Mogden STC Bioaerosol Risk Assessment

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Thames Water Utilities Ltd
EPR/WP3533LT/V006

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Mogden STC Bioaerosol Risk Assessment

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1. Introduction

The purpose of this Bioaerosols Risk Assessment is to provide supplementary information to support the permit variation application for a bespoke installation permit for the Mogden STC, EPR/WP3533LT/V006.

1.1 Site description

The site is located within the Twickenham area of south-west London, an industrialised urban area consisting of residential, commercial, and industrial premises. The site is bounded on all sides by residential or commercial premises but maintains a small vegetation buffer between the site assets and nearby receptors.

The whole of the STW and STC is within a Flood Zone 1 indicating that there is a low annual probability of river flooding (less than 1:1000 annual probability of flooding). The only exception to this is the Duke of Northumberland's River, an artificial channel that runs from south to north through the middle of the site towards the River Thames. This channel is within Flood Zone 3 with a high annual probability of flooding, greater than 1:100. However, this has not been known to flood outside of the channel and into the works.

The whole of the site sits outside of a Source Protection Zone but is within the Hounslow Air Quality Management Area (AQMA). The Hounslow AQMA was declared by the London Borough of Hounslow encompassing the entire Borough of Hounslow for annual mean nitrogen dioxide (NO_2).

There are six designated habitat sites within the relevant distances of the site and 24 non-statutory designated local wildlife sites within 2 km of the site. The nearest is a Local Nature Reserve (LNR), Isleworth Ait, which is approximately 950 m north-east of the site. Syon Park, a Site of Special Scientific Interest (SSSI) is approximately 1.5 km to the north-east and Ham Lands LNR is approx. 2 km south-east of the site. Richmond Park Special Area of Conservation (SAC) is approximately 3 km to the south-east and Wimbledon Park SAC is approximately 6.6 km away in a south-easterly direction. Parts of the South West London Waterbodies, which is both a Ramsar site and Special Protection Area (SPA) can be found within 5 km and 10 km of the site in a south-westly direction. There is no Ancient Woodland within 5 km of the Mogden STW.

The address of the installation is:

Mogden Sludge Treatment Centre,

Mogden Sewage Treatment Works,

Mogden Lane,

Isleworth,

Middlesex,

TW7 7LP

1.2 Site Activities

Mogden Sludge Treatment Centre (STC) is located at the Mogden Sewage Treatment Works (STW), Middlesex, operated by Thames Water Utilities Ltd (Thames Water). The STC undertakes the biological treatment of sewage sludge, both indigenous and imported from other wastewater treatment sites, by anaerobic digestion, with a capacity above the relevant thresholds for requiring an environmental permit. It also includes the importation of specified wastes to the works inlet for treatment through the Urban Waste Water Treatment Directive (UWWTD) regulated works. Due to the thermal input of combustion plant at the site, the permit also has a listed activity for combustion plant.

Digested Sludge cake is not produced or stored on the site. Digested sludge is transferred off-site via sludge transfer pipes to separate dewatering operations, so there is no risk of bioaerosol releases from these activities.

Activities at the site include biogas upgrading plant (gas-to-grid) at the site.

Listed activities include S1.1A1(a) Burning any fuel in an appliance with a rated thermal input of 50 megawatts or more;

S5.4A1(b)(i) Recovery or a mix of recovery and disposal of non-hazardous waste with a capacity exceeding 75 tonnes per day (or 100 tonnes per day if the only waste treatment activity is anaerobic digestion) involving biological treatment.

The site includes the following Directly Associated Activities (DAA):

- Biogas storage and scrubbing.
- Biogas processing for siloxane removal.
- Emergency Flares.
- Oil storage.
- Surface water drainage and transfer back to the head of the sewage treatment works via site drainage.
- Condensate drainage and transfer back to the head of the sewage treatment works via site drainage.
- Imports of waste, including sludge from other sewage treatment works for treatment;
- Dewatering liquor drainage and transfer back to the head of the sewage treatment works via site drainage.
- Blending of indigenous sludges and imported wastes/ waste sludge prior to treatment.
- Pre-treatment of sewage sludge by pasteurisation.
- Storage of digestate prior to dewatering.
- Transfer/ export of waste digested sewage sludge/ digestate for off-site dewatering.
- Storage and handling of wastes, including waste oils.
- Storage of raw materials.

There are two waste management activities at the site:

Import of sewage and sewage derived wastes to the works inlet for treatment through the UWWTD route and screening of imports;

Upgrading of biogas to biomethane (including the removal of moisture and other substances such as carbon dioxide, hydrogen sulphide and Volatile organic compounds) for injection into the National Grid.

The facility can treat up to 8,100,000m^3 of sludge per year (equating to approximately 8,100,000 tonnes). The sludge treatment facility has a total maximum treatment input of 5,500m^3 per day (equating to approximately 5,500 tonnes per day).

Within the area covering the permitted activities, there are four odour control units (OCUs) linked to specific tanks or processes which produce potentially odorous air. These units treat the air through a variety of means, including the use of biofilters.

