RotaCut Datasheet

VOGELSANG

				Date:	31.08.2021
Customer:	BioConstruct GmbH				Vogelsang-Data
Project:	BGA Arrow Bio			Offer:	10051200
Project-Nr.:		Projectpos.-Nr.:	RCX-58G	Orderconfirmation:	12336884
Order-Nr.:	BE21-001897	Orderpos.-Nr.:		Position Nr.:	10

Operating conditions

Medium:	Biosuspensio	Temperature:	< 60 °C
Flowrate:	30 m³/h	Viskosity:	well flowable
		pH-Value:	neutral
Density:	1 - 1,1 kg/dm³	DM-content:	10. Jan %

Machine

RotaCut type: RCX-58G

RotaCut-specification

RotaCut blades:		stainless steel hardened		Suction pipe:	DN250 EN10(. .
RotaCut rotor:		St 52 nitrided		Discharge pipe:	DN250 EN10(. .
Mechanical seal:				Cleaning port:	1 x 8" DN200
wetted O-Rings:		NBR		Gesamtgewicht:	.
Cutter screen:	hochverschleißfester Spezialstahl	Design:		Waben	Ø10mm (Honeycombed)
Separator:					
Cutterhead:					

Drive System

Geared motor:

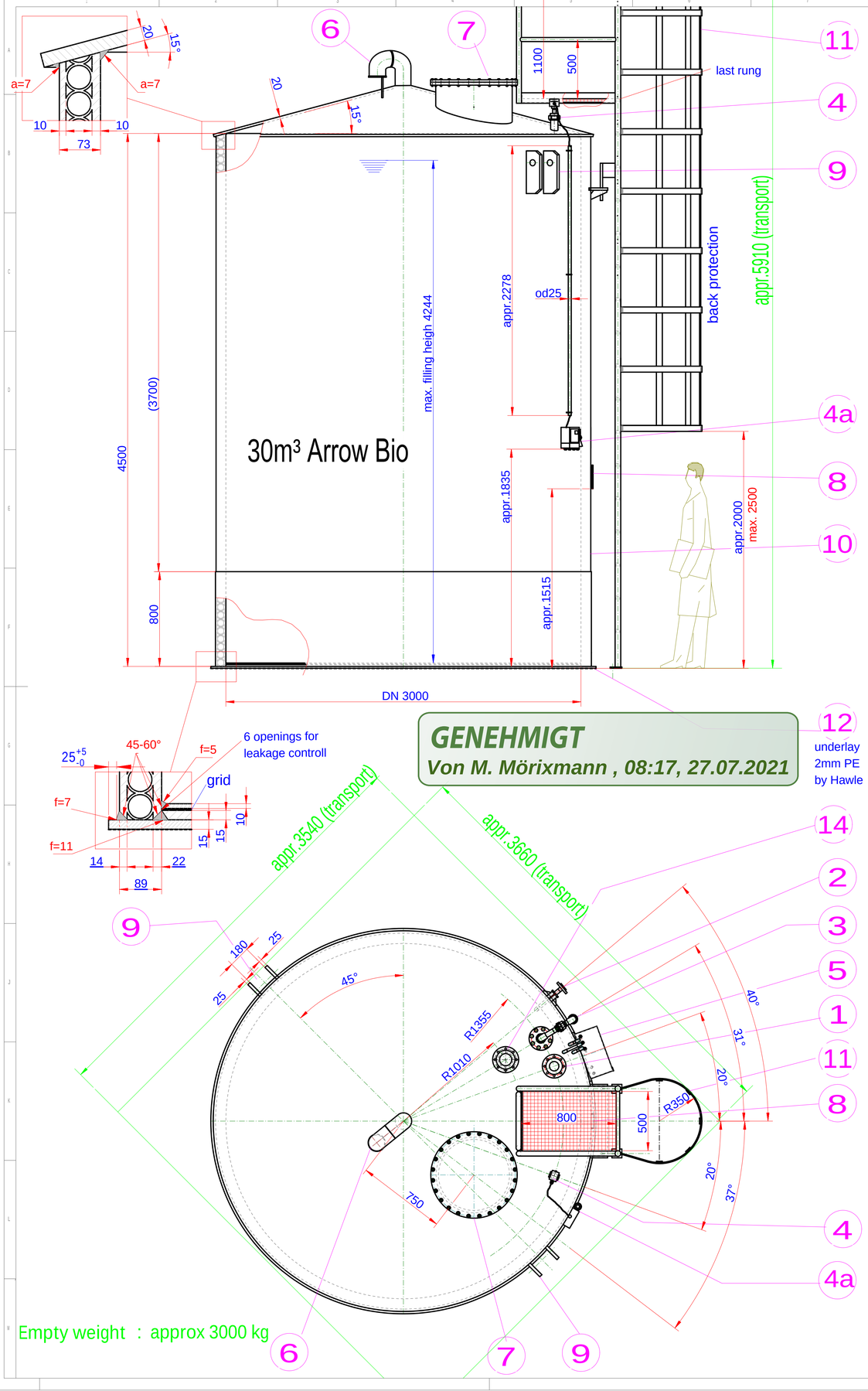
Manufacturer:	Getriebebau Nord	Frequency:	50 Hz
Type:	SK5282 AZ VL-160 L/4 TF	Motor rev.:	1460 U/min
Power:	16,5 kW	Protection type:	IP 55
Output rev.:	276 min-1	Iso-class:	F
Voltage:	3x400/690 V	Thermistors:	3
			.

Accessories

Zubehör:

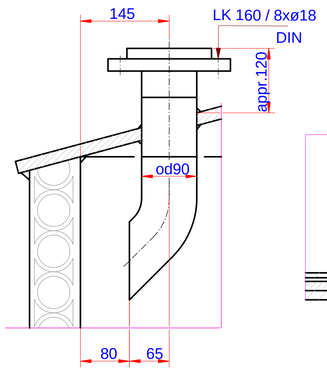
Automatic Cut Control (ACC)
Automatic cutting force control via compressed air. For constant contact pressure of the cutter blades on the cutting screen during the operation.
When the blades are worn out, the system switches of with a pressure switch. Besides a position switch indicates a warning for knife change.
Easy adjustment of the contact force with constant pressure, during the blade-lifetime.
Optimal cutting performance at low pre-pressure and low wear.
Adjustment of the contact force via compressed air adaptor, or manual admission with a hand air-pump.

Notes:



GENEHMIGT
Von M. Mörixmann , 08:17, 27.07.2021

Pos.1 (1:5)



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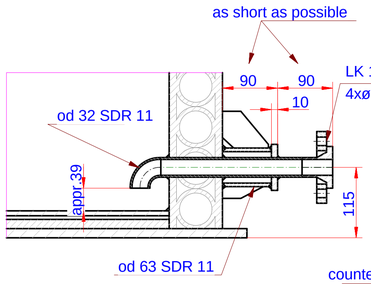

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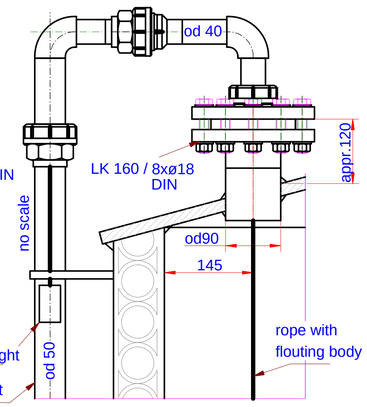

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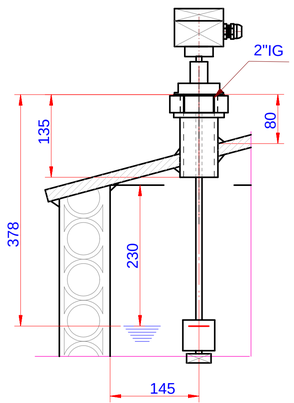
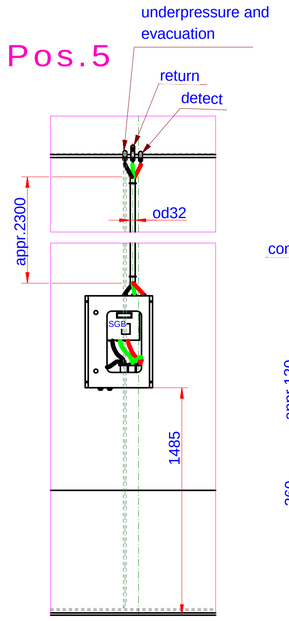


Pos.5



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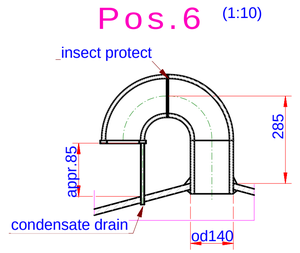
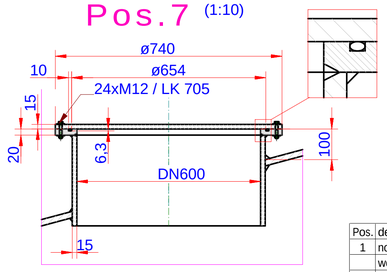


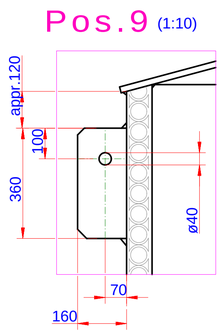
Pos.7 (1:10)



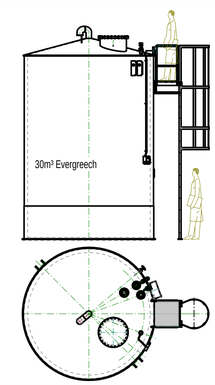
Board 1 admissible tolerance for dimensions without tolerance indication in mm (extract from data sheet DVS2206 Nov.1975)

Tolerance-group	>315 ...1.000	>1.000 ...2.000	>2.000 ...3.000	>3.000 ...5.000	>5.000 ...8.000	
C	± 8	± 12	± 15	± 18	± 21	tolerances at 20°C

Pos.9 (1:10)

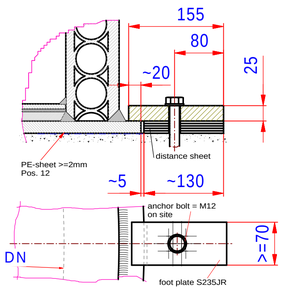


ladder option

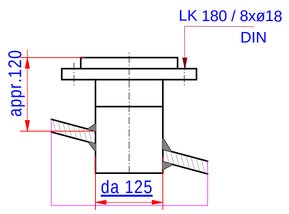


Pos.	designation	DN	SDR	odxt	length	quant.	material
1	nozzle for filling	80	11	90x8,2		1	PE 100
	welding collar	80	11	90x8,2		1	PE 100
	loose flange (drilled by DIN/PN10)	80				1	PP/steel
	angle 45°/shorted	80	11	90x8,2		1	PE 100
2	nozzle for extraction	25	11	32x2,9		1	PE 100
	welding collar	25	11	32x2,9		1	PE 100
	loose flange (drilled by DIN/PN10)	25				1	PP/steel
	elbow 90° R=D	25	11	32x2,9		1	PE 100
	cladding tube with lid	50	11	63x5,8		1	PE 100
3	mech. Level indicator (no scale)	80	11	90x8,2			PE /PVC
4	nozzle for overfill controll with 2" IG	50	11	63x5,8		1	PE 100
	overfill controll T-200F with KR 163/ELB					1	
4a	alarm unit OAA100					1	
	cable pipe	20	11	25		1	PE 100
5	leakage unit with under pressure SGB VL 330					1	
	protection box for outdoor assambly					1	
	cable pipe	25	11	32		1	PE 100
6	nozzle for ventilation	125	17	140x8,3		1	PE 100
	elbow 90° R=D	125	17	140x8,3		2	PE 100
	insect protection					1	PE 100
	condensate drain					1	PE 100
7	manhole standard for no pressure	600		630x15		1	PE 100
	flange			t=20			
	lid			t=15			
	bolted connection M10x55					24	stainless steel
	seal ø8mm					1	EPDM
8	tank sign					1	PE 100
9	lifting hooks					2x2	PE 100
10	tank pipe	3000			4500	1	PE 100
						1	PE 100
	bottom			t=15		1	PE 100
	intermideate bottom			t=15		1	PE 100
	bottom inside			t=10		1	PE 100
	grid					1	PE 100
	conical roof 15°			t=20		1	PE 100
11	ladder (seperate drawing)					1	steel galvanized
12	underlay / PE sheet			t=2mm		1	PE
13	foot plates					4	steel galvanized
14	nozzle device by Bioconstruct	100	11	125x11,4		1	PE 100
	welding collar	100	11	125x11,4		1	PE 100
	loose flange (drilled by DIN/PN10)	100				1	PP/steel

Pos.13



Pos.14 (1:5)



Pos.8

hawle kunststoff & service

Doublewalled Tank 30 m³

Nominal diameter	: DN 3000
Year of fabrication	: 20**25**
Number of fabrication	: **to be confirmed**
	: PE 100
Material	: 30 m³
Capacity	: 4244 mm
Allowable filling height	: approx 3000 kg
Empty weight	: 30° C
Permissible working temperature	: Iron (III) Chlorid / FeCl3
	: **5**,5 KN/m³
Medium	: outdoor
	: free flow by pumping, underpressure is not permitted
Specific weight	
Installation	
Filling and emptying	

Please follow strictly the regulations for storing water polluting materials!

Ges.	Date	Name
	17.07.21	U.Tsp.

Client : BioConstruct GmbH

Projekt: HK-21251 30m³ FeCl3

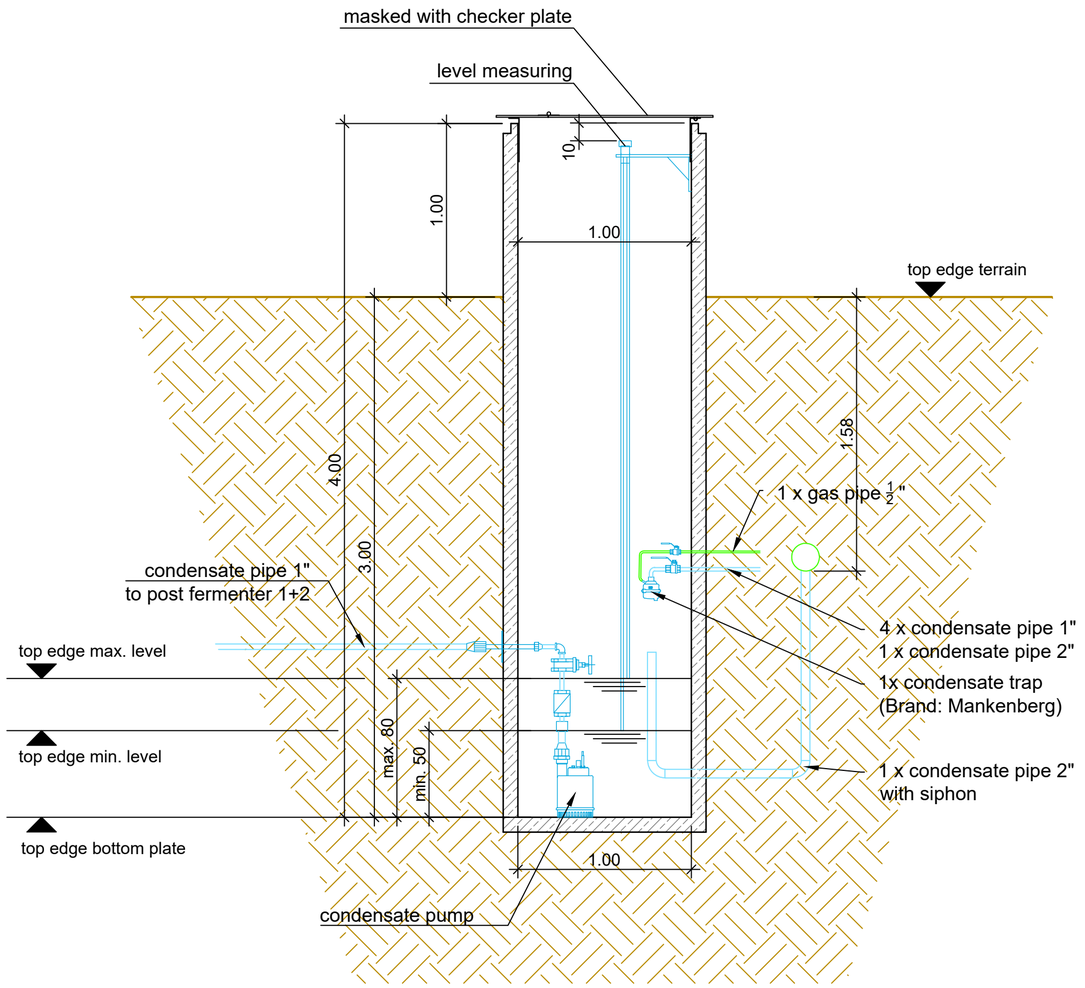
scale 1:20 (1:10,1:5)

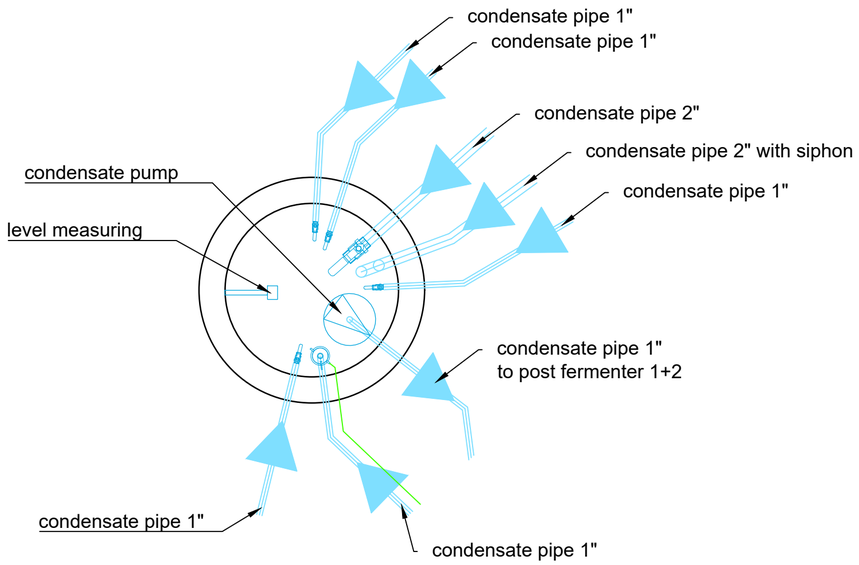
Description: doublewalled, free standing Tank 30m² DN 3000

hawle kunststoff & service

AB 21401898 (contract no.) | 1 (F.) | -001 (drawing-no.) | A (Rev.)

condensate pit





BIOCONSTRUCT

condensate pit - BGP Arrow Bio

Planverfasser: BioConstruct GmbH. Wellingstraße 66, D-49328 Melle
Tel.: +49 (0)5226 / 5932-0, Fax: +49 (0)5226 / 5932-11

Dateiname: condensate pit_Arrow_Bio

Projektnr./Zeichnungsnr.:	Maßstab:	Zeichenblattgröße:	Gezeichnet:
B202106 / A28	1:25	DIN A2	Feb.25/WS

Epoxy Universal

Crack-bridging protective coating

Colour	Availability			
	Quantity per pallet			
	Packaging unit	**5 kg**	**10 kg**	**30 kg**
	Type of container	Tin bucket	Tin bucket	Tin bucket
	Container code	06	11	31
	Art. no.			
black	5590	■	■	■
	5592	■	■	■

Application rate

According to authorisation

Range of use

- Crack-bridging protective coating for reinforced concrete tanks
- Anti-corrosion coating for steel and galvanised steel
- Coating for liquid manure/silage and biogas facilities, tanks and horizontal silo walls (AbZ Z-59.17-436)

Property profile

- With static crack-bridging ability
- Can be subjected to chemical loads
- Application by brush or spraying
- Contains solvents

Characteristic data of the product

■ **On delivery**

	Component A	Component B	Mixture
Density (20 °C)	1.37 g/cm³	1.08 g/cm³	1.30 g/cm³
Viscosity (25 °C)	2000 mPa s	5650 mPa s	1900 mPa s

■ **Once fully cured**

Crack bridging class	A 2 (> 0.25 mm)

The values stated represent typical characteristic data of the product and are not to be understood as binding product specifications.

Certificates

- General building inspectorate approval Z-59.15-368
- Certificate of compliance Z-59.15-368

- General building inspectorate approval Z-59.17-436
- Certificate of compliance Z-59.17-436

Additional information

- Processing instructions

Preparation

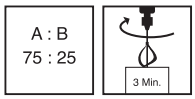
Substrate requirements

The substrate must be firm, dimensionally stable, capable of bearing loads and free of loose constituents, dust, oil, grease, rubber marks and other substances that could interfere with adhesion.
The adhesive pull strength of the surface after priming must be at least 1.5 N/mm² on average (smallest single value min. 1.0 N/mm²), compressive strength at least 25 N/mm².
For works within the framework of the general building inspectorate approval, the substrates must correspond to the requirements of the approval and the system products mentioned therein must be used.

Substrate preparation

Prepare the substrate by suitable means, e.g. steel ball jetting or diamond grinding, so that it meets the requirements specified above.
Before coating, close pipes and pores using a stable material, e.g. Epoxy MT 100 with the addition of a standardising agent (Add TX).
Remove rust and rolling skin from steel surfaces e.g. by sandblasting SA 2 1/2.

Production of the mixture



Combi-container

Add the entire quantity of the hardener (component B) to the basic compound (component A).
Mix thoroughly with a slow-speed electric mixer
(approx. 300 - 400 rpm).
Pour the mixture into a separate container and mix again thoroughly.
Mix for at least 3 minutes.
Insufficient mixing is indicated by streaks forming.
When working with airless spraying equipment (e.g. Storch SL 1100 – piston stroke pump), the prepared mixture can be mixed with up to 20% by mass of Thinner V 103 to achieve the spraying viscosity.

Mixing ratio (A : B)	75 : 25 parts by weight

As soon as the mixture is ready to use, apply it in full to the prepared surface and spread it using suitable tools.

Directions

For professional users only!

Conditions for use

Temperature of the material, air and substrate: from min. +10 °C to max. +25 °C
After application, protect the surface for at least 48 hours from exposure to water and moisture.
Relative humidity should not exceed 80%.
The temperature of the substrate must be at least 3 °C above the dew point temperature during application and curing.

Working time (+20 °C)

approx. 120 minutes

Waiting time (+20 °C)

Waiting times between coats should be at least 12 hours and max. 48 hours.
If conditions on site require longer waiting times, the surface must be slightly sanded (until it turns white) before the following application.

■ **Drying time (+20 °C)**
Foot traffic after 12 hours, mechanical loading after 2 days,
full loading capacity after 7 days.

As a general principle, higher temperatures will reduce and lower temperatures will increase the times stated.

Application examples

■ **Coating**
Apply the material to the prepared surface and spread evenly using a suitable tool, e.g. an epoxy roller.
Three-layer application in alternating colours (black/black-red/black) according to test certificate.

Application rate	1.2 kg/m² binder in three coats

Notes

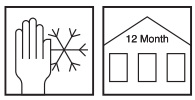
Unless otherwise specified, all of the values and application rates given above have been determined under laboratory conditions (20 °C) using standard colours. Slight deviations from these values may arise if the product is worked with on site.
Not suitable for frequent or constant thermal loads > 60 °C.
The maximum application quantity of 0.40 kg/m² per coat must not be exceeded, otherwise the adhesion of intermediate layers may be affected.
In case of repairs on the surface or working up to existing surfaces, there will be a visible transition in appearance and texture.
Highly abrasive loads lead to increased wear.
Suitable for vehicle traffic with rubber tyres; not suitable for vehicle loads with metal or polyamide tyres nor for dynamic point loads.
Epoxy resins are generally not colourfast when exposed to UV light or weather.
Further notes on working, system construction and maintenance of the listed products can be found in the latest Technical Data Sheets and the Remmers system recommendations.

Tools / Cleaning

Epoxy roller, brush, surface brush or airless spraying equipment (e.g. Storch SL 1100 – piston stroke pump), suitable mixing equipment

More detailed information can be found in the Remmers Tool Programme.
Clean tools and remove any contamination immediately after use and while fresh using Thinner V 103.
Take suitable protective and waste disposal measures when cleaning.

Storage / Shelf life



If stored unopened in the original container and kept cool, dry and protected from frost, min. 12 months (component A)/min. 24 months (component B).

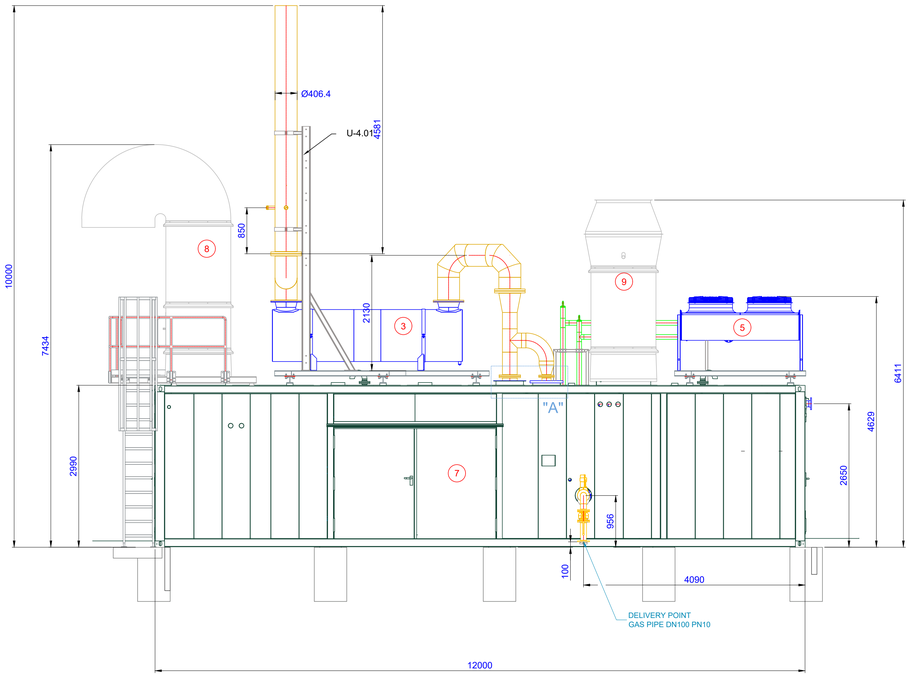
Safety data / Regulations

For professional users only!

