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1. Introduction

United Utilities Water Limited (UUW) submitted a permit application for the biological treatment of waste at an anaerobic digestion facility co-located at Burnley Wastewater Treatment Works (WwTW). The application was required due to the implementation of the Industrial Emission Directive (IED) for the biological treatment of waste following the issue of the waste treatment Best Available Technique Reference (BREF) document.

The permit variation application was refused on 15th September 2022 as it was considered that UUW had not demonstrated that the proposals meet all of the Best Available Techniques (BAT) requirements or proposed suitable alternative measures to provide the same level of environmental protection. This document supplies outline information regarding proposed improvements at the site.

2. Containment

2.1. Secondary Containment Assessment and Solutions

A review of our previous Burnley WwTW secondary containment assessment submission has been undertaken and as such we are proposing to construct permanent containment solutions, in relation to these assets, in order to meet the requirements of BAT conclusion 19.

Attached with this permit application is the updated Burnley Secondary Containment Modelling Assessment prepared by Stantec. The assessment has been undertaken using the Anaerobic Digestion & Bioresources Association (ADBA) Risk Assessment Tool, which is based on CIRIA C736: Containment systems for the prevention of pollution. Based on the ADBA risk assessment tool, the class of secondary containment for the site is Class 2 (moderate risk, intermediate degree of containment integrity required).

The ADBA risk assessment was used to inform the hydraulic modelling undertaken for the site. A 2D model of the Burnley site was constructed in InfoWorks ICM to assess the impact of failure or loss of containment on site. Use of the 2D hydraulic model allows the failure of a containment vessel to be represented, including the subsequent overland flow and ponding of released flow.

The following assets were modelled under a catastrophic failure scenario:

Table 2.1.1: Tank Capacities

Group	Asset Description	No. of units	Total Capacity (m^3)	110% of largest tank	25% of aggregate
1	Digesters x2 (only 1 operational)	1	2,025 each	2,228	N/A
2	Screened Sludge Tank	1	2,500	2,750	N/A
3	Digested Sludge Tanks (only 1 operational)	2	763 each	839	203
	DAF	1	48	53	
4	Thickened Sludge Silo	1	353	388	N/A
5	Thickening Centrate Buffer Tank	1	200	220	53
	Screened Sludge Buffer Tank	1	10	11	
6	Dewatering Centrate Buffer Tank	1	217	239	N/A

A simulation was carried out for each group of tanks representing the release of 110% of the largest tank within the group. Results from the simulations indicate that the spilled flows from these tanks could reach receptors, as detailed in the Stantec report. High-level containment solutions for each critical asset have therefore been developed to meet the requirements set out in CIRIA C736. The proposed mitigation measures to be installed at Burnley to comply with Class 2 storage requirements are as follows:

- Containment walls
- Sacrificial areas
- Flood gate
- Existing hardstanding area containment
- Leak and spillage detection monitoring

Based upon the conceptual design, the following containment measure quantities will be required. Detailed design will be necessary to confirm the final quantities.

Table 2.1.2: Containment Measure Quantities

Mitigation	Length (m)	Area (m^2)
Retaining Wall (1.5m)	234	N/A
Retaining Wall (1.0m)	426	N/A
Flood gate	17	N/A
Sacrificial area	N/A	8,000
Existing hardstanding	N/A	15,000

Solution modelling has been completed on all tanks to show the simulated flood extents and the depths of the settled sludge with the proposed mitigation measures in place. The modelling has confirmed that the solutions proposed would provide adequate containment, and thus meet the requirements under BAT conclusion 19.

Additionally, in order to manage and monitor the risk of potential leakages from the existing sealed drainage system, in particular the underground components in use, we have assessed the risk rating of all below or partially below ground assets. Further detail on this risk assessment process and the design of the containment system is provided below.

2.1.1 Containment Walls

Where containment walls have been proposed, these will be in accordance with Chapter 7 of CIRIA C736. Liquid retaining and containment structures”. Detailed design will determine the best design solution (i.e. in-situ reinforced concrete or pre-cast units) including material, dimensions and finishes. Following installation, detailed inspection shall be completed by a competent person every five years and following a spill event.

2.1.2 Sacrificial Areas

All sacrificial areas will be reprofiled to include an impermeable membrane which will prevent spilled sludge entering the soil until the clean up operation can be completed. The final solution will be determined in detailed design with the most likely options being impermeable geosynthetic membrane or concrete.

2.1.3 Flood Gate

The proposed flood gate, for the area around the SAS thickening plant, has been provided to comply with the containment requirement and provide a fully contained bund, whilst allowing operational and maintenance vehicular access to the assets.

Following installation, routine inspection shall be undertaken by the operational team during regular site walkovers and following a spill event.