The anaerobic digestion process gives rise to biogas, a mixture of biomethane and carbon dioxide, in a mixture with trace components. This biogas is either combusted through CHP Engines at the site; or upgraded through the Gas to Grid plant for injection into the national gas grid; with excess biogas being subject to flaring. The biogas handling system is equipped with a number of pressure relief valves (PRVs) which activate as a safety precaution when there is excess gas over what the CHP Engines and Emergency Flares can handle.

1.3 Regulatory requirements

The sludge treatment activity has not previously required an environmental permit as the digested sewage sludge from the site is normally sent for recovery to land. However, a permit application has been submitted based on the Environment Agency's recent conclusion that sewage sludge is a waste and therefore the treatment of sewage sludge by anaerobic digestion for recovery is a permittable activity under Schedule 1 of the EPR 2016, specifically Chapter 5, Section 5.4, Part A 1(b)(i). The combustion activities at the site remain as currently permitted.

For new permits, if the site is within 250m of sensitive receptors then there is a requirement to monitor bioaerosols in accordance with the EA technical guidance note[1] *'M9: environmental monitoring of bioaerosols*

[1] Environment Agency. 2018. Technical Guidance Note (Monitoring) M9: Environmental monitoring of Bioaerosols at regulated facilities, v2, July 2018.

at regulated facilities'. M9 describes bioaerosols and the risks that they pose, as well as identifying potential sources within biological treatment facilities.

The Mogden Sludge Treatment installation is within 250m of sensitive receptors, as defined by M9. These are detailed in Section 2.5 of this report.

1.4 Bioaerosols

Bioaerosols are found naturally within the environment. They consist of airborne particles that contain living organisms, such as bacteria, fungi and viruses or parts of living organisms, such as plant pollen, spores and endotoxins from bacterial cells or mycotoxins from fungi. The components of a bioaerosol range in size from around 0.02 to 100 micrometres (µm) in diameter. The size, density, and shape of a bioaerosol will affect its behaviour, survivability and ultimately its dispersion in the atmosphere.

Bioaerosols are easily breathed into the human respiratory system, potentially causing allergic responses and inflammation. They also have the potential to cause eye irritation, gastrointestinal illness, and dermatitis.

Bioaerosols are associated with composting, anaerobic digestion and mechanical biological treatment, which are the main processes used to treat organic wastes in the UK. As organic waste material breaks down it goes through different temperature dependent stages that are dominated by certain groups of bacteria and fungi. Bacteria are the most numerous groups of microorganisms. Aspergillus fumigatus is a mesophilic fungus that is thermotolerant and is present throughout the different stages of the organic breakdown process. This fungus can cause severe respiratory infection if inhaled.

The dependence on microorganisms to degrade organic material and the way in which the material is processed make biological treatment facilities a potential source of bioaerosols. However, we note that the 2012 EA guidance note[2] for developments requiring planning permission and environmental permits states that the EA do not consider bioaerosols from anaerobic digestion to be a serious concern. This is due to the fact, that anaerobic digestion is generally a wet process undertaken in enclosed tanks and equipment, whereas composting is often undertaken using open systems such as windrows and static piles.

The Mogden STC does not undertake any aerobic composting activities and the anaerobic digestion process on site, undertaken in the Primary Digester Tanks, is an enclosed process with all produced gases captured within the biogas system.

1.4.1 High Risk Activities

The M17 guidance document, in section 3.3.3, outlines a number of potential sources and release mechanisms of particulate matter, including bioaerosols from waste management facilities. These potential sources are not graded for importance within M17 and include: the movement of waste to and from the STC; storage of waste (under certain conditions) on site; the handling and processing of waste materials e.g., shredding of green waste, turning of windrows, daily cover; and wind scouring of waste surfaces.

In terms of potential sources of bioaerosol release at the Mogden STC. These are limited to the OCUs with bio-filter application. Digested sludge is transferred off-site via sludge transfer pipes, subsequently, there is no sludge cake storage for wind abrasion to occur and or releases via handling of storage materials. The site does not undertake shredding of waste or turning of stockpiles.

1.4.2 Relevant Thresholds

Based on the accepted Levels at sensitive receptors as set out in the Environment Agency M17 guidance[3] '*M17 Monitoring of particulate matter in ambient air around waste facilities*', and in line with the Governments regulatory position statement (RPS) 209 outlining when a specific bioaerosol risk assessment

[2] Environment Agency. October 2012. Guidance for developments requiring planning permission and environmental permits

[3] Environment Agency. 2013. Technical Guidance Note (Monitoring) M17: Monitoring Particulate Matter in Ambient Air around Waste Facilities, v2, July 2013 *https://www.gov.uk/government/publications/m17-monitoring-of-particulate-matter-in-ambient-air-around-waste-facilities*

and/or monitoring is required and use of the Environment Agency Technical Guidance Note M9[4]; key bioaerosols of interest and their respective threshold Levels (including background) at sensitive receptors are outlined below:

- Total bacteria: 1000 cfu/m^3
- Aspergillus Fumigatus: 500 cfu/m^3

[4] Environment Agency. 2018. Technical Guidance Note (Monitoring) M9: Environmental monitoring of Bioaerosols at regulated facilities, v2, July 2018.