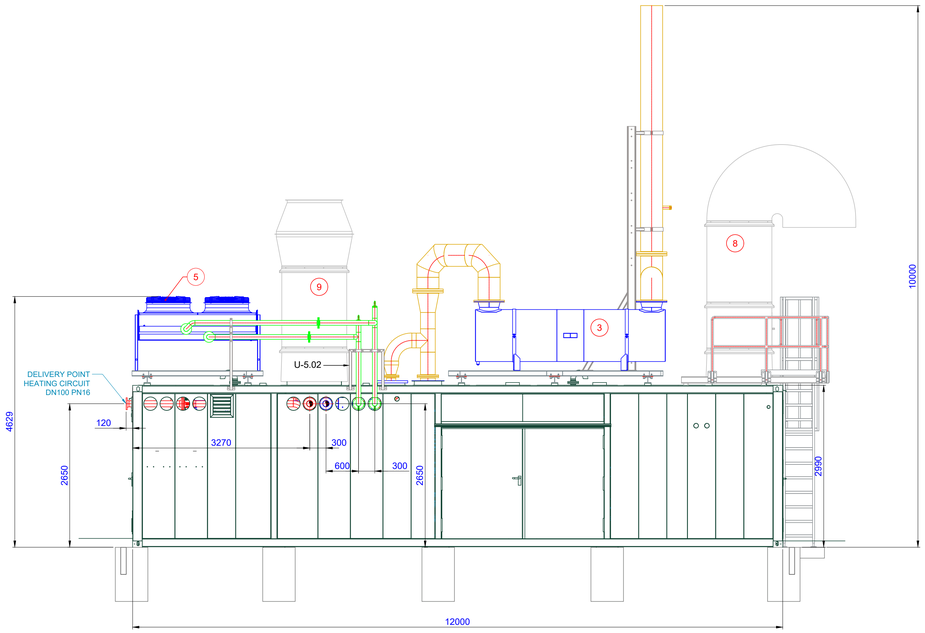
For further information on the safety aspects of transporting, storing and handling the product and on disposal and environmental matters, please see the current Safety Data Sheet and the brochure entitled "Epoxy Resins in the Construction Industry and the Environment", issued by Deutsche Bauchemie e.V. (2nd edition 2009).

Personal protective equipment	This information can be obtained from the current Safety Data Sheets and/or the relevant professional associations. Respiratory protection with at least an A/P2 combination filter must be worn during spraying, together with safety goggles. Wear suitable protective gloves and clothing.
Disposal	Larger quantities of leftover product should be disposed of in the original containers in accordance with the applicable regulations. Completely empty, clean containers should be recycled. Do not dispose of together with household waste. Do not allow to enter the sewage system. Do not empty into drains.
VOC content as per the "Decopaint" Directive (2004/42/EC)	EU limit value for the product (Cat. A/j): max. 500 g/l (2010). This product contains < 500 g/l VOC.

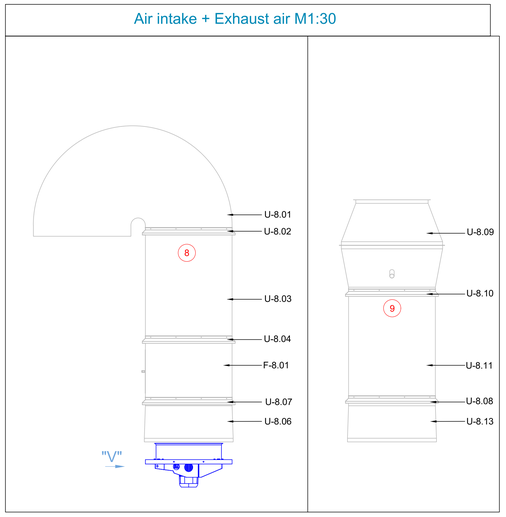
View "Y"



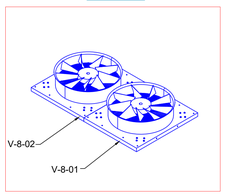
View "X"



Air intake + Exhaust air M1:30

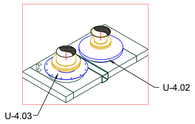


View "V"

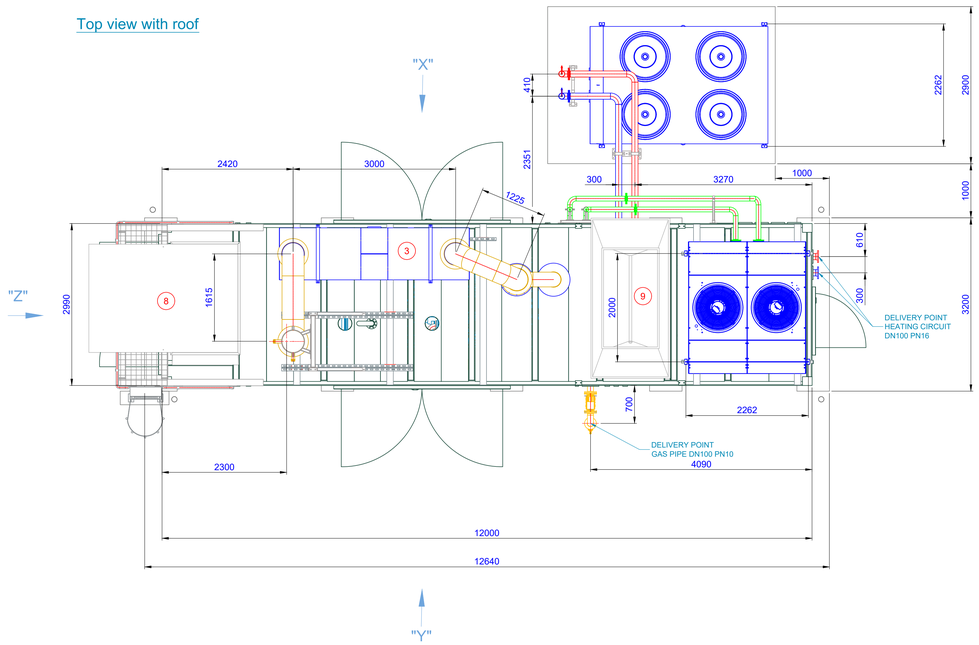


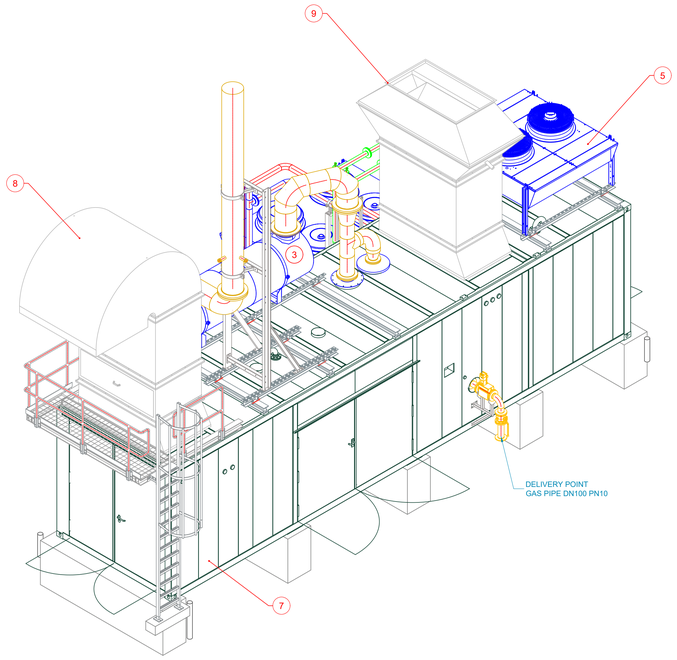
Detail "A"

M1:20



Top view with roof





[1] Option for Earth terminal on the construction side

CONTAINER EXECUTION

Color: RAL 6005 - moss green
Designed to a sound pressure level of 65 dB(A) in a distance of 10m (mean value, open field conditions)

Container is designed acc. to:
Max. wind speed: 25 m/s; 56 mph
Max. snow load: 0,85 kN/m²; 79 N/ft²

GENERAL INFORMATION

1. THE 2G PLAN IS AN INTERFACE DRAWING.
2. A GEODESIC ELEVATION PROFILE AT THE SITE IS NOT INCLUDED IN THE FOUNDATION DRAWING AND IS NOT CONSIDERED.
3. THE PLANNING AND PROFESSIONAL EXECUTION OF THE FOUNDATIONS MUST BY PROVIDED BY THE CUSTOMER.
4. THE FOUNDATIONS SHOWN IN THE DRAWING REFER TO EMPIRICAL VALUES AT A SOIL PRESSURE > 200 kN/m².
5. A STATIC CALCULATION AS WELL AS A REINFORCEMENT PLAN ARE NOT PART OF THE 2G SCOPE OF DELIVERY.
6. EARTHWORK AND FOUNDATIONS ARE PROVIDED BY THE CUSTOMER.
7. ALL OPENINGS AND CABLE BUSHINGS MUST BE CLOSED SAFELY FROM RODENTS ON SITE.

Legend: Item numbers

1. avus 1200e NG
2. ...
3. Muffler / Silencer
4. ...
5. Intercooler radiator
6. Dump radiator
7. 12m Container
8. Air intake system
9. Exhaust air system
10. Oil tanks
11. Electrical sub-distributor
12. Control cabinet CHP unit
13. Main switch CHP unit
14. Intercooler circuit unit
15. Heat unit
16. Gas control system

INDEX	MODIFICATION	DATE	DRAWN BY
INDEX	ÄNDERUNG	DATUM	ERSTELLT DURCH

2G Energietechnik GmbH
Benzstraße 3
48619 Heek
Telefon: 02568/9347-0
e-Mail: info@2-g.de

AB-Nummer:	ID-Nummer:	Projektleiter:
810-24-000261	T0121 + T0122	F. Demes
AB-NUMBER	ID-NUMBER	PROJECT MANAGER

Kunde:	Anlagenstandort:
2G Energy Ltd. Unit 1 Sycamore Court, Warrington Road Runcorn, WA1 3RS Great Britain	Deeside tbc Deeside, CH5 2LL Great Britain
CUSTOMER	SITE / LOCATION

Projekt:

PROJECT

BCN - Deeside avus1200e NG

Dokumentenart:	Benennung:
Layout 1	12m CO avus1200e NG T0121+T0122
DOCUMENT	DESIGNATION

Datum:	Erstellt durch:	Genehmigt von:	Maßstab:
09.12.2024	D.Alfert		1:40
DATE	DRAWN BY	APPROVED BY	SCALE

Dok.-ID:	Status:	Vers. / Rev.
DOC-ID	STATUS	VERSION / REVISION

Ausgabedatum: 2024-12-09, 10:11 Uhr

VIESMANN

VITOPLEX 200

Low temperature oil/gas boilers
700 to 1950 kW

Datasheet

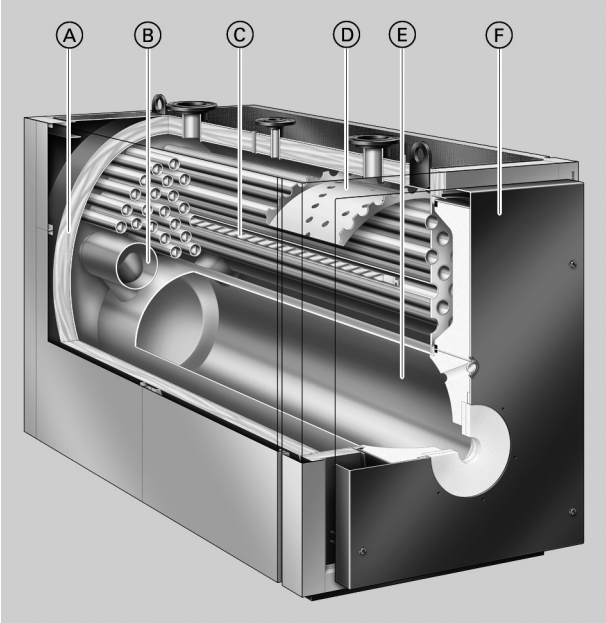
Part no. and prices: See pricelist

VITOPLEX 200 Type SX2A

Low temperature oil/gas boilers
- **Three-pass boiler**
- **For operation with modulating boiler water temperature**
- **With Vitotrans 300 as condensing unit**

Benefits at a glance

- Economical and environmentally responsible due to modulating boiler water temperature.
- Standard seasonal efficiency [to DIN] for operation with fuel oil: 89 % (H_s) [gross cv].
- Optional stainless steel flue gas/water heat exchanger enables the utilisation of condensing technology for higher standard seasonal efficiency [to DIN].
- Three-pass boiler with low combustion chamber loading, resulting in clean combustion with low emissions.
- Wide water galleries and large water capacity provide excellent natural circulation and reliable heat transfer.
- Large water content results in long burner runtimes and fewer switching intervals, thereby protecting the environment.
- Compact design for easy transportation into boiler rooms – important for modernisation projects.
- Easy to use Vitotronic control unit with colour touchscreen.
- Integral LAN interface for internet communication and integral WLAN for service interface.
- Economical and safe operation of the heating system through the Vitotronic control system with communication capability which, in conjunction with Vitogate 300 (accessories), enables integration into building management systems.
- Vitocontrol control panel can be supplied on request.



Ⓐ Highly effective thermal insulation
Ⓑ Second hot gas flue
Ⓒ Third hot gas flue
Ⓓ Water deflector with return injectors
Ⓔ Combustion chamber (first pass)
Ⓕ Boiler door

Boiler specification

Specification

Rated heating output	**kW**	**700**	**900**	**1100**	**1300**	**1600**	**1950**
Rated heat input	kW	761	978	1196	1413	1739	2120
CE designation According to Gas Appliances Directive		CE-0085BQ0020					
Permiss. flow temperature (= safety temperature)	°C	110 (up to 120 °C on request)					
Permiss. operating temperature	°C	95					
Permiss. operating pressure	bar	6					
	kPa	600					
Pressure drop on the hot gas side	mbar	2.7	4.6	4.0	5.7	8.2	8.5
	Pa	270	460	400	570	820	850
Boiler body dimensions							
Length (dim. k)*1	mm	2200	2500	2450	2670	3075	3075
Width (dim. c)	mm	1085	1085	1180	1180	1280	1280
Height (incl. connectors) (dim. e)	mm	1670	1670	1900	1900	2120	2120
Total dimensions							
Total length (dim. f)	mm	2280	2580	2530	2750	3175	3175
Total width							
– Incl. control unit (dim. a)	mm	1460	1460	1555	1555	1660	1660
– Excl. control unit (dim. b)	mm	1285	1285	1380	1380	1485	1485
Total height (incl. lifting eyes) (dim. h)	mm	1690	1690	1920	1920	2140	2140
Height of anti-vibration boiler supports (under load)	mm	37	37	37	37	37	37
Foundation							
Length	mm	1900	2200	2150	2300	2700	2700
Width	mm	1200	1200	1300	1300	1400	1400
Combustion chamber diameter	mm	620	620	720	720	720*2	720*2
Combustion chamber length	mm	1700	2000	1930	2150	2530	2530
Weight boiler body	kg	1620	1870	2120	2340	3000	3580
Total weight Boiler incl. thermal insulation and boiler control unit	kg	1725	1985	2255	2485	3180	3760
Capacity boiler water	litres	935	1325	1525	1690	2510	2420
Boiler connections							
Boiler flow and return	PN 6 DN	100	100	125	125	150	150
Safety connection (safety valve)	PN 16 DN	50	50	65	65	65	65
Drain (male thread)	R	1¼	1¼	1¼	1¼	1¼	1¼
Flue gas parameters*3 Temperature (at 60 °C boiler water temperature)							
– At rated heating output	°C	180					
– At partial load	°C	125					
Temperature (at 80 °C boiler water temperature)	°C	195					
Flue gas mass flow rate							
– For natural gas	kg/h	1.5225 x combustion output in kW					
– For fuel oil EL	kg/h	1.5 x combustion output in kW					
Flue gas connection	Ø mm	300	300	350	350	400	400
Total gas capacity Combustion chamber, hot gas flues, return pipes, bend and flue gas collector	m^3	0.90	1.00	1.35	1.45	2.50	2.50
Standard seasonal efficiency [to DIN] (for operation with fuel oil) At heating system temperature 75/60 °C	%	89 (H_s) [gross cv]					
Standby loss $q_{B,70}$	%	0.15	0.13	0.13	0.12	0.13	0.11

*1 *Boiler door removed.*

*2 *Conical combustion chamber 720/840 mm (combustion chamber diameter front/rear)*

*3 *Calculation values for sizing the flue system to EN 13384, relative to 13.2 % CO_2 for fuel oil EL and 10 % CO_2 for natural gas. Flue gas temperatures captured as gross values at 20 °C combustion air temperature. The details for partial load refer to an output of 60 % of rated heating output. If the partial load differs (depending on operating mode), calculate the flue gas mass flow rate accordingly.*

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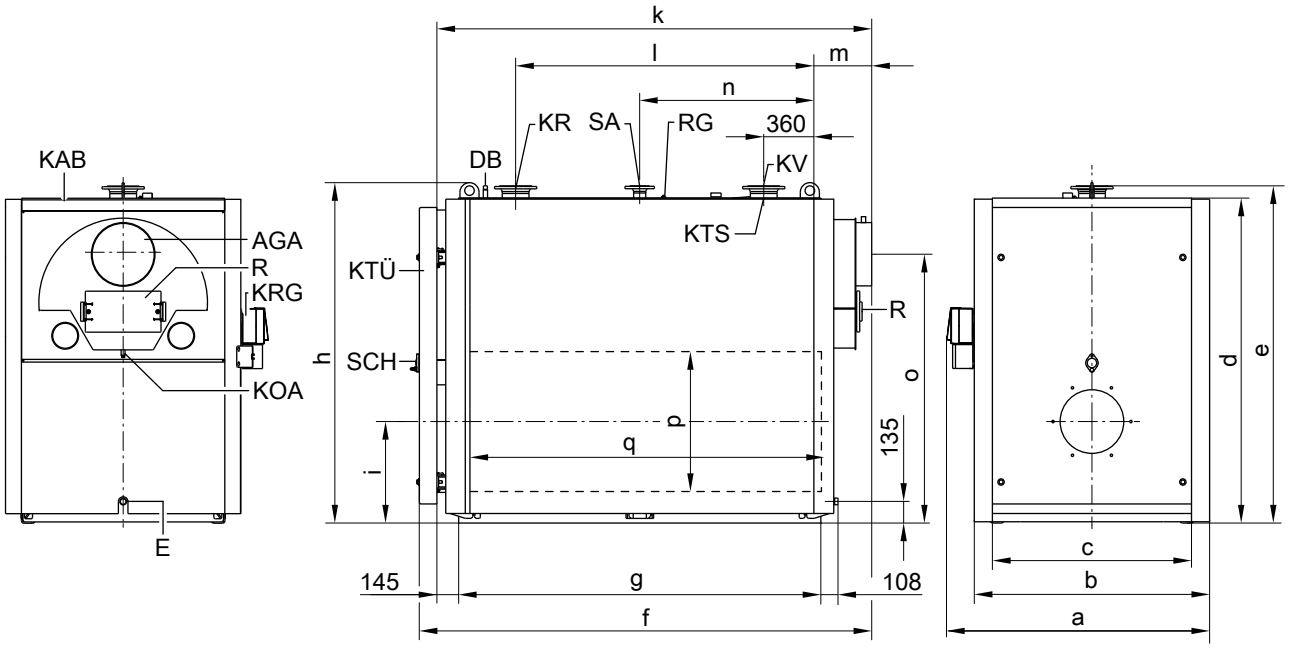
Boiler specification (cont.)

Rated heating output	kW	700	900	1100	1300	1600	1950
Matching Vitotrans 300							
– Gas operation	Part no.	Z007212		Z007213		Z007214	
– Oil operation	Part no.	Z007215		Z007216		Z007217	
Rated heating output Boiler with Vitotrans 300							
– Gas operation	kW	773.5	994.5	1215.0	1436.0	1768.0	2154.0
– Oil operation	kW	750.0	964.0	1179.0	1393.0	1715.0	2090.0
CE designation Vitotrans 300 in conjunction with boiler as a condensing unit		CE-0085BS0287					
Pressure drop on the hot gas side Boiler with Vitotrans 300	mbar	3.2	5.4	5.2	7.3	10.0	10.1
	Pa	320	540	520	730	1000	1010
Total length Boiler with Vitotrans 300 excl. burner	mm	3820	4120	3670	3890	4140	4470

Dimensions



AGA Flue outlet
DB Female connection for maximum pressure limiter (R ½, male thread)
E Drain
KAB Boiler cover (walk-on)
KOA Condensate drain
KR Boiler return
KRG Boiler control unit
KTS Boiler water temperature sensor (shown offset)
KTÜ Boiler door
KV Boiler flow
R Cleaning aperture
RG Female connection for additional control equipment (R ½, male thread)
SA Safety connection (safety valve)
SCH Inspection port

Dimensions

Rated heating output	kW	700	900	1100	1300	1600	1950
a	mm	1460	1460	1555	1555	1660	1660
b	mm	1285	1285	1380	1380	1485	1485
c	mm	1085	1085	1180	1180	1280	1280
d	mm	1590	1590	1815	1815	2035	2035
e	mm	1670	1670	1900	1900	2120	2120
f	mm	2280	2580	2530	2750	3175	3175
g (length of base rails)	mm	1775	2075	2005	2225	2610	2610
h	mm	1690	1690	1920	1920	2140	2140
i	mm	525	525	580	580	640	640
k (transport dimension)	mm	2200	2500	2450	2670	3075	3075
l	mm	1420	1720	1650	1870	2250	2250

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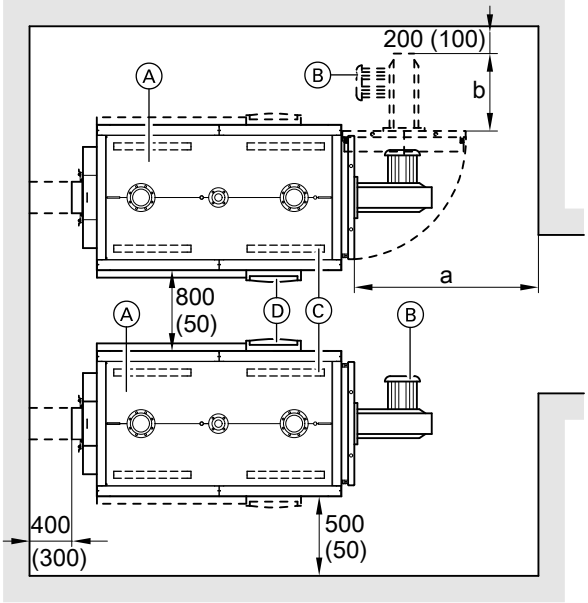
Boiler specification (cont.)

Rated heating output	kW	700	900	1100	1300	1600	1950
m	mm	280	280	300	300	320	320
n	mm	890	1040	1005	1115	1305	1305
o	mm	1270	1270	1480	1480	1690	1690
p	∅ mm	620	620	720	720	720*4	720*4
q	mm	1700	2000	1930	2150	2530	2530

Dim. k: With boiler door removed

Siting

Minimum clearances



Ⓐ Boiler
Ⓑ Burner
Ⓒ Anti-vibration boiler supports
Ⓓ Boiler control unit

The stated dimensions should be observed to ensure straightforward installation and maintenance. Where space is tight, only the minimum clearances (dimensions in brackets) need to be maintained. In the delivered condition, the boiler door is fitted so it opens to the right. The hinge pins can be repositioned so the door opens to the left.

Dimensions

Rated heating output	kW	700	900	1100	1300	1600	1950
a	mm	2000	2000	2200	2400	2900	2900
b	mm	Installed burner length					

Dim. a: Maintain this space in front of the boiler to enable the hot gas flues to be cleaned.
If the control units are fitted on opposite sides of the boilers, the 800 mm clearance between the individual boilers can be reduced to 50 mm.

Siting conditions

- Prevent air contamination by halogenated hydrocarbons (e.g. as contained in sprays, paints, solvents and cleaning agents)
- Prevent very dusty conditions
- Prevent high levels of humidity
- Prevent frost and ensure good ventilation

Otherwise the system may suffer faults and damage.
In rooms where air contamination through **halogenated hydrocarbons** may occur, install the boiler only if adequate measures can be taken to provide a supply of uncontaminated combustion air.

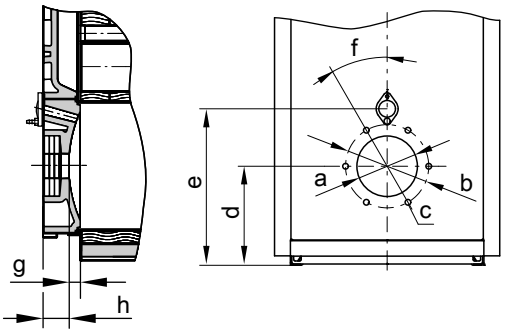
Burner installation

Fit the burner plate included in the standard delivery on the hinged boiler door.
The burner must be fitted to the burner plate; mounting it directly onto the boiler door without a burner plate is not possible.
Drill the supplied burner plate on site, in accordance with the burner dimensions.

Burner plates can be prepared at the factory on request (chargeable option). If this is required, state the burner make and type when ordering.
The flame tube must protrude from the thermal insulation of the boiler door.
The burner must not exceed a total weight of 180 kg, otherwise supports will need to be provided on site.

