





Environmental Risk Assessment

GWE Biogas Permit Variation



Report produced for GWE Biogas Ltd

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2	30/09/19	Annual review. Brought in line with annual audit cycle.
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4	14/12/20	Reviewed in line with permit variation application for gas to grid connection, reception hall extension, new digester and capacity increase
5	04/05/2022	Annual Review.
6	31/10/2022	Update for Permit Variation for D6, D7, & CCUS
7	12/05/2023	Update for CCUS
8	31/05/2023	Update to include vehicle refuelling

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1.0 INTRODUCTION

The Guidance *Risk assessments for your environmental permit* produced by the Environment Agency and DEFRA gives a five-step process for assessing the site activity and the risk to local amenity to successfully produce an Environmental Risk Assessment:

1. Identify and consider risks for your site, and the sources of the risks.
2. Identify the receptors (people, animals, property and anything else that could be affected by the hazard) at risk from your site.
3. Identify the possible pathways from the sources of the risks to the receptors.
4. Assess risks relevant to your specific activity and check they're acceptable and can be screened out.
5. State what you'll do to control risks if they're too high.

This risk assessment will identify people or parts of the environment that could be harmed by the activity and carry out risk assessments for:

- Odour from the settlement lagoon
- Site Flooding
- Noise and Vibration
- Process or Plant Failure
- Fugitive emissions
- Other potential Nuisance effects

Assessment of potential accidents at the facility and the consequential effects on sensitive receptors have been accounted for within this risk assessment.

1.1 Assessment Criteria

Each specific risk has been explored as part of the review with a risk rating being assigned based upon WRM's analysis.

Risk has been considered in terms of likelihood of occurrence and consequences in terms of the impact it will have on the environment or receptor.

Table 1 presents the risk scoring criteria used throughout this assessment with the Risk Rating being based on the information provided by WRM in the 'justification of magnitude' column.

Table 1 - Risk Assessment Criteria

Likelihood of risk arising		Significance of a resulting risk	
1	Rare - Will only occur in exceptional circumstances.	1	Negligible - Minimal impact or no discernible impact at all.
2	Unlikely - Unlikely to occur but definite potential exists.	2	Minor - Impact of risk materialising is unlikely to have any permanent or significant effect on local area/sensitive receptors.
3	Possible - Reasonable chance of occurring – has happened before at an industry level on occasions.	3	Moderate - Impact of risk materialising will have a significant effect on local area/sensitive receptors in the short term.
4	Likely - Likely to occur – strong possibility.	4	Major - Impact of risk materialising will have a serious effect on local area/sensitive receptors in the medium term.

Likelihood of risk arising		Significance of a resulting risk	
5	Almost certain - The event will occur in most circumstances.	5	Catastrophic - Impact of risk materialising will have a serious effect on local area/sensitive receptors in the long term.

The application of likelihood and significance scores enables an overall rating to be assigned to each risk. Each risk score has been calculated by multiplying the likelihood score by the significance score with the resulting value indicating the overall level of risk (Figure 1.1).

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

Figure 1 - Risk Grading Matrix

Risk ratings identified in the matrix include:

- **Low risk (1-5)** – minor risks that are unlikely to have an impact on the local environment/sensitive receptors in any significant way. Aspects with this rating are considered to have adequate management systems or mitigation measures to address any identified risks.
- **Medium risk (6-14)** – moderate risks that have potential to impact on the local environment/sensitive receptors. The proactive implementation of described mitigation measures will enable risk level to be reduced to an acceptable level.
- **High risk (15-25)** – Major risks that have the potential to impact on the local environment/sensitive receptors.

1.2 Mitigation Measure and Residual Risk

Where appropriate, WRM has proposed mitigation measures that seek to reduce the risk level, improve best practice and operational performance of the operation. Where proposed, mitigation measures are justified with an indication of the intended outcome.