2. Bioaerosol risk assessment

2.1 Introduction

A source-pathway-receptor risk assessment has been undertaken to appraise the potential for risk to human health at sensitive receptors within the relevant distance from operations at the Mogden STC. This risk assessment follows a standardised approach, namely:

- Hazard identification: what sources of bioaerosols are present on site;
- Exposure assessment: what are the mechanisms or pathways allowing bioaerosols to migrate off site and reach a sensitive receptor; and
- Risk evaluation: who is potentially exposed to bioaerosols; what is the probability, magnitude, and duration of that exposure.

The assessment describes:

- The processing techniques and equipment used within the installation;
- Feedstock, tonnages processed and any seasonal variations;
- Potential sources of bioaerosols;
- The site layout, including any screens, bunds, or trees around the site;
- What is beyond the site boundaries and the location of sensitive receptors; and
- Local wind direction data.

2.2 Processing equipment and techniques

2.2.1 Waste Reception

Waste is delivered directly into the works inlet through enclosed connections at two waste import points using site supplied flexible hoses. The imported waste combines with incoming flow from the sewer and is treated through the STW, outside of the permit. The site also accepts imports of sludge from other Thames Water sites to a sludge import point to the Sludge Import Tank.

Indigenous sludge from the aerobic treatment processes of the UWWTD is treated through three sludge thickening routes.

Operations prior to the thickening of sludge are not included within the Mogden STC permit, other than the receipt of imported cess and septic tank wastes. Once thickened sludge has left the Thickener Plant, it falls within the scope of the STC permit and within the scope of this risk assessment.

If a sludge spillage occurs, operators will follow the site's spillage response plan in a timely manner and inform the relevant site personnel and authorities. Spill kits are available onsite. Sludge is relatively viscous and not highly mobile.

2.2.2 Waste Treatment

Primary sludge is transferred to the Primary Sludge Buffer Tanks where it mixes with the imported sludge. Primary sludge is then pumped to the Primary Sludge Thickening Plant by dedicated pumps for thickening. The thickened sludge falls from the belts and is pumped into the Thickening Sludge Buffer Tank where it is mixed with thickened Surplus Activated Sludge (SAS). SAS from the aerobic process is pumped to the SAS Thickening Plant. The thickened SAS is then pumped to the Thickening Sludge Buffer Tank where it is mixed with thickened primary sludge. Liquors from the thickening of both primary sludge and SAS is returned for additional treatment outside of the STC by Liquor Return Pumping Stations.

The thickened sludge is pumped to the covered Pasteurisation Process. The Pasteurisation Process is a two-step process which commences with a small batch of cold fresh sludge being pumped into the pre-heat tank, where the sludge enters an inner chamber and is subject to mechanical mixing while being held and heated. The pre-heated sludge is then pumped into the reactor tank for pasteurising at a minimum of 60°C and 60 minutes, which increases the pathogen kill. After 60 minutes, the pasteurised sludge is pumped back to the outer envelope of pre-heat tank to cool, by pre-heating a fresh batch of incoming sludge. The entire system is connected to an OCU for odour abatement. The SCADA system monitors parameters within the system,

including the pressures, levels and temperatures and would inhibit further feeding in the event of a high-level alarm.

The pasteurised sludge is pumped to two Pasteurised Sludge Buffer Tanks (PSBT) and then pumped to 16 Primary Digester Tanks. All Primary Digester Tanks are fitted with ultrasonic levels measuring both the sludge depth and the Biogas Storage floating roof height PRVs, for safety. Sludge is pumped from the Primary Digester Tanks after approximately 12 days, to a Digested Sludge Buffer Tank (which is connected to an OCU), before being pumped offsite for de-watering.

Biogas from the Primary Digester Tanks is captured in roof mounted Biogas Storage holders on top of each of the Primary Digester Tanks. The Biogas Storage holders rises and falls depending upon the levels of biogas in each holder, before being drawn off and into a common biogas line, where the biogas is passed through activated carbon biogas scrubbers to remove impurities. This common biogas line is fed to biogas compressors which either pressurise the biogas and either transfer biogas to the biogas upgrading plant for injection into the national gas grid; or transfer to the CHP Engines and boilers, diverting unpressurised biogas to the Emergency Flares as required.

The above ground biogas transfer pipeline is equipped with condensate pots that capture entrained moisture from the generated biogas. The biogas is primarily used as a fuel within the three CHP Engines that are present on site to generate electricity which is normally used within the site or transferred to the biogas upgrading plant for treatment prior to export in the national gas grid. Biogas can also be combusted in one of the four dual fuelled boilers to generate heat for the pasteurisation process or digesters. If none of the CHP Engines or boilers are available or the Gas to Grid export is not online, biogas can be diverted to the emergency flares.

A siloxane removal system is located at the power-house, upstream of the CHP Engines on the biogas line and operate in series to remove impurities from the biogas prior to combustion in the CHP Engines.

