is fed to two combined heat and power (CHP) engines and three dual fuel boilers. If excess biogas is produced and cannot be stored it is burned off in a standby flare.

3.3. Potential Sources of Odours

Source materials associated with the treatment process and the nature of odours that these may give rise to are detailed in Table 3.1.

Table 3.1. Source Materials

Source Material	Odorous Compound	Odour Characteristics	Odour Potential
Raw sludge – indigenous and imported	Hydrogen Sulphide Mercaptans Dimethyl Sulphide	Rotten eggs Decayed cabbage Decayed vegetables	Moderate to High

Source Material	Odorous Compound	Odour Characteristics	Odour Potential
Sludge screening and thickening	Hydrogen Sulphide Mercaptans Dimethyl Sulphide	Rotten eggs Decayed cabbage Decayed vegetables	Moderate to High
Surplus activated sludge (SAS)	Hydrogen Sulphide Mercaptans Dimethyl Sulphide	Rotten eggs Decayed cabbage Decayed vegetables	Moderate
Filtrate and centrate	Ammonia/ amines Hydrogen Sulphide	Ammoniacal/ fishy Rotten eggs	Moderate to High
Digested sludge	Ammonia/ amines	Ammoniacal/ fishy	Low to Moderate
Biogas	Hydrogen Sulphide Range of VOCs including amines	Rotten eggs Ammoniacal	Moderate to High
Digested cake	Ammonia	Ammoniacal/ fishy	Low
Grit – tank bottoms	Hydrogen Sulphide Mercaptans Dimethyl Sulphide	Rotten eggs Decayed cabbage Decayed vegetables	Moderate to High
Polymer	Amines	Fishy	Low

Potential source areas of odour associated with the sludge treatment process are detailed in Table 3.2.

Table 3.2 Potential Sources of Odours

Source Area	Source Material	Quantity Stored on Site	Odour Potential	Probability of Release	Additional comments
Raw sludge tanks (4No.)	Untreated sludge	660m^3	High	Low	Fugitive emissions
Imported sludge tanker off-loading points	Raw sludge and thickened sludge	N/A	High	Moderate	Fugitive emissions
Screening unit	Untreated sludge	N/A	High	High	Fugitive emissions
Separated solids storage	Solids screened from sludge	2 x 8m^3 skips	High	High	Fugitive emissions
Gravity belt thickeners (GBTs)	Undigested and Digested sludge	Maximum throughput 1,776m^3/day	High	High	Fugitive emissions
Polymer storage and dosing	Polymer degradation	10,500 kg dry polymer	Moderate	Low	Fugitive emissions
SAS buffer tank*	Untreated surplus activated sludge	469m^3	Moderate	High	Fugitive emissions
Rotating drum thickeners (3)*	Untreated surplus activated sludge	Maximum throughput 140m^3/hr	Moderate	High	Fugitive emissions

Source Area	Source Material	Quantity Stored on Site	Odour Potential	Probability of Release	Additional comments
Thickened SAS tank	Thickened surplus activated sludge	834m^3	Moderate	High	Fugitive emissions
Thermophilic Aerobic Digesters (TAD) vents	Biogas	N/A	High	High	Point source emissions
Mesophilic Anaerobic Digester PVRVs (A5, A6 and A7)	Biogas	N/A	High	High	Point source emissions
Digested sludge storage tanks vents	Digested sludge storage tanks	N/A	Moderate	Moderate	Point source emissions
Dewatering Centrifuges	Digested sludge	150m^3/ hour	Moderate	Moderate	Fugitive emissions
Centrate storage and buffer tank vents	Liquid centrate	N/A	High	High	Point source emissions
Gas Holder PVRV (A8)	Biogas	N/A	Moderate	Low	Point source emissions
CHP stacks (A1 & A2)	Combustion of biogas	N/A	Very low	High	Point source emissions
Steam boilers stack (A3)	Combustion of biogas	N/A	Very low	High	Point source emissions
Flare (A4)	Combustion of biogas	N/A	Very low	Moderate	Point source emissions
Leaks in gas pipework e.g. around flanges	Biogas	N/A	Moderate	Low	Fugitive emissions
Sludge cake storage trailers	Digested sludge cake	Approximately 60 tonnes	Low	Low	Diffuse emissions
Contingency cake storage pad	Digested sludge cake	Approximately 100 tonnes	Low	High	Diffuse emissions
Tank cleaning	Grit	N/A	High	High	Fugitive emissions
Leaks/spills of sludge from process	Digested or Undigested Sludge	N/A	Moderate	Low	Fugitive emissions
*infrastructure anticipated to be commissioned during Spring 2023					

Control measures for these sources are detailed in Section 4.

A site plan showing the layout of the site and the location of the odour control units and cake bay (open storage) is provided as Figure 3.1A below. The layout of the new SAS treatment area is shown on Figure 3.1B below.

Figure 3.1A Site Layout Plan showing the location of the odour control units and cake bay (open storage)

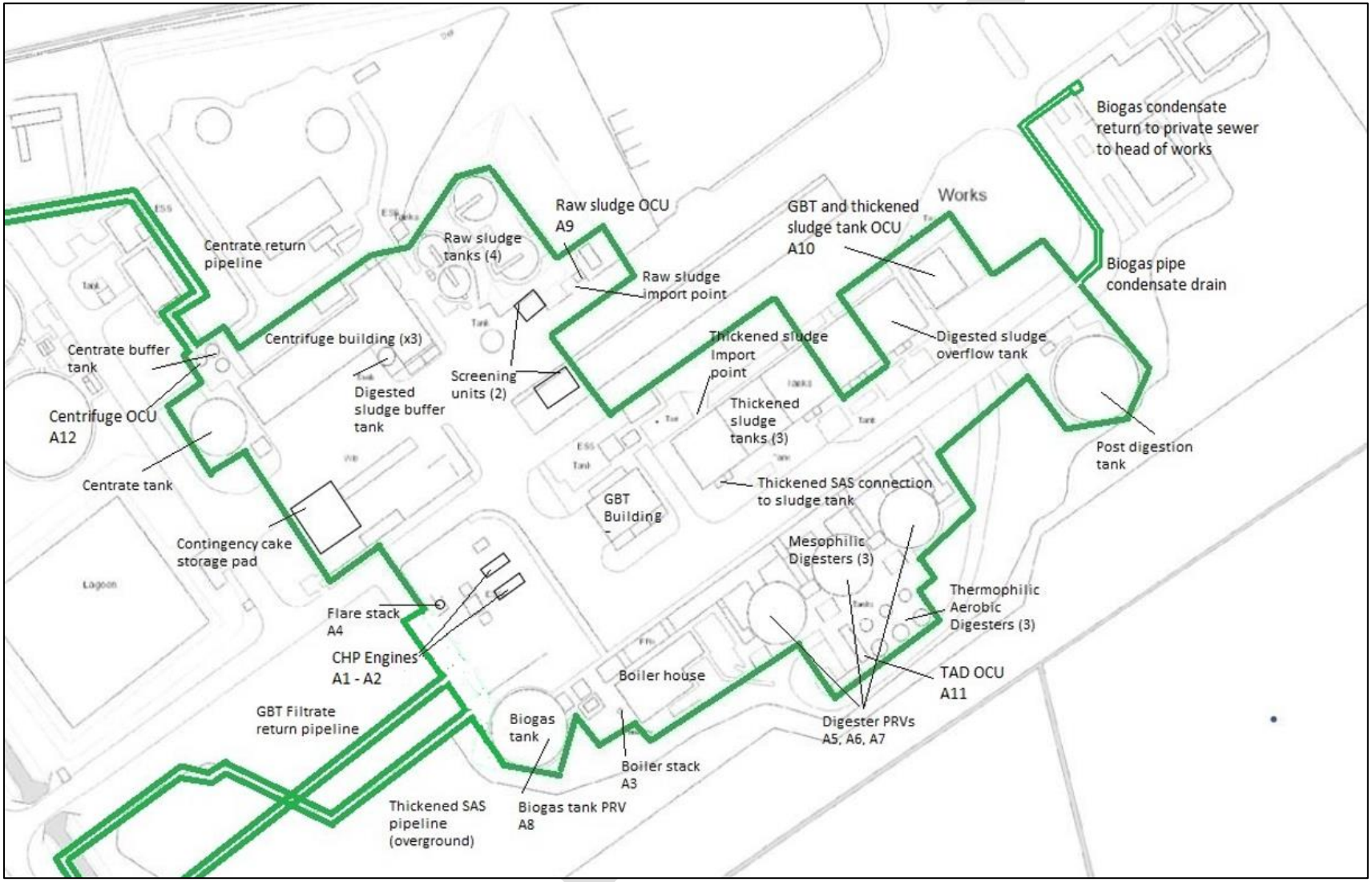
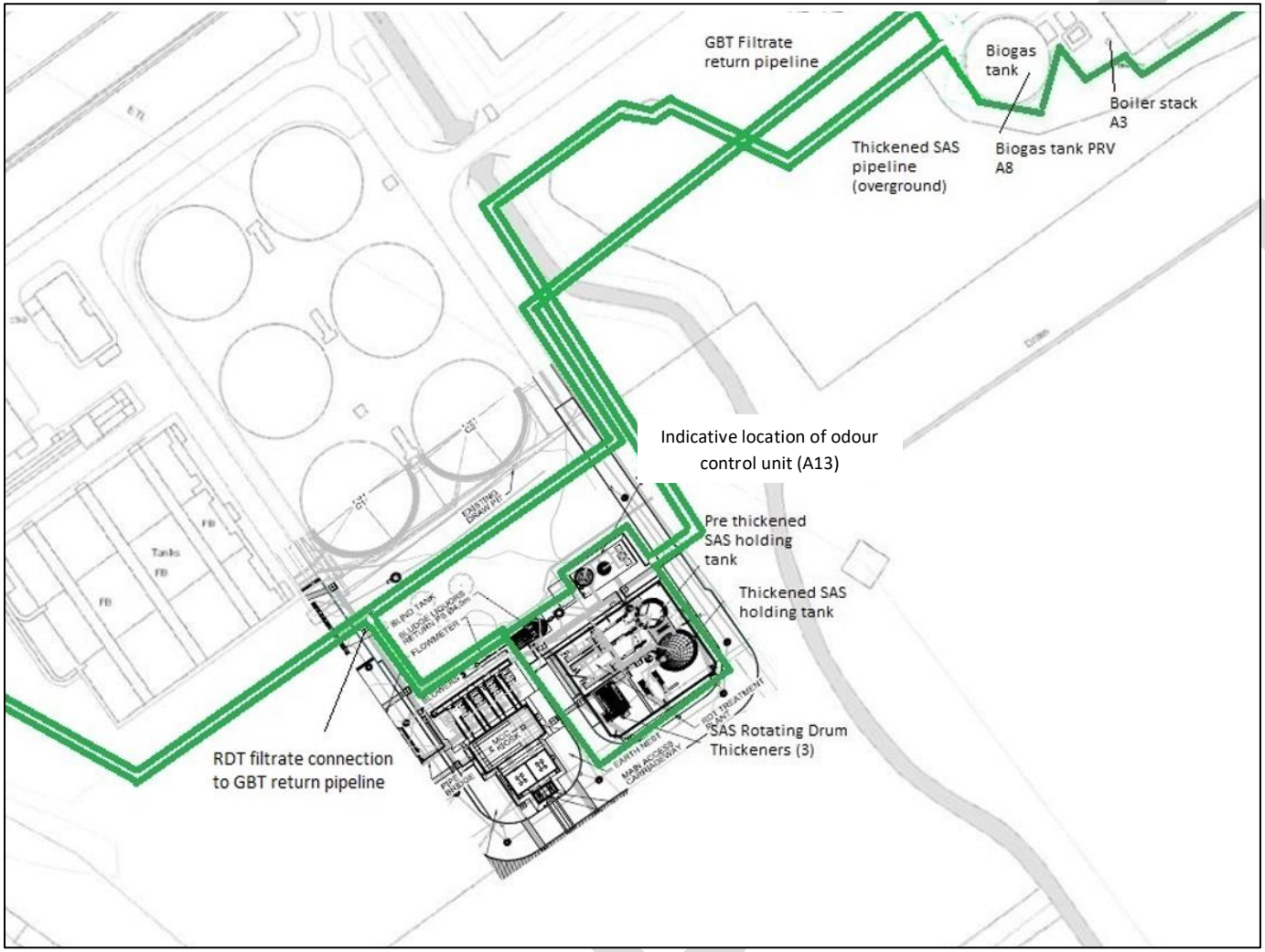


Figure 3.1B Site Layout Plan showing the new SAS Treatment Plant



3.4. Odour Exposure Pathways

In order for an odour impact to occur off site, all the following conditions must be achieved:

- The formation of odorous compounds in the sludge;
- Transfer of compounds from the sludge to the atmosphere; and
- Transport of compounds from source to receptor, and the degree of dispersion/dilution achieved during the transport process.

Odour management covers a range of strategies and procedures which seeks to mitigate negative impact to the company, its employees and customers against the potential for odour generation within its collection and treatment systems and disposal routes.

If any of those key conditions are prevented through management practices, off site odour impact cannot occur.

