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1. Purpose

- 1.1 This Site Specific Instruction describes the methods applied to locating, identifying and mitigating against fugitive emissions to air as part of the Environmental Permitting Regulations requirements. As well as protecting the environment the benefits of this plan include the safety protection of site staff and increased productivity of the process.

2. Scope

- 2.1 This Site Specific Instruction is applicable to Anaerobic Digestion (AD) sites which produce biogas for consumption in the Combined Heat and Power (CHP) engines and generate a source of electricity. It details the maintenance requirements to identify fugitive biogas emissions from seals, flanges, valves, pumps, pipework and tanks.
- 2.2 Note – Emissions of sludge to the environment are minimal due to site surfacing and regular operator site tour inspections therefore not included in this plan.

3. Responsibility


- 3.1 The Production Manager for the AD site is responsible for ensuring environmental permit conditions are complied with. The Regional Planned Maintenance Team are responsible for undertaking the monitoring and reporting any defects for repair.

4. Asset Monitoring Schedule

- 4.1 The following assets are scheduled for routine proactive inspection by thermal imaging camera on a 6 monthly basis. This asset list is based on the potential for biogas leakage at each specific location.
- 4.2 The below assets are also monitored daily as part of the operator’s site tour and monthly Environmental Regulatory Advisors compliance inspection which whilst not identifying individual assets on a schedule use human senses to detect leakage which are reported centrally and a work order raised for repair by the appropriately skilled operative.
- 4.3 If the source of the emission is unknown during the daily and monthly human senses tour then the use of Optical Gas Imaging will be requested to attend site and undertake an assessment to locate the source.

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Asset	Method of Monitoring	Detection Equipment	Frequency	Priority	Priority Rationale
Digester(s)	Optical Gas Imaging	Flir GF320 Gas Imaging Camera	6 monthly	H	Volume of contained gas and level detection. Existing air emission point. Location to receptors.
Flare Stack	Optical Gas Imaging	Flir GF320 Gas Imaging Camera	6 monthly	M	Frequency of use, for excess gas production and emergency use. Existing air emission point
CHP Engine(s)	Optical Gas Imaging	Flir GF320 Gas Imaging Camera	6 monthly	H	Frequency of use, throughput of gas. Existing air emission point
Boiler(s)	Optical Gas Imaging	Flir GF320 Gas Imaging Camera	6 monthly	M	Dependant on fuel used housed in building
Gas Booster Compressor	Optical Gas Imaging	Flir GF320 Gas Imaging Camera	6 monthly	M	Differing gas pressure in the system
Gas Bag	Optical Gas Imaging	Flir GF320 Gas Imaging Camera	6 monthly	H	Volume of gas contained. Existing air emission point. Location of receptors to the north
Emergency shut off valve	Optical Gas Imaging	Flir GF320 Gas Imaging Camera	6 monthly	M	Operation & maintenance frequency
Pressure Release Valve	Optical Gas Imaging	Flir GF320 Gas Imaging Camera	6 monthly	M	Operation & maintenance frequency. Used infrequently

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					as a safety measure.
General Gas Pipework	Optical Gas Imaging	Flir GF320 Gas Imaging Camera	6 monthly	M	Volume of gas contained, potential for corrosion
General Gas Valves	Optical Gas Imaging	Flir GF320 Gas Imaging Camera	6 monthly	M	Operation & maintenance frequency & potential for seal leakage

(Source; Maintenance Workbank Download 29/10/2021)