2.2.3 Digested cake

The digested sludge is stored before being pumped offsite for de-watering. There is no digestate sludge cake produced or stored at Mogden STC.

2.2.4 Odour Control Units

Sewage treatment works have a number of potentially odorous sources within their boundary. Some of these sources may be linked to OCUs to treat potentially odorous compounds given off by the process. These units take air extracted from above tanks or process areas and treat the odour compounds by means of different methodologies dependent upon the nature of the odour compounds. Treatment methodologies include activated carbon systems; biofilters or other biological treatment; and chemical scrubbing. Individual OCUs may use one or more of these methodologies in series. The four OCUs at Mogden STC abate a number of different processes and tanks.

Under the M9 guidance documents, the Environment Agency has identified that biofilters may give rise to bioaerosols during operation. For completeness all OCUs using biofilters within the installation boundary have been considered in this assessment. All four OCUs at Mogden STC are considered in the scope of this assessment.

2.2.5 Seasonality

Sewage treatment is undertaken at the STC on a continuous basis, 24 hours a day 365 days of the year. Digested sludge is, therefore, produced daily and at similar levels across the whole year.

However, the digested sludge is pumped offsite for de-watering, so there is no production of digested sludge cake and subsequently no storage of digested sludge cake on site.

2.3 Potential Sources

There are twenty-one point-source emissions to air from the processes within the installation boundary, as presented in Table 1 and illustrated in Appendix B. The references and source descriptions match those in the permit.

Table 1: Point source emissions to air

Air emission reference	Source	In scope?
A5	Boiler 1	X
A6	Boiler 2	X
A7	Boiler 3	X
A8	Boiler 4	X
A11a	CHP Engine 5	X
A11b	CHP Engine 6	X
A11c	CHP Engine 67	X
A11e	Siloxane and VOC removal	X
A14	Flare Stack	X
A15a,b – A21a,b	MTU Diesel Engines (Standby Emergency Generators)	X
A22	Standby Storm Pumps x 4	X
A23	Pumphouse Standby Generator	X
A24	Deluge Standby Generator	X
A25	Flare Stack (to replace A14)	X
A26	Biogas Upgrader Exhaust Flue	X
A27	Reject Biomethane Waste Gas Burner	X
A28	GEU Process Vent	X
A29	Carbon Filter PRV	X
A30	Pasteurisation Process PRV	X
A31 – A46	Sludge Digester PRV	X
A47	OCU 12	✓
A48	Transfer PS OCU	✓
A49	GBT Building OCU	✓
A50	Sludge Thickening Plant OCU	✓

2.3.1 Source Assessment

The CHP Engines, boilers, and Emergency Flare (points A5 – A11a-c, A14 or A25) combust the produced biogas at high temperatures (in excess of 450°C). Due to the combustion of the biogas, these points can be discounted as sources of bioaerosols emissions.

The emission points associated with the biogas upgrading plant, A26 – A29 have been discounted as sources, as these release separated CO_2 (A26) combusted biogas (A27) or dried biogas (A28-29)

Points A15a,b to A21a,b and A23- A24 relate to diesel fuelled generators at the site, which are not linked to any source of bioaerosols. The boilers may also be operated on diesel, which again excludes them as a source of bioaerosols.

There are four OCUs (points A47 – A50) serving the STC. A47 (OCU 12) comprises of 1 wet chemical scrubber, 8 biofilters and 4 carbon filters. A48 (Transfer PS OCU) comprises of 1 biofilter and 1 carbon unit. A49 (GBT building OCU) comprises of 1 carbon unit and A50 (Thickening plant building OCU) comprises of 1 biofilter and 2 carbon units.

The OCUs are typically a two stage biofilter and scrubber system. Extracted air from the tanks is passed through the support media. The microbes on the support media, remove potentially odorous contaminants and the partially treated air from the bio-trickling filter are passed to Activated Carbon adsorbers to achieve a stack emission standard of <= 1000 $OuEm^3$ at the outlet. Treated air discharges via the stack. The configuration of the OCU means that any bioaerosols emitted from the biofilter stage should be captured by the activated carbon stage, and therefore, the likelihood of bioaerosol release is anticipated to be minimal. These sources have been included for completeness.

The PRVs (points A30 and A31 – A46) are normally closed and do not emit to atmosphere. However, in the event of an abnormal situation such as the failure of the Emergency Flare stacks and/or CHP Engines, the PRV's would open to relieve excess biogas pressure, potentially resulting in the release of bioaerosols. While the problem is rectified, biogas generation is limited by reducing or inhibiting the digester feed. These abnormal events are unlikely, temporary, and infrequent due to the extensive monitoring and maintenance programmes undertaken at the site, as well as the procedures and warning systems in place.

2.3.2 Risk

The overall treatment process is considered to a be a low source of bioaerosols as discussed above, there are control measures in place at the site to reduce and contain emissions of bioaerosols. These control measures are regularly maintained to sustain their efficacy and reduce the risk of equipment failure. Storage tanks, treatment tanks and associated pipework are all enclosed. In addition, the PRVs are only open in abnormal situations which are temporary and unlikely.