4. Control Measures and Process Monitoring

4.1. Control Measures

Odour control is currently achieved through process optimisation, engineered containment and good operational practice.

All storage tanks, treatment tanks and associated pipework are enclosed. The only open storage of waste is screening waste within an open skip arising from the sludge screen and, on occasions, digestate cake at the contingency cake pad area.

Tanks that are connected to the gas management system only vent to atmosphere under abnormal operating conditions. Pressure vacuum relief valves (PVRVs) on the digesters and gas holder operate on a duty/stand-by configuration to protect against over/under pressurisation of the tank. The PVRVs are a critical safety system and are maintained, monitored, inspected and calibrated on a periodic basis to ensure correct operation of the valves.

Where tanks are not gas tight and vent to atmosphere, these are connected to odour control units. However, these odour control units are not currently operational (see Section 4.3.1). As the OCUs are not operating and actively drawing air through the units, emissions are currently being released fugitively from the tanks and duct work. Engineering studies are being undertaken to allow a programme of refurbishment and recommissioning of the existing OCUs (see Section 4.3.2).

A significant spill or leak of sludge or digestate from the tanks, associated pumps or pipework could result in fugitive odour emissions. Risk scenarios and control measures are considered in detail in the site Accident Management Plan. Any spills must be dealt with promptly and cleaned down to avoid odorous releases.

Maintenance requirements, including prioritisation and consideration of criticality for individual assets, form part of the maintenance strategy within United Utilities (see Section 4.3).

4.2. Process Monitoring

Maintaining the sludge treatment process within the defined operating conditions for the plant is important in maintaining the health of the digesters, the quality of the sludge cake and minimising the potential for odour emissions. Process monitoring controls are set out in the Primary Digestion SOP (WwP/3021/15/01) and the HACCP (WwP/I/3021/18/39).

The HACCP contains critical control limits to maintain digester health and digestate quality, as set out in Table 4.2.1.

Table 4.2.1: HACCP Critical Control Points

Critical Control Point (CCP)	Description	Critical Limit	Frequency of monitoring
CCP1	TAD temperatures & time	54° C for minimum 45 minutes	Daily, Continuous and Automatic

Critical Control Point (CCP)	Description	Critical Limit	Frequency of monitoring
CCP2	MAD temperature (Digester 1 2 & 3)	29.7°C	Daily, Continuous and Automatic
CCP3	MAD feed (Digester 1, 2 & 3 feed); displayed on the digester MCC HMI & the SCADA	Maximum of 286 m^3/day to each digester	Daily, Continuous, Automatic
MAD = mesophilic anaerobic digestion TAD = thermophilic anaerobic digestion			

In addition, target operating parameters for the digestion process include:

- pH: 7 to 8
- MAD retention time: 12 – 22 days
- MAD temperature: 37-41°C
- VFA in digested sludge: <300mg/l
- Alkalinity in digested sludge: 2,500-4,000mg/l
- VFA/Alkalinity ratio: <0.2
- Biogas quality: 60-70% CH_4
- Gas production: 150 to 250m^3/hr
- Solids – in and out: TAD 7% in, 6.5% out
  MAD 6.5% in, 4.0% out

The monitoring of digester key process parameters and biogas key process parameters is summarised in Table 4.2.2 below.

Table 4.2.2: Summary of Process Monitoring

Parameter	Frequency of measurement	Point of measurement	System of measurement
pH	Weekly	Sample taken (digester feed)	Lab analysis
Alkalinity	Weekly	Sample taken (digester feed)	Lab analysis
Volatile fatty acids concentration	Weekly	Sample taken (digesters)	Lab analysis
Temperature	Continuous	Temperature probe within digesters	SCADA
Sludge feed rate	Continuous	Flow meters	SCADA
Flow	Continuous	Flow meter	SCADA/ STS
Methane	Continuous	Gas meter	SCADA/ STS
Oxygen	Continuous	Gas meter	Engine HMI
Hydrogen Sulphide	Continuous	H_2S analyser	SCADA/ STS
Pressure	Continuous	Pressure Transducer	SCADA/ STS

Sludge feed is measured using flowmeters which are also used to control batch timings. Flowmeters are calibrated annually to maintain accuracy. Temperature probes are also calibrated annually.

4.3. Odour Abatement

The facility was designed with the containment and odour control of certain process units. There are four odour control units that have fallen into disrepair and are not currently operational. The design of these units is detailed in Section 4.3.1. Remedial actions to reinstate these units are detailed in Section 4.3.2. A fifth odour control unit is proposed to serve the new SAS Plant. This is also detailed in Section 4.3.1.

4.3.1. Odour Control Units

The facility has four odour control units, each with its own emission stack. These are:

- A biological filter bed (woodchip) and single activated carbon unit serving the four raw sludge tanks (emission point A9);
- A biological filter bed (woodchip) and two activated carbon units serving the GBT building, imported sludge tanks, thickened sludge tanks, digested sludge tank, the co-settled sludge well and the filtrate well (emission point A10);
- A woodchip biological filter bed serving the three TAD vessels (emission point A11);
- A single activated carbon unit serving the digested sludge buffer tank, centrifuge building (containing cake skips and conveyors), centrate buffer tank and centrate tank (emission point A12).

These odour control units are not currently operational.

The new facility to treat surplus activated sludge (SAS) is expected to come online in Spring 2023 and will include a new odour control unit serving the buffer tank, rotating drum thickeners and thickened SAS storage tank. The odour control unit will comprise a two-stage process with a trickling bio-filter (pumice stone media) followed by a second stage carbon filter (emission point A13).

The process flow diagram in Appendix B shows the process connections to the odour control units and the emission points (including the new SAS Plant OCU).

The odour control technologies were designed in accordance with UUW's Asset Standard for Odour Control and Removal[1]. A combination of biofilter and activated carbon technologies were chosen for this facility.

The design operating parameters and odour removal efficiencies for the OCUs at Ellesmere Port are detailed in Appendix C. The design operating parameters for air flow rate and odour emission concentration were used to conduct odour dispersion modelling using ADMS 5.2.4 software to quantify the odour impacts at relevant sensitive receptor locations, surrounding the site[2]. The dispersion model included the site layout buildings and infrastructure (as appropriate).

For the modelling exercise, emissions of odour from the on-site OCUs were assessed against an odour benchmark level of 1.5 ouE/m^3 at nearby sensitive receptors, which is the H4 odour benchmark for the

[1] Odour Control and Removal Asset Standard, Document Reference 33412
[2] Odour Impact Assessment, UUW Ellesmere Port, Jacobs, September 2022

most offensive odours and the UU Odour Control and Removal Asset Standard (for high sensitivity receptors).

The results indicate that the maximum predicted 1-hour mean (98th percentile) odour concentration at the assessed sensitive receptors is less than 0.6 ouE/m^3, which is well below the 1.5 ouE/m^3 benchmark.

Table 4.3.1: OCU operating parameters and emission rates

Emission Point	Source	Stack height (m)	Stack diameter (m)	Efflux velocity (m/s)	Design air flow rate (m^3/s)	Temp (K)	Design odour conc. (ou_e/m^3)	Design odour release rate (ou_e/s)
A9	Raw sludge tanks	2.99	0.33	15.5	1.326	Ambient	1,000	1,347.22
A10	GBTs, sludge tanks & wells	3.54	0.53	15.0	3.309	Ambient	1,000	3,305.55
A11	TAD vessels	3.60	0.50	5.0	0.994	Ambient	10,000	9,944.44
A12	Centrifuge building & centrate tanks	4.00	0.48	15.0	2.714	Ambient	1,000	2,694.44
A13	SAS Plant	14.50	0.27	15.0	0.859	Ambient	1,000	866.94

The odour dispersion modelling demonstrates that the design operation of the OCUs at the site is compliant with H4 standards and with the UUW Odour Control and Removal Asset Standard.

The design of the odour control technologies is considered to comply with BAT for the treatment process.

Engineering studies are being undertaken to allow a programme of refurbishment of the existing OCUs to be costed and funding secured for implementation of the works. The proposed timescale for reinstatement of the OCUs is detailed in Section 4.3.2 and is to be agreed with the Environment Agency. It should be noted that despite the OCUs not currently being operational, the site is not receiving odour complaints and there are no on-going odour issues.

4.3.2. Remedial Action Plan and Timescales

The timescale for completion of the refurbishment of the odour control units is June 2023, based on our P25 (25% likelihood of completion) forecast which means it is the best-case date for completion. The P50 date (50% likelihood of completion), which is based on construction programme norms is October 2023.

The refurbishment works will include:

- Replacement of all media
- Reinstatement of biofilter irrigation systems – water or final effluent will be required to irrigate the biological filter beds
- Replacement of fan units
- Repair of ducting where necessary

- Replacement of H_2S sensors, pressure gauges and flow switches
- Replacement control panels
- Recommissioning and testing

4.4. Inspection, Maintenance and Monitoring

Once the odour control units are recommissioned, they will be added to the schedule of Environmental Permitted assets and scheduled for maintenance on the work planning system, MAMS.

Records of maintenance requirements, including prioritisation and consideration of criticality for individual assets forms part of the maintenance strategy within United Utilities. The OCUs will be listed as Environmental Permitted assets and flagged as a priority for scheduled inspection tours. The MAMS work order system will be utilised to schedule the frequency of inspection tours and the preventative maintenance tasks carried out as part of these tours. This schedule is agreed between the Resource Coordinators and the Production Manager, it is reviewed and amended as deemed necessary.

Site-Specific Instructions (SSIs) will be developed for the operation of the OCUs. These will document local set points and operating parameters and provide advice on trouble shooting and corrective actions for abnormal operating conditions.

A general list of tasks and activities to monitor and maintain the performance of biological OCU filter systems and carbon absorptions filter systems is provided in Appendix D. This is intended to give a guide to the range of activities that will be included in the SSIs.

As the OCUs are not operating and actively drawing air through the units, emissions are currently being released fugitively from the tanks and duct work. Once operational, the following emissions monitoring is to be undertaken for each odour control unit stack:

- Hydrogen sulphide once every six months
- Ammonia once every six months

Total volatile organic compounds (TVOC) and HCL will monitored on one occasion to check for their presence in the emissions from each stack and the results provided to the EA. The sampling will be undertaken three times over the course of one day. Dependent upon the results, TVOCs and/or HCL may be added to the bi-annual monitoring schedule. In addition, each stack will be sampled for odour concentration on two occasions during the first year of monitoring to validate that the design odour concentration is being achieved. Measurements will be taken at the OCU inlet and outlet.

Suitable measurement ports will be provided to allow access and monitoring of the OCU stacks. Emissions monitoring will be carried out by an MCERTS accredited third party laboratory.

Until such time that the OCUs are operating, olfactory monitoring ('sniff' testing) will be undertaken on a weekly basis at the boundary of the sludge treatment facility. Sniff testing will be undertaken in accordance with the guidance contained in H4. In addition, a Jerome hydrogen sulphide monitor will be utilised as hydrogen sulphide is typically the dominant compound of interest. This is detailed in Section 5.4 (Pro-active Odour Monitoring) and in the Site Instruction contained in Appendix G.

Odour control measures are detailed in Table 4.2 below. Reference to the OCUs assumes that these are operational, following recommissioning (post June 2023).

Table 4.2. Odour Control Measures

Source	Nature	Odour Potential	Probability of Release	Control Measures*	Residual Risk
Raw sludge tanks (4No.)	Untreated sludge	High	Low	• Partially submerged, enclosed tanks • All four tanks are connected to an odour control unit comprising a biological filter bed (woodchip) and two activated carbon units (emission point A9) • Six monthly monitoring of the OCU emissions for H2S and ammonia	Low
Imported sludge tanker off-loading points	Untreated sludge	High	Moderate	• Imports limited to sewage sludges arising from UUW facilities only. • All movements assessed in advance in accordance with a Biosolids Assurance Scheme (BAS) source material risk assessment. • Driver to remain with the vehicle while discharging to supervise offloading • Delivery vehicles normally operated by UUW and routinely serviced and maintained, including regular checks to delivery pipework and couplings. • All delivery drivers provided with appropriate training, including the safe use of tanker equipment and safe unloading/loading procedures. • Waste accepted via a fixed offloading point which includes an alarmed, auto-shutoff when the high level is reached. • Sludge is discharged directly into enclosed tanks • In the event of any spillage, clean up measures are implemented in accordance with the Flood and Spill Plan.	Low
Screening unit	Untreated sludge	High	High	• Screening unit and pipework are enclosed • Maintenance in accordance with MAMS schedule to minimise risk of blockages • Hatches kept shut except for inspections or maintenance	Moderate
Separated solids storage	Solids screened from sludge	High	High	• Skip is open and therefore prone to odour emissions – skip is sheeted if not in use and emptied frequently, especially	Moderate

