Burnley WwTW Sludge Treatment Facility

Permit Reference No. EPR/HP3509MM

Odour Management Plan

October 2023

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Site Details

Site name:	Burnley WwTW Sludge Treatment Facility
Site address:	Woodend Lane, off Barden Lane, Burnley, BB12 9DS
Operator name:	United Utilities Water Limited
Application number:	EPR/HP3509MM/A001
National Grid Reference	SD 82725 35620

Document Owner

Document owner: Production Manager

Version number: 2

Revisions

Revision number	Revision authorised by	Date submitted to Environment Agency	Revision owner
Draft for EA review	Alison Barnes (Production Manager)	14.01.2022	
Second Draft for EA Review	Production Manager	18.03.2022	
Final – Revision 1	Production Manager	21.12.2022	
Final – Revision 2	Production Manager	31.10.2023	

The OMP will be reviewed annually, or in the event of complaints, incidents or relevant changes to operations/infrastructure.

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

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Digester Safety Controller
Hub Technical Officer
Field Technical Officer
Area Business Manager
Area Production Manager
H&S Business Partner

Incident Response contacts:

Environment Agency	0800 80 70 60
ICC Duty Manager	07713 887302

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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 Burnley 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 (EA).

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

Burnley Wastewater Treatment Works (WwTW) is located approximately 3 kilometres northwest of Burnley town centre. 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). The treatment of indigenous sewage sludge arising from the wastewater treatment process at Burnley comprises:

- Sludge screening (solids separation);
- Sludge thickening;
- Thermal hydrolysis;
- Anaerobic digestion;
- Sludge dewatering; and
- Storage of digestate cake.

In addition to indigenous sludge, the facility receives imported sludge from other wastewater treatment works by road tanker. The facility can treat up to 630,720m^3 of wet sludge per year (equating to approximately 630,720 wet tonnes). There is one operational digester, with a storage capacity of 2,250m^3. Biogas is combusted in an on-site combined heat and power (CHP) engine, generating electricity for the process.

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The treatment process is automated and operates 24 hours per day, 365 days per year. Indigenous sludge is fed automatically from the three primary tanks into a receiving wet well. Imported sludge is accepted by road tanker 24 hours per day with prior agreement from Bio-processing.

The WwTW is situated in an agricultural area with the River Calder flowing approximately 90m to the west and 85m to the south east. There are several isolated farms and residential properties within 1km of the installation boundary. The location of receptors is considered in more detail in Section 2.

1.3. Maintenance and Review of the OMP

The OMP is held on the Environmental Management System (EMS) electronically, which can be viewed on site.

The WwTW Production Manager (PM) is responsible for compliance and review of the OMP, with support from the wastewater operations technical team and WwTW operations staff.

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:

- The Environment Agency or Local Authority EHO conducts an investigation in response to complaints or requests an updated report;
- Regulations or guidelines are updated;
- An internal audit or post incident review dictates an update; or
- 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 2011).

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2. Receptors

2.1. Receptor List

The WwTW is situated in an agricultural area with the River Calder flowing approximately 85m to the south east of the installation boundary. There are several isolated farms and residential properties within 1km of the installation boundary. Receptors are detailed in Table 2.1.1 and shown on Figure 2.1.1. The location of the site in relation to the wider surrounding is shown in Figure 2.1.2, which shows a 2km radius.

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

Table 2.1.1. Receptor List

Receptor	Description	Closest distance from Installation boundary (m)	Direction from the site	Sensitivity to odour
R1	Residential property at Wood End Barn Farm, Woodend Road	160	NNE	High
R2	Commercial property at Wood End Barn Farm, Woodend Road	200	NNE	Medium
R3	Residential property at Wood End Barn Farm, Woodend Road	160	NNE	High
R4	Camping and Caravan Park at Smithson Farm, Woodend Road	370	ENE	High
R5	Residential properties at Smithson Farm, Woodend Road	480	ENE	High
R6	Residential property at Inghams Farm	315	SSE	High
R7	Commercial property at Inghams Farm	330	SSE	Medium
R8	Commercial property at Hollins Farm	800	SW	Medium
R9	Commercial property at Moor Isles Farm	900	NW	Medium
R10	Commercial property at Nest Farm School	610	NE	Medium
R11	Residential properties at Wood End, Reedley	770	ENE	High
R12	Residential properties between Lower Manor Lane and Lower Mead Drive, Burnley	1,000	SE	High
R13	Residential properties off A682	1,700	ENE	High
R14	Residential properties Burnley town centre	1,400	ESE	High
R15	Hotel and Spa	1,200	SSW	High

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Receptor	Description	Closest distance from Installation boundary (m)	Direction from the site	Sensitivity to odour
R16	Residential properties off Pendle Way, Burnley	1,300	S	High
R17	Residential properties off Helvelyn Way, Burnley	1,200	SW	High
R18	Cornfield Fisheries	1,800	SW	Medium
R19	Pendle Hall Farm	1,100	W	Medium
R20	Residential properties off Barrowford Road	1,900m	N	High
R21	Residential properties off Cuckstool Lane	1,600	NE	High

Figure 2.1.1 Map of site location and receptors within 1km

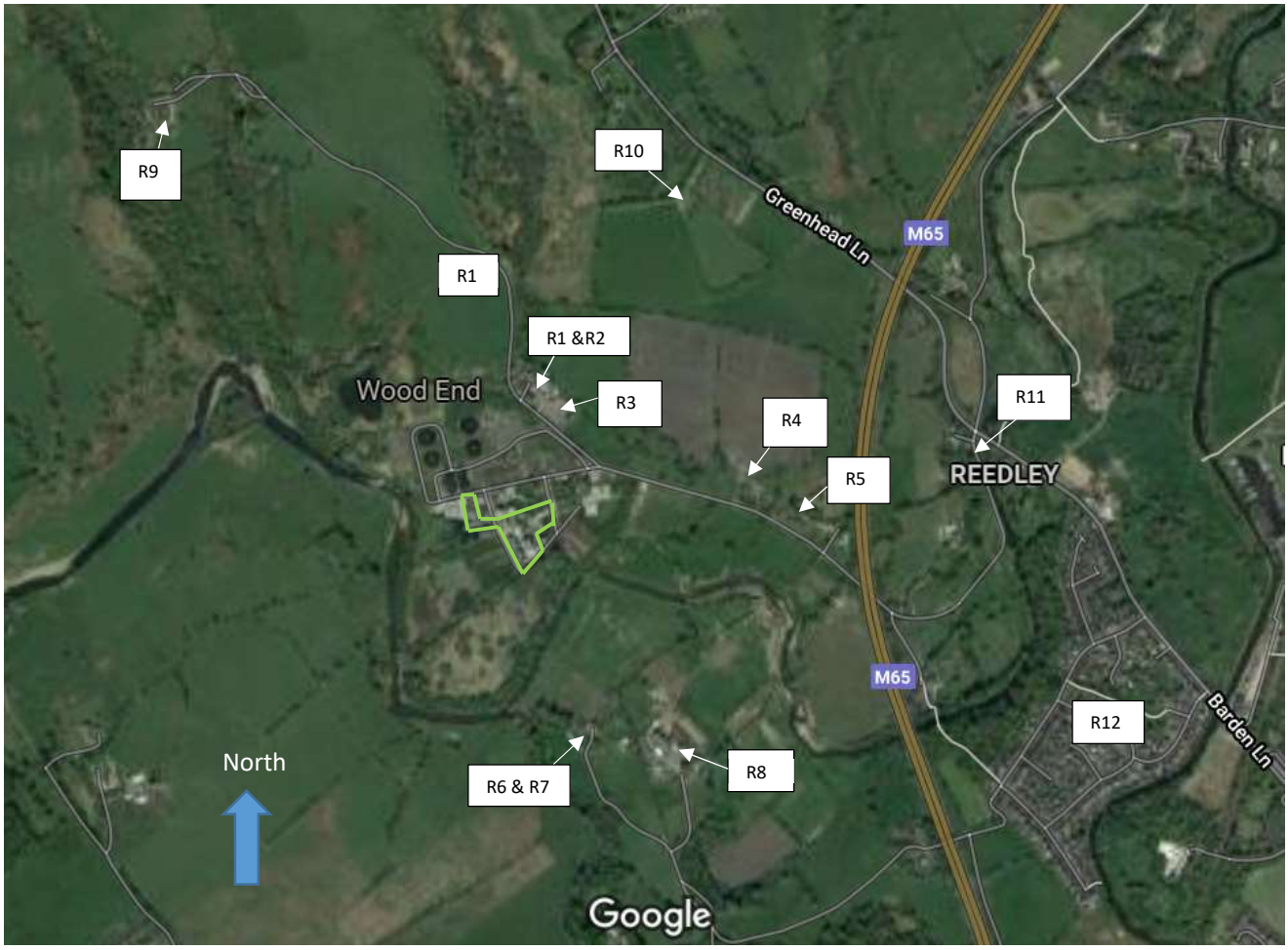

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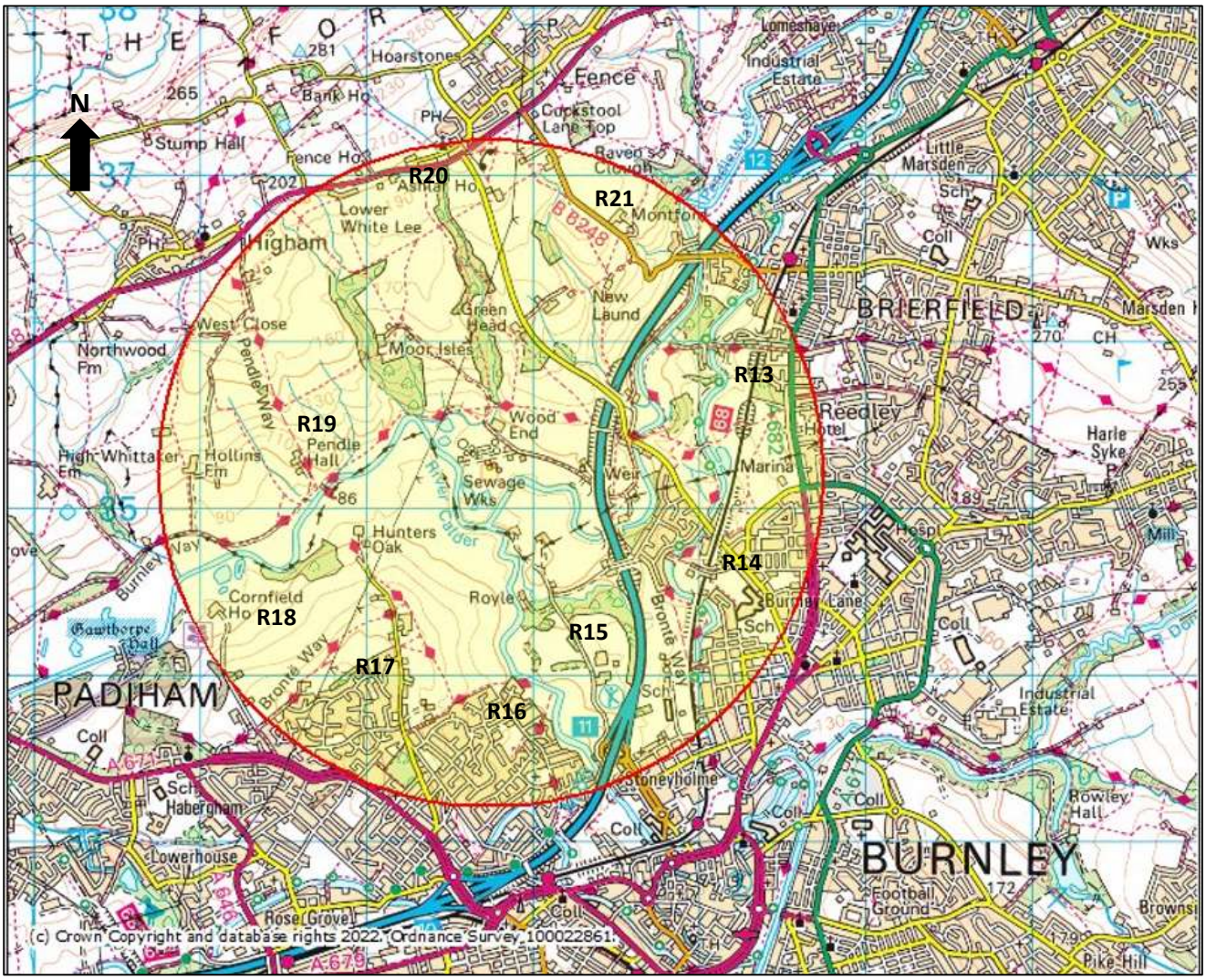
Figure 2.1.2 Map showing a 2km radius from the installation centre point



2.2. Wind Rose and Source of Weather Data

Wind rose data from 2016-2020 for the site is provided in Appendix A. The wind rose data shows that the site experiences strong prevailing west-south-westerly winds, predominantly in excess of 6 knots, meaning any odorous emissions released from site are likely to be dispersed to the east/north east of the works.

The Burnley Sludge Treatment Facility and surrounding area has a relatively flat topography with few natural barriers to wind movement. However, there is an earth bund and a line of mature trees that provide some screening along the north eastern boundary of the site, adjacent to the closest residential property.

