MOTT MACDONALD

Leak Detection and Repair Plan Summary

Afan Sludge Treatment Centre

September 2024

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Issue and Revision Record

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1 Introduction

1.1 Leak detection and repait

Failures in site processes or assets can lead to uncontrolled releases of liquids (e.g., sludge) to land and water as well as gases to air.

This document outlines our control measures for reducing these events and minimising the impact from these releases.

The generation of odour from the processing of sewage is primarily associated with the release of odorous Volatile Organic Compounds (VOCs) that are generated because of the anaerobic breakdown of organic matter by micro-organisms.

Since the main source of VOCs is the solid organic matter, the majority is generated from the operations involving the handling of sludge i.e., the processes applied to dewater, treat, and store raw sludge. These processes are generally considered to present the greatest risk of fugitive air emissions unless adequate controls are put in place.

To mitigate fugitive emissions to air, such as VOCs and methane, from treatment plants and associated infrastructure including pipework, combustion plants, conveyors and tanks, a site-specific Leak Detection and Repair (LDAR) plan forms part of the overall asset maintenance strategy.

The plan looks to decrease the risk to local sensitive receptors from VOCs, bioaerosols and odour, as well as to reduce the probability of and impact from any spills or leaks.

The sources of these potential emissions are shown in the following drawing:

100123523_LocationLayoutPlan_AFA September 2024

The LDAR describes the methodology used to locate, identify and mitigate against fugitive emissions to air of Volatile Organic Compounds (VOC) or 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 also aligns to the Afan Sludge Treatment Centre (STC) Odour Management Plan (OMP) and Accident Management Plan (AMP).

1.2 Purpose of the LDAR plan

This LDAR plan has been written in line with the Environment Agency's 'Appropriate measures for the biological treatment of waste' guidance.

The overall LDAR plan is supported by site-specific aspects in relation to site processes, equipment, or procedures. Other site-specific information includes maps to identify the known locations (point and area sources) for potential fugitive emissions to air, and descriptions of any site-specific additional measures where applicable.

The LDAR plan forms part of the existing company Environmental Management System.

Leaks are considered most likely to occur at the points of weakness, namely connections, interconnection, joins and bends. The potential sources are identified on site-specific LDAR maps.

The plan will act to improve safety for site operatives, decrease exposure of local sensitive receptors to VOCs, bioaerosols and odour, as well as to reduce product losses.

An LDAR plan consists of five basic elements:

- Identifying and recording the location key components
- Leak detection
- Monitoring components
- Repairing or replacing components
- Recordkeeping

The plan includes the followings to identify leaks and carry out repairs or replacement of plant and equipment:

- Methods for locating unknown emission sources
- Programme of work for monitoring and controlling emissions
- Leak mitigation measures
- Maintenance and repair programme

Leaks are most likely to occur at the points of weakness; connections, interconnection, joins and bends.

1.3 Identifying and recording the location of key components

The most likely leak points include the following (where applicable):

- double membrane roofs (air blower vent)
- roof and cover fixings
- pressure relief valves and vents
- feeding and digestate separation units
- gas pipework
- conveyors and presses
- combined heat and power plant (methane slippage)
- reception storage
- digestate storage
- anaerobic digesters
- sludge holding tanks
- biogas holder
- condensate pits and other sumps
- building containment

2 Local sensitive receptors

The location of odour sensitive receptors in relation to the site are illustrated in Figure 2.1 and listed in Table 2.1. Residential receptors are shaded in blue and commercial/industrial receptors in orange.

The nearest potentially odour sensitive receptors to the site are isolated industrial premises which are located to the north and west of the works, and the Associated British Ports Port Talbot land to the west northwest. These works are therefore the closest commercial/industrial receptors. Due to the nature of the activities conducted in these areas, their sensitivity to odour emissions from the WwTW is likely to be low. It should be noted that as of August 2024 the blast furnaces of the steelworks at Port Talbot are in the process of being shut down and so there may be reduced industrial activity going forward.

The nearest residential receptors are located further away, approximately 2.5km to the north-northwest in Aberavon, and 2km to the north-northeast and east in Taibach and Margram respectively, both of which are located along the A48.