Source	Nature	Odour Potential	Probability of Release	Control Measures*	Residual Risk
				in warm weather. Normal service is for next working day removal • Provision of masking sprays around area will be considered if required	
Gravity belt thickeners (GBTs)	Undigested and Digested sludge	High	High	• GBTs are housed within a building. Building air is extracted through an OCU comprising a biological filter bed (woodchip) and two activated carbon units (emission point A10) • Routine operation checks and maintenance to ensure the extraction system and OCU are functioning as per design • Routine operational checks and maintenance to ensure the OCU is functioning as per design • Six monthly monitoring of the OCU emissions for H2S and ammonia • GBT filtrate is stored in a covered sump	Low
Polymer storage and addition	Polymer degradation	Moderate	Low	• Dry polymer for centrifuge stored in a room in sealed plastic bags with an outer hessian layer • Polymer for GBTs stored externally in an enclosed silo • Polymer make up tanks are enclosed and contained within a building • Staff are trained in the operation of spill kits to ensure that prompt and effective action is taken in the event of accidental spillage.	Low
SAS buffer tank**	Untreated surplus activated sludge	Moderate	High	• Enclosed tank • Tank will be connected to a new OCU (pumice stone filter and second stage carbon filter; emission point A13) • Six monthly monitoring of the OCU emissions for H2S and ammonia	Low
Rotating drum thickeners (3)**	Untreated surplus activated sludge	Moderate	High	• Enclosed units and pipework connected to new OCU as above (emission point A13)	Low

Source	Nature	Odour Potential	Probability of Release	Control Measures*	Residual Risk
				• Maintenance in accordance with MAMS schedule to minimise risk of blockages • Hatches kept shut except for inspections or maintenance	
Thickened SAS tank**	Thickened surplus activated sludge	Moderate	High	• Enclosed tank • Tank will be connected to a new OCU (pumice stone filter and second stage carbon filter; emission point A13) • Six monthly monitoring of the OCU emissions for H2S and ammonia	Low
Thermophilic Aerobic Digesters (TAD)	Biogas	High	High	• Tanks are enclosed and vented to an odour control unit (a woodchip biological filter bed - emission point A11) • Routine operational checks and maintenance to ensure the OCU is functioning as per design • Six monthly monitoring of the OCU emissions for H2S and ammonia • Tank high level alarms	Low
Mesophilic Anaerobic Digester PVRVs (A5, A6 and A7)	Biogas	High	High	• Valves sized on design specification to accommodate normal pressure variations and minimise/prevent non-essential releases • PVRV set points calibrated every 2 years by a specialist contractor to ensure safe and effective operation within design parameters • PVRVs at Ellesmere Port are set to operate at 40 mB, as per the design criteria • Basic visual inspection of PVRV's undertaken weekly. Annual inspection carried out by a mechanical Field Service Engineer • Operation of PVRVs minimised by monitoring pressures within the digesters and controlling the feed rate accordingly • Digester gas pressure monitored via pressure sensors in the Digesters, linked to a PLC. Signals derived from the PLC are	Low

Source	Nature	Odour Potential	Probability of Release	Control Measures*	Residual Risk
				sent via telemetry to the Dashboard and can also be viewed on the SCADA. A high-pressure alarm is also generated and sent to the ICC. • Hydrogen sulphide levels in the biogas feed to the gas holder are continuously monitored and maintained below 100ppm, in accordance with the permit limit • In the event of an emergency, actions are taken in accordance with the Digestion & Biogas (WwP-I-3021-01-16).	
Digested sludge storage tank	Digested sludge	Moderate	Moderate	• Tank enclosed and vented to an odour control unit (a woodchip biological filter bed and two activated carbon units- emission point A10) • Routine operational checks and maintenance to ensure the OCU is functioning as per design. • Six monthly monitoring of the OCU emissions for H2S and ammonia • Tank high level alarm	Low
Digested sludge buffer tank	Digested sludge	Moderate	Moderate	• Tank enclosed and vented to an OCU (a single activated carbon unit - emission point A12) • Routine operational checks and maintenance to ensure the OCU is functioning as per design • Six monthly monitoring of the OCU emissions for H2S and ammonia	Low
Dewatering centrifuges	Digester sludge	Moderate	Moderate	• Centrifuge units are housed within a building. Building air is extracted through an OCU (a single activated carbon unit - emission point A12) • Doors are kept closed to prevent fugitive emissions escaping • Routine operational checks and maintenance to ensure the OCU is functioning as per design	Low

Source	Nature	Odour Potential	Probability of Release	Control Measures*	Residual Risk
				• Six monthly monitoring of the OCU emissions for H2S and ammonia	
Centrate storage and buffer tank vents	Liquid centrate	High	High	• Enclosed tanks connected to an odour control unit (single bed activated carbon unit - emission point A12) • Routine operational checks and maintenance to ensure the OCU is functioning as per design • Six monthly monitoring of the OCU emissions for H2S and ammonia	Low
Gas Holder PVRV (A8)	Biogas	Moderate	Low	• Calibrated to the safe working limit of the gas holder • PVRVs calibrated every 2 years by a specialist contractor to ensure safe and effective operation within design parameters • Basic visual inspection of PVRV's undertaken weekly. Annual inspection carried out by a mechanical Field Service Engineer • Operation of PVRVs is minimised by monitoring pressures within the gas holder and controlling the digester feed accordingly • An online monitor is provided to continuously monitor hydrogen sulphide levels in the biogas. This is located in front of the gas holder within an enclosed Gas Monitoring Kiosk • Hydrogen sulphide levels in the biogas maintained below 100ppm, in accordance with the permit limit	Low
CHP stacks (A1 & A2)	Combustion of biogas	Very low	High	• On combustion, hydrogen sulphide will predominantly be converted into oxides of sulphur (primarily SO_2) thus hydrogen sulphide is not expected to be present in the stack emissions • CHP maintained in accordance with the manufacturer's maintenance schedule for the engine. Additional	Low

Source	Nature	Odour Potential	Probability of Release	Control Measures*	Residual Risk
				maintenance scheduled based on UUW's experience of running such plant.	
Steam boilers stack (A3)	Combustion of biogas	Very low	High	• On combustion, hydrogen sulphide will predominantly be converted into oxides of sulphur (primarily SO_2) thus hydrogen sulphide is not expected to be present in the stack emissions • Boilers are maintained in accordance with the manufacturer's maintenance schedule.	Low
Flare (A4)	Combustion of biogas	Very low	Moderate	• Flare emissions are of short duration, under abnormal operating conditions • Flare operates at high temperatures, combusting volatile organic compounds that typically give rise to odours and converting hydrogen sulphide into oxides of sulphur.	Low
Leaks in gas pipework e.g. around flanges	Biogas	Moderate	Low	• Annual VOC leak detection programme of gas related infrastructure and equipment using a thermal infrared gas camera, carried out by a specialist team within the business • Inspections also arranged on a reactive basis if required • On detection of a possible leak, an escalation procedure is followed and repairs or maintenance actioned promptly.	Low
Digestate cake storage skips	Digested sludge cake	Low	Low	• Dewatered cake is stored in trailers on the lower level of the centrifuge building • Roller shutter doors are kept closed unless access is required	Low
Contingency digestate cake storage pad	Digested sludge	Low	High	• Due to the size of this pad and the need for continuous operation of sludge production, a maximum of 5 loads can be stored before being removed. The usual turnaround time for this is 5 days; however, notwithstanding the bay is emptied each week.	Low
Tank cleaning	Grit	High	High	• Opportunities to minimise odour emissions and any potential nuisance are identified when planning	Moderate

Source	Nature	Odour Potential	Probability of Release	Control Measures*	Residual Risk
				maintenance tasks, this may include the timing of routine maintenance tasks • Provision of masking sprays around area will be considered if required	
Leaks/spills of sludge from process	Digested or Undigested Sludge	Moderate	Low	• Spillages are a risk during maintenance of assets. Possible sources of spillage should be considered during the planning of maintenance task and avoided through design where possible • Ensure spills are cleaned up promptly. Spill training is provided to operational staff and spill kits/hoses are readily available • Site inspection tours are carried out daily by site-based staff and monthly by the site's Environmental Regulatory Advisor (ERA). Any leaks or spillages identified are investigated and actioned promptly.	Low

* Reference to the OCUs as control measures assumes that these are operational, following recommissioning.

**SAS Plant infrastructure expected to be commissioned during Spring 2023

5. Odour Investigation and Reporting

5.1. Complaints Reporting

5.1.1. Receipt of Customer Odour Complaints

Customers are important to us and we need to minimise any impact we could cause. If customers feel the need to complain, a rapid and thorough response is important.

Customer complaints regarding odour should be directed to the Integrated Control Centre (ICC) Customer Liaison Team to be recorded on the Dynamics System and a case number assigned. The Customer Liaison Team will log details of the complaint and pass the details to the Production Manager for investigation as soon as possible, but normally within 2 hours (24 hours at weekends).

If telephone contact is received outside of the Integrated Control Centre (ICC) or written contact is sent direct to a UUW member of staff, the following procedure needs to be actioned.

Table 5.1. Recording Receipt of an External Odour Complaint

Telephone Contact	Written contact – letter, email, text	Face to face contact – customer attends site
Details of the contact need to be recorded – name, contact information, query. Details sent to the ICC Duty Desk Manager.	Scanned and sent to Customer Liaison Team along with any details to help respond to the contact.	Collect customer details and send to Duty Desk Provide customer with the odour hotline number.
01925 233224 DutyDesk@uuplc.co.uk	CustomerRelationsServiceDrafts@uuplc.co.uk	0800 781 7134

If a verbal complaint is received at site and the customer is not happy to be directed to the odour hotline, the site should log the complaint using the Odour Diary Form. A copy of the form is contained in Appendix E and is available on the company's Sharepoint site here:

Odour Diary Form

5.1.2. Receipt of Regulatory Odour Complaints

A customer complaint received via the Environment Agency will usually be directed to the site Environmental Regulatory Advisor (ERA). The EA maintains a list of ERA contacts for each permitted site. If a complaint is received at site from the EA or Local Authority Environmental Health Department, these should be passed to the ERA who will log the complaint using the Odour Diary Form and liaise with the Production Manager to ensure that the complaint is investigated, and the findings communicated back to the regulator (see Section 5.1.2).

5.1.3. Investigation of Odour Complaints

As soon as possible upon notification of a complaint, the Production Manager or Technical Officer will discuss the nature of the complaint and appoint suitable members of staff to investigate the complaint and review all site activities.

Odour concerns and complaints will be substantiated by olfactory 'sniff testing' carried out on site and off site at the locations shown in Appendix G and Appendix H. The on-site testing will be carried out by operational staff but where it is reasonably practicable, we will use office staff or people who have not recently been working on the site to conduct the off-site monitoring. It is recognised that employees who are routinely exposed to odours may experience a reduced perception of odour intensity. However, the working environment is not inherently odorous and desensitisation is not considered to be a significant risk at this site.

In order to ensure odours from the site are differentiated from any other potential odour sources in the local area, the assessment locations may be varied to take into account the location of the off-site receptors and their location in relation to the wind direction occurring during the assessment period.

If necessary, the personnel undertaking the assessment will work from the site boundary into the wind to assess sources/direction of odour and to identify if it originates on site.

The sniff testing will also aim to identify any WwTW activities that could be either be the source of the odour, contribute to the odour, or be a confounding factor.

At each location observations shall be made concerning odour intensity, persistence, character and weather conditions.

Odour intensity shall be recorded on a scale from 0 - no odour, to 6 - extremely strong odour, as follows:

- 0 - No odour (no odour can be detected)
- 1 - Very faint odour (only detectable if you specifically sniff for it)
- 2 - Faint odour (detectable if you casually sniff for it)
- 3 - Distinct odour (detectable by just standing there normally)
- 4 - Strong odour (unavoidable odour)
- 5 - Very strong odour (likely to leave lingering smell on clothes, or lingering taste)
- 6 - Extremely strong odour (likely to causes immediate physical symptoms such as nausea, sore throat and headaches)

Where odours are substantiated as coming from UUW activities, the following questions should be considered as part of the investigation process:

- Is the process under control?; and
- Have odour containment measures failed, e.g. has a door been left open; have adverse conditions, such as weather, overwhelmed containment structures?

As a minimum the investigation needs to document:

- Sniff testing results;
- Operating conditions at the time of the complaint;
- Weather conditions (including wind direction) at the time of the complaint;

- Conclusions and recommendations;
- Discussions with relevant regulators (if held);
- Communication with the complainant; and
- Preventive measures to reduce the probability of re-occurrence.

The Production Manager/ Technical Officer will report the findings of the investigation to the site Environmental Regulatory Advisor (ERA) who will complete the Odour Investigation Form.

The ERA shall communicate the findings of regulatory complaints directly to the EA or Environmental Health Department.

For complaints originating from the ICC, the ERA shall feedback the investigation findings to the Customer Liaison Team, who will in turn communicate this information to the customer.

All odour complaints shall be investigated and reported back to the complainant within ten working days.

The Production Manager or Technical officer shall brief the site team on the number and details of any complaints received and the findings of associated odour investigations shall also be reported. Escalation points for communications are detailed in Section 5.2.

5.1.4. Records of Odour Contacts & Complaints Investigation Procedure

Details of odour complaints received via the ICC can be viewed via the Tableau software.

Any Odour Diary Forms completed by the operations team should be held electronically on site. A copy of the Odour Diary Form is provided in Appendix E.

A standard Odour Investigation Form (Reference: WwP/F/001/30/16) is used for all investigations to ensure a consistent approach to recorded keeping. A copy of the form is included in Appendix F.