2.1.4 Existing Hardstanding Area Containment

All existing hardstanding areas being used for secondary/ tertiary containment will be routinely checked for cracks and defects to ensure they are compliant with CIRIA C736 secondary containment Class 2. Site inspection tours of the impermeable surface are carried out daily by site-based staff and monthly by the site’s Environmental Regulatory Adviser (ERA).

2.1.5 Leak and Spillage Detection

A programme of leak and spillage detection monitoring, which for Burnley, includes the use of existing flow meters or periodical surveys and interlock connection of various high level alarms to feed pumps as outlined below:

- Pipework: where no flow meters are currently installed, pipework with buried mechanical fittings will be surveyed every 2 years and every 5 years where not present, using techniques such as thermal cameras, magnetic flux leakage and in pipe crack detection technology.
- Sludge storage tanks: the high level alarms installed on the sludge storage tanks (which do not currently inhibit feeds) will, where possible be interlocked to the feed pumps to allow automatic shut offs to prevent tank overflow when a high level alarm is triggered.

As well as undertaking the monitoring identified above, site inspection tours of the impermeable surface, storage tanks and above ground drainage system are carried out daily by site-based staff and monthly by the site’s Environmental Regulatory Adviser (ERA). These tours include visual inspection of the site drains to ensure they are working as expected. Regular CCTV inspections will also be carried out (every 5 years) on the drainage systems. If any issues or concerns are identified, they will be logged on the corporate action tracker for prompt remediation.

2.2. Timescales to Achieve BAT

To reduce the timeline for delivery of improvements UU has had to split the site works into individual small projects. This is not our normal approach to delivery of a site programme of works as it leads to inefficiencies and multiple site contractor establishments. In developing dates for delivery our standard approach is to model the timeline for completion and use our P50 estimate (50% likelihood of completion) as the target date. We have applied this approach to the revised delivery model.

The timescale for completion of the spill containment improvements is December 2024 and is based on our P10 (10% likelihood of completion) forecast which means it is the best-case date for completion. Our P50 date, which is based on construction programme norms is2027. We will endeavour to deliver the improvements as quickly as possible but, as with any construction project involving ground works there are unknowns, e.g. ground conditions, constraints from underground services etc., that can impact the timeline. It is important to note that there are also supply chain shortages currently which are impacting all industries. We will, as part of our implementation, work with the relevant EA officers to keep them informed of progress and, if required, any change in the delivery timeline.

Table 2.2.1 sets out the programme of works to achieve BAT compliance, regarding secondary containment at Burnley Sludge Treatment Installation.

Table 2.2.1: Containment Improvement Programme to Achieve BAT

Activity	Timescale – Expected Completion (P10 estimate)	Interim Actions/Measures until BAT Compliant
Secondary containment (existing infrastructure) – installation of impermeable surfaces and curbing/walls where risk of overflows and failures from mass breach has been identified, in order to meet the requirements of BAT conclusion 19d	December 2024	Ongoing maintenance and inspection of tanks to ensure that integrity is maintained. Daily housekeeping tours by site based staff, including checks for any evidence of leaks or spills. The site is either manned, or when not, monitored by the Integrated Control Centre (ICC) on a 24/7 basis using SCADA and critical process alarms.

3. Odour Management

3.1. Odour Abatement Assessment and Solutions

There is one operational odour control unit (OCU) at the site, emission point A4. This serves the following sludge treatment assets:

- 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 OCU comprises two stages of treatment; two dual bed trickling biofilters operating in parallel followed by activated carbon adsorption. The first stage biofilters are predominantly 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 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.

There are also two non-operational OCUs at the site:

- OCU serving the serving the sludge screen press enclosure; and
- OCU serving the dewatering building (centrifuges/conveyors).

A review of the operation of these OCUs has been undertaken by UU technical staff during the preparation of the updated permit application, odour management plan and associated BAT assessments. Following this review, it is proposed that the flow from the smaller non-operational OCUs is diverted to the main OCU (A4). The rationale for this is that the main OCU has additional treatment capacity currently not being utilised and so can accommodate the flow from the other two smaller OCUs. This has the benefit of reduced maintenance (only one unit to maintain) and improved monitoring, since this unit has online monitoring for hydrogen sulphide in the discharge stack.

The OCU has a design airflow of 6,000m^3/hr, which included for 2 x digested sludge buffer tanks, each extracting at 903m^3/hr. As only one tank is in operation and the second tank is no longer required, there is a spare 903m^3/hr air flow capacity. Airflow from the dewatering building OCU represents a total airflow of 768m^3/hr and the sludge screen enclosure 148m^3/hr, therefore the main OUC (A4) has sufficient capacity to treat this additional flow. The existing fans on the main OCU may need to be modified to draw this airflow but this is yet to be determined.

