Ellesmere Port WwTW EPR/ZP3031LJ
BAT Improvement Programme September 2022

Contents

1. Introduction

United Utilities Water Limited (UUW) submitted a permit variation application for the biological treatment of waste at an existing anaerobic digestion facility co-located at Ellesmere Port 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 application proposes to add biological treatment to the existing specified generator permit (EPR/ZP3031LJ) for the combined heat and power (CHP) engines, which will become a directly associated activity.

The permit variation application was refused on 8th June 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 Ellesmere Port 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 Ellesmere Port 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 Southport 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	Mesophilic Digesters	3	10,200 (1,992 above ground each)	2,191	1,584
	Thermophilic Digesters	3	360		
2	Post Digestion Tank	1	2,200	2,420	N/A
3	Centrate Tank	1	1,200	1,320	310
	Centrate Buffer Tank	1	40		
4	Thickened SAS Tank	1	834	917	326
	Unthickened SAS Tank	1	469		

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 Ellesmere Port to comply with Class 2 storage requirements are as follows:

- Containment kerbs

- Containment walls
- Sacrificial areas
- Speed humps
- Flood gate
- Existing hardstanding area containment
- Leak detection for below ground assets

Based upon the preliminary design, the following containment measure quantities will be required.

Table 2.1.2: Containment Measure Quantities

Mitigation	Length (m)	Area (m^2)
Retaining Wall (1.5m)	505	N/A
Retaining Wall (1.0m)	275	N/A
Retaining Wall (0.5m)	40	N/A
Raise concrete curbs (0.3m)	160	N/A
Raise concrete curbs (0.15m)	140	N/A
Flood gate	6	N/A
Speed bumps (0.15m)	16	N/A
Sacrificial area	N/A	12,000
Existing hardstanding	N/A	17,500

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 Kerbs

All kerbing would be as a minimum to UU standard detail. This proposal utilises the BS EN 1340 Type HB1 kerb units and provides c.150mm depth of containment. To provide enhanced containment as necessary larger precast concrete kerb units would be used (Trief GST2A or equivalent) to provide c.325mm depth of containment).

2.1.2 Containment Walls

Where containment walls have been proposed, these will be in accordance with Chapter 7 of CIRIA C736 and additionally "BS EN 1992-3:2006 Eurocode 2 Design of concrete structures. 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. The walls currently proposed will be 0.5m, 1m or 1.5m in height above existing finished ground level on the spill side of the wall with suitable panel widths and watertight construction joints. The design life of the wall will be a minimum of 50 years. Following installation, detailed inspection shall be completed by a competent person every five years and following a spill event.

2.1.3 Speed Humps

The proposed speed humps have been provided with two objectives:

1. Containment; the 150mm high speed humps are to be located to provide containment of any spill on the site access roads.
2. Baffle; where the speed humps have been proposed in series, this is to reduce the velocity of the spill and to channel flow to achieve containment within the identified areas of the site.

The design of the speed humps will be in accordance with "The Highways (Road humps) Regulations 1999" in relation to approach gradients and crest widths. As a minimum, the ramp will be the full width of the access road to tie-in with kerbing and to a height of 150mm (deviation from above regulation) above the existing finished surface level over a minimum length of 1m, in either concrete or tarmac (to be determined during detailed design) to create an impermeable surface. Following installation, routine inspection shall be undertaken by the operational team during regular site walkovers and following a spill event.

2.1.4 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 proposal is to place an impermeable geosynthetic barrier beneath all existing permeable areas with the potential to be impacted within the installation boundary. In the event of a spill all material above the barrier would be treated as a sacrificial media as per the guidance in C736. The outline design of the system is as follows:

- The geosynthetic barrier shall conform to the relevant provisions of BS EN 13362:2018.
- A 50 Year service life is proposed for the barrier.
- The barrier shall be resistant to water, hydrocarbons and any anticipated chemicals used in the proximity of proposed location.
- The barrier shall be laid in accordance with manufacturer's instructions by experienced and suitably qualified staff (British Geomembrane Association (BGA) accredited or equivalent).

- Prior to placing the barrier, the existing surface layer shall be removed and the sub-base appropriately prepared. As necessary, the barrier lining shall be protected from damage with use of appropriate geotextiles and/or fill material. Above any protective layers there shall be a minimum of 150mm of cover material.
- The barrier shall be anchored in accordance with manufacturer's instructions and overlap all existing impermeable surfaces to ensure continuity in impermeable surface.
- The permeable cover layer shall be drained via perforated land drainage connected into the existing closed site drainage system. The land drainage shall be laid in trenches lined with the impermeable geosynthetic barrier jointed and anchored as necessary to ensure continuity in impermeable surface.
- Following installation detailed inspection shall be completed by a competent person every five years.