- 4.2 **Identifying assets** – the above assets are all uniquely identified with ID numbers therefore are easily identifiable by the person undertaking the leak detection monitoring. This enables the assets to be scheduled for inspection and identified for repair if necessary. All new or replacement assets go through an asset tagging process to ensure an accurate site list is maintained. The use of diaphragm pumps and valves are used wherever possible so as to reduce the likelihood of leaks from the system.
- 4.3 **Monitoring** – The sequence of events when monitoring assets on site are outlined in the ‘Flir Gas Camera Method Statement & Escalation Process’ (Appendix B). EPA Guidance (Method 21 – Determination of Volatile Organic Compound Leaks) is the generally accepted method of monitoring being followed.
- 4.4 **Leak Repair** – On detection of a gas leak the monitoring operative will inform the Site Manager/Controller and complete the ‘Gas Leak Detection Notification Form’ (Appendix A) ensuring all relevant information is completed including a work order to enable the work to be scheduled to an appropriate Field Service Engineer for repair and an audit trail is available.
- 4.5 **Recordkeeping** – All gas assets are uniquely identified and an electronic site register is available and kept up to date. Leak detection is scheduled to the appropriately trained person using the site asset list via the MAMS system. Following inspection an electronic record is made of the checks undertaken and any follow up work required which will be scheduled to the appropriate person. Any work which is not undertaken in the predetermined time dependant on priority will be highlighted as being overdue and scheduled at the next available opportunity.
- 4.6 **Type & Quantity of Emission** – All combusted biogas is emitted to air via a point source emission point directly from the combustion unit therefore any likely fugitive emission will be of non-combusted biogas as this accounts for the majority of stored gas with a composition of Methane (60-70%) and Hydrogen Sulphide (50-<100ppm). The quantity emitted will be variable dependant on, the location of the emission source i.e. a hole in a gas storage


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vessel has the potential to release a large quantity in comparison to an isolated pipework length, when the leakage was detected and the pressure of the contained gas.

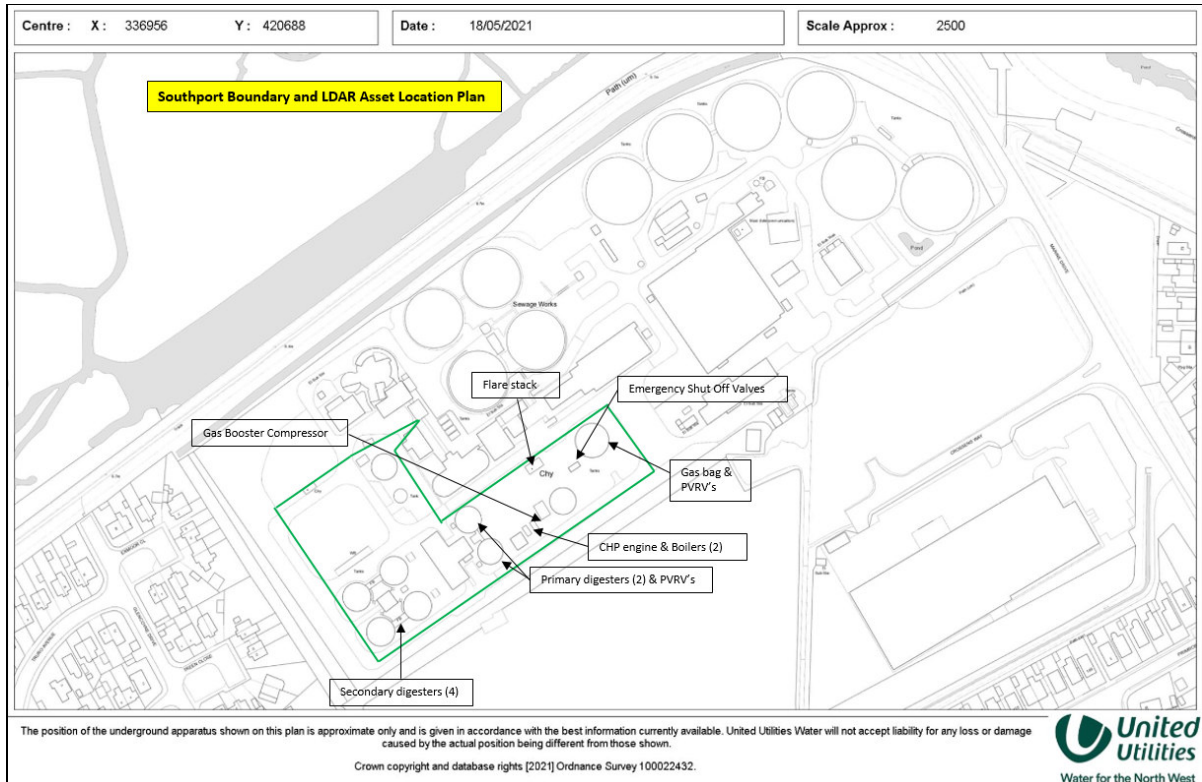
5. Key Personnel

Responsibilities for implementation of the LDAR plan are outlined in Section 3. A more detailed list is shown in the below table.