Investigation forms can be completed electronically on the Odour Page of the Sharepoint site or printed to complete by hand and then scanned and uploaded. The odour investigation form is available here (for UUW staff only):

https://uusp/Asset/QA/QualityAssurance/WasteWater%20Standard%20Forms%20%20Lists/Site%20Odour%20Investigation%20Form.docx?web=1

5.2. Odour Risk Identification and Management Process

The following section sets out the escalation points for communications to internal and external customers for pro-active and reactive communications and to:

- Identify internal and external customers; and
- Set out the expected standard of communications with roles and responsibilities.

Normal Operation

A generic senses tour shall be undertaken as part of the daily EO&M (Effective Operations & Maintenance) site checks which will flag potential odour issues. As part of daily team meetings, site Operators and Process Controllers will identify and communicate to the wider team any operational issue or condition

which they believe has the potential to develop to site risk and this shall be recorded on the site issues board. A weekly formalised and documented odour senses tour shall be undertaken until such time that the OCUs are reinstated, as detailed in the Site Instruction in Appendix G.

When planning maintenance activities, Process Controllers (PCs)/ Field Service Engineers (FSEs) shall review the potential for off-site odour mitigation and the need to provide mitigation or conducting the activities during favorable weather conditions (preferable wind directions and speeds). Where mitigation measures cannot be provided the PC/FSE shall raise an escalation to the Production Manager.

Escalation Levels

Tier 1 On Site Risk - No External Communications

Should the following circumstances arise, the Production Manager will confirm a Tier 1 risk:

- Minor risk of odours generated by maintenance work; and
- Noticeable odour on site – ideally this would be confirmed via an on-site reading with a portable hydrogen sulphide gas analyser and operator Sniff tests

The site Process Controller will be responsible for initiating the associated actions and communications. The Technical Officer has the discretion not to proceed initiating a Tier 1 response, but the reason for doing so must be documented.

The outcome of which is to be risk assessed by the Technical Officer for consideration of further escalation and if there is a need to inform the customer team to update customers should they contact United Utilities.

The site Process Controller will be responsible for initiating the associated actions and communications.

The Technical Officer has the discretion not to proceed initiating a Tier 1 response, but the reason for doing so must be documented.

If a Tier 1 (internal) escalation point is met, then the following shall be contacted:

- East Area HUB;
- Maintenance Manager; and
- Environmental Regulatory Advisor

The communication will contain the following information:

- What has occurred or is planned;
- The expected duration;
- The expected impact;
- Customer/ street map to highlight area of potential impact and communication if applicable.

Tier 2 - (External Communications) – Neighbourhood Risk

Should the following circumstances arise the Production Manager will confirm a Tier 2 risk:

- Knowledge of at least 5 no. of telephone odour complaints/ contacts received with 24hr period

The site Technical Officer will be responsible for initiating the associated actions and communications.

The Production Manager can, at their own discretion, decide not to proceed initiating a Tier 2 response based on on-site/internal trigger levels being generated, but the reason for doing so must be documented.

If a Tier 2 (external) escalation point is met, then the following shall be contacted:

- External Affairs Manager;
- Area Stakeholder Manager (within Area impacted);
- Area Production Manager (within Area impacted);
- Area Business Manager (within impacted area);
- Asset Manager (within area impacted);
- Customer Focal Lead (Production Manager within area impacted);
- Area Engineering Manager; and
- Area Deployed Team- Process Engineering or Odour Technical Specialist

Following internal consultation, the Production Manager shall determine if communication with relevant external stakeholders and is to be conducted. External stakeholders may include:

- the Environment Agency;
- the Local Environmental Health Officer;
- customers in the impacted area;
- the Parish Council;
- the local Councilor and/or MP (within area impacted).

The purpose of the internal discussion will be to review the situation and agree the content and nature (e.g. text blast, phone call, e-mail, website, suitable conduit) of communication to external parties.

The messages should be clear and concise. The discussion shall agree what is communicated and by who.

The communication will contain the following information:

- What has occurred or is planned;
- The expected duration;
- The expected impact;
- Risk factors;
- Complications; and
- Customer / street map showing where letters / voice blasts should be focused.

The escalation criteria are summarised in Table 5.1.

Table 5.1: Escalation Table

	Tier 1 **On site risk - no external communications**	Tier 2 **Neighbourhood risk – external communications**
Measure	Minor risk of odours generated by maintenance work Noticeable odour on site – confirmed via operator Sniff tests	Knowledge of at least 5 no. of telephone odour complaints / contacts received with 24 hour period 10 telephone odour complaints / contacts received with 7-day period
Example	• Minor risk of odours generated by planned or reactive maintenance work has been identified • Noticeable odour on site – confirmed via operator Sniff tests • Septic influent or odorous trade effluent discharge reported by site operations team • Minor sludge or centrate spillage on site reported by site operations team	• Complete system failure of odour control equipment i.e. loss of all treatment stages and or extract fans • Moderate risk of odours generated by maintenance work has been identified • Noticeable odour on site – confirmed via human senses sniff tests • Moderate sludge or centrate spillage on site
Internal Contact	• East area HUB • Production Manager • ERA	ICC to log details of customer complaint and pass details to the Production Manager (PM) for investigation as soon as possible, but normally within 2 hours (24 hours at weekends). Customer complaints received via the EA are usually directed to the site ERA. The EA maintains a list of ERA contacts for each permitted site. Site ERA is to ensure the complaint is investigated as soon as possible and that the findings are reported back to the EA Site Inspector. PM to initiate investigation and consultation with the following internal stakeholders, as considered appropriate by the PM: • External Affairs Manager • Area Stakeholder Manager • Area Production Manager • Area Business Manager • Asset Manager • Customer Focal Lead • Area Engineering Manager • Area Deployed Team- Process Engineering or Odour Technical Specialist
External Contact		All odour complaint investigation findings to be reported back to the complainant within ten working days (the customer charter response time). Wherever possible, the investigation

	Tier 1 On site risk - no external communications	Tier 2 Neighbourhood risk – external communications
		findings should be reported back within 5 working days. ICC to detail the reason behind the issue to the complainant (if substantiated) and the actions taken to resolve the matter. Following internal consultation, the Production Manager may determine that external communication with all of some of these stakeholders is required: • The Environment Agency • The Local Environmental Health Officer • Customers in the impacted area • The Parish Council The local Councilor and/or MP (within area impacted) Where required, following consultation with the Production Manager, the ERA will complete and submit the permit Schedule 5 Part A notification to the Environment Agency.

5.3. Community Engagement

In accordance with the Escalation Procedure detailed in Section 5.2, if the Production Manager deems it appropriate, external engagement will be initiated. The level of external engagement will be dependent upon the number of complaints received, the nature of the complaints received and findings of the investigation. For example, if the complaints are substantiated and there is an ongoing source of odour due to a plant failure the level of engagement will be greater than a transient source where the issue has been resolved. The site typically receives very few odour complaints and there are currently no on-going odour issues with neighbours or local residents groups.

5.4. Pro-active Odour Monitoring

Site inspection tours are carried out daily by site-based staff. If any abnormal operating conditions or odours are identified during the tour, these are reported to the Production Manager.

Until such time that the OCUs are operating, olfactory monitoring ('sniff' testing) will be undertaken on a weekly basis at the locations shown in Appendix G. At each location observations shall be made concerning odour intensity, persistence and character. This will include the use of a Jerome hydrogen sulphide monitor at each location. The use of the Jerome meter is detailed in Appendix G. This instrument has been chosen as it is highly sensitive, having a limit of detection of 3 ppb (0.003 ppm). The instrument will be maintained within the calibration period specified by the manufacturers.

Weather conditions and any 'abnormal' site operating conditions at the time of the survey will also be recorded. Observations will be recorded on a weekly monitoring record form (see Appendix G).

Operational staff undertaking the weekly olfactory monitoring shall rotate so that a range of staff are engaged in the monitoring and the time of day that the monitoring is undertaken shall also be varied. This is detailed in the Site Instruction contained in Appendix G.

Odour intensity shall be recorded on a scale from 0 - no odour, to 6 - extremely strong odour, as follows:

- 0 - No odour (no odour can be detected)
- 1 - Very faint odour (only detectable if you specifically sniff for it)
- 2 - Faint odour (detectable if you casually sniff for it)
- 3 - Distinct odour (detectable by just standing there normally)
- 4 - Strong odour (unavoidable odour)
- 5 - Very strong odour (likely to leave lingering smell on clothes, or lingering taste)
- 6 - Extremely strong odour (likely to causes immediate physical symptoms such as nausea, sore throat and headaches)

The character of the odour shall be noted i.e. whether it can be likened to another smell (e.g. rotten eggs, earthy, musty, fishy, vegetation, cabbagey, vinegar/acid, oil, rotten onions vegetables, sludge, sceptic sludge, normal wastewater, septic wastewater, sweet pear drops, or other descriptor). Also whether the odour is constant or intermittent.

The Production Manager shall be notified in the following circumstances:

- following human senses detection of any odour of intensity 3 (distinct odour) or above at any of the monitoring points
- if a reading of >20ppb (0.02 ppm) hydrogen sulphide is recorded at a boundary location
- if a reading of >2.5 ppm hydrogen sulphide is recorded on site.

Plant operations shall be reviewed to investigate the source of the odour and ensure wastewater treatment processes are operating normally. The Production Manager will raise a Tier 1 or 2 escalation as appropriate (see Table 5.1). Any issues raised will be logged on the corporate action tracker and assigned to the relevant colleague for completion.

Pressure monitoring of the digesters and gas holder will also be used to identify leaks, i.e. pressures recorded above the set PVRV operation value would indicate PVRV operation. If releases from PVRVs are observed, they will be recorded in the site diary along with any escalations or remedial actions taken.

Site infrastructure and equipment are subject to a regular schedule of site inspections, which includes a leak detection programme and incorporates requirements set out in the IGEM standard, IGEM/UP/1. This comprises non-intrusive testing and inspection of gas related assets for leaks of volatile organic compounds (VOCs) using a thermal infrared gas camera and is carried out by a specialist team within the business. Inspections are carried out annually and will also be arranged on a reactive basis if required. On detection of a possible leak, an escalation procedure will be followed, and repairs or maintenance will be actioned promptly.

5.5. Reactive Odour Monitoring

Odour concerns and complaints will be substantiated by on-site and off-site 'sniff testing' carried out by an employee, as detailed in Section 5.1.2 on odour investigation.

6. Abnormal Events

6.1. Abnormal Events Potentially Leading to Odorous Emissions

In the event of failure of one or more of the existing fixed assets within the sludge treatment process the site will bring emergency contingency temporary/ mobile equipment onto the installation. These units shall be operated until such time that the fixed units are repaired and can be brought back into the process stream.

Temporary/ mobile equipment will be utilised for the task required and will be positioned within the installation boundary whenever feasible. The units will be positioned on impermeable hardstanding when required. The sludge will be transferred between fixed and temporary/ mobile assets through suitable flexible hosing where appropriate. Any accidental spillages shall be washed down into the sealed installation drainage system, to be returned to the head of the on-site, off-installation drainage system, downstream of the storm overflow, for treatment. Any process effluent discharges, such as centrate will be discharged into site drainage and returned to the head of the works.

Abnormal operating events are considered in detail in the site Accident Management Plan. Table 6.1 summarises abnormal event scenarios which may lead to odorous emissions.

