



<b>WASTE WATER SERVICES</b>	<b>TECHNICAL NOTE</b>
<b>Date Modified: 12/12/2023</b>	<b>Version: 1</b>
<b>LEAK DETECTION AND REPAIR (LDAR) PROGRAMME</b>	

### LDAR Programme

Project:	LDAR Programme
Revision:	1
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## A. INTRODUCTION

### Associated Documentation

Table 1 presents a summary of South West Water (SWW) documentation associated with Leak Detection and Repair (LDAR), along with the scope of the documents and their location.

**Table 1: Summary of SWW documents associated with this Leak Detection and Repair programme.**

<b>Document</b>	<b>Scope</b>
FM-QWW-HAYLE-0644 Site Information Plan	Plan of Hayle Wastewater Treatment Works (WwTW).
Maintenance Schedule	Scheduled maintenance work.
7237.Stantec.A5.HayleZZ.RP.Z.10045	Environmental Incident and Accident Management Plan for Hayle.
SWW-TS-104 - Technical Standard for Hazardous Area Classification Flammable Gas or Vapour Risks	General technical requirements for classification of hazardous areas where flammable gas or vapour risks may arise. Applies to the construction of all new plant and to the maintenance or upgrading of existing plant.
Technical Standard for Best Available Techniques	General technical requirements for classification of hazardous areas where flammable gas or vapour risks may arise. Applies to the construction of all new plant and to the maintenance or upgrading of existing plant which falls under the Industrial Emissions Directive (IED).

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## Regulations and Guidance

**Table 2: Summary of regulations and guidance specific to this addendum.**

<b>Terminology</b>	<b>Definition</b>	<b>Link</b>
Environmental Permitting Regulations (EPR)	This refers to Instrument 2016/1154 of the UK government of 11 December 2016 on Environmental Protection, for England and Wales.	<a href="#">EPR</a>
Industrial Emissions Directive (IED)	This refers to Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions. This is the main EU instrument regarding pollutant emissions from industrial installations.	<a href="#">IED</a>
Best Available Techniques (BAT)	This refers to Commission Implementing Decision (EU) 2018/1147 of 10 August 2018 establishing best available techniques (BAT) conclusions for waste treatment, under Directive 2010/75/EU of the European Parliament and of the Council (notified under document C(2018) 5070) (Text with EEA relevance).	<a href="#">BAT</a>
Appropriate measures	This refers to “Biological waste treatment: appropriate measures for permitted facilities” Environment Agency guidance document published 21 September 2022 explaining the standards (appropriate measures) that are relevant to permitted waste management facilities that handle organic waste.	<a href="#">Appropriate Measures</a>
BS EN 15446:2008	Fugitive and diffuse emissions of concern to industry sectors. Measurement of fugitive emission of vapours generating from equipment and piping leaks.	<a href="#">BS EN 15446:2008</a>
Dangerous Substances and Explosive Atmospheres Regulations (DSEAR)	Instrument 2002/2776 of the UK government of 9 <sup>th</sup> December 2002. This requires employers to control the risks to safety from fire, explosions and substances corrosive to metals.	<a href="#">DSEAR</a>

## Applicability

The EPR 2016 section 5.4 lays out the interpretation and application of the IED for disposal, recovery or a mix of disposal and recovery of non-hazardous waste. The legislation is open to interpretation, and the explanation here provides current best understanding (06/2023).

Where the only waste treatment activity is anaerobic digestion, IED applies if the capacity of the facility exceeds 100 tonnes per day.

Where waste treatment includes liming, with or without anaerobic digestion, and 50 tonnes per day of limed waste are sent for disposal from a site, this would also fall under the scope of the IED.

Sites which do not have anaerobic digestion or liming may also fall under the scope of IED where their capacity exceeds 50 tonnes per day.

The site capacity limitations are applied as a maximum and based on the mass of thickened sludge prior to digestion. Installations which fall under the IED, including anaerobic digestion sites are



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required to adhere to BAT. BAT includes the requirement to implement a leak detection and repair (LDAR) programme.