The OCU 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
- Carbon filter differential pressure

3.2. Timescales

Table 3.2.1 sets out the programme of works to consolidate the odour abatement system into one OCU.

Table 3.2.1: Odour Abatement Improvement Programme

Activity	**Timescale – Expected Completion (P50 estimate)**	**Interim Actions/Measures**
Odour abatement systems – consolidation of abatement to one OCU	December 2024	Ongoing maintenance and inspection of OCU's to ensure that integrity is maintained. Daily housekeeping tours by site based staff, including checks for any evidence of odour emissions. See Odour Management Plan included with this permit application for details regarding sniff testing etc.

4. Open Tanks

4.1. Diffuse Emission Assessment and Solutions

BAT 14 requires control measures to be used to reduce diffuse emissions to air, and containment/ enclosure (BAT 14d) is identified as being most relevant depending on the risk posed by the waste. However, BAT 14d also acknowledges that the use of enclosed equipment may be restricted by safety considerations (e.g. due to the risk of explosion). The installation has one open tank at Burnley as detailed in in Table 4.1.1 below.

Table 4.1.1: Sludge Storage/Treatment Tank Construction and Capacities

Tank Name	Construction	Tank Emplacement	Tank Capacity
Unscreened sludge buffer tank	Glass-fused-to-steel construction	Wholly above ground	37m^3

In order to characterise and, as far as possible, quantify the diffuse emissions from these tanks, we propose to carry out a programme of monitoring for ammonia, hydrogen sulphide, methane and volatile organic compounds (VOCs). Currently we have assumed that this monitoring will be undertaken either as grab samples or using hand held instruments in line with the MCERTS Performance Standard for Handheld Emission Monitoring Systems (Version 4, September 2018) combined with the use of a sampling hood to determine process specific, unit area emission rates. If this approach is not considered acceptable by the Environment Agency the methodology would be modified based on taking discrete samples subject to off-site analysis.

The monitoring will be carried out on at least two occasions over a 6-month period in order to consider seasonality (i.e. summer and winter conditions). In determining the most appropriate monitoring methodology for diffuse emission, guidance will be sought from The JRC Reference Report on Monitoring of Emissions to Air and Water from IED Installations, 2018.

The proposed sampling methods and standards for off-site analysis are:

- Ammonia (NH_3) - EN ISO 21877
- Hydrogen Sulphide (H_2S)- CEN TS 13649 for sampling, NIOSH 6013 for analysis
- VOCs GCMS - CEN TS 13649
- Methane – EN 2513
- Oxygen – electrochemical cell

The monitoring data collected will be used to confirm the level of emissions and to determine the need to provide mitigation, i.e. if BAT 14 should or should not apply. The base design solution highlighted by the EA is that tanks should be enclosed and directed to an appropriate abatement system. This is one of a number of potential solutions for mitigating emissions. Our approach will be to confirm the need and then, if required, develop an appropriate solution to reduce emissions. The design solution will need to satisfy all relevant legislative and UUW safety criteria.

4.2. Timescales to Achieve BAT

The monitoring programme will be completed and confirmation of the need to meet BAT 14, along with the proposed solution for the tanks will be submitted to the EA as per the permit improvement conditions.

The Sector EA/WaSC's IED Workshop 29th September 2022 (via MS Teams) provided the following feedback to WASCs:

1. "EA's approach will be to permit facilities and add improvement conditions until the end of 2024. There will be no deadlines beyond this".
2. "If best endeavours are being undertaken to comply then recommendation to area colleagues not to implement enforcement post December 2024".

The challenge of managing emissions from open tanks is complex and has been raised by the Sector as a concern in terms of timescales and ensuring it does not introduce safety concerns. Our proposed timeline for delivery of a solution, if required, is December 2024. This is to align with Point 1 above. We will use best endeavours to deliver any required solution in order to meet obligations referenced in Point 1 but delivery of assets by December 2024 cannot be guaranteed. The delivery time is subject to confirmation of the solution and supply chain capability to deliver this over the appropriate timescale. Delivery needs to take into account, timescales for procurement of equipment, pre-construction risk reviews (HAZOPs etc.) and construction. The risk reviews to ensure safe delivery and future operation and maintainability are critical stages in ensuring the final solution is safe and effective.

Table 4.2.1 sets out the programme of works to achieve BAT compliance for the open tank.

Table 4.2.1: Improvement Programme to Achieve BAT

Activity	**Timescale – Best Endeavours Completion**	**Interim Actions/Measures until BAT Compliant**
Monitoring to confirm the need for mitigation under BAT 14d and then, if required, develop an appropriate solution to reduce emissions.	December 2024	A monitoring programme as per the permit improvement condition requirements