Live data on wind speed and direction can be obtained from numerous websites, including the Windfinder website which provides information for two local weather stations at Higham to the north west and Rosehill to the south east:

- Higham: https://www.windfinder.com/#12/53.8433/-2.2464
- Rosehill: https://www.windfinder.com/#12/53.7951/-2.1633

Past data on wind speed and direction can be obtained from the following website for Manchester Airport and Bingley. Whilst some distance from the site, this data 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 in the United Kingdom (timeanddate.com)

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3. Sources of Odour and Site Processes

3.1. Odorous Materials Entering and Leaving Site

Only waste codes EWC 19 08 05 (urban wastewater sludges) and 19 02 06 (sewage sludges from physico/chemical treatment) may be accepted at the facility.

Waste accepted at the facility is limited to sewage sludges arising from UUW facilities only (indigenous and imported) where inputs are either domestic effluent or rigorously controlled trade effluent, both of which are strictly monitored either into the sewer network or at the wastewater treatment works. The process has been designed to treat sewage sludges generated from UU wastewater treatment sites in compliance with the Biosolids Assurance Scheme (BAS). A BAS risk assessment is carried out for each source of sewage sludge, indigenous sewage sludge and imported raw sludge. Under Burnley's Waste Characterisation and Acceptance Procedure SSI, each incoming waste stream is subject to pre-acceptance checks and records are retained in electronic format for a minimum of 3 years.

All movements of sludge wastes within UUW are planned and tracked using planning software (Podfather) for all sewage sludge movements and the business collaborator system for all sludge cake movements. 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.

Indigenous sludge from the WwTW is fed from three primary settlement tanks via enclosed pipework. This is a combination of raw sludge and surplus activated sludge (SAS). The feed is controlled automatically by three timer-controlled pumps. The sludge is pumped into a receiving wet well.

Sludge road tanker imports from other wastewater treatment works are off-loaded and pumped directly into the same wet well. The wet well is below ground and covered with metal plates and thus there is limited potential for diffuse emissions to atmosphere.

De-watered digestate cake is carried by an enclosed conveyor and deposited in a concrete surfaced and walled external storage bay. The cake is transferred onto trucks using an excavator and loading shovel and removed off site for agricultural land spreading. Cake storage amounts vary depending upon production and availability of the land bank for spreading. Sufficient capacity is provided to enable storage to manage these variables.

3.2. Overview of Odorous Processes and Emissions

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

The wastewater sludge received for treatment consists of sludges imported from other WwTW and indigenous sludges produced from Burnley WwTW (on-site). WwTW's sludge streams are well known and have been fully characterised over the years.

Indigenous sludge from the WwTW is fed from the three primary tanks automatically by three timer-controlled pumps. This is a combination of raw sludge and surplus activated sludge (SAS). The sludge is

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pumped into a receiving wet well. Sludge tanker imports from other wastewater treatment works are also off-loaded and pumped directly into the wet well. The wet well is below ground and covered with metal plates. The untreated sludge is then pumped to a screening plant. All transfer pipework is enclosed.

The screening plant comprises two Huber Strainpress units, operating on a duty/stand-by basis. The screening equipment is contained within enclosed units. The separated solids are deposited in skips beneath the Strainpresses. The solids skips are housed in a steel-clad enclosure fitted with a roller shutter door, which is kept shut except when the skip requires removing and replacing.

The screened sludge is then pumped via a small buffer tank into the screened sludge tank. From the screened sludge tank, the sludge passes through macerators to two centrifuges to be thickened. The centrifuges are sealed units housed in individual steel enclosures. Polyelectrolyte is automatically dosed into the centrifuges to enhance the sludge thickening process.

The thickened sludge from the centrifuges is pumped via a buffer tank into an enclosed thickened sludge silo, whilst the centrate is transferred into the thickened centrate collection tank. This tank then controls the return of centrate to the main UWWTD works flow for full treatment.

Sludge from the silo is fed into a thermal hydrolysis (TH) plant. The TH plant is housed in a dedicated building and comprises a pulper, four reactors and a flash tank. The TH process sterilises the sludge and reduces its viscosity (by breaking down gelatinous cell structures).

Leaving the flash tank, the sludge is diluted and cooled by the addition of UV treated final effluent water and use of a heat exchanger. Cooled sludge is batch fed into the digester at between 2.5 and 6.5m^3/hr. The digester is a concrete fixed roof tank with a capacity of 2,025m^3. The retention time of sludge in the digester is approximately 14 - 20 days.

Biogas generated in the digester is drawn off directly to the CHP engine for combustion. When gas production exceeds the CHP gas consumption, excess biogas is diverted to the biogas storage tank (gas holder). There are safety pressure vacuum relief valves (PVRVs) on the roof of the digester tank and the gas holder, which will operate automatically if a set pressure is exceeded.

From the digester, the digested sludge is pumped into a de-gassing tank. The purpose of the de-gassing tank is to blow compressed air into the sludge to cease the anaerobic biogas production. The de-gassing tank vents are connected to an odour control unit. The tank is protected from over pressurisation by a bursting disk.

From the de-gassing tank, the digested sludge is passed into one of two digested sludge (holding) tanks (only one tank in operation at any given time. As and when one is required for cleaning and maintenance, the alternate tank is brought back online to allow work on the other tank). Following storage in this tank, the sludge is fed through a final de-watering process. This is undertaken in a dedicated building and comprises three macerators, three dewatering centrifuges and a polyelectrolyte make up system.

Liquid separated by the centrifuge process (centrate) may be passed through a dissolved air flotation (DAF) unit for solids removal. This tank is a covered tank. Separated solids are pumped to the digested sludge tanks. Treated centrate from the DAF unit is gravity fed to a collection tank and then pumped to the

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centrate storage tank. The DAF unit can be by-passed with the centrate being pumped directly into the storage tank.

Centrate discharged from the centrifuges is discharged into a buffer tank outside the building. The liquor from both the thickening and dewatering centrifuges is returned to the inlet of the WwTW for full biological treatment.

De-watered digestate cake is carried by a conveyor and deposited in a concrete surfaced and walled storage bay. The cake is transferred onto trucks using an excavator and loading shovel and removed off site for agricultural land spreading.

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 3.3.1.

Table 3.3.1. 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	Medium to High
Sludge screening and thickening	Hydrogen Sulphide Mercaptans Dimethyl Sulphide	Rotten eggs Decayed cabbage Decayed vegetables	Medium to High
Centrate	Ammonia/amines Hydrogen Sulphide	Ammoniacal/fishy Rotten eggs	Medium to High
Digested sludge	Ammonia/amines	Ammoniacal/fishy	Low to Medium
Biogas	Hydrogen Sulphide Range of VOCs including amines	Rotten eggs Ammoniacal	Medium to High
Digested cake	Ammonia	Ammoniacal/fishy	Low
Grit – tank bottoms	Hydrogen Sulphide Mercaptans Dimethyl Sulphide	Rotten eggs Decayed cabbage Decayed vegetables	Medium to High
Polymer	Amines	Fishy	Low

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Potential source areas of odour associated with the sludge treatment process are detailed in Table 3.3.2.

Table 3.3.2 Potential Sources of Odours

Source Area	Source Material	Quantity Stored on Site	Odour Potential	Probability of Release	Additional comments
Receiving wet well	Untreated sludge	140m^3 Continuous Process	High	Low	Mostly below ground. Enclosed. Fugitive emissions
Imported sludge tanker off-load point	Untreated sludge	N/A	High	Low – short duration	Fugitive emissions
Unscreened sludge buffer tank	Untreated sludge	37m^3 Continuous Process	High	Medium	Open tank - fugitive emissions
Screenings building	Untreated sludge	N/A	High	High	Fugitive emissions
Separated solids storage	Solids screened from sludge	9m^3	High	High	Fugitive emissions
Screened sludge buffer tank	Screened sludge	10m^3 Continuous Process	High	Low	Enclosed tank. Fugitive emissions
Screened sludge tank	Screened sludge	2,500m^3 Continuous Process	High	High	Enclosed tank. Point source emissions - vent
Thickening Centrifuges	Undigested sludge	Maximum throughput 1,728m^3/day	High	Medium	Fugitive emissions
Thickened sludge buffer tank	Undigested sludge	200m^3	High	Low	Enclosed tank. Fugitive emissions
Thickened sludge storage silo	Undigested sludge	353m^3 Continuous process	High	High	Enclosed tank. Point source emissions - vent
Polyelectrolyte storage and dosing	Polyelectrolyte degradation	8,400 kg dry polymer	Medium	Low	Fugitive emissions
Thickening Centrate Collection Tank	Liquid centrate	8.2m^3	Medium	Low	Enclosed tank. Fugitive emissions
TH Plant	Undigested sludge	16m^3	High	Low	Point source emission – bursting disc (emergency only)

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Source Area	Source Material	Quantity Stored on Site	Odour Potential	Probability of Release	Additional comments
Digester PVRVs	Biogas	2,025m^3 Continuous process	Medium	Low	Point source emissions
De-gassing tank	Biogas	46m^3 Continuous process	High	High	Enclosed tank. Point source emissions - vent
Digested sludge tanks	Digested sludge	763m^3 Continuous process	Medium	Medium	Enclosed tank. Point source emissions - vent
Dewatering Centrifuges	Digested sludge	60-100m^3 per day	Medium	Medium	Fugitive emissions
DAF tank	Liquid centrate	48m^3 - Not currently operational	Medium	Medium	Enclosed tank. Fugitive Emissions
Treated centrate storage tank	Liquid centrate	2.5m^3 - Not currently operational	Medium	Medium	Enclosed tank. Point source emission - vent
Dewatering Centrate Buffer Tank	Liquid centrate	217m^3	Medium	Medium	Enclosed tank. Point source emissions - vent
Gas Holder PVRVs	Biogas	900m^3 Continuous process	Medium	Low	Point source emissions
CHP stack	Combustion of biogas	N/A	Very low	High	Point source emissions
Flare	Combustion of biogas	N/A	Very low	Medium	Point source emissions
Leaks in gas pipework e.g. around flanges	Biogas	N/A	Medium	Low	Fugitive emissions
Digestate cake storage pad	Digested sludge	Max. 1,200 m^3 typically 100 m^3	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	Medium	Low	Fugitive emissions

Control measures for these sources are detailed in Section 4.

A site plan showing the location of the odour control units and cake bay (open storage) is provided as Figure 3.3.1 below.

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Figure 3.3.1 Map of site showing the location of the odour control unit (OCU) and cake bay (open storage)

Emission Points	National Grid Reference
A4 – Odour Control Unit	SD 82740 35209
Cake Bay	SD 82801 35218

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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.

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4. Control Measures and Process Monitoring

4.1. Control Measures

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

All storage tanks, treatment tanks and associated pipework are enclosed, with the exception of the unscreened sludge buffer tank which is an open topped tank. This a small above ground tank (37m^3 capacity) with a small surface area and is not agitated and thus the potential for odour release is considered to be relatively low.

Where tanks are not gas tight and vent to atmosphere, these are connected to an odour control unit. Tanks that are connected to the gas management system only vent to atmosphere under abnormal operating conditions. Pressure vacuum relief valves (PVRVs) on the digester 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 there is a high risk of odorous fugitive emissions, such as the centrifuge discharge chutes, these areas are extracted to the odour control unit.

The only open storage of waste is the digestate cake. De-watered digestate cake is carried by an enclosed conveyor and deposited in a concrete surfaced and walled storage bay. The cake is transferred onto trucks using an excavator and loading shovel and removed off site for agricultural land spreading. Cake storage amounts vary depending upon production and availability of the land bank for spreading.

Under normal operating conditions there should be no detectable odours at the site boundaries. However, it is recognised that under abnormal event scenarios (including emergencies, maintenance, breakdowns, etc) the ability to control odorous releases may be reduced.

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 4.4).

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.

The thermal hydrolysis and anaerobic digestion process are fully automated with key process parameters including flow rates, temperature and pressure continually monitored and displayed on the plant SCADA.

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The anaerobic digestion process operates within the following process parameters:

- Average retention time - 15 days
- Minimum retention time – 12 days
- Average feed rate - 100m^3/day (2.5-6.5 m^3/hr)
- Temperature (range) - 32-38^oC
- Volatile acids - 450-750mg/l, average 600mg/l
- VFA/Alkalinity ratio – 0.3-0.5
- Alkalinity - 6,000-10,000mg/l, average 8,500-9,000mg/l
- Solids – in 10-11%, out 5.5-6.5%
- pH range - 7.8-8.3
- Gas production – 4,500-6,000 m^3/day
- Gas quality - CH_4 –60%, SO_2 – 5-30ppm, CO_2-37%

Process information on gas levels, tank levels, gas quality and temperature are continuously monitored and displayed on the SCADA system in the control room.

Routine process sampling and testing is undertaken for the FOS/TAC ratio (volatile acid to alkalinity ratio), pH and dry solids.

A daily visual tour is also undertaken of the process, including a visual check for foaming in the Digester.

The monitoring of digester key process parameters and biogas key process parameters is summarised in Table 4.2.1 below.

