Leak Detection and Repair Plan (LDAR) – Basingstoke

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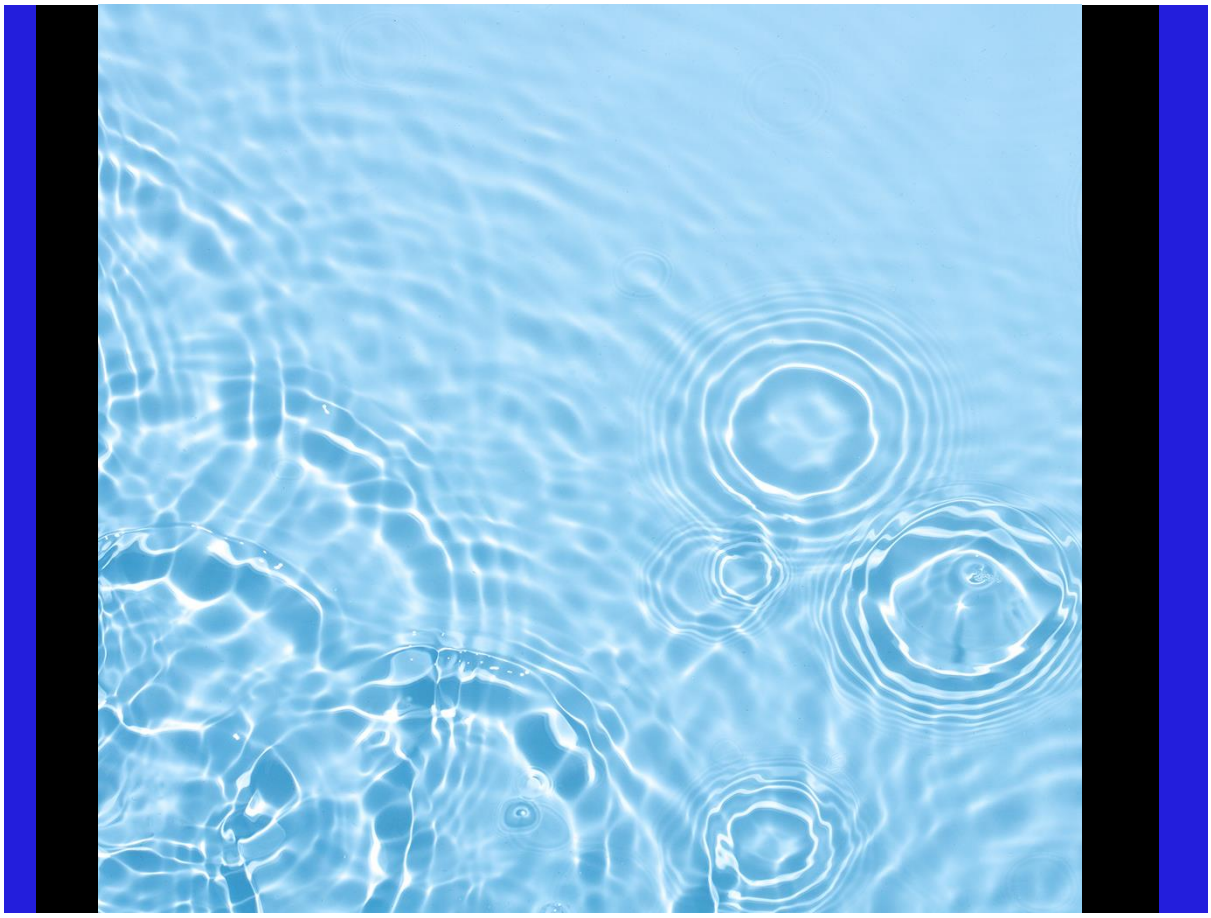

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Acronyms and abbreviations

EPR	Environmental Permitting Regulation
PRV	Pressure Relief Valve
EA	Environment Agency
VOC	Volatile Organic Compounds
BAT	Best Available Techniques
SHE	Safety Health and Environment
STC	Sludge Treatment Centre
STW	Sewage Treatment Works
TWUL	Thames Water United Ltd

Document Control

This document is due to be reviewed every four years, unless there is a change to the biogas system described in the document.

