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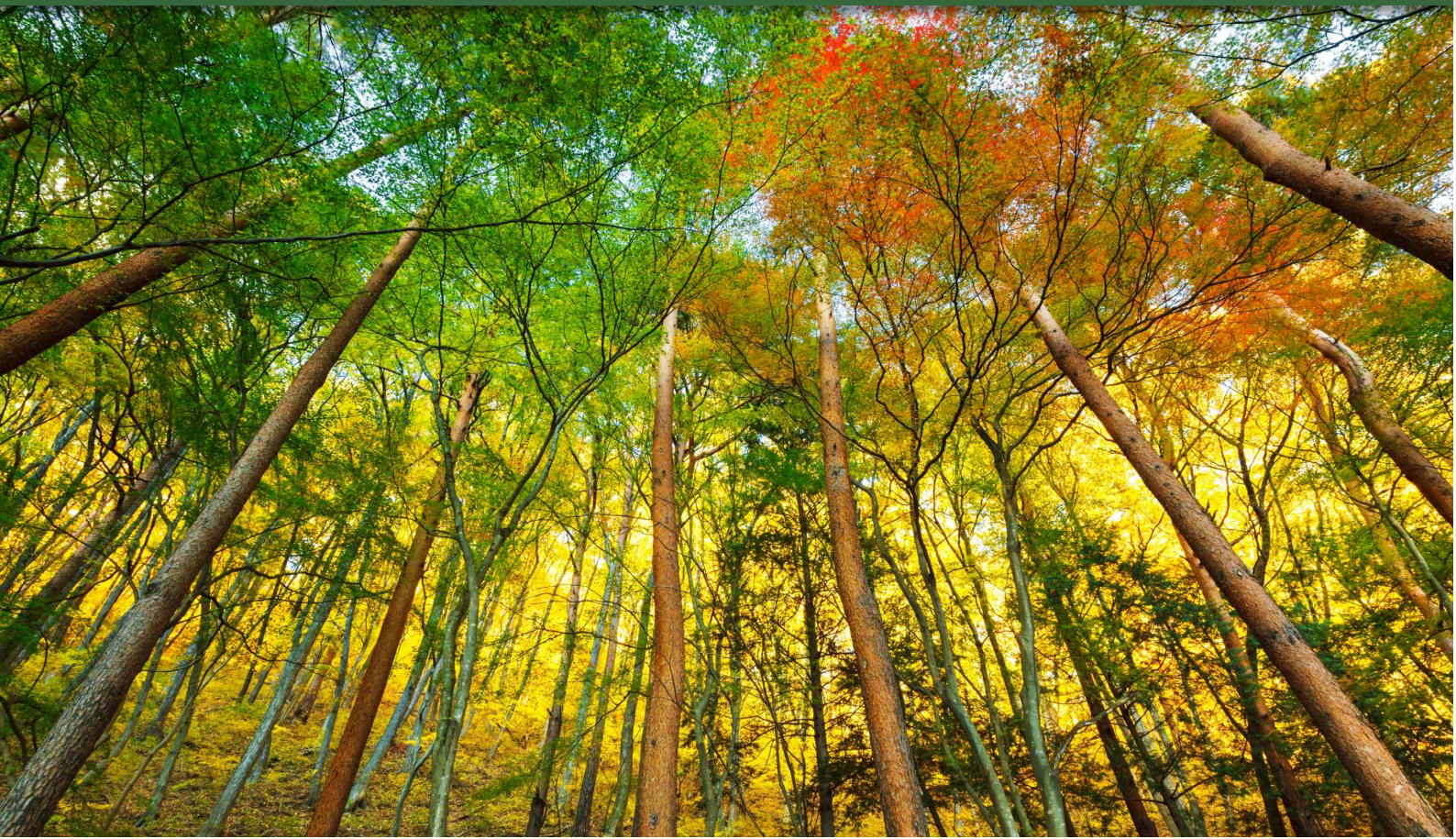
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## Leak Detection and Repair Plan

v1.2

Environmental and sustainability solutions provided to  
Haworth Scouring Company Limited



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## REVISION LOG

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0.2	Update following information return	27/10/2025
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## 1.0 INTRODUCTION

Walker Resource Management Ltd (WRM) have been commissioned by Haworth Scouring Company Limited (hereon referred to as 'HSC') to develop a Leak Detection and Repair (LDAR) Plan as part of an application to vary their existing Environmental Permit (reference: EPR/BS6025IF) to implement a small-scale Anaerobic Digestion (AD) stage to the current effluent treatment system on site.