Table 4.2.1: Summary of Process Monitoring

Parameter	Frequency of measurement	Point of measurement	System of measurement
pH (sludge)	Weekly	Sample taken (digester feed)	Lab analysis
Alkalinity	Weekly	Sample taken (digester feed)	Lab analysis
Temperature - Digester	Continuous	Temperature probe within digester	SCADA
Volatile fatty acids concentration	Weekly	Sample taken (digester)	Lab analysis
Ammonia	Monthly	Sample taken (digester)	Lab analysis
Hydraulic loading rate	Continuous/daily throughout	Digester feed	SCADA

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Parameter	Frequency of measurement	Point of measurement	System of measurement
Organic loading rate	Monthly	Calculation from lab analysis and SCADA data	Calculation from lab analysis and SCADA data
Liquid foam levels	Continuous	Level probe	SCADA
Flow	Continuous	Flow meter	SCADA
Methane	Continuous	Gas meter	SCADA
Carbon dioxide	Continuous	Gas meter	SCADA
Oxygen	Continuous	Gas meter	SCADA
Hydrogen sulphide	Continuous	H2S analyser	SCADA
Pressure	Continuous	Pressure transducer	SCADA

The sludge digestion process is operated under a HACCP Plan which sets out operating conditions, critical control points within the process and sampling requirements. It also sets out a corrective action plan in the event of a critical control point breach. Digester feed rates are defined in the HACCP Plan and will be maintained unless process control monitoring identifies any problems indicative of a reduction in active volume. If monitoring indicates operational parameters (i.e. digested sludge composition and digester temperatures) are close to compliance limits (as per the HACCP Plan) then digester feeds will be reduced accordingly and appropriate maintenance actions will be taken.

The HACCP sets out the process to be taken in the event of a breach of a critical control point (CCP). Site specific corrective actions are set out below.

Local Action Plan Assumption 1: Failure to Meet Critical Control Point Parameter (HACCP) (Hazard analysis critical control point)

Thermal Hydrolysis Plant:

- Check that Thermal Hydrolysis Plant was operational, interrogate SCADA trends at the time of sampling.
- Check that Digestion retention time is 12 days or greater based of digester feed flow calculation.
- Stop all Sludge Cake Movements from site by informing the Recycling Controller or the Biosolids Technical Officer.
- Inform Area Production Manager, Production Manager and Production Engineer.

Local Action Plan Assumption 2: Failure to meet six Log Kill or, a Maximum Allowable Concentration (MAC) of 1,000 E. coli/gram dry solids and be free from Salmonella spp before Disposal to Land

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Sludge Disposal/Sludge Management:

- Stop all Sludge Cake Movements from site by informing the Recycling Controller or the Biosolids Technical Officer.
- Inform Area Production Manager and Production Manager.
- Sample Sludge Cake and send for analysis until it becomes compliant.
- Segregate the Cake by placing it into daily piles and send daily samples for analysis.
- Ensure Thermal Hydrolysis Plant is HACCP compliant (temperature, retention) (follow assumption 1).
- Check that Digestion retention time is 12 days or greater.

Several Site Specific Instructions (SSI) (such as Digester High Pressure WwP/I/3017/15/13, Digestion and Biogas Emergency Plan WwP/I/3017/01/16 and the Process Loss Contingency Plan WwP/I/3017/30/01) are also contained within the overall Environmental Management System for the site. If normal operating parameters are not met, then suitable actions are undertaken in accordance with the relevant SOPs.

4.3. Odour Abatement

The facility was designed with the containment and odour control of certain process units. The design of the OCU is detailed in Section 4.3.1. The odour control technologies chosen are designed to comply with Best Available Techniques (BAT) for the treatment process.

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 odour control technologies were chosen for this site. The installation of these technique complies with BAT 34
The design operating parameters and odour removal efficiencies for the OCUs at Southport are detailed in Appendix C, as are the units design performance levels, principle operating parameters and associated trigger points. 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. The dispersion model included the site layout buildings and infrastructure (as appropriate).

For the modelling exercise, emissions of odour from the on-site OCU 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 most offensive odours and the UU Odour Control and Removal Asset Standard (for high sensitivity receptors).

The results, as shown in Table 4.3.1, indicate that the maximum predicted 1-hour mean (98th percentile) odour concentration at the assessed sensitive receptors is less than 0.1 ouE/m^3, which is significantly below the 1.5 ouE/m^3 benchmark.

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Table 4.3.1: OCU Operating Parameters and Emission Rates

Emission point	Source	Stack height (m)	Effective stack diameter (m)	Efflux velocity (m/s)	Design air flow rate (m^3/s)	Odour conc. (ou_E/m^3)	Odour release rate (ou_E/s)
A4	Site OCU	15.00	0.39	13.95	1.667	1,000	1666.7

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

The odour control units operating at the facility are described in the following section.

4.3.1 Odour Control Unit

There is one odour control unit (OCU – A4) which serves the following tanks and sludge treatment assets:

- Sludge screen press enclosure;
- Screened sludge tank;
- Thickening centrifuges;
- Thickened sludge silo;
- Degassing tank;
- Digested sludge tanks;
- Dewatering building (centrifuges/conveyors);
- Dewatering centrate buffer tank;
- DAF tank (not currently operational); and
- Treated centrate tank (not currently operational).

The process flow diagram in Appendix B shows the process connections to the odour control units and the emission points.

The OCU comprises two stages of treatment; two dual bed trickling biofilters operating in parallel followed by an activated carbon adsorption. The first stage biofilters are predominately designed for ammonia, and hydrogen sulphide removal, but are expected to remove approximately 50% of incoming VOCs. Each biofilter has two different layers of media comprising of pumice stone followed by coir fibre. The filter media is wetted with final effluent to maintain biological activity. Spent effluent is discharged to the site's drainage system. The final stage of treatment (adsorption) uses copper impregnated carbon to treat residual sulphide odours as well as VOCs. A dehumidifier (heater unit) is fitted prior to the carbon to enhance the unit's performance with regard to VOC removal. Treated air discharges via a stack (emission point A4).

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The odour control unit airflow rates and contaminant design parameter are summarised in Appendix C, as are the units design performance levels, principle operating parameters and associated trigger points.

The trigger for replacement of adsorption media will be either:

- Exceedance of outlet odour concentration (ammonia - 15 mg/Nm^3); or
- Media bed pressure drop exceeding design values (nominally increases of >+20% would be investigated if combined with a reduction in of airflow >10%.

The trigger concentration of 15 mg/Nm^3 ammonia for media replacement represents 75% of the associated emission level (AEL) specified in BAT 34 (20 mg/Nm^3) for odour emissions to air from the biological treatment of waste.

Media may be sampled and sent for external lab analysis to determine the remaining media life/adsorption capacity prior to a decision on change out. The requirement for media change out will be determined by the Production Manager in consultation with the Process Engineering Department. The OCUs are designed to provide a minimum of 12 months media life.

4.4. Inspection, Maintenance and Monitoring

4.4.1 Inspection & Maintenance

Records of maintenance requirements, including prioritisation and consideration of criticality for individual assets form part of the maintenance strategy within United Utilities. All Environmental Permitted assets are flagged as a priority, as are scheduled inspection tours. All work completed is held on United Utilities' asset inventory and work planning system, MARS.

The MARS work order system schedules 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.

OCU tours are scheduled through the RCM workbank, which in turn would generate maintenance activities. Certain cyclic tasks present in the RCM workbank, such as the lubrication of fan bearings and checking drive belt condition/alignment, are scheduled but vary from installation to installation depending on the equipment installed.

The company maintains a general Standard Operating Procedure (SOP) for each odour control technology utilised at the company's sites. The objective of these SOPs is to provide the user with an understanding of the fundamental aspect of biological odour control technologies and to help them develop best practice management of the Odour Control Units installed on their works in order to prevent odour nuisance. The documents aim to provide clear and comprehensive instructions to allow operational and maintenance staff to operate, service and maintain the OCU assets as scheduled, in order to deliver effective treatment and ensure compliance with UU's statutory, regulatory and mandatory obligations.

The SOPs provide details of the inspection, maintenance and monitoring tasks required for the relevant units. A summary table of tasks and frequencies is contained at the end of each document. There is also a

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section on trouble shooting and corrective actions for abnormal operating conditions. The summary tables for biological OCU filter systems and carbon absorption filter systems are provided in Appendix D.

The SOPs are supplemented by Site-Specific Instructions (SSIs). These documents detail any site specifics which differ from the standard operating procedures, local set points and operating parameters. The Burnley odour control unit operating parameters and associated trigger points are detailed in Appendix C. The Site-Specific Instruction (SSI) for the OCU (A4) is contained in Appendix E.

4.4.2 Monitoring

The odour control unit is monitored using a telemetry system, which allows plant operations personnel to be notified by alarm of faults or readings that are out of range. The following parameters are monitored continuously:

- Influent air – hydrogen sulphide;
- Discharge stack - hydrogen sulphide;
- Biofilter 1 - outlet to drain conductivity;
- Biofilter 2 - outlet to drain pH;
- Biofilter 1 and 2 - differential pressure; and
- Carbon filter differential pressure

The escalation trigger point for hydrogen sulphide emissions is 1,500 ppb.

Site staff also carry out daily checks and inspections of the OCU. This includes but is not limited to checking:

- All monitors are within their ranges;
- The SCADA for indicated faults;
- The OCU fans for excess vibration or heating;
- The bed pressures across the carbon filter bed via the pressure/transmitter; and
- The inlet final effluent conductivity and log.

In addition, the following emissions monitoring is to be undertaken as a minimum from the OCU:

- Hydrogen sulphide once every six months; and
- Ammonia once every six months.

Total volatile organic compounds (TVOC) and HCl will be 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.

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Suitable measurement ports will be provided to allow access and monitoring of the OCU stacks.

4.4.3 Responsible Persons & Role

- Process Controller – responsible for completing the scheduled routine monitoring of the plant;
- Production Engineer/Technical Officer - responsible for the ordering of chemicals, media and consumables or 3rd party sampling;
- Field Service Engineer - responsible for completing scheduled routine and reactive maintenance tasks;
- Environmental Regulatory Advisor – responsible for reviewing compliance with the OMP; and
- Production Manager – responsible for ensuring monitoring and maintenance tasks are completed and when carbon media change out is required on the OCU.

Odour control measures are detailed in Table 4.4.1 below.

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Table 4.4.1: Odour Control Measures

Source	Nature	Odour Potential	Probability of Release	Control Measures	Residual Risk
Imported sludge tanker off-load	Untreated sludge	High	Low – short duration	• 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 follow tanker unloading procedure (Bioprocessing Waste Acceptance WwP-I-3017-05-04). • Sludge is pumped directly into a covered wet well. • Any spills are immediately cleaned up via local wash water hoses into surface water drainage for return to the WwTW.	Low
Receiving wet well	Untreated sludge	High	Low	• Wet well is below ground and covered with metal plates. • Site inspection tours are carried out daily by site-based staff and monthly by the site's ERA. Any leaks or spillages identified are investigated and actioned promptly. • Provision of masking sprays around area will be considered, if required.	Low
Unscreened sludge tank	Untreated sludge	High	Medium	• Tank is open tank with no roof but holds a small volume (37m^3). • Sludge is continuously fed and thus low potential for anoxic conditions.	Medium

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Source	Nature	Odour Potential	Probability of Release	Control Measures	Residual Risk
				• Site inspection tours are carried out daily by site-based staff and monthly by the site's ERA. Any leaks or spillages identified are investigated and actioned promptly.	
Screenings building and separated solids storage	Untreated sludge	High	High	• Building air is extracted through an OCU comprising a biofilter and an activated carbon adsorption unit (Emission Point A4). • Duty/Standby fan being out of service on the OCU would be considered a Tier 1 event with associated response (see Section 5.2). • Loss of both OCU fans for a period >4 hrs would be considered a Tier 2 event with associated response (see Section 5.2). • Routine operation checks and maintenance to ensure the tank and OCU is functioning as per design. • Six-monthly monitoring of the OCU emissions for H_2S and ammonia for BAT compliance. H_2S emissions are also continuously monitored on the discharge stack. • Trigger level for potential media change is >15mg/Nm^3 ammonia. • Total volatile organic compounds (TVOC) and HCl to be monitored on one occasion to check for their presence. 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	Low

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Source	Nature	Odour Potential	Probability of Release	Control Measures	Residual Risk
				concentration is being achieved. Measurements will be taken at the OCU inlet and outlet. • Separated solids stored in skips within a steel-clad enclosure fitted with a roller shutter door. Door is kept closed (apart from access) to prevent fugitive emissions escaping.	
Screened sludge buffer tank	Screened sludge	High	Low	• Tank holds a small volume (10m^3) and is enclosed. • Sludge is continuously fed and thus low potential for anoxic conditions. • Site inspection tours are carried out daily by site-based staff and monthly by the site's ERA. Any leaks or spillages identified are investigated and actioned promptly.	Medium
Screened sludge tank	Screened sludge	High	High	• Tank is enclosed. Hatches are kept shut except for inspections or maintenance. • Tank connected to the OCU comprising a dual bed trickling biofilter and an activated carbon adsorber polishing unit (Emission Point A4). • Duty/Standby Fan being out of service on the OCU would be considered a Tier 1 event with associated response (see Section 5.2). • Loss of both OCU fans for a period >4 hrs would be considered a Tier 2 event with associated response (see Section 5.2).	Low