Figure 2.1: Location of nearby sensitive receptors

Source: DCWW Odour Management Plan

2.1 Summary of receptors within 500m

Table 2.1: Nearby sensitive receptors

Receptor	Name	Land use	Direction	Distance from site (m)	Sensitivity to odour
A	Associated British Ports	Commercial	Northwest	1500	Medium
B	Offices	Commercial/industrial	Northwest	450	Medium
C	Industry and supporting offices	Commercial/industrial	East	350	Low/medium
D	Sinter plant (including offices)	Commercial/industrial	Northeast	650	Low/medium
E	Industry and supporting offices	Commercial/industrial	East	850	Low/medium
F	Llewellyn's Road	Mixed commercial	Northeast	1700	Medium
G	West End Road	Residential	Northeast	1800	High
H	Tal-Y-Wern	Residential	East	1800	High
I	Industry and supporting offices	Commercial/industrial	Southeast	1050	Low/medium

Further information on the locations of sensitive receptors within 2km of the site can be found in 100123523_ConstraintsMaps_AFA September 2024.

3 Assets and Methodology

3.1 Site assets

Afan STC has a number of sludge related assets (some of which are biogas assets), which are scheduled for routine, planned inspection and maintenance on a regular and ongoing basis. The list below identifies the main (but not limited to) sources where biogas and VOCs are commonly generated, transported, stored and utilised at the STC.

- 2 No. Digesters (4250m^3 each)
- 1 No. Post digested sludge storage tank (PDST) (500m^3)
- 1 No. Gas bag holder (2000m^3)
- 1 No. Indigenous sludge silo (100m^3)
- 1 No. Thermal Hydrolysis Plant (THP) feed silo (600m^3)
- 1 No. THP (comprising 1 No. flash tank 42m^3, 1 No. pulper 42m^3 and 4 No. reactors 13m^3 each)
- 2 No. Imported cake hoppers into silo (40m^3 each)
- 2 No. Centrifuges
- 3 No. Sludge thickeners (belt presses)
- 2 No. Odour Control Units (1 No OCU for the raw sludge silos in the import area and 1 No. OCU for the belt press room (currently not in use))
- 1 No. Cake barn (with 3 No. cake bays, 4-day retention time, approx. 450m^3 total cake bay storage capacity, covered by barn)
- 2 No. Boilers (input of 3.9MWth each)
- 2 No. CHP (input of 3.745MWth each)
- 1 No. Biogas flare stack (1,500m^3/hr max)

Prior to commencing any monitoring or inspection, the most recent process flow diagrams and plans for the biogas system should be obtained for the 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. This makes it easy to identify an asset in the case of a leak or repaired required. 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. Biogas compressors / boosters and valves are utilised, when possible, to reduce the risk of leaks from the system.

3.2 Design specifications

PRVs are fitted with intrinsically safe limit switches, which operate when an event occurs (pressure or vacuum relief) and which are wired back to the SCADA system, in accordance with DCWW specifications.

All assets are inspected and maintained in accordance with DCWW maintenance standards, which are based on Water Industry Best Practice and manufacturer requirements.

The CHP engines and boilers are subject to routine inspection and planned preventative maintenance by specialist contractors.

The biogas system is designed to be a closed, pressured system.

3.3 Method for locating emission sources

The following activities are undertaken to identify potential emissions:

- Yearly biogas maintenance & inspections are carried out by a gas safe contractor, six monthly on boilers, flare stacks and compressors.
- Trained operators carry out monthly maintenance scheduled task (MSTs) on the digester PVRVs
- Trained operators completing regular site walks and sensory inspections.
- LDAR regular site surveys with faults documented and acted upon
- Identified leaks/ release points are tracked on site specific area maps.

Table 3.1: Methods for locating emission sources

Heading	Frequency	Method	Comments
Site – Specific Odour Management Plan (OMP)	Daily	● Sniff Tests ● Risk Assessments if any unusual activities are likely to cause Odour	Operators to conduct daily 'Sniff Test' walks & react to any issues identified on these inspections.
On the Job odour training	Onboarding and Annual Refresher	● On the Job training with skilled operators	This is part of the DCWW Training for new staff.
LDAR site surveys using area maps for reference	Daily	● Carry out surveys in line with LDAR plan	Team records Surveys undertaken & logs identified issues in Site Diary. Remedial actions depend on the nature of the issue and in line with the LDAR guidance in this document.

3.4 Method for locating unknown emission sources

In the event of a suspected leak, the following methods are available to the operational team to investigate:

- Visual (as a consequence of a pressure drop)
- Handheld gas monitors
- Instrumentation on site SCADA
- 24/7 trained operational team

Specifically associated with pressure relief valves:

- Live data from SCADA
- bursting disk sensors,
- pressure monitors,
- 24/7 trained operational team

If an emission source is unknown, it may be necessary to undertake Optical Gas Imaging to locate the source of the leakage. This may need to be undertaken by an approved Framework Contractor.