This LDAR Plan outlines the methodology used to locate, identify and mitigate against fugitive emissions to air of Volatile Organic Compounds (VOC) and biogas from a small-scale AD plant as part of the Environmental Permitting Regulations (EPR) 2016 and Best Available Techniques (BAT) requirements for Waste Treatment. This methodology benefits the safety protection of site staff and increases productivity and value of the process, as well as protecting the environment. This document supports the implementation of BAT 14 (h) and has been developed in association with HSC's Odour Management Plan (OMP).

HSC, in accordance with BAT 14(h) will utilise a suitable method for the detection of a leak of biogas, in accordance with 'sniffing methods' as defined in Table 6.6.2 of the Best Available Techniques (BAT) Conclusions for Waste Treatment.

### 1.1 Site Description

The site is located off Birksland Street, Bradford. The site is approximately 1.3 kilometres to the east of Bradford City Centre and lies immediately north of a railway line connecting Bradford Interchange and New Pudsey. The area surrounding of the site is a mix of industrial, residential and commercial land use. The nearest residential property is approximately 90m north of the site boundary.

The closest watercourse, Fagley Beck, flows approximately 2km northeast of the site and flows from south to north, however the site is not within a flood zone.

### 1.2 Scope

This document is applicable to the following listed activities undertaken at the installation as per the site's Environmental Permit (reference: EPR/BS6025IF) under the Environmental Permitting Regulations:

- Section 6.4 Part A(1)(c) – Scouring of loose wool with a capacity of 192 tonnes per day.

The following Directly Associated Activities (DAA) are also undertaken taken at the installation:

- Generation of heat and steam via gas fired boiler
- Generation of heat and power via CHP
- Flaring of biogas in an emergency
- Treatment of effluent

HSC are seeking to vary their Environmental Permit to include an anaerobic digestion stage to the current effluent treatment system on site. This will entail moving effluent by pipeline from the current collection tank to a bunded area containing seven tanks (with space for a further two if necessary) which the effluent will flow through in turn undergoing anaerobic digestion in its various stages in each tank. The digested effluent will then be pumped back to the current physico-chemical effluent treatment system to the decanter to be treated before release to sewer via the existing monitored and auto-sampled release point.

The anaerobic tank site will be fully bunded to 110% of the largest tank. Additionally, the site has had soil samples analysed to provide a baseline for potential pollutants.

The only emission from this new process will be exhaust gases from the stack of the Combined Heat and Power (CHP) unit that will be co-installed at the anaerobic digestion site. Digestion of the effluent will produce a biogas primarily of methane with carbon dioxide and a small amount of nitrogen, which will be combusted in the CHP to produce electricity and heat to be utilised on the site. The exhaust gases, mainly carbon dioxide and nitrogen oxides, will be emitted from the CHP stack. The flare shall only be used in emergencies to flare off any excess biogas.

Leak detection, monitoring and maintenance requirements from the following are within scope:

- Biogas pipework and storage including:
  - Welds / joins
  - Seals;
  - Flanges;
  - Valves;
  - Biogas Compressors / Boosters;
  - Conveyors and presses;

- Biogas Storage system including:
  - Pressure relief valves;
  - Condensate traps;
  - Digester tanks.

### 1.3 Responsibility

The Site Manager for the 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 site's Engineering and Effluent Managers.

## 2.0 ASSETS AND MONITING

### 2.1 Identifying Assets

The following assets will be scheduled for routine proactive inspection via OGI or laser detection on an annual basis as shown on the Site Layout Plans (Annex A):

- 2 x CHP Engines;
- 1 x Flare Stack;
- 7 x Digester Tanks with biogas storage;
- Pipework;
- Condensate Pots / Traps on the biogas lines;
- Pressure Relief Valves (PRV); and,
- Biogas compressors / boosters.

The risks associated with the assets set out above have been assessed with a risk rating determined as can be seen in the table below.

