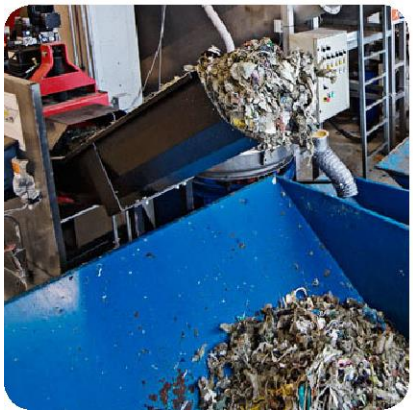
REnescience Northwich

Appendix C: Environmental Risk Assessment







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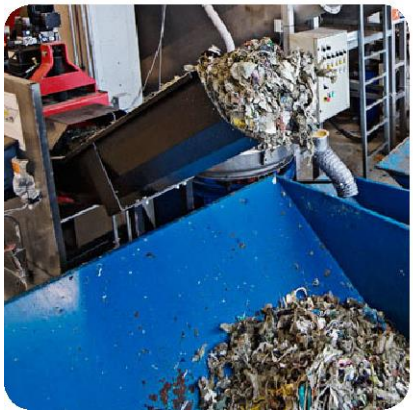
Environmental Risk Assessment

REnescience Northwich







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Quality Management

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1 Introduction

1.1 As part of an application for an environmental permit, operators must assess the risk to the environment and human health from the activities they seek to permit. The Environment Agency's Horizontal Guidance Note H1 *Environmental Risk Assessment for Permits* [1] covers a range of environmental risks. Those aspects relevant to the activities proposed at the REnescience Northwich facility are covered within the following sections:

Section 2 Amenity and Accidents

Section 3 Emissions to Air

Section 4 Global Warming Potential and Photochemical Ozone Creation Potential

1.2 This document provides the relevant risk assessments covering the above aspects.

2 Amenity and Accidents

2.1 This section provides an assessment of risks to environmental amenity and from accidents that could arise from activities proposed at the REnescience facility. The assessment has been completed in accordance with the Horizontal Guidance Note *H1 Environmental Risk Assessment for Permits* [1].

2.2 The scope of the assessment has covered the following aspects:

- odour;
- noise and vibration;
- fugitive emissions;
- visible plumes; and
- accidents.

2.3 For each of the above, the approach to the assessment has followed the following four stage process:

1. identify the hazards;
2. assess the risks (assuming that any control measures proposed are in place);
3. choose appropriate further measures to control these risks (if required); and
4. present the assessment of overall risk.

2.4 Results of the assessment are provided in the following tables.

Table 2.1 Assessment of odour risks

Table 2.2 Assessment of noise and vibration risks

Table 2.3 Assessment of fugitive emission risks

Table 2.4 Assessment of visible plume risks

Table 2.5 Assessment of accident risks

2.5 A number of assessments and supporting documents have been used to assess the potential environmental risks from operation of the facility and should be referred to for further information on the risks and mitigation methods put into place. These are as follows:

- The Air Quality Assessment – Appendix D
- The Odour Management Plan – Appendix D
- The Noise and Vibration Assessment – Appendix E
- The Drainage Plan – Appendix B, Figure 6
- The Drainage Strategy – Appendix G

2.6 In completing the assessment, prevention and control measures proposed by DONG Energy REnescience Northwich O&M Limited (DERN O&M Ltd) are assumed to be in place. Details of DERN O&M Ltd's measures are identified within the assessment.

Table 2.1: Odour risk assessment and management plan

Hazard What has the potential to cause harm?	**Receptor** What is at risk? What do I wish to protect?	**Pathway** How can the hazard get to the receptor?	**Risk management** What measures will you take to reduce the risk? If it occurs – who is responsible for what?	**Probability of exposure** How likely is this contact?	**Consequence** What is the harm that can be caused?	**What is the overall risk?** What is the risk that still remains? The balance of probability and consequence.
Odour emissions from waste reception hall, waste transfer area, waste handling areas and waste delivery vehicles.	Local residents/ businesses (nearest sensitive residential receptor 180m from the site boundary and nearest low sensitivity business/industrial receptors 20m from the site boundary). Nearby industrial installations: Solvay and Tata chemical works, INEOS brine purification plant are directly east of the site.	Air	The following odour control measures are proposed: The waste reception building is fully enclosed and sorting of waste materials takes place within the enclosed loading hall. All waste delivered shall be within enclosed containers. Exterior doors to potentially odorous buildings will remain closed except when vehicles and people enter or exit.. Doors shall be fast-acting automatic doors, which shall open manually but close automatically. Air from the waste reception hall and waste bunker will be kept under slight negative pressure, with the air extracted by a ventilation hood and passed through a carbon filter to control and minimise odour. Air from the waste sorting hall and waste transfer station is anticipated to have low odour, hence dispersion will provide a sufficient management measure. The site will be operated in accordance with the Odour Management Plan (which can be found in Appendix D). High standards of housekeeping will be maintained to ensure waste remains in waste storage areas and other areas remain clean and tidy. Routine monitoring will take place to ensure releases do not result in odour nuisance at sensitive receptors. In the event of a complaint, DERN O&M Ltd will follow its complaints	Low	Low Minor odour annoyance (at worst)	Insignificant

