



COMPLIANCE

DSEAR Assessment

(Dangerous Substances and Explosive
Atmospheres Regulations 2002)

Adapt Biogas

Somerset Farm, Murrow, Cambridgeshire, PE13 4HN

10th May 2021

one of the team

Quality Management

Client Name	Adapt Biogas
Address of premises surveyed	Somerset Farm, Murrow, Cambridgeshire, PE13 4HN
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Survey Date (s)	10 th May 2021
QC Check By	Liza Elston
Review Date	May 2021

Revision Status / History

Rev	Date	Description	Who
1	22 nd May 2021	First Issue	RLD

Executive Summary

As a requirement of the DSEAR 2002 regulations, this assessment has identified that there are potentially explosive atmospheres and there are some immediate and long-term actions that will significantly reduce the risk of explosion or fire.

The summary of actions includes:

- Training for staff and contractors
- Improvements in housekeeping
- Signage improvements
- Firefighting arrangements
- Earthing investigations
- Repairs and maintenance
- Critical plant and equipment inspection and maintenance

Summary

In summary, the highest risk factor is the introduction of ignition sources in conjunction with poor housekeeping standards causing a fire and subsequently that fire resulting in an explosion or secondary explosion.

The above controls will significantly reduce the likelihood and in some cases the severity and consequence of any explosion or fire. It is important to note that DSEAR regulations not only cover explosive atmosphere but also dangerous substances and processes, and so fire risk and employee exposure are also an important factors in ensuring legal compliance.

Introduction

This risk assessment and area classification exercise forms part of the legal requirements of the UK legislation covering fires and explosions from the presence of dangerous substances in the workplace. The Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) came into force on the 1st July 2003 and implements the European Union ATEX Directive.

In workplaces where potentially dangerous substances are present or may occur, it is a requirement that the employer undertakes a risk assessment and also a hazardous area classification exercise. This will then facilitate the correct use of electrical and mechanical equipment in the hazardous areas in order to minimise the risk of an ignition.

The basis of the technique is that areas where combustible Gas, Vapour or Mist and/or dusts are present, these are set into zones depending on the persistence and frequency of the flammable atmosphere. This then enables the correct equipment to be used within the different zones to minimise the risk of the equipment causing an ignition of the flammable atmosphere.

Note that some ATEX rated equipment may only be suitable for Powder, some only for Gas or vapour and some for all.

This report details the results of the risk assessment exercise and area classification study undertaken for the potentially explosive atmospheres including:

- **Bulk LNG compound**
- **Bulk diesel tanks**
- **Bio-gas CHP Plant**
- **Digesters and feed system**
- **Liquid slurry tank**
- **Storage tank**
- **Bio-gas flare**
- **Cooler unit and condensate Pits**
- **Gas upgrade Plant**
- **Bio-methane Flare**
- **Grid entry unit**
- **Gas analyser**

The risk assessment report is intended to be a “living” document, as part of the requirements under DSEAR and EU ATEX 137 and ATEX 95 Directive. Any future changes to the areas will need to be documented and re-assessed in relation to its effect on the risk assessment to determine if such changes will alter the area classification. For example, this could include physical changes e.g., change of materials handled; or operational, e.g., certain processes used less frequently.

Dangerous substances handled

The first part of the risk assessment is to identify all the materials handled in the work place covered in this report, that have the potential to act as a fuel for a fire and explosions.

Substances

The following products are the only products to be used in the workplace in line with this assessment. Any other products should be tested prior to use and this assessment should be reviewed and updated to show such additions.

Hazardous Substance	Nature of Hazard
Bio-Methane (Natural gas)	Extremely flammable gas – Produced in upgrade plant from Biogas with addition of Propane
Propane	Extremely flammable gas – Used for calorific value enrichment of the Bio-methane stream. Stored in two large bulk tanks with associated pressure boost pump sets.
Biogas	Extremely flammable gas – May be found in anaerobic digestion system in high percentage
Carbon Dioxide	Non-combustible gas – May be found in anaerobic digestion system in low percentage
Nitrogen	Non-combustible gas – May be found in anaerobic digestion system in low percentage
Oxygen	Oxidising gas – May be found in anaerobic digestion system in low fractional percentage
Hydrogen Sulphide	Extremely flammable gas – May be found in anaerobic digestion system in low fractional percentage
Aerosols (Iso-Butane)	Extremely flammable gas – Used in maintenance operations, such as leak and flaw detection, paints, and Lubricants
Inert test gases	Non-combustible gas – Used in gas entry unit
Argon	Non-combustible gas – Used in workshop welding equipment
Solvents	Highly flammable and flammable – Used in cleaning solutions and found in paints and thinners
Diesel	Flammable – Used for powering standby generators and workplace transport
Dusts	Combustible sludge dust – may be found as accumulations on equipment
Miscellaneous Combustibles	Minimal flammable/combustible consumables present - includes misc. maintenance, cleaning, or waste

Gases											
Substance	Key Hazard	Flammable Range (LFL – UFL % in Air)	Flash Point	Boiling Point	Vapour pressures kPa	Relative density to Air @ 20°C	Auto Ignition Temp.	Gas Group	T Class	Quantity	Comment
Biogas	H220: Extremely Flammable gas	5.0 – 15%	-188°C	-162°C	20°C – 150 kPa	0.56	537°C	IIC	T1	Various depending on site operations	CAS 74-82-8
Hydrogen	H220: Extremely Flammable gas	4.0 – 75%	< -250°C	< -253°C	N/A	0.07	585°C	IIC	T1	4 x 65kg cylinders in gas entry unit	CAS 1333-74-0 MIE 0.011mJ
Propane/LNG	H220: Extremely Flammable gas	1.7 – 10.9%	-104°C	-42°C	20°C – 832.7 30°C – 1080 50°C – 1708	1.55	470°C	IIA	T1	2 x 24,000L bulk tanks externally 2 X 47kg each externally 2 X 47kg cylinders in gas entry unit	CAS 74-98-6, MIE 0.24mJ
Methane	H220: Extremely flammable gas	4.4 – 17%	N/A	-161.5°C	N/A	0.6	595°C	IIA	T1	Biogas and Bio-methane	CAS 74-82-8 MIE 0.29mJ
Hydrogen Sulphide	H220: Extremely flammable gas	4.3 – 45.5%	n/a	-60.2°C	20°C – 1819 30°C – 2310 50°C – 3650	1.19	270°C	IIB	T3	Appx 1,000 - 5,000ppm of biogas	CAS 7783-06-4 MIE 0.068mJ
Iso-Butane	H220: Extremely Flammable gas	1.5 – 9.4%	-83°C	-11.7°C	20°C – 301.9 30°C – 410 50°C – 677.8	2.07	460°C	IIA	T1	500g each, several canisters	CAS 75-28-5 MIE 0.25mJ
Oxygen	H270: May cause or intensify fire; oxidiser	N/A	N/A	-183°C	N/A	1.11	N/A	N/A	N/A	Appx < 0.5% of biogas	CAS 7782-44-7
Argon	H280: Contains gas under pressure; may explode if heated	N/A	N/A	-185.9°C	N/A	N/A	N/A	N/A	N/A	18 kg cylinder, 1 internally for welding	CAS 7440-37-1 UN 1951