The assessment includes a residual risk column which provides an indication of the risk level that could be achieved if all mitigation measures are implemented comprehensively.

2.0 RISK ASSESSMENT

The risks associated with the operation of the anaerobic digestion facility are summarised within Table 2.

Table 2 - Environmental Risk Assessment

No.	Pollutant Model				Judgement				Action	
	Source	Harm / Outcome	Pathway	Receptor at Risk	Likelihood (1-5)	Significance (1-5)	Risk Rating	Justification	Risk Management	Residual Risk
1	Releases of NO _x (Oxides of Nitrogen) from CHPs.	Harm to human health - through respiratory irritation and illness.	Air transport then Inhalation.	Local human population.	2	3	6	There is a potential for exposure to anyone living close to the site or at locations where members of the public may be exposed.	<ul style="list-style-type: none"> • Operation of the plant shall be managed and operated in accordance of a management system, including inspection and maintenance of plant equipment and engine management systems. • CHPs designed to keep NO_x emissions less than 500mg/Nm³. • A comprehensive Air Quality Impact Assessment 	3

No.	Pollutant Model				Judgement				Action	
	Source	Harm / Outcome	Pathway	Receptor at Risk	Likelihood (1-5)	Significance (1-5)	Risk Rating	Justification	Risk Management	Residual Risk
									<p>has previously been undertaken for the CHP engines on site.</p> <ul style="list-style-type: none"> Although trace impurities and moisture are removed, the off-gas containing all non-condensable gases (CH₄, O₂, N₂) is purged as off-gas and can be brought back to the inlet of the upgrading unit. There is therefore no direct slip of impurities, such as nitrogen. Additionally, Pentair guarantee a minimum capture rate of 90% of the Co₂ processed 	

No.	Pollutant Model				Judgement				Action	
	Source	Harm / Outcome	Pathway	Receptor at Risk	Likelihood (1-5)	Significance (1-5)	Risk Rating	Justification	Risk Management	Residual Risk
									through the CCUS system.	
2	Releases of CO (Carbon Monoxide) from CHPs.	Harm to human health - through respiratory irritation and illness.	Air transport then Inhalation.	Local Human Population.	2	3	6	There is a potential for exposure to anyone living close to the site or at locations where members of the public may be exposed.	<ul style="list-style-type: none"> • Operation of the plant shall be managed and operated in accordance with the site management system, including inspection and maintenance of equipment and engine management systems. • CHPs designed to keep CO emissions less than 1400 mg/Nm³ • A comprehensive Air Quality Impact Assessment has previously been undertaken for the CHP engines on site. 	3

No.	Pollutant Model				Judgement				Action	
	Source	Harm / Outcome	Pathway	Receptor at Risk	Likelihood (1-5)	Significance (1-5)	Risk Rating	Justification	Risk Management	Residual Risk
3	Onsite operations releasing VOCs into atmosphere.	Harm to human health - through respiratory irritation and illness.	Air transport then inhalation.	Local human population.	2	3	6	Biogas and its combustion products have negligible amounts of particulates.	<ul style="list-style-type: none"> VOCs will be minimised through good combustion control. Fugitive emissions are prevented by gas tight process and storage tanks. Oil tanks on site are integrally bunded, natural venting will be minimal. 	3
4	Release of microorganisms (bioaerosols).	Harm to human health - respiratory irritation and illness.	Air transportation, then inhalation.	Local Human Population.	2	4	8	There is the potential for release at waste reception/ treatment areas.	<ul style="list-style-type: none"> All pre-processing of waste material is undertaken in doors. All biological activity will take place in sealed digestion tanks. 	2
5	Odour from waste activities.	Nuisance, loss of amenity.	Air transportation, then inhalation.	Local Human Population.	3	3	9	Local residents are often sensitive to odour. The wide range of waste	<ul style="list-style-type: none"> Activities shall be managed and operated in accordance with a management 	5