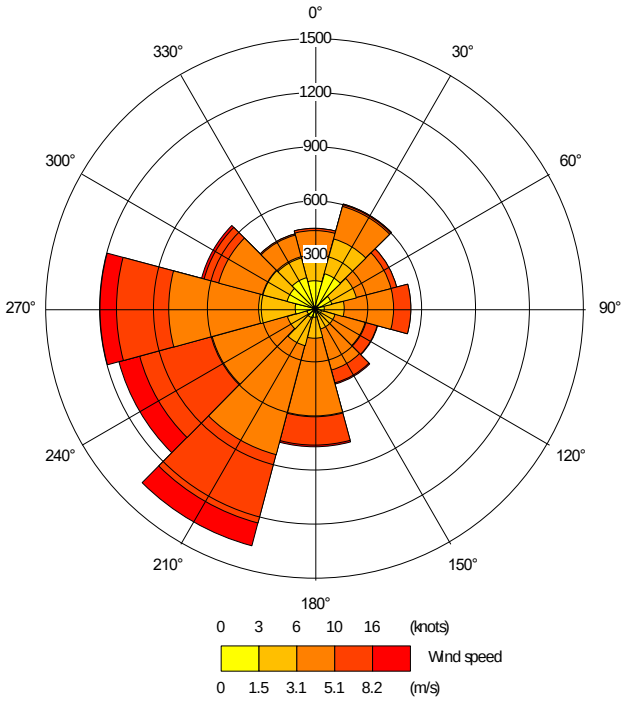
The greatest probability of exposure from bioaerosols emitted from an STC site is from uncovered operations such as the cake bay and cake conveyor, of which there are none present at Mogden.

2.4 Pathways

Bioaerosols are very small and light in weight so can easily be transported by the wind from their source to a receptor. The 2019 wind rose for the most representative meteorological site, Heathrow airport (located approximately 13 km North East of the Site), is shown in figure 1.

The wind rose data shows that the site experiences strong prevailing south westerly winds, predominantly in excess of 6 knots. The Mogden Sludge Treatment Centre and surrounding area has a relatively flat topography. The site is surrounded by mature trees that provide some screening along the site boundary.

Figure 1 – Heathrow Airport Wind rose (2019)



Because of the dilution effect in open air, bioaerosol concentrations fall away rapidly with distance from the source. It has been shown by research by the HSE[5] that by 100 to 200m away, the bioaerosol concentration has mostly returned to background levels. Between 50m and 100m distances downwind of the process, bioaerosol concentrations were substantially reduced by comparison to those level measurements at source. Research Report (RR)786 confirmed previous published studies which showed that at a distance of 250m from composting activity, in most cases, the bioaerosol concentrations will be reduced to background levels. Note that this research was undertaken on aerobic composting sites, which generate higher levels of bioaerosols than anaerobic digestion sites, although the 250m separation distance has been retained.

At present, Thames Water do not have any empirical evidence for the levels of bioaerosols that might be associated with the potential sources at their sludge treatment centres.

2.5 Receptors

Environment Agency guidance note M9 recommends a screening distance of 250m from bioaerosol emission sources to static receptor locations. Sensitive receptors are defined as: 'permitted activities where people are likely to be for prolonged periods. This term would therefore apply to dwellings (including any associated gardens) and to many types of workplaces. We would not normally regard a place where people are likely to be present for less than 6 hours at one time as being a sensitive receptor. The term does not apply to those controlling the permitted facility, their staff when they are at work or to visitors to the facility, as their health is covered by Health and Safety at Work legislation but would apply to dwellings, commercial or industrial premises nearby where people might be exposed for the requisite period.

Sensitive receptors (identified for the Odour Management Plan (OMP)) within 250m of potential bioaerosol emission sources were considered. An additional residential receptor (R31) is the only relevant exposure and is presented in Table 2 and shown in Appendix C. The distance and direction from each potential bioaerosol emission source to the closest sensitive receptor has been reported.

Table 2: Static Receptors within 250m of Potential Bioaerosol Sources

[5] Research Report (RR)786 - Bioaerosol emissions from waste composting and the potential for workers' exposure https://www.hse.gov.uk/research/rrhtm/rr786.htm

Receptor	Description	Source	Distance from closest source (m)	Direction from the source
R31	Residential	A47 (OCU 12)	223m	Southeast
		A50 (Sludge thickening plant)	214m	Southeast
R30	Public footpath	A49 (GBT Building OCU)	220m	Southwest
R29	Residential	A49 (GBT Building OCU)	225m	Southwest

2.6 Risk Assessment

The method used for this bioaerosol risk assessment is adapted from the EA's standard guidance on risk assessments for environmental permitting, which recommends using a Source-Pathway-Receptor model[6] to help determine the magnitude of the risk associated with bioaerosol emissions from a facility.

There are three potential sources of bioaerosols release within 250m of static receptors.

- A47 OCU 12 ;
- A49 OCU and
- A50 OCU.