Liquids											
Substance	Key Hazard	Flammable Range (LEL – UEL % in Air)	Flash Point	Boiling Point	Vapour pressures kPa	Relative density to Air @ 20°C	Auto Ignition Temp.	Gas Group	T Class	Quantity	Comment
General solvent borne paints	H226: Flammable liquid and vapour	N/A	29°C	N/A	N/A	N/A	N/A	N/A	N/A	Several x 2.5 and 5L in paint store	
White spirit	H226: Flammable liquid and vapour	0.6 – 8%	38°C	150-200°C	20°C – 0.44	N/A (>1)	230°C	IIA	T3	Several 1L in paint store	CAS 78-93-3 MIE 0.27mJ
Diesel	H226: Flammable liquid and vapour	0.6 – 7.5%	55°C	160°C	40°C – 0.04	N/A (>1)	220°C	IIA	T3	10,000L and 2,500L external storage tanks	CAS 68476-34-6

Dusts / Powders									
Substance	Key Hazard	Lower Explosion Concentration	Auto Ignition Temperature	Maximum Over Pressure	Kst [bar m/s]	Explosibility	Combustibility	Quantity	Comment
Sludge dust	IIIB combustible dust	60 g/m ³	470°C	8.1 Bar	102	ST1	BZ2 – catches fire briefly and extinguishes rapidly	Accumulations on drying side of equipment	MIE 10-100 mJ

NA – Not Available

Assessment areas

Areas reviewed where flammable and explosive atmospheres are or may be present.

Area / Plant / Process Description of materials and process	Description of protection measures (I.E. Explosion panels / Inert gas systems / Sprinkler protection / LEV Extraction)
Bulk LNG compound Flammable gas Compressed gas	<ul style="list-style-type: none"> • 30,000 litre LNG tanks within a secure compound. • LNG used to supply enrichment gas to the bio-methane upgrade process to raise its calorific value. • Two tanks, valving, relief vents, pressure regulation booster sets and metering with telemetry.
Bulk diesel tanks Flammable liquid	<ul style="list-style-type: none"> • Two self-bunded diesel tanks of appx. 10,000L gas oil (red diesel). • Diesel fuel now falls within scope of DSEAR risk assessment due to CLP2015 classification raising the flash point temperature band to 60°C from 55°C. • Tank inlets and outlets locked. • 10,000L tank controls cabinet trailing earth
Workshop Workshop areas / Handling, storage and decanting of flammables.	<ul style="list-style-type: none"> • At the site, a workshop is located in a storage container This has a welding set and flammable aerosols and liquids are kept within the container. • Fire extinguishers available and within service periods in workshop.
Bio-gas CHP Plant Flammable gas	<ul style="list-style-type: none"> • Contained biogas fired CHP unit. • External emergencies stop controls. • Interlocked forced / artificial ventilation. • EX rated VOC detection at high level. • Fire early detection • Fire extinguishers • VOC monitoring to shut-down CHP plant. • VOC Monitor and Artificial ventilation system is within site critical asset register.
Bio-methane Flare Flammable gas	<ul style="list-style-type: none"> • Bio-methane flare safely burns off excess Bio-methane in event of a failure within the Bio-methane processing plant. • Earthing of steel structures and electrical equipment present • Identification of electrical circuits present. • EX signs
Digesters and feed system	<ul style="list-style-type: none"> • Vegetable matter feedstock liquid feed system into tank 1, side mounted agitation

Flammable gas	<ul style="list-style-type: none"> • Positive pressure within the tanks with system shutdown. • Lightning protection • EX signs in place • EX equipment within Hazardous Areas • System to shut-down operations in event of loss of containment.
Liquid slurry tank Flammable gas Combustible dust	<ul style="list-style-type: none"> • Liquid slurry is passed through the liquid slurry tank for fibre separation. • Low occupancy
Storage tank Flammable gas Combustible dust	<ul style="list-style-type: none"> • Digestate liquid storage • Positive pressure within the tank with pressure and vacuum relief valves. • Pressure relief system shutdown • Good level of housekeeping present around lorry loading area. • EX signs and associated equipment. • Lightning protection system installed.
Bio-gas flare Flammable gas	<ul style="list-style-type: none"> • Emergency Bio-gas flare. Safely system designed to burns off excess Biogas in event of a failure within the plant. • Equipment EX rated • EX signs
Cooler unit and condensate Pits Flammable gas	<ul style="list-style-type: none"> • Once Biogas is produced and as part of the transfer to the gas upgrade plant, it passes through the cooler unit. Here Biogas is cooled and dried to remove moisture, which collects as condensate. Associated plant items are two condensate pits. • The cooler unit is surrounded by higher structures, lightning strike unlikely - lightning protection system may not be required.
Gas upgrade Plant Flammable gas	<ul style="list-style-type: none"> • Bio-gas pressure is raised by external gas pressure booster before entering gas upgrade plant. • Biogas is compressed and purified by scrubbers and filtration. • Calorific value of the gas is improved until Bio-methane produced. • CO2 processing plant – segregated. • Artificial ventilation system installed to ensure adequate ventilation within congested plant. • Gas monitoring and alarm system installed at high and low level. • Earthing of steel structures and electrical equipment

<p>Grid entry unit</p> <p>Flammable gas</p> <p>Compressed gas</p>	<ul style="list-style-type: none"> • Grid entry unit • Analysis and metering of Bio-methane • Compressed gas cylinders secured. • Equipment EX rated. • Adjacent office sealed with cable transition frames. • Evidence of earthing present. • Identification of electrical circuits present
<p>Gas analyser</p> <p>Flammable gas</p>	<ul style="list-style-type: none"> • Bio Methane analysis unit within the control room. • Self-contained unit. • Gas monitors in use

Potential ignition sources

- Hot surfaces (Ovens and Light fittings)
- Electrical spark due to the operation of a switch or the opening/closing of a contact.
- Electrical lighting
- Short circuit
- Electrical arc
- Earth fault
- Discharges of static electricity
- Loose contact (Ark when adding Hook – Outside zoned areas)
- Excessive temperature rises due to overload.
- Friction, e.g., overheating
- Hot work, including welding, cutting, and grinding.