No.	Pollutant Model				Judgement				Action	
	Source	Harm / Outcome	Pathway	Receptor at Risk	Likelihood (1-5)	Significance (1-5)	Risk Rating	Justification	Risk Management	Residual Risk
								<p>may cause odour issues at reception from wastes, release of biogas and digestate, hence control measures adopted.</p>	<p>system (will include inspection and maintenance).</p> <ul style="list-style-type: none"> • The site manages risk and controls through the implementation of an odour management plan (EPR-A07). • Liquid wastes will be delivered in enclosed containers. • Doors will be kept closed except when vehicles are entering or leaving. • All processes downstream of waste reception and de-packaging will take place within sealed 	

No.	Pollutant Model				Judgement				Action	
	Source	Harm / Outcome	Pathway	Receptor at Risk	Likelihood (1-5)	Significance (1-5)	Risk Rating	Justification	Risk Management	Residual Risk
									pipes, tanks etc. <ul style="list-style-type: none"> An odour complaints and action procedure will be used. See odour management plan for more details. 	
6	Noise and vibration.	Nuisance, loss of amenity, loss of sleep	Noise through the air and vibration through the ground.	Local human population.	3	2	6	Local residents often sensitive to noise and vibration. However, there is a significant distance between the site and nearest sensitive receptor, therefore a lower exposure.	<ul style="list-style-type: none"> Deliveries between 07:00 to 19:00 hours, Monday to Saturday. All vehicles, plant and machinery will be maintained in accordance with manufacturers specifications. Significant amounts of plant and activity are situated inside a building. Material moving 	2

No.	Pollutant Model				Judgement				Action	
	Source	Harm / Outcome	Pathway	Receptor at Risk	Likelihood (1-5)	Significance (1-5)	Risk Rating	Justification	Risk Management	Residual Risk
									<p>through the process will be pumped in enclosed pipework.</p> <ul style="list-style-type: none"> • A noise complaints and action procedure will be used. • The CCUS system has an indicated noise level of 75dBA. The CCUS is enclosed within a container designed to provide acoustic dampening of noise emissions from the plant in operation. Furthermore, the skid enclosed housing, wherein the offered CO2 recovery 	

No.	Pollutant Model				Judgement				Action	
	Source	Harm / Outcome	Pathway	Receptor at Risk	Likelihood (1-5)	Significance (1-5)	Risk Rating	Justification	Risk Management	Residual Risk
									system will be installed, consists of a steel structure and prefabricated components.	
7	All on-site hazards: machinery.	Bodily injury.	Direct physical contact.	Local human population and / or livestock after gaining unauthorised access to the installation.	2	5	10	Digestion activity carried out within enclosed digesters but pre-processing of materials is undertaken in a waste reception hall where there is potential for operatives to come into contact with fixed and mobile plant..	<ul style="list-style-type: none"> • Operation of the plant shall be managed and operated in accordance with the site management system. • All operatives and visitors to the site have to wear PPE when going on to operational areas. • Facility includes site security measures to prevent unauthorised access, such as fenced perimeter. 	5

No.	Pollutant Model				Judgement				Action	
	Source	Harm / Outcome	Pathway	Receptor at Risk	Likelihood (1-5)	Significance (1-5)	Risk Rating	Justification	Risk Management	Residual Risk
8	Arson and / or Vandalism causing the release of polluting materials to air (smoke or fumes), water or land.	Respiratory irritation, illness and nuisance to local population. Injury to staff, fire fighters or arsonists/vandals. Pollution of water or land.	Air transport of smoke. Spillages of digestate and contaminated firewater by direct run-off from site and via surface water drains and ditches.	Local human population and local environment.	2	5	10	Biogas is flammable and could cause significant harm in certain circumstances. Risk of direct contact is reduced by activity being carried out within enclosed systems.	<ul style="list-style-type: none"> Site implements full accident management plan, which details how to deal with fire and spillages. Operation of the plant shall be managed and operated in accordance with the site management system which will include site security measures to prevent unauthorised access. Facility includes site security measures to prevent unauthorised access, such as fenced perimeter. 	5