Hazard What has the potential to cause harm?	**Receptor** What is at risk? What do I wish to protect?	**Pathway** How can the hazard get to the receptor?	**Risk management** What measures will you take to reduce the risk? If it occurs – who is responsible for what?	**Probability of exposure** How likely is this contact?	**Consequence** What is the harm that can be caused?	**What is the overall risk?** What is the risk that still remains? The balance of probability and consequence.
			procedure and will take appropriate action or further monitoring as necessary.			
Odour emissions from enzymatic treatment process	Local residents/ businesses (nearest sensitive residential receptor 180m from the site boundary and nearest low sensitivity business/industrial receptors 20m from the site boundary). Nearby industrial installations: Solvay and Tata chemical works, INEOS brine purification plant are directly east of the site.	Air	The enzymatic process takes place in fully enclosed vessels ('bioreactors'). Routine sampling will be undertaken without opening of any inspection points. The feed into the bioreactor units and the discharge of treated material is enclosed within a building with secondary odour control provided using carbon filters. Odour will be routinely monitored. In the event of a complaint, DERN O&M Ltd will follow its complaints procedure and will take appropriate action or further monitoring as necessary.	Low	Low Minor odour annoyance (at worst)	Insignificant
Odour emissions from anaerobic digestion process	Local residents/ businesses (nearest sensitive residential receptor 180m from the site boundary and nearest low sensitivity business/industrial receptors 20m from the site boundary). Nearby industrial installations: Solvay and Tata chemical works, INEOS brine purification plant are directly east of the site.	Air	AD and biogas tanks and associated pipework etc. are fully enclosed. All systems will be fully tested prior to brining into operation to ensure they are leak free. Gas pressure monitoring will be carried out and controlled, with gas sent to the engines or for excess gas sent for combustion in a high temperature flare. Odour will be routinely monitored. In the event of a complaint, DERN O&M Ltd will follow its complaints procedure and will take appropriate action or further monitoring as necessary.	Low	High Biogas smell with potential for some hydrogen sulphide	Insignificant

Hazard What has the potential to cause harm?	**Receptor** What is at risk? What do I wish to protect?	**Pathway** How can the hazard get to the receptor?	**Risk management** What measures will you take to reduce the risk? If it occurs – who is responsible for what?	**Probability of exposure** How likely is this contact?	**Consequence** What is the harm that can be caused?	**What is the overall risk?** What is the risk that still remains? The balance of probability and consequence.
Odour emissions from the compost-like-output (CLO)	Local residents/ businesses (nearest sensitive residential receptor 180m from the site boundary and nearest low sensitivity business/industrial receptors 20m from the site boundary). Nearby industrial installations: Solvay and Tata chemical works, INEOS brine purification plant are directly east of the site.	Air	The compost-like output (CLO, left after the digestate is de-watered) will have a relatively low odour potential after degassing and dewatering and will have low biological activity. The dewatering activities will be housed within an enclosure with sealed pipework. The will be stored within a dedicated storage building which is covered and enclosed on three sides. CLO will be removed regularly from the site. Odour will be routinely monitored. In the event of a complaint, DERN O&M Ltd will follow its complaints procedure and will take appropriate action or further monitoring as necessary.	Low	Medium Moderate odour annoyance	Insignificant
Odour emissions from handling and storage of recovered recyclables/RDF	Local residents/ businesses (nearest sensitive residential receptor 180m from the site boundary and nearest low sensitivity business/industrial receptors 20m from the site boundary). Nearby industrial installations: Solvay and Tata chemical works, INEOS brine purification plant are directly east of the site.	Air	Cleaned recyclables are expected not to be odorous; however, shall be stored in enclosed containers either within the sorting building or externally prior to onward transfer. The refuse-derived fuel or solid recovered fuel (RDF/SRF) produced will be stored within the sorting hall. All doors to the sorting building will remain closed other than for access. Given the low odour potential from activities within this building odour control for air from this building will be by effective dispersion. Volumes of RDF/SRF beyond the capacity for storage within the sorting hall will be baled and plastic wrapped to both contain odours and prevent ingress and egress of any liquid. Baled and plastic wrapped material will be stored in the covered storage area. Daily visual inspection of any baled waste will be carried out to ensure that the baled material remains	Low	Low Minor odour annoyance (at worst)	Insignificant

Hazard What has the potential to cause harm?	**Receptor** What is at risk? What do I wish to protect?	**Pathway** How can the hazard get to the receptor?	**Risk management** What measures will you take to reduce the risk? If it occurs – who is responsible for what?	**Probability of exposure** How likely is this contact?	**Consequence** What is the harm that can be caused?	**What is the overall risk?** What is the risk that still remains? The balance of probability and consequence.
			fully contained whilst stored externally. Any bale identified with defect plastic wrapping will be transferred back into the sorting hall for re-wrapping. Storage times in this area will be minimised. High standards of housekeeping will be maintained to ensure recyclables and RDF remains in the appropriate storage areas and other areas remain clean and tidy. Odour will be routinely monitored. In the event of a complaint, DERN O&M Ltd will follow its complaints procedure and will take appropriate action or further monitoring as necessary.			

Table 2.2: Noise risk assessment and management plan

Hazard What has the potential to cause harm?	**Receptor** What is at risk? What do I wish to protect?	**Pathway** How can the hazard get to the receptor?	**Risk management** What measures will you take to reduce the risk? If it occurs – who is responsible for what?	**Probability of exposure** How likely is this contact?	**Consequence** What is the harm that can be caused?	**What is the overall risk?** What is the risk that still remains? The balance of probability and consequence.
Noise from onsite vehicle movement and offloading	Local residents/ businesses (nearest sensitive residential receptor 180m from the site boundary and nearest low sensitivity business/industrial receptors 20m from the site boundary). Nearby industrial installations and units, as defined above.	Air	Space for loading/unloading of six HGVs simultaneously and management of haulage contractors through an operational travel plan (delivery and servicing management plan) will avoid queuing and idling HGVs on site. HGVs will follow approved accessed routes to and from site. In the event of a complaint, DERN O&M Ltd will follow its complaints procedure and will take appropriate action or further monitoring as necessary.	Medium Noise will be intermittent and all deliveries will be between 07:00-19:30 Monday to Friday and 08:00-13:00 on Saturday.	Low Noise modelling (Appendix E) indicates that noise from activities on site is expected to be low. At the closest Noise Sensitive Receptors (NSR), there will be little change from baseline conditions and it is likely noise levels will be within the No Observable Effect Level (NOEL) and in the worst case for nearby receptors will not exceed Lowest Observed Adverse Effect Level (LOAEL).	Insignificant
Noise from gas engines and stack	Local residents/ businesses (nearest sensitive residential receptor 180m from the site boundary and nearest low sensitivity business/industrial receptors 20m from the site boundary). Nearby industrial	Air	Gas engines will be located within acoustic containers. Engines will be regularly maintained as part of the planned maintenance system to ensure they remain in good working order. The exhaust stack will be fitted with a silencer. In the event of a complaint, DERN O&M Ltd will follow its complaints procedure and will take appropriate action or further monitoring as necessary.	Medium	Low Noise modelling (Appendix E) indicates that noise from activities on site is expected to be low. At the closest NSRs, there will be little change from baseline conditions and it is	Insignificant