Table 1 - Site Asset Risk Rating

Likelihood of risk arising		Significance		Significance of a resulting risk	
1	Rare - Will only occur in exceptional circumstances.	1	1	1	Negligible - Minimal impact or no discernible impact at all.
2	Unlikely - Unlikely to occur but definite potential exists.	2	2	2	Minor - Impact of risk materialising is unlikely to have any permanent or significant effect on the environment / human health.
3	Possible - Reasonable chance of occurring.	3	3	3	Moderate - Impact of risk materialising will have a significant effect on environment / human health.
4	Likely - Likely to occur - strong possibility.	4	4	4	Major - Impact of risk materialising will have a serious effect on environment / human health.
5	Almost certain - The event will occur in most circumstances.	5	5	5	Catastrophic - Impact of risk materialising catastrophically impacts the environment / human health.

No.	Gas Processing Infrastructure - Monitoring Locations	Risk Likelihood (1-5)	Risk Significance (1-5)	Risk Rating	Mitigation Measures
1	Digester tanks	2	4	8	Personal Detector / OGI / Laser Detection & Maintenance and Repair
3	Digester tanks - Filling level sensor	2	3	6	Personal Detector / OGI / Laser Detection & Maintenance and Repair
5	Booster - Gas sensor location	2	3	6	Personal Detector / OGI / Laser Detection & Maintenance and Repair
6	Connecting external gas pipework joints	3	2	6	Personal Detector / OGI / Laser Detection & Maintenance and Repair
7	Pressure relief valves	3	2	6	Personal Detector / OGI / Laser Detection & Maintenance and Repair
8	Gas flare	3	3	9	Personal Detector / OGI / Laser Detection & Maintenance and Repair
9	Gas filter prior to CHP	2	3	6	Personal Detector / OGI / Laser Detection & Maintenance and Repair
10	CHP - Gas connection	2	4	8	Personal Detector / OGI / Laser Detection & Maintenance and Repair
11	CHP -Emission point	2	2	4	Personal Detector / OGI / Laser Detection & Maintenance and Repair

The above lists are based on the sources where biogas and potentially VOCs are generated; transported; stored and utilised on site as detailed in the Risk Assessment in Section 3.0. Prior to commencing any monitoring or inspection, the most recent PNID plans for the biogas system should be obtained for the site, 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 site 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.

Biogas Compressors / Boosters and valves are utilised, when possible, to reduce the risk of leaks from the system.

## 2.2 Monitoring

The assets mentioned are subject to daily monitoring also, as part of the operator's daily site duties. Site operational staff are required to wear hydrogen sulphide detective personal biogas monitors which detect leakage in the area surrounding the site operator. 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 HSC approved training provider must be completed to be able to use the personal biogas monitors. This training is recorded on staff training records and is 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 is monitored on a continuous basis via the SCADA system, as a proxy for biogas generation. A change in CHP Engine utilisation and electricity 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 daily. This would be alarmed to a control room via the SCADA system for the appropriate action to be undertaken. Process works and remedial works are completed on pipework or similar by a contractor. PRVs are monitored and if a PRV is activated, operational staff respond to re-seat the valve as required. PRVs do not require periodic emissions monitoring against an Emission Limit Value because they are only utilised in abnormal or emergency conditions, any emissions are not continuous, PRVs remain sealed when not in use and do not contribute to diffuse emissions. Any alert of potential leakage is reported

centrally and repaired by appropriately skilled operatives. Checks are completed 6 monthly on digestors and associated assets 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 equipment such as but not limited to Optical Gas Imaging or Laser-Based monitoring equipment will be requested to complete an assessment to locate the source of the leakage.

This monitoring should be undertaken by a suitably trained individual. The biogas storage locations have the highest potential for the largest immediate volumetric release, 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 includes biogas boosters or condensate pots. 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 on site via the SCADA system and an on-site control room with remote access to raise alarms on high or low pressure.