No.	Pollutant Model				Judgement				Action	
	Source	Harm / Outcome	Pathway	Receptor at Risk	Likelihood (1-5)	Significance (1-5)	Risk Rating	Justification	Risk Management	Residual Risk
									<ul style="list-style-type: none"> The main materials and fabric of the site are not combustible. 	
9	Accidental explosion of biogas.	Respiratory irritation, illness and nuisance to local population. Injury to staff, fire fighters or arsonists/vandals. Pollution of water or land.	Air transport of smoke. Spillages of digestate and contaminated firewater by direct run-off from site and via surface water drains and ditches.	Local human population and local environment.	1	5	5	Unlikely to happen, reduced by effective management system.	<ul style="list-style-type: none"> Site management system details bunding of tanks. Operation of the plant shall be managed and operated in accordance with the site management system. Digester tanks are bunded. 	3
10	Accidental fire causing the release of polluting materials to air (smoke or fumes), water or land.	Respiratory irritation, illness and nuisance to local population. Injury to staff or fire fighters. Pollution of water or land.	Air transport of smoke. Spillages of digestate and contaminated firewater by direct run-off from site and via surface water drains and ditches.	Local human population and local environment.	2	5	10	Risk of accidental combustion of waste is low due to quick processing time. However, presence of refuelling station increases the risk of accidental fire.	<ul style="list-style-type: none"> Site management system details bunding of tanks. Operation of the plant shall be managed and operated in accordance with the site 	5

No.	Pollutant Model				Judgement				Action	
	Source	Harm / Outcome	Pathway	Receptor at Risk	Likelihood (1-5)	Significance (1-5)	Risk Rating	Justification	Risk Management	Residual Risk
									management system. <ul style="list-style-type: none"> • Digester tanks are bunded. • Adequate control measures put in place for refuelling station (see section 18). 	
11	Spillage of liquids, including oil.	Acute effects: fish kill.	Direct run-off from site across ground surface, via surface water drains, ditches etc.	All surface waters close to and downstream of site.	2	3	6	Potential for spillage from digestion tanks, storage vessels, and refilling station. Only one surface water pond close to the site.	<ul style="list-style-type: none"> • No point source emissions to water. • Waste storage area on impervious surface. Liquids collected from this area will be fed into the digestion process. • The site is built on a clay surface with a bund around the whole site. • The individual tanks for the storage of oil 	3

No.	Pollutant Model				Judgement				Action	
	Source	Harm / Outcome	Pathway	Receptor at Risk	Likelihood (1-5)	Significance (1-5)	Risk Rating	Justification	Risk Management	Residual Risk
									and other liquids will be built on individual impervious bunded areas. <ul style="list-style-type: none"> • Vehicle wash area will be on an impervious surface. 	
12	Spillage of liquids, including oil.	Chronic effects: deterioration of water quality.	As above. Indirect run-off via the soil layer.	All surface waters close to and downstream of site.	2	3	6	Potential for spillage from digestion tanks, storage vessels, and refilling station. Only one surface water pond close to the site.	<ul style="list-style-type: none"> • No point source emissions to water. • Waste storage area on impervious surface. Liquids collected from this area will be fed into the digestion process. • The site is built on a clay surface with a bund around the whole site. • The individual tanks for the storage of oil and other 	3