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Source	Nature	Odour Potential	Probability of Release	Control Measures	Residual Risk
				• Six-monthly monitoring of the OCU emissions for H_2S and ammonia for BAT compliance. H_2S emissions are also continuously monitored on the discharge stack. • Trigger level for potential media change is >15mg/Nm^3 ammonia. • Total volatile organic compounds (TVOC) and HCl to be monitored on one occasion to check for their presence. 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. • Routine operation checks and maintenance to ensure the tank and OCU is functioning as per design. • Raw sludge storage times are minimised to avoid septicity and odour. • Site inspection tours are carried out daily by site-based staff and monthly by the site's ERA. Any leaks or spillages identified are investigated and actioned promptly. • Sludge feed is measured using flowmeters.	
Thickening centrifuges	Digested sludge	High	Medium	• Centrifuges units are housed in individual steel enclosures which are extracted to the odour control unit (emission Point A4).	Low

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Source	Nature	Odour Potential	Probability of Release	Control Measures	Residual Risk
				• Duty/Standby Fan being out of service on the OCU would be considered a Tier 1 event with associated response (see Section 5.2). • Loss of both OCU fans for a period >4 hrs would be considered a Tier 2 event with associated response (see Section 5.2). • Six-monthly monitoring of the OCU emissions for H_2S and ammonia for BAT compliance. H_2S emissions are also continuously monitored on the discharge stack. • Trigger level for potential media change is >15mg/Nm^3 ammonia. • Site inspection tours are carried out daily by site-based staff and monthly by the site's ERA. Any leaks or spillages identified are investigated and actioned promptly. • Doors are kept closed to prevent fugitive emissions escaping.	
Thickening centrifuge discharge chutes	Digested sludge	High	Medium	• The discharge chutes are enclosed and connected to the odour control unit (emission Point A4). • Duty/Standby Fan being out of service on the OCU would be considered a Tier 1 event with associated response (see Section 5.2). • Loss of both OCU fans for a period >4 hrs would be considered a Tier 2 event with associated response (see Section 5.2).	Low

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Source	Nature	Odour Potential	Probability of Release	Control Measures	Residual Risk
				• Six-monthly monitoring of the OCU emissions for H_2S and ammonia for BAT compliance. H_2S emissions are also continuously monitored on the discharge stack. • Trigger level for potential media change is >15mg/Nm^3 ammonia. • Site inspection tours are carried out daily by site-based staff and monthly by the site's ERA. Any leaks or spillages identified are investigated and actioned promptly. • Inspection and preventative maintenance tasks for the centrifuges are set out in the MARS work order schedules.	
Polyelectrolyte storage and addition	Polyelectrolyte degradation	Medium	Low	• Dry polymer for centrifuge stored in a building in sealed plastic bags. • Polymer make up tanks are enclosed and contained within the 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. • Site inspection tours are carried out daily by site-based staff and monthly by the site's ERA. Any leaks or spillages identified are investigated and actioned promptly.	Low
Thickened sludge buffer tank	Undigested sludge	High	Low	• The tank is enclosed. • Sludge is continuously fed and thus low potential for anoxic conditions.	Medium

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Source	Nature	Odour Potential	Probability of Release	Control Measures	Residual Risk
				• Site inspection tours are carried out daily by site-based staff and monthly by the site's ERA. Any leaks or spillages identified are investigated and actioned promptly.	
Thickened sludge storage silo	Undigested sludge	High	High	• Tank is enclosed. Hatches are kept shut except for inspections or maintenance. • Tank connected to the OCU comprising a dual bed trickling biofilter and an activated carbon adsorber polishing unit (Emission Point A4). • Duty/Standby Fan being out of service on the OCU would be considered a Tier 1 event with associated response (see Section 5.2). • Loss of both OCU fans for a period >4 hrs would be considered a Tier 2 event with associated response (see Section 5.2). • Six-monthly monitoring of the OCU emissions for H_2S and ammonia for BAT compliance. H_2S emissions are also continuously monitored on the discharge stack. • Trigger level for potential media change is >15mg/Nm^3 ammonia. • Total volatile organic compounds (TVOC) and HCl to be monitored on one occasion to check for their presence. 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	Low

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Source	Nature	Odour Potential	Probability of Release	Control Measures	Residual Risk
				concentration is being achieved. Measurements will be taken at the OCU inlet and outlet. • Site inspection tours are carried out daily by site-based staff and monthly by the site's ERA. Any leaks or spillages identified are investigated and actioned promptly. • Routine operation checks and maintenance to ensure the tank and OCU is functioning as per design.	
Thickening centrate collection tank	Liquid centrate	Medium	Low	• Tank holds a small volume (8.2m^3) and is enclosed. • Site inspection tours are carried out daily by site-based staff and monthly by the site's ERA. Any leaks or spillages identified are investigated and actioned promptly.	Low
Digester PVRVs	Biogas	Medium	Low	• Calibrated to the safe working limit of the digester. • PVRVs calibrated every 2 years by a specialist contractor to ensure safe and effective operation within design parameters. • Operation of PVRVs is minimised by monitoring pressures within the digester and controlling the feed rate accordingly. • Digester gas pressure monitored via pressure sensors in the Digester, linked to a PLC. Signals derived from the PLC are 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.	Low

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Source	Nature	Odour Potential	Probability of Release	Control Measures	Residual Risk
				• In the event of a high-pressure alarm activating, actions are taken in accordance with the Digester High Pressure SSI (WwP/I/3017/15/13).	
De-gassing tank vents	Biogas	High	High	• Tank connected to the OCU comprising two dual bed trickling biofilters and a single bed activated carbon polishing unit (Emission Point A4). • Duty/Standby Fan being out of service on the OCU would be considered a Tier 1 event with associated response (see Section 5.2). • Loss of both OCU fans for a period >4 hrs would be considered a Tier 2 event with associated response (see Section 5.2). • Six-monthly monitoring of the OCU emissions for H_2S and ammonia for BAT compliance. H_2S emissions are also continuously monitored on the discharge stack. • Trigger level for potential media change is >15mg/Nm^3 ammonia. • OCU monitored using a telemetry system, allowing plant operations personnel to be notified by alarm of faults or readings that are out of range. Discharge stack monitored continuously for hydrogen sulphide. • Odour stripped from sludge within the de-gassing tank minimises odour release from downstream sludge storage tanks. • Provision of duty/standby equipment for critical kit such as pumps, air mixing system.	Low

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Source	Nature	Odour Potential	Probability of Release	Control Measures	Residual Risk
Digested sludge tanks	Digested sludge	Medium	Medium	• Tanks are enclosed. Hatches are kept shut except for inspections or maintenance. • Tanks are connected to the OCU comprising a dual bed trickling biofilter and an activated carbon adsorber polishing unit (Emission Point A4). • Duty/Standby Fan being out of service on the OCU would be considered a Tier 1 event with associated response (see Section 5.2). • Loss of both OCU fans for a period >4 hrs would be considered a Tier 2 event with associated response (see Section 5.2). • Six-monthly monitoring of the OCU emissions for H_2S and ammonia for BAT compliance. H_2S emissions are also continuously monitored on the discharge stack. • Trigger level for potential media change is >15mg/Nm^3 ammonia. • Total volatile organic compounds (TVOC) and HCl to be monitored on one occasion to check for their presence. 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. • Site inspection tours are carried out daily by site-based staff and monthly by the site's ERA. Any leaks	Low

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Source	Nature	Odour Potential	Probability of Release	Control Measures	Residual Risk
				or spillages identified are investigated and actioned promptly. • Routine operation checks and maintenance to ensure the tanks and OCU is functioning as per design.	
Dewatering centrifuges	Digested sludge	Medium	Medium	• The dewatering centrifuges are enclosed units housed within a building. The building is extracted to the OCU (Emission Point A4). • Duty/Standby Fan being out of service on the OCU would be considered a Tier 1 event with associated response (see Section 5.2). • Loss of both OCU fans for a period >4 hrs would be considered a Tier 2 event with associated response (see Section 5.2). • Screw conveyors used for cake transfer are enclosed and connected to connected to the OCU. • Six-monthly monitoring of the OCU emissions for H_2S and ammonia for BAT compliance. H_2S emissions are also continuously monitored on the OCU discharge stack. • Trigger level for potential media change is >15mg/Nm^3 ammonia. • Site inspection tours are carried out daily by site-based staff and monthly by the site's ERA. Any leaks or spillages identified are investigated and actioned promptly.	Low

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Source	Nature	Odour Potential	Probability of Release	Control Measures	Residual Risk
				• Inspection and preventative maintenance tasks for the conveyor are set out in the MARS work order schedules.	
DAF tank	Liquid centrate from digested sludge	Medium	Medium	• Tank not currently in use. Tank enclosed and connected to the OCU (Emission Point A4).	Low
Treated centrate storage tank	Pre-treated liquid centrate from digested sludge	Medium	Medium	• Tank not currently in use. Tank enclosed and connected to the OCU (Emission Point A4).	Low
Dewatering centrate buffer tank	Liquid centrate (pre-treated and untreated)	Medium	Medium	• Tank is enclosed. Hatches are kept shut except for inspections or maintenance. • Tank connected to the OCU comprising a dual bed trickling biofilter and an activated carbon adsorber polishing unit (Emission Point A4). • Duty/Standby Fan being out of service on the OCU would be considered a Tier 1 event with associated response (see Section 5.2). • Loss of both OCU fans for a period >4 hrs would be considered a Tier 2 event with associated response (see Section 5.2). • Six-monthly monitoring of the OCU emissions for H_2S and ammonia for BAT compliance. H_2S emissions are also continuously monitored on the discharge stack. • Trigger level for potential media change is >15mg/Nm^3 ammonia.	Low

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Source	Nature	Odour Potential	Probability of Release	Control Measures	Residual Risk
				• Total volatile organic compounds (TVOC) and HCl to be monitored on one occasion to check for their presence. 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. • Site inspection tours are carried out daily by site-based staff and monthly by the site's ERA. Any leaks or spillages identified are investigated and actioned promptly. • Routine operation checks and maintenance to ensure the tank and OCU is functioning as per design.	
Gas Holder PVRVs	Biogas	Medium	Low	• Valves sized on design specification to accommodate normal pressure variations and minimise/prevent non-essential releases. • PVRV calibrated to the safe working limit of the gas holder. • PVRVs set points 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.	Low

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Source	Nature	Odour Potential	Probability of Release	Control Measures	Residual Risk
				• Operation of PVRVs is minimised by monitoring pressures within the gas holder and controlling the digester feed accordingly. • Gas pressure monitored via pressure sensors in the holder, linked to a PLC. Signals derived from the PLC are 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.	
CHP stack	Combustion of biogas	Very low	High	• On combustion, hydrogen sulphide will predominantly be converted into oxides of sulphur (primarily SO_2) thus hydrogen sulphide not expected to be present in the stack emissions. • CHP maintained in accordance with the manufacturer's maintenance schedule for the engine. Additional maintenance scheduled based on UUW's experience of running such plant.	Low
Flare	Combustion of biogas	Very low	Medium	• 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	Medium	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.	Low

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Source	Nature	Odour Potential	Probability of Release	Control Measures	Residual Risk
				• 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.	
Open digestate cake storage pad	Digested sludge	Low	High	• Cake bay is bounded by concrete walls approximately 3.5m in height that provide some protection from wind dispersion. • Site inspection tours are carried out daily by site-based staff and monthly by the site's ERA. Any leaks or spillages identified are investigated and actioned promptly. • Sensor on the cake conveyor ensures height of the cake pile does not exceed the height of the walls.	Low
Tank cleaning	Grit	High	High	• Opportunities to minimise odour emissions and any potential nuisance are identified when planning maintenance tasks, this may include the timing of routine maintenance tasks. • Provision of masking sprays around area will be considered if required.	Medium
Leaks/spills of sludge from process	Digested or Undigested Sludge	Medium	Low	• Spillages are a risk during maintenance of assets. Possible sources of spillage should be considered during planning of the maintenance task and avoided through design where possible.	Low

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Source	Nature	Odour Potential	Probability of Release	Control Measures	Residual Risk
				• 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 ERA. Any leaks or spillages identified are investigated and actioned promptly.	

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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 in all cases within 2 hours (24 hours at weekends).

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

Table 5.1.1. 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 F 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 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 5.2).

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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 by an employee at the locations shown in Appendix G. 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 prevailing wind direction and 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 whether 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)

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, cabbage, 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.

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

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- Is the process under control?
- 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 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 to the complainant within ten working days, in line with the company's Customer complaints procedure that requires responses to customers within agreed timeframes set by OFWAT.

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 F.

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 G.

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

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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.

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

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- Environmental Regulatory Advisor

The communication will contain the following information:

- What has occurred or is planned;
- The expected duration;
- The expected impact; and
- 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 impacted area);
- Area Production Manager (within impacted area);
- Area Business Manager (within impacted area);
- Asset Manager (within impacted area);
- Customer Focal Lead (Production Manager within impacted area);
- 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; and
- The local Councilor and/or MP (within impacted area).

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:

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- 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 5.2.1.