Monitoring methods and Frequencies are noted in the table below:

**Table 2 - Monitoring Methods and Frequencies**

Task	Expected Frequency	Method	Priority	Priority Rationale
Inspection of Digester Tanks	Every 6 months	Sniffing, Personal Biogas Monitor, OGI / Laser Monitoring	High	Volume of contained biogas and level detection
Inspection of Biogas Storage	Every 6 months	Sniffing, Personal Biogas Monitor, OGI / Laser Monitoring	High	Operation and Maintenance task
Inspection of pipework between Biogas Storage and CHP Engine	Every 6 months	Sniffing, Personal Biogas Monitor, OGI / Laser Monitoring	Medium	Biogas volume contained. Look for degradation of pipework including all

				joins, flanges, seals and valves
Inspection of PRVs	Every 6 months	Sniffing, Personal Biogas Monitor, OGI / Laser Monitoring	High	Operation and Maintenance Task
Inspection of condensate traps	Every 6 months	Sniffing, Personal Biogas Monitor, OGI / Laser Monitoring	Medium	Biogas volume contained. Look for degradation of pipework that the condensate release tap moves freely and reseals
Inspection of pipework between Biogas Storage and emergency flare	Every 6 months	Sniffing, Personal Biogas Monitor, OGI / Laser Monitoring	Medium	Biogas volume contained. Look for degradation of pipework including all joins, flanges, seals and valves

### 2.3 Leak Repair

After a biogas leak is detected, the site monitoring operative informs the Site Manager or Technically Competent Manager. An observation and incident and corresponding action will then be raised (*Corrective Action Procedure*). 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 made available electronically. The Environment Agency (EA) is to be informed, where necessary, 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.

### 2.4 Record Keeping

As mentioned above, all biogas assets on site are uniquely identified and an electronic site register will be available and kept up to date. Leak detection activities are assigned to a person / to persons appropriately trained. 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 noted as urgent. Maintenance activities will be monitored monthly to ensure that all urgent tasks are close off. Records shall be kept of all inspections, tests and monitoring. Additionally, any detected leaks and associated corrective action shall be recorded and kept within the Site Office. Records shall be kept on site by HSC for at least two years and will be readily available for the Environment Agency to examine.

## 2.5 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 (CHP stack). Non-combusted biogas accounts for most of the stored biogas. Emission quantity will vary depending on:

- Location of emission source (from which asset);
- Date and time of Detection;
- Duration between detection and repair; and
- Pressure of contained biogas

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 within the asset involved, and the asset involved itself. 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 of unknown duration, the appropriate persons will be contacted (e.g. DSEAR Engineer; Health and Safety Advisor; other subject matter experts) to determine what would be safely practicable. 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 HSC instrumentation and/or potentially needed longer term, including on odour.

## 2.6 Training and Calibration

Any members of staff involved in leak detection are trained in the use of specialist equipment used and all relevant Health and Safety requirements. For example, DSEAR awareness before attending a site. Specialist equipment will be calibrated according to the recommendations of the manufacturer.



### 3.0 RISK ASSESSMENT

The table below considers the likely source-pathway-receptor for any leakages, the magnitude of a leak occurring and the risk management.

Pollutant Model			Judgement				Action	
Source	Pathway	Receptor	P	C	M	Justification of Magnitude	Mitigation	Residual Risk
Accidental Leak of Biogas – Digester tanks	Air transport and then inhalation.	Local human population and local environment.	Low	High	High	Biogas is highly flammable. Respiratory illness from the inhalation of Biogas (Ammonia and Hydrogen Sulphide). Emission to atmosphere of Methane, potent Greenhouse Gas.	<ul style="list-style-type: none"> <li>No point source emissions.</li> <li>Personal Methane Detector worn by any persons on site.</li> <li>OGI / Laser Detection.</li> <li>Maintenance and Repair Procedure and Log.</li> <li>Tanks and gas pipework are sealed.</li> <li>DSEAR Plan.</li> </ul>	Low risk
Accidental Leak of Biogas – Digester tanks (Filling Level Sensor)	Air transport and then inhalation.	Local human population and local environment.	Low	Med	Med	Biogas is highly flammable. Respiratory illness from the inhalation of Biogas (Ammonia and Hydrogen Sulphide). Emission to atmosphere of Methane, potent Greenhouse Gas.  Sensor itself does not contain Biogas.	<ul style="list-style-type: none"> <li>No point source emissions.</li> <li>Personal Methane Detector worn by any persons on site.</li> <li>OGI / Laser Detection.</li> <li>Maintenance and Repair Procedure and Log.</li> <li>Tanks and gas pipework are sealed.</li> <li>DSEAR Plan.</li> </ul>	Low risk