*4 *Conical combustion chamber 720/840 mm (combustion chamber diameter front/rear)*

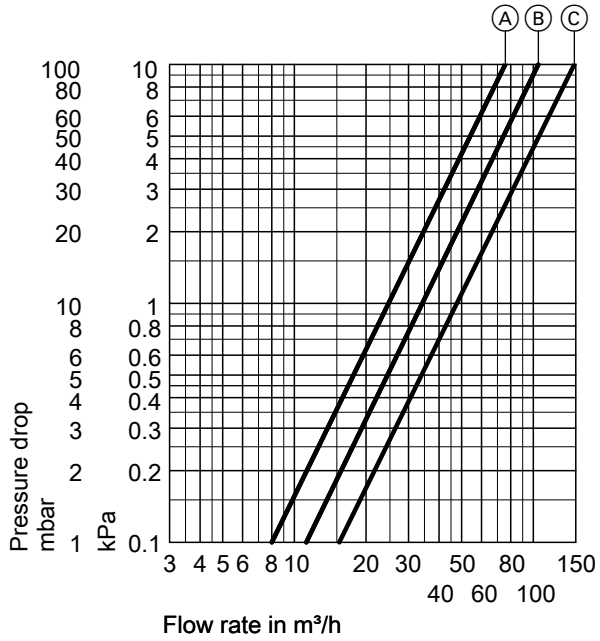
Boiler specification (cont.)



Dimensions

Rated heating output	kW	700	900	1100	1300	1600	1950
a	∅mm	350	350	400	400	400	400
b	∅mm	400	400	490	490	490	490
c	Quantity/ thread	6/M12					
d	mm	525	525	580	580	640	640
e	mm	785	785	885	885	970	970
f	°	15	15	30	30	30	30
g	mm	75	75	75	75	75	75
h	mm	150	150	150	150	170	170

Pressure drop on the heating water side



The Vitoplex 200 is only suitable for fully pumped hot water heating systems.

Ⓐ Rated heating output 700 and 900 kW
Ⓑ Rated heating output 1100 and 1300 kW
Ⓒ Rated heating output 1600 and 1950 kW

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Vitotrans 300 specification

Specification

Vitotrans 300 **– gas operation** **– oil operation**	**Part no.** **Part no.**	**Z007212** **Z007215**	**Z007213** **Z007216**	**Z007214** **Z007217**
Rated boiler heating output	kW	620-900	630-1300	1600-2000
Rated heating output of the Vitotrans 300 for				
– gas operation	from kW	62.0	63.0	160.0
	to kW	94.5	136.0	204.0
– oil operation	from kW	43.0	44.0	115.0
	to kW	64.0	93.0	140.0
Permiss. operating pressure	bar	6	6	6
	kPa	600	600	600
Permiss. flow temperature (= safety temperature)	°C	110 (120)	110 (120)	110 (120)
Pressure drop on the hot gas side	mbar	0.4-0.8	0.4-1.6	1.0-1.75
	Pa	40-80	40-160	100-175
Flue gas mass flow rate	from kg/h	1010	1057	2670
	to kg/h	1500	2160	3300
Overall dimensions				
Total length (dim. f)	mm	1046	1046	1200
Total width (dim. m), incl. mating flanges	mm	1097	1097	1226
Total height (dim. i)	mm	1783	1783	2024
Transport dimensions				
Length (dim. f)	mm	1046	1046	1200
Width (dim. m), excl. mating flanges	mm	989	989	1112
Height (dim. a)	mm	1674	1674	1915
Total weight heat exchanger incl. thermal insulation	kg	355	355	470
Content				
Heating water	litres	215	215	295
Flue gas	m^3	0.336	0.336	0.544
Connections				
Heating water flow and return	PN 16 DN	100	100	125
Condensate drain	∅ mm	32	32	32
Flue gas connection[*5]	DN	300	300	350

Rated heating output range of the Vitotrans 300 and flue gas temperature

Heating output of the Vitotrans 300 with flue gas cooling of 200/65 °C during gas operation and 200/70 °C during oil operation, with a heating water temperature rise in the Vitotrans 300 from 40 °C to 42.5 °C.

For conversion to other temperatures, see chapter "Output data".

Pressure drop on the hot gas side

Pressure drop on the hot gas side at rated heating output. The burner must overcome the hot gas pressure drop of the boiler, the Vitotrans 300 and the flue pipe.

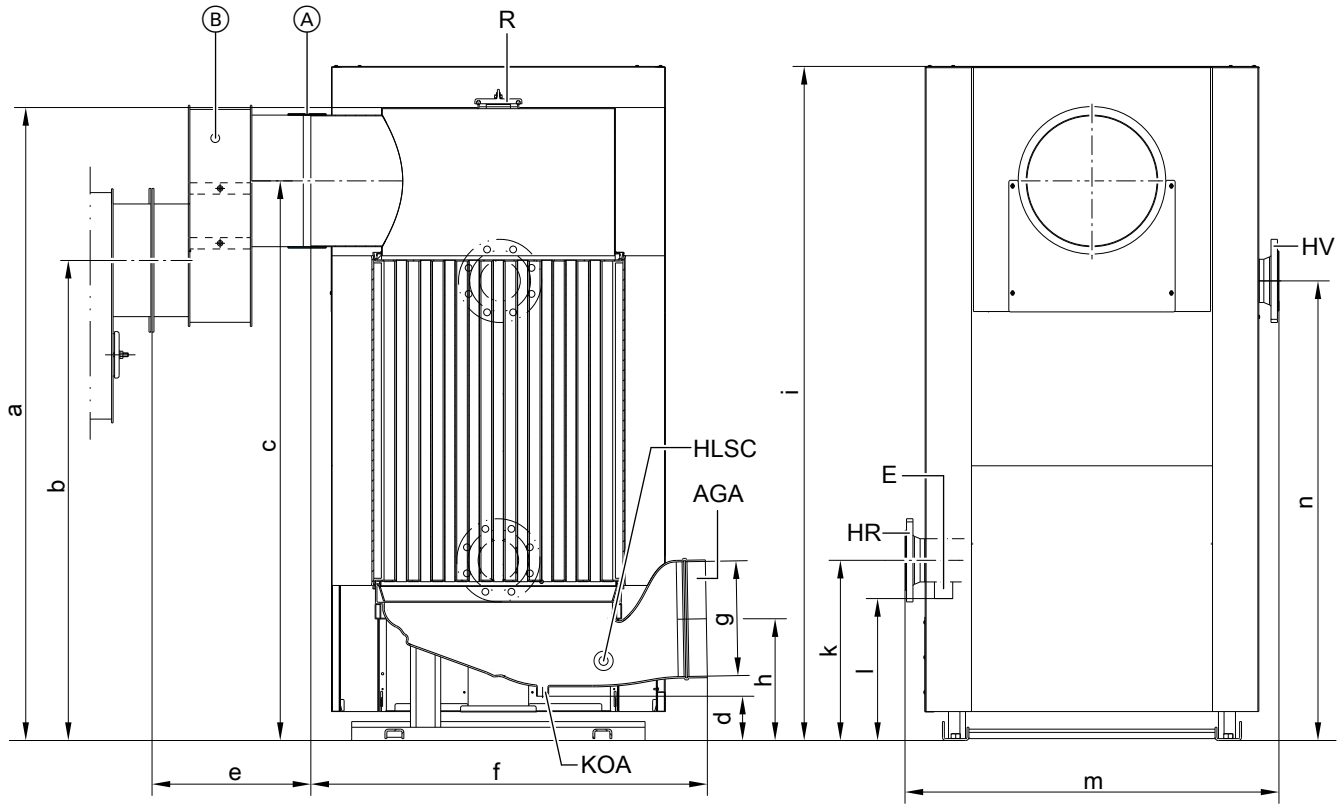
Tested quality

CE designation according to current EC Directives at a permissible flow temperature (safety temperature) of up to 110 °C to EN 12828.

*[*5] For connection dimensions see dimensioned drawing*

Vitotrans 300 specification (cont.)

Dimensions



Ⓐ Connection collar
Ⓑ Offset flue adaptor, only with Z007 212 and Z007 215 for Vitoplex boilers
AGA Flue outlet
E Drain connector
HR Heating water return (inlet)
HV Heating water flow (outlet)
KOA Condensate drain
R Cleaning aperture
HLSC Fem. connection for flue gas high limit safety cut-out

Dimensions

Part no.		**Z007212 Z007215**	**Z007213 Z007216**	**Z007214 Z007217**
a	mm	1674	1674	1825
b	mm	1270	1480	1690
c	mm	1480	1480	1690
d	mm	116	116	116
e	mm	420	15	15
f	mm	1046	1046	1200
g (internal)	∅ mm	301	301	352
h	mm	321	321	356
i	mm	1783	1783	1934
k	mm	476	476	580
l	mm	375	375	469
m	mm	989	989	1112
n	mm	1215	1215	1297

Note
Height is adjustable for Vitotrans 300.

Delivered condition

Heat exchanger body with fitted flue gas header and integral feet.
Mating flanges and screws are fitted to the connector.

1 Box with thermal insulation for flue gas/water heat exchanger
1 Box with collar
1 Crate with offset flue adaptor
1 Box with thermal insulation for offset flue adaptor

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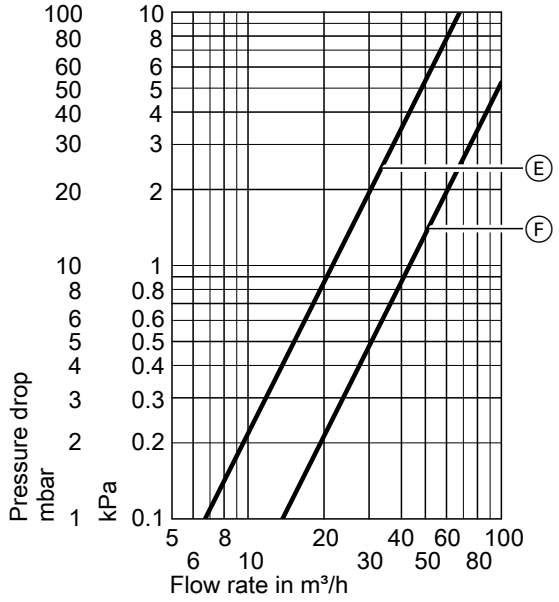
Vitotrans 300 specification (cont.)

Pressure drop on the heating water side

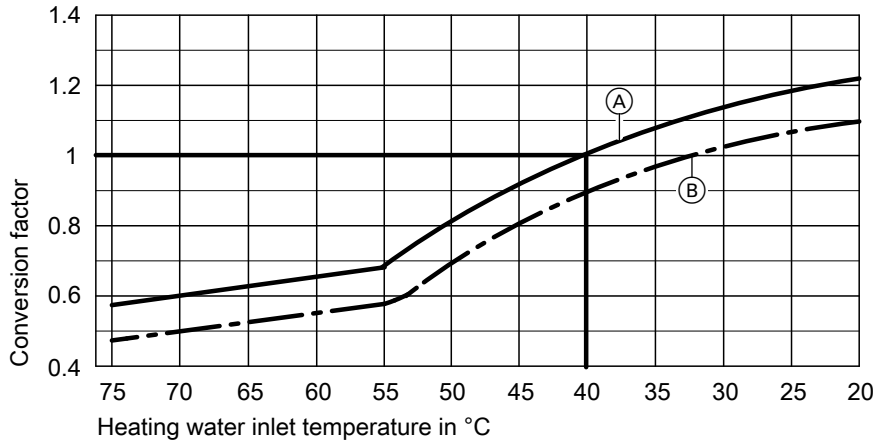
Part no. Z007212 to Z007217



Part no.	Curve
Z007212 Z007213 Z007215 Z007216	Ⓔ
Z007214 Z007217	Ⓕ

Output data

Vitotrans 300 for gas operation



Ⓐ Flue gas inlet temperature 200 °C
Ⓑ Flue gas inlet temperature 180 °C

Conversion of the output data
The heating output data of the Vitotrans 300 flue gas/water heat exchanger refers to a flue gas inlet temperature of 200 °C and a heating water inlet temperature into the heat exchanger of 40 °C.

For different conditions the heating output can be calculated by multiplying the specified rated heating output by the conversion factor established from the diagram.

Delivered condition of the boiler

Boiler shell with fitted boiler door, fitted cleaning cover and permanently fitted boiler cover.
Mating flanges are fitted to all connectors.
The adjusting screws and burner plate can be found inside the combustion chamber.

2 boxes with thermal insulation and 1 cleaning brush
1 box with boiler control unit and 1 bag with technical documentation
1 coding card and technical documentation for Vitoplex 200

Control unit versions

For a single boiler system

- **Vitotronic 100, type CC1E**
  For the control unit with a constant boiler water temperature.
  For weather-compensated or room temperature-dependent operation in conjunction with an external control unit.
- **Vitotronic 200, type CO1E**
  For weather-compensated operation and mixer control for up to 2 heating circuits with mixer. For the 2 heating circuits with mixer, the accessory "Extension for heating circuits 2 and 3" is required.

For a multi boiler system (up to 8 boilers)

- **Vitotronic 300, type CM1E**
  For weather-compensated operation of a multi boiler system. This Vitotronic control unit also handles control of the boiler water temperature of a boiler within this multi boiler system.
  Vitotronic 100, type CC1E and LON communication module
  To control the boiler water temperature for each additional boiler in the multi boiler system.
- **Vitocontrol 100-M/200-M multi mode system controller**
  For weather-compensated cascade control of boilers with Vitotronic 100 control unit and a Vitobloc 200 CHP unit or other heat generators.

Multi mode system controller in the control panel

For single and multi boiler systems

Vitocontrol 100-M

- For operation of multi mode heating systems with up to 4 heat generators, with various combinations of oil/gas boilers, heat pumps, CHP units and solid fuel boilers. The Vitocontrol 100-M can operate a range of defined standard schemes. The schemes are available via the Viessmann Schematic Browser. For the compatibility of the Vitocontrol 100-M in conjunction with Viessmann control units, see the compatibility list. Connection to Vitoscada for web-based system visualisation is available as an option. This requires an internet connection.
  Viessmann Schematic Browser: **www.viessmann-schemes.com**
  Compatibility list: **www.vitocontrol.info**

Vitocontrol 200-M

- For the operation of customer-specific multi mode energy systems with any number of heat generators in various combinations, as well as cooling, solar, ventilation and electricity components. Solutions are based on a modular system and can be flexibly extended with new functions and process applications. Connection to Vitoscada for web-based system visualisation is available as an option. This requires an internet connection.

Boiler accessories

See pricelist and "Boiler accessories" datasheet.

Operating conditions with Vitotronic boiler control units

For water quality requirements, see the technical guide to this boiler

		Requirements	
Operation with burner load		**≥ 60 %**	**< 60 %**
1.	Heating water flow rate	None	
2.	Boiler return temperature (minimum value)*6	– Oil operation 40 ºC – Gas operation 53 ºC	– Oil operation 53 ºC – Gas operation 58 ºC
3.	Lower boiler water temperature	– Oil operation 50 ºC – Gas operation 60 ºC	– Oil operation 60 ºC – Gas operation 65 ºC
4.	Two-stage burner operation	Stage 1: 60 % of rated heating output	No minimum load required
5.	Modulating burner operation	Between 60 and 100 % of rated heating output	No minimum load required
6.	Reduced mode	Single boiler systems and the lead boiler in multi boiler systems – Operation with lower boiler water temperature Lag boilers in multi boiler systems – Can be shut down	
7.	Weekend setback	As per reduced mode	

*6 *A suitable system example showing the installation of a return temperature raising facility can be found in the technical guide "System examples".*

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Notes

Installing a suitable burner

Delivery without burner.
Suitable pressure-jet oil/gas burners are available from Weishaupt or ELCO and should be ordered separately (see pricelist). Delivery directly from Weishaupt or ELCO.
The material of the burner head must be suitable for operating temperatures of at least 500 ºC.

Pressure-jet oil burner
The burner must be tested and designated to EN 267.

Pressure-jet gas burner
The burner must be tested to EN 676 and CE designated in accordance with Directive 2009/142/EC.

Burner adjustment
Adjust the oil or gas throughput of the burner to suit the rated boiler heating output.

Permissible flow temperatures

Hot water boiler for permissible flow temperatures (= safety temperatures)

- Up to 110 °C
  CE designation:
  CE-0085 in compliance with the Gas Appliances Directive
- Above 110 °C (up to 120 °C on request)
  CE designation:
  CE-0035 in compliance with the Pressure Equipment Directive
  For operation with safety temperatures in excess of 110 °C additional safety equipment is required.
  – Boilers with a safety temperature **above 110 °C** must be supervised in accordance with the Operational Safety Ordinance [Germany]. In accordance with conformity assessment diagram no. 5 of the Pressure Equipment Directive, these boilers must be classed as category IV.
  The system must be tested prior to initial commissioning.
  – Annually – external inspection (inspection of the safety equipment and water quality)
  – Every 3 years – internal inspection (alternatively carry out a water pressure test)
  – Every 9 years – water pressure test (for max. test pressure, see the type plate)
  The test must be carried out by an approved inspection body (e.g. TÜV [in Germany]).

Further information on design/engineering

See the technical guide to this boiler.

Tested quality

CE designation according to current EC Directives

ÖVGW Quality Mark for gas and water equipment

Subject to technical modifications.

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3 TECHNICAL PROPOSAL

3.1 DESIGN CONDITIONS

The below design conditions apply to the design of the biogas upgrading plant and CO2 liquefaction plant. For reference, a design case has been identified. The equipment selection and performance values of the plant are provided in this proposal based on this case.

3.1.1 GAS INLET CONDITIONS

	UNIT	OPERATING RANGE Min. – Max.	OPERATIONAL INLET At battery limit DMT	DESIGN INLET At battery limit DMT
Flow	Nm^3/h	1500 – 3000	2908	3000
Flow	Sm^3/h	1582 – 3165	3068	3165
Temperature	°C	15 – 30	25	25
Dew point	°C	5,0 – 10,0	5	5
Pressure	mbar	100 – 200	100	100
CH_4	% (v/v)	55 – 67	63,1	63,1
CO_2	% (v/v)	33 – 40	36,2	36,2
N_2	% (v/v)	0,0 – 0,8	0,2	0,2
O_2	% (v/v)	0,0 – 0,3	0,3	0,3
H_2S	ppm (v/v)	0 – 2	0	0
NH_3	ppm (v/v)	0 – 1	1	1
VOCs	mg/Nm^3	0 – 5	5	5
Siloxanes	mg/Nm^3	0	0	0

1) Provided gas must be free of any liquids, foam, or particles.
2) Provided gas at the agreed boundary should be equal to the design values as per Table A.
3) The installation is designed for optimal performance at design inlet values.
5) Presence of any component not listed above might affect the process.

3.1.2 BIOMETHANE OUTLET CONDITIONS[1)]

	UNIT	OPERATIONAL	DESIGN
Flow[2)]	Nm^3/h	1891	1951
Flow	Sm^3/h	1995	2058
Temperature	°C	15 – 30	
Dew point	°C	≤ - 50	
Pressure	barg	7,0 – 9,6	
CH_4	% (v/v)	≥ 97,0	
CO_2	% (v/v)	≤ 2,5	
N_2	% (v/v)	≤ 0,7	
O_2	% (v/v)	≤ 0,5	

1) Design outlet gas conditions and specifications in accordance with Gas Grid Specifications (a per Chapter 3.1.8).
2) Biomethane flows indicated are at the skid's edge, prior to propane injection.

3.1.3 LIQUID CO_2 OUTLET CONDITIONS

	UNIT	OPERATIONAL	DESIGN
NET flow[1)]	kg/h	2288	2357
Temperature	°C	- 25 to - 18	
Pressure	barg	16 – 20	
CO_2 recovery[2)]	%	≥ 92,0%	
CO_2 quality[3)]	% (v/v)	≥ 99,9	

1) CO_2 net flow is considering CO_2 loss for dryer media regeneration.
2) Refers to the recovery of the system (CO_2 to the storage tanks), only considering losses to atmosphere (from the dryer).
3) Liquid CO_2 according to EIGA 70/17 specifications (see Chapter 3.1.9).

3.1.4 UTILITIES BY CUSTOMER

POWER SUPPLY (24/7)	
Voltage main panels	1x 400 VAC + N + PE
Voltage compressor panels	1x 400 VAC + PE
Voltage variation limits	+5% / -5%
Frequency	50 Hz
Frequency variation limits	+/- 1%
Harmonic filtration	Inside LV-Transformer
Electrical power supply system	TN-S
Control Voltage	24 VDC / 230 VAC

3.1.5 UTILITIES BY DMT

COMPRESSED AIR (24/7)	
Pressure	≥ 6,0 bar(g)
Quality Standard	> ISO 8573-1 class 3.3.3
GASES FOR START-UP AND COMMISSIONING	
Refrigerant (NH_3)	First fill refrigerant system
CO_2	Flushing CO_2 storage tanks and initial start-up
Compressed air	Pressure and leakage tests
Calibration gasses	Calibration of sensors and analyzers
Inerts gasses (N_2)	Flushing equipment and piping
Odorant (THT)	Odorization of biomethane for grid injection

3.1.6 GEOGRAPIC- AND CLIMATE CONDITIONS

DESCRIPTION	
Site location	Deeside, United Kingdom
Wet bulb temperature	Max.: 22°C
Dry bulb temperature (indoor)	Max.: 30°C / Min.: > 0°C / Design average: 10°C
Dry bulb temperature (outdoor)	Max.: 30°C / Min.: -10°C / Design average: 10°C
Site elevation	Max.: 10 meters a.S.L
Seismic activity	None
Wind speeds	≤ 35 m/s
Snow loads	≤ 2,4 kN/m²
Equipment area classification	non-ATEX

1) Climate conditions according to the ASHRAE Handbook 2021.

3.1.7 OPERATIONAL AND PLANT DATA

CONSUMABLES[1)]	
DESCRIPTION	**QUANTITY**
Combined consumed power - Design case	0,365 ±10% kWh/Nm³ of raw biogas
Combined consumed power - Operational case	0,350 ±10% kWh/Nm³ of raw biogas
Installed power biogas upgrading plant	Approx. 1095 kW
Installed power CO_2 liquefaction plant	Approx. 1070 kW
EMISSIONS, GASEOUS WASTE	
Methane slip	± 0,0% in combination with CO2 liquefaction
Recycle gas from CO_2 condenser	Approx. 5 – 15% of inlet flow
Regeneration gas	Approx. 2 – 7% of inlet flow
EFFLUENTS, LIQUID WASTE	
Various condensate drains[2)]	Approx. 19 l/h

1) Final operational data is subject to final engineering.

2) Could include traces of feed gas/process.

3.1.8 BIOMETHANE QUALITY

DMT guarantees the biomethane purities in accordance with the below Gas Grid Specifications and table 3.1.2 under the condition that the gas inlet design conditions are met as per design gas inlet condition where purities are measures at the grid entry unit.

GAS QUALITY			
PAMATETER		**VALUE**	**UNIT**
Odor	No uncharacteristic odor of masking of odor		
Hydrogen Sulphide (H_2S)		≤ 5	mg/Sm³
Total Sulphur		≤ 50	mg/Sm³
Hydrogen (H_2)		< 0,1	mol%
Oxygen (O_2)	If pressure > 38 bar(g) If pressure ≤ 38 bar(g)	≤ 0,2 ≤ 1,0	mol% mol%
Inerts	Total inerts Carbon Dioxide (CO_2)	≤ 7,0 ≤ 2,5	mol% mol%
Hydrocarbon Dewpoint	At any pressure < 85 bar	≤ -2	°C
Water Dewpoint	At 7 bar(g) at grid injection into < 7 bar(g) grid At 7 bar(g) at grid injection into 7 – 16 bar(g) grid At 85 bar(g) at grid injection into > 16 bar(g) grid	≤ -10 ≤ -10 ≤ -10	°C °C °C
Gross Calorific Value: values after propane injection, DMT output may vary as propane injection is not part of scope DMT.		36,9 – 42,3	MJ/Sm³
Wobbe Number; values after propane injection, DMT output may vary as propane injection is not part of scope DMT.		47,20 – 51,41	MJ/Sm³
Incomplete Combustion Factor (ICF)		≤ 0,48	
Soot Index (SI)		≤ 0,60	
Contaminants	The gas shall not contain solid, liquid, or gaseous material that may interfere with the integrity or operation of pipes or any gas appliance within the meaning of regulation 2(1) of the Gas Safety (Installation and Use) Regulations 1998 that a consumer could reasonably be expected to operate.		
Organo Halides		≤ 1,5	mg/Sm³
Hydrogen Chloride (HCl)		≤ 1,5	mg/Sm³
Hydrogen Fluoride (HF)		≤ 5	mg/Sm³
Ammonia (NH_3)		≤ 20	mg/Sm³
Radioactivity		≤ 5	Bq/g
Pressure	The delivery pressure shall be the pressure required to deliver natural gas at the Delivery Point into the Entry Facility at any time taking into account the back pressure of the System at the Delivery Point as the same shall vary from time to time. The entry pressure shall not exceed the Maximum Operating Pressure at the Delivery Point.		
Temperature		1 – 38	°C
Unless stated otherwise all volumes are for the real dry gas at ISO Standard Reference conditions of 15°C and 1,01325 bar			

3.1.9 LIQUID CO2 QUALITY

DMT guarantees the liquid CO_2 purities in accordance with table 3.1.4 under the condition the gas inlet design conditions are met as per gas inlet conditions where purities are measured at the CO_2 collection vessel.