Revision	Date Issued	Next Review Due	Owner

1. Introduction

The following document describes the methodology used to locate, identify and mitigate against fugitive emissions to air of Volatile Organic Compounds (VOC) and biogas from the permitted activities as part of the Environmental Permitting Regulations (EPR) and Best Available Techniques (BAT) requirements. This methodology benefits the safety protection of site staff and increases productivity and the value of the process, as well as protecting the environment. This document supports the implementation of BAT 14 (h) and is aligned with the Basingstoke STW Odour Management Plan. Where a Safety Health and Environment (SHE) SHE6 form has been completed, or a SHE39 assessment undertaken, the outcomes should be used to inform how to proceed with biogas investigations and / or monitoring.

Thames Water, in accordance with BAT 14(h) utilise flame ionisation for the detection of leak of biogas, in accordance with 'sniffing methods' as defined in Table 6.2 of the Waste Treatment Best Available Technique conclusions document.

1.1 Scope

This document is applicable to all the permitted activities at the Thames Water Utilities Ltd ("Thames Water" or TWUL) Basingstoke Sludge Treatment Centre (STC) site, which produces biogas for combustion in the two Combined Heat and Power (CHP) engines, one boiler and one emergency flare stack from the anaerobic digestion of sewage sludge, creating an energy and electricity source and helping to minimise Thames Water's environmental impact.

- Biogas pipework and storage including:
    - Welds / joins;
    - Seals;
    - Flanges;
    - Valves;
    - Feeding and digestate separation units;
- Biogas Compressors / Boosters;
- Conveyors and presses;
- Reception storage;
- Digestate storage;
- Building containment;
- Biogas storage system including:
    - Pressure relief valves;
- Condensate traps;
- Primary Digester Tanks including:
    - Roof and cover fixings; and
    - Pressure Relief Valves.

Across sites, emissions of sludge to the environment tend to be minimal due to the site surface drainage measures in place and regular tour inspections. Therefore, emissions of sludge are not within the scope of this document.

1.2 Responsibility

The Site Manager for the Basingstoke site is responsible for ensuring the environmental permit conditions are complied with. Responsibility for undertaking the monitoring and reporting of any defects for repair falls to the Operations and Maintenance team for the site.

2. Assets and Monitoring

2.1 Identifying Assets

The following assets are scheduled for routine proactive inspection via flame ionisation detection on an annual basis:

- 2 x CHP Engines;
- 1 x Boiler;
- 1 x ground mounted Emergency Flare Stack;
- 3 x Primary Digester Tanks;
- 1 x dual membrane Biogas Storage holder;
- Pipework;
- Condensate Pots / Traps on the biogas lines
- Siloxane Filter;
- Pressure Relief Valves (PRV); and,
- Biogas compressors / boosters.

This list is based on the sources where biogas and potentially VOCs are generated; transported; stored and utilised at the Basingstoke STC.

Prior to commencing any monitoring or inspection, the most recent P&ID plans for the biogas system should be obtained for the Basingstoke STC, to ensure all relevant pipework, fittings and equipment are identified for inspection.

The primary assets listed above are all uniquely identified with ID numbers except for pipework, which makes them easy to identify by the individual conducting the leak detection monitoring. Therefore, the assets across sites can be scheduled for inspection and identified for repair if necessary. Any new or replacement assets must complete an asset tagging process to maintain an accurate list for each site within SAP. Biogas Compressors / Boosters and valves are utilised, when possible, to reduce the risk of leaks from the system.

2.2 Design Specifications

All TWUL biogas assets have been built to a design specification (Thames Water, Water Industry [WIMES], national and international standards), which includes an operational lifespan.

For example, the PRVs are fitted with intrinsically safe limit switches which operate when an event occurs (pressure or vacuum relief) in accordance with Thames Water specifications.

All assets are inspected and maintained in accordance with Thames Water maintenance standards which are based on Water industry best practice.

The boiler and CHP engines are subject to routine inspection and maintenance by specialist contractors.