No.	Pollutant Model				Judgement				Action	
	Source	Harm / Outcome	Pathway	Receptor at Risk	Likelihood (1-5)	Significance (1-5)	Risk Rating	Justification	Risk Management	Residual Risk
									liquids will be built on individual impervious bunded areas. <ul style="list-style-type: none"> Vehicle wash area will be on an impervious surface. 	
13	Spillage of liquids, including oil.	Chronic effects: contamination of groundwater, requiring treatment of water or closure of borehole.	Transport through soil/groundwater then extraction at borehole.	Groundwater.	2	3	6	Potential for spillage from digestion tanks and storage vessels. The site is built on a clay surface.	<ul style="list-style-type: none"> No point source emissions to water. Waste storage area on impervious surface. Liquids collected from this area will be fed into the digestion process. The site is built on a clay surface with a bund around the whole site. The individual tanks for the storage of oil and other liquids will be 	3

No.	Pollutant Model				Judgement				Action	
	Source	Harm / Outcome	Pathway	Receptor at Risk	Likelihood (1-5)	Significance (1-5)	Risk Rating	Justification	Risk Management	Residual Risk
									<ul style="list-style-type: none"> built on individual impervious bunded areas. Vehicle wash area will be on an impervious surface. 	
14	Any, but principally NOx.	Harm to protected site through toxic contamination, nutrient enrichment, disturbance etc.	Any.	Protected nature conservation sites - European sites and SSSIs.	2	3	6	<p>Emissions to air may cause harm to and deterioration of nature conservation sites.</p> <p>The nearest SSSI - River Hull Headwaters, is 1.25km away.</p>	<ul style="list-style-type: none"> Operation of the plant shall be managed and operated in accordance with the site management system, including inspection and maintenance of plant equipment and engine management systems. CHPs designed to keep NOx emissions less than 500mg/Nm³. A comprehensive Air Quality 	3

No.	Pollutant Model				Judgement				Action	
	Source	Harm / Outcome	Pathway	Receptor at Risk	Likelihood (1-5)	Significance (1-5)	Risk Rating	Justification	Risk Management	Residual Risk
									Impact Assessment has previously been undertaken for the CHP engines on site.	
15	Material being transported to and from site.	Dust and mud.	Air: windblown.	Local atmosphere, amenity of local public.	3	1	3	The nature of the waste delivered to site is not dusty.	<ul style="list-style-type: none"> Roadways are concrete and will be maintained / kept clean to prevent dust or mud arising from vehicle movements. Vehicle wheels will be washed and the road dampened if required during very dry conditions. 	3
16	Material being transported to and from site.	Litter.	Air: Windblown.	Local Amenity.	3	1	3	Waste deliveries will be in sealed or covered containers to prevent windblown material.	<ul style="list-style-type: none"> All waste handling including de-packaging will be undertaken within the sealed building. The packaging removed will 	3

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	Source	Harm / Outcome	Pathway	Receptor at Risk	Likelihood (1-5)	Significance (1-5)	Risk Rating	Justification	Risk Management	Residual Risk
									be stored in enclosed skips within the building.	
17	Material escaping from the onsite lagoon.	Chronic effects: contamination of groundwater, requiring treatment of water or closure of borehole.	Transport through soil/groundwater then extraction at borehole.	Groundwater.	2	5	10	If the material is managed incorrectly or lagoon bunding is breached, then there is the potential for material to contaminate groundwater.	<ul style="list-style-type: none"> Material / digestate is pumped to the on-site lagoon through a series of pipes. The lagoon has been built with a composite bunding layer. This lagoon has a total storage capacity of 40,000m³, providing ample amounts of storage. 	5
18	Vehicle refuelling station.	Respiratory irritation, illness, and nuisance to local population. Injury to staff and fire fighters. Pollution of water or land.	Air transport of smoke. Spillages of digestate and contaminated firewater by direct run-off from site and via surface water drains and ditches.	Local human population and local environment.	1	5	5	A refilling station increases the risk of a biogas explosion on site for the risk management measures are not followed. However, if safety guidelines	<ul style="list-style-type: none"> Restrict access to refuelling area while refuelling is in progress. No ignition sources within the refuelling area. Vehicles must be turned off 	3

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								are followed the risk of this happening is low. However if there is an explosion the significance would be high.	while refuelling is taking place.	



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