PURITIES BASED UPON EIGA CODE: 70/17 CARBON DIOXIDE FOOD AND BEVERAGE GRADE, SOURCE QUALIFICATION, QUALITY STANDARDS AND VERIFICATION; Revision of Doc 70/08		
PARAMETER	**NOMINAL VALUE**	**UNIT**
Assay	≥ 99,9	% v/v
Moisture	≤ 20	ppm v/v
Ammonia	≤ 2,5	ppm v/v
Oxygen	≤ 30	ppm v/v
Oxides of nitrogen (NO/NO_2)	≤ 2,5 each	ppm v/v
Non-volatile residue (particulates)	≤ 10	ppm v/v
Non-volatile organic residue (oil and grease)	≤ 5	ppm v/v
Phosphine ***	≤ 0,3	ppm v/v
Total volatile hydrocarbons (calculated as methane)	≤ 50 of which ≤ 20 non-methane	ppm v/v
Acetaldehyde	≤ 0,2	ppm v/v
Aromatic hydrocarbon	≤ 0,02	ppm v/v
Carbon monoxide	≤ 10	ppm v/v
Methanol	≤ 10	ppm v/v
Hydrogen cyanide *	≤ 0,5	ppm v/v
Total sulfur (as S) **	≤ 0,1	ppm v/v
Taste and odor in water	No foreign taste or odor	-
Appearance in water	No color or turbidity	-
Odor and appearance of solid CO_2 (snow)	No foreign odor or appearance	-

* Analysis necessary only for carbon dioxide from coal gasification sources.

** If the total sulphur content exceeds 0,1 ppm v/v as sulphur then the species must be determined separately, and the following limits apply:

- Carbon Sulphide: ≤ 0,1 ppm v/v
- Hydrogen Sulphide: ≤ 0,1 ppm v/v
- Sulphur Dioxide: ≤ 1,0 ppm v/v

*** Analysis necessary only for carbon dioxide from phosphate rock sources.

Where carbon dioxide complies with the specification then by definition the requirements for acidity and reducing substances as required by European Law are met.

3.2 SCOPE OF SUPPLY

The plant is designed to deliver preassembled units manufactured in our factories in The Netherlands. During manufacturing the highest quality standards and materials are applied to ensure a lifetime of the plant greater than 15 years. A full breakdown of the preassembled units is described below.

Each preassembled unit comes including necessary valves and piping terminated at skid edge. Wiring and instrumentation are terminated at junction box. Sample points, vents, and drains at connection point.

3.3 SCOPE OF SUPPLY BIOGAS UPGRADING PLANT EQUIPMENT PACKAGES

3.3.1 BIOGAS COMPRESSOR(S)

BIOGAS COMPRESSOR(S)	
Configuration	2x 50%
Cooling	Water-cooled via dry-cooler
Capacity control	Yes, frequency controlled
Heat recovery	No
Location	Indoors, ATEX zone 2

3.3.2 COMPRESSED GAS TREATMENT

The compressed gas treatment includes several heat exchangers for temperature control of the gas, removal of oil, particles and condensate.

HEAT EXCHANGER AND WATER SERARATOR	
Cooling capacity	40,5 kW thermal
Condensate discharge	18,0 L/h (may contain traces of compressor oil)
Cooling	Water-cooled via chiller
Material selection	Stainless steel heat exchanger + condenser
Installation	Indoors, ATEX zone 2

3.3.3 MEMBRANE UNIT

The membrane skid is designed to hold a 2-stage membrane system capable of operating at the various design conditions and capacities.

MEMBRANE UNIT	
Configuration	2-stage
Material selection	Stainless steel
Membrane skid	***System is designed with spare membrane slots***
Location	Indoors, ATEX zone 2

3.4 SCOPE OF SUPPLY CO_2 LIQUEFACTION PLANT EQUIPMENT PACKAGES

3.4.1 CO_2 COMPRESSOR(S)

Two stage reciprocating, oil free, compressors are applied to avoid oil contamination in the final product which could otherwise result in a rejected batch of CO_2. These reciprocating compressors are exceptional energy efficient and are flexible to accommodate process changes. The reciprocating compressors' good adjustability enables different suction- and final pressures as well as adaptable volume flow quantities.

CO_2 COMPRESSORS	
Configuration	1x 100%
Type	2-stage reciprocating compressor
Capacity control	Yes, frequency controlled
Cooling	Water-cooled via dry-cooler
Cooling medium	30% propylene glycol provided at ambient +7°C
Cooling control	Yes, control valve in cooling water supply lines
Location	Indoors, non-ATEX zone

3.4.2 CO_2 CONDITIONING UNIT

The cooling and dewatering unit is designed to reduce the water content of the CO_2 gas through condensation. It will reduce the water load on the activated carbon polisher to improve the performance. In addition, it also reduces the water load onto the dehydration part which reduces the chance of freezing the CO_2 condenser and thus improves the CO_2 recovery and liquefaction efficiency.

CO_2 CONDITIONING UNIT	
Configuration	1x 100%
Type	Gas/Liquid plate heat exchanger
Material selection	Stainless steel
Cooling	Water-cooled via chiller
Cooling medium	35% propylene glycol provided at +2°C
Capacity control	Yes, control valve in cooling water supply line
Location	Indoors, non-ATEX zone

3.4.3 CARBON UNIT & REGENERATIVE DEHYDRATION

The carbon unit and regenerative dehydrator is a fully automated system. This unit will pre-clean the CO_2 gas of undesired impurities that affect the quality of the food grade CO_2. The second step is to remove the remaining moisture to prepare the CO_2 for lowering the temperature down towards approx. -30°C to prevent freezing in the system. This system will be executed in full automated dual mode; one unit is running, and the other unit will be regenerated.

CARBON UNIT & REGENERATIVE DEHYDRATION	
Configuration	1x 100%
Materials	Stainless steel vessel(s) and piping
Insulation	Aluminum cladding
Location	Indoors, non-ATEX zone

3.4.4 CO_2 PRE-COOLING

After conditioning and dehydration, the CO_2 gas is passed through the reboiler tube bundle to pre-cool the gas prior to liquefaction.

CO_2 PRE-COOLING	
Configuration	1x 100%
Type	Gas/Liquid shell & tube heat exchanger
Material selection	Stainless steel

Cooling medium	Liquid CO_2 from reboiler sump
Location	Indoors, non-ATEX zone

3.4.5 LIQUID CO_2 COLLECTION VESSEL & STRIPPING COLUMN

The CO_2 collection vessel and stripping column is designed to remove the last non-condensable impurities such as N_2, O_2 and CH_4 to achieve the required CO_2 liquid specification. These non-condensable impurities will be removed in the CO_2 condenser by purging these via a special designed venting system. This system is fully automated, embedded, and integral part of the overall system to reach the agreed CO_2 liquid quality.

LIQUID CO2 COLLECTION VESSEL & STRIPPING COLUMN	
Configuration	1x 100%
Type	Reboiler + stripper
Material Vessel	Carbon steel
Material Piping	Stainless steel
Insulation	Aluminum cladding
Location	Outdoors, non-ATEX zone

3.4.6 CO_2 CONDENSER/REFRIGERANT EVAPORATOR

The CO_2 condenser liquefies the incoming CO_2 gas by evaporating the refrigerant. This system is optimally designed to separate, in conjunction with the stripping column and CO_2 collection vessel, the non-condensable gasses from the liquified CO_2 resulting in less CO_2 loss from during purging. A buffer vessel is installed to further optimize production.

CO2 CONDENSER/REFRIGERANT EVAPORATOR	
Configuration	1x 100%
Type	Gas/Liquid shell & plate heat exchanger
Material selection	Stainless steel plate, carbon steel shell
Refrigerant type	NH_3
Insulation	Aluminum cladding
Location	Outdoors, non-ATEX zone

3.4.7 CO_2 LIQUID PUMP

The purified CO_2 collected in the CO_2 collection vessel will be transferred into the CO_2 storage tank(s) by a specially selected liquid pump.

CO2 LIQUID PUMP	
Configuration	1x 100%
Material Piping	Stainless steel
Insulation	Aluminum cladding
Location	Outdoors, non-ATEX zone

3.4.8 REFRIGERANT PACKAGE

The refrigerant package including the compressor is chosen based upon a natural refrigerant, ammonia, which is the most efficient and common industrial refrigerant currently available. This package provides the condensing capacity to liquefy the dry CO_2 gas in the CO_2 condenser. The extracted heat will be transferred to the refrigerant that dissipates the heat directly to an evaporative condenser. The refrigerant system is completely prefabricated.

REFRIGERANT PACKAGE	
Configuration	1x 100%
Refrigerant type	NH_3
Refrigerant cooling	Ambient air
Capacity control	Yes, frequency controlled

Compressor cooling	Water-cooled via dry-cooler
Cooling medium	35% propylene glycol provided at ambient +7°C
Cooling control	Yes, control valve in cooling water supply lines
Location	Indoors, non-ATEX zone

3.4.9 REFRIGERANT CONDENSER

The refrigerant condenser liquifies the high-pressure refrigerant gas coming from the compressors. For optimal performance and energy management of the complete process, a special selected condenser will be provided to regulate on pressure and outside temperature fluctuations.

REFRIGERANT CONDENSER	
Configuration	1x 100%
Type	Gas/Gas Air cooler
Material selection	Stainless steel plate, carbon steel shell
Refrigerant type	NH_3
Location	Outside, non-ATEX zone

3.4.10 CO_2 EVAPORATOR

The CO_2 evaporator is used to drain the CO_2 tanks for the regeneration of the regenerative dehydration unit.

CO2 EVAPORATOR	
Type	Air heaters
Refrigerant type	Liquid CO_2
Insulation	Aluminum cladding
Location	Outdoors, non-ATEX zone

3.5 SCOPE OF SUPPLY AUXILIARIES

3.5.1 DRY-COOLER(S)

The installed equipment must be provided with sufficient cooling medium to cool down the various positions in the process. Dry cooler(s) include heat recovery system, pump modules and control valves.

DRY COOLER	
Configuration	1x 100%
Type	Dry-cooler
Material Piping	Stainless steel
Cooling medium	35% propylene glycol provided at ambient +7°C
Location	Outdoors, non-ATEX zone

3.5.2 CHILLER

The installed equipment must be provided with sufficient cooling medium to cool down the various positions in the process. A chiller is required to provide sufficient cold medium for low temperature dehydration. The chiller will provide cooling for both biogas upgrading plant and CO2 liquefaction plant.

CHILLER	
Configuration	1x 100%
Refrigerant type chiller	R-454B or equivalent
Cooling medium	35% propylene glycol provided at +2°C
Location	Out, non-ATEX zone

3.5.3 GAS ANALYSERS

At different locations in the overall plant, analysers are included for safety and quality measurements.

GAS ANALYSERS	
O_2 analyser	Inlet biogas compressor(s) (continuous measurement) CO_2 system to monitor increased O2 levels. (continuous measurement)
H_2S analyser	Inlet biogas compressor(s). (intervals of ±10 minutes)
CO_2 analyser	In product gas for controlling quality.
CH_4 analyser	In off gas for slip control and inlet of the CO_2 plant.
Flow meter	In off gas for slip control and total gas throughput calculation. In product gas.

3.5.4 MAIN CONTROL PANEL, HMI, AND INSTRUMENTATION

The DMT plant is fully automated and controlled by a Siemens PLC with a local interface. The local control system with Human Interface (HMI), a display for proper reading and daily operation, is situated on the electrical cabinet and is built in accordance with the DMT standards.

It allows for easy monitoring of the plant and its instrumentation. The setting- and changing of parameters, including switching between different operation modes (manual control/stop/automatic control) and reset of alarms, can be done using the HMI. Optionally, selected messages (for example occurring alarms) can be sent as an email. The control system can be accessed remotely through a VPN internet connection. Data logging and backups of the settings are made daily. The PLC and safety systems will be connected to an Uninterruptible Power Supply (UPS). The UPS will ensure sufficient time for a safe and efficient shutdown of the local control system during power interruptions.

The control panel(s) must be placed in a non-ATEX room.

3.5.5 TANK AUTOMATION

DMT includes tank automation based on four (4) CO_2 tanks which are provided by client. Tank automation includes the supply of a remote IO cabinet with local 9” display. Wiring of transmitters and control valves to remote IO cabinet, and wiring from remote IO cabinet to DMT control panel is included.

TANK AUTOMATIO	
Type	Remote IO (Siemens)
Display	TP900
Materials	AISI304
Conditioning	Heater
Location	Outside, IP55 non-ATEX zone

Tank automation does not include any piping, insulation, valves, transmitters and other items not specially mentioned.

3.6 SCOPE OF SUPPLY SERVICES

DMT can deliver interconnecting scope required for the full onsite works enabling to complete the total project. The provided works and materials are based upon standard layout and dimensions as provided in this offer.

3.6.1 BUILDING

To house the main equipment for both the biogas upgrading plant and CO2 liquefaction plant, a specially designed building is used. The building will consists of 2 rooms separated via a gas-tight wall. Both systems will be installed under a single roof with proper ventilation and conditioning for a safe and optimal performance of both systems.

BUILDING	
Panelling	Sw80 sandwich panels
Rooms	1x non-ATEX + 1x ATEX zone 2
Overhead doors	One (1) per room
Standard doors	Minimum one (1) per room
Gas detection	CO2 detection in non-ATEX room NH_3 detection in non-ATEX room CH_4 detection in ATEX zone 2 room
Ventilation	Flow controlled ventilation in non-ATEX room Flow controlled ventilation incl. flow safeguarding in ATEX zone 2 room
Lights and sockets	Included
Room conditioning	Included

3.6.2 ONSITE LABOUR, TOOLS AND EQUIPMENT

DMT offers all necessary subcontracted onsite labor, tool, and equipment for the onsite works of the agreed scope of supply. It includes all related works within the agreed layout by pre-selected subcontractors for full completion of the turnkey works.

The works of the onsite subcontracted labor includes the following:

- Qualified welders including tools;
- Fitters including tools;
- Insulators including tools;
- Electricians including tools.

3.6.3 ONSITE SUPERVISOR FOR MOUNTING, INSTALLATION ,COMMISSIONING AND TRAINING

DMT provides a qualified supervisor for the duration of the onsite labor to instruct, guide and realizes the onsite works until final commissioning and training of the full project. It's assumed a week will consist of maximum 50 working hours provided in the budget. DMT assumes that once the equipment is delivered onsite, there are no interruptions for the full duration of execution the project within the agreed timeline. In case there is a delay, not being caused by DMT, additional costs will be charged in accordance with DMT's hourly rates.

The works of the onsite supervisor includes the following:

- Provide guidance of locating and erection of all delivered items;
- Provide guidance of the installation works, piping, cabling, and insulation;
- Hot commissioning the equipment directly after mechanical completion and cold commissioning;
- Training of the appointed operators during hot commissioning in English;
- Handover of the plant after a final performance and acceptance test.

3.6.4 TURNKEY DESIGN PACKAGE

DMT will supply a Design Package (DP) for all related onsite turnkey works related to onsite piping, insulation, and cabling. This package will enable the customer to arrange and supervise the required onsite turnkey works himself. The package will be prepared in accordance with DMT standard specifications enabling a speedy process.

The design package will include the following:

- Layout drawing and foundation plan including drainage points;
- Electrical schematics including electrical loads;
- Piping isometrics and piping bill of materials;
- Cable bill of materials and cable trays;
- Piping support drawings;
- Insulation specifications.

3.7 SCOPE OF SUPPLY ONSITE MATERIALS

DMT can deliver interconnecting materials required for the full onsite works enabling to complete the total project. The supplied materials are based upon standard layout and dimensions as provided in this offer.

3.7.1 ONSITE PIPING MATERIALS

The following piping materials such as pipes, T-pieces, reducers, sockets etc. are included in the scope of supply:

- Interconnecting piping between the offered scope based upon the agreed layout.
- Connecting piping and return line to and from the CO_2 storage tanks included;
- Sample points for Carboscan measurements included;
- CO_2 and utility piping are executed in stainless steel, refrigerant piping can be executed in carbon steel;
- Supports, pipe clamps, special insulation clamps in accordance with the agreed layout;
- Piping materials such as main CO_2 supply line from the source is not included;
- Piping materials for recirculating gases back towards the main source is not included;
- Piping materials for blow-off lines, drain connections and CO_2 piping to and from the storage tanks are not included.

3.7.2 ONSITE INSULATION MATERIALS

The pre-packaged units are pre-insulated in case it's possible, however, some items will be insulated onsite.

Our scope for insulation consists of the following items:

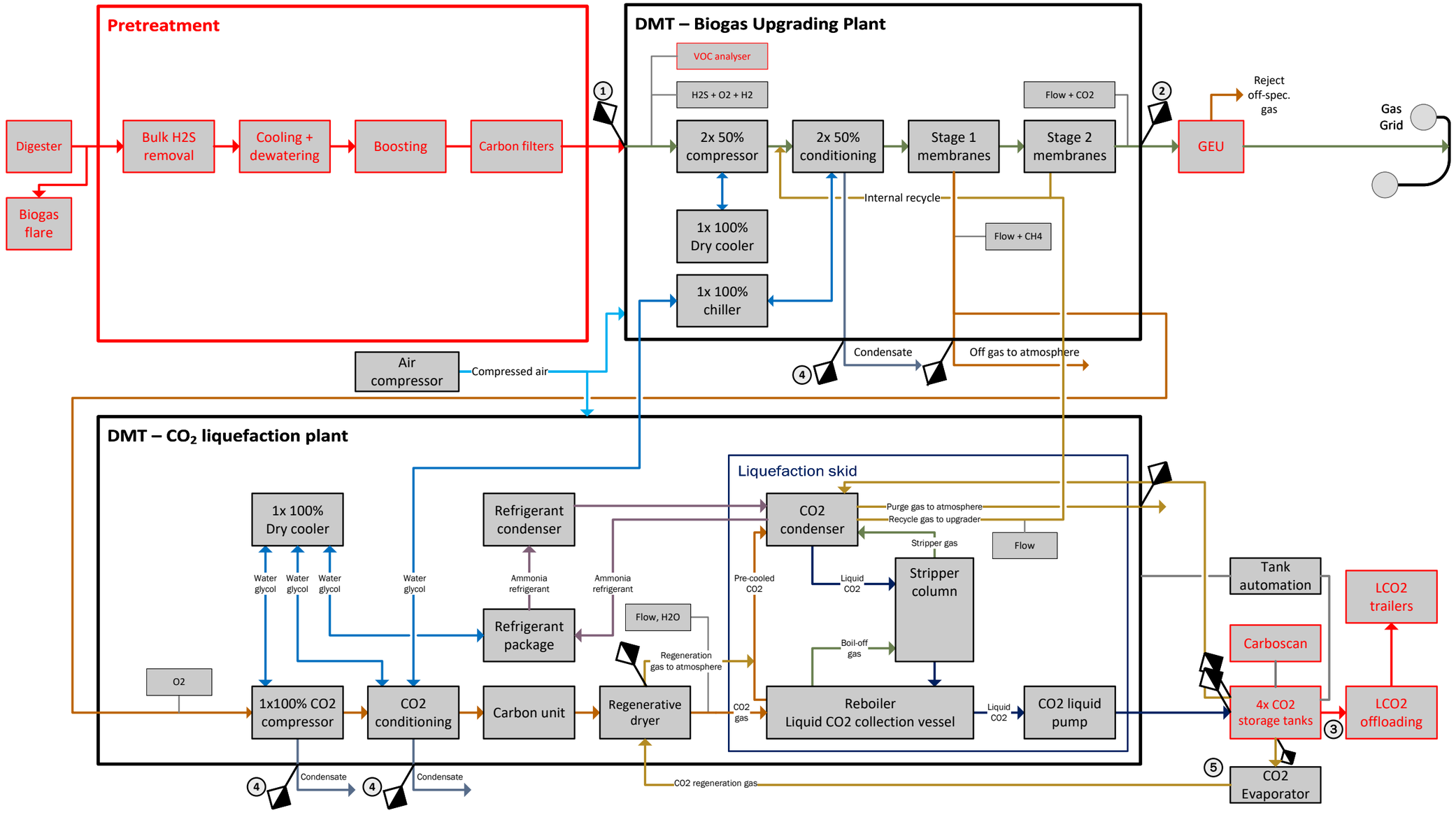
- CO_2 condenser (cold insulation);
- Liquid CO_2 collection vessel & stripping column (cold insulation);
- CO_2 liquid pump (cold insulation);
- CO_2 & refrigerant piping (cold insulation);
- Glycol piping (cold insulation);
- Regenerative dehydrator & carbon unit (heat insulation).

3.7.3 ONSITE ELECTRICAL MATERIALS

DMT's pre-packaged units will be pre-cabled in our factories before arriving at the customer facility. Once delivered all units must be connected via interconnecting cables and wires required to finalize the project.

Our scope for electrical onsite materials consists of the following:

- Interconnecting cables and wires between the offered scope based upon the agreed layout;
- Cable trays (zinc coated), supports and all required small mounting materials;
- Signal interfacing between Carboscan (excluded scope DMT) and control panels DMT included;
- Main power cables from the site power distribution into DMT's main control panel and connection thereof inside the panel is excluded.



1 – Inlet biogas		2 – Outlet biomethane		3 – Outlet liquid CO2		4 – Outlet condensate		5 – Generation gas		General	
Medium:	BIOGAS+H2S	Medium:	CH4	Medium:	LCO2	Medium:	WATER	Flow*:	95 -190 kg/h at design case	Site elevation:	10m A.S.L.
Capacity:	2908 Nm³/h	Capacity:	1891 Nm³/h	Capacity*:	1830 kg/h	Capacity:	≤ 19 l/h		< 235 kg/h at all cases	Ambient T:	-10°C / +30°C
Capacity:	3068 Sm³/h	Capacity:	1995 Sm³/h	Temp.:	≤ -22°C	Temp.:	0 – 15°C			Area classification:	Non-ATEX
Temp.:	25°C	Temp.:	15 – 30°C	Dewpoint:	≤ 20 ppmv	Pressure:	Atmospheric		*Actual flow, discontinuous.*	Seismic zone:	N/A
Dewpoint:	5°C	Dewpoint:	≤ -50°C	Pressure:	≤ 18,5 barg					Wind load:	≤ 9 Bft.; 35 m/s
Pressure:	100 mbarg	Pressure:	7,0 – 9,5 barg	CH4:	≤ 20 ppmv					Snow load:	≤ 2,4 kN/m²
CH4:	63,1 vol%	CH4:	≥ 97,0 vol%	CO2:	≥ 99,9 vol%						
CO2:	36,2 vol%	CO2:	≤ 2,5 vol%	N2:	≤ 50 ppmv						
N2:	0,4 vol%	N2:	≤ 0,7 vol%	O2:	≤ 10 ppmv						
O2:	0,3 vol%	O2:	≤ 0,5 vol%	H2S:	≤ 0,1 ppmv						
H2S:	0 ppmv										
NH3:	1 ppmv			*Accounts for regeneration gas losses.*							
VOCs:	5 ppmv										
Siloxanes:	0 mg/Nm³										

Included scope | Optional scope | Excluded scope | Client | DMT

DOCUMENT INDICATIVE ONLY AND SUBJECT TO DETAILED ENGINEERING

TITLE:	Block Diagram	PROJECT NO:	230313 v8.1
CLIENT:	Bioconstruct	STATUS:	FOR INFORMATION ONLY
PROJECT:	Deeside biogas upgrading and CO2 liquefaction	DATE:	17/10/2024

RobinsonBrothers

SAFETY DATA SHEET

ODORANT NB

Compilation date: 24/11/2005

Revision date: 5/03/2013

Revision No: 7

Section 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product name: ODORANT NB

Product code: 16410

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of substance / mixture: Odorant for gas.

1.3. Details of the supplier of the safety data sheet

Company name: Robinson Brothers
Phoenix Street
West Bromwich
West Midlands
B70 0AH
United Kingdom

Tel: +44 (0) 121 553 2451

Fax: +44 (0) 121 500 5183

Email: cjtaylor@robinsonbrothers.co.uk

1.4. Emergency telephone number

Emergency tel: +44 (0) 121 553 0356

Section 2: Hazards identification

2.1. Classification of the substance or mixture

Classification under CHIP: F: R11; Sens.: R43; N: R51/53

Classification under CLP: Aquatic Chronic 2: H411; Eye Irrit. 2: H319; Flam. Liq. 2: H225; Skin Sens. 1: H317

Most important adverse effects: Highly flammable. May cause sensitisation by skin contact. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

2.2. Label elements

Label elements under CLP:

Hazard statements: H225: Highly flammable liquid and vapour.
H317: May cause an allergic skin reaction.
H319: Causes serious eye irritation.
H411: Toxic to aquatic life with long lasting effects.

[cont...]

Signal words: Danger

Hazard pictograms: GHS02: Flame
GHS07: Exclamation mark
GHS09: Environmental

Precautionary statements: P241: Use explosion-proof electrical/ventilating/lighting equipment.
P243: Take precautionary measures against static discharge.
P303+361+353: IF ON SKIN (or hair): Remove immediately all contaminated clothing. Rinse skin with water/shower.
P280: Wear protective gloves/protective clothing/eye protection/face protection.
P305+351+338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P501: Dispose of contents/container to to regulated landfill site in accordance with local, regional, national and international regulations.

Label elements under CHIP:

Hazard symbols: Highly flammable.
Irritant.
Dangerous for the environment.

Risk phrases: R11: Highly flammable.
R43: May cause sensitisation by skin contact.
R51/53: Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety phrases: S24: Avoid contact with skin.
S37: Wear suitable gloves.
S61: Avoid release to the environment. Refer to special instructions / safety data sheets.

Precautionary phrases: Warning! Do not use with other products. May release dangerous gases (chlorine).

2.3. Other hazards

Other hazards: May be irritating to respiratory mucous membranes. In use, may form flammable / explosive vapour-air mixture. Toxic to aquatic organisms.

PBT: This product is not identified as a PBT substance.

Section 3: Composition/information on ingredients

3.2. Mixtures

[cont...]

Hazardous ingredients:

TERTIARY BUTYL MERCAPTAN

EINECS	CAS	CHIP Classification	CLP Classification	Percent
200-890-2	75-66-1	F: R11; Sens.: R43; N: R51/53	Flam. Liq. 2: H225; Skin Sens. 1: H317; Aquatic Chronic 2: H411	78-90%

DIMETHYLSULPHIDE

200-846-2	75-18-3	F: R11; -: R52	Flam. Liq. 2: H225; Eye Irrit. 2: H319; Asp. Tox. 1: H304; Aquatic Chronic 3: H412	10-30%

Section 4: First aid measures

4.1. Description of first aid measures

Skin contact: Remove all contaminated clothes and footwear immediately. Drench the affected skin with running water for 10 minutes or longer if substance is still on skin. A residual odour may cling to skin. Consult a doctor.