Table 5.2.1: 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 within a 24 hour period. 10 telephone odour complaints/contacts received within 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:

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	Tier 1 On site risk - no external communications	Tier 2 Neighbourhood risk – external communications
		• 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 initial investigation findings should be reported back to the complainant in a shorter timescale than 10 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 and instructed to do so by 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

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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 and monthly by the site ERA. If any abnormal operating conditions or odours are identified during the tour, these are reported to the Production Manager who would raise a Tier 1 or 2 escalation as appropriate (see Table 5.2.1). 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 biogas 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 program 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 every six months. 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.

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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 6.1.1 summarises abnormal event scenarios which may lead to odorous emissions.

Table 6.1.1: 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.

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Abnormal Event	Control Measures	Recovery Steps
Loss of sludge from Digester PVRV or overflow due to foaming	Daily visual monitoring of foam level in digester through sight glass as part of the EO+M Tour Pressure and operating levels monitored via telemetry Routine process monitoring of digester health Dosing with anti-foam if required	Monitor pressure until foaming subsides 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 digester leading to potential odorous emissions	Regular calibration of pressure monitors. Pressure monitors display locally on 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
Normal route for cake off-take is not available leading to excess storage on cake pad	Contingency arrangements for alternative off-take	Cake to be removed off site to a suitably licensed waste disposal facility Cake to be reduced to normal storage levels within 48 hours
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	Conduct checks set out in relevant SOP for OCU equipment, for example:

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Abnormal Event	Control Measures	Recovery Steps
	Monitoring and maintenance in accordance with relevant SOP for OCU equipment and Site-Specific Instruction (SSIs)	Check when media was last changed Check load against design Check airflow rate in ductwork against design Check and adjust set points
Processing equipment damaged or malfunctioning	All EP assets are flagged as a priority and scheduled on inspection tours. All work completed is held on the asset inventory and work planning system, MARS The MARS work order system schedules the frequency of inspection tours and the preventative maintenance tasks carried out as part of these tours	Check loading against design 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
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-3017-01-16) 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	Follow the Process Loss Contingency Plan

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Abnormal Event	Control Measures	Recovery Steps
	Ensure sufficient fuel stocks and manpower to facilitate operation of the generators Process Loss Contingency Plan in place (Ref. WwP-I-3017-30-01)	Establish estimated time for return of electrical supply Integrated Control Centre to be contacted to update them on the 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	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.

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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.

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Appendix A: Wind Rose Data

Numerical Weather Prediction (NWP) data was sourced from ADM Ltd. for the location of the site (NGR E 382723 N 435292) as it is considered the most representative meteorological data for the site. NWP data was used as it is a site-specific location. The closest alternative meteorological stations to the site were Manchester airport (approximately 52 km from the site), which is not representative due to the distance from the site, and Bingley, which is also not representative due to distance (approximately 29 km from the site) and an elevation difference.

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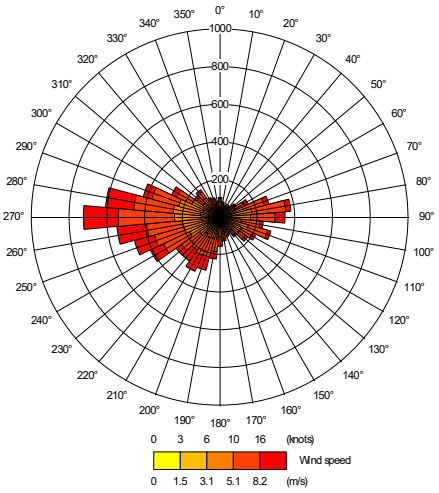
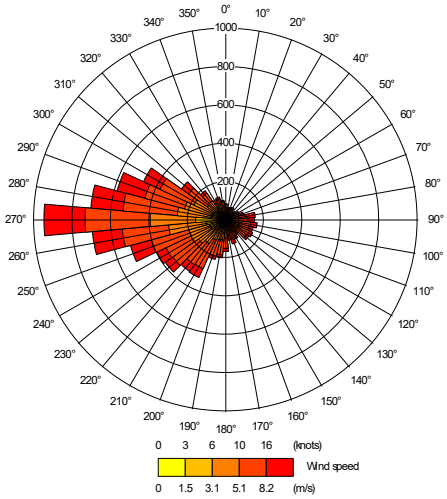
<tr><td> 
</td><td> 
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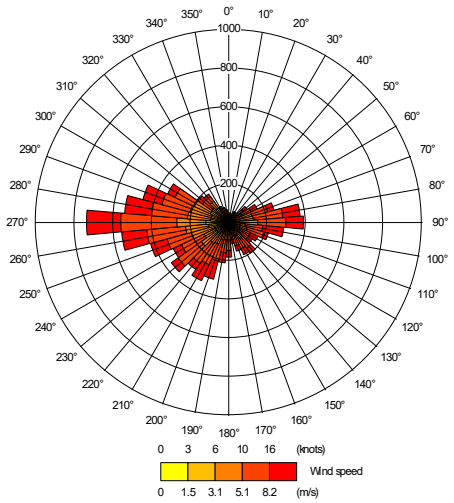
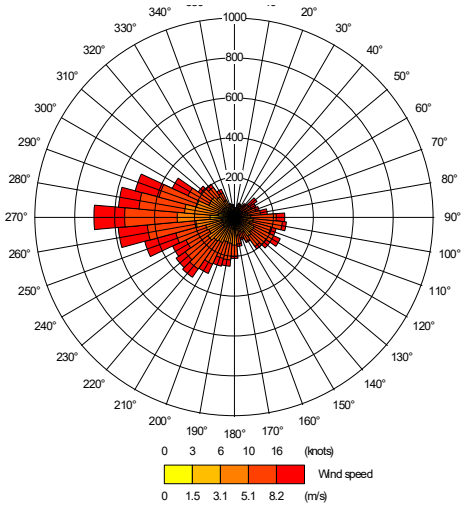
<tr><td> 
</td><td> 
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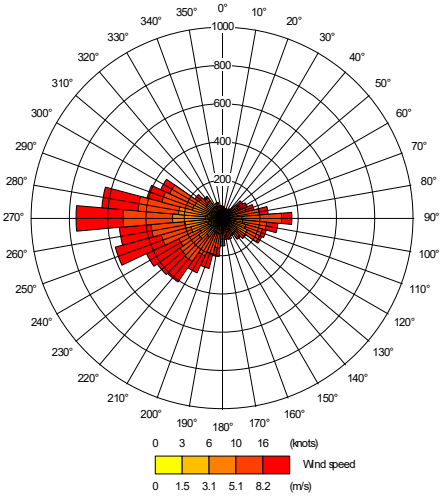

NWP data, 2020

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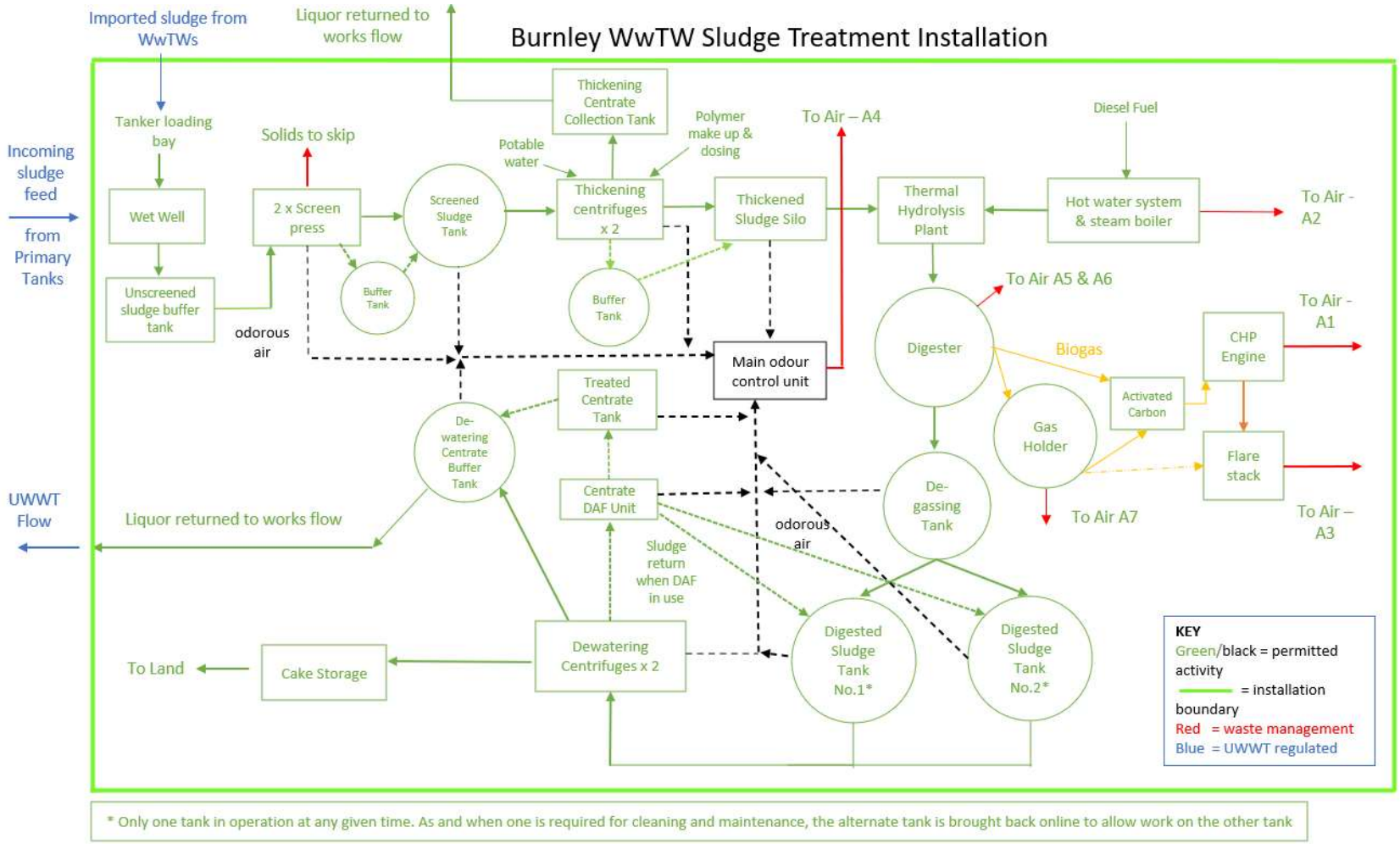
Appendix B: Process Flow Diagram

Burnley WwTW Sludge Treatment Facility
EPR/HP3509MM
Odour Management Plan



* Only one tank in operation at any given time. As and when one is required for cleaning and maintenance, the alternate tank is brought back online to allow work on the other tank

Appendix C: Design Operating Parameters for Odour Control Units

OCU - Emission Point A4			
Parameter	Units		
Airflow OCU	m^3/hr	6,000	
Temp	°C	Average 15°C Max 30°C	
Contaminants	Ammonia	6/12	Ave/Max
	H_2S	50/150	Ave/Max
	RSH	7.5/20	Ave/Max
	DMS	0.5/1	Ave/Max
	Misc VOCs	15/35	Ave/Max
Parameter	Units		
Outlet odour biological	OU_e/m^3	>95% Removal	
Hydrogen Sulphide	% Rem	>98	
Mercaptans	% Rem	50% max	
DMS	% Rem	50% max	
VOCs	% Rem	50% max	
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% Diff pressure should be investigated	
pH	pH	Design is pH 2-3. Identifying a significant change is important <2.0 irrigation rate /load check /adjustment	
Irrigation flow minimum flow 1,700 l/hr	l/hr	5,132 same for both beds Pumice - constant flow Coir 30-60sec /15mins	
-		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		

OCU - Emission Point A4		
		227 Pumice layer/ 97 Coir Low trigger 150 High Trigger 450. Carbon Bed 940 Pa 550Pa low trigger 1100 Pa high trigger

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Appendix D: General Inspection and Maintenance Activities for 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

BIOLOGICAL ODOUR CONTROL FILTER SYSTEMS – INSPECTION & MAINTENANCE ACTIVITIES											
Sub Task	Activity	Ops/Main	Shift	Daily	Week	Month	Quarter	6 Month	Annual	Greater	Comment
											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 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.

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BIOLOGICAL ODOUR CONTROL FILTER SYSTEMS – INSPECTION & MAINTENANCE ACTIVITIES											
Sub Task	Activity	Ops/Main	Shift	Daily	Week	Month	Quarter	6 Month	Annual	Greater	Comment
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.
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

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BIOLOGICAL ODOUR CONTROL FILTER SYSTEMS – INSPECTION & MAINTENANCE ACTIVITIES											
Sub Task	Activity	Ops/Main	Shift	Daily	Week	Month	Quarter	6 Month	Annual	Greater	Comment
											Check for vibration/noise. Check integrity of any flexible connector between ductwork and fans.