Receptor 31 is situated to the Southeast. The prevailing wind direction is from the Southwest. Whilst the receptor is not situated immediately down-wind of these sources, there is potential for wind-borne transportation of bioaerosols. The risk of bioaerosols being generated from the permitted processes on site is, however, low.

Receptors 29 and 30 are both upwind of the prevailing wind direction meaning they are less likely to be exposed to bioaerosols from this source. Receptor R30 is Glen Walk, a footpath, meaning that human receptors are unlikely to be present for more than 6 hours.

Most storage tanks, treatment tanks and associated pipework are enclosed. Where tanks are not gas tight and vent to atmosphere, these are connected to an OCU. The OCUs are 2 stage biofilter and activated carbon scrubbers. Given the types of OCU, the likelihood of bioaerosol release is anticipated to be minimal.

There is no digestate cake produced at Mogden and therefore no source of bioaerosols emissions.

The closest residential property (R31) is approximately 214m and 223m southeast of A47 and A50 respectively. R31 is not upwind of the potential bioaerosol emission points and at distances where dilution would be increased. There is mature vegetation between the source and receptor, further reducing the probability to exposure.

The probability of exposure from bioaerosols generated from the permitted processes on site is considered to be **Low.** However, when considering the location of receptors, receptor distances from source, the prevailing wind direction and the onsite management and mitigation measures in place, the overall risk is reduced to very **Low**.

Table 3 summarises the risk assessment.

[6] Risk assessments for your environmental permit - GOV.UK (www.gov.uk)

Table 3: Risk Assessment of Potential Bioaerosols Sources

What has the potential to cause harm? Source	How can the source reach the receptor? Pathway	Who can be affected? Receptors	Assessing the risk Probability of Exposure	What is the harm that can be caused? Consequence	Control Measures Managing the Risk	Overall / Residual risk
Odour Control Units	Inhalation via wind-borne transportation	R29, R30, R31	The closest receptor (R31) is approximately 214m and 223m southeast of OCU 12 and sludge thickening plant OCU respectively, and downwind (of prevailing SW'ly wind direction). Receptors of other OCUs are at a greater distance and upwind of the potential sources. Mature vegetation surrounds the site boundaries, offering some screening. Other receptors are >250m away. Probability of exposure from A47, A49 and A50 is considered to be **low**	Impact on human health (considered to be a sensitive receptor).	Most storage tanks, treatment tanks and associated pipework are enclosed. Where tanks are not gas tight and vent to atmosphere, these are connected to an OCU. The OCUs are typically a 2-stage unit, with the final state being an activated carbon absorber designed to achieve a stack standard of <= 1000 $OuEm^3$. In addition, the OCUs are monitored and regularly maintained making the uncontrolled release of bioaerosols very unlikely. Control measures are regularly maintained to sustain the efficacy and reduce the risk of equipment failure.	Very Low

2.7 Abnormal Situations

In the event of plant failures or abnormal situations, an alarm would be raised on the Site Supervisory Control and Data Acquisition (SCADA) or telemetry systems, which will be reacted to by on-site or regional control room operators and Duty Managers. Depending upon the nature of the fault or emergency, where required, an operator would contact a mechanical or electrical technician, both of whom are on-call 24-hours, to attend site as soon as practicable.

If the on-call technicians are already engaged upon other response work, there is the facility to access staff from other TW geographic divisions, coordinated by the Duty Manager. All faults, breakdowns and emergencies are logged electronically together with records of the action taken and the solutions reached. One such abnormal event would be failure of the flare stack and/or CHP engines. Such an event would result in releases of biogas from the PRV's located on the roofs of the Primary Digester Tanks/Biogas Storage holders, which would release bioaerosols. This occurs to prevent over pressurisation of the digesters and gas systems. While the problem is rectified, biogas generation is reduced by reducing or inhibiting the digester feed.

3. Conclusions

A source-pathway-receptor risk assessment has been undertaken to appraise the potential for risk to human health in dwellings and other nearby buildings from bioaerosols arising from operations at the Mogden STC. The risk assessment followed a standardised approach, namely:

- Hazard identification: what sources of bioaerosols are present;
- Exposure assessment: what are the mechanisms or pathways allowing bioaerosols to migrate off site and reach a receptor; and
- Risk evaluation: what is the probability, magnitude, and duration of exposure. This considered control measures in place to reduce the probability or magnitude of release.

A small number of potential sources of bioaerosols within the site processes have been identified, connected to the operation of the 2-stage biofilter OCUs. The risk from abnormal releases from PRVs was scoped out.

Although only qualitative data is available, the overall bioaerosol risk to the identified receptors within 250m of potential bioaerosol sources associated with the sludge treatment process is considered to be very **Low** based on the receptor distances, probability of exposure and onsite management and maintenance, which would minimise the magnitude of any releases.

3.1 Sampling

Thames Water confirms it will use MCERTS accredited providers for the sampling from the OCUs A47 (TQ 15274 74870), A49 (TQ 15153 74873) and A50 (TQ 15337 74898). OCUs will be sampled on a bi-annual basis.