Eye contact: Bathe the eye with running water for 15 minutes. Consult a doctor.

Ingestion: Wash out mouth with water. Do not induce vomiting. If conscious, give half a litre of water to drink immediately. Consult a doctor.

Inhalation: Remove casualty from exposure ensuring one's own safety whilst doing so. If conscious, ensure the casualty sits or lies down. If breathing becomes bubbly, have the casualty sit and provide oxygen if available. Consult a doctor.

4.2. Most important symptoms and effects, both acute and delayed

Skin contact: There may be irritation and redness at the site of contact. May give delayed skin sensitisation

Eye contact: There may be irritation and redness. The eyes may water profusely.

Ingestion: Not likely due to odour. There may be soreness and redness of the mouth and throat. Nausea and stomach pain may occur. There may be vomiting.

Inhalation: There may be irritation of the throat with a feeling of tightness in the chest. May be irritating to respiratory mucous membranes. Exposure to vapour may cause headache

Delayed / immediate effects: Immediate effects can be expected after short-term exposure.

4.3. Indication of any immediate medical attention and special treatment needed

Immediate / special treatment: Eye bathing equipment should be available on the premises.

Section 5: Fire-fighting measures

5.1. Extinguishing media

Extinguishing media: Alcohol or polymer foam. Carbon dioxide. Dry chemical powder. Use water spray to cool containers.

[cont...]

5.2. Special hazards arising from the substance or mixture

Exposure hazards: Highly flammable. Vapour may travel considerable distance to source of ignition and flash back. In combustion emits toxic fumes of carbon dioxide / carbon monoxide. / In combustion emits toxic fumes of sulphur oxides.

5.3. Advice for fire-fighters

Advice for fire-fighters: Wear self-contained breathing apparatus. Wear protective clothing to prevent contact with skin and eyes.

Section 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Personal precautions: Refer to section 8 of SDS for personal protection details. Mark out the contaminated area with signs and prevent access to unauthorised personnel. Eliminate all sources of ignition. Turn leaking containers leak-side up to prevent the escape of liquid.

6.2. Environmental precautions

Environmental precautions: Contain spillage Do not discharge into drains or rivers. Alert National Rivers Authority or other appropriate regulatory body of spillages or uncontrolled discharges into watercourses.

6.3. Methods and material for containment and cleaning up

Clean-up procedures: **NOTIFY LOCAL GAS SUPPLY UNDERTAKINGS FOR POSSIBLE FALSE ALARM CALLS** Absorb into dry earth or sand. Transfer to a closable, labelled salvage container for disposal by an appropriate method. Do not use equipment in clean-up procedure which may produce sparks. Destroy residual odorant with sodium hypochlorite (bleach) or hydrogen peroxide. Refer to section 13 of SDS for suitable method of disposal.

6.4. Reference to other sections

Reference to other sections: Refer to section 8 of SDS.

Section 7: Handling and storage

7.1. Precautions for safe handling

Handling requirements: Ensure there is exhaust ventilation of the area. Do not handle in a confined space. Avoid the formation or spread of mists in the air. Avoid direct contact with the substance. Smoking is forbidden. Use non-sparking tools. Take precautions against static discharges

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions: Store in cool, well ventilated area. Keep container tightly closed. Keep away from sources of ignition. Prevent the build up of electrostatic charge in the immediate area. Ensure lighting and electrical equipment are not a source of ignition.

[cont...]

7.3. Specific end use(s)

Specific end use(s): No data available.

Section 8: Exposure controls/personal protection

8.1. Control parameters

Hazardous ingredients:

TERTIARY BUTYL MERCAPTAN

Workplace exposure limits: **Respirable dust**

State	8 hour TWA	15 min. STEL	8 hour TWA	15 min. STEL
UK	0.5ppm	-	-	-

DIMETHYLSULPHIDE

UK	10ppm	-	-	-

8.1. DNEL/PNEC Values

DNEL / PNEC No data available.

8.2. Exposure controls

Engineering measures: Ensure there is exhaust ventilation of the area. Ensure lighting and electrical equipment are not a source of ignition.

Respiratory protection: Self-contained breathing apparatus must be available in case of emergency.

Hand protection: PVC gloves. / Rubber gloves.

Eye protection: Safety glasses. / Safety goggles. Ensure eye bath is to hand.

Skin protection: Protective clothing. Boots.

Section 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

State: Liquid

Colour: Pale yellow

Odour: Pungent

Solubility in water: Insoluble

Also soluble in: Most organic solvents.

Boiling point/range°C: 55 **Flash point°C:** -30

Autoflammability°C: 247

9.2. Other information

Other information: No data available.

Section 10: Stability and reactivity

[cont...]

10.1. Reactivity

Reactivity: Stable under recommended transport or storage conditions.

10.2. Chemical stability

Chemical stability: Stable under normal conditions.

10.3. Possibility of hazardous reactions

Hazardous reactions: Hazardous reactions will not occur under normal transport or storage conditions. Decomposition may occur on exposure to conditions or materials listed below.

10.4. Conditions to avoid

Conditions to avoid: Heat. Flames. Sources of ignition.

10.5. Incompatible materials

Materials to avoid: Strong oxidising agents. Strong acids.

10.6. Hazardous decomposition products

Haz. decomp. products: In combustion emits toxic fumes of carbon dioxide / carbon monoxide. / In combustion emits toxic fumes of sulphur oxides.

Section 11: Toxicological information

11.1. Information on toxicological effects

Hazardous ingredients:

TERTIARY BUTYL MERCAPTAN

IHL	RAT	4H LC50	26643	ppmV
ORL	RAT	LD50	4729	mg/kg
SKN	RBT	LD50	>2000	mg/kg

DIMETHYLSULPHIDE

DERMAL	RBT	LD50	>5000	mg/kg
IHL	RAT	4H LC50	26643	ppmV
ORAL	RAT	LD50	>5000	mg/kg

Relevant effects for mixture:

Effect	Route	Basis
Sensitisation	DRM	Hazardous: calculated

Symptoms / routes of exposure

Skin contact: There may be irritation and redness at the site of contact. May give delayed skin sensitisation

Eye contact: There may be irritation and redness. The eyes may water profusely.

Ingestion: Not likely due to odour. There may be soreness and redness of the mouth and throat. Nausea and stomach pain may occur. There may be vomiting.

[cont...]

Inhalation: There may be irritation of the throat with a feeling of tightness in the chest. May be irritating to respiratory mucous membranes. Exposure to vapour may cause headache

Delayed / immediate effects: Immediate effects can be expected after short-term exposure.

Section 12: Ecological information

12.1. Toxicity

Ecotoxicity values: No data available.

12.2. Persistence and degradability

Persistence and degradability: Biodegradable.

12.3. Bioaccumulative potential

Bioaccumulative potential: No bioaccumulation potential.

12.4. Mobility in soil

Mobility: Insoluble in water.

12.5. Results of PBT and vPvB assessment

PBT identification: This product is not identified as a PBT substance.

12.6. Other adverse effects

Other adverse effects: Toxic to aquatic organisms. May taint water.

Section 13: Disposal considerations

13.1. Waste treatment methods

Disposal operations: By incineration or at authorised site as special/hazardous waste. Residual amounts of odorant can be destroyed by reaction with dilute solutions of sodium hypochlorite or hydrogen peroxide.

Disposal of packaging: Dispose of in a regulated landfill site or other method for hazardous or toxic wastes.

NB: The user's attention is drawn to the possible existence of regional or national regulations regarding disposal.

Section 14: Transport information

14.1. UN number

UN number: UN3336

14.2. UN proper shipping name

Shipping name: MERCAPTAN MIXTURE, LIQUID, FLAMMABLE, N.O.S. (TERTIARY BUTYL MERCAPTAN; DIMETHYLSULPHIDE)

14.3. Transport hazard class(es)

Transport class: 3

[cont...]

14.4. Packing group

Packing group: II

14.5. Environmental hazards

Environmentally hazardous: Yes **Marine pollutant:** No

14.6. Special precautions for user

Special precautions: No special precautions.

Tunnel code: D/E

Transport category: 2

Section 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

15.2. Chemical Safety Assessment

Chemical safety assessment: A chemical safety assessment has not been carried out for the substance or the mixture by the supplier.

Section 16: Other information

Other information

Other information: This safety data sheet is prepared in accordance with Commission Regulation (EU) No 453/2010.

REVISION Changes in Section: 2, 8, 11.

Phrases used in s.2 and 3: H225: Highly flammable liquid and vapour.

H317: May cause an allergic skin reaction.

H319: Causes serious eye irritation.

H411: Toxic to aquatic life with long lasting effects.

R11: Highly flammable.

R43: May cause sensitisation by skin contact.

R51/53: Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

R52: Harmful to aquatic organisms.

Legal disclaimer: The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. This company shall not be held liable for any damage resulting from handling or from contact with the above product.

List of Emission Points

Prepared for: Bioconstruct NewEnergy Ltd

By:

ENVIROSOLUTION LTD

Suite 53

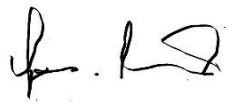
3a Bridgewater Street

Liverpool

LI OAB

Date: February 2025

EnviroSolution Ltd
Document Verification

Site Address	Arrow Bio Waste Recycling Facility, Weighbridge Road, Deeside Industrial Park, Deeside, CH5 2LL		
Report Title	List of Emission Points		
Job Number	ES25O2	**Document Ref.**	ES25O2-6
Date Issued	February 2O25	**Report Version**	Vl
Prepared by	James Meredith	**Signature**	
Checked by	Gemma Lucus	**Signature**	

Disclaimer

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1 Form Part 83

1.1 List of Emission Points

Application Form B3 Section 2 requires that all emissions to air, water and land are listed. Table 1 below provides the list of emissions as required. All emissions points referred to are shown in section 1.3 of this document..

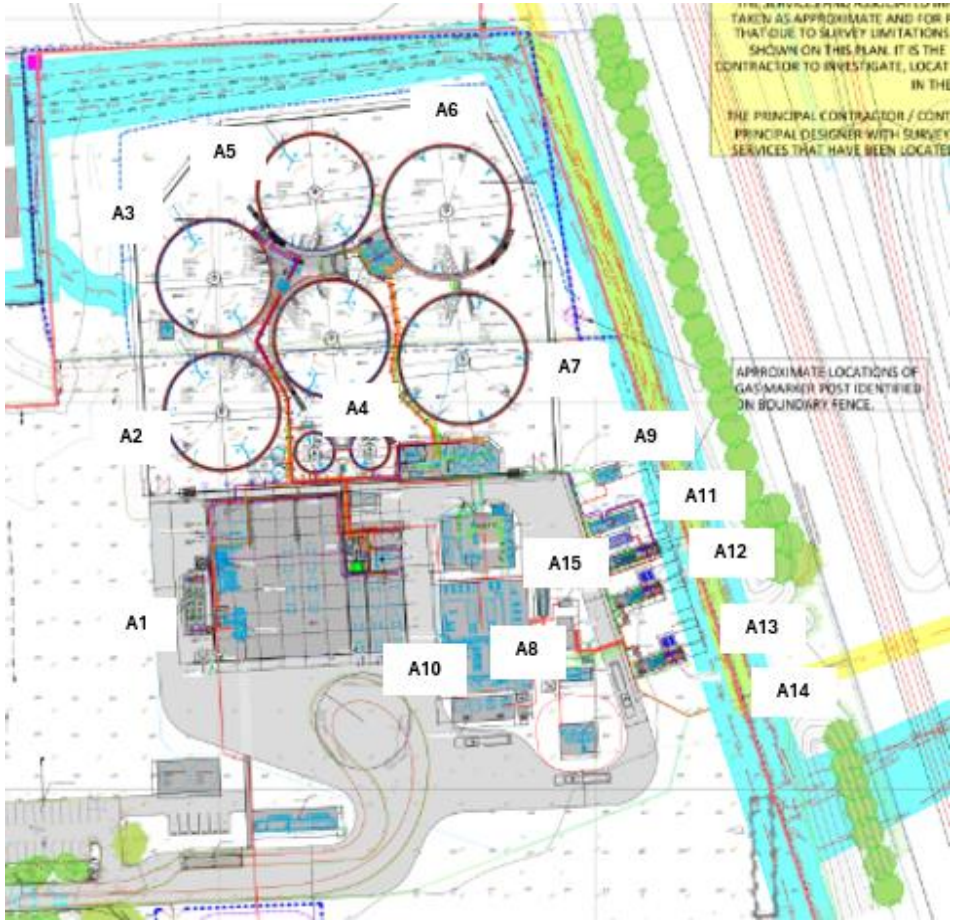
1.2 Table 1 - Emissions (releases)

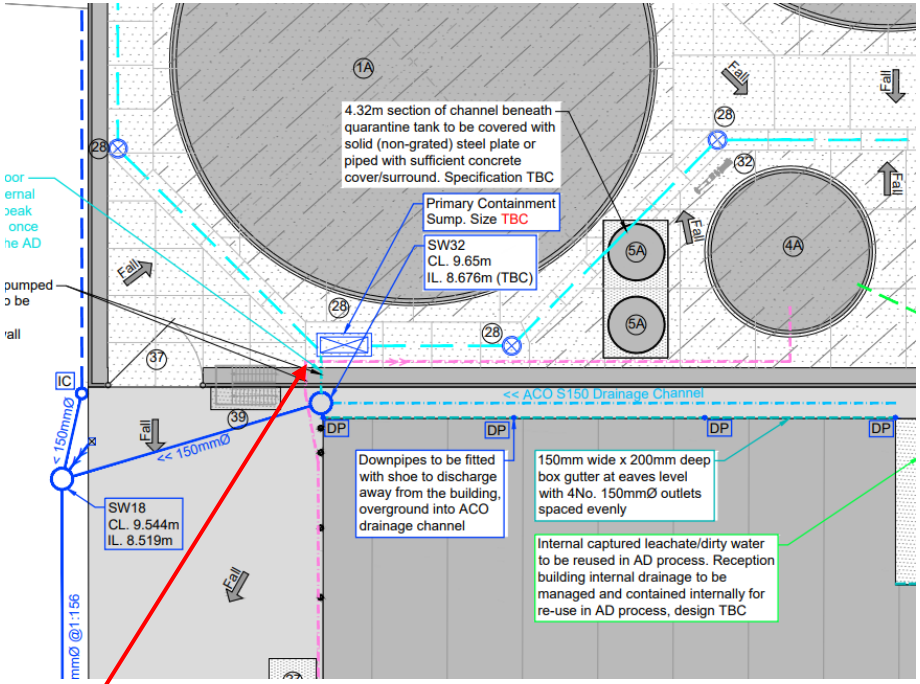
Emission point reference and location	Source	Parameter	Quantity	Unit
Point source emissions to air				
Emission point reference and location	Source	Parameter	Quantity	Unit
A01-Vent from odour abatement system	Odour Abatement System	Extracted and treated air	Treated air – units and ammonia. Ammonia emissions monitored only (limit 20mg/m^3).	mg/m^3 ammonia
A02- Under/over pressure relief valve	Fermenter tank 1	Biogas from headspace storage over tank	Time in use to be recorded	Minutes in use
A03- Under/over pressure relief valve	Fermenter Tank 2	Biogas from headspace storage over tank	Time in use to be recorded	Minutes in use
A04- Under/over pressure relief valve	Fermenter Tank 3	Biogas from headspace storage over tank	Time in use to be recorded	Minutes in use
A05 – Under/over pressure relief valve	Post Fermenter Tank 1	Biogas from headspace storage over tank	Time in use to be recorded	Minutes in use
A06- Under/over pressure relief valve	Digestate Storage Tank	Biogas from headspace storage over tank	Time in use to be recorded	Minutes in use
A07- Under/over pressure relief valve	Digestate Storage Tank	Biogas from headspace storage over tank	Time in use to be recorded	Minutes in use
A08 – process vents — DMT Environmental Technology Biogas Upgrading and CO_2 Liquefaction Plant (membrane off-gas, condenser purge gas, regeneration gas)	DMT Environmental Technology Biogas Upgrading and CO_2 Liquefaction Plant	CO2 and trace VOC's/H2S	No limit set	-
A09 – Emergency flare	Emergency Flare	Oxides of Nitrogen	≤ 150 hourly average	mg/m^3
		Carbon Monoxide	≤ 50 hourly average	mg/m^3
		Total VOC's	≤ 10 hourly average	mg/m^3

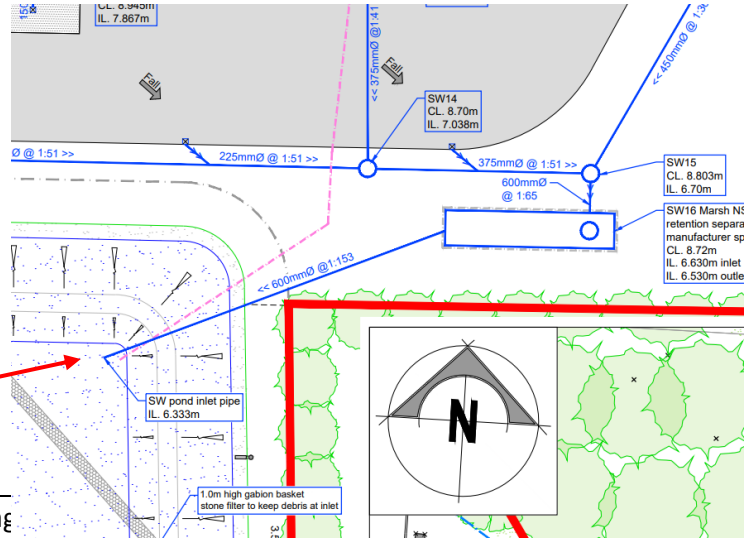
Emission point reference and location	Source	Parameter	Quantity	Unit
A10 – Emergency pressure relief valve on gas upgrading unit	Gas upgrading unit	Biogas/ biomethane	Time in use to be recorded	Minutes in use
A11- Exhaust stack from emergency natural gas boiler	Viessmann Vitoplex 200, 1,100 kW thermal, natural gas only (emergency/backup)	Oxides of Nitrogen	No limit set	-
		Carbon Monoxide	No limit set	-
		Sulphur Dioxide	No limit set	-
		Total VOC's	No limit set	-
A12-Exhaust stack from CHP engine (MCP)	CHP Engine and CHP Engine	Oxides of Nitrogen	≤ 500 hourly average	mg/m^3
		Carbon Monoxide	≤ 1400 hourly average	mg/m^3
		Sulphur Dioxide	≤ 107 hourly average	mg/m^3
		Volatile Organic Compounds	No limit set	-
A13-Exhaust stack from CHP engine (MCP)	CHP Engineboiler	Oxides of Nitrogen	≤ 500 hourly average	mg/m^3
		Carbon Monoxide	≤ 1400 hourly average	mg/m^3
		Sulphur Dioxide	≤ 107 hourly average	mg/m^3
		Volatile Organic Compounds	No limit set	-
A14-Exhaust stack from CHP engine (MCP)	CHP Engine and CHP Engine	Oxides of Nitrogen	≤ 500 hourly average	mg/m^3
		Carbon Monoxide	≤ 1400 hourly average	mg/m^3
		Sulphur Dioxide	≤ 107 hourly average	mg/m^3
		Volatile Organic Compounds	No limit set	-
A15 – Exhaust stack emergency generator	Emergency generator	Exhaust gases	No limit set	-

Emission point reference and location	Source	Parameter	Quantity	Unit
Point source emissions to water (other than sewers)				
Emission point reference and location	Source	Parameter	Quantity	Unit
W1 – Bund surface water collection sump release point to drainage system	Rainwater from bund sump Rainwater from roadways and yard and bund following controlled release from bund			
		pH	6-9	pH
		COD	<180	mg/l
		Suspended Solids	<60	mg/l
		Ammonia	<0.1	mg/l
		Total Phosphorus	<2	mg/l
W2 – Final release point of surface water from site to attenuation pond	Rainwater from roadways and yard and bund following controlled release from bund	Visible oil and odours	None present on inspection	-
W3 – Release point for surface water from reception building roof, yard and roadways internal surface water drainage system	Rainwater from roadways and yard	Visible oil and odours	None present on inspection	-
Point source emissions to sewers, effluent treatment plants, or other transfers off site				
Emission point reference and location	Source	Parameter	Quantity	Unit
S1 – Release point for domestic sewage from office building into foul sewer	Domestic sewage	BOD, Ammonia, Suspended Solids	Not set	-
Point source emissions to land				
Emission point reference and location	Source	Parameter	Quantity	Unit
None				

1.3 Diagram Showing Emission Points







Lucion
Protecting people and planet

Odour Management Plan

Proposed AD Plant, Land off Weighbridge Road, Deeside

Presented to: Deloitte LPP

Issued: March 2025

Lucion Contract Reference: 127254.661033

Report Details

Client	Deloitte LPP
Report Title	Odour Management Plan
Site Address	Proposed AD Plant, Land off Weighbridge Road, Deeside
Contract Reference	127254.661033
Lucion Contact	Sarah Slater (sarah.slater@luciongroup.com)

Quality Assurance

Issue No.	Status	Issue Date	Comments	Author	Technical Review	Authorised
1	Draft	March 2025	-	S.Slater Associate		

About Us

Lucion Delta Simons is part of Lucion, a technology-led environmental services company dedicated to protecting people and the planet. With expert advice, guidance, and a comprehensive array of services, we support you at every stage of your asset lifecycle, helping you mitigate regulatory impact, improve business practices, and ensure safety and environmental protection.

As part of Lucion's group of companies, we can support you with a broader range of holistic services. Through our pool of multidisciplinary experts, we help you navigate complex regulatory frameworks, saving you time and money.

Being part of your sustainable supply chain is a key goal for our team. As a member of the UN Global Compact and a commitment to sustainability, we are the partner of choice for businesses looking to make informed decisions and mitigate risks across your portfolio.

Lucion is carbon neutral. We annually measure and report our Scope 1, Scope 2 and specified Scope 3 carbon emissions, and offset 100% of residual emissions through verified carbon credits, supporting carbon reduction and prevention projects overseas. We are taking steps to reduce our carbon emissions and have committed to setting and achieving near-term and Net Zero Science-Based carbon reduction targets in line with the goals of the Paris Agreement to limit global warming to 1.5°C above pre-industrial levels. Lucion is a signatory of Pledge to Net Zero and Members of the United Nations Global Compact.

If you would like support in understanding your carbon emissions, or those of your supply chain, please get in touch with your Lucion contact above who will be happy to help.

Executive Summary

Site and Report Context	Lucion Delta-Simons Ltd ("Lucion") was instructed by Deloitte LPP (the 'Client') to undertake an Odour Management Plan in support of a planning application for an anaerobic digestion plant (the 'Proposed Development') at land off Weighbridge Road, Deeside (the 'Site'). This report presents the odour sources during the operational phase of the Proposed Development and the measures that should be employed to minimise any odour impacts on the surrounding area.
This is intended as a summary only. Further detail and limitations of the assessment is provided within the main body of the Report.	

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Figures

Appendices

1.0 Introduction

1.1 Appointment

1.1.1 Lucion Delta-Simons Ltd ("Lucion") was instructed by Deloitte LPP (The 'Client') to undertake a review and update of the Odour Management Plan (OMP) to supplement the planning application for a Refuse Derived Fuel (RDF) production, anaerobic digestion power plant facility (the 'Proposed Development') at the Land east of Weighbridge Road, Deeside Industrial Park, Flintshire (the 'Site').

1.1.2 To support a Section 73 application which considered a proposed layout change to the original permission, and in aid of discharging Condition 24 of the extant application FUL/000689/24 for the Anaerobic Digester facility, this OMP adapts the previously approved plan to reflect the Site changes and discharge Planning Condition 24 which states the following:

"Prior to the commencement of works above the ground floor slab level, an odour abatement scheme shall be submitted to and approved in writing by the Local Planning Authority. The scheme shall be implemented as approved and the site shall not receive waste unless and until fitted with the approved odour abatement measures, unless otherwise agreed in writing by the Local Planning Authority.

Reason: In the interests of protecting the amenity of the area, in accordance with policy EN18 of the Flintshire Local Development Plan."

1.1.3 Reference should be made to **Figure 1** for a map of the Site and surrounding area.

1.2 Site Location and Context

1.2.1 The Site is located on Land east of Weighbridge Road, Deeside Industrial Park, Flintshire.

1.2.2 Flintshire County Council have determined a planning application for the construction and operation of a waste management facility for RDF production, the management of municipal, commercial and industrial waste, comprising a waste reception hall, sorting hall, refused derived fuel hall, control room, electrical room, workers facilities and anaerobic digestion facility and associated infrastructure. It is understood the facility will accept waste of which part will be digested to produce electricity for export. The AD process will use water and mechanical equipment to separate the organic fraction, produce green energy and recycle up to 70-80% of the waste. The materials recycling facility will be processing municipal solid waste, commercial and industrial waste.

1.2.3 Following receipt of planning permission for an anaerobic digestion (AD) and combined power plant off Weighbridge Road on Deeside, there is the requirement to submit an Odour Management Plan (OMP) as part of the discharge of Planning Condition 24.

1.2.4 The application Site comprises of an area of vacant brownfield land and grassland. The former use of the Site was Shotton Power Station, a 210-megawatt gas-fire combined heat and power generating station. The station ceased generating in June 2012 and was subsequently closed. Following a restoration scheme, the majority of the site comprises of remediated previously developed land and undeveloped grassland.

1.2.5 The Site is currently a disused industrial site. The eastern boundary of the Site is defined by a railway line which runs from north to south along the boundary, beyond which is more industrial development. The western boundary of the wider site is defined by Weighbridge Road and industrial buildings and green fields beyond which forms part of the DEE Estuary RAMSAR site. The northern boundary of the application Site has no defining boundary features a parcel of land exists which is an Energy Recovery Facility. To the south is the development of the Flintshire Bridge Converter Station, this is on land formerly part of Shotton Steelworks.