One of the main causes of explosions is during maintenance work involving cutting and welding activities. Hot working can cause sparks and localised hot spots and hence any work of this nature should be subject to a hot work permit system.

This should ensure that the area is clean and flammable materials removed prior to work starting.

Area classification

The areas are classified as follows and cover the plant and equipment of the process up to and including the transfer to the next part of the process.

The areas are defined using the following key:

Grade of release	Degree of ventilation	Availability of ventilation
Continuous	High	Good
Primary	Medium	Fair
Secondary	Low	Poor

Zone 0 / 20 - ATEX Category 1 Equipment

A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of Powder / Dust / Fumes / Vapours or Gasses is present continuously or for long periods or frequently.

Zone 1 / 21 - ATEX Category 1 or 2 Equipment

A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of Powder / Dust / Fumes / Vapours or Gasses is likely to occur in normal operation occasionally.

Zone 2 / 22 - ATEX Category 1, 2 or 3 Equipment

A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of Powder / Dust / Fumes / Vapours or Gasses is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

Area Classification

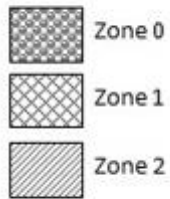
Area / Plant / Process	Grade of Release	Degree of Ventilation	Availability of Ventilation	Description of Zone
Bulk LNG compound, vessel relief valve	Primary	High	Good	<ul style="list-style-type: none"> Zone 2 for 3 metres radius around pressure relief valve outlet Zone 1 for 0.5 metre radius around level gauge, connections, flanges, compressor, drain and bleed valves
Flammable's cabinet / store	Continuous	Medium	Fair	<ul style="list-style-type: none"> Zone 0 within headspace of solvent containers Zone 2 within store / cabinet volume Zone 1 for 0.5 metre radius above and around funnel lip
Digesters	Secondary	High	Good	<ul style="list-style-type: none"> Zone 2 for 3 metres radius above and around vessel top mounted flexible membrane Zone 1 for 1 metre radius around PVRV outlet Zone 2 for 2 metres radius around PVRV Zone 1
Liquid feed, small rectangular tank	Primary	Low	Poor	<ul style="list-style-type: none"> Zone 1 within tank
Liquid slurry tank	Primary	Low	Poor	<ul style="list-style-type: none"> Zone 1 within tank and submerged vent pipe Zone 2 for 1 metre radius around vent opening at top of tank
Lorry loading, connections	Secondary Primary Secondary	High	Good	<ul style="list-style-type: none"> Zone 2 for 0.5 metre radius around lorry loading connections. Zone 1 within tanker vessel Zone 2 for 0.5 metre radius around tanker vessel vent
Bio-gas flare bio-methane flare	Secondary	High	Good	<ul style="list-style-type: none"> Zone 2 for 2 metres radius above and around Bio-gas flare unit
Bio-gas cooler	Secondary	High	Good	<ul style="list-style-type: none"> Zone 2 for 0.5 metre radius above and around Bio-gas cooler unit
Condensate pits	Primary Secondary	Low	Poor	<ul style="list-style-type: none"> Zone 1 within condensate pit Zone 2 for 1 metre radius above and around condensate pit
Gas upgrade plant, external gas	Primary	High	Good	<ul style="list-style-type: none"> Zone 2 for 1.5 metres radius around gas pressure booster fan

pressure booster, doorways and openings and vents	Secondary			<ul style="list-style-type: none"> • Zone 2 within congested plant room • Zone 2 for 1 metre radius above and around doorways and openings externally • Zone 1 for 0.5 metre radius around vent pipe outlet • Zone 2 for 4 metres radius around vent pipe outlet
Grid entry unit, gas cylinder compartment	Secondary	Medium	Fair	<ul style="list-style-type: none"> • Zone 2 within gas cylinder compartment • Zone 2 within metering section room
Gas analyser	Secondary	Medium	Fair	<ul style="list-style-type: none"> • Zone 2 within gas analyser enclosure

