Crawley STC Bioaerosol Risk Assessment

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Thames Water Utilities Ltd
EPR/HP3632TS/V005

IED STC Permitting
4 December 2023

Crawley 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 Crawley Sludge Treatment Centre (STC), EPR/HP3632TS/V005.

1.1 Site description

The Crawley STC site is located approximately 5 km north-east of the town of Crawley, West Sussex and close to London Gatwick airport. To the north of the site is an area of woodland and car parking associated with London Gatwick Airport while to the east is a balancing pond and further woodland and greenspaces. To the south is green space and the Radford Road, which is a residential road. To the west of the site is a railway line and a commercial business park.

The site location plan is shown in Appendix A and the address of the installation is:

Crawley STW;

Radford Road,

Crawley,

West Sussex,

RH10 3NW.

The nearest surface water body is the Gatwick Stream, which flows south to north along the western boundary of the STC, approximately 30 metres from the boundary at the closest point near the cess/waste import point. A balancing pond can also be found towards the north-east of the site entrance. Most of the STW and STC is within a Flood Zone 1, indicating that there is a low probability of river flooding (<1:1000 annual probability of flooding). However, assets within the south-west corner of STC including the cess/waste import point and an internal road are within a Flood Zone 2 indicating an increased risk of flooding, with between a 1 in 100 and 1 in 1,000 annual probability of river flooding.

There is only designated habitat site within the relevant distance of Crawley STC. There is a LNR approximately 1.7 km south of the site, Grattons Park LNR. There are no National Nature Reserves or SSSIs within 2 km of the site. There are no SAC, SPA, MPA or Ramsar sites within 10 km of the site. There are 23 areas of Ancient & Semi-Natural Woodland within 2 km of the site, with closest on the northern boundary of the wider STW but not within 50 m of the STC. There are two Local Wildlife Sites (LWS) within the relevant distance of the site. The site is not within a Source Protection Zone (SPZ). The site is not within an Air Quality Management Area (AQMA).

1.2 Site Activities

Crawley Sludge Treatment Centre (STC), is located at the Crawley Sewage Treatment Works (STW), 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.

There are a number of directly associated activities, including the operation of a biogas fuelled CHP engines for the generation of electricity and heat at the site.

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

- Imports of waste, including sludge from other sewage treatment works for treatment
- Blending of indigenous sludges and imported wastes/waste sludge prior to treatment.
- Pre-treatment of sewage sludge by thermal hydrolysis plant (THP) including operation of associated boiler.
- Storage of digestate prior to dewatering.

- Dewatering of digested sewage sludge.
- Transfer of dewatering liquors back to the works inlet of the sewage treatment works.
- Transfer of surface water runoff back to the works inlet of the sewage treatment works.
- Storage of dewatered digested sludge cake prior to offsite recovery.
- Storage of biogas.
- Transfer of biogas condensate via site drainage back to the works inlet of the sewage treatment works.
- Combustion of biogas in a Medium Combustion Plant Directive (MCPD) and Specified Generator (SG) compliant biogas CHP unit and biogas or diesel in MCPD boiler.
- Operation of siloxane filter plant
- Operation of an emergency flare.
- Storage of diesel.
- Storage of wastes, including waste oils.
- Storage of raw materials.

The facility can treat up to 730,000m^3 of sludge per year (equating to approximately 730,000 tonnes). The sludge treatment facility has a total maximum treatment input of 309m^3 per day (equating to approximately 309 tonnes per day).

Some of this throughput is sludge, which is subject to dewatering and storage as treated sludge cake at the site prior to removal from site for application to land. Within the area covering the permitted activities, there are three 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 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 combusted through CHP engines at the site with excess biogas being subject to flaring. The biogas handling system is equipped with pressure relief valves (PRVs) which activate as a safety precaution when there is excess biogas over what the CHP engines and flare 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).

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

The Crawley STC 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

[1] Environment Agency. July 2018. M9: Environmental monitoring of bioaerosols at regulated facilities v2, July 2018

through different temperature dependent stages that are dominated by certain groups of bacteria and fungi. Bacteria are the most numerous group 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 Crawley STC does not undertake any aerobic composting activities and the anaerobic digestion process on site, undertaken in the primary digesters, is an enclosed process with all produced gases captured within the biogas system.

1.4.1 High Risk Activities

The M17 guidance document (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 facility; 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 Crawley STC, which meet the M17 guidance, only the storage of sludge cake and export i.e., the handling and storage of waste (under certain conditions) and wind scouring of waste surfaces would apply. Sewage waste to site is received via pipes and is contained and shredding of waste or turning of stockpiles is not undertaken.