Table 6.1: Abnormal Events

Abnormal Event	Control Measures	Recovery Steps
Damage to tank roofs	Routine inspection regime of digester and tank roofs Gas pressures monitored Gas pressure alarms	Conduct investigation of damage Rectification of fault Temporary /mobile equipment utilised if required until permanent asset can be repaired or replaced
Damage to fabrication of sludge buildings	Visual inspection of the sludge building fabrication	Conduct investigation of damage and rectify cause if possible Commission and undertake repair work Temporary repair may be required until permanent repairs can be undertaken
PVRVs activate	Calibrated to the safe working limit of the digester Gas pressures monitored Gas pressure alarms Digester feed and volumes controlled to maintain safe biogas level.	Investigate cause of high pressure, check for foaming and blockages Check sizing of valve is correct against design Reset and recalibrate PVRVS if required.
Loss of sludge from Digester PVRV or	Daily visual monitoring of foam level in digester through sight glass as part of the EO+M Tour	Monitor pressure until foaming subsides

Abnormal Event	Control Measures	Recovery Steps
overflow due to foaming	Pressure and operating levels monitored via telemetry Routine process monitoring of digester health Dosing with anti-foam if required	Cease digester feed during foaming incident. Temporarily cease mixing to reduce foaming Purge plan in place Longer term - investigate reasons for, and ways to mitigate foaming.
Leakage of biogas from seals, flanges, valves, pumps, pipework and tanks	Assets are scheduled for routine proactive inspection by thermal imaging camera on a 6-monthly basis Asset list is based on the potential for biogas leakage Planned maintenance assessment work is scheduling using the MARS system at the appropriate time and frequency Any detection of leakage is escalated for action.	Reactive monitoring for biogas emissions by thermal imaging camera Route cause analysis of leakage Rectification of fault Temporary /mobile equipment utilised if required until permanent asset can be repaired or replaced
High High pressure in the digesters (>38mb) leading to potential odorous emissions	Regular calibration of pressure monitors. Pressure monitors display locally on the SCADA with telemetry back to the ICC Immediate response alarm generated to alert site operators	Reduce digester sludge feed therefore reducing gas production Immediate investigation of the issue to prevent reoccurrence
Valves, pipes or pumps damaged or malfunctioning	Selection of correct pipework for pressure and flow loads. Frequent on-site checks	Temporary /mobile equipment utilised for the task required until permanent asset can be repaired or replaced Clean any spills promptly
OCUs damaged or malfunctioning	OCUs designed in accordance with UU asset standards Monitoring and maintenance in accordance with relevant SOP for OCU equipment and Site-Specific Instruction (SSIs)	Conduct checks set out in relevant SOP for OCU equipment, for example: Check when media was last changed Check load against design Check airflow rate in ductwork against design Check and adjust set points
Processing equipment	All EP assets are flagged as a priority and scheduled on inspection tours. All work completed is held on the asset	Check loading against design

Abnormal Event	Control Measures	Recovery Steps
damaged or malfunctioning	inventory and work planning system, MAMS. The MAMS work order system schedules the frequency of inspection tours and the preventative maintenance tasks carried out as part of these tours.	Conduct route cause analysis of damage/malfunction Rectification of fault Temporary /mobile equipment utilised if required until permanent asset can be repaired or replaced
Loss of containment from tanks or digester	Selection of correct pipework for pressure and flow loads Frequent on-site checks Maintenance in accordance with pressure vessel regulations, where appropriate Batch process	Follow spill response plan Investigate route cause of loss of containment Rectification of fault Temporary /mobile equipment utilised if required until permanent asset can be repaired or replaced
Open storage of sludge cake (on contingency cake pad) resulting in increased odour being detected	Regular site odour checks	Removal of sludge cake from site within 24 hours
Fire and/or explosion	Staff training and supervision DSEAR zones identified on plan with appropriate signage on site Fire extinguishers placed for quick access and checked regularly Fire hydrants positioned at key locations Emergency isolation valves available Incident management planning and training No smoking or other sources of ignition. No Mobile phones	Follow the Emergency Fire Response Plan and Biogas Emergency Plan (Ref. WwP/I/3021/01/16) This procedure includes site evacuation details, site checks to be undertaken, a list of emergency equipment, plant exclusion areas and plans detailing purge points and location of fire hydrants
Failure of electricity supply	Backup generators Ensure sufficient fuel stocks and manpower to facilitate operation of the generators Process Loss Contingency Plan in place (Ref. WwP/I/3021/30/01)	Follow the Process Loss Contingency Plan Establish estimated time for return of electrical supply Remote Monitoring Control Centre to be contacted to update them on the

Abnormal Event	Control Measures	Recovery Steps
		status of the incident and to inform EA of power outage Request adequate presence of Field Service Engineers for connection and operation of the generators Arrange for sufficient operations personnel to be present during the power outage to assist the FSE's and to monitor the plant and processes.
Flood	Relocate key equipment where possible Power down electrical units Protect sensitive areas with sandbags Secure objects that could float in floodwater e.g. skips, gas bottles Check surface water drains to ensure they are clear if debris Shutdown and drain flammable liquid piping Isolate gas supplies Refer to the Flood and Spill Plan (Ref. WwP/I/3021/30/03)	Hire pumps to remove standing water from site areas Clean and dry equipment, prioritising vital or susceptible equipment Check, clean and test all electrical distribution equipment and components exposed to flooding or humidity Remove flood debris Implement plan to resurrect process/part of process impacted by flood

6.2. Responsibility

Any operational problem that cannot be dealt with by normal operational procedures shall be classed as an INCIDENT and the current issue of UU Incident Management Procedure shall be referred to and SOP (WP/S/001/30/01 Incident Response).

All Standard Operating Procedures, Instructions and other documented operational procedures and activities are to be carried out by the Process Controller or other trained person designated by the Production Manager.

If in carrying the instruction it is not possible to rectify any problem encountered within a reasonable timescale the Production Manager or senior equivalent person must be contacted. Timescales for rectification will be dependent on the nature of the problem and guided by the relevant Standard Operating Procedure/ Instruction.

All actions and communications carried out while applying any Standard Operating Procedure, Instruction or other documented operational procedure or activity shall be recorded using form WwP/F/001/31/08 Site Diary Log.

Refer to WP/S/001/30/01 Incident Response for incident escalation and communication procedures.

6.3. Notification

The Environment Agency must be notified without delay of any accident which has caused, is causing or has the potential to cause significant pollution, as required by the Environmental Permit. The following procedure shall be followed for EA notification:

- Site Operations/Production Manager to notify ERA of the incident, the ERA will assess if a Part A notification is required. If required, the Part A notification form is to be agreed with the Production Manager and Waste Compliance Manager and submitted to the EA within 24 hours.
- During out of hours, Site operations to contact EA hotline then inform the ERA as soon as possible.
- E-mail the Part A notification form to the local EA Officer and the EA Installations mailbox: (Incident_Communication_Service@environment-agency.gov.uk)
- Provide a copy of the completed form to the Waste Compliance mailbox and EA correspondence and Regulatory Services mailbox: WasteCompliance@uuplc.co.uk; EACorrespondence@uuplc.co.uk
- ERA to complete the Part B notification form within 21 days or provide an update to the EA on progress.
- Follow the SOP for EPR Waste & Installations Incident Notification and Reporting (WwP/S/001/01/14).

If considered necessary following an incident or application of a contingency measure, this OMP will be reviewed.