Zone Map

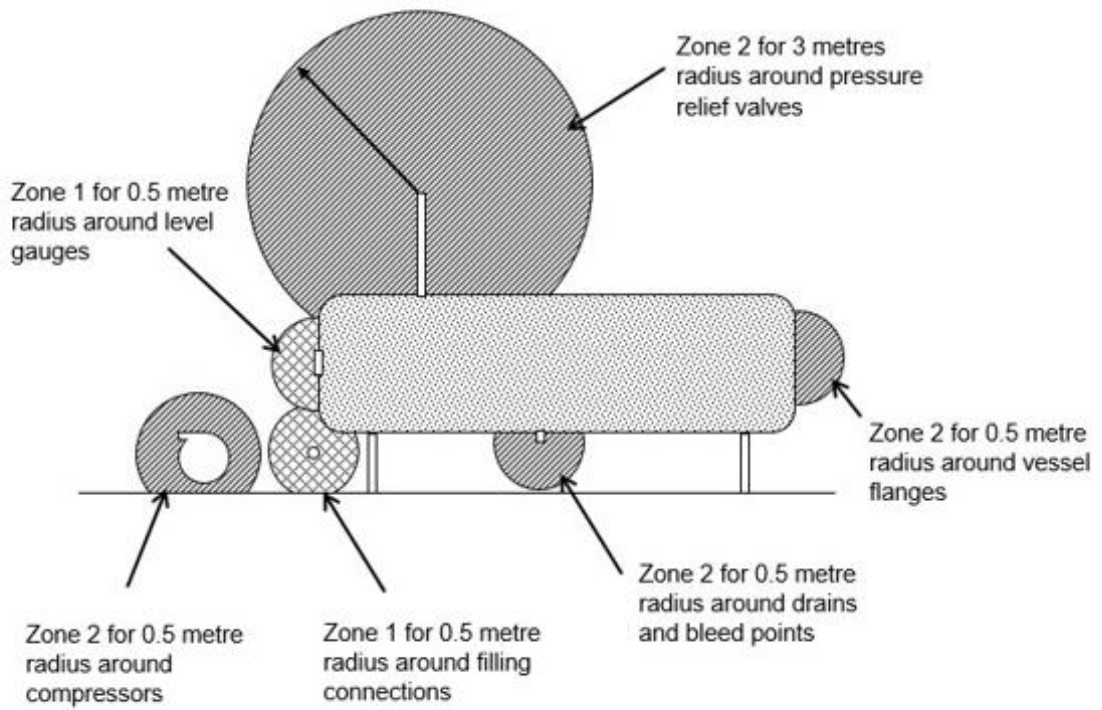
LNG Compound

Key



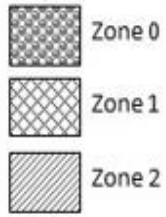
Gas group: IIA
Temp class: T1

Side view

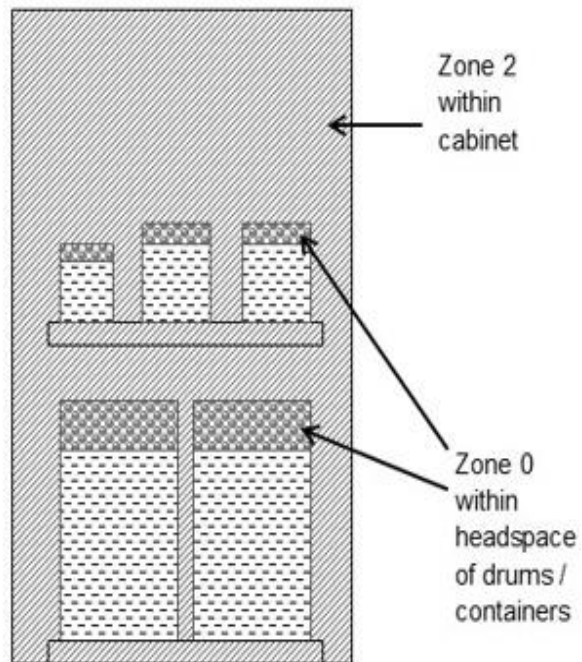


Flammables store / cabinet

Key

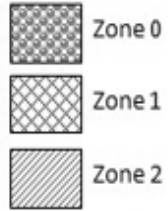


Gas group: IIB
Temp class: T3



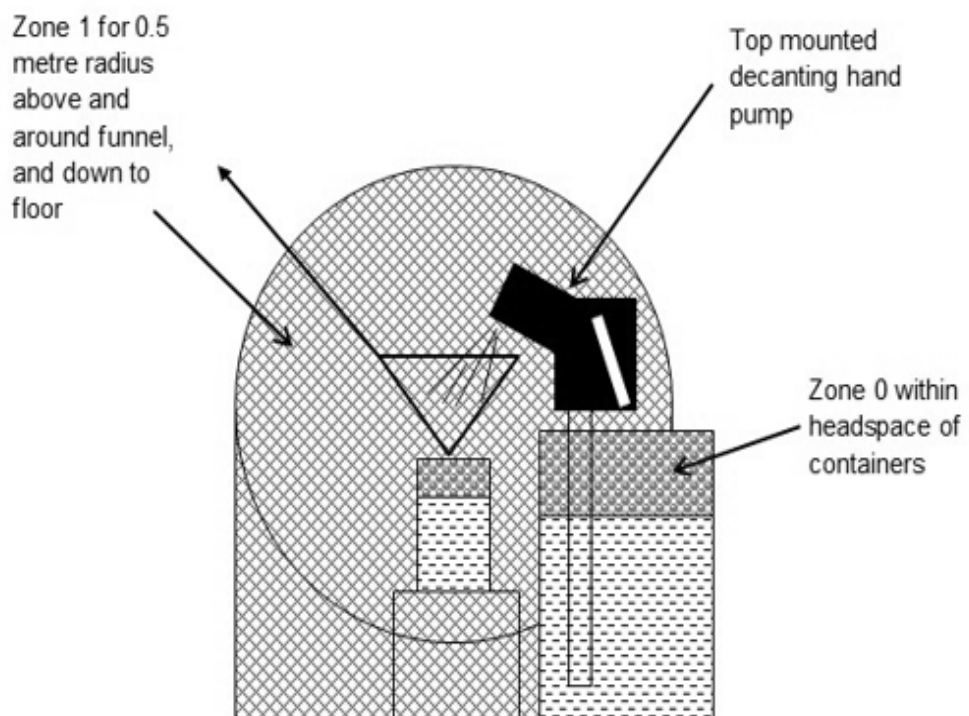
Flammable decanting

Key



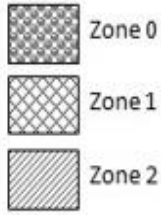
Gas group: IIB

Temp class: T3



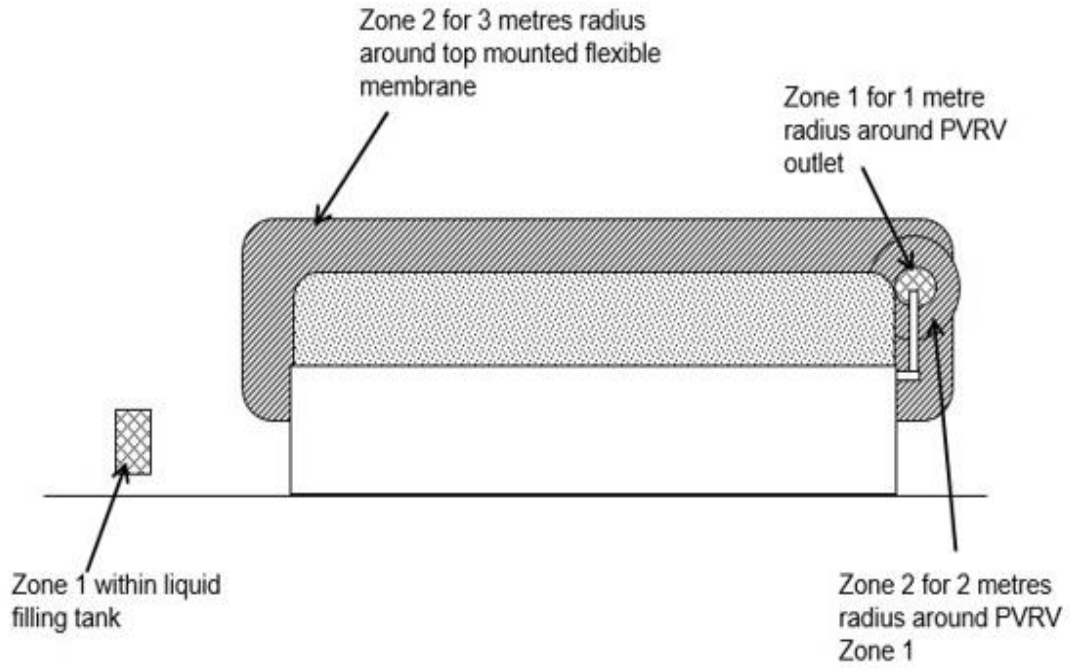
Digester tanks

Key



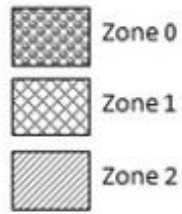
Gas group: IIA
Temp class: T1

Side view



Liquid slurry tank

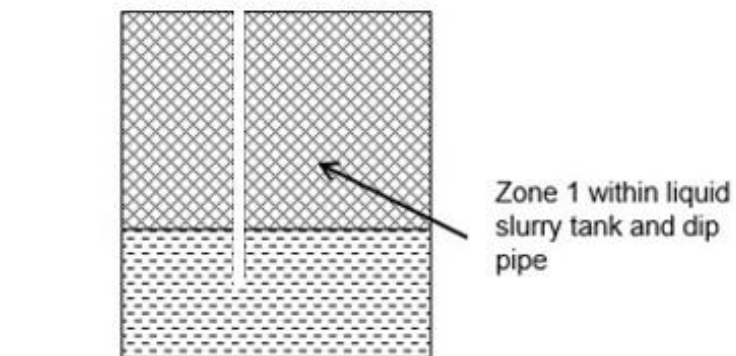
Key



Gas group: IIA

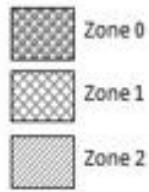
Temp class: T1

Side view



Tanker loading connections.