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 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

[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

[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 Crawley 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 vegetation 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 to the covered works inlet channel, from tanker deliveries through an enclosed connection, before being processed through the STW outside of the permit boundary. Incoming sludge, in a mixture with other sewerage material is subjected to preliminary treatment through screening and degritting before separation of sludge from the main flow in the Primary Settlement Tanks. Sludge is transferred to the two Picket Fence Thickeners (PFTs), which are of steel reinforced fibreglass construction, covered and connected to an OCU for odour abatement.

Sludge thickening within the PFTs falls within the scope of the STC permit and within the scope of this risk assessment. Surplus Activated Sludge (SAS) from elsewhere in the works is thickened with SAS Thickening Plant before it is pumped to the Sludge Blending Tank via SAS Screens.

If a sludge spillage occurs, operators will carry out clean up as soon as possible.. Significant spillage incidents will be recorded in the site diary.. No wheel wash facility is available on the site, but a standpipe is available and can be utilised to wash spillage from vehicles as required.

2.2.2 Waste Treatment

The thickened sludge is pumped via a dedicated sludgeline to a covered Sludge Blending Tank, where it is mixed with thickened SAS. The Sludge Blending Tank is an enclosed concrete tank, linked to an Odour Control Unit (OCU). From the Sludge Blending Tank, mixed sludge is pumped to the THP Dewatering Feed Buffer Tank. The blended sludge is then thickened in a Pre-THP Dewatering Plant, then pumped to the steel THP Feed Silo, which is connected to an OCU. Undigested, thickened sludge from other STWs can be imported to a Cake Import Facility, via a cake hopper, located centrally within the STC. The Cake Import Facility is odour abated via an OCU. The imported sludge is pumped to the THP Feed Silos and combines with indigenous dewatered sludge.

Thickened, blended sludge will then undergo a THP process with the application of temperature and pressure. Sludge is then transferred to one of two above ground, concrete, Primary Digester Tanks at the site. Pressure relief valves (PRVs) are fitted to the roof of each tank for safety. Digested sludge is then transferred to the Digested Sludge Buffer Tank and dewatered in the Digested Sludge Dewatering Plant using a powder

polymer. Alternatively, digested sludge may be transferred to a Sludge Contingency Tank for storage before being returned to the Digested Sludge Buffer Tank.

Anaerobic digestion of sludge takes place within a closed system, so the risk of bioaerosols from this source is low.

Biogas from the Primary Digester Tanks is collected into Biogas Storage holders and either used to fuel the Combined Heat and Power (CHP) Engines, heating boilers or combusted in an enclosed flare.

Odorous air from a number of locations is continuously extracted to an Odour Control Unit (OCU). The air is treated within the OCUs to remove odour and bioaerosols using various methods such as biofilters and activated carbon (described in Section 2.3), before it is released to the atmosphere.

Biofilters are considered to be a potential emission source for bioaerosols. Scrubbers are unable to remove 100% of bioaerosols, so in any location where there is a biofilter there is still the potential for bioaerosol emission, however it is expected to be minimal. It should however be noted that where carbon filters are used in combination with biofilters, whilst any emission of bioaerosols are expected to be minimal the possibility of emission cannot be entirely ruled out.

2.2.3 Digested cake

Digested sludge cake is conveyed to the Cake Barn, an enclosed and odour abated building. Conveyors are covered to minimise the risk of cake escaping. The cake is deposited from the conveyor onto the bay surface from a distance of approximately 2m. The sludge cake is deposited wet and moved to storage, where it forms a crust within 24 hours. It is not disturbed, until it is taken for export.

Digested sludge cake is then loaded onto trucks using a loading shovel and removed off site for agricultural land spreading under the Sludge Use in Agriculture Regulations 1989 (SUiAR), and in accordance with the Biosolids Assurance Scheme (BAS). There is considered to be a low risk of bioaerosols from digested sludge cake in the Cake Barn and there are no sensitive receptors within 250 metres.

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 the above mentioned tanks or process areas and treat the odorous compounds by means of different methodologies dependent upon the nature of the odorous 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.

Under the M9 guidance documents, the Environment Agency has identified that biofilters may give rise to bioaerosols during operation. For completeness OCUs with biofilters and within the permit installation boundary have been included in 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. Sludge cake is, therefore, produced daily and at similar levels across the whole year.