In addition, Flame Ionisation Detectors (FIDs) may need to be hired in. FIDs are handheld devices which can measure both the presence and level of biogas in a sample of ambient air. This enables the presence of leaks to be identified and localised.

3.5 Method for estimating type and volume of release

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 engine, boiler or flare stack. Non-combusted biogas accounts for most of the stored biogas and is typically 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 larger volume 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.

In the event of a leak, an assessment will be carried out to quantify the release, as far as practicable. The following methods will be adopted to assess the impact:

- Source of release and associated flow, pressure and production rates
- Length of time leak not rectified, based on visual or other inspections

Any unmonitored releases receive immediate consideration as a component part of the incident response following the reporting of a biogas release. Where resolution of the underlying issue is not immediate but instead of unknown duration, the views of appropriate and competent people (e.g. DSEAR; Health and Safety Advisor; other subject matter experts) would be sought to determine what the most applicable action would be.

Framework contractors may be contacted to provide input to defining monitoring methods, at appropriate frequencies, in any circumstances where the need for data resolution is higher than current systems or instrumentation allow or the potential need for longer term monitoring.

Identification of monitoring methods and frequency of monitoring

To quantify general operational emissions, mostly odour related, the following methods and equipment is available:

Table 3.2: 'Normal' monitoring methods and frequencies

Asset	Inspection frequency	Method	Priority	Reason
Inspection of primary digesters	Annually	Sniff test, sense check, personal gas monitors	High	Volume of biogas contained
Inspection of biogas Storage	Annually	Sniff test, sense check, personal gas monitors	High	Operation and Maintenance task
Inspection of PRVs	Annually	Sniff test, sense check, personal gas monitors	High	Operation and Maintenance task
Gas flare	Annually	Sniff test, sense check, personal gas monitors	Medium	Operation and Maintenance task. Look for degradation of pipework including all joins, flanges, seals and valves. Look for damage which may cause a blockage or leak

Asset	Inspection frequency	Method	Priority	Reason
Inspection of pipework along whole biogas system route	Annually	Sniff test, sense check, personal gas monitors	Medium	Gas volume contains. Look for degradation of pipework including all joins, flanges, seals and valves. Look for damage which may cause a blockage or leak

There are occasions where additional requests to monitor for biogas emissions are required, or requested. For example, when new assets are installed and leakage checks are required before putting the system back into operation. The same processes will be followed, as set out above, for monitoring, recording and escalation.

4 Leak Detection & Monitoring Activities on site

4.1 Monitoring

During routine maintenance, visual daily walkover surveys for pipework, tanks, ancillary plants etc. is conducted to check for integrity, corrosion and leaks. The operator will also listen out for escape of gas from PRVs as part of this daily walkover. Any leaks from these valves are indicated by a hissing noise.

Operators also wear personal gas detection monitors, in some areas. These are designed to detect gases in areas they are working in. Where gases are detected, either at unsafe levels or over a duration of time an alarm will sound on the gas monitor. These monitors can also indicate if there is a leak in the area surrounding the operator.

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

An up-to-date DSEAR zoning drawing is held on site and is a routine point of reference in day-to-day working for where operators must wear a gas monitor.

Sight, sound and smell can also be used to detect potential leaks of certain emissions. While conducting visual inspections of tanks and pipework, for example, the operator will look for signs of degradation or damage to equipment. They may also hear hissing sounds, where gases may be escaping such as from pipework.

A 'sniff test' is also undertaken, in accordance with the site's OMP, to further monitor for potential fugitive emissions. This is undertaken on site and at the site boundary, starting at an upwind location. Where possible, the sniff testing will be carried out by an operator not accustomed to the odours generated by on-site activities. Sniff testing is designed to detect any abnormal plant fugitive emissions.

In addition, it is important to document any potential contribution from other potential off-site sources of fugitive emissions, outside the boundary. At Afan STC, this can be from the adjacent to the Port Talbot Tata Steel works, and the sea. Hence, odour may be generated by the industrial operations and by sea debris such as seaweed that may accumulate on the foreshore. However, it should be noted that some of the industrial activities at Port Talbot are in the process of being significantly scaled down, such as blast furnaces being shut down.