Hazard What has the potential to cause harm?	**Receptor** What is at risk? What do I wish to protect?	**Pathway** How can the hazard get to the receptor?	**Risk management** What measures will you take to reduce the risk? If it occurs – who is responsible for what?	**Probability of exposure** How likely is this contact?	**Consequence** What is the harm that can be caused?	**What is the overall risk?** What is the risk that still remains? The balance of probability and consequence.
	installations and units, as defined above.				likely noise levels will be within the NOEL and in the worst case for nearby receptors will not exceed LOAEL.	
Noise from main operational plant, other than engines and stack (conveyors, waste sorting machinery, bioreactors etc.)	Local residents/ businesses (nearest sensitive residential receptor 180m from the site boundary and nearest low sensitivity business/industrial receptors 20m from the site boundary). Nearby industrial installations and units, as defined above.	Air	The majority of processes and plant are located within a building which will reduce noise impact. External plant including pumps and dewatering plant etc. will be located within enclosures. Planned maintenance of all mechanical plant will be carried out to ensure it remains in good working order. In the event of a complaint, DERN O&M Ltd will follow its complaints procedure and will take appropriate action or further monitoring as necessary.	Medium Waste sorting activity noise will be intermittent with activities normally only operating between 7:00-19:30. Other machinery such as pumps and bioreactors will operate on a 24-hour, 7-day a week basis.	Low Noise modelling (Appendix E) indicates that noise from activities on site is expected to be low. At the closest NSRs, there will be little change from baseline conditions and it is likely noise levels will be within the NOEL and in the worst case for nearby receptors will not exceed LOAEL.	Insignificant
Vibration from plant	Local residents/ businesses (nearest sensitive residential receptor 180m from the site boundary and nearest low sensitivity business/industrial receptors 20m from the site boundary).	Land	Significant vibration from the operation of the REnescience facility is not expected due to the nature of operations carried out.	Zero No activities will cause sufficient vibration to be perceptible at receptors	None	Insignificant

Hazard What has the potential to cause harm?	**Receptor** What is at risk? What do I wish to protect?	**Pathway** How can the hazard get to the receptor?	**Risk management** What measures will you take to reduce the risk? If it occurs – who is responsible for what?	**Probability of exposure** How likely is this contact?	**Consequence** What is the harm that can be caused?	**What is the overall risk?** What is the risk that still remains? The balance of probability and consequence.
	Nearby industrial installations and units, as defined above.					

Table 2.3: Fugitive emissions risk assessment and management plan

Hazard What has the potential to cause harm?	**Receptor** What is at risk? What do I wish to protect?	**Pathway** How can the hazard get to the receptor?	**Risk management** What measures will you take to reduce the risk? If it occurs – who is responsible for what?	**Probability of exposure** How likely is this contact?	**Consequence** What is the harm that can be caused?	**What is the overall risk?** What is the risk that still remains? The balance of probability and consequence**.**
To air						
Dust from waste delivery and waste/recovered recyclables/RDF handling	Local residents/ businesses (nearest sensitive residential receptor 180m from the site boundary and nearest low sensitivity business/industrial receptors 20m from the site boundary). Nearby industrial installations and units, as defined above.	Air	Waste deliveries and handling will take place inside buildings, where automatic doors will remain closed except for access. Air in the waste reception hall and waste bunker will remain under slight negative pressure, to reduce dust escape, from any potential dust. This will be released via the carbon filter which includes pre-treatment to remove entrained dust. Any processed recyclables/RDF stored within the external waste storage areas will be contained within an enclosed container or baled and plastic wrapped prior to transfer to the external store. The external CLO store will be enclosed on three sides and covered with a roof.	Low Air quality assessment (Appendix D) predicts dust emission magnitude to be small and receptors in the surrounding area are industrial and considered low sensitivity, therefore risk of dust impacts to receptors is negligible.	Low Dust deposition or annoyance	Insignificant
VOCs from deliveries and storage of fuel oil	Atmosphere	Air	Deliveries to be overseen by qualified member of staff and delivery vehicles will off load using a sealed connection.	Low As above, the air quality assessment predicts a small dust magnitude and negligible risk of dust impacts.	Low due to low VOC potential.	Insignificant