However, digested sludge cake storage on site, both in relation to duration and volume, varies across time. Digested sludge cake is removed from site for spreading to land. Land spreading is controlled under the Biosolids Assurance Scheme and Sludge Use in Agriculture Regulations (1989), as well as the Farming Rules for Water. As such, sludge cake will remain on site longer during wet periods and during autumn and winter periods where there would be limited uptake of nutrients from the solids. This means that there will be more cake within the storage bays during the autumn and winter, under normal conditions, than during the summer period.

2.3 Potential Sources

There are thirteen 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 as a source?
A6	CHP1	x
A7	CHP2	x
A8	Boiler	x
A9	Flare Stack	x
A10	THP PRV	x
A11	Primary Digester PRV	x
A12	Primary Digester PRV	x
A13	Biogas Storage PRV	x
A14	Biogas Storage PRV	x
A15	OCU 1	✓
A16	OCU 2	✓
A17	THP OCU	✓
A18	Siloxane Filter Stack	x

The location of these emission points is shown on the site layout plan at the emission plan in Appendix B.

The cake barn is not considered a source of bioaerosol emissions and is odour abated by OCU 1.

2.3.1 Source Assessment

The CHP engines, boiler, and emergency flares (points A6 – A9) 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.

There are three OCUs (point A15-A17) serving the STC (within the installation boundary:

OCU1 (A15) - 2-stage OCU with a Lava rock biofilter followed by annular carbon filters that extracts air from the Digested Sludge Dewatering Plant and the Cake Barn.

OCU2 (A16) - Lava rock biofilter followed by a Deep Bed Carbon unit extracts air from the Picket Fence Thickeners (PFTs)

THP OCU (A17) – An OCU consisting of one biofilter followed by carbon filters which extracts air from the following process units: Sludge Blending Tank, THP Dewatering Feed Buffer Tank, Pre-THP Dewatering Plant, THP Feed Silo, Cake Import Facility and the SAS Buffer Tank.

Biofilters are considered to be a potential emission source for bioaerosols, whether used in isolation or with a second methodology. The configuration of the OCUs means that any bioaerosols emitted from the biofilter stage should be captured by the activated carbon stage, and therefore, the likelihood of bioaerosol releases is anticipated to be minimal if at all. However, biofilters are considered to be a potential emission source for bioaerosols, whether used in isolation or with a second methodology.

The Pressure Relief Values (PRVs) (points A10 – A14) are normally closed and do not emit to atmosphere. However, in the event of an abnormal situation such as the failure of the flare stack 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. While the problem is rectified, biogas generation would be 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.

In addition to the point sources identified above, there is also an unchanneled potential release (diffuse source) from treated, dewatered sewage cake which is transferred via conveyor and stored in the cake barn at the site.

2.3.2 Risk

The overall treatment process is considered to be a low source of bioaerosols as discussed above, there are a number of 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. The digested sludge cake is handled and stored within a fully enclosed Cake Barn, which is odour abated. Therefore, fugitive releases of bioaerosols would be minimised.

The digested sludge cake is at the end of the sludge treatment process and is moist on deposition from the conveyor to the Cake Barn and requires no further treatment, prior to export onto before being deposited on agricultural land. It therefore is likely to have low concentrations of bioaerosols. The Cake Barn is also an enclosed building with an associated OCU (A15), therefore, the probability of exposure from this source is also minimised.

In addition, all storage tanks, treatment tanks and associated pipework are enclosed. The wet wells used to receive incoming sludge are below ground and covered with metal plates. Sludge screening and dewatering takes place in enclosed units. In addition, the PRVs are only opened in abnormal situations which are temporary and unlikely.

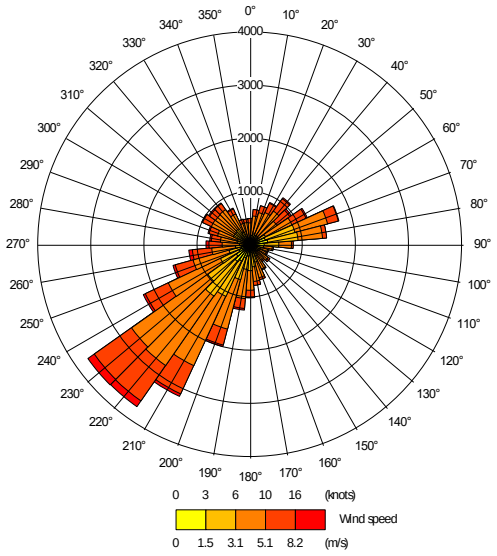
2.4 Pathways

Bioaerosols are very small and light in weight so can easily be transported by the wind from their source to a human health receptor where they may be inhaled.