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BIOLOGICAL ODOUR CONTROL FILTER SYSTEMS - TROUBLE DIAGNOSTIC TABLE					
OBSERVATION	PROBABLE CAUSE	NECESSARY CHECK	CORRECTIVE ACTION	ROLE RESPONSIBLE FOR ACTION	INDICATIVE TIMESCALE FOR COMPLETION
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	• Process Controller to complete checks- should be resolved during check	• PC will attempt to resolve issue in first instance as part of routine check. If unable to resolve will raise job for FSE or engineering support
	Inlet hydrogen sulphide concentration exceeds design range	Check inlet hydrogen sulphide concentration	• Complete site investigation to reduce sulphide loading onto OCU	• Process Controller to complete checks on site check – escalate to ADT if source of high load cannot be identified	• Could be resolved immediately depending on root cause • Up to 7 days if airflow rebalancing required • Potential for >7-14days if process issue is root cause
	Bypassing of gas around stages	Check position of dampers	• Close any bypass damper found to open	• Process Controller to complete checks should be resolved during check	• PC will attempt to resolve issue in first instance as part of routine check. If unable to resolve will raise job for FSE or engineering support
	Gas loading rate too high through scrubber	Check gas flow rate	• Adjust volume control damper local to OCU • Reduce fan speed(VSD)	• Process Controller to complete checks should be resolved during check	• PC will attempt to resolve issue in first instance as part of routine check. If unable to resolve will raise job for FSE or engineering support
	Recirculating liquor conductivity too high	Check conductivity in recirculating liquor effluent/drain	• Increase blowdown rate	• Process Controller to complete checks should be resolved during check	• 24hrs

Burnley WwTW Sludge Treatment Facility
EPR/HP3509MM
Odour Management Plan

BIOLOGICAL ODOUR CONTROL FILTER SYSTEMS - TROUBLE DIAGNOSTIC TABLE					
OBSERVATION	PROBABLE CAUSE	NECESSARY CHECK	CORRECTIVE ACTION	ROLE RESPONSIBLE FOR ACTION	INDICATIVE TIMESCALE FOR COMPLETION
	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	• 3rd party/Engineering Only identified through engineering support	• 2-4weeks upon identifying Nutrient deficiency
High outlet odour concentration (not H_2S)	pH too low	Check pH in OCU effluent/drain	• Increase/decrease blowdown or irrigation rate	• Process Controller to complete checks should be resolved during check	• 24hrs
	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	• Process Controller to complete initial check on site check – escalate to ADT and Trade Effluent to investigate root cause possible	• Could be resolved immediately depending on root cause- could be one off trade issue • Potential for >7-14days if process issue is root cause
	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	• Process Controller to complete checks on site check – escalate to ADT if source of VOC load cannot be identified	• Could be resolved immediately depending on root cause • Up to 7 days if airflow rebalancing required • Potential for 7-28 days if process issue is root cause time form OCU to adapt to VOC/adjusted irrigation rate. • If VOC load not treatable due to OCU limitations may require additional treatment min 4 weeks

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Odour Management Plan

BIOLOGICAL ODOUR CONTROL FILTER SYSTEMS - TROUBLE DIAGNOSTIC TABLE					
OBSERVATION	PROBABLE CAUSE	NECESSARY CHECK	CORRECTIVE ACTION	ROLE RESPONSIBLE FOR ACTION	INDICATIVE TIMESCALE FOR COMPLETION
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	• Process Controller to complete checks	• Could be resolved immediately depending on root cause • Replacements belts/Fan motor/flexi replacement within 5-7 days
	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	• Process Controller to complete checks • Process Controller to raise work order for FSE to assess repair	• PC will attempt to resolve issue in first instance as part of routine check. If unable to resolve will raise job for FSE or engineering support • Equipment repair/rectification dependent upon nature of repair and supply chain logistics
	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	• Process Controller to complete checks • Process Controller to raise work order for FSE to assess repair	• PC will attempt to resolve issue in first instance as part of routine check. If unable to resolve will raise job for FSE or engineering support • Fan motor replacement within 5-7 days

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BIOLOGICAL ODOUR CONTROL FILTER SYSTEMS - TROUBLE DIAGNOSTIC TABLE					
OBSERVATION	PROBABLE CAUSE	NECESSARY CHECK	CORRECTIVE ACTION	ROLE RESPONSIBLE FOR ACTION	INDICATIVE TIMESCALE FOR COMPLETION
	Leakage-	Check for leaks in ductwork	• Repair ductwork	• Process Controller to complete checks • Process Controller to raise work order for FSE to assess repair	• Equipment repair/rectification dependent upon nature of repair and supply chain logistics

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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.

ACTIVATED/DRY MEDIA ODODUR CONTROL UNITS – INSPECTION & MAINTENANCE ACTIVITIES											
Sub task	Activity	Ops/Main	Shift	Daily[$]	Week	Month	Quarter	6 Month	Annual	Greater	Comment
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.
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.

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ACTIVATED/DRY MEDIA ODOUR CONTROL UNITS - TROUBLE DIAGNOSTIC TABLE					
OBSERVATION	PROBABLE CAUSE	NECESSARY CHECK	CORRECTIVE ACTION	ROLE RESPONSIBLE FOR ACTION	INDICATIVE TIMESCALE FOR COMPLETION
High NH_3 value at OCU outlet (>15 mg/Nm^3)	Media depleted	• Check when media was last changed • Check load against design • Consider testing media to determine the remaining media life/adsorption capacity	• Replace media where required • Change type/blend of media	• Process Controller to complete checks • Technical officer/Production Engineers to arrangement media replacement	• 7 -14 days for media replacement subject to supply chain
High H_2S value at OCU outlet	Media depleted	• Check when media was last changed • Check load against design • Check odour type i.e. H_2S Vs VOC against carbon type • Consider testing media to determine the remaining media life/adsorption capacity	• Replace media where required • Change type/blend of media	• Process Controller to complete checks • Technical officer/Production Engineers to arrangement media replacement	• 7 -14 days for media replacement subject to supply chain
	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	• If airflow rate exceeds design close dampers to achieve design air flow • Close damper(s) • Place fan into Auto	• Process Controller to complete checks	• PC will attempt to resolve issue in first instance as part of routine check. If unable to resolve will raise job for FSE or engineering support

Burnley WwTW Sludge Treatment Facility
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ACTIVATED/DRY MEDIA ODOUR CONTROL UNITS - TROUBLE DIAGNOSTIC TABLE					
OBSERVATION	PROBABLE CAUSE	NECESSARY CHECK	CORRECTIVE ACTION	ROLE RESPONSIBLE FOR ACTION	INDICATIVE TIMESCALE FOR COMPLETION
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	• Process Controller to complete checks • Process Controller to raise work order for FSE to assess repair • Technical officer/Production Engineers to arrangement media replacement	• PC will attempt to resolve issue in first instance as part of routine check. If unable to resolve will raise job for FSE or engineering support • 7 -14 days for media replacement subject to supply chain • Equipment repair/ rectification dependent upon nature • of repair and supply chain logistics
	Media depleted	• Check when media was last changed • Check load against design • Check odour type against carbon type • Consider testing media to determine the remaining media life/adsorption capacity	• Replace media where required • Change type/blend of media	• Process Controller to complete checks • Technical officer/Production Engineers to arrangement media replacement	• 7 -14 days for media replacement subject to supply chain
	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	• Process Controller to complete checks	• PC will attempt to resolve issue in first instance as part of routine check. If unable to resolve will raise job for FSE or engineering support

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Odour Management Plan

ACTIVATED/DRY MEDIA ODOUR CONTROL UNITS - TROUBLE DIAGNOSTIC TABLE					
OBSERVATION	PROBABLE CAUSE	NECESSARY CHECK	CORRECTIVE ACTION	ROLE RESPONSIBLE FOR ACTION	INDICATIVE TIMESCALE FOR COMPLETION
Insufficient airflow through the OCU	Fans out of service	• Check the fans operation	• Check fans are in working order. • Start-up fan	• Process Controller to complete checks • Process Controller to raise work order for FSE to assess repair	• PC will attempt to resolve issue in first instance as part of routine check. If unable to resolve will raise job for FSE or engineering support • Failure of both duty and stand by fan will result in same day response from FSE (subject to higher priority alarms needing to be resolved). • Fan motor replacement within 5-7 days
	Bed collapse	• Check pressure drop across all beds. • Perform visual inspection.	• Place unit out of service. • Contact OCU supplier	• Process Controller to complete checks • Process Controller to raise work order for FSE to assess repair	• Equipment repair/rectification dependent upon nature of repair and supply chain logistics
	Duct broken/cracked	• Visual inspection.	• Organise repair.	• Process Controller to complete checks • Process Controller to raise work order for FSE to assess repair	• Equipment repair/rectification dependent upon nature of repair and supply chain logistics

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ACTIVATED/DRY MEDIA ODOUR CONTROL UNITS - TROUBLE DIAGNOSTIC TABLE					
OBSERVATION	PROBABLE CAUSE	NECESSARY CHECK	CORRECTIVE ACTION	ROLE RESPONSIBLE FOR ACTION	INDICATIVE TIMESCALE FOR COMPLETION
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	• Process Controller to complete checks • Process Controller to raise work order for FSE to assess repair	• PC will attempt to resolve issue in first instance as part of routine check. If unable to resolve will raise job for FSE or engineering support • Equipment repair/rectification dependent upon nature of repair and supply chain logistics
	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	• Process Controller to complete checks • Process Controller to raise work order for FSE to assess repair	• PC will attempt to resolve issue in first instance as part of routine check. If unable to resolve will raise job for FSE or engineering support • Fan motor replacement within 5-7 days
	Leakage	• Check for leaks in ductwork	• Repair ductwork	• Process Controller to complete checks • Process Controller to raise work order for FSE to assess repair	• Equipment repair/rectification dependent upon nature of repair and supply chain logistics
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	• Process Controller to complete checks • Process Controller to raise work order for FSE to assess repair	• PC will attempt to resolve issue in first instance as part of routine check. If unable to resolve will raise job for FSE or engineering support • Equipment repair/rectification dependent upon nature of repair and supply chain logistics

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Odour Management Plan

ACTIVATED/DRY MEDIA ODOUR CONTROL UNITS - TROUBLE DIAGNOSTIC TABLE					
OBSERVATION	PROBABLE CAUSE	NECESSARY CHECK	CORRECTIVE ACTION	ROLE RESPONSIBLE FOR ACTION	INDICATIVE TIMESCALE FOR COMPLETION
	Bypass damper in open position	• Check position of bypass dampers	• Close damper(s)	• Process Controller to complete checks	• PC will attempt to resolve issue in first instance as part of routine check. If unable to resolve will raise job for FSE or engineering support
	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	• Process Controller to complete checks	• PC will attempt to resolve issue in first instance as part of routine check. If unable to resolve will raise job for FSE or engineering support

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Appendix E: Site Specific Instruction for OCU (A4)

Burnley WwTW Sludge Site Specific Instruction Odour Control System Operation and Maintenance Tasks

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Table of Contents

Section 1 Introduction

1.1 Purpose of Document

A suite of documents have been developed which detail how United Utilities operates and maintains Burnley Sludge WwTW assets. The documents are held on the Quality Assurance SharePoint and are able to be accessed and referenced by all personnel.

This document defines the site specific instructions (SSIs) for operation of the Odour Control System

1.2 Assets in scope

This document covers the activities required to allow safe operation and maintenance of the Sludge Odour Control System.

The Odour Control Unit comprises:

- 2No Biofilters in duty/duty arrangement (Incl final effluent irrigation system)
- 1 No Electric Heater
- 1No Activated Carbon Filter Unit
- 2 No D/S Odour Control Fans
- 1 No Discharge Stack

1.2.1 OCU Plant

Plant ID.	Description
A5-AV2331	Biofilter 1 Coir Fibre Irrigation Control Valve
A5- AV2332	Biofilter 1 Pumice Rock Irrigation Control Valve
A5- AV2333	Biofilter 2 Coir Fibre Irrigation Control Valve
A5- AV2334	Biofilter 2 Pumice Rock Irrigation Control Valve
A5-B2502	Odour Control Valve No1
A5- B2503	Odour Control Valve No2
A5-E2505	Pre Carbon Filter electric Heater

1.2.2 OCU Instrumentation

Plant ID.	Description
A5-FS12301	Biofilter 1 Irrigation System Low Flow Switch
A5-FS12302	Biofilter 2 Irrigation System Low Flow Switch
A5-FS12501	Odour Control fan No1/No2 Low Flow Switch
A5-PDT42301	Biofilter No1 Differential Pressure Transmitter
A5-PDT42302	Biofilter No2 Differential Pressure Transmitter
A5-PDT42501	Carbon Absorber Differential Pressure Transmitter
A5-QIT52301	OCU Inlet Sulphide Monitor
A5-QIT52302	Biofilter 1 Irrigation Drain pH Monitor
A5-QIT52303	Biofilter 2 Irrigation Drain pH Monitor
A5-QIT52304	Biofilter Irrigation Inlet Conductivity Monitor
A5-QIT52501	Intermediate Sulphide Monitor

Plant ID.	Description
A5-QIT52502	Discharge Stack Sulphide Monitor
A5-TS62501	Pre-carbon Filter electric Heater Element 1 Temperature Switch
A5-TS62502	Pre-carbon Filter electric Heater Element 2 Temperature Switch
A5-TS62503	Pre-carbon Filter electric Heater Exhaust High High Temperature Switch

Bio-filters

Carbon filter

D/S Odour Control Fans

Discharge Stack

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H2S Monitor

1.3 Legislation

1.3.1 Background of Safety Systems

Info here to be provided by associated plant Range Manager if applicable (See example below)

This task is required in order to align with the recommendations within The Pressure Systems Safety Regulations 2000.