Hazard What has the potential to cause harm?	**Receptor** What is at risk? What do I wish to protect?	**Pathway** How can the hazard get to the receptor?	**Risk management** What measures will you take to reduce the risk? If it occurs – who is responsible for what?	**Probability of exposure** How likely is this contact?	**Consequence** What is the harm that can be caused?	**What is the overall risk?** What is the risk that still remains? The balance of probability and consequence**.**
To water **(for more information Figure 6 Drainage Plan and Drainage Strategy mentioned above)**						
Minor leak of oil/fuel/ process chemicals from storage or during delivery	Local water course (Wade Brook)	Surface water drainage system	Deliveries to be overseen by a qualified member of staff, who will ensure sufficient capacity within storage tanks to hold delivery. Fuel storage is double skinned to prevent escape in case of leak and is designed to be compliant with Oil Storage Regulations. Enzyme storage tanks will be bunded to prevent leakage and located within a building. Drainage within the building is discharged to the process water tanks. Other smaller volumes of process chemicals e.g. pH dosing reagent will be stored within a bunded area. Spill kits will be available to contain and clean up leakage and a spill procedure will be established and communicated to all employees. Drainage from external hardstanding used by vehicles will be via oil interceptors.	Low	High Contamination of local water course (Wade Brook) and potential environmental effects resulting from this	Insignificant
Run-off from recovered materials waste storage areas, recovered materials and other waste storage areas	Local water course (Wade Brook)	Surface water drainage system	Incoming waste storage areas will be enclosed within a building to prevent surface runoff and enable easier clean-up of any spilled material. Drainage will be sent to the process water tank. Material delivered to for processing within the REnescience facility will be stored within a concrete bunker, and liquid collecting in the bunker will be mixed with the incoming material and fed into the process. Recovered materials will be stored in enclosed containers within the sorting hall. Drainage from this area is collected and returned into the process water system or removed for off-site	Low	High Contamination of local water course (Wade Brook) and potential environmental effects resulting from this	Insignificant

Hazard What has the potential to cause harm?	**Receptor** What is at risk? What do I wish to protect?	**Pathway** How can the hazard get to the receptor?	**Risk management** What measures will you take to reduce the risk? If it occurs – who is responsible for what?	**Probability of exposure** How likely is this contact?	**Consequence** What is the harm that can be caused?	**What is the overall risk?** What is the risk that still remains? The balance of probability and consequence**.**
			disposal if unsuitable. Volumes of clean rqin water that cannot be re-used within the process will be discharged to surface water. Testing of water collected in the sump will be carried out to confirm if the collected water is clean. Alarms installed on the sump will alert the operator before the sump becomes full and allow time for appropriate action to avoid uncontrolled overflow. Emptying of the sump will be manually activated. Additional volumes of recovered wastes may be stored within an external storage area. This may include baled and plastic wrapped RDF/SRF. This area is covered and drains to a sump. The sump contents will be checked and if clean will be discharged back into the process or into the surface water drainage system. This action will be manually activated. If contaminated or suspected of being contaminated, the sump contents will be cycled back into the process water tank or arrangements for off-site disposal made. Baled and plastic RDF/SRF stored externally will be subject to daily inspection to ensure the plastic wrap remains fully contained. Any bale identified with defect plastic wrapping will be transferred back into the sorting hall for re-wrapping . Storage periods within this area will be minimised. CLO is stored in a three sided and covered store. Drainage from this area will collect in a sump and will be collected and returned to process or arrangements for off-site disposal made.			
Contaminated rainwater collected within bunds	Local water course (Wade Brook)	Surface water drainage system	Water collected within bunds will be tested (e.g. pH and conductivity) and if contaminated or contamination is suspected, will be cycled back into the process water tank or arrangements	Low	High Contamination of local water course (Wade Brook) and	Insignificant

Hazard What has the potential to cause harm?	**Receptor** What is at risk? What do I wish to protect?	**Pathway** How can the hazard get to the receptor?	**Risk management** What measures will you take to reduce the risk? If it occurs – who is responsible for what?	**Probability of exposure** How likely is this contact?	**Consequence** What is the harm that can be caused?	**What is the overall risk?** What is the risk that still remains? The balance of probability and consequence**.**
			made for off-site disposal. Where clean, the rainwater will be discharged into surface water system. This action will be manually activated.		potential environmental effects resulting from this	
To land						
Waste release from waste storage areas, waste reception hall and delivery vehicles	Local residents/ businesses (nearest sensitive residential receptor 180m from the site boundary and nearest low sensitivity business/industrial receptors 20m from the site boundary).	Windblown to air	The waste reception building is fully enclosed and sorting of waste materials takes place within the enclosed loading hall. All waste delivered and recovered materials awaiting collection for off-site removal shall be within enclosed containers. All doors to process buildings will remain closed except when vehicles and people enter or exit. Good housekeeping will ensure any spilled waste or litter is cleaned up immediately. A vehicle wash down facility will be provided if necessary.	Low	Low Minor nuisance and visual impact	Insignificant
Waste release from recovered recyclables pending transport to other facilities	Local residents/ businesses (nearest sensitive residential receptor 180m from the site boundary and nearest low sensitivity business/industrial receptors 20m from the site boundary).	Windblown to air	RDF/SRF will be either stored within storage containers in the sorting hall or will be baled and plastic wrapped pending transport. Other recovered recyclables shall be stored within the mechanical sorting/loading area of the building pending removal and shall be stored separately in enclosed containers, which will prevent escape of material during handling and storage.	Low	Low Minor nuisance and visual impact	Insignificant
Pests						
Flies or other vermin in waste	Local residents/ businesses (nearest	Air/land	Incoming waste reception and storage areas are enclosed within buildings where doors are kept	Low Good site	Low/medium Nuisance to local	Insignificant