The 2011-2015 wind rose for the most representative meteorological site, Gatwick airport (located approximately 2.2km East of the Site), is shown in Figure 1.

The figure illustrates the predominant wind direction to be southwesterly, predominantly in excess of 6 knots.

Figure 1 – Gatwick Airport Wind rose (2011-2015)



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. RR786 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 quantitative data for the levels of bioaerosols that might be associated with the potential sources at their sludge treatment centres. As a responsible operator, Thames Water are arranging for bioaerosol monitoring at a number of typical STC's in order to confirm that the understanding of the wider waste water treatment industry, that sewage sludge treatment processes do not give rise to elevated levels of bioaerosols, is correct. The sampling will be in accordance with the requirements of M9 and M17, and consist of a series of agar gel plates being placed downwind and upwind of the cake barn, including sampling points both directly upwind of the downwind sampling point and additional samples in the direction of the nearest sensitive receptors.

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.

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

Sensitive receptors (as identified for the OMP) have been considered. There are no receptors located within 250m of potential bioaerosols emission sources. Table 2 presents the closest receptor for completeness.

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

Receptor	Description	Source	Distance from closest source (m)	Direction from the Source
R1	Pickett's Wood (residential)	A18 OCU 1	800m	North East
		A19 OCU 2	850m	North East
		A20 OCU THP	880m	North East
R2	Upper Forecourt (car park)	A18 OCU 1	455m	North
		A19 OCU 2	450m	North
		A20 OCU THP	455m	North

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.

The assessment has demonstrated that the potential sources of bioaerosols emissions are more than 250m from the closest sensitive receptor (R1& R2). A dispersion distance greater than 250m would likely result in concentrations of bioaerosols falling to within background levels i.e., 'acceptable level' thresholds set out within the EA guidance. Receptors beyond 250m are not required to be considered. The location of R2 is also North of the prevailing West Southwest / Southwest wind direction, so the likely frequency of a bioaerosol event at this receptor would also be low.

The magnitudes of release from the sources considered would be small, by the nature of the releases and the site's monitoring, maintenance, mitigation, and management practices undertaken (as presented in Section 2.3). The probability of exposure under normal operating conditions would be low.

Planned monitoring of bioaerosol emissions by Thames Water is expected to validate the expectation that process contributions of bioaerosols from sewage sludge treatment works would comply with the 'acceptable level' thresholds, set out within EA guidance.

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

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. Such an event would result in releases of biogas from the PRV's located on the roofs of the digesters and in the gas holder compound, 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 Crawley 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 of exposure. This considered control measures in place to reduce the probability or magnitude of release.

Three potential sources of bioaerosols within the site processes have been identified, connected to the operation of OCU 1, OCU 2, OCU THP. These sources were considered to have a small magnitude for release. The risk of abnormal releases from PRVs was scoped out.

The assessment identified no bioaerosol emission sources within 250m of a static receptor. The closest receptor was noted as North to the prevailing south westerly wind direction.

Taking the site control measures, maintenance and management practices into consideration, the probability of exposure would likely be low and duration of release short.

Therefore, with the dispersion distances being equivocal to a likely 'background concentration' of bioaerosols, the risk of bioaerosol effects at sensitive receptors, from normal operating conditions at Crawley would be **negligible**.

3.1 Sampling

Due to the lack of sensitive receptors within 250m of potential bioaerosol emissions at Crawley STC, no sampling locations are proposed.

Appendix A. Site Location Plan

KEY:

Site Location

P01	JAN. 2022	FOR INFORMATION	AR	MM	JK	MM
Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Revd	Apprv'd