Pollutant Model			Judgement				Action	
Source	Pathway	Receptor	P	C	M	Justification of Magnitude	Mitigation	Residual Risk
Accidental Leak of Biogas – Booster (Gas Sensor Location)	Air transport and then inhalation.	Local human population and local environment.	Low	Med	Med	Biogas is highly flammable. Respiratory illness from the inhalation of Biogas (Ammonia and Hydrogen Sulphide). Emission to atmosphere of Methane, potent Greenhouse Gas. Sensor itself does not contain Biogas.	<ul style="list-style-type: none"> <li>No point source emissions.</li> <li>Personal Methane Detector worn by any persons on site.</li> <li>OGI / Laser Detection.</li> <li>Maintenance and Repair Procedure and Log.</li> <li>Tanks and gas pipework are sealed.</li> <li>DSEAR Plan.</li> </ul>	Low risk
Accidental Leak of Biogas – Connecting External Gas Pipework Joints	Air transport and then inhalation.	Local human population and local environment.	Med	High	High	Biogas is highly flammable. Respiratory illness from the inhalation of Biogas (Ammonia and Hydrogen Sulphide). Emission to atmosphere of Methane, potent Greenhouse Gas. Continual flow of Biogas through pipes.	<ul style="list-style-type: none"> <li>No point source emissions.</li> <li>Personal Methane Detector worn by any persons on site.</li> <li>OGI / Laser Detection.</li> <li>Maintenance and Repair Procedure and Log.</li> <li>Tanks and gas pipework are sealed.</li> <li>DSEAR Plan.</li> </ul>	Low risk
Accidental Leak of Biogas –	Air transport and then inhalation.	Local human population	Low	Med	Med	Biogas is highly flammable. Respiratory illness from the inhalation	<ul style="list-style-type: none"> <li>No point source emissions or diffuse emissions as valves remain closed when not in use.</li> </ul>	Low risk

Pollutant Model			Judgement				Action	
Source	Pathway	Receptor	P	C	M	Justification of Magnitude	Mitigation	Residual Risk
Pressure Relief Valves		and local environment.				<p>of Biogas (Ammonia and Hydrogen Sulphide). Emission to atmosphere of Methane, potent Greenhouse Gas.</p> <p>Trigger controlled, small quantity of Biogas in comparison to entire system.</p> <p>Emissions only occur for short periods in the event of over-pressurisation of the tanks.</p>	<ul style="list-style-type: none"> <li>• Personal Methane Detector worn by any persons on site.</li> <li>• OGI / Laser Detection.</li> <li>• Maintenance and Repair Procedure and Log.</li> <li>• Tanks and gas pipework are sealed.</li> <li>• DSEAR Plan.</li> </ul>	
Accidental Leak of Biogas – Filter before combustion in CHP engine	Air transport and then inhalation.	Local human population and local environment.	Low	High	High	<p>Biogas is highly flammable. Respiratory illness from the inhalation of Biogas (Ammonia and Hydrogen Sulphide). Emission to atmosphere of Methane, potent Greenhouse Gas.</p>	<ul style="list-style-type: none"> <li>• No point source emissions.</li> <li>• Personal Methane Detector worn by any persons on site.</li> <li>• OGI / Laser Detection.</li> <li>• Maintenance and Repair Procedure and Log.</li> <li>• Tanks and gas pipework are sealed.</li> <li>• DSEAR Plan.</li> </ul>	Low risk