### **Additional Requirements**

There are significant requirements for compliance with BAT that fall outside the scope of this document. This includes (but is not limited to):

- Implementation of and adherence to an environmental management system, which includes (but is not limited to):
  - Set up and adherence to waste characterisation, pre-acceptance, acceptance and rejection procedures, along with a waste tracking system
  - Set up and adherence to waste handling and transfer procedures
  - Monitoring and / or sampling of key process parameters and emissions (to air, land or water)
  - Implementation of a maintenance system including planned, proactive and reactive maintenance tasks for plant and equipment
  - Set up and implementation of an odour management plan, a noise and vibration management plan and an accident management plan
- Design and construction of facilities in accordance with BAT standards

For more information on these requirements, please consult the Environmental Management System, available upon request.

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## B. SCOPE

This document describes the LDAR programme which will be carried out at SWW sites which fall under IED legislation, currently Hayle Sludge Treatment Facilities (STF).

The LDAR programme is required under BAT 53 to provide a structured approach to reduce fugitive emissions of organic compounds by detection and subsequent repair or replacement of leaking components. IED defines volatile organic compounds as any organic compound as well as the fraction of creosote, having at 293.15 K a vapour pressure of 0.01 kPa or more, or having a corresponding volatility under the particular conditions of use. As such, the LDAR programme applies to all IED permitted plant and equipment which has the potential in normal or abnormal operating conditions to result in the release of such fugitive emissions. This means the focus of the LDAR programme in SWW IED permitted areas is methane.

Emissions to water are covered within BAT but are not required to be subject of a LDAR programme. Mitigation measures to prevent and / or monitor emissions to water are covered within other parts of the environmental management systems (such as the maintenance programme) and within design standards, such as those referenced in Table 1 above.

This LDAR programme includes:

- Potential sources of leakage (Section 4)
- Prioritisation of the potential sources of leakage (Section 5)
- Mitigation measures (Section 6)
- A methodology for locating unknown emission sources (Section 7)
- A methodology for estimating the type and volume of release from each leak location (Section 8)
- Maps and inventories identifying point and source leak locations for SWW IED sites (Section 9)

This LDAR programme presents a risk-based approach to detection, quantification and mitigation of point and area source leaks.

### Roles and Responsibilities

Table 3 displays the key roles and responsibilities for implementation of the LDAR programme.

**Table 3: Key roles and responsibilities for implementation of the LDAR programme.**

<b>Role</b>	<b>Responsibility</b>
BAT manager (or delegated authority)	Implementation of the LDAR programme
Operations, All (or delegated authority)	Identify and report to system
Biogas contractor, LPG contract (or delegated authority)	Repair
Site Manager (or delegated authority)	Quantification of emission
Site Manager (or delegated authority)	Reporting leaks to the EA

### Review



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This LDAR programme will be reviewed and updated a minimum of every year. It will also be updated in response to changes on site or improvements to best practice.

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#### **D. POTENTIAL SOURCES OF LEAKAGE**

Table 4 provides a generic list of potential leak locations on SWW sites which will be covered by this LDAR programme.

**Table 4: Potential leak locations.**

<b>Location</b>	<b>Likely leak type</b>
Membrane rooves	Diffuse
Gas pipelines (flanges, joins, valves and bends)	Diffuse
Feeding and digestate separation units	Diffuse
Conveyors and Presses	Diffuse
Gas upgrading plant	Diffuse
Reception storage	Diffuse
Digestate storage	Diffuse
Building containment	Diffuse
Roof and cover fixings	Point
Pressure Relief Valves and Vents	Point
Combined heat and power plant	Point
Boilers	Point
Flare stack	Point
Grid injection	Point
Pits and sumps, including condensate pots	Point

Inventories and maps of potential leak locations are included in Section 9.

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## E. PRIORITISATION OF SOURCES OF LEAKAGE

The leak detection methods applied to a specific location will be selected based on a risk-based approach, including consideration of factors including:

- Proximity of a sensitive receptor
- DSEAR zoning of the environment – this includes:
  - Likelihood of the emission
  - Potential volume of the emission (including pressure differential and size of the leak area)
  - Composition of the emission
- Age of asset and any repair work undertaken recently

**Table 5: Potential leak locations and associated leak detection methods**

<b>Risk level</b>	<b>Characteristics of the location</b>
High	Moderate / high probability of leak (point sources such as pressure relief valves / vents, flare stack, CHP, boilers). DSEAR zone present or generated by leak.
Medium	Moderate probability of leak (sources such as flanges, joins, valves and bends on pipework). DSEAR zone may be generated by leak.
Low	Low probability of leak (such as continuous pipework). No applicable DSEAR zone.