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Client

Thames Water

Project

STC IED PERMIT
CRAWLEY STW

Drawing title

FIGURE 1
SITE LOCATION PLAN

Drawing status

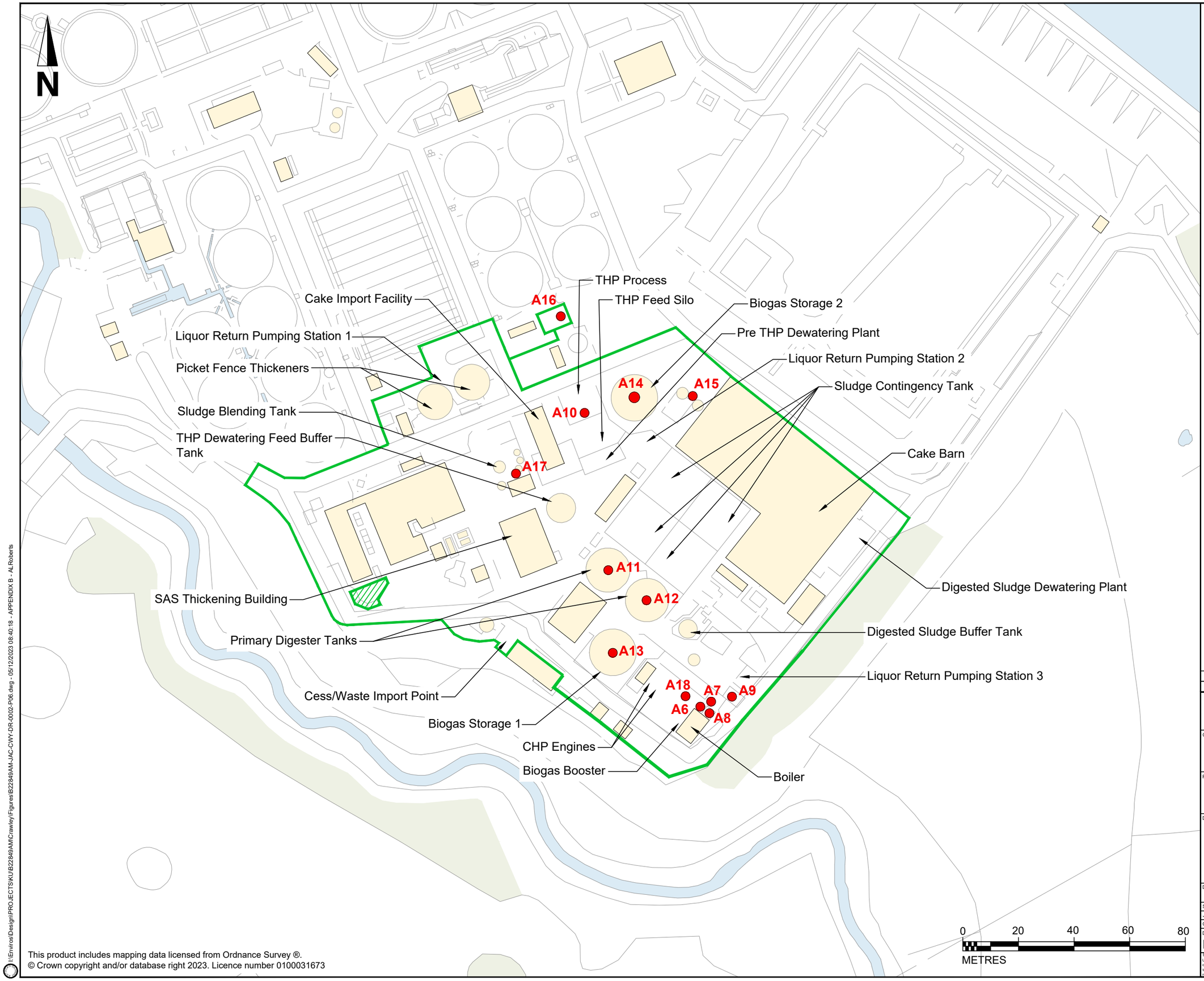
PERMITTING

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

Drawing number

B22849AM-JAC-CWY-DR-0001

Appendix B. Potential Bioaerosol Emission Points



KEY:

Installation Boundary

Area Excluded from Permit Scope

A6 - CHP 1
A7 - CHP 2
A8 - Boiler
A9 - Flare Stack
A10 - THP PRV
A11 - Primary Digester PRV
A12 - Primary Digester PRV
A13 - Biogas Holder PRV
A14 - Biogas Holder PRV
A15 - OCU 1
A16 - OCU 2
A17 - THP OCU
A18 - Siloxane Filter Stack

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
P01	DEC 2023	FOR INFORMATION	AR	MM	JK	MM

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Client: Thames Water

Project: STC IED PERMIT
CRAWLEY STW

Drawing title: APPENDIX B
INSTALLATION BOUNDARY
AND AIR EMISSION POINTS

Drawing status: PERMITTING

Scale	1:1250	DO NOT SCALE
Jacobs No.	B22849AM	Rev P01
Client no.		

Drawing number: B22849AM-JAC-CWY-DR-0002

Appendix C. Receptors within 250m of potential emission points