Pollutant Model			Judgement				Action	
Source	Pathway	Receptor	P	C	M	Justification of Magnitude	Mitigation	Residual Risk
						Continual flow of Biogas.		
Accidental Leak of Biogas – CHP (Gas connection)	Air transport and then inhalation.	Local human population and local environment.	Low	High	High	Biogas is highly flammable. Respiratory illness from the inhalation of Biogas (Ammonia and Hydrogen Sulphide). Emission to atmosphere of Methane, potent Greenhouse Gas.  Continual flow of Biogas.	<ul style="list-style-type: none"> <li>No point source emissions.</li> <li>Personal Methane Detector worn by any persons on site.</li> <li>OGI / Laser Detection.</li> <li>Maintenance and Repair Procedure and Log.</li> <li>Tanks and gas pipework are sealed.</li> <li>DSEAR Plan.</li> </ul>	Low risk
Accidental Leak of Biogas – Gas Flare	Air transport and then inhalation.	Local human population and local environment.	Low	High	Med	Biogas is highly flammable. Respiratory illness from the inhalation of Biogas (Ammonia and Hydrogen Sulphide). Emission to atmosphere of Methane, potent Greenhouse Gas.	<ul style="list-style-type: none"> <li>No point source emissions.</li> <li>Personal Methane Detector worn by any persons on site.</li> <li>OGI / Laser Detection.</li> <li>Maintenance and Repair Procedure and Log.</li> <li>Tanks and gas pipework are sealed.</li> <li>DSEAR Plan.</li> </ul>	Low risk

Pollutant Model			Judgement				Action	
Source	Pathway	Receptor	P	C	M	Justification of Magnitude	Mitigation	Residual Risk
						Gas to be flared off only in an emergency when there is excess biogas.		
Accidental Leak of Biogas – CHP (Emission point)	Air transport and then inhalation.	Local human population and local environment.	Low	Med	Med	Biogas is highly flammable. Respiratory illness from the inhalation of Biogas (Ammonia and Hydrogen Sulphide). Emission to atmosphere of Methane, potent Greenhouse Gas. Good combustion control within CHP.	<ul style="list-style-type: none"> <li>• Personal Methane Detector worn by any persons on site.</li> <li>• OGI / Laser Detection.</li> <li>• Maintenance and Repair Procedure and Log.</li> <li>• AQIA</li> <li>• DSEAR Plan.</li> </ul>	Low risk
P = Possibility C = Consequence M = Magnitude								

## 4.0 PRESSURE RELIEF VALVES

A pressure relief valve (PRV) is a critical safety device designed to protect pressurised systems—such as AD tanks and pipes—from catastrophic failure, explosions, or damage caused by excessive pressure. It automatically opens to release gas, liquid, or vapor when pressure exceeds a pre-set limit, closing once safe, lower pressure levels are restored.

The 7No. AD tanks each feature a sealed PRV, purely for use as a safety device and designed to prevent fugitive leaks during normal operation. The PRVs are not a source of uncontrolled fugitive emissions; rather, they are engineered emergency release points.

Where PRVs activate:

- The release is intentional, controlled, and safety-critical
- The release is short-term and self-limiting

If/when they are used, they will only be used for short periods of time until lower pressure levels are restored when the valves will close and will remain closed.

It is not considered that emissions abatement is required on the PRVs, on the basis that they are not intended for regular or frequent use, when they are used it shall be for very short periods of time and when they are not in use the valve is closed and sealed, thus preventing fugitive emissions of gas. Additionally, whilst the PRVs are expected to feature on the environmental permit as emission points, it is expected that there will be no requirement to monitor the emissions from them. Accordingly, PRV emissions are not fugitive emissions as defined under BAT 15, but rather BAT-recognised abnormal emissions necessary for plant safety

As detailed above, the PRVs shall be covered by the LDAR plan in terms of as a focus of LDAR monitoring.