All PRVs are subject to regular inspection. Continuous monitoring of biogas pressure takes place within the biogas system which is connected to a SCADA system. A change in pressure either, higher or lower than 'normal' ranges, may be a sign that the digestion process is out of equilibrium or that there is a leak within biogas system. This would send an alarm to the off-site control room via the SCADA system for the appropriate action to be undertaken. If a PRV is activated, an alert is sent through SCADA, as this will identify a drop in pressure.

The biogas holders have 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). Leak detection (methane gas analyser) is installed on the biogas holders to ensure any leaks from the inner bag are detected. Any leaks detected on the biogas system will be fixed immediately by DCWW due to the process safety risk posed by biogas.

Gas leak detection (methane gas analyser) is also installed on biogas holder/s to ensure any leaks from the inner bag are detected. Any leaks detected on the biogas system would always be fixed immediately by DCWW due to the process safety risk posed by biogas.

All inspections are recorded in the Site Diary/log.

4.2 Detection and repair

Once a leak is detected and located, the Operative will check whether the problem can be resolved immediately, for example closing or tightening hatches, valves or other loose connections. Operators can raise a job centrally for maintenance or for issues that require further investigation and possible capital intervention.

Smaller maintenance issues are sorted in-house, and any major repairs are organised by an appropriately skilled and competent contractor e.g. pipe repair. Any remedial work required on the site would be completed in accordance with the water industry specifications. Prioritisation for maintenance and repairs (and requirement for monitoring of fugitive emissions) is identified on a risk based LDAR programme of work:

- The high-risk assets are informed by the DSEAR and will be given first priority for monitoring and repair as they pose the greatest risk of explosions, e.g. digesters
- Level of risk decreases with estimated volumes and emission type:
  - Assets containing post-digested sludge (e.g. reception storage) pose a great risk of VOCs and bioaerosols
  - Post-digested sludge in digester storage, in cake silos etc have decreased levels of VOCs and bioaerosols
  - Methane slippage from combined heat and power plants are a lower risk with regard to sensitivity to receptors

Minor repairs and routine maintenance work are carried out continuously throughout the year during the working day, avoiding evenings and weekends, except in emergencies. Where possible, more major maintenance tasks are carried out in a planned manner according to priority and resources.

Odour and VOCs sensitive major maintenance tasks will be aimed to be undertaken during the winter period (between October and April), where appropriate. The emphasis in planning this maintenance is to minimise the time required to carry out the work, ensuring as far as possible, that odours and VOCs are contained or abated during the work and to deploy alternative odour suppression systems, if required.

Where a maintenance operation is likely to release quantities of odour likely to be detectable off-site, the relevant authorities and DCWW Smart Hub would be informed in advance.

For high-risk assets, such as pressure vessels, these are already covered by a formal inspection regime under the “The Pressure System Safety Regulations 2000, written Scheme of Examination”.

This work includes an annual inspection and working test, and a thorough exam that includes non-destructive testing of the pressure vessels. The working test and thorough exam are currently carried out in alternate years.

Following the identification of a leak that requires major repairs the following mitigation measures are implemented whilst awaiting emergency gas maintenance contactors to carry out remedial works:

- Sludge processing on-site is minimised and diverted to a controlled release point via the combined vacuum and pressure release valve.
- The leak source is surrounded with portable odour sprays as appropriate.
- Biogas is diverted to the CHP plant or gas burner.
- Reported to NRW, where appropriate or required by the permit through the permit Schedule 5 notification procedure.

In all instances of a leak being detected, the site manager will be informed, who will make the decision as to whether further action, over and above that already undertaken, is required or escalation, in accordance with procedures in the Accident Management Plan (AMP) is necessary.

4.2.1 Repairing or replacing components

Any repairs or replacement of equipment will be conducted in line with the site-specific Odour Management Plan with a risk assessment for any work likely to cause an odour nuisance.

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5 Maintenance and repair programme

5.1 Planned Maintenance Activities/ Sources of Information

In order to mitigate any potential emissions to any receptors, it is important to routinely check the tightness of connections on flanges and valves, condition and security of mechanical components, fittings, and structures. If issues are found remedial actions are then raised for the Asset maintenance team or Gas Safe contractors if on Gas systems.

Procedures relating to processes and equipment posing a risk of fugitive emissions air include the LDAR plan consolidates existing measures, training and procedures undertaken by DCWW regarding leak prevention, detection and repair including:

- Site-specific Odour Management Plan
- Operation and Maintenance (O&M) Manuals
- Maintenance Task Manual – featuring procedures for inspecting for leaks, corrosion, damage as above for tightness of connections etc.,

5.2 Programme of work for monitoring and controlling emissions.

The LDAR plan consolidates existing measures and procedures undertaken by DCWW regarding leak prevention, detection, and repair.