The digestion plant and the biogas storage facilities are provided with combined pressure relief valve and vacuum safety valves (PRVR) to prevent over pressurisation of the installation or implosion in the case of pressure loss, by whatever cause.

These valves must be maintained in good operational order at all times in order to provide an adequate layer of protection to maintain process safety.

1.3.2 Environmental Permitting

Info here to be provided by associated plant Range Manager if applicable (See example below)

If an unplanned release of biogas is made from the PVRVs on an EPR site **the event must be notified to the local ERA.** A decision will then be taken on whether any further action is required. This may include notification to the Environment Agency and notification as a RIDDOR

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Section 2 Process Safety

Full details of Process Safety requirements for the Odour Control System can be found in the SOP for this plant. The relevant UU processes and procedures and policies must be observed during work on this equipment together with additional points below.

Only those personnel trained in the operation of sludge plant assets are permitted to carry out this task and must have the approval of the Technical Officer

2.1 Hazards identified:

Automatic Start Up Hazard

Biological Hazard

2.2 DSEAR Considerations

Info here to be provided by associated plant Range Manager if applicable (See example below)

No smoking, mobile phones or other ignition sources are permitted when working on or near the pressure relief valves on a digestion or biogas system.

Only copper tools or other non-ferrous metal may be used when undertaking the tasks described below.

AS to agree wording with Engineering AF/ MW

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2.3 Operational Changes

Under no circumstances are any changes or additions to be made to the system operating set points without Engineering input.
The operating set points for this site are detailed in the table in section 3.0 below.

Once set no changes to these values are permitted without reference to the Principal Range Manager.

2.4 Personal Protective Equipment (PPE)

Standard PPE for working in the sludge process plant as specified by UU guidelines must be worn.

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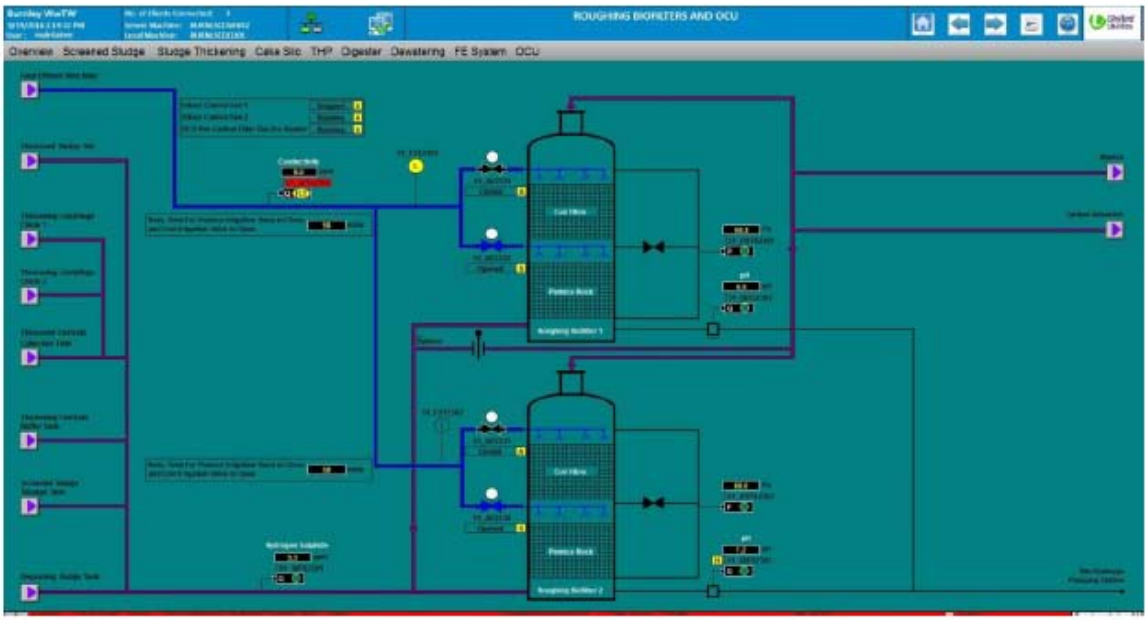
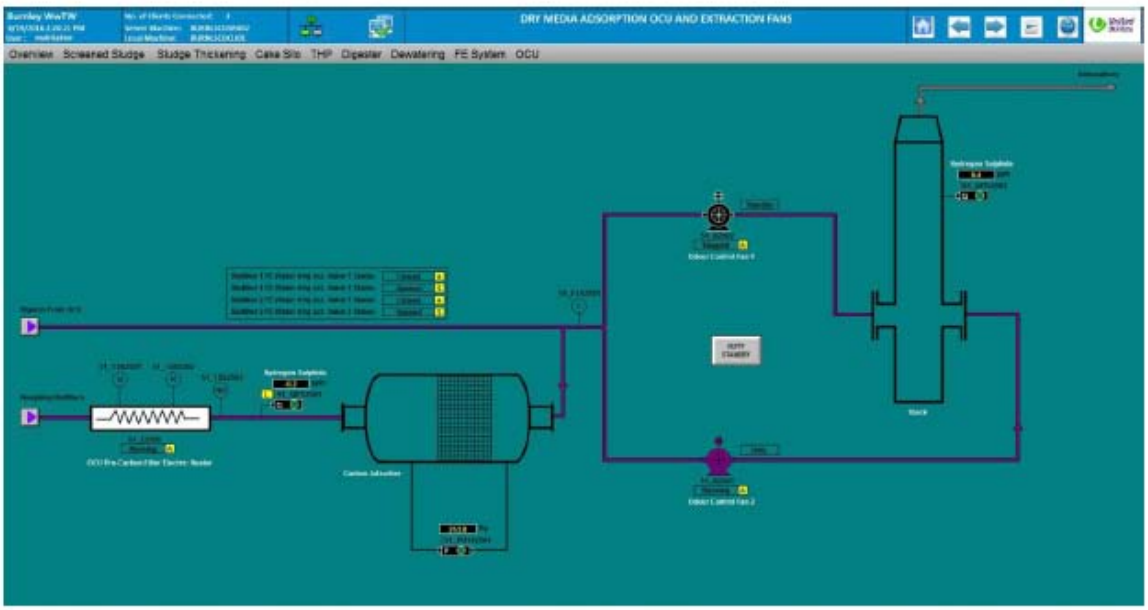
Section 3 Plant and Process Description

3.1 Description





The Odour Control Unit treats foul air from the screened sludge storage tank, the centrifuge discharge chutes, thickened sludge cake silo, digester sludge degassing tank and the thickening centrate collection tank.

The OCU has 2 stages of treatment. 2No dual bed trickling Biofilters and a single bed activated carbon adsorber polishing unit. Each Biofilter has 2 different layers of media to remove the bulk of the odorous components whereas the carbon polisher allows the system to meet stringent consents by removing residual odours.
The blowers operate duty/standby to force ventilate the odour pipework, drawing the gases through the biofilter for initial scrubbing, then through a carbon filter for final treatment before discharging through a flue stack. A heater prior to the carbon filter removes humidity from the gas to protect the carbon filter.
Final effluent is sprayed onto the biomass to maintain the moist conditions required to keep the medium healthy. The final effluent also offers additional nutrition.
The Quality instruments are for monitoring purposes only.

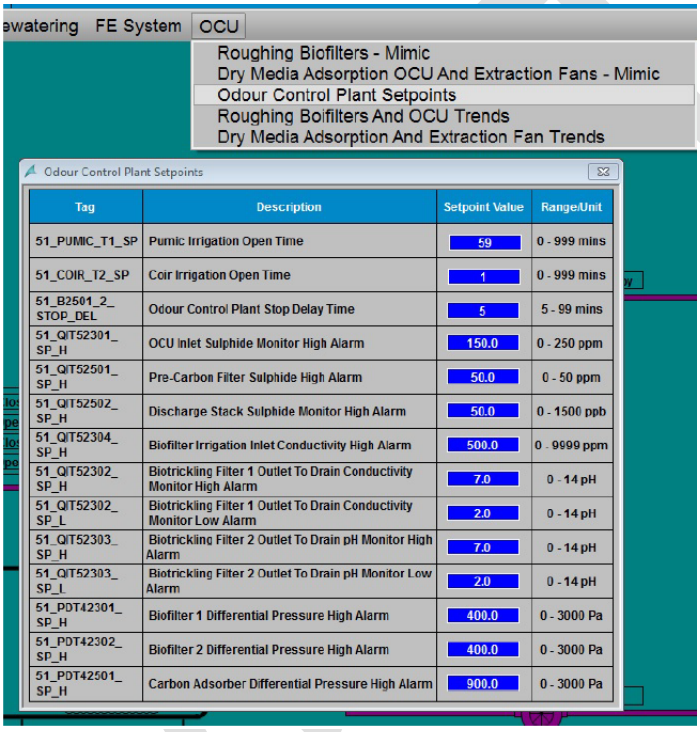
Conductivity Monitor

DRAFT

3.2 Set-Points

Note: Under no circumstances are any changes or additions to be made to the system operating set points without Engineering input.
Once set no changes to these values are permitted without reference to the Principal Range Manager.

Odour control set points are located in the OCU drop down menu. The setpoints relate to alarm limits and sequence timers.



Tag	Description	Setpoint Value	Range/Unit
51_PUMIC_T1_SP	Pumic Irrigation Open Time	59	0 - 999 mins
51_COIR_T2_SP	Coir Irrigation Open Time	1	0 - 999 mins
51_B2501_2_STOP_DEL	Odour Control Plant Stop Delay Time	5	5 - 99 mins
51_QIT52301_SP_H	OCU Inlet Sulphide Monitor High Alarm	150.0	0 - 250 ppm
51_QIT52501_SP_H	Pre-Carbon Filter Sulphide High Alarm	50.0	0 - 50 ppm
51_QIT52502_SP_H	Discharge Stack Sulphide Monitor High Alarm	50.0	0 - 1500 ppb
51_QIT52304_SP_H	Biofilter Irrigation Inlet Conductivity High Alarm	500.0	0 - 9999 ppm
51_QIT52302_SP_H	Biotrickling Filter 1 Outlet To Drain Conductivity Monitor High Alarm	7.0	0 - 14 pH
51_QIT52302_SP_L	Biotrickling Filter 1 Outlet To Drain Conductivity Monitor Low Alarm	2.0	0 - 14 pH
51_QIT52303_SP_H	Biotrickling Filter 2 Outlet To Drain pH Monitor High Alarm	7.0	0 - 14 pH
51_QIT52303_SP_L	Biotrickling Filter 2 Outlet To Drain pH Monitor Low Alarm	2.0	0 - 14 pH
51_PDT42301_SP_H	Biofilter 1 Differential Pressure High Alarm	400.0	0 - 3000 Pa
51_PDT42302_SP_H	Biofilter 2 Differential Pressure High Alarm	400.0	0 - 3000 Pa
51_PDT42501_SP_H	Carbon Adsorber Differential Pressure High Alarm	900.0	0 - 3000 Pa

Failure of the OCU will not shutdown any other system

Section 4 Methodology for Operating & Maintenance Tasks

4.1 Normal Operation

The Odour Control Unit is available to start-up when the following conditions are met:

The duty odour control fan is 'Healthy' and the PLC is in Auto

If the above conditions are met and the odour control fan (A5-B2501 or A5-B2502) is called to run by PLC51.

- Start duty Odour control Fan (A5-B2501 or A5-B2502)
- Once the OCU Fan is operational, start the Pre-carbon electric Heater (A5-E2505)
- Once the heater is operational the Biofilter will operate as follows:

  The No2 pumice rock irrigation valves will open for a set time
  When the time expires the No2 coir fibre irrigation valves open and the 2No pumice rock irrigation valves will close for a set time.
  This cycle continues until manually stopped.