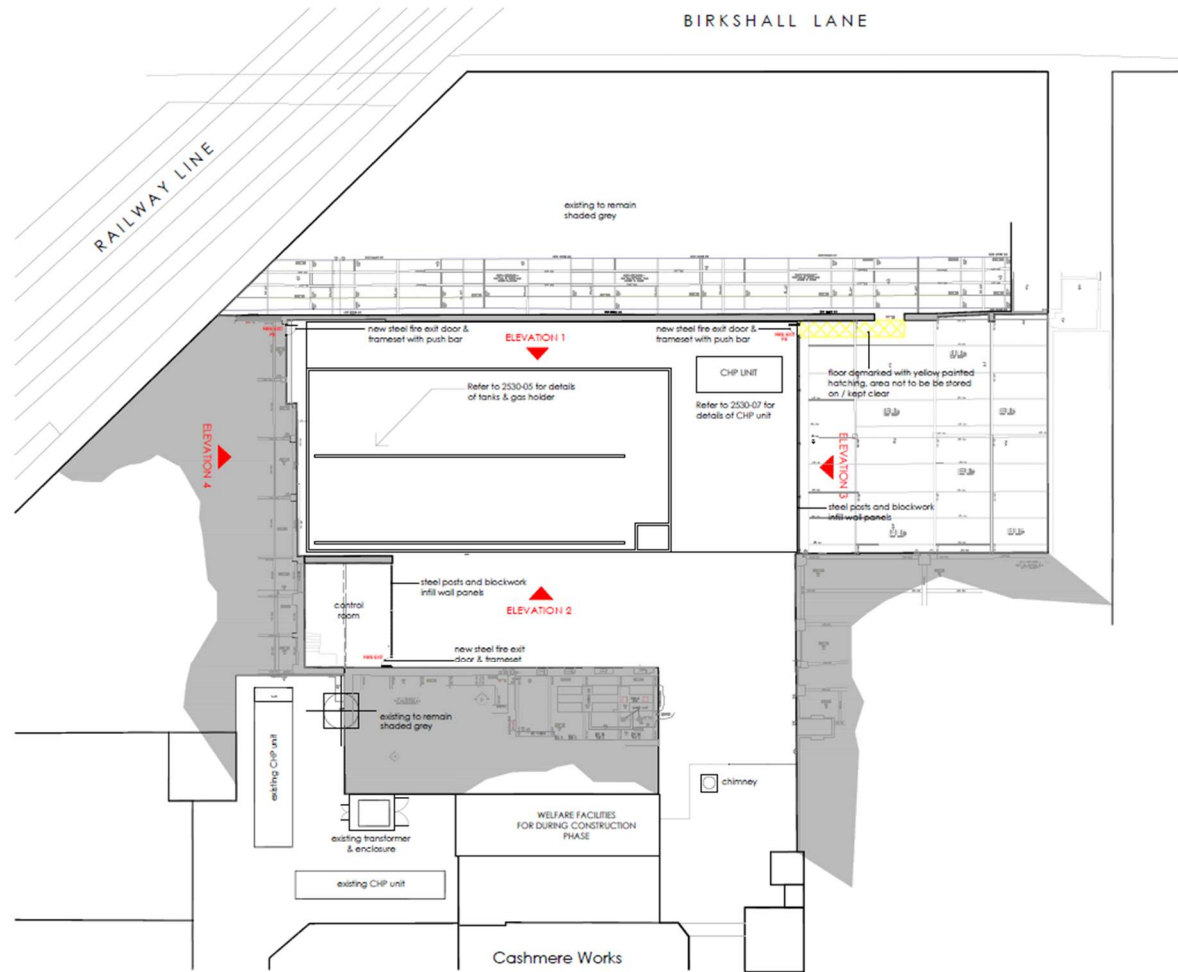
## ANNEX A – LDAR SURVEY FORM

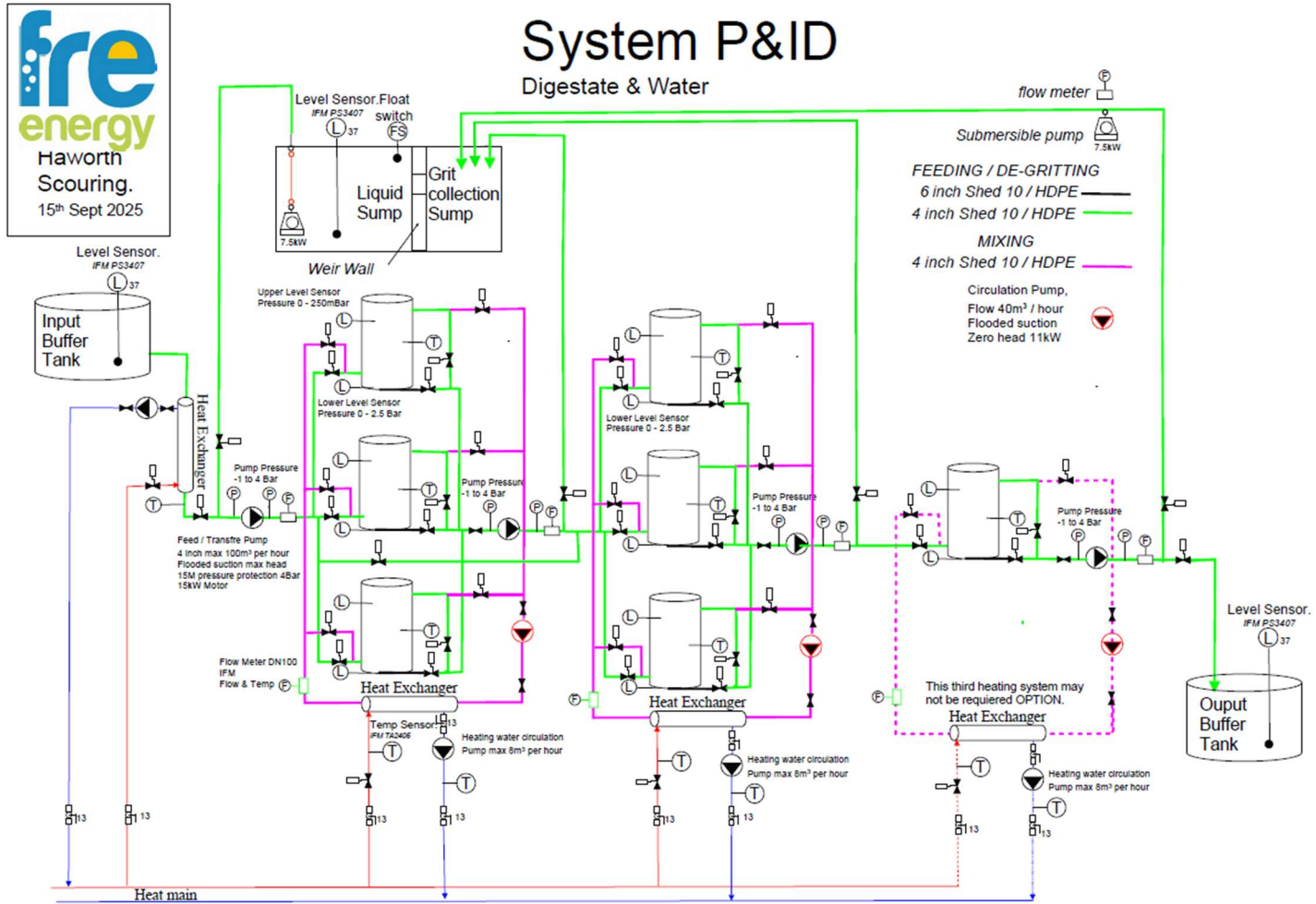
LDAR Survey Form			Date:
Site Name		Site Address:	
Operator Name (or name of Organisation carrying out monitoring including: <ul style="list-style-type: none"> <li>names, experience and qualifications of the personnel carrying out the monitoring;</li> <li>accreditation status of the monitoring organisation;</li> <li>documented procedures used for the LDAR campaign and reporting</li> <li>quality assurance or quality control criteria;</li> <li>name of the person approving the report for the monitoring organisation; and,</li> <li>the signature of the person approving the report).</li> </ul>			
Permit Number			
Site Operating Conditions (for example, operating at full capacity or reduced load due to X and Y)			
Time of test			
Location of test			
Make, model and serial number of detection equipment			
Detection Limit			
Calibration certificate (if applicable)			

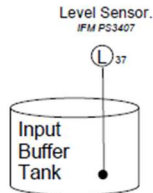
Weather conditions (including temperature, wind speed and wind direction)				
measurement objectives (for example, targeted processes, site areas)				
Areas of site that were not surveyed and why				
Leak definition used for the survey				
Distance from which components were surveyed				
Duration of measurement				
Leaks identified				
Time leaks were identified				
Description of leaking component (including reference number if applicable)				
Severity of the leak - leak rate, or the risk posed due to the component type and location (or both)				

Any non-conformities against the quality assurance or quality control procedures				
Additional comments plus photographs of the leak and an annotated site plan showing leak locations				

## ANNEX B – SITE LAYOUT PLANS







# System P&ID

## Gas, Tank protection and mixing