Key

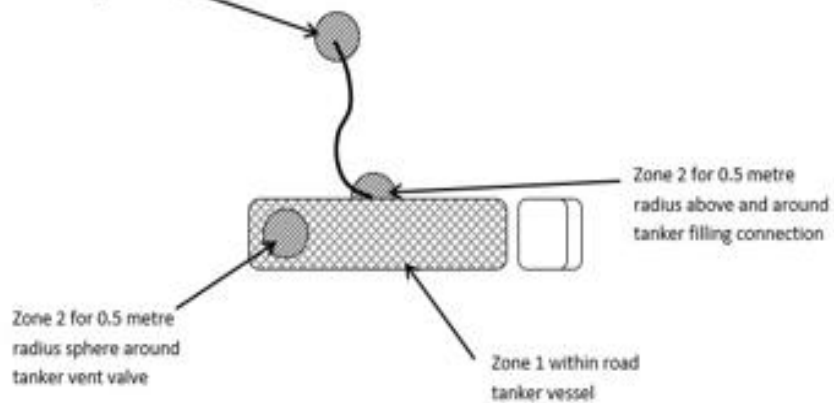


Temp class: T1

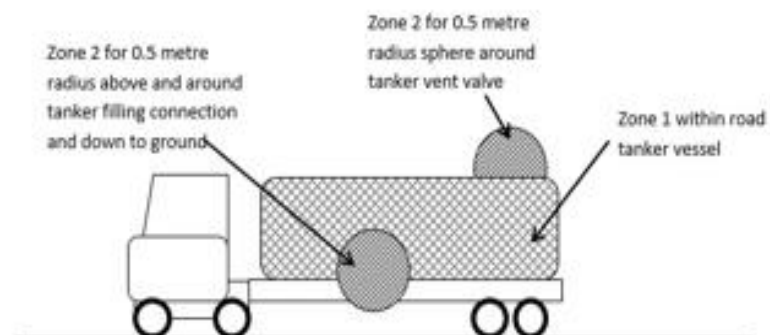
Gas group: 1

Plan view

Zone 2 for 0.5 metre radius above and around loading valve

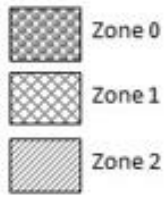


Side view



Gas flares

Key

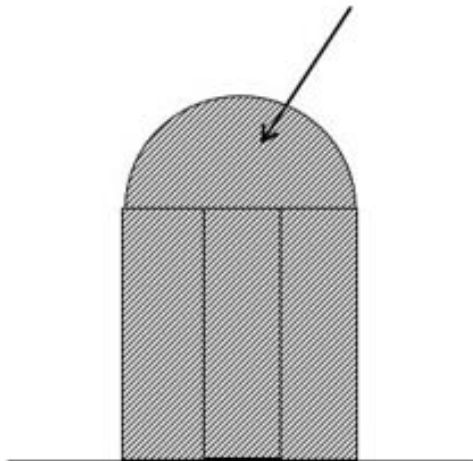


Gas group: IIA

Temp class: T1

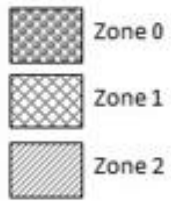
Side view

Zone 2 for 2 metres
radius above and
around gas flare unit



Cooler unit

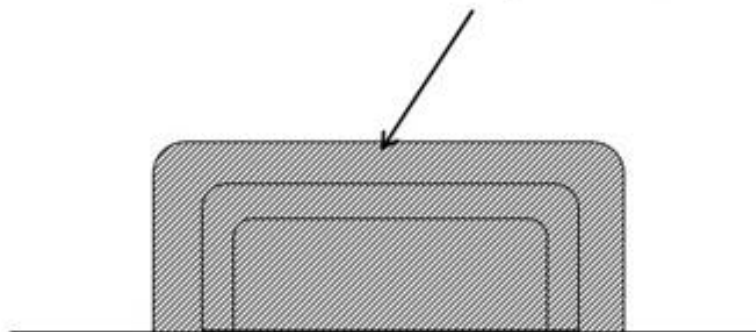
Key



Gas group: IIA
Temp class: T1

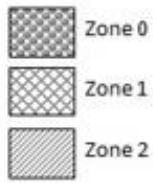
Side view

Zone 2 for 0.5 metre
radius above and
around gas cooler unit



Condensate pits

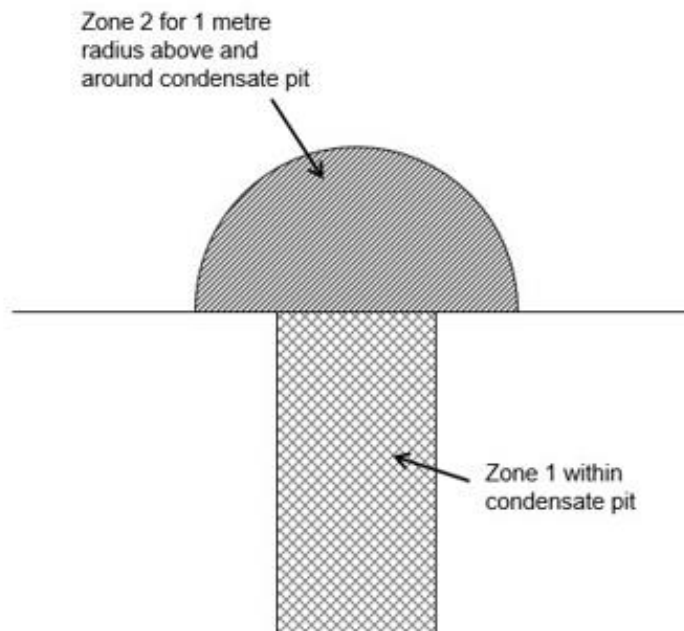
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Gas group: IIA