This proposal is considered to be the most sustainable option given the significant size of the area that is affected. The only feasible alternative, to provide comparable impermeability, is the use of reinforced concrete. This would have a number of disadvantages:

- It would result in higher net excavation waste.
- There would be no surface water attenuation resulting in a need for site drainage to deal with higher peak rainfall flows.
- The size of the area is such that a significant number of construction and movement joints would be required.
- The size of the area is such the potential for settlement and cracking would be significant.

The flexible geosynthetic barrier approach proposed would avoid these disadvantages.

2.1.5 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. The flood gate will be a fully automated proprietary system set as normally closed. The system will include open and close sensors and set to alarm in the open position.

The gate will be designed in accordance with various and relevant standards, including, but not limited to, BS EN 12453:2001 – Industrial, commercial and garage doors and gates, as well as PAS 1188:2014 Flood Protection products. Typically, the coating provided to the gates are based on 25-30 year design life with the main gate material having a design life of 40-50 years. Following installation, routine inspection shall be undertaken by the operational team during regular site walkovers and following a spill event.

2.1.6 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).

2.1.7 Leak Detection

The risk rating of all below or partially below ground assets has been assessed based on the following approach:

1. The likelihood of a leak occurring; based on consideration of the existing physical condition, material and location of the asset.
2. The severity of this event were it to happen; based on consideration of the contents of the asset and the volumes/flow rates.
3. The presence and likelihood of the leak reaching a receptor; based on the type of receptor, distance from the asset and general topographical considerations.

The output of this exercise generated a "risk of harm" score that served to categorise assets into high, medium or low risk. Based on this risk and being cognisant of the physical realities on site (provided by site walkovers and inputs from the site operational team, supervisors, operational and area mangers, and technical experts) decisions were made on the best approach to mitigate the risk of leaks from the assets. Assets of medium and high risk were deemed to require leak detection mitigation. Those of low risk were assessed on a case-by-case basis.

The assessment identified a programme of leak detection improvements, which for Ellesmere Port includes the installation of flow meters, interlock connection of various high level alarms to feed pumps and groundwater boreholes as outlined below:

- Pipework: In the majority of cases for pipework the only option available was the installation of network/PLC linked flow meters at appropriate locations (upstream and downstream of each pipe run) to allow for real time indication of any issues, triggering a rapid intervention at site level by operations.
- Sludge storage tanks: the high level alarms installed on the sludge storage tanks (which do not currently inhibit feeds) will be interlocked to the feed pumps to allow automatic shut offs to prevent tank overflow when a high level alarm is triggered.
- Sludge storage tanks (partially or wholly below ground): the construction and installation of boreholes adjacent to these tanks to allow the periodic sampling and analysis of groundwater, this would identify any potential issues and trigger a site intervention. This would supplement the inspections of the assets, undertaken by the site operations team on a daily basis under standard management procedures.

In some minor case where the risk of harm was low and where practically possible, inspections of assets would be undertaken by the site operations team on a daily basis under standard management procedures.

As well as undertaking the improvements 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, with the first inspection being completed by 31 March 2023. If any issues or concerns are identified, they will be logged on the corporate action tracker for prompt remediation.

2.1.8 SAS Thickening Plant

Prior to operating the SAS thickening plant and associated assets, as a technically connected process to the main IED installation, United Utilities Water Ltd will ensure that the assets and operation satisfy the requirements of BAT conclusion 19. For the avoidance of doubt this shall include secondary containment and spill monitoring. Due to timescales involved with delivering a permanent capital solution for secondary containment of the SAS thickening plant, we may need to consider a temporary BAT compliant containment solution as a stop-gap. This temporary containment may be required in order to facilitate the operation of the SAS thickening plant as a technically connected activity whilst the permanent containment solution is progressed. The EA will be notified as and when it is intended to operate the SAS thickening assets.