Hazard What has the potential to cause harm?	**Receptor** What is at risk? What do I wish to protect?	**Pathway** How can the hazard get to the receptor?	**Risk management** What measures will you take to reduce the risk? If it occurs – who is responsible for what?	**Probability of exposure** How likely is this contact?	**Consequence** What is the harm that can be caused?	**What is the overall risk?** What is the risk that still remains? The balance of probability and consequence**.**
storage areas	sensitive residential receptor 180m from the site boundary and nearest low sensitivity business/industrial receptors 20m from the site boundary).		shut except for access. Similarly recovered materials will be stored within buildings where the doors are kept shut other than for access. Externally stored recovered materials shall be stored separately in enclosed containers, which will control access by pests. SRF/RDF will be plastic wrapped. External storage times will be minimised. If necessary, further pest control methods can be implemented in accordance with recommendations from a specialist pest control advisor.	management will prevent this.	receptors	
Birds attracted to waste and CLO storage areas	Manchester Airport flightpath risk from bird strike	Air	A Bird Management Plan will be implemented as part of the Environmental Management Plan, which will be put into place pre-operation. The Bird Management Plan will outline measures to reduce potential for bird pests to be attracted to the facility and cause a potential hazard from bird strike for aeroplanes with flightpaths in proximity to the site.	Low Good site management alongside the Bird Management Plan will prevent this.	High Risk of engine damage to aeroplanes from high volumes of bird strike	Insignificant

Table 2.4: Visible plume risk assessment and management plan

Hazard What has the potential to cause harm?	**Receptor** What is at risk? What do I wish to protect?	**Pathway** How can the hazard get to the receptor?	**Risk management** What measures will you take to reduce the risk? If it occurs – who is responsible for what?	**Probability of exposure** How likely is this contact?	**Consequence** What is the harm that can be caused?	**What is the overall risk?** What is the risk that still remains? The balance of probability and consequence.
Plume from start-up generator	Local residents/ businesses (nearest sensitive residential receptor 180m from the site boundary and nearest low sensitivity business/industrial receptors 20m from the site boundary). Users of Griffiths Road and Manchester Road	Visual	A visible plume is only anticipated during start-up. The start-up generator will only be operational for a maximum of four weeks a year.	Low	Low Minor visual disturbance	Insignificant
Plume from stack connected to gas engines	Local residents/ businesses (nearest sensitive residential receptor 180m from the site boundary and nearest low sensitivity business/industrial receptors 20m from the site boundary). Users of Griffiths Road and Manchester Road	Visual	Visible plumes are not anticipated to occur for the majority of operation time due to the dry nature of the biogas to be combusted. Plumes are anticipated for <5% of the year, where meteorological conditions are such to create a plume.	Low	Low Minor visual disturbance	Insignificant
Plume from flare to burn off-gas gas.	Local residents/ businesses (nearest sensitive residential receptor 180m from the site boundary and nearest low sensitivity business/industrial	Visual	No visible plume is expected from the flare under typical operating conditions.	Low	Low Minor visual disturbance	Insignificant

Hazard What has the potential to cause harm?	**Receptor** What is at risk? What do I wish to protect?	**Pathway** How can the hazard get to the receptor?	**Risk management** What measures will you take to reduce the risk? If it occurs – who is responsible for what?	**Probability of exposure** How likely is this contact?	**Consequence** What is the harm that can be caused?	**What is the overall risk?** What is the risk that still remains? The balance of probability and consequence.
	receptors 20m from the site boundary). Users of Griffiths Road and Manchester Road					

Table 2.5: Accidents risk assessment and management plan

Hazard What has the potential to cause harm?	**Receptor** What is at risk? What do I wish to protect?	**Pathway** How can the hazard get to the receptor?	**Risk management** What measures will you take to reduce the risk? If it occurs – who is responsible for what?	**Probability of exposure** How likely is this contact?	**Consequence** What is the harm that can be caused?	**What is the overall risk?** What is the risk that still remains? The balance of probability and consequence.
Operator error	Local residents, businesses and local water course (Wade Brook)	Air/ land/ water – dependent on nature of error	The plant will be automatically controlled under normal operation, thus reducing potential for operator error. The automatic control system will include alarms to alert the operator of potential problems. All operational staff will be fully trained in the site operating procedures. Training will include awareness raising for key plant parameters and potential implications of failure to control operations as designed. An accident management plan will be established prior to commencing operation and a system will be put in place for reporting and investigating accidents.	Low	Variable, depending upon nature of incident. For example ranging from minor dust nuisance through to high consequence of potential pollution to surface waters.	Insignificant, provided operating procedures are followed.
Failure of digester tank	Local water course (Wade Brook) Local residents/ businesses (nearest sensitive residential receptor 180m from the site boundary and nearest low sensitivity business/industrial receptors 20m from the site boundary).	Water/ air (odour)	Tanks will be reinforced concrete structures. Tanks are designed in accordance with relevant standards e.g. BS 8007 (Code of practice for design of concrete structures for retaining aqueous liquids), BS 8110 (Structural use of concrete code of practice for design and construction) and Eurocode 2 (BS EN 1992, Design of concrete structures. General rules and rules for buildings). The process is automatically controlled and monitored with alarms which would provide rapid detection of an incident. Tanks are located within a bunded area designed to contain 25% of the total working volume of all tanks, which is greater than 110% of the largest tank. Procedures will be in place to handle a large spillage incident and will ensure that spilled material is removed as soon as possible.	Very low given that secondary containment in the form of a bund wall is in place around tanks. Would require multiple failure of tanks and secondary containment to cause exposure to receptor.	High/Low (if contained within bund) Potential contamination to ground and local water course (Wade Brook), although as per previous column to reach Wade Brook failure of both tank and secondary containment would need to simultaneously occur. Odour/ air quality effects for nearby receptors	Insignificant