Temp class: T1

Side view



Gas pressure booster set

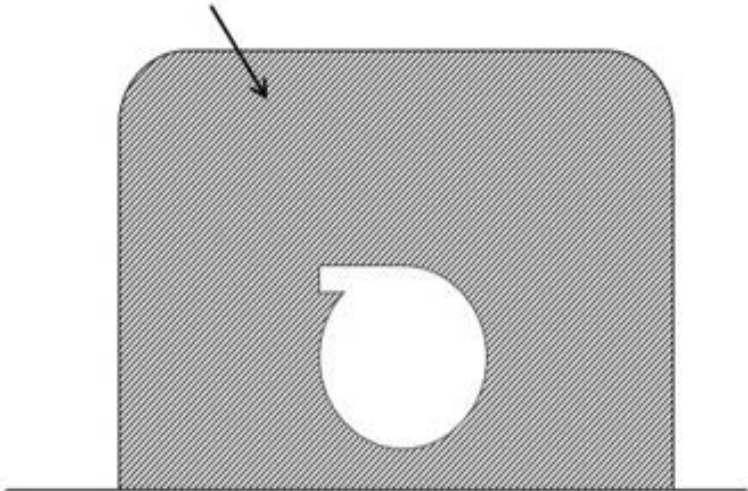
Key

-  Zone 0
-  Zone 1
-  Zone 2

Gas group: IIA
Temp class: T1

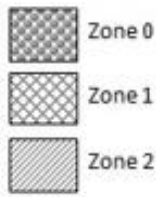
Side view

Zone 2 for 1.5 metres radius
above and around pressure
booster set



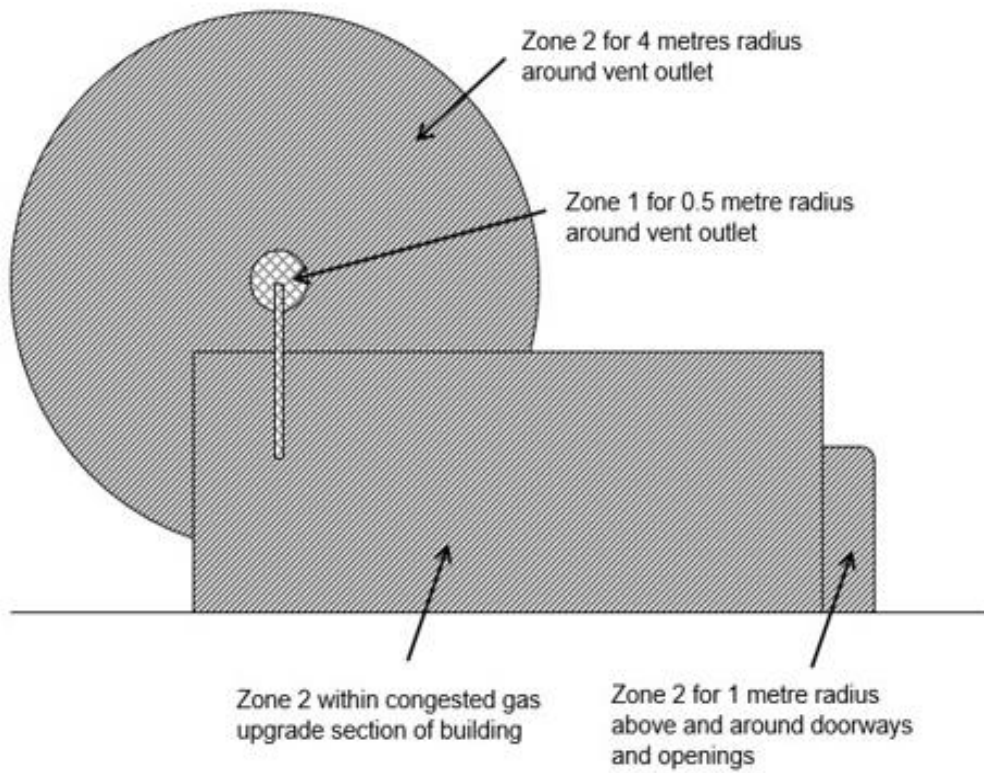
Gas upgrade plant

Key



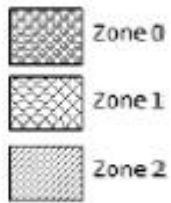
Gas group: IIA
Temp class: T1

Side view

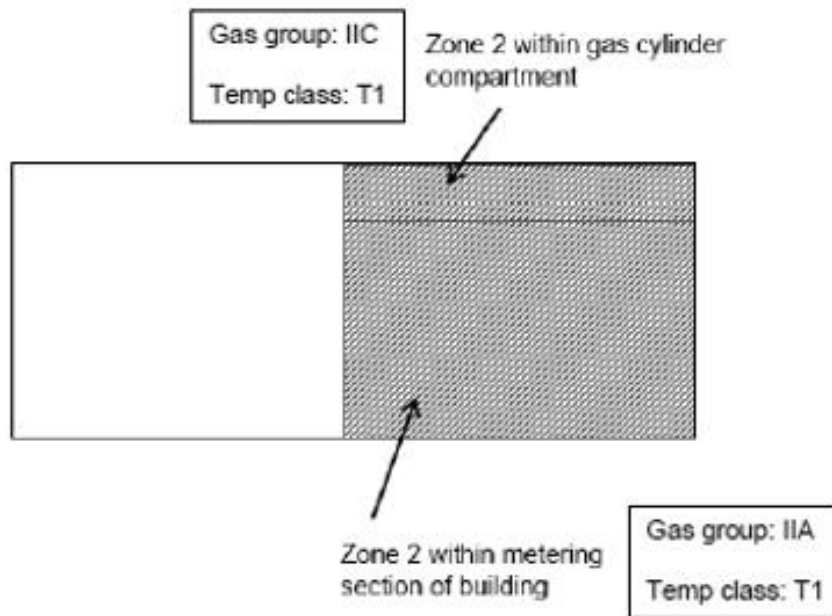


Grid entry unit

Key

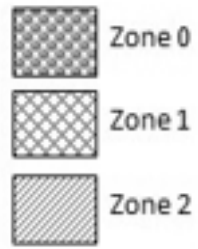


Plan view



Gas analyser

Key

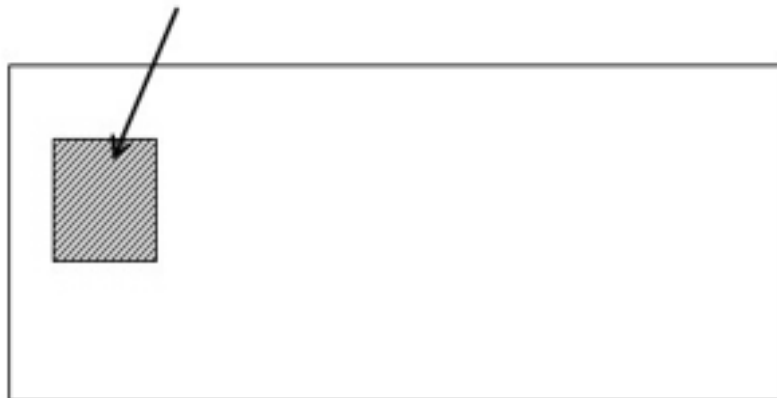


Gas group: IIA

Temp class: T1

Side view

Zone 2 within gas analyser
unit





Evaluation of risk

The risk evaluation outlined in this section only concerns the hazards from a fire and/or explosion, directly as a result of the ignition of a gas. The likelihood value is assessed from the likely presence of a flammable atmosphere in conjunction with a source of ignition, assuming there is sufficient oxygen present.

Risk Matrix

LIKELIHOOD (L)	VALUE	SEVERITY OF OUTCOME (S)
Negligible	1	Negligible
Low (>100,000hrs / incident)	2	Slight damage to property, Minor injury to occupants, first aid required
Medium (10,000 - 100,000 hrs / incident)	3	Moderate damage to property Injury to occupants, medical attention required
Significant (1000 – 10,000hrs / incident)	4	Large scale damage to property Occupants require hospitalisation
High (<1000hrs / incident)	5	Major loss of property Major loss of life

		Likelihood				
		1	2	3	4	5
Severity	1	2	4	6	8	10
	2	3	6	9	12	15
	3	4	8	12	16	20
	4	5	10	15	20	25
	5					

Note: Beware of low likelihood but high severity

Risk Rating	Action
1 - 5	Record findings, review in twelve months
6 - 12	Risk should be reduced where reasonably practicable.
15 - 25	Stop! Implement additional controls.

Comments and assumptions

- Equipment inside zoned areas will need to be Ex rated to satisfy the zone.
- LEV extraction in place is in good working order.
- Hot work controls in place mitigating ignition sources in areas when needed.

Risk Rating

Hazard (Fire / Explosion)	Likelihood	Severity	Risk factor
Bulk LNG compound	1	4	4
Bulk diesel tanks	1	4	4
Bio-gas CHP Plant	1	5	5
Digesters and feed system	1	5	5
Liquid slurry tank	1	5	5
Storage tank	1	5	5
Bio-gas flare	1	5	5
Cooler unit and condensate Pits	1	5	5
Gas upgrade Plant	1	5	5
Bio-methane Flare	1	5	5
Grid entry unit	1	5	5
Gas analyser	1	4	4

Action plan

NOTE – Should the plant and equipment be modified or moved, this assessment should be reviewed and revised as required to incorporate any changes.

Action	Priority	Target Completion	Responsibility
Signage will need to be displayed on the entrance to all areas where DSEAR zones and where people interact. An example of a sign is pictured below.	Medium	3 Months	Management
It will be important to implement a documented policy for No Mobile phones or other appliances and devices such as Vape, radio and phone chargers within the zoned areas. It will be important for staff to receive training in the form of a toolbox talk for these requirements and the hazards of introducing electrical appliances / devices or any other ignition source.	Medium	3 Months	Management / Stallard Kane to review