The proposal for temporary containment around the SAS Plant is to use a proprietary modular wall system tied into an impermeable geosynthetic barrier. The outline design of the system is as follows:

- Modular interlocking wall and corner sections are proposed to form a bund to the required area (110% of the largest tank which is the thickened sludge tank at 830m^3 i.e. 913m^3 minimum containment capacity is required).
- The geosynthetic barrier shall conform to the relevant provisions of BS EN 13362:2018.
- The barrier shall be resistant to water, hydrocarbons and any anticipated chemicals used in the proximity of proposed location.
- The barrier shall be laid in accordance with manufacturer's instructions by experienced and suitably qualified staff (British Geomembrane Association (BGA) accredited or equivalent).
- Prior to placing the barrier, the existing areas of gravel surfacing shall be removed and replaced with sand or another appropriate sub-base.
- The barrier shall be anchored in accordance with manufacturer's instructions and overlap all existing impermeable surfaces to ensure continuity in impermeable surface.
- It may be necessary to create temporary sumps within the temporary bund for surface water collection where it is not possible to tie into the existing closed drainage system. These sumps would be in the newly created impermeable areas currently surfaced with gravel. Each sump would be appropriately lined with the geosynthetic barrier (jointed and anchored as necessary) to ensure continuity in impermeable surface.

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. For the delivery of improvements, the dates presented in Table 2.2.1 are based on our P50 estimate for implementing techniques to reduce the likelihood and impact of overflows and failures from tanks and pipework.

The timescale for completion of the spill containment improvements we have provided is October 2024 and is based on our P25 (25% likelihood of completion) forecast which means it is the best-case date for completion. Our P50 date, which is based on construction programme norms is October 2025. 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 and leak detection at Ellesmere Port Sludge Treatment Installation.

Table 2.2.1: Containment Improvement Programme to Achieve BAT

Activity	Detailed Design Timescale	Timescale – Expected Commencement	Timescale – Expected Completion	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	From now until October 2023	October 2023	October 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.
Installation of leak detection system for underground pipework to allow detection and repair of leaks, in order to meet requirements of BAT conclusion 19h	From now until October 2023	October 2023	October 2024	Daily housekeeping tours, which include visual inspection of the site drains to ensure they are working as expected (no blockages). Regular CCTV inspections will also be carried out (every 5 years) on the drainage systems

Activity	Detailed Design Timescale	Timescale – Expected Commencement	Timescale – Expected Completion	Interim Actions/Measures until BAT Compliant
				– the first inspection will be undertaken by 31 March 2023).
Interim secondary containment for SAS thickening plant (new infrastructure) – in order to meet requirements of BAT conclusion 19c and 19d	Optioneering to be conducted during permit determination. Detailed design will be confirmed during permit determination.	To be agreed with the EA prior to issue of the permit	To be agreed with the EA prior to issue of the permit	Prior to operating the SAS thickening plant and associated assets, as a technically connected process to the main IED installation, United Utilities Water Ltd will ensure that the assets and operation satisfy the requirements of BAT conclusion 19.
Permanent secondary containment for SAS thickening plant (new infrastructure) – in order to meet requirements of BAT conclusion 19c and 19d	Optioneering to be conducted during permit determination. Detailed design will be confirmed during permit determination.	To be agreed with the EA prior to issue of the permit	To be agreed with the EA prior to issue of the permit	Prior to operating the SAS thickening plant and associated assets, as a technically connected process to the main IED installation, United Utilities Water Ltd will ensure that the assets and operation satisfy the requirements of BAT conclusion 19.

3. Odour Management

3.1. Odour Abatement Assessment and Solutions

The facility has four odour control units (OCUs), each with its own emission stack, which are not currently operational. These are:

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

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

Adsorption is identified in BAT 34 as a suitable technique for abating channelled emissions to air. To further support this, odour modelling of the OCU channelled emission points to air has been undertaken, to demonstrate the effectiveness of the odour abatement solutions.

The odour dispersion modelling (supplied with this permit application) demonstrates that the design operation of the OCUs at the site is compliant with H4 standards and with the UUW Odour Control and Removal Asset Standard. As such OCUs A9 to A12 will be reinstated. Prior to operating the SAS thickening plant and associated assets, as a technically connected process to the main IED installation, OCU A13 will be commissioned/made operational.

3.2. 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. For the delivery of improvements the dates presented are based on our P50 estimate for odour emissions (refurbishment of four odour control units and commissioning of a fifth odour control unit).

We will endeavour to deliver the improvements as quickly as possible. It is important to note that there are also supply chain shortages currently which is 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 3.2.1 sets out the programme of works to achieve BAT compliance for the OCUs.

Table 3.2.1: Improvement Programme to Achieve BAT

Activity	Detailed Design Timescale	Timescale – Expected Commencement	Timescale – Expected Completion	Interim Actions/Measures until BAT Compliant
Odour abatement systems –reinstatement of suitable OCU's, in order to meet the requirements of BAT conclusion 14d and 34	From now until June 2023	June 2023	October 2023	See Odour Management Plan included with this permit application.