2.3 Monitoring

The assets mentioned are subject to daily monitoring also, as part of the operator's daily site duties. The Thames Water SHE 6M (visual assessment), which is completed quarterly by the Site Manager, and the site's SHE 39 Biogas Management Plan are examples of monitoring completed on site. Site operational staff are required to wear methane detective personal biogas monitors which detect leakage in the area surrounding the site operator. Human senses (i.e. sight and smell), can also be utilised to detect a potential methane leak in a general area). While conducting visual inspections, the operator will look for signs of degradation of the equipment. These systems would detect any significant leaks within the system.

Gas monitoring training delivered through a Thames Water approved training provider must be completed to be able to use the personal biogas monitors. This training is recorded on staff training records and subject to periodic refresher training. All personal biogas monitors are checked prior to use on site and are periodically externally recalibrated in accordance with manufacturer's requirements.

All PRVs are subject to regular inspection and energy generation from the CHP engines are monitored on a continuous basis through SCADA systems, as a proxy for biogas generation. Heat generation from the boiler is

also monitored. A change in CHP utilisation and generation may be a sign that the digestion process is out of equilibrium or that there is a leak within biogas system. Electricity metering is completed half hourly. This would be alarmed to a control room via the SCADA system for the appropriate action to be undertaken. Process works is undertaken by a local operator and remedial works are completed on pipework or similar by a contractor. PRVs are monitored and if a PRV is activated, operational staff would respond to re-seat the valve as required. I

Any alert of potential leakage is reported centrally, and a work order is raised for repair by appropriately skilled operatives. Checks are completed twice a year on Digester asset bases via an external contractor, who provide a report with recommendations for the asset.

If the source of the emission is unknown during the daily monitoring, then Optical Gas Imaging will be requested to complete an assessment to locate the source of the leakage. The responsibility of this falls to a Thermographic Engineer as seen in Table 2.2.

The process flow used when monitoring assets on each site is outlined in training guidance completed to utilise the Flame Ionisation Detector. This detector is a handheld device which can measure both the presence and level of biogas in a sample of ambient air, allowing the presence of leaks to be identified and localised.

The dedicated Biogas Storage holder has the highest potential for the largest immediate volumetric release, noting the presence of a PRV and double membrane design, but residual risks are inherently present across all critical plant. Immediate risk assets would include biogas transport (pipework: valving). Assets with a proportionally lower risk of biogas release would include ancillaries such as biogas boosters or condensate pots (i.e., are essentially sealed within normal use).

An up-to-date DSEAR zoning drawing is held on site and is a routine point of reference in day-to-day working.

Continuous monitoring of biogas pressure takes place within the biogas system which is connected to SCADA and an off-site control room to raise alarms on high or low pressure.

The tasks associated with monitoring the above assets are listed in Table 2.1.

Table 2.1 – Monitoring Methods and Frequencies

Task	Expected Frequency	Method	Priority	Priority Rationale
Inspection of Primary Digester Tanks	Every six months	Flame ionisation detector (sniffing), Personal biogas monitors.	High	Volume of contained biogas and level detection.
Inspection of pipework between Primary Digester Tanks and Biogas Storage	Every six months	Flame ionisation detector (sniffing), Personal biogas monitors.	Medium	Biogas volume contained. Look for degradation of pipework including all joins, flanges, seals and valves.
Inspection of dual membrane Biogas Storage	Every six months	Flame ionisation detector (sniffing), Personal and fixed biogas monitors.	High	Operation and Maintenance task.
Inspection of pipework between Biogas Storage and siloxane filters	Every six months	Flame ionisation detector (sniffing), Personal biogas monitors.	Medium	Biogas volume contained. Look for degradation of pipework including all joins, flanges, seals and valves.
Inspection of siloxane filters	Every six months	Flame ionisation detector (sniffing), Personal and fixed biogas monitors.	Medium	Operation and Maintenance task.
Inspection of pipework between	Every six months	Flame ionisation detector (sniffing), Personal biogas monitors.	Medium	Biogas volume contained. Look for degradation of