Hazard What has the potential to cause harm?	**Receptor** What is at risk? What do I wish to protect?	**Pathway** How can the hazard get to the receptor?	**Risk management** What measures will you take to reduce the risk? If it occurs – who is responsible for what?	**Probability of exposure** How likely is this contact?	**Consequence** What is the harm that can be caused?	**What is the overall risk?** What is the risk that still remains? The balance of probability and consequence.
			Tanks will be subject to routine inspection and planned maintenance. Vehicle access routes and working areas are separate from the tanks. The probability of impact is therefore low.			
Tank overflow/failure due to overfilling	Local water course (Wade Brook) Local residents/ businesses (nearest sensitive residential receptor 180m from the site boundary and nearest low sensitivity business/industrial receptors 20m from the site boundary).	Water/ air (odour)	The process is automatically controlled and monitored with alarms which would provide rapid detection of an incident. Tanks will include level monitoring with audible alarms in the event of a high level trigger being breached. The AD process will be automatically controlled and monitored with feedback to the manned control room. Operators will be trained in the actions to take to bring the plant back under control, including manual overrides where necessary. Tanks are located within a bunded area designed to contain 25% of the total working volume of all tanks, which is greater than 110% of the largest tank. Procedures will be in place to handle a spillage incident and will ensure that spilled material is removed as soon as possible.	Very low given that secondary containment in the form of a bund wall is in place around tanks. Would require multiple failure of tanks and secondary containment to cause exposure to receptor.	High/Low (if contained within bund) Potential contamination to ground and local water course (Wade Brook), although as per previous column to reach Wade Brook failure of both tank and secondary containment would need to simultaneously occur. Odour/ air quality effects for nearby receptors	Insignificant
AD plant pipework failure	Local water course (Wade Brook) Local residents/ businesses (nearest sensitive residential receptor 180m from the site boundary and nearest low sensitivity business/industrial receptors 20m from	Water/ air (odour)	All pipework will be routinely inspected as far as practicable to ensure it remains in good repair and any signs of wear/corrosion will be identified at an early stage to allow for corrective action/repair/replacement as required. Pipework located within a bunded area which is designed to contain 25% of the total working volume of all tanks, which is greater than 110% of the largest tank. Procedures will be in place to handle a spillage incident and will ensure that spilled material is	Very low given that secondary containment in the form of a bund wall is in place around tanks. Would require multiple failure of tanks and	High/Low (if contained within bund) Potential contamination to ground and local water course (Wade Brook), although as per previous column to reach Wade Brook failure of both	Insignificant

Hazard What has the potential to cause harm?	**Receptor** What is at risk? What do I wish to protect?	**Pathway** How can the hazard get to the receptor?	**Risk management** What measures will you take to reduce the risk? If it occurs – who is responsible for what?	**Probability of exposure** How likely is this contact?	**Consequence** What is the harm that can be caused?	**What is the overall risk?** What is the risk that still remains? The balance of probability and consequence.
	the site boundary).		removed as soon as possible.	secondary containment to cause exposure to receptor.	tank and secondary containment would need to simultaneously occur. Odour/ air quality effects for nearby receptors	
Loss of containment during transfer or storage of chemicals and fuels	Local water course (Wade Brook)	Site drainage system	An emergency spillage management plan will be implemented. Spill kits will be provided to clean up spills. Bunds will be checked regularly. Storage containers will be made of material resistant to contents. A maintenance programme will be established to inspect storage tanks. Transfer areas will be on hardstanding to prevent infiltration and aid spill clean-up. Deliveries to be overseen by qualified member of staff, who will ensure sufficient capacity within storage tanks to hold delivery. An accident management plan will be established prior to commencing operation and a system will be put in place for reporting and investigating accidents, with corrective and preventative procedures.	Low	Medium, depending on nature of material released	Insignificant, providing that delivery procedures are adhered to and spillage management plan followed
Fire in waste bunker and resultant emissions to air	Nearby receptors – workers or general public.	Air	The facility has been designed so that waste bunker is separated from ignition sources. A small fire may be controlled by the exclusion of air. The crane operator will keep the waste bunker under continuous surveillance, Fire protection procedures for firefighting will be in place in the event of fire. A sprinkler system will be in place in the waste bunker and reception area.	Low	Low/medium Uncontrolled release of combustion gases to air, with likely short term impacts	Insignificant

Hazard What has the potential to cause harm?	**Receptor** What is at risk? What do I wish to protect?	**Pathway** How can the hazard get to the receptor?	**Risk management** What measures will you take to reduce the risk? If it occurs – who is responsible for what?	**Probability of exposure** How likely is this contact?	**Consequence** What is the harm that can be caused?	**What is the overall risk?** What is the risk that still remains? The balance of probability and consequence.
			An accident management plan will be established prior to commencing operation and a system will be put in place for reporting and investigating accidents, with corrective and preventative procedures.			
Fire within main process buildings, fuel storage areas and storage for process outputs	Nearby receptors – workers or general public.	Air	Fire alarm detection/suppression systems will be installed. Fire protection procedures for fire fighting will be in place in the event of fire. An accident management plan will be established prior to commencing operation and a system will be put in place for reporting and investigating accidents.	Low	Medium, dependent on nature of fire. Uncontrolled release of combustion gases to air, with likely short term impacts.	Insignificant
Explosion or fire associated with gas system	Nearby receptors – workers or general public and Wade Brook	Air/Surface water drainage (where not held within containment)	Gas pressure monitoring will be carried out to ensure that pressure levels within gas production and storage areas do not increase to a level that may represent a risk of explosion. Alarm systems will be installed and isolation valves to detect and prevent biogas leakage and potential fire risk. Pressure relief valves directing biogas to the flare are fitted to each AD tank to prevent catastrophic failure should overpressure develop Intrinsically safe equipment will be used which has be designed to not cause a spark which could result in fire or explosion. Presence of carbon dioxide within the biogas reduces flammability. Fire fighting residues would be held within containment bunds assuming the explosion has not affected their integrity. The manual shut-off valve on the discharge to Wade Brook will be closed to isolate and contain fire fighting residues not held within a bund and to prevent any discharge to Wade Brook	Low	Medium to high dependent on nature of fire or explosion	Insignificant