  Timer adjustable settings

Valve	**Operation**	**Timer**	**Adjustable Settings**
Pumice Irrigation	Open Timer	Timer 1	(14mins, 0-999mins)
Coir Irrigation	Open Timer	Timer 2	(2mins, 0-999mins)

The OCU will automatically shutdown in the following sequence:

All irrigation system control valves will close.
The pre-carbon heater will de-energise
Once the heater has shutdown the duty odour control fan will run for 5mins (adjustable)

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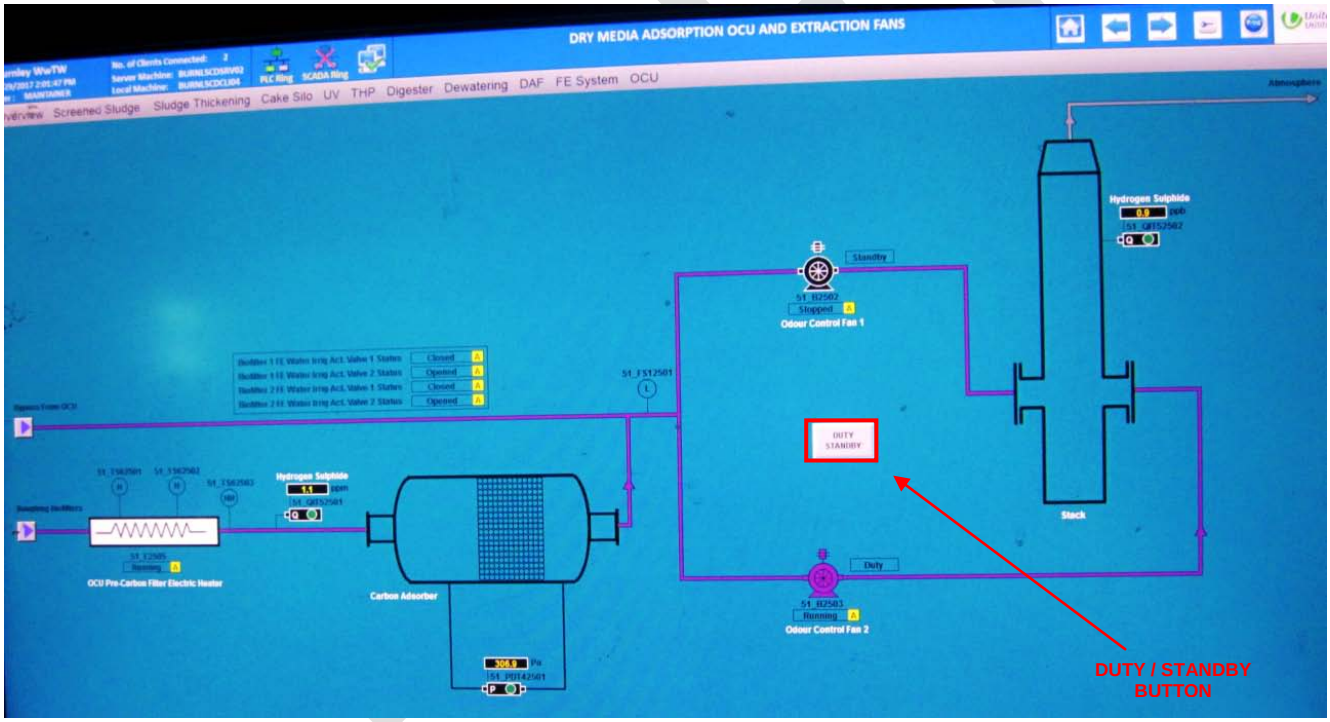
4.2 Abnormal Operation

If during routine tasks and inspections any of the following conditions are found please contact your Production Engineer:

4.2.1 Failure of an Odour Control Fan

If a duty odour control fan fails, an alarm will be raised.
Carrie out a Duty/Standby change over

The duty of the odour control fans are selected at the SCADA



If both fans fail a shutdown sequence will start.

4.2.2 Irrigation Strainers

The final effluent has 2 local strainers which operate duty/standby and require regular cleaning and inspection.
In order to do this open the isolation valves on strainer 1 and close the isolation valves on strainer 2. Remove the No2 strainer from the line, clean and inspect. Replace the strainer on completion. This strainer is now ready for duty.

Irrigation Strainers Duty/Standby

Strainer with lagging removed

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4.3 Common Tasks

Daily

1. Check all monitors are within their ranges
2. Check SCADA for indicated faults
3. Check the OCU fans for excess vibration or heating
4. Carbon Filter - Check the bed pressures across the carbon bed via the pressure/transmitter
5. Check inlet final effluent conductivity and log

Weekly

1 Check the irrigation outlet pH and record for each biofilter
2 Check U traps for dirt and solids

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5.0 Reference Information

5.1 Site Specific Drawings

These can be found on the QA Sharepoint and on the Sludge Digestion Range Management Sharepoint.

Add link here

5.2 List of Acronymns used in the document

Acronym	Description
DSEAR	Dangerous Substances and Explosive Atmospheres Regulations
ERA	Environmental Regulatory Advisor
HACCP	Hazard Analysis and Critical Control Points
HMI	Human Machine Interface
PPE	Personal Protective Equipment
PS	Pumping Station
SCADA	System Control & Data Acquisition
SOP	Standard Operating Procedure
SSI	Site Specific Instruction

5.3 List of symbols used in this document

Automatic Start Up Hazard

Biological Hazard

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6.0 Contacts

6.1 Contacts for Document Changes or Corrections

Quality Team

Production Engineer (for site specific changes)

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Appendix F: Odour Diary Form

Burnley WwTW Sludge Treatment Facility
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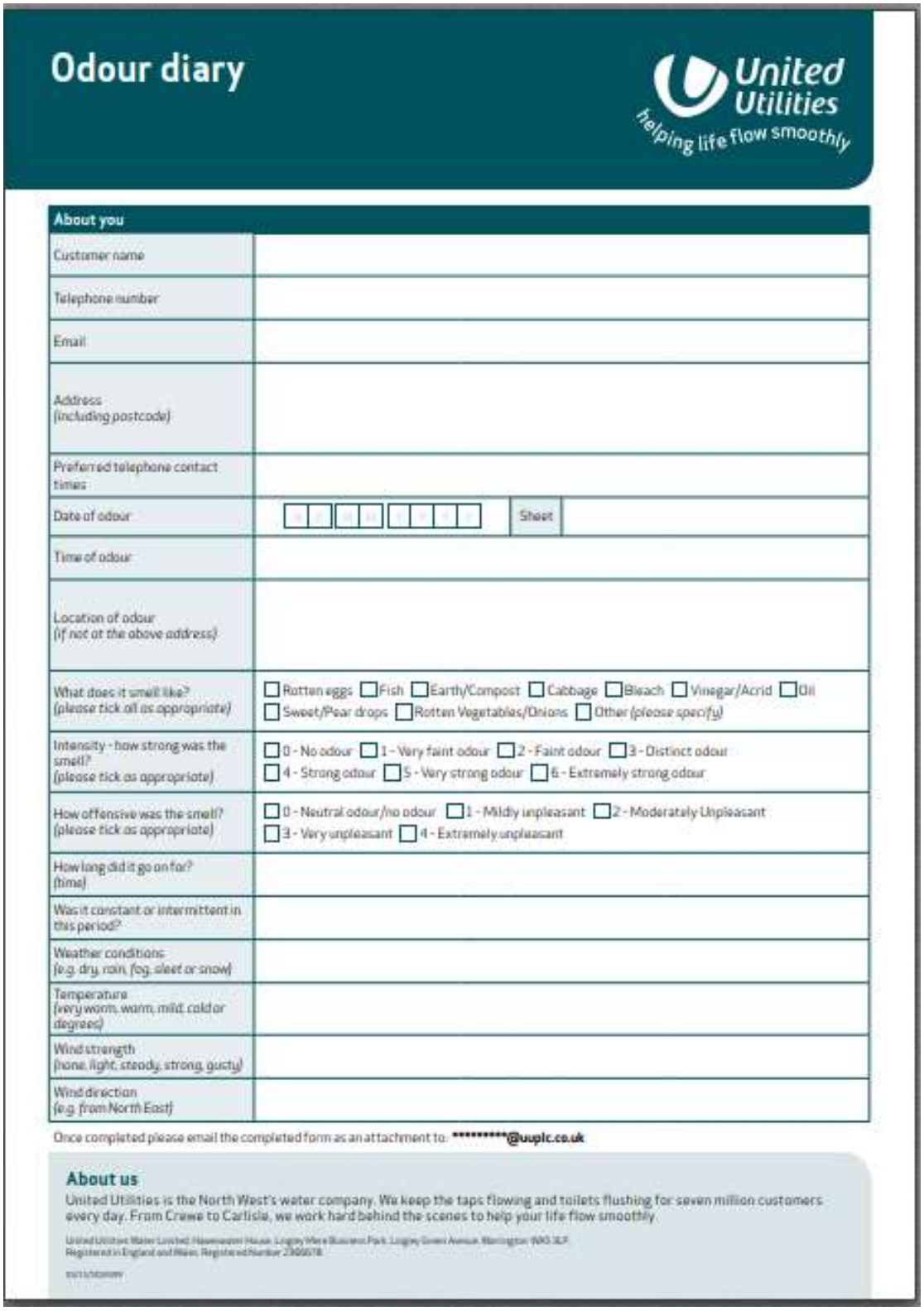
Odour Management Plan



Odour diary

United Utilities
helping life flow smoothly

About you	
Customer name	
Telephone number	
Email	
Address (including postcode)	
Preferred telephone contact times	
Date of odour	☐☐/☐☐/☐☐☐☐ 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 ☐ Earthy/Compost ☐ Cabbage ☐ Bleach ☐ Vinegar/Acrid ☐ Oil ☐ Sweet/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.

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Appendix G: 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?):		
Actions taken: Investigation completed and checked site area.		
Form completed by:	Date	

Burnley WwTW Sludge Treatment Facility
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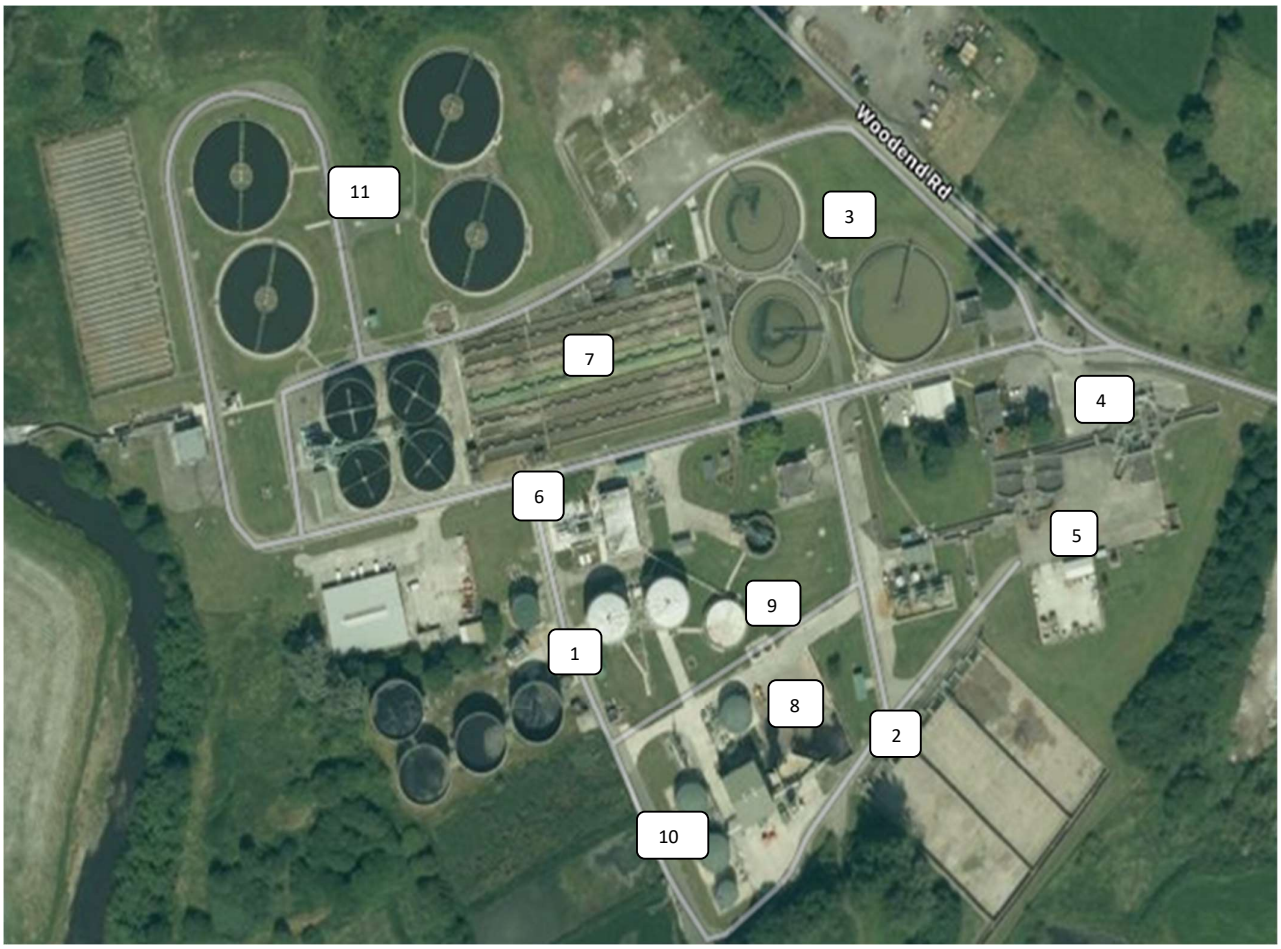
Appendix H: Sniff Test Monitoring Locations

On Site Monitoring Locations



Number	Description	Number	Description
1	Sludge Holding Tanks & Digester	7	Aeration Lanes
2	Storm Tanks	8	Sludge Cake Bay
3	Primary Tanks	9	Gas Holder
4	Inlet Screens	10	Centrifuge Feed Tanks
5	Detritors	11	Final Tanks
6	Thermal Hydrolysis Plant		

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Off-site Monitoring Locations

ID	Description	ID	Description
A	Woodend Barn Farm – residential properties	D	Hollins Farm
B	Smithson Farm - caravan and camping site and residential properties	E	Moor Isles Farm
C	Inghams Farm	F	Pendle Hall Farm

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