Task	Expected Frequency	Method	Priority	Priority Rationale
siloxane filters and CHP engines				pipework including all joins, flanges, seals and valves.
Inspection of pipework between Biogas Storage and boiler	Every six months	Flame ionisation detector (sniffing), Personal biogas monitors	Medium	Biogas volume contained. Look for degradation of pipework including all joins, flanges, seals and valves.
Inspection of pipework between Biogas Storage and Emergency Flare	Every six months	Flame ionisation detector (sniffing), Personal biogas monitors	Medium	Biogas volume contained. Look for degradation of pipework including all joins, flanges, seals and valves.
Inspection of PRVs	Every six months	Flame ionisation detector (sniffing), Personal biogas monitors	High	Operation and Maintenance Task.
Inspection of condensate traps	Every six months	Flame ionisation detector (sniffing), Personal biogas monitors	Medium	Biogas volume contained. Look for degradation of pipework and that the condensate release tap moves freely and reseals.

2.4 Leak Repair

After a biogas leak is detected, the site monitoring operative informs the Site Manager or Senior Technician via the most appropriate communication method. A safety observation and corresponding action will then be raised regarding health and safety. If required, a contractor will be utilised to ensure the action is completed by a person with the relevant competencies, for example biogas safety. An audit trail will be available via the Thames Water planning tool. The Environment Agency (EA) is to be informed, if applicable, through the EPR permit Schedule 5 notification procedure.

A RIDDOR Dangerous Occurrence would be raised in the case of a serious health and safety incident that met the requirements.

2.5 Record Keeping

As mentioned above, all biogas assets on each site are uniquely identified and an electronic site register is available and kept up to date (SAP). Leak detection activities are assigned to a person appropriately trained using the site asset list via the MAMS system. After inspection, an electronic record is made of all checks completed and any follow up work which would be required is assigned to another appropriately trained person. Any work which is outstanding will be flagged as "mandatory work" on SAP, which is monitored monthly to ensure full completion.

2.6 Type and Quantity of Emission

It is likely that any fugitive emissions will be non-combusted biogas, since all combusted biogas is emitted via a point source emission directly from the combustion unit i.e. the CHP engines, boiler or emergency flare stack. Non-combusted biogas accounts for most of the stored biogas and is made up of Methane (60-70%) and Hydrogen Sulphide (50-<100ppm). The quantity emitted will be variable depending on:

- The location of the emission source i.e., a hole in a biogas storage vessel could potentially release a large quantity compared to a length of isolated pipework;
- When the leakage was detected;
- Duration of the leak prior to repair; and,

- The pressure of the contained gas.

An assessment will be carried out to quantify the release as far as practicable, including a consideration of the potential time period the leak has occurred over (based on visual and other inspections), the pressure and flow in the component with the leak in it, and the asset involved.

Any unmonitored releases receive immediate consideration as a component part of the incident response following the reporting of a biogas release to the TWUL Pollution Desk. Where resolution of the underlying issue is not immediate but instead of unknown duration, the views of approved persons (e.g. DSEAR Engineer; Health and Safety Advisor; other subject matter experts) would be sought to determine what would be practicable and safely deployable. Framework contractors would be contacted to provide input to defining monitoring methods, at appropriate frequencies, in any circumstances where the need for data resolution is higher than TWUL instrumentation and/or potentially needed longer term, including on odour.

2.7 Key Personnel

Those responsible for the implementation of the LDAR plan are outlined in section 1.2. A more detailed list is shown in Table 2.2 below.

Table 2.2 - Key Personnel

Title	Responsibility
Site Manager / Senior Technician	Ensuring the LDAR is implemented, site repairs are carried out in a timely manner by the onsite maintenance team. Responsible for reporting issues to appropriate authorities.
Site Operators	Operation of site assets, detection and reporting of leakage if discovered during out site duties.
Thermographic Engineer (Contractor)	Undertake site-based leakage monitoring and raising any leaks to the site management team.

2.8 Reactive Leakage Detection Process

There are occasions where additional requests to monitor for biogas emissions are directed to the team. For example, when new assets are installed, and leakage checks are required before putting back into operation. The same processes as above are followed for monitoring and escalation.

2.9 Training and Calibration

Any members of staff involved in leak detection using specific equipment are trained in the use of that equipment and all relevant Health and Safety requirements. For example, DSEAR awareness before attending a site. Specialist equipment, such as the flame ionisation detector, are calibrated according to the recommendations of the manufacturer.