1.2.6 The nearest residential properties to the Site are located within Connah's Quay, approximately 1.8km to the southwest of the site. Several industrial buildings also lie within this vicinity and the River Dee lies 1.5km to the southwest of the Site.

1.3 OMP Structure

1.3.1 The elements to be included within an OMP are detailed in Defra and Environment Agency (EA) guidance. Whilst these guidance notes focus on odour for Environmental Permitting, they provide a robust structure upon which this OMP is based. The EA H4 guidance states: 'all OMPs will need to consider sources, releases and impacts, and use these to identify cost effective opportunities for odour management. For a particular activity, some methods may be more effective/applicable than others.'

1.3.2 The following sections of the OMP detail:

- Odour Sources, Pathways and Receptors;
  - Proposed Development Overview;
  - Odour Sources and potential Odour Pathways; and
  - Odour Receptors.
- Odour Management and Control Measures;
  - Abnormal and Emergency Events; and
  - Odour Management Review.

1.3.3 The standard limitations associated with this assessment are presented in **Appendix A**.

1.3.4 A glossary of terms used in this report is provided in **Appendix B**.

2.0 Process Overview

2.1 Proposed Development Overview

2.1.1 The Site is located at the land east of Weighbridge Road, Deeside Industrial Park. The land is currently brownfield with a former use of Shotton Power Station combined heat and power station which completed operations in 2012.

2.1.2 The Site is bound by industrial land to the north, Weighbridge Road to the west, Flintshire Bridge HVDC Converter Station to the south and the railway line to the east. The Site and surrounding area are shown in **Figure 1** .

2.1.3 The closest high sensitivity receptors (residential) are the properties at Connah's Quay, located approximately 1.8km to the south of the development Site.

2.2 Process Overview

2.2.1 The Proposed Development aims to process specified organic wastes streams through an anaerobic digestion process which will also provide biomethane for injection into the natural gas grid and/or for direct usage at the facility. The Proposed Development comprises the following components:

- Reception building (equipped with odour control filters);
- Technical Building which contains the Pre-Storage Tanks (2), Anaerobic Digestion tanks (3), digest storage tanks (2), post fermenter tank (1);
- Biogas holder;
- CHP, Steam Generator and gas flare;
- Car parking area, bin storage, maintenance depot/fuel and oil storage; and
- Office.

2.2.2 The AD has the following process:

- Reception and feed systems;
- Fermentation process;
- Substrate distribution system;
- Post-fermentation process;
- Pasteurisation of by-products;
- Digestate and residue management, including
  - Storage
  - Recirculation;
- Heating system;
- Ancillaries for the operation and safety of the process, including
  - Process management systems
  - Safety systems;
- Gas Conditioning/upgrading; and
- Control Systems

2.2.3 The following describes the detailed process flow:

Reception and Feed system:

2.2.4 On arrival the waste will be put through the processing unit for mechanical separation and preparation. This includes the waste reception hall, sorting hall with associated equipment for separation and processing. The building also includes a Refused Derived Fuel RDF (hall), control room, electrical room and workers facilities;

Fermentation Process and Substrate Distribution System:

2.2.5 There are three fermentation tanks fitted with mixers which are heated to 40 degrees Celsius and are used to generate biogas of approximately 55% methane and 45% carbon dioxide with other trace gases. The substrate distribution system enables distribution of the substrate and digestate between the fermentation tanks, post digestion, pasteurisation, storage tanks and feed pit and solids feeder.

Post-fermentation Process and Pasteurization

2.2.6 The substrate/digestate generated from the fermenters is transferred to the post fermenter for further biological degradation. This ensures the maximum amount of biogas to be generated. The post fermenter is heated to ferment at 40 degrees Celsius.

2.2.7 Digestate is transferred from Post Fermenter to pasteurisation tanks via the substrate distribution system to three identical stainless-steel tanks heated to over 70 degrees Celsius for a minimum of an hour. The purpose of pasteurisation is to cease biological activity of the digestate and remove pathogens.

2.2.8 Once pasteurisation is complete the digestate is pupped to the digestate storage tanks which later can be removed for off-site distribution.

Gas Conditioning

2.2.9 Biogas generated in the fermenters and post fermenter is collected in the gas membrane PVC roofs where injections of oxygen remove sulphides and hydrogen. The biogas is chilled and scrubbed with sulphuric acid to remove ammonia prior to being further chilled and passed through an activated carbon filter.

2.2.10 Biogas is then compressed and passed through a series of membranes which strip the biogas of the methane which is then passed to the grid for propanation and odorization prior to injection into the grid. The remaining carbon dioxide is upgraded in a recovery unit and stored in tanks to pump into the tanker for offsite distribution.

2.3 Description of Odour Control Systems

2.3.1 The odour control comprises of an air extraction system situated in the reception building, with extraction points located within close proximity to the areas which are known for their potential odour release, such as tipping bays, biomass mixers, mixing units and the centrifuge.

2.3.2 Introduction of clean air as high velocity air induction aims to direct internal air flow toward air extraction fans and away from external doorways. The building will be maintained under negative pressure with continuous extraction through carbon and dust filters.

2.3.3 Connection of the storage tanks to the odour control system complete with damper valves helps regulate the flow of the gas stream within the extraction ducts, ensuring that optimum balancing rates are achieved before the malodorous gas is introduced to the filters.

2.3.4 Carbon filtration (Carbon Adsorber Filtration High and Low Flo system) will be used as the primary pollution control technique using two sets of carbon adsorber filtration systems. The air will first pass through the Nodour Hi-Flo horizontal bed activated carbon system will be used for the reception building and filling station area and will be combined with a particulate/dust pre-filter filter bed to protect the carbon media.

2.3.5 Connections will also be made separately to the de-pack machines in the reception area, to the mixing pit in the filling station area and the tanker vent one in the taking station. The air will flow through the carbon adsorber filtration system prior to passing through the carbon beds for further filtration.

2.3.6 The filters are covered and has a single discharge point, which has a sealed connection leading to the stack. Duty and standby air extraction fans, complete with alarm sensor controls and remote monitoring, allow the air flow to be regulated. A variable speed drive is also fitted to help optimise air extraction to reflect operational activities and to conserve energy.

3.0 Receptors and Odour Pathway

3.1 Receptors

3.1.1 The closest human receptors to the Site are occupants of the industrial facilities directly adjacent to the Site. Due to the nature of the activities and duration of exposure to odour impacts, these are considered medium sensitivity receptors.

3.1.2 The closest high sensitivity receptors are the residential units located approximately 1.8km to the south of the Site at Connah's Quay.

3.1.3 A review of receptors (medium and high sensitivity) within 1km of the Site are shown in **Table 1**.

Table 1 - Receptors within 1km of the Site

Receptor Name	Type	Sensitivity	Distance and Direction
Parc Adfer ERF	Industrial – waste to energy facility	Medium	Directly adjacent 0-5m North
Weighbridge Road	Public Road	Low	35m West
Flintshire Bridge HVDC Convertor Station	Industrial – Power Station	Low	55m South
UPM Shotton	Industrial – Paper Mill	Medium	150m West to Northwest
Toyota Motor Manufacturing UK	Industrial - Car Factory	Medium	185m East
Sunhill Transport	Commercial - Trucking company	Medium	250m
Great Bear Distribution Deeside	Commercial - Logistic Services	Medium	350m Northeast
KK Fine Foods	Commercial – Food production	Medium	450m East
Whole Ice Limited	Commercial – Food production	Medium	470m East
Commercial Colours	Commercial – Car body shop	Medium	480m North
Saica Flex – Deeside	Commercial – Label Printer	Medium	605m East
Westbridge Furniture Designs	Commercial – Furniture Maker	Medium	630m North East
Unilever	Commercial - Logistic Services	Medium	680m North
UPD Deeside	Commercial - Logistic Services	Medium	690m West
Eriks Limited	Industrial - Manufacturer	Medium	700m Northwest
Panels and Profiles	Industrial - Manufacturer	Medium	850m Southwest
Akzo Nobel	Commercial- Paint shop	Medium	980m Southwest
Gwynedd Shipping and Transport	Commercial - Logistic Services	Medium	930m South Southwest

Receptor Name	Type	Sensitivity	Distance and Direction
TATA Steel	Industrial - Manufacturer	Medium	1000m Southeast
TI Group Automotive Systems	Industrial - Manufacturer	Medium	1000m West Northwest

3.2 Odour Pathway

3.2.1 The predominant wind direction is from the west and the south southeast as seen in **Table 2**.

Table 2 - Wind Direction (2022)

Wind Direction	Percent Frequency
N	2%
NNE	2%
NE	3%
ENE	5%
E	6%
ESE	6%
SE	11%
SSE	11%
S	7%
SSW	6%
SW	8%
WSW	5%
W	13%
WNW	8%
NW	4%
NNW	3%

3.2.2 Meteorological data for 2022 Liverpool meteorological station shows the prevailing wind in this location is from the west for approximately 13% of the year and from the southeast and south southeast for 11% of the year. Receptors located downwind of the prevailing wind directions will be most impacted from adverse odours from the Site.

3.2.3 There are no residential receptors located within 1km of the Site downwind of the prevailing wind directions.

4.0 Odour Sources and Mitigation Measures

4.1 Odour – Normal Conditions

4.1.1 Potential odour sources from the Proposed Development during the regular operational phase which may cause a nuisance or loss of amenity in the surrounding environment have been identified and are discussed below as well as the control measures to be instilled to mitigate odour impacts.

4.2 Reception and Storage of Waste Materials

Odour Source:

4.2.1 Waste reception and offloading of dry waste material at the building may generate odour. This will be dependent on a number of factors including ambient weather conditions, the nature and age of material imported to the Site (ie. high temperatures and prolonged storage may cause odorous waste due to degradation and fermentation).

Odour Minimising Procedures:

4.2.2 The following measured will be adopted to minimise odour releases during receipt, offloading and storage of waste materials.

4.2.3 All waste will be inspected on delivery to ensure waste conforms to the Site's permit conditions, it's individual waste transfer note and that the waste has been packaged and contained correctly.

4.2.4 The Site Manager will ensure there is sufficiently trained staff and sufficient plant capacity to deal with the anticipated waste loads coming in.

4.2.5 Dry waste vehicle will deliver to the Reception; fast acting roller shutter doors will open and allow the vehicle to reverse into the building. The doors will close as soon as the vehicle is fully within the delivery hall. This method ensures the access door is open for minimal time.

4.2.6 This part of the building will be highly ventilated with all extract air going to the Odour Control Plant. In addition, the reception building will be kept under negative pressure to ensure the potential odours from waste can not exit the building.

4.2.7 The operational area of the Site will be maintained in a clean and tidy manner, including the prompt clean-up of any potentially odorous spillages.

4.2.8 Waste inputs will be managed to ensure there is sufficient capacity in the feedstock reception pit to deal with the incoming waste material.

4.2.9 Where necessary, periodic audits of the suppliers will be conducted to ensure that contracts are being adhered to and waste is not being stored for significant periods of time prior to arrival at Site.

4.3 Anaerobic Digestion Process

Odour Source:

4.3.1 The anaerobic digesters can lead to the emission of odour if controls are not maintained throughout the process.

4.3.2 The digester has been designed as a high end Mesophilic Anaerobic Digester (MAD) operating at a temperature of 40°C (+/- 2°C).

4.3.3 Odorous biogases are produced as a result of the anaerobic digestion process.

4.3.4 Biogas will be stored within the roof space of each digester. A membrane is installed in the headspace; above the membrane is an external bio dome.

Odour Minimising Procedures:

4.3.5 Duty/standby air blowers pressurise the space between the membrane and the fixed roof, thus providing a fixed pressure in the digester. Gas is stored within the space between the membrane and top water level and eventually discharged to the biogas train.

4.3.6 Biogases are controlled and discharged into the CHP Plant from the anaerobic digester.

4.3.7 Excess biogas not used in the CHP plant will be diverted to a flare stack.

4.3.8 Pressure/vacuum relief valves will be utilised to prevent overpressure and to relieve vacuum to prevent digester roof failure in the event of a sudden loss of level and significant gas release.

4.3.9 Ferric is dosed into the pumped discharge line to prevent Hydrogen Sulphide accumulation in the digester.

4.4 Pasteurisation of Digestate

Odour Source:

4.4.1 The Pasteurisation process can lead to the emission of odour if controls are not maintained throughout the process.

4.4.2 Digestate from the digesters passes through filters and then on to the pasteurisation tank which is designed to heat the sludge to 70^{o}C for a minimum of one hour, to remove any traces of pathogens that still may exist in the digestate. The heated digestate and any biogases represent a significant potential source of odour.

Odour Minimising Procedures:

4.4.3 The tank is fully contained and is connected to the odour control system to ensure odours are collected and treated.

4.5 Dewatering of Digestate

Odour Source:

4.5.1 The dewatering process and subsequent handling of solid and liquid fractions can lead to the emission of odour if controls are not maintained throughout the process.

4.5.2 Prior to liquor treatment, the digestate will be dewatered. Liquids discharge by gravity into a small holding tank from where they are pumped into the larger Digestate Liquors Balancing Tank prior to treatment. Solid centrifuge cake is emptied into small skips

Odour Minimising Procedures:

4.5.3 The centrifuge and skip area is located in an annex of the main building which is connected to the Odour Control Plant.

4.5.4 Small skips will be used for centrifuge cake collection; these may require emptying during the working day, before the day's sludge load has been processed.

4.5.5 When a skip is removed it will involve opening a set of roller-shutter doors. When the roller shutter doors are opened, a motorised valve will open on a separate odour control duct on the skip area. The Odour Control Plant will increase its flow rate to accommodate the extra flow from the door area.

4.6 Treatment of Liquor in Sequence Batch Reactor (SBR)

Odour Source:

4.6.1 The treatment process can lead to the emission of odour if controls are not maintained throughout the process.

4.6.2 Treatment will be carried out using a Sequence Batch Reactor (SBR). This consists of a single tank in which waste is treated to the consent level in a batch process. The sequence is typically as follows:

- Fill and aerate

- Settle
- Decant
- Desludge (manual)

Odour Minimising Procedures:

4.6.3 The tank is sealed to control the release of odours.

4.7 Maintenance of Plant and Equipment

Odour Source:

4.7.1 The treatment process can lead to the emission of odour if controls are not maintained throughout the process.

4.7.2 Failure of plant or equipment or the biofilter losing its efficiency could result in the release of odours.

Odour Minimising Procedures:

4.7.3 Planned Preventative Maintenance programme should be in place for all items of plant and equipment that are critical in preventing the release of odour, such as CHP plant and flare, air extraction equipment and the carbon filter system.

4.7.4 Filter stack emission testing will be carried out regularly as a preventative measurement indicating the need for change of the carbon filter medium.

4.8 Odour – Abnormal Conditions

4.8.1 In accordance with the current EA guidance the following abnormal situations have also been considered:

4.9 Plant Failure or Malfunction

Odour Source:

4.9.1 Breakdown or malfunction of the loader, screening equipment or AD plant could result in unprocessed waste material being left in the reception area for extended periods of time, increasing the risk of further decomposition prior to processing.

Odour Minimising Procedures:

4.9.2 In the event of a prolonged mobile plant failure or malfunction, alternative equipment will be sourced as soon as possible (typically within 48 hours) until the equipment can be repaired or replaced as necessary. Contingency arrangements are in place with third party treatment facilities, to enable the diversion of waste material if required.

4.9.3 In the event of screening equipment malfunction, the dry waste material may continue to be accepted and stored within the reception hall until the repairs are completed. Planned deliveries of waste will be managed during this period and postponed if the capacity of the reception area is reached.

4.9.4 In the event of a breakdown of the AD plant, the dry waste material may continue to be accepted and stored within the reception hall until the repairs are completed. If the operation of the dual waste storage tanks is unaffected, they can be filled with processed dry waste until capacity is reached. Planned deliveries of waste will be managed during this period and postponed if necessary.

4.9.5 In the event that the Plant malfunctions or becomes anaerobic due to operating problems, resulting in malodour issues, excess liquor will be tanked away until the problem is resolved. Peroxide dosing may be considered to alleviate short term odour problems.

4.9.6 All plant and equipment will be maintained and regularly serviced in accordance with the manufacturer's recommendations and planned maintenance procedures to minimise breakdowns.

4.10 Site Staff

Odour Source:

4.10.1 A shortage of trained operational staff may result in waste material being stored for long periods without processing and/or AD plant becoming non-operational. Failure of plant or equipment or the carbon filter losing its efficiency could result in the release of odours.

Odour Minimising Procedures:

4.10.2 In the event there is a shortage of trained operational staff at the Facility, alternative staff will be sourced from the Operator's other facilities or hired in as necessary. If necessary, waste deliveries will be controlled until the situation can be rectified. Contingency arrangements are in place with third party treatment facilities, to enable the diversion of waste material.

4.11 Digestate/Transport Haulier

Odour Source:

4.11.1 The identified outlet for the solid digestate is no longer able to accept the material at short notice or the transport haulier is unavailable.

4.11.2 Liquid digestate is discharged to sewer under a trade effluent consent and therefore is not reliant on vehicle transportation.

Odour Minimising Procedures:

4.11.3 The Operator has a number of alternative waste hauliers who can be contacted in the event the regular haulier is unavailable to remove the solid digestate from the Site.

5.0 Engaging With Neighbours

5.1 Complaints Procedure

5.1.1 As part of this OMP, engagement with the neighbours will be undertaken.

5.1.2 Typically, any complaints received at the Facility are likely to be through the NRW or Local Authority although the operator is willing to deal directly with the complainants and where necessary the following can be implemented:

- Information can be provided to the local neighbours (via the NRW) regarding the point and method of contact for the Facility in the event an odour has been detected or they want to discuss any activities etc at the Facility.
- The neighbours can be advised that any complaints / concerns will be addressed immediately following identification/notification and contingency action implemented.
- The neighbours can be advised of any corrective action and a follow up call carried out if required.

5.1.3 The primary point of contact at the Facility for complaints and liaison within the neighbours is the Site Manager who will ensure the recording, investigation and close out of complaints is undertaken as described above and in accordance with company management procedures.

6.0 Monitoring

6.1 Schedule

6.1.1 Odour Monitoring will be undertaken in order to assess how successful the operational management and mitigation control measure are at the Facility and to identify if necessary whether odour is causing a potential nuisance to ensure that appropriate remediation measures are adopted early.

6.1.2 Monitoring will be undertaken by designated staff who will be fully trained by Site management. All Site personnel will be responsible for reporting any problem odours identified during their day to day operations.

6.1.3 Monitoring at the Facility is summarised in **Table 3**.

Table 3 - Monitoring

Parameter	Monitoring Technique	Frequency
Meteorological Monitoring	On Site weather station	Manually checked at start of each working day. Data logged on Site computer.
Olfactory Monitoring	Site perimeter and off Site checks (towards the identified sensitive receptors)	Daily (or more frequently following odour complaints)
Odour Control Plant Stack – Emissions Testing	Grab sample (Total OUE/m3) as per 'BS EN 13725:2003: Air Quality, Determination of odour concentration by dynamic olfactometry'	On commission, and then 6-monthly thereafter
Complaints Monitoring	Logged in accordance with complaints procedure	Ad-Hoc

6.2 Meteorological Monitoring

6.2.1 The on-site weather station will be utilised for meteorological monitoring at the Facility and will include monitoring for atmospheric pressure, temperature, wind speed and direction, rainfall and humidity. The data will be logged and fed into a central data base, with data readily available to Site management.

6.2.2 In the event of odour complaints, the data enables complaints to be assessed against the meteorological conditions for the relevant period. Meteorological information will be recorded on the Odour Complaints Form.

6.3 Olfactory Monitoring

6.3.1 As part of the daily inspections, appropriately trained and experienced Site personnel will carry out olfactory monitoring at the site perimeter and off site at the locations.

6.3.2 Additional locations for monitoring may also be included, depending on the frequency and location of any complaints received at the Facility.

6.3.3 The monitoring results will be recorded in the site log, and immediate investigation/remedial action undertaken where necessary. The forms are inspected on a weekly basis by the Site manager to ensure actions have been implemented as required.

6.3.4 Olfactory monitoring will be carried out in accordance with the recommendations detailed in the Environment Agency H4 guidance, including avoid strong foods or drinks and strongly scented deodorisers or toiletries etc. for at least half an hour prior to the monitoring. In addition, individuals suffering from a cold, sore throat or sinus problems that may impair their ability to detect odours will not be used.

6.3.5 The designated person will conduct the olfactory monitoring on arrival at Facility prior to exposure to odorous material at the Facility to avoid odour fatigue affecting sensitivity.

6.3.6 Any external activities that may contribute to odour generation in the surrounding area will also be noted on the form and an assessment of the intensity of the odour will be made using the key provided.

6.3.7 In the event odour is detected above intensity ranking 3 (moderate odour), the Site management will be informed immediately, and the approximate location and extent of the odour plume assessed and site operations reviewed and remediated.

6.4 Odour Control Plant Stack Emission Testing

6.4.1 Emission monitoring from the stack of the Odour Control Plant will be carried out in line with the guidelines set out in 'H4 Odour Management' for determination of odour concentration by dynamic olfactometry. It involves taking grab samples that will be analysed in the laboratory in accordance with BS EN 13725:2003 to determine the emitted odour concentration (OUE/m3).

6.4.2 Testing will be done initially on commission of the Odour Control Plant, and then regularly to act as a preventative measurement, indicating biofilter medium change requirements.

6.5 Complaints Monitoring

6.5.1 Any complaints received directly by the Facility or via the Regulatory bodies, including the EA and Local Authority, will be recorded on the Odour Complaints Form and will instigate further olfactory monitoring at the location of the complaint and on site to determine the extent and location of the plume and the source of the odour will be identified.

6.5.2 If necessary, monitoring will also be carried out at the nearest sensitive receptors to the Facility and the monitoring results recorded.

6.6 Remedial Action Plan

6.6.1 Following receipt of a complaint, identification of an odour at the Facility which may give rise to an offsite odour impact or a significant odour (intensity 3 or above) being detected during the daily odour survey, the following action plan will be undertaken, including:

- Additional olfactory monitoring as detailed above to identify the extent of the plume and potential cause for the odour;
- Examination of the operational activities at the Facility at the time of the odour complaint or odour identification;
- Examination of the meteorological conditions at the time of the complaint or odour identification;
- Carry out a review of the operational procedure and process controls as detailed within Section 3 detailed above and instigate any control measures immediately following identification of the problem;
- Further olfactory monitoring will be carried out to ensure the issue has been addressed and to monitor the effectiveness of any control measures undertaken.

6.7 Record Keeping and Reporting

6.7.1 The Odour Complaints Form will be completed, maintained free from damage and kept within the Site office, available to the regulating authorities on request. The record keeping will form part of the Facilities Management System.

6.8 OMP Review

6.8.1 This OMP will be reviewed by site management on a regular basis to ensure that the controls described are effective and reflect best available techniques. The OMP will also be reviewed following a number of complaints at the Facility or relevant changes in the Site operations or procedures.

Figure 1 – Site Location and Context

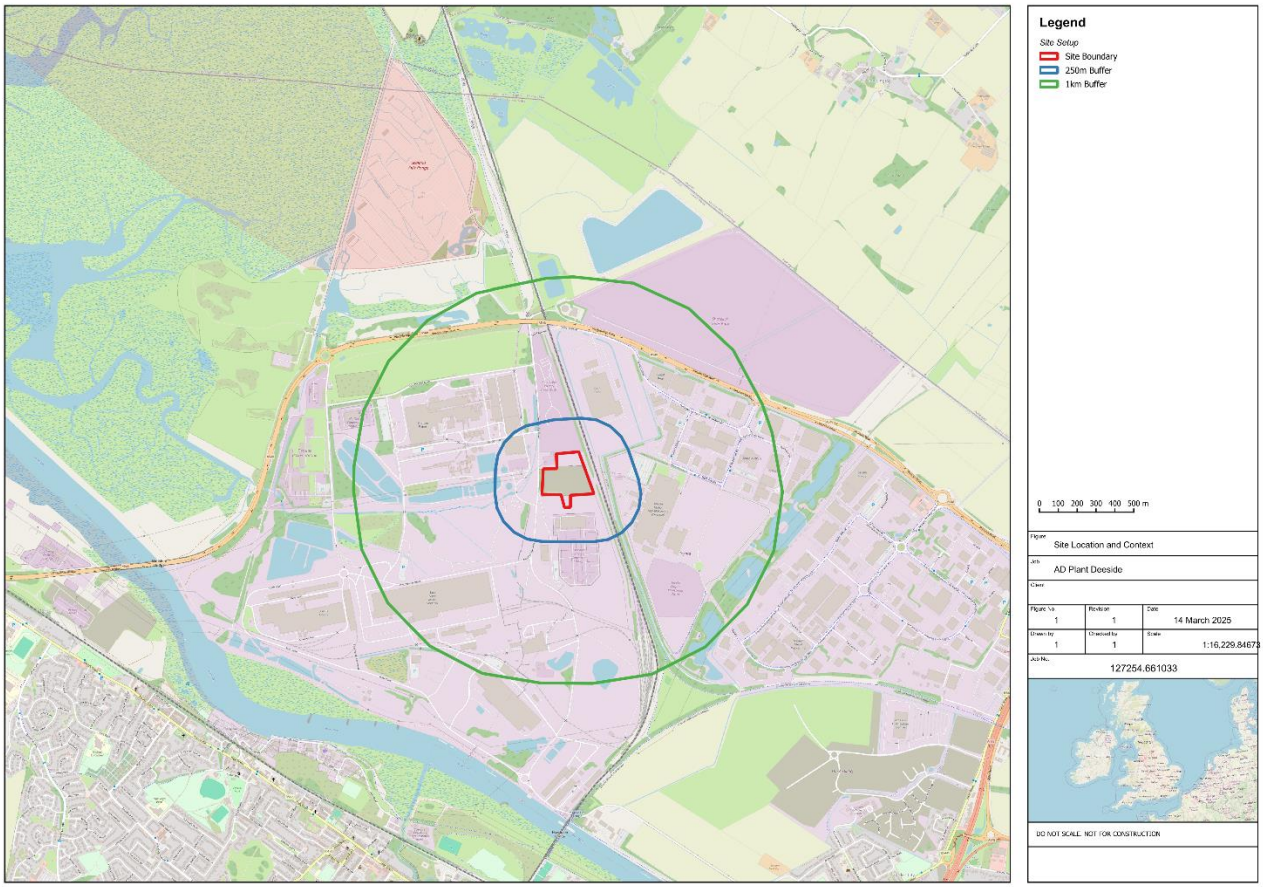

Figure 1 - Site Location and Context

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Protecting people and planet

Appendix A - Limitations

Limitations

The recommendations contained in this Report represent Lucion's professional opinions, based upon the information listed in the Report, exercising the duty of care required of an experienced Environmental Consultant. Lucion does not warrant or guarantee that the Site is free of hazardous or potentially hazardous materials or conditions.