Engineering and Maintenance staff will need to undergo awareness training to ensure confidence that zoned environments and ATEX compliance is considered for all repairs, maintenance or introduction of new plant and equipment.	Medium	3 Months	Management / Stallard Kane to review
It is recommended that employees working within, near or accessing zoned environments (and other hazardous environments or activities) undergo initial Health surveillance to establish a	Medium	3 Months	Management

baseline of employee health as a minimum and is repeated periodically based on the commissioning analysis review of exposure.			
<p>It is recommended that emergency arrangement procedures are reviewed and updated to ensure suitable measures are taken in the event of release, alarm, or failure of plant.</p> <p>Such systems should be periodically tested with test results recorded, similar to fire alarm and fire evacuation system (weekly fire alarm tests and 6 monthly evacuation drills).</p> <p>It would be good practice to check these on a 6-monthly audit.</p>	Medium	3 Months	Management / Stallard Kane to review
<p>Earth connectivity.</p> <p>Ensure adequate earthing of all metal parts of the gas pipework and equipment. This can be introduced as a periodic phased inspection by a competent contractor.</p> <p>Where earth connections exist, earth leads are to be checked monthly, which includes a visual inspection.</p>	Medium	3 Months	Management
<p>DSEAR compliance should be assessed on a regular basis, ideally 6 monthly as part of the site Health and Safety management arrangements.</p> <p>It is important to note the auditing team competence to assess against DSEAR and ATEX requirements.</p> <p>This can be with the use of internal audits or external specialist audits, however the competence and understanding of DSEAR is a prerequisite for the person completing the site audit.</p>	Medium	3 Months	Management / Stallard Kane to review
<p>It is recommended that the monthly visual inspection of the essential safety plant is completed, accompanied with a formal inspection procedure itemising each inspection point and utilising a dedicated inspection form and also procedure to capture inspection frequency, escalation process and inspector competency.</p> <p>Where protection systems exist, such as flame arresters and explosion vents on filters, they should be on a recorded inspection and maintenance schedule.</p> <p>Where relevant, bunds and spill containment to be on a recorded inspection schedule.</p>	Medium	3 Months	Management
<p>It is recommended that the management of contractors, Permit to work, LOTO and Hot works arrangements are reviewed, updated, and implemented with the aim to ensure all contractors are competent, understand the nature of site risks and adopt safe practices.</p> <p>These arrangements should be documented and reviewed frequently.</p>	Medium	3 Months	Management / Stallard Kane to review
<p>It is recommended that the site emergency response plan is reviewed to ensure the inclusion of flammable gases and liquid loss of containment, e.g., during delivery offloading or in maintenance</p>	Medium	3 Months	Management / Stallard Kane to review