Title	Responsibility
Site Production Manager	Ensuring the LDAR is implemented on site and any asset repairs are undertaken in a timely manner. Responsible for Health & Safety of site personnel.
Reliability Maintenance Manager	Overall management of the condition based monitoring team including work completion
Condition Based Monitoring Team Leader	Day to day management of the Thermography Engineer including escalating risk and H&S requirements
Thermography Engineer	Undertaking the site based leakage monitoring to the required standards and raising any leakage via the relevant processes
Production Engineer	Technical specialist in relation to the biogas system and to be made aware of any leakage detected
Environmental Regulatory Advisor	Company contact with the local EA officer. Responsible for assessing and reporting permit non-compliance. Undertakes monthly site inspection which may detect leakage
Site Operational Staff	Operation of the site assets. Detection and reporting of leakage if discovered during site tours

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6. Asset Location Plan




7. Planned Leakage Detection Process

Planned maintenance assessment work is distributed to the relevant teams via the company scheduling system (MARS) (see Section 4) at the appropriate time and frequency.

The appropriately trained operative in Infrared advanced gas detection will attend site and follow the requirements of the 'Safety Method Statement' ensuring all site access and safety requirements are being met.

All biogas assets (as listed) in the schedule are monitored for leakage using Optical Gas Imaging as they are the most likely points of gas escape due to pipework and tank joins. The relevant asset are located within the permit boundary as shown in the Asset Location Plan. Monitoring is undertaken in this area due to the location of the assets containing biogas. Any detection of leakage should be escalated using the 'Gas Leak Detection Form'.

8. Reactive Leakage Detection Process

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Reactive requests to monitor for biogas emissions may also be 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.

9. Training & Calibration

Personnel involved in undertaking leak detection using specific equipment are trained in the use of that equipment and all relevant Health & Safety requirements e.g. DSEAR awareness before attending sites. Equipment such as the thermal imaging camera are calibrated as per the manufacturer's recommendations.


10. References

Gas Leak Detection Notification Form (see Appendix A)
 Flir gas camera Method Statement & Escalation Procedure (see Appendix B)
[Best Available Techniques \(BAT\) Reference Document for Waste Treatment; Conclusion 14](#)
 Maintenance Workbank download 29/10/2021
 EPA Leak Detection & Repair Plan – A Best Practice Guide

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Appendix A

Gas Leak Detection Notification Form



REGIONAL SERVICES GAS LEAK DETECTION NOTIFICATION

FOR ACTION



United Utilities
helping life flow smoothly

+ Detected By		Fed back to operations locally?	
Date Detected		Priority	
Site			
Conditions			
Method of Detection:	Gas	Camera	Other


Asset Type	Picture of Defect
ADH Code	
Work Type	
Defect Summary:	

Work Order Summary			
Work Order Raised	Y/N	Work Order No.	
Airline Raised	Y/N	Airline No.	
Additional Information		Work Order Status	

Send a copy (email) of the completed defect notice to:

- Production manager of the site
- Production engineer of the site
- Condition Monitoring Team Leader
- Environmental Regulation Advisor (ERA)
- H&S Process Safety Team
- Principle Mechanical Engineer – Gas Systems

Prepared by: P Cooper
Issued by: Maintenance Optimisation, Operational Engineering

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Appendix B

Flir Gas Camera Method Statement & Escalation Process

Safety Method Statement

Description of Works and Location

Process to follow whilst undertaking gas leak inspections using Non-Ex certified optical imaging equipment; no other work may be carried out than as described in the method statement below.