Appendix A: Wind Rose Data

Figure A1: Wind Rose for Liverpool meteorological station 2011

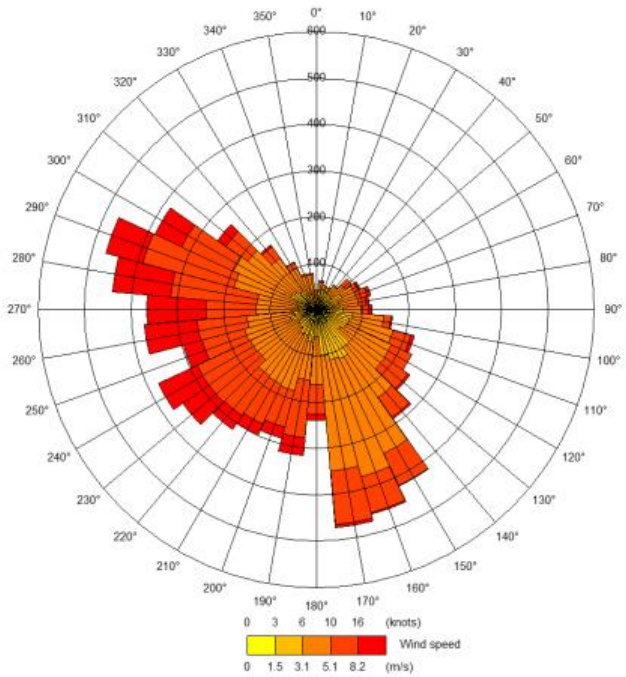


Figure A2: Wind Rose for Liverpool meteorological station 2012

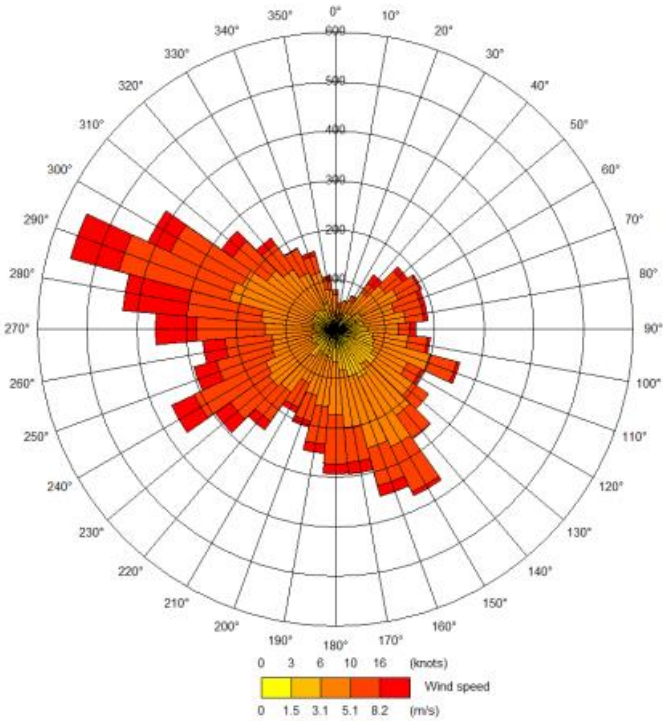


Figure A3: Wind Rose for Liverpool meteorological station 2013

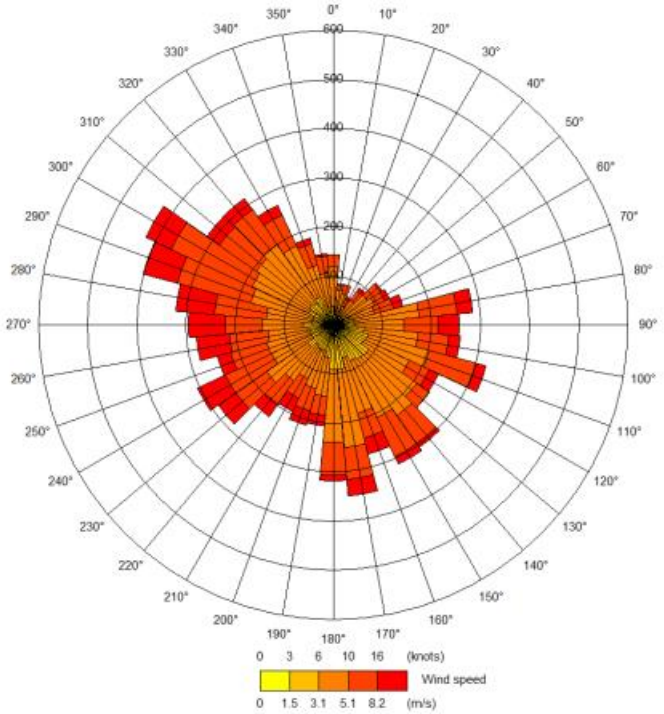


Figure A4: Wind Rose for Liverpool meteorological station 2014

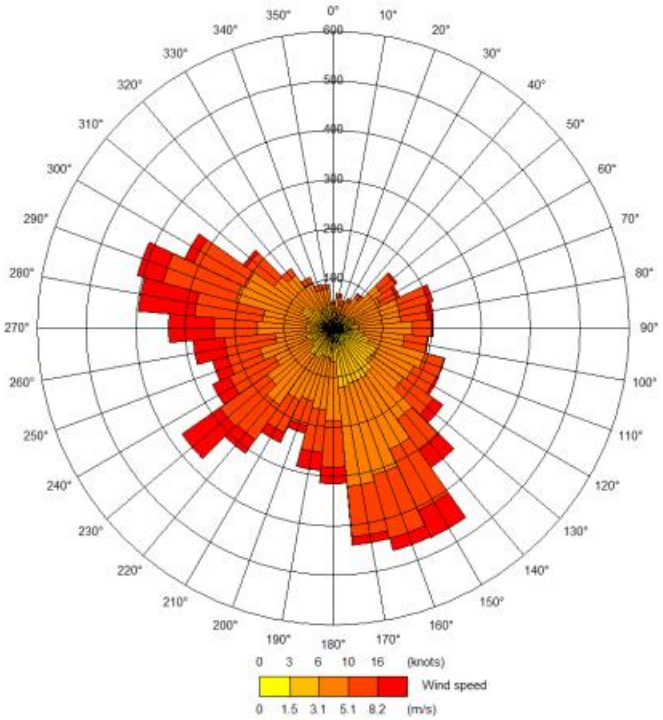
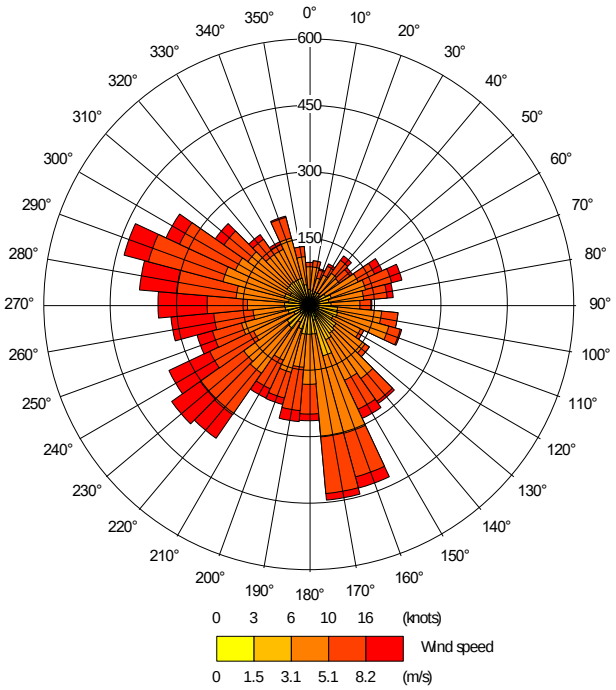
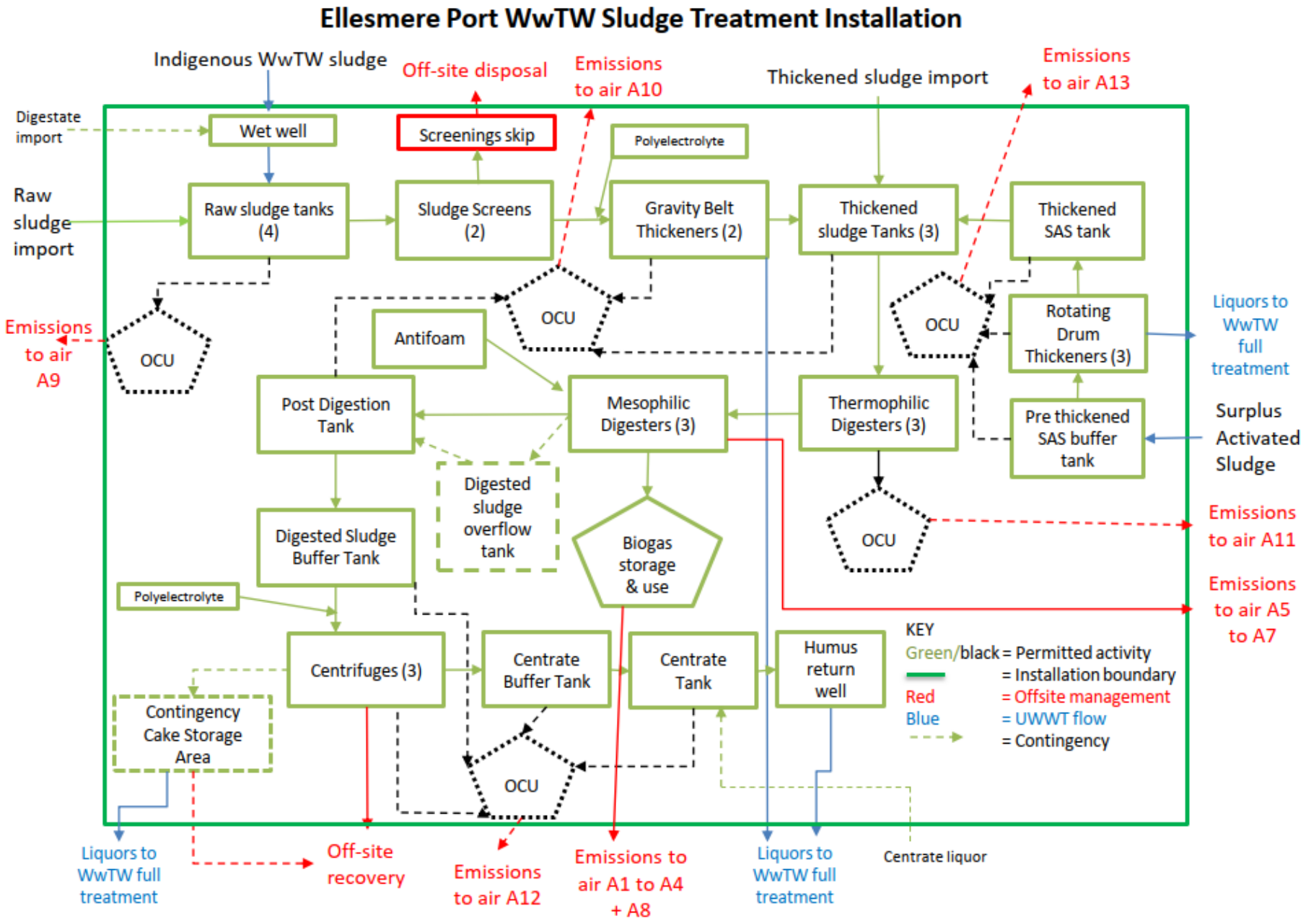


Figure A5 Wind Rose for Liverpool meterological station 2020



Appendix B: Process Flow Diagram


Ellesmere Port WwTW Sludge Treatment Installation
Indigenous WwTW sludge
Off-site disposal
Emissions to air A10
Thickened sludge import
Emissions to air A13
Digestate import
Wet well
Screenings skip
Polyelectrolyte
Raw sludge import
Raw sludge tanks (4)
Sludge Screens (2)
Gravity Belt Thickeners (2)
Thickened sludge Tanks (3)
Thickened SAS tank
OCU
Emissions to air A9
OCU
Antifoam
OCU
Rotating Drum Thickeners (3)
Liquors to WwTW full treatment
Post Digestion Tank
Mesophilic Digesters (3)
Thermophilic Digesters (3)
Pre thickened SAS buffer tank
Surplus Activated Sludge
Digested sludge overflow tank
Digested Sludge Buffer Tank
Biogas storage & use
OCU
Emissions to air A11
Polyelectrolyte
Emissions to air A5 to A7
Centrifuges (3)
Centrate Buffer Tank
Centrate Tank
Humus return well
KEY
Green/black = Permitted activity
= Installation boundary
Red = Offsite management
Blue = UWWT flow
= Contingency
Contingency Cake Storage Area
OCU
Liquors to WwTW full treatment
Off-site recovery
Emissions to air A12
Emissions to air A1 to A4 + A8
Liquors to WwTW full treatment
Centrate liquor

Appendix C: Design Operating Parameters for Odour Control Units

RAW SLUDGE OCU - A9* all design info TBC			
Parameter	Units		
Airflow OCU	m^3/hr	1,516	
Temp	oC	N/A	
Contaminants	Ammonia	N/A	Ave/Max
	H2S	50	/Max
	RSH	N/A	Ave/Max
	DMS	N/A	Ave/Max
	Misc VOCs	N/A	Ave/Max
Parameter	Units		
Outlet odour biological	OU_e/m^3	>95% Removal	
Hydrogen Sulphide	% Rem	>98	
Mercaptans	% Rem		
DMS	% Rem		
VOCs	% Rem		
Outlet odour Carbon	OU_e/m^3	<1,000 Typical >98% Removal	
H_2S, RSH, DMS, VOCs		N/A	
Airflow System balanced to be checked/confirmed during re-commissioning	m^3/hr	+/- 10% of design acceptable Changes of >20% should be investigated	
pH	pH	Design is pH not specified but will vary <2 – 7.5 Depending on H_2S load. Identifying a significant change is important <1.5 irrigation rate /load check /adjustment	
Irrigation flow flow set points to be rechecked as part of re-commissioning	l/hr l/s	7920 l/hr Min 2mins/12hrs Max 2.5min/2hrs 2.2	
-		Failure of the irrigation system to be instigated immediately and should be reinstated as soon as possible. Loss of irrigation for 24hrs will compromise performance and shall be escalated.	
Differential pressure	Pa	~2000 Pa Max per stage Changes of >20% should be investigated	

RAW SLUDGE OCU - A9* all design info TBC			
GBT, THICKENED SLUDGE, DIGESTED SLUDGE TANKS OCU - A10 * all design info TBC			
Parameter	Units		
Airflow OCU	m^3/hr	10,742	
Temp	oC	N/A	
Contaminants	Ammo	N/A	Ave/Max
	H2S	50	/Max
	RSH	N/A	Ave/Max
	DMS	N/A	Ave/Max
	Misc VOCs	N/A	Ave/Max
Parameter	Units		
Outlet odour biological	OU_e/m^3	>95% Removal	
Hydrogen Sulphide	% Rem	>98	
Mercaptans	% Rem		
DMS	% Rem		
VOCs	% Rem		
Outlet odour Carbon	OU_e/m^3	<1,000 Typical >98% Removal	
H_2S, RSH, DMS, VOCs		N/A	
Airflow	m^3/hr	+/- 10% of design acceptable	
System balanced to be checked/confirmed during re-commissioning		Changes of >20% should be investigated	
pH	pH	Design is pH not specified but will vary <2 – 7.5 Depending on H_2S load. Identifying a significant change is important <1.5 irrigation rate /load check /adjustment	
Irrigation flow	l/hr	24,000 l/hr Min 2mins/12hrs Max 2.5min/2hrs	
flow set points to be rechecked as part of re-commissioning	l/s	6.7	
-		Failure of the irrigation system to be instigated immediately and should be reinstated as soon as possible. Loss of irrigation for 24hrs will compromise performance and shall be escalated.	
Differential pressure	Pa	~2000 Pa Max per stage Changes of >20% should be investigated	

TAD TANKS OCU - A11 * all design info TBC			
Parameter	Units		
Airflow OCU	m^3/hr	3,580	
Temp	oC	35oC Max	
Contaminants	Ammonia	0.0/0.0	Ave/Max
	H2S	42/81	Ave/Max
	RSH	61/100	Ave/Max
	DMS	10/40	Ave/Max
	Misc VOCs	67/74	Ave/Max
Parameter	Units		
Outlet odour biological	OU_e/m^3	>95% Removal	
Hydrogen Sulphide	% Rem	>98	
Mercaptans	% Rem	>98	
DMS	% Rem	60% max	
VOCs	% Rem	605 max	
Outlet odour Carbon	OU_e/m^3	<10,000 Typical	
H_2S, RSH, DMS, VOCs		>98% Removal	
Airflow System balanced to be checked/confirmed during re-commissioning	m^3/hr	+/- 10% of design acceptable Changes of >20% should be investigated	
pH	pH	Design is pH not specified but will vary <2 – 7.5 Depending on H_2S load. Identifying a significant change is important <1.5 irrigation rate /load check /adjustment	
Irrigation flow flow set points to be rechecked as part of re-commissioning	l/hr l/s	Not yet known Not yet known	
-		Failure of the irrigation system to be instigated immediately and should be reinstated as soon as possible. Loss of irrigation for 24hrs will compromise performance and shall be escalated.	
Differential pressure	Pa	Not yet known Not yet known	

CENTRIFUGE BUILDING, CENTRATE TANKS & DIGESTED SLUDGE BUFFER OCU - A12* all design info TBC			
Parameter	Units		
Airflow OCU	m^3/hr	2,714 treated 5,100 at stack	
Temp	oC	N/A	
Contaminants	Ammonia	Not known	Ave/Max
	H2S	Not known	Ave/Max
	RSH	Not known	Ave/Max
	DMS	Not known	Ave/Max
	Misc VOCs	Not known	Ave/Max
Parameter	Units		
Outlet odour biological	OU_e/m^3	N/A	
Hydrogen Sulphide	% Rem	N/A	
Mercaptans	% Rem	N/A	
DMS	% Rem	N/A	
VOCs	% Rem	N/A	
Outlet odour Carbon	OU_e/m^3	<1,000 Typical >98% Removal	
H_2S , RSH, DMS, VOCs		>98% Removal	
Airflow	m^3/hr	+/- 10% of design acceptable	
System balanced to be checked/confirmed during re-commissioning		Changes of >20% should be investigated	
pH	pH	N/A	
Irrigation flow	l/hr	N/A	
flow set points to be rechecked as part of re-commissioning	l/s	N/A	
-		-	-
Differential pressure	Pa	150 pre-filter -estimate	
		1440 media bed	

ESSAR & SAS Sludge Processing OCU - A13 Not yet commissioned			
Parameter	Units		
Airflow OCU	m^3/hr	3,121	
Temp	oC	-10 - 40oC	
Contaminants	Ammonia	1.0/6.0	Ave/Max
	H2S	12.8/66.8	Ave/Max
	RSH	1.3/6.7	Ave/Max
	DMS	1.3/6.6	Ave/Max
	Misc VOCs	4.2/8.3	Ave/Max
Parameter	Units		
Outlet odour biological	OU_e/m^3	99%	
Hydrogen Sulphide	% Rem	99%	
Mercaptans	% Rem	99%	
DMS	% Rem	TBC	
VOCs	% Rem	TBC	
Outlet odour Carbon	OU_e/m^3	<1,000 Typical >98% Removal	
H_2S , RSH, DMS, VOCs		>98% Removal	
Airflow	m^3/hr	+/- 10% of design acceptable Changes of >20% should be investigated	
pH	pH	Design is pH 6.5-7.5 Identifying a significant change is important	
Irrigation flow	l/hr	3,000	
-	l/s	0.83	
-		Failure of the irrigation system to be instigated immediately and should be reinstated as soon as possible. Loss of irrigation for 24hrs will compromise performance and shall be escalated.	
Differential pressure	Pa	BTF - TBC after commissioning Demister - TBC after commissioning Carbon filter TBC after commissioning	