Lucion obtained, reviewed and evaluated information in preparing this Report from the Client and others. Lucion's conclusions, opinions and recommendations has been determined using this information. Lucion does not warrant the accuracy of the information provided to it and will not be responsible for any opinions which Lucion has expressed, or conclusions which it has reached in reliance upon information which is subsequently proven to be inaccurate.

This Report was prepared by Lucion for the sole and exclusive use of the Client and for the specific purpose for which Lucion was instructed. Nothing contained in this Report shall be construed to give any rights or benefits to anyone other than the Client and Lucion and all duties and responsibilities undertaken are for the sole and exclusive benefit of the Client and not for the benefit of any other party. In particular, Lucion does not intend, without its written consent, for this Report to be disseminated to anyone other than the Client or to be used or relied upon by anyone other than the Client. Use of the Report by any other person is unauthorised and such use is at the sole risk of the user. Anyone using or relying upon this Report, other than the Client, agrees by virtue of its use to indemnify and hold harmless Lucion from and against all claims, losses and damages (of whatsoever nature and howsoever or whensoever arising), arising out of or resulting from the performance of the work by the Consultant.

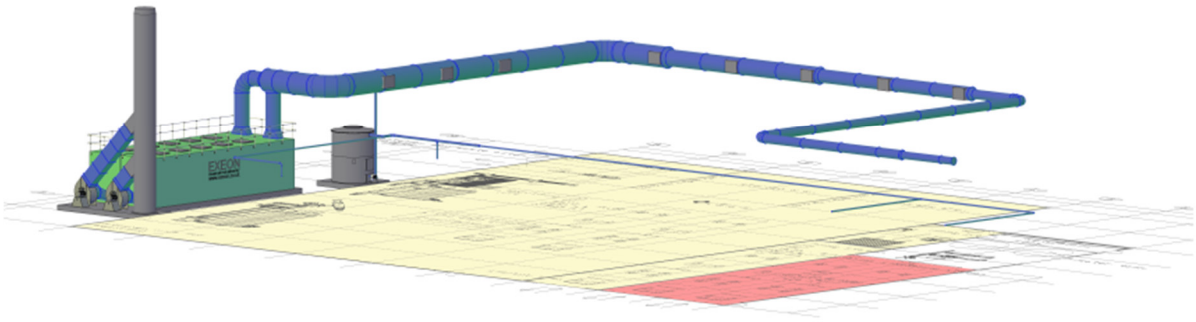
Appendix B - Glossary

Glossary

Term	Definition
AD	Anaerobic Digestion
CHP	Combined Heat and Power
EA	Environment Agency
OMP	Odour Management Plan
RDF	Refuse Derived Fuel
MAD	Mesophilic Anaerobic Digester
RDF	Refuse Derived Fuel
SBR	Sequence Batch Reactor

The Odour Treatment system of the Reception Hall

is brand EXEON (Unit 6, Fen End, Stotfold, Hitchin, SG5 4BA).



The Reception Hall area has a treatable air volume requirement of 17,982m3, and our calculations are based on this quantity, extracted at x3no air changes per hour.

The Filling Station has a treatable air volume requirement of 2,331m3 extracted at x3no air changes per hour. The area also has a hooded mixing pit which requires extraction. This is combined with the local extraction from the de-pack machinery and taking station area, with an extraction rate of max 600m3/hr for carbon filtration.

The Taking Room had a requirement for extraction from the tankers as they vent during the loading process. As noted above, this is combined with the mixing pit and de-pack extraction. In addition to it include background extraction to the area of 2,650m3 at an extraction rate of x5no air changes per hour.

Total airflow for the main extract therefore is 74,189m3/hr, and for the local extract 600m3/hr.

In conjunction with the above the contact time of 1.5 seconds across the carbon beds to achieve sufficient odour reduction and achieve the 1,000ou/m³ required by the EA.

A dust filtration is a key requirement, it had been integrated into this applications. The volume of dust going through the system can risk

blinding the carbon within months, especially in summer conditions of higher dust loading.

Carbon Adsorber Filtration High-Flo

The Nodour Hi-Flo horizontal bed, activated carbon system is utilized for the reception building and the filling station area, combined with an integral particulate/dust 'pre-filter' filter bed to protect the carbon media. Carbon as a media is the most efficient and recognised form of odour treatment.

Carbon Adsorber Filtration Low-Flo

Connections are also be made separately to the 2no de-pack machines in the Reception area, to the Mixing Pit in the Filling Station area and to the Tanker Vent Zone in the Taking Station. Extraction is at a combined rate of 600m3/hr. This airstream will be particularly concentrated and most suited to a second Carbon Adsorber Filtration system prior to passing through the carbon beds for further 'polishing'.

Ducting

The ducting for the background extraction within the Reception Building is installed in

galvanised steel spiral and will be routed from the adsorber through to the main de-pack area at high level with sufficient supports gained from the main roof purlin structure. The background ducting is extended to extract from the Filling and Taking areas too. The ducting will also be used to form a stack.

The ducting for the second Carbon Adsorber Filtration system is installed in Upvc due to the concentrated nature of the airflow, thus protecting against corrosion that may occur otherwise. This is routed at high level with sufficient supports gained from the main roof purlin structure prior to connecting second Carbon Adsorber Filtration system.

Supply Air

We anticipate a large quantity of extract air, and this will result in the identical amount of replacement supply air. The location of the supply air provision is key to ensure replacement air is brought in, in a controlled and well distributed manner, and to provide acceptable working conditions inside the factory when doors are shut. To ensure the building is under sufficient negative pressure, supply air is via well-placed pressure relief dampers & weather louvres at low level.

Controls

We have installed standard controls which will include a control panel housing the inverter, with Hand/Off/Auto switch, control healthy, fan running, fan tripped & filters blocked lamps, and volt-free outputs for fan running, fan tripped, and filter change required, which is connected to the main SCADA of the ad-plant.

Specifications

Nodour 12m High-Flo Odour Abatement System

Pre-filter: High capacity dust filters, providing protection to carbon beds. 50Pa clean and 250Pa dirty.

Duty: Activated horizontal bed carbon system providing a minimum of 1.5 second dwell time.

Carbon type: CX65 high grade 60CTC

Construction: Painted 3.0mmth mild steel.

Access: Via integral doors to side of housing for prefilter access. Carbon pod access through multiple filling hatches in top side of adsorber.

Size: 2895mmH x 2440mmW x 12190mmL

Colour: RAL6005 Moss Green

Low-Flo Odour Abatement System

Duty: Activated horizontal bed carbon system providing a minimum of 40 seconds dwell time against an airflow of 600m3/hr

Size: 2000mmØ x 3000mm tall approx

Construction: Welded 4mm polypropylene construction

Support mesh: Perforated polypropylene

Media type: CX65 high grade 60CTC

Inlet/outlet connections: Flanged spigots

Filter access: Via access hatch at top of filter housing for ease of filter change

Colour: Black

Extract fan: Appx 1.5kW Polyfan.

Accessories: Access steps, Fan

Extract Fans – Centrifugal (x2no)

Type: Centrifugal extract fan with motor out of airstream,

direct drive

Material: Mild steel, inc support parts.

Duty: TBA based on system selected

Estimated power: 35kW appx

Motor: 3-phase, 4-pole

Controls: Main switch panel with inverter controls

Ductwork – PVC (Low-Flo Odour Abatement System)

The efficiency, performance and noise levels of an extraction system are determined largely by the extract system connected to it. Our experienced teams are aware of and will confirm to the ductwork legislation of DW/154.

Material: PVC ductwork, with long radius bends,

fabricated and installed to the recommendations of

HVCA DW/154.

Ductwork – Galvanised Spiral (High-Flo Odour Abatement System)

The efficiency, performance and noise levels of an extraction system are determined largely by the extract system connected to it. Our experienced teams are aware of and will confirm to the ductwork legislation of DW/144.

Material: Galvanized spiral ductwork, with high radius

bends, fabricated and installed to the recommendations of

HVCA DW/144.

Standard Controls

Panel: IP54 rated, internally mounted near plant area to receive 3-phase incoming.

Indications: Normal and alarm indication of operation with appropriate signal lights, normally taken as outputs from the inverters

Differential pressure: Switch to indicate blocked filter with signal light.

Switches: On/Off and isolator control and provision for remote start/stop

Gauges: Magnehelic pressure gauge for dust filter loading.

Control method: Manual electromechanical control

Accessories: Integral inverter for speed control

For SCADA integration: volt free contact terminals are provided to show fan healthy, run, and tripped status as well as filter blocked alarm.

Colour: RAL 7035

Corrosion level coating: C3

BioConstruct NewEnergy Ltd

Arrow Bio Waste Plant

Deeside Industrial Park

DOCUMENT TITLE:	**Indicative Bund Surface Water Discharge Procedure**
DOCUMENT NUMBER:	**BCNE-PROC-51**
REVISION NUMBER:	**Pre-Operational**

1.0 Objective

That any surface water released from the main site process bund to the adjacent surface water attenuation pond is of a suitable quality to ensure that there are no significant resulting environmental impacts.

2.0 Scope

All batches of surface water discharged from the site will be inspected by BioConstruct NewEnergy personnel for evidence of contamination prior to release. This will include an inspection for visible grease and oils, staining and discolouration, from ferric chloride, and odour.

All batches of surface water discharged from the site will be subject to spot sample chemical analysis in the onsite labs prior to release. Surface water will only be released if the quality is found to be within acceptable benchmark thresholds as specified in this procedure.

3.0 Responsibilities

It is the responsibility of the **Operations Manager** to ensure this procedure is followed at all times. It is the responsibility of all **Operational Staff** to enact this procedure.

Staff training and competence to carry out this procedure will be overseen by the **Operations Manager** and the **Operations and Services Manager.**

4.0 PPE and First Aid

A stock of PPE is held on site in the Welfare Building. This will include, as a minimum, the following items:

- Hi Viz Vest/Jacket
- Safety Boots
- Hard Hat
- Rubber Gloves
- Safety Glasses

First aid facilities are available on site if required, including eye wash facilities. Refer to the relevant ***COSHH Assessment*** and ***Material Safety Data Sheet*** for additional information.

5.0 Procedure

BioConstruct NewEnergy personnel will carry out an inspection of the chamber in the bund where surface water that is intended to be released is contained. They will carry out a visual check for visible oil, grease, and discolouration from ferric chloride and will check the water for odours. A visual check will also be carried out for evidence of spills or leaks within the bund that could have entered the surface water collection chamber.

In addition, consideration will be given to any incidents or spillages that may have occurred in the bund during the period since the last batch released, as recorded in the site diary or on daily site inspection records or incident reports within the site Environmental Management System.

If there is no visual or olfactory evidence of surface water contamination BCNE personnel will proceed to immerse a clean plastic sample bottle within the surface water in the chamber to take a sample for further chemical analysis.

The location of the surface water collection chamber and sample collection point is shown in Figure 1 below.

Figure 1 – Location of Bund Surface Water Collection Chamber Spot Sampling Point

The sample will be taken straight away for further testing in the onsite laboratory.

The sample will be tested for the parameters indicated in Table 1 below.

Table 1 – Parameters to be Tested and Acceptable Benchmarks for Water Release

Parameter to be Tested	Benchmark Threshold to Indicate Water Release	Unit
pH	6-9	pH
COD	80	mg/l
Suspended Solids	30	mg/l
Ammonia	0.1	mg/l
Total Phosphorus	2	mg/l

Analysis will be undertaken using equipment and methods in line with the Environment Agency M18 Guidance for Monitoring Discharges to Water and Sewer.

Staff will be trained and competent to carry out the analysis procedures, and all equipment will be subject to regular documented calibration and inspection in line with the manufacturer's recommendations and carried out by competent and trained personnel.

The Site Operator will make the final decision to release water from the bund based on the on-site lab sample analysis results, indicative benchmark thresholds for release, and the results of the visual and olfactory assessments made at the point of sampling.

Surface water will be tested immediately after the sample has been taken and if suitable to release, the release will take place immediately after the results of testing are available. This is to ensure that the analysis results continue to be representative of the water intended to be released and that no further significant additions have been made between sampling and release.

The operator will manually operate the collection chamber pump to release surface water. This will be carried out via the SCADA system interface. An MCERTS flowmeter connected to the SCADA system will measure the volume discharged during each batch release.

A record of the surface water evaluation and release will be made on form BCNE-OD-036

Emergency shut off valves on the drainage system are checked and recorded on the Surface Water Maintenance Schedule ensure that they are continuing to be fit for purpose.
These checks form part of the daily/weekly/monthly routines for the operational management of the site.

6.0 Water Quality Benchmarks Not Met

In the event that water quality checks indicate that water is not of a suitable quality to be released from the bund to the surface water attenuation pond, the operator will divert the water for use within the AD process if suitable for this purpose. If the water in question is not suitable for use within the process it will be removed from site via tanker to a suitable permitted treatment or disposal facility.

7.0 Additional Measures

In the event that a spillage or incident occurs in the bund, the operator recognises that there may be the need for additional monitoring for a period of time after the incident to ensure that any water discharged from the bund is of a suitable quality. This additional monitoring may require inclusion of a more extended analysis suite depending on the nature of the spill or incident. Therefore, the operator will evaluate the specific circumstances and risks associated with any incident that might occur, and devise and implement any additional monitoring as required.

In order to check the reliability of sample analysis results undertaken in the onsite lab, the operator will send periodic samples for the same analysis that is conducted on site to an outside accredited lab to allow the accuracy of sampling methods to be monitored and verified. This will be undertaken quarterly for the first year of operations, and on an ad hoc basis thereafter.

8.0 Reports

All reports relating to this procedure must be retained for a period of six years.

Fugitive
Emissions Plan

Prepared for: Bioconstruct NewEnergy Ltd

By:

ENVIROSOLUTION LTD

Suite 53

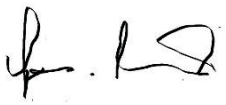
3a Bridgewater Street

Liverpool

LI OAB

Date:

EnviroSolution Ltd
Document Verification

Site Address	Arrow Bio Waste Recycling Facility, Weighbridge Road, Deeside Industrial Park, Deeside, CH5 2LL		
Report Title	Fugitive Emissions Plan		
Job Number	ES2502	**Document Ref.**	ES2502-2
Date Issued	28th February 2025	**Report Version**	V1
Prepared by	James Meredith	**Signature**	
Checked by	Jemma Lucus	**Signature**	

Disclaimer

This report has been prepared by EnviroSolution Ltd who has exercised such professional skill, care and diligence as may reasonably be expected of a properly qualified and competent consultant experienced in preparing reports of a similar scope.

However, to the extent that the report is based on or relies upon information contained in records, reports or other materials provided to EnviroSolution Ltd, which have not been independently produced or verified, EnviroSolution Ltd, gives no warranty, representation or assurance as to the accuracy or completeness of such information.

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1 Introduction

Envirosolution Ltd has prepared this formal Fugitive Emissions Management Plan and Risk Assessment to demonstrate that through the consideration of risks and implementation of mitigation measures there would be no unacceptable adverse environmental effects arising from fugitive emissions and no consequential detriment reaching any nearby sensitive receptors as a result of the proposed development.

This Fugitive Emissions Management Plan and Risk Assessment (the Plan) has been compiled with reference to formerly available guidelines in Environment Agency/NRW Guidance EPR - H1, Part 1 'Simple Assessment of Environmental Risk for Accidents, Odour, Noise, and Fugitive Emissions dated April 2008' and also considers the Environment Agency/NRW 'How to comply with your Environmental Permit. Additional Guidance for: Anaerobic Digestions' (LIT 8737, v1.0 Nov 2013). Current guidance available on the EA and NRW websites 'Control and Monitor Emissions from your Environmental Permit', and 'Risk Assessments for your Environmental Permit' have also been referred to.

Evidence of achieving the accreditation is provided in appendix 1 of this document.

2 Site Setting, Surrounding Land Uses and Location of Receptors

The site is situated within the district of Deeside, in Flintshire, North Wales within Zone F, Renewable Energy Park of the Deeside Enterprise Zone, a 2,000-hectare (4,942 acre) area in Northeast Wales home to skilled, contemporary, manufacturing across a diversity of sectors. It lies 2.5 km west of the A550 and 840 m south of the A548. It is also located 2.6 km north of Connah's Quay and approximately 10 km northwest of Chester City Centre.

The National Grid Reference for the site is SJ 31114 71232.

The application site comprises an area of vacant brownfield land and grassland. The former use of the site was as Shotton Power Station, a 210-megawatt gas-fire combined heat and power (CHP) generating station. The previous buildings have been demolished and much of the site comprises hard standing situated to the central and southwest side of the site, with grass areas to the north, west and south.

The site itself is elevated approximately 4m above the level of Weighbridge Road with a planted bank of trees and shrubs separating the site from the road along the western boundary. To the east the Borderlands railway line creates the sites eastern boundary. To the north the site is bounded by the adjacent Parc Adfer/ Wheelabrator site, currently under construction and to the south the site boundary is formed by the adjacent Siemens Western Link Southern Convertor Station site.

The site is generally flat, however the site slopes gradually down to the main road along the western boundary. Given the site's remediated status the majority of the site has limited tree cover. The majority of trees lie adjacent to the site boundaries to the west and east.

The site is located off Weighbridge Road, Deeside Industrial Estate and the site covers an area of approx. 5.6 ha and is located between the Flintshire Bridge 400kV Converter Station to the south, UPM Shotton Paper Mill to the west, the recently approved Parc Adfer Energy Recovery Facility to the north and a railway line and Deeside Industrial Park to the east.

The nearest residential properties to the application site are located within Connah's Quay approximately 1.8km to the southwest of the site. There are several other industrial buildings between the site and Connah's Quay, as well as the River Dee which lies approx.1.5km to the southwest of the site.

The River Dee Estuary located 1.6km to the west of the site is designated as a Ramsar site. This land and the land to the north of Weighbridge Road, approximately 0.9km north of the site are designated sites of International Importance and Statutory sites of National Importance.

3 Fugitive Emissions Risk Assessment

In accordance with Natural Resources Wales (NRW) Guidance, this report assesses the risks posed by fugitive emissions to air, land, water, and members of the public. This Plan demonstrates that the risk of fugitive emissions arising from the site has been fully considered and that appropriate controls will be established during the operation, maintenance and monitoring of the plant to manage these within acceptable limits. This plan will be used in conjunction with the Odour Management Plan and Noise Management Plan for the site, which provide a detailed account of how these specific areas of risk will be managed. It also refers to the site wide environmental risk assessment and associated impact modelling reports submitted in support of the permit application for the site.

A risk assessment considering all aspects of environmental risk for the whole site is submitted with the permit application, document reference ES25O2-II. This assessment has included consideration of the potential impact of fugitive emissions from the site. Sections from this document relevant to assessment of risk from fugitive emissions have been re-produced in this document for ease of consideration. The risk rating matrix associated with the original assessment and submitted under document reference ES25O2-II is included in this document for ease of reference.

3.1 Figure 1 - Risk Rating Matrix Applied

Severity	**5**	5	IO	I5	20	25
	4	4	8	I2	I6	20
	3	3	6	9	I2	I5
	2	2	4	66	8	IO
	1	**I**	2	3	4	5
		1	**2**	**3**	**4**	**5**
		Likelihood →				

Severity	Likelihood
1 – No environmental harm arising 2 – Fleeting localised impacts 3 – Localised impacts medium term 4 – Wider scale impacts of a fleeting nature, or localised impacts of a more persistent nature 5 – Widespread/persistent impacts on high amenity/sensitive sites	1 - Very unlikely to happen 2 - Low probability - occasional 3 - Likely to occur 4 - Highly likely to occur 5 - Inevitable

Final calculated risk level rating bands are as follows:

Insignificant	1 – 5	Low	6 – 10
Medium	11 – 15	High	16 – 20
Very High	20 - 25		

4 Table 1 Fugitive Emissions Risk Assessment

What do you do that can harm and what could be harmed?			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure (likelihood)**	**Consequence (severity)**	**What is the overall risk?**
What has the potential to cause harm?	What is at risk, what do I want to protect?	How can the hazard get to the receptor	What measures will you take to reduce the risk – Who is responsible for what?	How likely is this contact? (1-5)	What is the harm that can be caused? (1-5)	What is the risk that still remains? The balance of probability and consequence (Likelihood x Severity) (1-25)
			The Site Manager is responsible for implementing all risk management measures described below at the Facility. The Site Manager is also responsible for ensuring that if the appropriate mitigation measures cannot be employed due to adverse weather or unexpected conditions site operations will be ceased until they can be carried out with all necessary mitigation measures in place.			
Dust from vehicle movements to and from the Facility	Local residents, users of nearby highway, local workplaces and local habitats.	Air - Wind- blown dispersion in atmosphere.	Site Manager is responsible for checking wind strength and direction and taking corrective action if necessary.road surfaces are concrete, so low likelihood of generation of materials. Wheel washing facilities are available on site. If the road surface becomes dry and more dust is being created therefore, the road surface will be dampened down to minimise dust. Surface will be kept swept clean.	1- Dust could reach the adjacent highway or if a strong wind blew on a dry summer day. However this would be unlikely as low risk of dust generation and minimised by management actions, if necessary. Local residential properties too far away to be impacted.	2 – Nuisance, dust on cars, clothing, and inhalation of dusts.	2 – Insignificant. The nature of wastes received and stored on site, and nature of storage facilities mean that there is a low risk of these releases from being generated from the site.

What do you do that can harm and what could be harmed?			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure (likelihood)**	**Consequence (severity)**	**What is the overall risk?**
Dust from burning of biogas.	Local residents, users of nearby highway, local workplaces and local habitats.	Emission to air from engine stack, boiler stack and flare.	Release of dusts is not a significant risk factor associated with burning of biogas fuels in this type of plant. Annual emissions monitoring to be carried out in accordance with permit requirements. Ongoing maintenance schedule for engine, boiler and flare.	1 - Unlikely not an associated risk with this type of fuel or plant.	1 - Nuisance, impact on amenity, and impact on local habitats.	1 – Insignificant.
Release of particulate matter and microorganisms from wastes delivered to, stored, treated at the site and dispatched from the site.	Local residents, users of nearby highway, local workplaces and local habitats.	Air. Windblown dispersion in atmosphere.	Wastes delivered to site via closed vehicles or tankers. Final digestate is stored in either a gas tight final store in the case of liquids, or in a trailer in the separator area in the case of separated solid digestate. Offloading of wastes and loading of digestate takes place in a sealed building. Air from the building is extracted and passed through an odour abatement system prior to release. Gas upgrading process applies use of acid scrubber and carbon filters for removal of unwanted elements of biogas. Bioaerosols risk assessment has been undertaken to evaluate potential impacts from this hazard. Risk found to very low. As such, potential impacts as a result of bioaerosol emissions from the facility are not considered to be significant.	1 – unlikely due to the nature of wastes and storage handling and treatment facilities applied at the site.	2 – nuisance to local farms and potential health impacts.	2 – Insignificant. The nature of wastes received and stored on site, and nature of treatment and storage facilities mean that there is a low risk of these releases from being generated from the site.

What do you do that can harm and what could be harmed?			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure (likelihood)**	**Consequence (severity)**	**What is the overall risk?**
Litter.	Local residents, users of nearby highway, local workplaces and local habitats.	Air, windblown, dispersion in atmosphere.	Wastes are received on site as pumpable slurries and unpackaged and packages solid wastes. All deliveries and storage of solid wastes made into a sealed building. All packaged wastes will be passed through a de-packaging unit before being passed into the process. Final packaging will be stored in the reception building in an 8-yard plastic waste skip before being removed from site for disposal.	2 – Removed packaging will be washed and stored inside building in a dedicated skip. Loss of containment is unlikely but may occur occasionally.	3 – Nuisance, loss of amenity, harm to animal health and potential impact on adjacent farmland/habitats and amenity sites.	6 – Low due to containment infrastructure in place.
Mud on roads from movement of vehicles to and from the facility.	Local residents, users of nearby highway, local workplaces and local habitats.	Deposited on the ground by vehicles accessing and leaving the site.	Road surfaces on site are concrete, so low risk of mud being generated from roads within the site. Wheel washing facilities are available in the waste reception shed.	2 – Mud is unlikely to get onto the local roads as a result of generation on the site, due to nature of road	2 – Road safety and amenity for local residents and road uses on roads external to the site.	4 – Insignificant due to control measures available on site, and low risk of

What do you do that can harm and what could be harmed?			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure (likelihood)**	**Consequence (severity)**	**What is the overall risk?**
			Roads and concrete reception/yard areas will be swept and kept clean on a regular basis. An inspection will be made of all vehicles entering the site at the weigh bridge, and any concerns over mud on the wheels of incoming vehicles can be recorded and addressed with the supplier /haulier in question. All vehicles entering and leaving the reception shed will be managed in line with ABPR requirements.	surfacing, road maintenance activities, wheel wash facilities on site. Potentially contaminated vehicles entering the site will be checked, and wheel wash facilities made available if needed.		mud generation from the site itself.
Odour from a range of activities on site.	Local residents, users of nearby highway, local workplaces and local habitats.	Release to air via venting, and subsequent wind-blown dispersion.	The operator has undertaken a full odour impact modelling exercise and produced a comprehensive odour management plan based on the outcome of these modelling exercises.	Probability of exposure variable depending on the source item on site in question. Overall rating of this area is 2. Reference should be made to the odour modelling assessment and management plan for a full account of the potentially odour generating activities on site and their various predicted levels of impact.	Overall rating in this area is 3. Reference should be made to the odour modelling assessment and management plan for a full account of the potentially odour generating activities on site and their various predicted levels of impact.	Overall rating is 6 – Low risk. Reference should be made to the odour model and management plan for a full account of the potentially odour generating activities on site and an account of how these will be managed to maintain low risk status for impacts from the site.