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## F. MITIGATION MEASURES

There are four types of measure used by SWW to mitigate against emissions of methane. These include:

- Design of plant and equipment.
- Control of plant and equipment.
- Routine maintenance activities.
- Processes for reporting and repair of detected leaks.

### **Design:**

Design of all SWW plant and equipment will follow SWW standards, and those which fall under IED will also follow the requirements of BAT. As such, measures will be in place to reduce the likelihood of emissions of methane, including:

All design of biogas systems will be undertaken in accordance with SWW-TS-104 (technical standard for hazardous area classification) and DSEAR regulations. These will reduce the consequence of potential leaks.

### **Control:**

Control systems will be in place to mitigate/inhibit significant leaks. Control measures implemented at SWW sites include:

- Methane detection between the inner and outer membranes on double membrane roofs (gas holders). On detection of methane outside the inner membrane, this will alarm and close slam shut valve.
- Pressure relief valves are fitted to avoid catastrophic failure of plant or equipment under high pressure through a controlled release, thereby mitigating against the release of the headspace of the asset associated with catastrophic failure.
- Gas leak detection within the boiler house and compartment housing the biogas engines which will alarm and activate the relevant slam shut valve.
- Safety interlocks on slam shut valves.

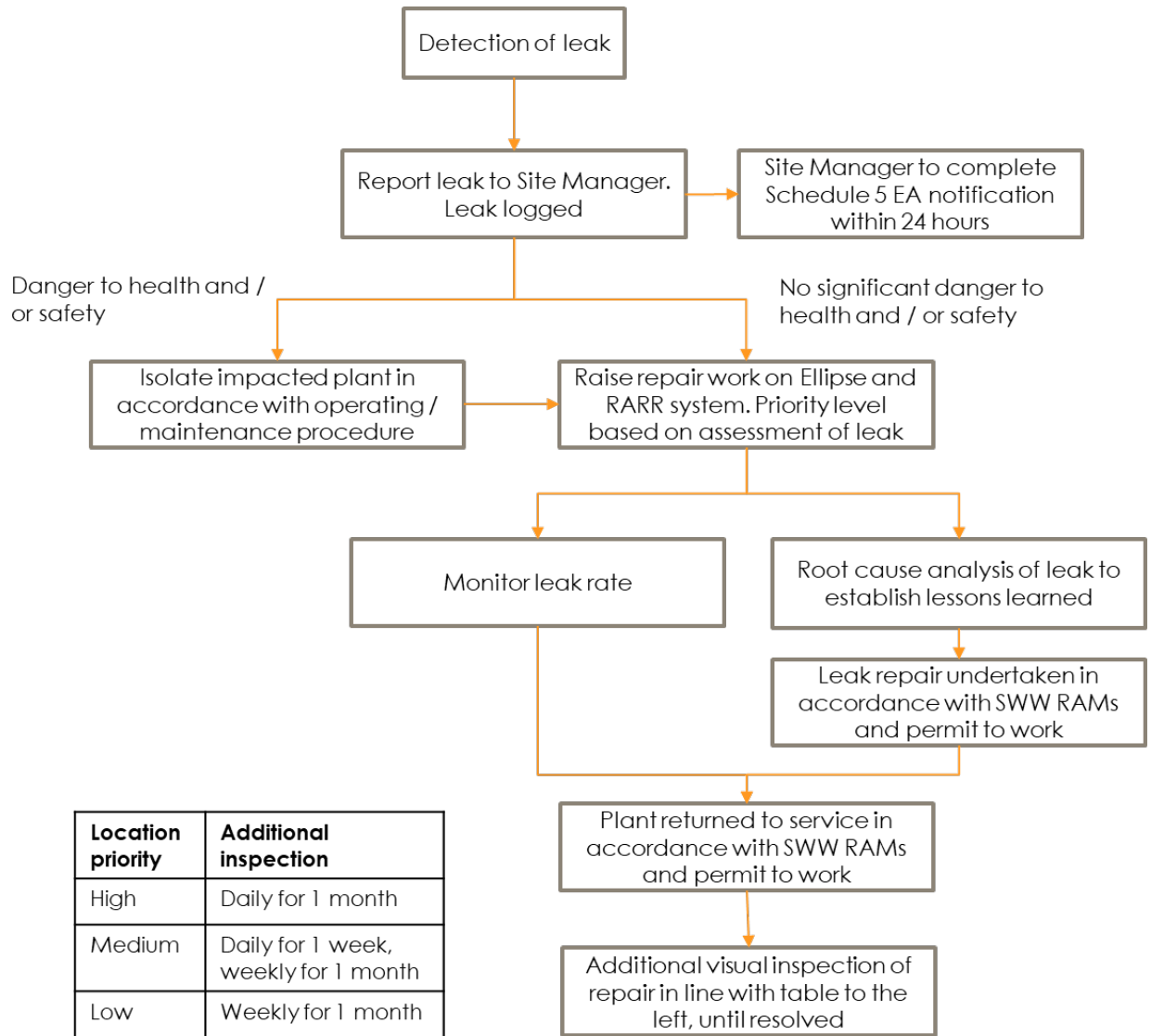
### **Routine Maintenance:**

South West Water follow a maintenance programme for their assets, found in the SWW Ellipse system.

### **Reporting and Repair of Leaks:**

Figure 1 provides a high-level outline of the process for reporting and repair of detected leaks. This applies both to leaks identified reactively, and those identified as part of a proactive inspection. All SWW operational staff working within the IED permit boundary will be trained to identify leaks and report them for repair.

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**Figure 1: Process for reporting and repair of detected leaks.**

For all identified leaks, a fugitive emission form (tbc) will be filled in to document the detection, assessment and the repair of the leak, along with any associated process shutdowns.

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## G. LOCATING UNKNOWN EMISSION SOURCES

### Leak Composition

The majority of leaks from SWW IED permitted facilities would be biogas. The exact concentration of this would vary but would typically be expected to include ~50 – 70 % methane.