Hazard What has the potential to cause harm?	**Receptor** What is at risk? What do I wish to protect?	**Pathway** How can the hazard get to the receptor?	**Risk management** What measures will you take to reduce the risk? If it occurs – who is responsible for what?	**Probability of exposure** How likely is this contact?	**Consequence** What is the harm that can be caused?	**What is the overall risk?** What is the risk that still remains? The balance of probability and consequence.
			An Accident Management Plan will outline procedures to manage major incidents such as fire or explosion.			
Failure to contain fire water	Surface water	Surface water drainage system	Fire response systems and procedures ensure rapid response, allowing fire to be extinguished quickly, will minimise firewater volumes. Fire water from fire suppression within the waste reception hall and waste bunker building would drain into the waste bunker and be contained here, where there is more than adequate capacity. Fire water elsewhere on site would be controlled using a manually activated valve on the outfall of the surface water drainage system. An accident management plan will be established prior to commencing operation and a system will be put in place for reporting and investigating accidents, with corrective and preventative procedures.	Low	Medium Potential contamination of surface waters resulting from contact with potentially contaminated fire water.	Insignificant
Flooding	Surface water	Surface water drainage system or overland flows	According to the EA flood map, the site is not located with an indicative fluvial floodplain and is an area with low risk of surface water flooding. As part of the site emergency plans, there shall be provision for procedures for responding to and investigating a flood event.	Low	Medium Potential contamination of flood waters	Insignificant
Vandalism	Air/ land/ water	Various – dependent on nature of vandalism	The site will be enclosed by a 2.5m steel fence with access control barriers. Additional security will be provided in the form of CCTV and intruder alarms linked to a manned control room manned 24 hours a day.	Low	Variable, depending on nature of vandalism	Insignificant, given low probability of unauthorised access to the site

3 Emissions to Air

3.1 An assessment of point source emissions to air from the REnescience facility has been completed utilising the H1 software tool from the Environment Agency.

3.2 The scope of the assessment has covered the following:

- release point characteristics;
- air emissions inventory and mass flows; and
- emissions screening for further assessment.

3.3 Air pollutant emissions screening under the H1 guidance has identified a subset of emissions whose significance warrants further modelling. The results of that modelling for these and a range of other emissions are presented in the air quality report in Appendix D to the main application document.

3.4 The relevant air pollutant emissions from the REnescience facility are oxides of nitrogen (NO_x), carbon monoxide (CO), sulphur dioxide (SO_2), volatile organic compounds (VOCs) and unburned hydrocarbons.

3.5 Regarding emissions of VOCs, Annex F of the Environment Agency Horizontal Guidance (H1) [2] recommends that where the VOC composition has not been characterised, then as a precaution it should be assumed that the VOCs are composed of 100% benzene (a VOC with significant health effects). This assumption has been made in the assessment in Appendix D. A similar approach has been adopted for unburned hydrocarbons, whereby it is assumed that they are composed of 100% benzene. This approach is considered to be extremely conservative.

3.6 NO_x is a mixture of nitrogen oxide (NO) and nitrogen dioxide (NO_2). NO oxidises to NO_2 over time following release, and impacts are assessed in terms of long-term and short-term NO_2 concentrations on the basis that 100% of NO_x emissions are NO_2 for screening purposes. In practice, it should be noted that NO_x emissions will typically comprise of approximately 90-95% NO and 5-10% NO_2 at source.

3.7 The Environment Agency has recommended that for a 'worst case scenario', a 70% conversion of NO to NO_2 should be considered for calculation of annual average concentrations. If a breach of the annual average NO_2 objective/limit value occurs, the Environment Agency requires a more detailed assessment where operators are asked to justify the use of percentages lower than 70%. For the purposes of this assessment, a 70% conversion of NO to NO_2 is assumed for annual average NO_2 concentrations in line with the Environment Agency's recommendations.

Release Points to Air

3.8 Point-source emissions to air from the proposed REnescience facility will be from several sources with the following characteristics. There will be a stack for the gas engines with an actual stack

height of 33 m and an effective stack height of 14.94 m (detail on modelling for stack height determination is given in Appendix D to the main application document). The efflux velocity will be 14.53 $m.s^{-1}$, for a normalised flow rate of 30,924 $m^3.hr^{-1}$.

3.9 Point source emissions include the flare, which will be used as a backup to combust biogas (avoiding the requirement to vent it) should the gas engines be unavailable and the on-site storage capacity be exhausted, and the exhaust stack from the start-up boiler, which will be used for a limited time (less than four weeks per year) when the gas engines are not in operation. The effective height of the stacks will be 0 m for both the flare and the start-up boiler (actual stack heights 10 m for the flare and 7 m for the start-up generator). The flare will have an efflux velocity of 10.70 $m.s^{-1}$ for an actual flow rate of 98,021 $m^3.hr^{-1}$ and the stack for the start-up boiler will have an efflux velocity of 6.60 $m.s^{-1}$at an actual flow rate of 3,779$m^3.hr^{-1}$. Actual stack flow data has been collected for the flare and start-up boiler for the purpose of air emissions modelling, whereas normalised data has been collected for the gas engine stack, hence the use of normalised rates for the engine stack and actual rates for the remaining emission points.

Mass Emissions Inventory

3.10 The air emissions inventory sheet within the H1 software tool shows the annual mass releases. Emission rates given are conservative and based on concentrations at the Industrial Emissions Directive (IED) limits where applicable, or as given by the technology provider for the specified fuel.

Emissions Screening

3.11 Estimated emission concentrations have been screened for significance against the applicable environmental standards for long-term and short-term human exposure. The Environmental Quality Standards (EQSs) used are as given in H1 guidance, which are the statutory air quality limits for the protection of human health specified in the Air Quality Standards Regulations 2010, for the pollutants concerned.