Appendix D: General Inspection and Maintenance Activities for Operational OCUs

BIOLOGICAL ODOUR CONTROL FILTER SYSTEMS – INSPECTION & MAINTENANCE ACTIVITIES											
Sub Task	Activity	Ops/Main	Shift	Daily	Week	Month	Quarter	6 Month	Annual	Greater	Comment
-	**Biological Odour Control**										
1	Visual inspection of extraction system – ductwork & covers	Ops			✓						Check integrity of ductwork, flexible connects and covers for damage/failure. Dampers in open position. Check air inlets are functional and clear of debris, access hatches closed, condensate lines/drain functioning and drained
2	Fire Dampers								✓		check condition and Operation of fire dampers
3	Measurement of system air flows	Ops					✓				Record airflow from all extract points, entering, exiting OCU. Compare against design/previous records. Identify and investigate any deviation. Check operation condition of volume control dampers. Non routine measurement instigated based on increase/ decrease OCU differential pressure/repeated fan low flow alarms.
4	Inlet, Outlet and inter-stage contaminant concentration H_2S (Could also be Ammonia, Mercaptans, Dimethyl Sulphide, Misc volatile compounds (VOCs	Ops				✓					Confirm performance of each process stage and that inlet is within max design range - investigate and identify source/cause if Max exceeded. Could be continuous H_2S measurement if online instrumentation is provided.
5	Continuous H_2S monitoring (OCU inlet/Stack (if fitted)	Ops		✓		✓		✓			Daily check to confirm operation of instrument check against inlet design parameters and check correct sample gas flow rates. Replacement of paper tapes –as required (monthly). Calibration/Replacement of electro chem sensor annual basis (3rd party).
6	Liquid drain operation/quality	Ops		✓							Visual observation of drain operation. Clear liquor with

BIOLOGICAL ODOUR CONTROL FILTER SYSTEMS – INSPECTION & MAINTENANCE ACTIVITIES											
Sub Task	Activity	Ops/Main	Shift	Daily	Week	Month	Quarter	6 Month	Annual	Greater	Comment
											some floc present is quality standard
7	Irrigation/recirculation system functionality	Ops		✓							Basic functionality check, log and adjust irrigation water feed pressure/flow. Check availability of recirc pumps (if fitted/Bio scrubber) Could be continuous measurement if online (flow pressure instrumentation is provided).
8	Irrigation supply Strainer	Ops			✓						Check condition of strainer and clean (if fitted). Damaged strainer to be replaced. Interval maybe increased dependant on rate of fouling/increase if frequent low irrigation flow encountered
9	High Level Overflow (if fitted)	Ops		✓							Check overflow not operating - investigate cause if it is. Check water trap is charged/Air not being discharged/drawn in. Charge lute if necessary
10	Media Bed Spray coverage	Ops			✓						Checked if OCU performance is observed to decrease below trigger level
11	Effluent pH and/or conductivity	Ops			✓						Manual check frequency may be extended if pH/conductivity remains stable. Manual check dependant on whether on-line instrumentation provided- periodic calibration check of on-line instruments required.
12	OCU pressure drop across bed media bed and Pre-filter (if fitted)	Ops			✓						Information logged to identify performance trends
13	Visual inspection of OCU Vessel	Ops			✓						Operational and asset condition check. Check for operation. Check vessel integrity (deformation/gas and liquid leaks – air infiltration/fugitive release, corrosion
14	Vessel Internal inspection	Ops							✓		Media replaced based on reaching performance trigger level value. Use opportunity to inspect vessel internals for corrosion/damage. Potential recertification of vessels if appropriate.

BIOLOGICAL ODOUR CONTROL FILTER SYSTEMS – INSPECTION & MAINTENANCE ACTIVITIES											
Sub Task	Activity	Ops/Main	Shift	Daily	Week	Month	Quarter	6 Month	Annual	Greater	Comment
15	Media Replacement	Ops								✓	Media replacement interval should 1-5yrs for organic media, >10yrs for pumice/inert media. However, if unit becomes fouled by solids from irrigation water media will require removal for cleaning/replacement.
16	OCU Fan & isolation/NRD damper operation/vibration	Ops		✓							Check for operation/function. Log hours run and fan availability. AMPs drawn Check for vibration/noise. Check integrity of any flexible connector between ductwork and fans

BIOLOGICAL ODOUR CONTROL FILTER SYSTEMS - TROUBLE DIAGNOSTIC TABLE			
OBSERVATION	PROBABLE CAUSE	NECESSARY CHECK	CORRECTIVE ACTION
High H_2S value at OCU outlet	Liquid irrigation rate too low	Check irrigation rate Supply pressure Spray coverage	• Reconnect/realign spray bars • clear blockages from irrigation supply and nozzles • Clean Strainer • Increase irrigation rate
	Inlet hydrogen sulphide concentration exceeds design range	Check inlet hydrogen sulphide concentration	• Complete site investigation to reduce sulphide loading onto OCU
	Bypassing of gas around stages	Check position of dampers	• Close any bypass damper found to open
	Gas loading rate too high through scrubber	Check gas flow rate	• Adjust volume control damper local to OCU • Reduce fan speed(VSD)
	Recirculating liquor conductivity too high	Check conductivity in recirculating liquor effluent/drain	• Increase blowdown rate
	No nutrient for microorganism growth	Check for change in source of irrigation water. Check nutrient tank	• Provide/Reorder nutrient soln • Source high qual sec effluent is possible
High outlet odour concentration (not	pH too low	Check pH in OCU effluent/drain	• Increase/decrease blowdown or irrigation rate

BIOLOGICAL ODOUR CONTROL FILTER SYSTEMS - TROUBLE DIAGNOSTIC TABLE			
OBSERVATION	PROBABLE CAUSE	NECESSARY CHECK	CORRECTIVE ACTION
H_2S)	Non-degradable VOCs in foul air stream	Use portable Photo ionisation detector (PID) to determine if high levels of VOCs are in the air stream. GC-MS analysis if required to identify compounds	• Undertake process investigation to identify source and reduce emissions • Provide additional stage of treatment if required
	Degradable VOCs in foul air stream	Determine if VOCs are in the air stream. GC-MS analysis if required to identify compounds Check pH in OCU effluent/drain Check pH profile through across media bed if possible	• Increase blowdown or irrigation rate to achieve pH >6 • Provide additional stage of treatment if required
Insufficient airflow through the OCU	Fans out of service	Check the fan operation Check isolation Damper positions Check none return damper is preventing recirculation through standby fan	• check fans are in working order/start fan • Replace belts/Motor • Open dampers • Repair/replace none return damper
	System pressure drop greater than design	• Measure airflow in ductwork headers • Check pressure drop across media bed any pre-filters and mist eliminators • Check position of dampers	• Ensure required damper are in the fully open position • Open field ductwork dampers to achieve design air flow • Clean -filters
	Damage to Fan	• Foreign object within the unit • Belt slip Faults with the motor	• Clean rotors or unit • Re-adjust belt tension or change belts • Check motor and power source
	Leakage-	Check for leaks in dductwork	• Repair ductwork

ACTIVATED/DRY MEDIA ODODUR CONTROL UNITS – INSPECTION & MAINTENANCE ACTIVITIES											
Sub task	Activity	Ops/Main	Shift	Daily[§]	Week	Month	Quarter	6 Month	Annual	Greater	Comment
	Activated Carbon/Dry Media										
1	Visual inspection of extraction system – ductwork & covers	Ops			✓						Check integrity of ductwork, flexible connects and covers for damage/failure. Dampers in open position. Check air inlets are functional and clear of debris, access hatches closed, condensate lines/drain functioning and drained
2	Fire Dampers								✓		check operation condition of fire dampers
3	Measurement of system air flows	Ops					✓		✓		Record airflow from all extract points, entering, exiting OCU. Compare against design/previous records. Identify and investigate any deviation. Check operation condition of volume control dampers. Non routine measurement instigated based on increase/decrease OCU differential pressure/repeated fan low flow alarms.
4	Inlet, Outlet and inter-stage contaminant concentration H_2S (Could also be Ammonia, Mercaptans, Dimethyl Sulphide, Misc. volatile compounds (VOCs	Ops				✓					Confirm performance of each process stage and that inlet is within max design range. Could be continuous H_2S measurement if online instrumentation is provided.
5	Continuous H_2S monitoring (OCU inlet/Stack (if fitted)	Ops		✓		✓		✓			Daily check to confirm operation of instrument check against inlet design parameters. And check correct sample gas flow rates. Replacement of paper tapes –as required (monthly). Calibration/Replacement of electro chem sensor 6 monthly-annual basis (3rd party).
6	Pre-heater functionality (if installed)	Ops		✓							Check heater is operational, AMPs drawn. Check external housing for corrosion. Check flow and temperature instruments functionality/alarms
7	Pre- filter inspection and cleaning (if installed)						✓				Could be triggered by differential pressure deviation
8	OCU pressure drop across bed media bed and Pre-filter (if fitted)	Ops			✓						Information logged to identify performance trends
9	Visual inspection of OCU Vessel	Ops			✓						Operational and asset condition check. Check for operation. Check vessel integrity (deformation/gas and liquid leaks – air infiltration/fugitive release, corrosion
10	Vessel Condensate drain	Ops			✓						More applicable to vessel held under negative pressure. Fans switched off and any drain valves opened. Any condensate allowed to drain.
11	Vessel Internal inspection and potential Media Replacement	Ops							✓	✓	Media replaced based on reaching performance trigger level value. Use opportunity to inspect vessel internals for corrosion/damage. Potential recertification of vessels if appropriate.
12	Media sampling	Ops								✓	Media sampled and sent for external lab analysis to determine remaining media life/adsorption capacity Check for activity, dependent on size of unit, length of time in service Vs performance.

ACTIVATED/DRY MEDIA ODODUR CONTROL UNITS – INSPECTION & MAINTENANCE ACTIVITIES											
13	OCU Fan & isolation/NRD damper operation/vibration	Ops		✓							Check for operation/function. Log hours run and fan availability. AMPs drawn Check for vibration/noise. Check integrity of any flexible connector between ductwork and fans

ACTIVATED/DRY MEDIA ODOUR CONTROL UNITS - TROUBLE DIAGNOSTIC TABLE			
OBSERVATION	PROBABLE CAUSE	NECESSARY CHECK	CORRECTIVE ACTION
High H_2S value at OCU outlet	Media depleted	• Check when media was last changed • Check load against design • Check odour type i.e. H2S Vs VOC • against carbon type	• Replace Media • Change type/blend of media
	Excessive gas flow through Unit	• Measure airflow in ductwork headers Check position of bypass dampers Check fan control: - Auto/manual etc. • Check fans speed Vs commissioning spec/datasheets	• If airflow rate exceeds design close dampers to achieve design air flow • Close damper(s) • Place fan into Auto • Reduce fan speed
High outlet odour concentration (not H_2S)	VOCs in foul air stream	• Check operation or for installation of Pre heater • Use portable Photo ionisation detector (PID) to determine if high levels of VOCs are in the air stream. GC-MS analysis if required to identify compounds. • Check inlet relative humidity is within range recommend by media suppliers • Check type of media installed and suitability to treat VOCs	• Repair pre-heater if necessary • Undertake process investigation to identify source and reduce emission • Change media or provide additional stage of treatment if required
	Media depleted	• Check when media was last changed • Check load against design • Check odour type against carbon type	• Replace Media • Change type/blend of media
	Excessive gas flow through unit	• Measure airflow in ductwork headers • Check position of bypass dampers	• If airflow rate exceeds design close dampers to achieve design air
Insufficient airflow through the OCU	Fans out of service	• Check the fans operation	• Check fans are in working order. • Start-up fan
	Bed collapse	• Check pressure drop across all beds. • Perform visual inspection.	• Place unit out of service. • Contact OCU supplier
	Duct broken/cracked	• Visual inspection.	• Organise repair.

ACTIVATED/DRY MEDIA ODOUR CONTROL UNITS - TROUBLE DIAGNOSTIC TABLE			
OBSERVATION	PROBABLE CAUSE	NECESSARY CHECK	CORRECTIVE ACTION
Insufficient airflow through the OCU	System pressure drop greater than design	• Measure airflow in ductwork headers • Check pressure drop across scrubbers and pre-filters and mist eliminators • Check position of dampers	• Ensure required damper are in the fully open position • Open field ductwork dampers to achieve design air flow • Clean -pre-filters
	Damage to Fan	• Foreign object within the unit • Belt slip • Faults with the motor	• Clean rotors or unit • Re-adjust belt tension or change belts • Check motor and power source
	Leakage-	• Check for leaks in dductwork	• Repair ductwork
Airflow exceeds design rate	Installed system pressure drop less than design	• Measure airflow in ductwork headers.	• If airflow rate exceeds design close dampers to • achieve design air flow
	Bypass damper in open position	• Check position of bypass dampers	• Close damper(s)
	Fan operating at higher than normal speed	• Check fan control:- Auto/manual • Check fans speed Vs comm spec/datasheets	• Place fan into Auto • Reduce fan speed

Appendix E: Odour Diary Form

Odour diary

helping life flow smoothly

About you	
Customer name	
Telephone number	
Email	
Address (including postcode)	
Preferred telephone contact times	
Date of odour	D D M M Y Y Y Y Sheet
Time of odour	
Location of odour (if not at the above address)	
What does it smell like? (please tick all as appropriate)	☐ Rotten eggs ☐ Fish ☐ Earth/Compost ☐ Cabbage ☐ Bleach ☐ Vinegar/Acrid ☐ Oil ☐ Sweat/Pear drops ☐ Rotten Vegetables/Onions ☐ Other (please specify)
Intensity - how strong was the smell? (please tick as appropriate)	☐ 0 - No odour ☐ 1 - Very faint odour ☐ 2 - Faint odour ☐ 3 - Distinct odour ☐ 4 - Strong odour ☐ 5 - Very strong odour ☐ 6 - Extremely strong odour
How offensive was the smell? (please tick as appropriate)	☐ 0 - Neutral odour/no odour ☐ 1 - Mildly unpleasant ☐ 2 - Moderately Unpleasant ☐ 3 - Very unpleasant ☐ 4 - Extremely unpleasant
How long did it go on for? (time)	
Was it constant or intermittent in this period?	
Weather conditions (e.g. dry, rain, fog, sleet or snow)	
Temperature (very warm, warm, mild, cold or degrees)	
Wind strength (none, light, steady, strong, gusty)	
Wind direction (e.g. from North East)	

Once completed please email the completed form as an attachment to: **********@uuplc.co.uk

About us

United Utilities is the North West's water company. We keep the taps flowing and toilets flushing for seven million customers every day. From Crewe to Carlisle, we work hard behind the scenes to help your life flow smoothly.