Additionally, were the digestion process to be taken offline, leaks of natural gas from the national grid could be observed. These would be expected to be at least 85% methane.

### Methods for Identifying Diffuse Emissions

#### Instrumentation:

Instrumentation will be in place to identify emissions of methane. These will include:

- Flowmeters on biogas pipework coming off the digestors and at the point of the CHP will alarm if a flow differential of 16% or more is detected between the two flow meters. This will only detect significant leaks.
- Methane detection between the inner and outer membranes on double membrane rooves. On detection of methane outside the inner membrane, this will alarm and close the slam shut valve.
- Pressure relief valves are fitted to avoid catastrophic failure of plant or equipment under high pressure through a controlled release. On activation of a pressure relief valve, they will alarm and close the slam shut valve.
- Gas leak detection within the boiler house and compartment housing the biogas engines which alarm on detection of a gas leak.

#### Inspections:

South West Water follow a risk-based maintenance programme for their assets. Key maintenance activities which may assist in identification of emissions include:

- Routine calibration and servicing of pressure relief valves undertaken annually as a minimum, and in line with manufacturer's recommendations.
- Membrane integrity testing on biogas holder every 6 months as part of a full service. Smaller investigations are undertaken in between the 6 months.
- Routine servicing and inspection of the boilers and flare stack every 6 months as part of a full service. Smaller investigations are undertaken in between the 6 months.
- Routine servicing and inspection of the combined heat and power (CHP) engines occurs every 750 hours.

In addition to this, LDAR inspections will take place using optical gas imaging using hand-held cameras to enable visualisation of gas leaks.

Equipment used for inspections will be calibrated and maintained in line with manufacturer recommendations. LDAR inspections will take place annually.

It is South West Water policy that all staff entering DSEAR zoned areas carry a portable gas detector. Although primarily a Health and Safety precaution, this will provide an audible alarm on detection of high concentrations of methane, and so would detect large leaks.

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## **H. ESTIMATING TYPE AND VOLUME OF EMISSIONS**

If a leak is identified, the total quantity of methane emitted to atmosphere will be estimated.