In line with M9, ambient sampling will be conducted to identify background emissions. A sampling round, consisting of four induvial sampling points, each with its own agar plate will be carried out. One point will be located upwind of the Cake Pad to give a background concentration, and three will be located in a fan like arrangement downwind at the same distance to the nearest sensitive receptor (as per M9).

Source	Upwind Location NGR	Downwind Location 1 NGR	Downwind Location 2 NGR	Downwind Location 3 NGR
A47 (OCU 12)	TQ 1525 7482*	TQ 1527 7509*	TQ 1546 7498*	TQ 1538 7506*
A49 (GBT Building OCU)	TQ 1512 7482	TQ 1514 7502*	TQ 1533 7498*	TQ 1524 7503
A50 (Sludge Thickening Plant)	TQ 1531 7485	TQ 1533 7511*	TQ 1552 7500*	TQ 1544 7508*
* location of sampling point may be restricted by existing STW structures				

NGR's for sampling locations are only 8 digits at present, to allow the contractor flexibility as to precise location, taking into account the ability to safely locate and access (and security) of the sampling plates.

Appendix A. Site Location Plan

KEY:

Site Location

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
P01	SEP 2021	FOR INFORMATION	AR	MM	JK	MM

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Client

Thames Water

Project

STC IED PERMIT
MOGDEN STW

Drawing title

FIGURE 1
SITE LOCATION PLAN

Drawing status

PERMITTING

Scale	1:25,000	DO NOT SCALE	
Jacobs No.	B22849AM	Rev	P01
Client no.			

Drawing number

B22849AM-JAC-MGN-DR-0001

Appendix B. Installation Boundary and Air Emission Points

N

WORTON ROAD

Worton Hall Estate

W O R T O N R D

HALL ROAD

O A K

Cess/Domestic Waste Imports 1

Cess/Domestic Waste Imports 2

Sewage Works

Sewage Works

Thickened Sludge Buffer Tank

Pasteurisation Process

Primary Sludge Thickening Buildings

Liquor Return Pumping Station 16

Digested Sludge Buffer Tank

Sludge Pumping Station 14

Liquor Return Pumping Station 9

SAS Thickening Building

Primary Sludge Buffer Tanks

SAS Buffer Tank

Contingency Storage Tank

Sludge Import Area

Sewage Works

Primary Digester Tanks

Sludge Import Tank

Boiler House

Power House

Pasteurised Sludge Buffer Tanks

Decommissioned Sludge Digesters x 4

Siloxane Filters

A11a,b,c & e

BEAUMONT PLACE

MOGDEN LANE

T R E V O R C L

BANKSIDE CL

Amb Sta

W H I T T O N D E N E

A R N O L D

H A R V E S T E R S C L O S E

W R I G H T G R

A I N

T1 T2 T3 T4 T5

S1 S2 S3 S4

A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15a,b A16a,b A17a,b A18a,b A19a,b A20a,b A21a,b A22 A23 A24 A25 A26 A27 A28 A29 A30 A31 A32 A33 A34 A35 A36 A37 A38 A39 A40 A41 A42 A43 A44 A45 A46 A47 A48 A49 A50

KEY:

- Installation Boundary
- Tanks Excluded from Permit Scope
- Area Covered by Urban Waste Water Treatment Regulations
- Subsurface Gravity Pipeline
- Presumed Route of Subsurface Biogas Pipeline
- Presumed Route of Subsurface Sludge Line
- Air Emission Point

A5 - Boiler 1
A6 - Boiler 2
A7 - Boiler 3
A8 - Boiler 4
A11a - CHP Engine 5 (via multiflue to 26m stack)
A11b - CHP Engine 6 (via multiflue to 26m stack)
A11c - CHP Engine 7 (via multiflue to 26m stack)
A11e - Siloxane and VOC Removal (to 26m stack)
A14 - Flare Stack
A15a,b-A21a,b - 7 x MTU Diesel Engines (Standby Emergency Generators)
A22 - 4 x Standby Diesel Storm Pumps
A23 - Pumphouse Standby Generator
A24 - Deluge Standby Generator
A25 - Flare Stack to replace A14
A26 - Biogas Upgrading Unit Exhaust
A27 - Reject Biomethane Waste Gas Burner
A28 - GEU process vents
A29 - Carbon filters PRVs
A30 - Pasteurisation Process PRV
A31-A46 - Primary Digester Tank PRVs
A47 - OCU 12
A48 - Transfer PS OCU
A49 - GBT Building OCU
A50 - Sludge Thickening Plant OCU

0 20 40 60 80 100
METRES

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
P03	DEC. 2024	FOR INFORMATION	AR	MM	JK	MM
P02	DEC. 2023	FOR INFORMATION	AR	SK	JK	MM
P01	JUN. 2022	FOR INFORMATION	AR	SK	JK	MM