<p>areas.</p> <p>It would also be prudent to review the Delivery offloading procedures with the contractor to ensure suitable arrangements are in place and adhered to.</p>			
<p>The LNG Tank compound</p> <ul style="list-style-type: none"> • The outlet valve will benefit from enclosure to the outlet valve as a means to protect from impact. • It is recommended that water supply is recorded in the form of nearby Fire Hydrant for emergency use and infrastructure adopted to utilise in emergency. • 2 x 9kg dry powder fire extinguishers for the delivery / loading vehicles operate to ensure rapid access in the event of fire. • Update site emergency response plan to identify this area as a potential hazard. 	Medium	3 Months	Management
<p>Metal tools such as shovels were available for use on site. Although these are not within zoned areas, it is recommended that non arcing tools should be used and any metal tools such as this, that may be used in the event of any spill clearing are not accidentally used.</p> <p>Remove metal shovels from use and replace with non-arcing shovels.</p>	Low	6 Months	Management
<p>At the time of assessment, it was unclear if suitable controls exist to prevent flame propagation of the Bio-Methane and Biogas and Bio-Methane flare returning to the process.</p> <p>It is recommended that this is investigated and recorded.</p> <p>It is also recommended that appropriate procedures are developed for the safe operation of flares and associated safety requirements.</p>	Medium	3 Months	Management
<p>It was evident that storage of combustibles within the containers in the LV Intake, BUU, CHP3 and CHP4 Yard has become common practice by contractors.</p> <p>It is recommended that all containers / units are checked, and combustibles are removed as much as practicable.</p>	Medium	3 Months	Management
<p>Various Gas bottles across site are mostly secured appropriately, however some are free standing.</p> <p>It is recommended that a site wide inspection is completed for all gas cylinders to ensure all are strapped, chained, or secured to avoid toppling.</p>	Medium	3 Months	Management
<p>Earth cables were secured to plant however it was evident that some cables were terminating in the dirt next to the facilities.</p> <p>It is recommended that all earthing is inspected with the aim to ensure suitable earth connectivity for all metal plant, units, and equipment.</p>	Medium	3 Months	Management
<p>Oils and / or Lubricants were stored within some plant room areas.</p>	Medium	3 Months	Management

It is recommended that such substances are removed from zoned atmospheres and relocated to a dedicated storage area.			
<p>In many areas, cladding was seen to be left unused or has come away from plant and pipework.</p> <p>It is recommended that all pipework is inspected with the aim to ensure appropriate cladding and removal of unwanted classing waste.</p>	Medium	3 Months	Management
<p>It was observed that temporary straps have been used to support plant in the CHP area.</p> <p>It is recommended that this is checked with the aim to make a permanent arrangement with appropriate support.</p>	Medium	3 Months	Management
<p>Oil drums were located near the CHP and Generator area.</p> <p>These should be removed to a dedicated storage area.</p>	Medium	3 Months	Management
<p>The control panel for the flare is not ATEX rated and within the zoned environment.</p> <p>It is recommended that the panel is relocated to over 2 meters away from the flare plant.</p>	High	1 Month	Management
<p>Various tools, plant, parts, and equipment were noticed to be left on site around the Flare unit.</p> <p>It is recommended that all plant, parts, and tools are stored appropriately to avoid misuse and damage.</p>	Medium	3 Months	Management
<p>For the Gas Analyser plant room, it was identified that a yellow 210v transformer cable was placed through the vent, likely used inside the control room.</p> <p>It is recommended that the wire is removed, and all contractors undergo awareness briefings to avoid such practices and ensure awareness of zoned environments and avoidance of ignition sources including non-ATEX rated appliances.</p>	High	1 Month	Management
<p>Inside the Digestion plant buildings and in the yard between the Digesters and the Liquid Slurry plant, housekeeping standards need significant improvement including:</p> <ul style="list-style-type: none"> • Removal of all combustibles • Removal and suitable storage of all chemicals and substances • Removal of unused plant, tools, and equipment • Fixing of all loose wires and hoses • Removal of unnecessary cables and hoses • Reconnection or removal of all cable terminals and loose wires • Cleaning and removal of all settled solids and dusts 	Medium	3 Months	Management

For the Liquid Slurry plant yard, it is recommended that appropriate cleaning programmes and inspections are introduced to avoid build-up of solids that pose a risk of dust generation in very warm periods.	Medium	3 Months	Management
Access panels to the sides of old digestors are missing. It is recommended that where possible these are replaced.	Medium	3 Months	Management
The extraction systems on the side of the older digestors need attention to ensure they are in good working order. Some appear to be neglected with old loose, plastic on the sides.	Medium	3 Months	Management
The Biogas filtration plant feeding the engines seemed to be of an age and condition to warrant regular periodic inspection. It is recommended that weekly inspections and remedial work is implemented with the aim to ensure where no further issues are identified, increase the period of inspection to monthly. Furthermore, access to the filtration plant is via bolts that are hand tight. It is recommended that to access such plant, tools or keys are required. This should be included in all training and procedures for maintenance teams and contractors.	Medium	3 Months	Management
It was observed that the engines showed signs of age and repair, particularly relating to DSEAR electrical connection blocks being loose and open to atmosphere. It is recommended that a full inspection programme for the engine plant is implemented to ensure all electrical connections are suitable and any repairs needed are identified.	Medium	3 Months	Management
It is recommended that all substances in the shipping container are reviewed with the aim to store in suitable bunds and shelving areas to avoid over storage and mixing incompatible substances being stored together, namely flammables and any oxidising substances.	Medium	3 Months	Management
Cladding around the agitator motors on the side of the old digestors need repair. Because these are in the zoned atmosphere, the loose metal cladding may be a source of ignition of damage.	High	1 Month	Management

References / Bibliography

- DSEAR Regulations 2002. Approved Code of Practice and guidance 2013. L138 (Second edition)
- The Equipment and Protective Systems for Use in Potentially Explosive Atmospheres Regulations 1996
- PD CLC/TR 50404 Electrostatics – Code of practice for the avoidance of hazards due to static electricity.
- BS EN 1127-:2011 Explosive atmospheres. Explosion prevention and protection. Basic concepts and methodology
- BS EN 60079 Explosive atmospheres. Classification of areas.
- BS EN 62305:2011 Protection against lightning
- Guidelines for Quantitative Risk Assessment (Purple Book). PGS (Netherlands)
- Guidance for design of occupied buildings on chemical sites. Chemical Industries Association
- BS EN ISO 20345 Personal protective equipment.
- AEMT Ex labels and reference data
- <http://www.hse.gov.uk/fireandexplosion/zoning.pdf>

Appendix 1 – Pictures

<p>Signage to be installed on entry to blending rooms and flammable storage areas</p>	
<p>LNG Compound</p>	
<p>Housekeeping in LV Unit</p>	

Unsecured bottled. Restrain to avoid toppling.



Earth cables to be reviewed



Improvements in storage of chemicals and substances



Cladding, tools, and materials left on site



Strap supporting plant temporary arrangement.



Flare control panel inside zoned environment.



210v power cable through vent



Housekeeping in Digester buildings



Housekeeping in yard near digestors and Slurry separation plant



Digester access side panels and Motor encasing



Engine plant room



Gas Filter plant improvements



Housekeeping in chemical storage container.