For point sources, the emissions will be quantified by:

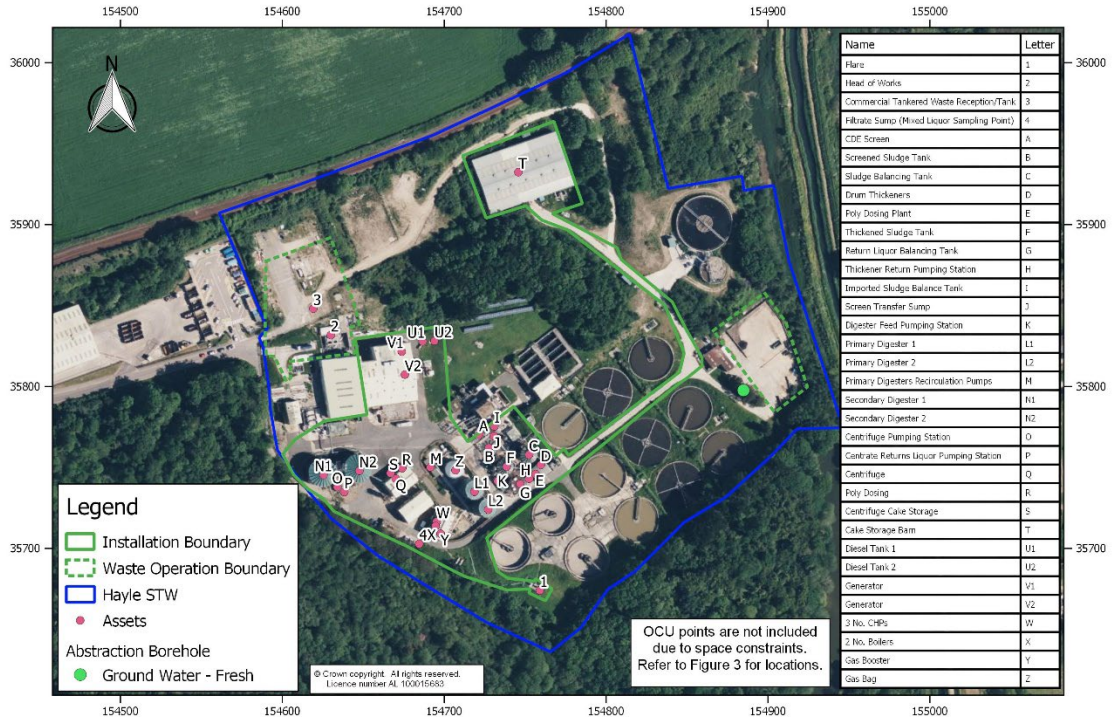
1. Using site data to evaluate the concentration of biogas within the leak;
2. Using the size of the hole and operating pressure of the effected component to estimate the flowrate of gas from the leak – this will be based on a look up table. Where the leak area is small and cannot be estimated, an area of 1 mm<sup>2</sup> will be assumed in line with DSEAR;
3. Estimating the duration of the leak based on the time since the last inspection or commencement of leak detection alarm;
4. Multiplying the leak flowrate by its estimated duration and the concentration of biogas within the leak to estimate the overall emission volume.

The leak will be reported to the EA as part of a schedule 5 notification by the site manager, or appropriate delegate.

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**I. SITE MAPS AND INVENTORIES**

**Site Map – Hayle STC**



**Site Inventory – Hayle STC**

Location	Pressure (MBar)	DSEAR zone	Sensitive receptor <250 m	Existing mitigation	Risk level	LDAR activities
Flare [1]	20	0	River Hayle (east), industrial units (north-west), residential land-uses (east)	Part of operations visual checks	Low	Undertake inspection via infra-red camera annually. Appropriate maintenance is to be undertaken and calibration of all important monitoring devices.
3 No. CHPs [W]	74	0		Low pressure switch linked to slam shut valve	Low	
2 No. Boilers [X]	20	0		Low pressure inhibit	Low	

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<b>Gas Boosters Inlet / Outlet [Y]</b>	13.5 / 74.5	0, 1, 2		Low pressure switch linked to slam shut valve	Low	
<b>Gas Bag [Z]</b>	20	1		Low pressure switch linked to slam shut valve	Low	
<b>Pipework from the Digester to the low pressure side of the Gas Booster</b>	20	0, 2		Part of operations visual checks	Medium	
<b>Pipework from the high pressure side of the Gas Booster to the consumer</b>	74.5	0, 2		Part of operations visual checks	Medium	