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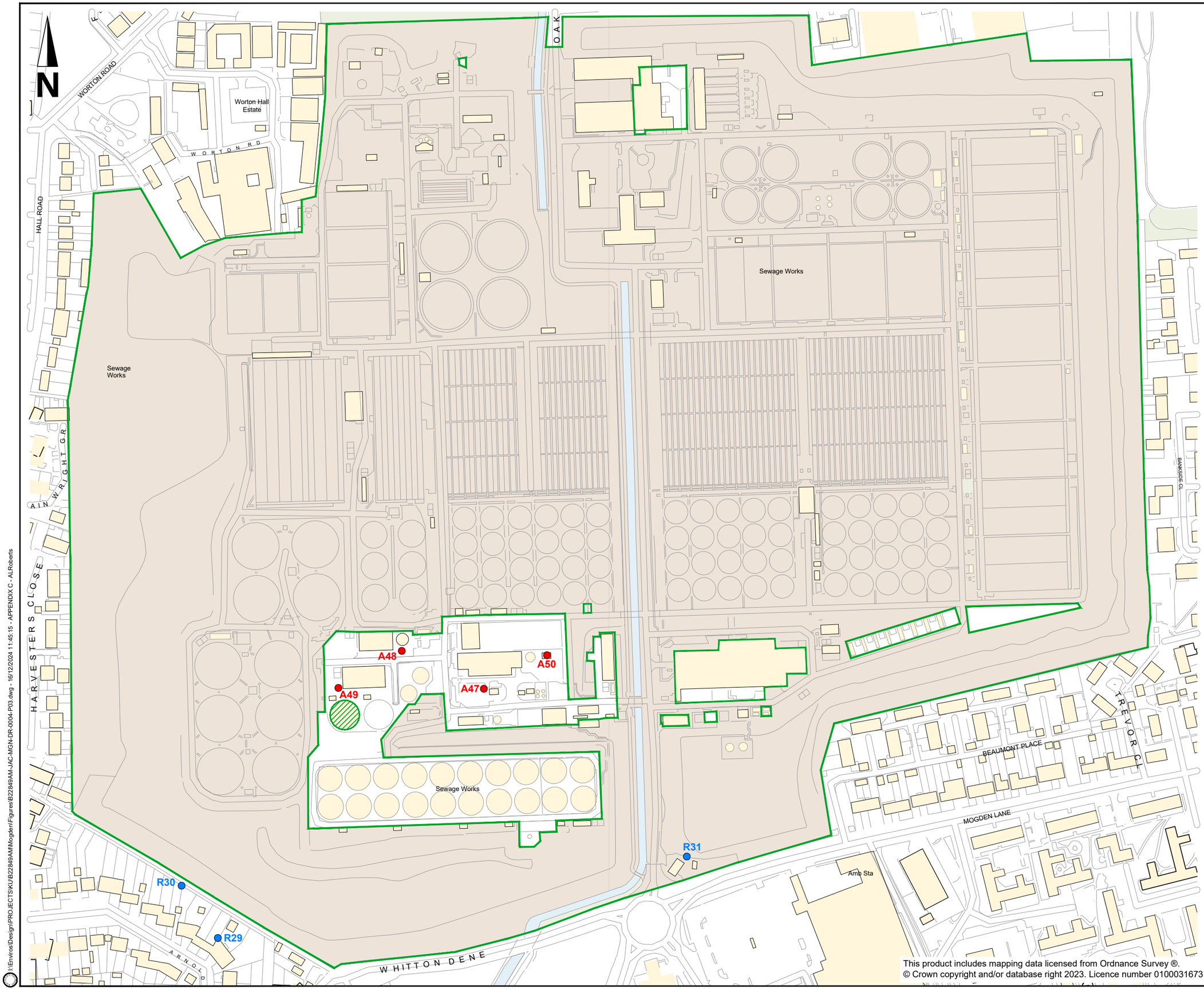
Drawing title: APPENDIX B
INSTALLATION BOUNDARY
AND AIR EMISSION POINTS

Drawing status: PERMITTING

Scale	AS SHOWN	DO NOT SCALE
Jacobs No.	B22849AZ	Rev P03
Client no.		

Drawing number: B22849AZ-JAC-MGN-DR-0002

Appendix C. Receptors within 250m of Potential Bioaerosol Emission Sources



KEY:

- Installation Boundary
- Tanks Excluded from Permit Scope
- Area Covered by Urban Waste Water Treatment Regulations
- Air Emission Point
- Receptor Point

A47 - OCU 12
A48 - Transfer PS OCU
A49 - GBT Building OCU
A50 - Sludge Thickening Plant OCU

0 20 40 60 80 100
METRES

P03	DEC. 2024	FOR INFORMATION	AR	JK	JK	MM
P02	DEC. 2023	FOR INFORMATION	AR	JK	JK	MM
P01	JUN. 2022	FOR INFORMATION	AR	SK	JK	MM
Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd

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Drawing title: APPENDIX C
RECEPTORS WITHIN 250m
OF POTENTIAL BIOAEROSOL
SOURCES

Drawing status: PERMITTING

Scale	AS SHOWN	DO NOT SCALE
Jacobs No.	B22849AZ	Rev P03
Client no.		

Drawing number: B22849AZ-JAC-MGN-DR-0002