Our inspection and maintenance activities are under ongoing review and the current work is looking to ensure alignment to BAT, including the following:

- Storage tank inspection including Digesters –testing and inspection of storage tanks to demonstrate integrity. Typically, through a combination of visual, hydrotesting and non-destructive testing (NDT) methods. Frequency is being revised to a condition-based basis by Asset Team and referenced standards updated to reflect best practice. Contractor support is required to complete the works required.
- Underground buried Pipe installation testing – Routine testing of buried pipe work by pressure testing lines, recording the test results, and completing and identified remedial works Additional visual checks on walk arounds and LDAR checks of ground.
- All new builds on STC or AD sites will be designed to incorporate IED requirements like leak detection in design of tanks etc and above ground pipe work.
- Digester Pressure Relief valve release identification.
- Digester pressure relief valve release identification will be identified by Over Pressure alarms generated by the SCADA system.
- Warning pressure levels to be set to alert the operational team before an actual release event, so alarm set below actual release point to allow operations to investigate over pressure before events.
- Full Pressure release pressure alarms will be set to the actual pressure the relief valves are set to and will be reported and recorded as release events and records kept on the SCADA system – these will be reported as Biogas releases via the pollution team.
- Daily Visual Checks - Operator walk around Visual Checks will be included in the daily Sniff Tests, Operators will record any leaks identified and react to the leaks by containing any spills, isolating equipment, stopping processes if possible and raising the alarm or incidents depending on the severity of the event, Operators will also report any pollution events.

- Digital thermal camera inspection for High level leak detection Aerosols (digesters and PDST's) – These will be completed by the Process team reporting any findings back to the operations team and raising jobs for any issues – For example pressure relief valve Aerosol releases identified on site checks.

5.3 Planning work activities to reduce the impact to customers.

Some of the activities can have a more significant impact on customers, especially if they create significant odour/VOCs. These maintenance tasks will be aimed to be undertaken during the winter period (between October and April), where possible.

The emphasis in planning this maintenance is to minimise the time required to carry out the work, ensuring as far as possible, that odours and VOCs are contained or abated during the work and to deploy alternative odour suppression systems, if required.

The planning exercise also includes monitoring of weather forecasts to determine if appropriate conditions are anticipated to complete the required works.

5.4 Competent staff - Operator Pollution Training

The LDAR plan consolidates existing measures and procedures undertaken by DCWW in regard to leak prevention, detection and repair including:

- Site-specific Odour Management Plan.
- Site-specific Accident Management Plan

Future competency, in terms of the requirements of the environmental permit, will be ensured through the appropriate training of all staff, covering:

- Awareness of the regulatory implications of the Permit for the permitted activity and their own work activities.
- Awareness of all potential environmental effects from operation under normal and abnormal circumstances.
- Awareness of the need to report any deviation from the Permit.
- Prevention of accidental emissions, and action to be taken when accidental emissions occur.

All staff are aware of the implications of activities undertaken including the operation of the Site. Skills and competencies necessary to work on-site are documented and records of training needs and training received for these posts are maintained.

6 Record keeping and notifications

All biogas assets on each site are uniquely identified and an electronic site register is available and kept up to date. Any new or replacement assets must be tagged to maintain an accurate record.

Leak detection activities are assigned to an appropriately trained person. After inspection, a record is made of all checks completed, actions taken and any follow up work required. Follow up work would be assigned to another appropriately trained person.

Daily checks are undertaken around the site, where visual checks and sniff tests are completed as part of those site walkovers. Records of all site walkovers and any issues observed are recorded in the site diary and escalated where necessary.

Any work which is outstanding will be flagged as “mandatory work” on the system, monitored and followed up to ensure full completion.

Where required by the IED Environmental Permit conditions, OMP and AMP, the Environment Agency will be informed, as soon as is practicable and as is appropriate, such as in the event of a major release of gaseous emissions to air etc.

Recording of LDAR related activities is through site-held records and electronic reporting.

7 Programme for Review

The LDAR Plan is a live document and subject to regular and ongoing review. The LDAR will form part of the EMS and relevant operational procedures will be developed for use on site.

It is intended the LDAR Plan for this site will be reviewed within 12 months. It may be reviewed more frequently, as appropriate, depending upon the programme of ongoing work and improvements.

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