Refer to Risk Assessment Dated: (.....)

Work to be carried out: Undertake Non Intrusive Testing and Inspection of gas related assets for leaks of VOC

Location of work: United Utilities All WwTW digestion sites including Gasholders

Equipment to be used:

- Flir GF320 Thermal Infrared Gas camera
- 3 way gas personal gas detector x 1
- Wind speed meter
- Note pad.

Personal Protective Equipment PPE

As per site-specific standard and as a minimum high visibility, boots, glasses, gloves, hardhat, overalls.

Supervision

On Site: Process Controller & Digester Safety Controller.

Off site: Regional Planned work Chris Bates [REDACTED] & Phillip Cooper [REDACTED]

Works Operation

Sequence of Events

1. Contact appropriate on site personnel upon arrival to discuss work to be undertaken and also emergency arrangements
2. Complete Site Induction via PC (If required / If WW passport doesn't cover what's required)
3. Identify area to be surveyed and review Hazardous Area plan for site
4. Review site gas system with PC
5. Estimate duration of survey



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6. Complete walk of designated Hazardous Area with personal gas detector set to alarm within source of emissions where possible.
7. Switch Gas Camera on before entering Zoned area (ground level) and complete daily operational functionality test.
8. Inspect site assets with camera looking for large gas leaks from approximately 20 metres (ground level if possible)
9. Move closer to assets with camera and carry out systematic survey of all components
10. Switch off camera, only when in a designated non-hazardous area
11. Report findings to the Process Controller or Manager of site
12. Complete defect notice (including airline number for airlines raised and work order number for work raised). Also take a picture of the source of the leak and insert that picture into the defect notice circling the leak on the picture.

Additional Information

- Always maintain at least 2 metres between any Zone 1 area and Gas Camera (e.g. PRV's)
- Always use Personal 3 way Gas Personal Monitor
- Note wind speed and direction, and stay up wind wherever possible.
- If required, use soap test to confirm exact point of leak

Leak Detection Escalation

On detection and location if possible of a leak, the following process will be followed;

1. Gas Leak Detection Form (Appendix A) completed
2. AIRLine raised and issued to process safety team
3. Gas Leak Detection Form issued via email to the following;
 - a. Production Manager and other applicable site personnel
 - b. Production Engineer
 - c. Condition Monitoring Team Leader
 - d. Environmental Regulation Advisor (ERA)
 - e. H&S Process Safety Team
 - f. Principle Mechanical Engineer – Gas Systems
4. (Optional) – Work order raised for FSE to enact corrective work.


Option 4 will be carried out if the solution to the root cause of the leak is assessed to be within the capability of local maintenance personnel. For example, the tightening of a flange on pipework.

Control of Operations

Refer to Risk Assessment Dated: (.....)

Internal United Utilities Reference Procedures

- United Utilities Code of Practice “ Installations in Potentially Explosive Atmospheres Associated with Water & Wastewater” Document No 60024
- Code of practice for the safe operation, maintenance and commissioning of sludge digesters and associated equipment
- Quality works. Site specific Zoned areas. (Yellow DSEAR Site Zoning Booklets)

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External Reference Documentation

Method 21, EPA 40 CFR Parts 60,63 and 65 Survey and report procedures

Competence of Operatives

Flir ITC Trained Inspectors:

Joe Holden [REDACTED]

Training requirements

- Flir Infrared Training Centre (ITC) GF 320 advanced gas detection,
- DSEAR awareness training
- Digester gas safety controller
- Confined Spaces

Storage /Materials /Handling

Equipment calibration and survey details

3 way gas personal gas detector (annual)

Flir GF 320 gas camera annual calibration as per standard requirements (GF320 to be tested daily and before each use)

All records of test and equipment to be stored as required.

Emergency arrangements

Refer to site specific emergency procedure, arrangements and the following contacts as appropriate:

Process Controller / FSE / Treatment Manager: / Digester Safety Controller

To be discussed, agreed and implemented on the day with the relevant Digester Safety Controller