3.12 The process contribution (PC) for each pollutant from the gas engines and flare combined has been modelled, on the very conservative assumption they both operate continuously (which cannot happen in practice). Modelling has not been undertaken for the start-up boiler, since due to the short run-time it is anticipated that the effects will be included within the conservative modelling for the gas engines and flare. Where the PC is calculated to be less than 1% of the long-term EQS and less than 10% of the short-term EQS, the pollutant is screened out as insignificant. The H1 software tool shows that long-term NO_2 emissions cannot be screened as insignificant on this basis, and therefore require further assessment. Similarly, the long term benzene PC is greater than 1% of the long term EQS, whilst the short term SO_2 PC exceeds 10% of the EQS. For this reason these emissions cannot be screened out and require further assessment. The short term CO level, however, is below the threshold for further assessment, whilst long term CO levels are not given due to there being no long term EAL for CO.

3.13 The predicted environmental concentration (PEC) for the pollutants has been calculated using the H1 software tool (details of the source of background concentration data are given in Appendix D to the main application document). Further assessment would be required if the long-term PEC were more than 70% of the EQS and/or the short-term PEC were more than 20% of the difference between twice the long-term background concentration and the EQS. The H1 software tool shows that the long term PEC for NO_2 would be 51.6% of the long-term EQS and the short-term PEC would be 37.4% of the difference between the short-term EQS and twice the background. Therefore the short-term PEC for NO_2 is above the threshold for further assessment. The long-term PEC for benzene has been calculated to be 26.0% of the long-term EQS and therefore is below the threshold for further assessment.

3.14 Emissions produced by the two emission sources at the REnescience facility have been subject to a detailed dispersion modelling assessment. Further consideration of the impacts of these emissions is given in Appendix D and is discussed in Section 5 of the main application. The assessment concludes that even under a number of worse-case assumptions, there will be no significant adverse impacts on sensitive human receptors from the facility's operation.

Deposition to Land

3.15 Potential deposition to land is estimated based on concentrations in releases to air, in accordance with the H1 guidance. Deposition is screened out as insignificant where the PC to air will be less than 1% of the maximum deposition rate (MDR) specified in the H1 guidance, if available; where an MDR is not available, deposition is screened out as insignificant where the PC to air is less than 1% of the relevant long-term EQS.

3.16 The H1 software assessment calculates that for NO_2, the PC is 14.8% of the EAL, therefore requiring further assessment. Similarly, benzene is calculated to have a PC of 16.0% of the EAL, therefore requiring assessment. As a result, dispersion modelling to predict contributions from the facility at local receptors has been carried out: see Appendix D of the main application document.

4 Global Warming and Photochemical Ozone Creation Potential

Global Warming Potential

4.1 The global warming potential (GWP) has been calculated for the plant in accordance with the H1 Annex H guidance; the results are shown in Table 4.1. The total GWP score of 8,275 is a result of two sources: methane released due to the incomplete combustion of biogas and the use of electricity from the grid.

4.2 Of the two sources, methane emissions account for 57% of the GWP, despite being a relatively minor release, due to the high GWP value of this greenhouse gas. The CO_2 releases associated with electricity consumption are indirect and result from electricity obtained from the grid, accounting for the remaining 3,582 of GWP. Non-CO_2 GHGs from grid electricity generation are ignored, in accordance with the H1 Annex H guidance.

4.3 As the heat and electricity generated on-site in the gas engines is from a renewable biogas, the CO_2 released is considered to have a net-neutral atmospheric GWP and has not been calculated here, in accordance with the H1 Annex H guidance.

Table 4.1: Global warming potential

Source	Release pathway	Amount per annum	GWP value per tonne of GHG	Annual GWP
Methane	Combustion	223 tpa	21	4,693
Electricity from the grid (CO_2)	-	8,992 MWh (delivered) 21,581 MWh (primary)	1	3,582
Total				**8,275**

Photochemical Ozone Creation Potential

4.4 The photochemical ozone creation potential (POCP) has been calculated utilising the H1 software tool. This identifies four substances as having the potential to form ozone: nitrogen dioxide, carbon monoxide, benzene and methane. The release rate and POCP factor for each is shown in Table 4.2. The total POCP score for the plant is calculated as 1,889.80. The POCP values given are considered conservative since it is based on the assumption that combustion of biogas occurs both in the flare and the CHP engines, resulting in double counting. Contributions from the start-up boiler are not included by the H1 analysis due to the short term nature of the emissions resulting from the brief time period the start-up boiler is anticipated to be in operation.

Table 4.2: Photochemical ozone creation potential

Substance	Annual rate tonne/yr	POCP value per tonne	POCP
Nitrogen dioxide	151.94	2.8	425.43
Carbon monoxide	326.87	2.7	882.55
Benzene	20.54	21.8	447.72
Methane	223.49	0.6	134.09
Total			**1,889.80**

5 Conclusions

5.1 The following hazards from the operation of the proposed REnescience Northwich facility have been assessed:

- odour;
- noise and vibration;
- fugitive emissions;
- visible plumes; and
- accidents.

5.2 The risk assessments show that with the proposed mitigation measures, the risks presented by the plant are not significant.

5.3 The H1 software tool indicates that emissions of NO_2, SO_2 and benzene cannot be screened out as insignificant. The effects of these emissions have therefore been assessed further, and the approach and results are detailed in Appendix D of the main application document. The results of the further assessment indicate that there will be no significant impacts on receptors due to long- or short-term concentrations or deposition to land.

5.4 The total POCP score for the facility is calculated to be 1,889.8, based on the emissions of nitrogen dioxide, carbon monoxide, benzene and methane, generated from the two emission sources: the biogas engines and flare stack.

5.5 The total GWP score is 8,275, based on the carbon dioxide emissions associated with generating electricity that is consumed from the grid and the methane emissions from incomplete combustion of biogas during electricity generation at the proposed facility.

References

1 Environment Agency, H1 Environmental Risk Assessment for Permits. Version 2.1 December 2011.

2 Environment Agency. H1 Annex F- Air Emissions. Version 2.2 December 2011.