United Utilities Water Limited, Haweswater House, Lingley Mere Business Park, Lingley Green Avenue, Warrington WA5 3LP
Registered in England and Wales. Registered Number 2366678.

Appendix F: Odour Investigation Form

United Utilities Water for the North West	Wastewater Treatment	Reference: WwP/F/001/30/16
	Site Specific Form (SSF)	Version: 1 Issue date: 04/03/2021 Expiry date: 04/03/2024
	Site Odour Investigation Form	

Site Odour Investigation Form	
Site:	
Name and Address of Complainant:	
Telephone number of complainant: N/A	
Date of odour:	
Time of odour:	
Location of odour, if not at above address:	
Weather conditions (i.e., dry, rain, fog, snow):	
Temperature (very warm, warm, mild, cold or degrees if known):	
Wind strength (none, light, steady, strong, gusting):	
Wind direction	
Complainant's description of odour: Prompts : Rotten eggs, Fish, Earth/Compost, Cabbage, Bleach Vinegar/Acrid, Oily, Sweet/Pear drops, Rotten Vegetables/Onions, Other (please specify)	
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	
Duration (time):	
Constant or intermittent in this period:	
Any other comments about the odour?	
Are there any other complaints relating to the installation, or to that location? (either previously or relating to the same exposure):	
Any other relevant information:	
Do you believe that the odour is likely to be from site activities?	
What was happening on site at the time the odour occurred? (Any potential cause of odour?)	
Operating conditions at time the odour occurred (e.g. OCU working ok? Sludge mixing, spillage, maintenance on PST/ST/Sludge tank?):	

Site Odour Investigation Form		
Actions taken: Investigation completed and checked site area.		
Form completed by:	Date	

Appendix G: Site Instruction - Sniff Test and Jerome H2S Monitor Odour Tour

		Reference: TBC
	Wastewater Services	Version: 1 Issue date: TBC Expiry date: TBC
	Sniff Test and Jerome H_2S Monitor **Draft Site Wide Odour Tour** **Ellesmere Port WwTW**	

1. Safety

Any person carrying out any of the following instructions shall do so in accordance with United Utilities Ltd. Blue Book and all Generic Risk Assessments (GRAs), details of which are contained in United Utilities Ltd. Health and Safety Policy – Organisations and Arrangements document and available via the UU intranet site.

If in carrying out this instruction, it is not possible to rectify any problem encountered within a reasonable timescale, the Production Manager or senior equivalent person must be contacted.

All other applicable regulatory and statutory requirements shall be observed at all times.

Detailed operating instructions, control philosophies and technical information may be found in the following;

- **Process Loss Contingency Plans**
- **Compliance Action Plans**
- **Environmental Permits**
- **Accident, Incident and Emergency Management Plans**
- **Drainage Plans**
- **Environmental Risk Assessments**
- **O & M Manuals**
- **Control philosophies**

2. Responsibility

All Standard Operating Procedures, Instructions and other documented operational procedures and activities are to be carried out by the Process Controller or other trained person designated by the Production Manager.

If in carrying the instruction it is not possible to rectify any problem encountered within a reasonable timescale the Production Manager or senior equivalent person must be contacted.

Any operational problem that cannot be dealt with by normal operational procedures shall be classed as an INCIDENT and the current issue of UU Incident Management Procedure shall be referred to and SOP (WP/S/001/30/01 Incident Response).

All actions and communications carried out while applying any Standard Operating Procedure, Instruction or other documented operational procedure or activity shall be recorded using form WwP/F/001/31/08 Site Diary Log.

3. Plant and Process Description

- This SSI sets out the procedures to conduct a human senses 'sniff' test and use of a Jerome H_2S monitor.
- The procedure has been developed to ensure a consistent approach is used for site (and surrounding neighbourhood) odour monitoring tours and that the risk of inaccurate data generation is minimised.
- This procedure details ambient air sampling only.
- In addition to the Jerome unit the use of a photo ionisation detector (PID) could also be implemented. The use of a PID should be considered on a case by case basis and is dependent upon instrument availability within the business. Further information on the use and operation of such equipment should be discussed with the company's odour specialist/Process Engineering Department.

4. Sampling Location and frequency

- Site odour tours will be conducted on a weekly basis at different times of the day, until such time that the OCUs are re-commissioned.
- Tours will be undertaken in response to odour complaints being received.
- The tour should follow the locations detailed in Appendix 1 of this Instruction.
- The odour assessor should complete a record for each location, detailing the results of the 'Sniff' test and the Jerome & PID instrument if used.

5. 'Sniff' Test Procedure

The following procedure has been based on guidance provided within the Institute of Air Quality Management's (IAQM) *Guidance on the Assessment of Odour for Planning.*

- In order to conduct an accurate sniff test, the odour assessor must consider and adhere to the following:
    a) The odour assessor should not carry out the assessment if they have a cold, sore throat, sinus trouble, etc. In the case that this cannot be avoided, this should be clearly documented on the Monitoring Record Sheet (See Appendix 2).
    b) The odour assessor should not be hungry or thirsty.
    c) The odour assessment should not be conducted within half an hour of the end of the assessor's last meal.
    d) The odour assessor should not smoke or consume strongly flavoured food or drink, including coffee, for at least half an hour before the field odour tour is carried out, or during the survey.
    e) The odour assessor should not consume confectionary or soft drinks for at least half an hour before the field odour tour is carried out, or during the tour.
    f) Scented toiletries, such as perfume/aftershave should not be used on the day of the field odour survey.
    g) The vehicle (if applicable) used during the field odour tour should not contain any deodorisers.
    h) If the odour assessor has had to travel a long distance, then a rest period should be taken before starting the 'sniff' test.
    i) To reduce the likelihood of odour fatigue, assessors should always carry out the field odour survey *before* making any works site visit, inspection or walk-through survey.

j) For sources with a diurnal odour release pattern there may be a need to conduct more than one set of 'sniff' tests during each site visit day; the odour assessor should remove themselves to a place well away from the odour source for the hours between 'sniff' tests.

- At the beginning of the tour the odour assessor must document weather conditions, including temperature, cloud cover, precipitation, wind direction and wind strength.

- Any noteworthy information relating to the operations and activities being undertaken on site and in the surrounding area should also be documented.

- The odour assessor should carry out the 'sniff' test at each test location for a standard observation time, typically a minimum of 2-3 minutes per location.

- For each test location, the start time of the observation period and the attributes of the odour over the observation period should be recorded. Note: even if there is no detectable odour this should still be recorded.

- To conduct the human senses/sniff test, the assessor should breathe normally, inhaling ambient air samples through the nose at regular intervals.

5.1 Describing/Classifying odours

Any odour encountered should be described and characterised using the following parameters to ensure consistent approach is maintained in documenting results:

i. The intensity of the odour using the following:
0. No odour, 1. Very faint odour, 2. Faint odour, 3. Distinct odour, 4. Strong odour, 5. Very strong odour, 6. Extremely strong odour
ii. Whether the odour was constant or intermittent.
iii. Whether the smell can be likened to another smell *(Rotten eggs, earthy, musty, fishy, vegetation, cabbagey, vinegar/acid, oil, rotten onions vegetables, sludge, sceptic sludge, normal wastewater, septic wastewater, sweet pear drops, or other descriptor).*

- In addition to odour attributes, the maximum H_2S/PID concentration registered during the 'sniff' test should be recorded. Please see next section for more information on how to prepare and operate Jerome & PIDs Monitors (if used).
- Both odour attributes and H_2S/PID values are recorded using the Monitoring Record Sheet (Appendix 2 of this Instruction).
- The above procedure is repeated at each test location.
- For more information on how to conduct odour testing, see the Institute of Air Quality Management's *Guidance on the Assessment of Odour for Planning* or the Environment Agency's H4 Guidance Document

6. Jerome Monitor - Pre sampling Preparation

- The operator must confirm that the Jerome unit used is not showing any fault alarms, is within its calibration period and the calibration due date is recorded.
- The operator must check that the instrument is displaying the correct date and time.
- The Jerome unit is to be left connected to mains power when not in use.
- Prior to use, the Jerome must be placed into regeneration mode- **this cycle will take approx. 45min to complete and cool down.**
- Select the Auto range function by doing the following

    a. Select SAMPLE menu. Use ▲ and ▼ to scroll through the ranges 0, 1, 2 and Auto, and press ENTER/START, then Esc.
- Selection Sample interval function by doing the following:

    b. Select sample menu and use ▲ and ▼ to scroll down to set select Survey mode

    c. Use the ▲and ▼arrow keys to scroll through to survey mode press ENTER/START, then Esc.

    d. The Jerome will then sample on a continuous basis and sampling will take between 10-50 seconds to take a sample.

    e. To pause sampling press start button on the units handle.
- **Prior to use the Jerome must complete a system Warm-up and a "zeroing" of the instrument.** This cycle will take approx. 5min to complete and cool down. This is required to ensure instrument accuracy where H_2S values may be. It can be achieved by doing the following:

    f. Insert Zero air filter into instrument air inlet ensuring confirm connection provided by O-ring seal and that direction of airflow indictor is correct (see Photos 1&2 in Guidance Photos at bottom of document).

    g. Select Menu from on keypad.

    h. Select **Regen** option from menu using ▲and ▼arrow keys and press enter.

    i. Scroll down to **Warmup** Option and using ▲and ▼arrow keys and press enter.

    j. Sensor should read zero. If it doesn't, change zero air filter with new unit then repeat warm up sequence.

    k. Once complete remove zero air filter and allow instrument to cool down in an area where air temperature is similar to areas to be sampled.

Note: If the Jerome unit is not used for more than 20 minutes, another warm-up is required to maintain maximum accuracy.

7. Power Loss / Network Failure Events

- Not applicable.

8. Control

- Results to be recorded on Monitoring Record Sheet (see Appendix 2). Any erratic or unusual readings must also be logged in accompanying notes.
- Tech officer to check Jerome results by viewing logged data. This can be done by going to Jerome Menu, scroll down to Data Tab, press enter, select View Stored Data, press enter to view stored data and time.

9. Trigger Points

- Boundary locations >20ppb or odour intensity equal to or greater than 5 to be investigated and escalated to TO/PE
- On site reading hydrogen sulphide readings greater than 2.5 ppm or step changes in concentration above process units to - investigated and escalated to TO

10. History - Common problems and their solutions

Problem(s)	Solution(s)
Erratic Jerome readings:	• Instrument not subject to temperature change – repeat sample. • If erratic readings continue – complete Jerome warm up and instrument zero.

GUIDANCE PHOTOS

Photo 1 - Jerome Zero Filter fitting

Appendix 1

Ellesmere Port odour sampling locations

The area map shows the site, the surrounding community and extent of the odour tour.

Appendix 2

Site	XXXX WwTW
Date	
Completed by	
Weather	e.g. Overcast, some rain, v calm no wind, 16°C

Notes:
Values recorded below is max value measured during sample period for given location
Increases in odour from given locations or odour with potential to impact off site (or off- site odour detected which could be attributed to site) should be investigated and cause identified if possible and reported back to PM and logged on issues board.

Odour Strength	Intensity Level	Comments
No odour/not perceptible	0	No odour when compared to the clean site
The Odour Detection Threshold (ODT) of 1 ou_E/m^3 is somewhere between 0 and 1		
Slight/very weak	1	There is probably some doubt as to whether the odour is actually present
Slight/weak	2	The odour is present but cannot be described using precise words or terms
Distinct	3	The odour character is barely recognisable
VDI 3940 says that the recognition threshold intensity is generally 3-10 times higher than the ODT (i.e. 3-10 ou_E/m^3)		
Strong	4	The odour character is easily recognisable
Very strong	5	The odour is offensive. Exposure to this level would be considered undesirable
Extremely strong	6	The odour is offensive. An instinctive reaction would be to mitigate against further exposure

Boundary locations >20ppb or odour intensity of 5 investigated and escalated to TO/PE
on site reading readings greater than 2.5 ppm or step changes in concentration above process units - investigated and escalated to TO

ID No.	Description	Time	H_2S (ppb)	VOCs ppb	Odour Intensity	Observations /Notes
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Monitoring Record Sheet

Field sniff Test
Odour Monitoring F

Appendix H: Off-site Monitoring Locations

Off-site Monitoring Locations

No.	Description	No.	Description
1	A5117 at works entrance	5	Little Stanney Lane at A5117
2	A5117 at River Gowy	6	Cheshire Oaks at Sainsbury's car park
3	Thornton-le-Moors village		
4	Little Stanney Lane at Stoak village		