What do you do that can harm and what could be harmed?			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure (likelihood)**	**Consequence (severity)**	**What is the overall risk?**
Pests (rodents, birds, flies, scavenging animals)	Impact on amenity and risk of health impacts/infectio n of local human population and animal health.	Infestation in waste prior to receipt on site, or secondary infestation on site. Scavenging animals may run between the site and neighbouring properties and carry material off site.	Site operates a robust pre-acceptance procedure, and acceptance procedure that incorporates assessments of the potential for contamination of wastes prior to receipt on site, and once on site. The site will use an outside contractor to manage bait stations on site and will monitor for signs of infestation on an ongoing basis.	2 – Occasional due to control of wastes received, and nature of storage and containment facilities.	3 – nuisance and harm to human health from wastes carried off site.	6 – Low
Noise from a range of activities on site	Local residents, users of nearby highway, local workplaces and local habitats.	Sounds may be detected by nearby receptors.	The operator has undertaken a noise impact modelling assessment exercise encompassing all of the potential sources of noise arising from the site. The operator has produced a comprehensive noise management plan based on the outcome of this assessment.	2 - Reference should be made to the specific noise assessment for a detailed breakdown of the probability of exposure from different aspects of the site.	3 - Reference should be made to the specific noise assessment for a detailed breakdown of the potential impacts from different aspects of the site.	6 – Overall low risk from this area resulting from management measures outlined in the specific noise management plan and plant design factors.

What do you do that can harm and what could be harmed?			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure (likelihood)**	**Consequence (severity)**	**What is the overall risk?**
Spillages of wastes, foot dips, or oil from vehicles during access to the site, and offloading and loading of wastes. Containment of wheel wash waters in delivery area.	Surface water, ground water and soils.	Seepage of spillages to ground, to sewer, or to aquifer.	All deliveries to be supervised and to take place in accordance with the waste acceptance procedures for the site. Deliveries of feedstocks and removal of digestate to take place in a building with a sealed drainage system. This will contain any spillages that occur, or any lightly contaminated water generated from washing activities in this area. Washing will take place in this area to manage spills, to clean vehicle wheels or to clean plant and building floors and surfaces. There will be no washing out of whole vehicles in this area. Tanker delivery pipes drain to a pit that is connected via pipe to the closed mixing pit for containment of any residue contained in the pipe after pumping. A daily check is made of the state of repair of the concrete in the yard, bund and reception shed areas. Spill kits are available to facilitate spill management. All surface water draining from the road areas of the site is discharged via an oil interceptor. The below ground mixing pit is installed with secondary containment and leak detection.	1 – Low as deliveries are supervised by an operative and take place on an impermeable surface that drains to a sealed pit. Ongoing maintenance and monitoring procedures are in place to maintain this infrastructure.	3 – site is on a secondary aquifer A with high vulnerability and not situated in a drinking water source protection zone.	3 – insignificant risk due to sealed drainage system, presence of oil interceptors, and risk characteristics of site location.

What do you do that can harm and what could be harmed?			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure (likelihood)**	**Consequence (severity)**	**What is the overall risk?**
Small spillages/leaks of process liquids due to breach of pipework or tanks in the waste treatment areas of the site.	Surface water, ground water and soils.	Seepage to ground, sewer, or aquifer following small releases from breaches in tanks or pipework.	All process material is moved between tanks via a closed pipework system. All tanks and pipework are contained within an impermeable bund that will contain both small and large spillages from tanks and pipework. Process and storage tanks are checked on a daily basis for evidence of small leaks arising from the tanks. All tanks and pipework are subject to a structured maintenance programme, that includes proactive periodic checks of the integrity of tanks, valves, seals, and pipework. All tanks and pipework are located above ground.	1 – low likelihood due to construction of tanks and pipework, bunding, and proactive maintenance programme that will be implemented.	1 – No environmental harm arising.	1 – Insignificant
Catastrophic failure of tanks and pipework in the main treatment area of site.	Surface water, ground water and soils.	Release to ground, sewer, or aquifer following significant loss of containment of a large section of pipework, or vessel.	All tanks and pipework are contained within an impermeable bund that will contain both small and large spillages from tanks and pipework. The management of larger catastrophic events of this nature have been considered in more detail within the site's accident management plan.	2 – low likelihood due to construction of tanks, and proactive maintenance programme that will be implemented	1 – No environmental harm arising.	1 – Insignificant

What do you do that can harm and what could be harmed?			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure (likelihood)**	**Consequence (severity)**	**What is the overall risk?**
Venting of gas to air via uncontrolled or unplanned releases	Air – impact on air quality.	Small losses from gas containing infrastructure, or pressure relief valves venting to air.	Gas containing infrastructure to be subject to regular ongoing proactive maintenance programme and checks for small leaks vid leak detection and repair plan (LDAR). Larger releases can be detected on external visual inspection. Additional leak detection survey will be considered if the plant feed to gas conversion figures are lower than anticipated, if an unaccounted-for smell of biogas can be detected around the site or following any significant maintenance work that may affect gas containing structures on the site. A certified leak detection exercise will be undertaken for the whole plant following commissioning, and prior to handover of the plant to the operator. Operation of pressure relief valves to be monitored and documented and investigated as an environmental incident should this occur. Plant has an emergency backup flare that can be used to burn biogas in a controlled manner when it is not possible for the gas to be used in the CHP. Facilities installed to allow for management of foaming incidents at the site and thus reduce potential for uncontrolled releases due to such incidents. In situ fixed gas monitors installed in key areas of the site to facilitate ongoing monitoring for leaks	2 – Risk of small losses will be managed by routine site maintenance and checks. However, small losses in more inaccessible parts of the site can be difficult to detect.	2 – Small losses may impact on air quality and have health and safety impact via toxicity of gases, and risk of explosion and or fire.	4 – Insignificant risk due to proactive maintenance and monitoring programme in place, and contingency measures for wider leak detection exercise if necessary.

5 Fugitive Emissions Management Plan

Envirosolution Ltd has prepared the Fugitive Emissions Management Plan for the proposed facility. The Plan describes the control measures outlined in the risk assessment tables above that will be implemented to manage risks arising from the Arrow Bio Waste Recycling Facility site within acceptable limits. This plan does not detail the measures in place to manage odours, noise, or impacts arising from accidents that may occur on site. These measures are outlined further in detail in the Odour Management Plan, Noise Management Plan, and Accident Management Plan in place within the site's Environmental Management System. Further reference should be made to these documents.

It should also be noted that the effectiveness of many of the control measures for managing fugitive emissions on site rely on the design, construction, and control measures that have been installed during the construction of the facility. Information regarding these aspects are detailed in the BAT Assessment document (ES2502-14), and on accompanying appendices and site plans. Details of the routine proactive maintenance schedule and containment measures for tanks and ancillary pipework is also outlined in the appendices to the BAT document.

Table 2 Fugitive Emissions Management Plan is provided below:

6 Table 2 Fugitive Emissions Management Plan

Potential Source	Infrastructure Control	Maintenance Control	Monitoring and Reporting Control
Releases of dusts and litter from the site including entry/exit roads.	Road surfaces are concrete and so the potential for generation of mud and dusts on the site is low. Tankers moving digestate to agricultural land may generate some minimal levels of mud and dusts from offsite locations. Where this is the case, wheel washing facilities are available for cleaning of wheels.	Daily maintenance checks to be carried out on concrete surfaces. Roads to be kept clean and free of debris. Litter picking to be instigated should litter be present on site.	Daily checks of the site for mud/dusts/litter about the site. In the event that dusts are generated from roads, surfaces will be damped down prevent release. Weighbridge operator to monitor vehicles entering the site to report to site manager in circumstances where vehicles have accessed the site with excessive amounts of mud on wheels. All vehicle wheels to be checked for cleanliness by supervision staff prior to leaving the site.
Small spillages from tankers, pipes, vehicles, and foot dips in the reception shed area. Containment of building wash waters.	All waste reception activities take place on a sealed concrete area that drains to the sealed mixing pit which pumps feedstocks to the digesters. All surface water run-off from road areas which may result in oil contamination drains off site via an oil interceptor. Drain down pits are provided for containment of run off from tanker pipes following tanker filling and delivery activities. These pits drain to the mixing pit. Washing facilities are available in the reception shed area if needed to clean small spillages. Spill kits are available in this area if required. All incoming waste sampling activities to take place in the reception shed area on sealed drainage. Below ground mixing pit is fitted with secondary containment and leak detection.	Daily maintenance checks to be carried out on concrete surfaces in this area – surfaces to be kept clean and free of debris, and drainage channels to be maintained to be free flowing. Regular weekly visual inspection of the internal surfaces of the mixing pit and drain down pit. Regular drainage cleansing operation to be carried out. Site operative supervises all deliveries and will monitor and implement cleaning if needed. Site operatives supervising incoming waste activities to ensure that sampling takes place in this area.	If the contents of spill kits are used, site operatives will report this to the plant manager, and contents will be replaced from items in store. Spill kits will be checked on a weekly basis to ensure that they have the necessary contents in place, and that this is in a suitable state of repair to be used. Spent samples to be disposed of in an appropriate manner.

Potential Source	Infrastructure Control	Maintenance Control	Monitoring and Reporting Control
Spillages from delivery and storage of raw materials at the site.	Ferric chloride and antifoaming agent to be stored inside technical building inside main bunded area. Ferric chloride tank fitted with an individual shut off arrangement to contain small spills during deliver and prevent these from entering the surface water drainage collection system in the main process bund area. Propane to be stored in fit for purpose tanks. Diesel stored in integrally bunded store. Engine oil stored in CHP container in purpose-built tank. Other material used in smaller volumes to be stored indoors or in technical building in main bunded area. Tailored spill kits provided in storage areas.	Spill kits kept topped up with materials ready for use. Proactive maintenance of storage facilities and delivery equipment.	Procedures in place regarding safe bulk delivery methods. Reporting and response procedure for all accidental spills.
Pests and Scavenging animals	Wastes are delivered to the site in the form of liquids and packaged and unpackaged solids. Liquid wastes to be stored in sealed pre-storage tanks, and solid packaged and de-packaged wastes to be stored inside the reception building on a sealed concrete surface with a sealed drainage system.	All tanks, pipework and storage areas are maintained according to the proactive maintenance plan for the site. Shed is subject to cleaning schedule as agreed with the APHA to prevent build-up of material. Site is kept clear of stored materials to reduce potential for harbourage. Waste feedstocks used within 48 hours of receipt at site.	External company to lay and maintain bait traps for management of pests on site. External company to carry out regular site checks and to produce inspection reports. Monitoring and maintenance activities will be and documented by the external contractor following site visits, and a record of this activity will be kept at the plant for inspection if required. Operator to carry out daily checks for signs of pests. Incoming wastes will be rejected if there are signs of infestation on receipt of material at the site.

Potential Source	Infrastructure Control	Maintenance Control	Monitoring and Reporting Control
Small spillages from tanks and pipework in the processing area.	All tanks and pipework are contained within an impermeable bund that is designed to contain large spillages, and to prevent any small spills or leaks from tanks/pipework from being released. All process tanks and pipework are above ground and therefore can be subject to regular visual inspection. Surface water from roadways discharged via an oil interceptor. Digestate is sampled directly from take-off points from the tanks. The activity is supervised, so spillages if they did occur, would only be small, and detected and addressed immediately. All digestate sampling points are contained within the bunded area.	Programme of regular proactive maintenance to be implemented, including checks on the integrity of pipework, tanks, and joints. Daily visual integrity checks of bund surfacing, and joints and tank integrity included within this proactive maintenance schedule. Processing tanks and above ground pipework system checked for integrity via visual inspection on a daily basis. Regular maintenance and inspection of oil interceptor on surface water system.	Tank/pipework inspection. Regular checks to be carried out for tank and bund integrity. Surface water accumulating in the bund area collects in a pump chamber and is pumped into the process or to surface water following water quality testing. A high-level alarm will operate on the bund sump to alert staff to the need for the sump to be emptied. Daily check on the water discharged from the site to surface water via interceptor for visible oil, grease and odour.
Releases to air from waste when delivered to store, and when in store.	All wastes delivered inside a building with an air extraction and abatement system in place. Air to be passed through an odour abatement system prior to release to air.	Programme of regular proactive maintenance to be implemented, including checks on the integrity of pipework, extraction system, fast acting roller shutter doors, tanks, and joints, and seals.	Any uncontrolled releases of waste during delivery to be cleaned up immediately to minimise impacts. Any such spillages to be recorded and monitored via the site diary and incident reporting and tracking measures provided within the site management system.

Potential Source	Infrastructure Control	Maintenance Control	Monitoring and Reporting Control
Releases of gas to air from digestate process tanks and pipework and upgrading unit during normal and exceptional operation.	All processing and storage of waste takes place in the closed sealed waste reception shed area or in closed/sealed tanks. Under/over pressure relief valves are installed on digesters, final digestate store, and upgrading unit, but these are for emergency use only. The site has an emergency flare that will operate during times when all the gas produced on site cannot be used within the CHP or boiler or injected to grid.	Programme of regular proactive maintenance to be implemented, including checks on the integrity of pipework, tanks, and joints and under/over pressure relief valves, and maintenance of emergency flare. Leak detection and repair programme (LDAR) established and implemented at the site.	Regular maintenance programme includes regular checks of pressure relief valves, and integrity of pipework, tanks, and covers for evidence of leaks. CHP container, boiler container, gas upgrading unit, grid entry unit and technical building to have permanently sited fixed multi gas detectors in situ. Full certified leak detection survey to be undertaken following plant commissioning and prior to handover to the operator. Any use of the emergency flare will be recorded and monitored on the SCADA system. Any use of pressure relief valves will be recorded and investigated as an environmental incident. Regular routine leak detection and repair programme (LDAR) established and implemented at the site. Additional leak detection campaigns to be instigated if wider site monitoring activities suggest this is required. Such circumstances may include the unaccounted-for smell of biogas on the site, indications of the presence of gas from gas monitors worn by staff on a routine basis, or from handheld gas sniffers used to check specific parts of infrastructure any large-scale infrastructure changes onsite that have the potential to impact on gas containing structures, and the plant feed to gas conversion figures are lower than anticipated.
Releases to air from tankers during digestate removal.	Digestate removal station is inside waste reception building. All displaced air from vacuum tankers removing digestate is extracted from the building and passed through an odour abatement system before being released to air.	Unit to be maintained in accordance with manufacturers recommendations.	The impact of this activity relating to odour impacts has been assessed via an impact modelling assessment. Ongoing monitoring and implementation of any corrective actions necessary with regard to this activity will be outlined in the odour management plan for the site, which takes into account the outcome of this modelling exercise. A full account of the management of odours arising from the site is documented in the site's odour management plan

7 Staff Training

The Site Manager will be responsible for ensuring staff receive proper and adequate training in respect of fugitive emissions management.

Site staff will undergo a training programme to ensure that they understand how their actions and the site operations can affect fugitive emissions. The staff will be trained so that they understand where spillages occurring in various parts of the site will run to. The staff will be trained in how to carry out the necessary maintenance and monitoring activities required. The staff will be trained to ensure that they are competent to supervise all waste deliveries to the site in accordance with the feedstock acceptance procedure. The staff will be trained to visually inspect for small gas leaks, and leaks on tanks and pipework. Staff will be instructed to report fugitive emissions to the Site Manager with immediate effect.

Staff training records will be updated and stored within the site office.

8 Contact with the Natural Resources Wales and Complainants and complaints

The operator will encourage any complainant wishing to complain about the impact of fugitive emissions to liaise directly with them but acknowledges that the complainant may wish to pursue a complaint through the Natural Resources Wales or the Local Authority.

In the event that a complaint is received, the operator will record the time, date, weather conditions, and severity and duration of the emission. This will enable site operations to be thoroughly investigated. The operator will monitor all fugitive emissions and complaints.

Accident Prevention & Management Plan

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Document Verification

Site Address	Arrow Bio Waste Recycling Facility, Weighbridge Road, Deeside Industrial Park, Deeside, CH5 2LL		
Report Title	Accident Prevention & Management		
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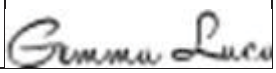
Checked by	Jemma Lucus	**Signature**	

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1 Introduction

Envirosolution Ltd has prepared this Accident Management Plan (AMP) describes the system to prevent accidents and manage responses at the Arrow Bio Waste Recycling Facility.

2 Scope of the Accident Prevention and Management Plan

This AMP applies to all staff working at Arrow Bio Waste Recycling Facility and aspects should be easily accessible in emergency scenarios. This plan also makes facility for the requirements of contractors and visitors attending the site on a regular or ad hoc basis.

3 Definitions

The following section lists out the relevant definitions for the AMP:

Abbreviation	**Description**
AMP	Accident Management Plan
CHP	Combined Heat & Power
COSHH	Control of Substances Hazardous to Health
MSDS	Material Safety Data Sheet
COD	Chemical Oxygen Demand
BOD	Biochemical Oxygen Demand
SCADA	Supervisory Control and Data Acquisition
HAZOP	Hazard and Operability Study
COMAH	Control of Major Accident Hazards Regulations
ABP	Animal By-Product
APHA	Animal and Plant Health Agency
HACCP	Hazard Analysis and Critical Control Points
NRW	Natural Resource Wales

4 Identification and Assessment of Risk

4.1 Hazard and Assessment of Risk

The following section sets out the relevant identification of hazard and assessment of risk for the AMP:

4.2 Risk Rating Matrix Applied

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

Severity (S)			Probability (P)		
5	=	Causing death, environmental event with detrimental effect, huge financial loss, significant publicity, corporate criminal penalties, substantial financial loss, loss of major contract before contract termination date, loss/suspension of permit considered to be a major environmental incident (CAT 1) by NRW.	1	=	Unlikely or remote
4	=	Causing permanent disability e.g. loss of limb, sight or hearing, release to environment contained with internal/external assistance. Major financial loss, loss/suspension of licence, loss of major contract, reasonable intimation of court proceedings/regulatory action, publicity, internal and external cost (both high), reportable event, substantial loss of production and/or service capacity, loss of production capability.	2	=	Low probability / isolated occurrence
3	=	Causing temporary disability e.g. unconsciousness, fracture, dislocation, release to environment contained with internal/external assistance, possibility of regulatory action. Regulator intervention (no escalation but cost), high financial cost, minor publicity, internal and external cost, reportable event, loss of production and/or service capacity, contract dispute.	3	=	Likely to occur
2	=	Causing minor injuries e.g. sprains, bruises, lacerations, release to environment immediately contained. Medium financial loss, minor loss of production and/or service capacity.	4	=	High probability of occurrence
1	=	Causing no injuries, no environmental harm, low financial cost	5	=	Inevitable occurrence

Final calculated risk level rating bands are as follows:

Insignificant	1 - 5	Low	6 - 10
Medium	11 - 15	High	16 - 20
Very High	20 - 25		

The following potential hazards are identified:

A Biogas Storage – Potential for a release of biogas.
B Biogas Transfer Operations – Movement of biogas between digesters and gas users
c Arrangements for the receipt and checking of incoming waste, including rejection and quarantine. Receipt of incompatible material.
D Event occurring during the transfer of substances including; chemical, oil, material delivery and removal
E Over filling of vessels
F Emissions from plant or equipment (leakage from joints, over pressurisation of vessels, blocked drains)
G Failure of containment (physical failure or overfilling of bunds or drainage sumps)
H Failure to contain fire waters

I Wrong connections made in drains or other systems.
J Incompatible substances coming into contact with each other. The event can occur in the following areas; gas users, in the lab, reception tanks, digester tanks and effluent tank
K Unexpected reactions or runaway reactions
L Release of an effluent before adequate checking of its composition.
M Failure of main services
N Operator error
o Vandalism
P Air/ventilation management
Q Failures of Abatement systems
R Storage of Waste

In considering the scale and nature of a hazard presented it is important to consider local population and environmental receptors.

The most sensitive local receptors are:

- Nearest housing is from approx. 500m;
- Nearest workplace immediately adjacent to the site boundary;
- Site is within critical distances of a designated special area of conservation (SAC) and several local wildlife sites; and
- Site is located adjacent to a small watercourse and agricultural land.

Local environmental receptors are defined in the HC1683-05 document and appendices. All staff will be informed of the content of this document so that any response to an accident ensures the most sensitive receptor is considered in the accident management response.

The tables below outline the assessment of risk for each hazard listed, the measures that are in place to reduce risk, and procedures for responding to incidents should they occur.

Parameter	Description
Hazard	**Biogas Storage – Potential for a release of biogas.**
ID	**A**
How likely is the event to occur (source frequency)?	Small releases will occur during a year via operation of pressure relief valves. Probability 5. Large releases are not anticipated during operation of the facility and would be the result of equipment failure or human error. Probability 1.
What substances are released and how much of each (risk evaluation of the event)?	Methane, carbon dioxide and hydrogen sulphide. Small release – Severity 2. Large release – Severity 4.
Where do the released sources end up (emission prediction – what are the pathways and receptors)?	Gases dispersed in the atmosphere. Route will depend on weather conditions on the respective day of release. Potential impact on local residential receptors, local workplaces, and local habitat and amenity sites.
What are the consequences (consequence assessment	Pollution to the atmosphere via greenhouse gas emissions. Impact on local air quality. Potential for odour complaints.

– what are the effects on the receptors)?	
What are the overall risks (determination of overall risk and its significant to the environment)?	The overall risk would be characterised by; Small release – Risk 10 Large release – Risk 4
What can prevent or reduce the risk (risk management – measures to prevent accidents and/or reduce their environmental consequences)?	Maintenance and inspection system for plant (tanks and pipework) and equipment (pumps, valves, macerators etc.) to ensure it is working within design parameters. Inspection also includes daily checks for fugitive emissions. Any identified issues will be repaired as soon as possible. Regular inspection includes checks on operation of under/over pressure relief valves. Critical spares kept on site to enable quick repair. P&ID diagrams available in management system to aid maintenance planning. Pipework plan available in management system to enable maintenance planning. Foam sensors included in head of digesters and anti-foaming agent dosing system available. Reduce risk of gas line being blocked due to foaming incident with subsequent release of gas via pressure relief valves. Staff members are trained to carry out activities and their competency is monitored. SCADA control system to manage plant systems including levels in gas storage through operation of the gas users (upgrading, CHP, flare, biogas boiler). Continuous monitoring of gas pressures, gas production and gas flows. Site operates a system of permits to work and Atex zone entry permits based on DSEAR assessment and zoning report. HAZOP assessment has been applied to site during design and construction phase. Fixed in situ gas detection in CHP, boiler, gas upgrading unit, and grid entry unit containers, and technical building. Lightning risk assessment to be undertaken and suitable protection measures installed. Daily odour sniff tests will enable operator to detect presence of biogas and use of gas body worn gas detectors by staff on site will give rises to alarm if gas present on site. Regular leak detection and repair surveys (LDAR) to be undertaken in accordance with fugitive emissions plan. Incident reporting procedures in place. Staff on site/call 24/7 who will respond to alarms and attend site for critical alarms. Staff served by a central service team that provide a call out service to enable speedy repair.
Procedures to Respond to Incidents	Cause of gas leak to be identified as soon as possible. Maintenance activity to be undertaken to reduce this immediately if applicable and including appropriate health and safety measures and safe equipment (use of gas monitors, ATEX rated equipment and breathing apparatus

	if applicable). Consider the possibility of isolating any part of the site to prevent loss of gas during remediation. Use of emergency flare if applicable to manage gas while repairs undertaken. Additional odour monitoring to be undertaken during known venting to monitor impacts. Consideration to be given to whether feed to plant should be reduced/ceased to reduce gas production while leak is addressed. Safe shut down procedures to be instigated if necessary. Close receptors to be informed of any increased risks if applicable. Emergency response to be instigated if relevant (Section 6 below) Guidelines for relevant scenarios in section 7 below to be followed. Incident to be recorded and events evaluated. Any preventative/corrective measures identified as a result of incident review to be entered onto the incident tracking sheet and be subject to review until completion. Schedule 5 notification to be sent to NRW. NRW to be notified via 24-hour incident reporting hotline if required. Internal reporting procedures to be followed.
Hazard	**Biogas Transfer Operations – Movement of biogas between digesters and gas users**
ID	**B**
How likely is the event to occur (source frequency)?	Any releases are likely to be small from leaks. Isolated occurrence possible over a 20-year operation period. Probability 2.
What substances are released and how much of each (risk evaluation of the event)?	Methane, carbon dioxide and hydrogen sulphide. Severity 2.
Where do the released sources end up (emission prediction – what are the pathways and receptors)?	Gases dispersed in the atmosphere. Route will depend on weather conditions on the respective day of release. Residential receptors and workplace receptors close to the site.
What are the consequences (consequence assessment – what are the effects on the receptors)?	Pollution to the atmosphere via greenhouse gas emissions. Impact on air quality. Potential for odour complaints.
What are the overall risks (determination of overall risk and its significant to the environment)?	Risk 4.
What can prevent or reduce the risk (risk management – measures to prevent accidents and/or reduce their environmental consequences)?	Maintenance and inspection system for plant (tanks and pipework) and equipment (pumps, valves, macerators etc.) to ensure it is working within design parameters. Inspection also includes daily checks for fugitive emissions. Regular leak detection and repair surveys (LDAR) to be undertaken in accordance with fugitive emissions plan.

	Any identified issues will be repaired as soon as possible. Regular inspection includes checks on operation of under/over pressure relief valves. Critical spares kept on site to enable quick repair. P&ID diagrams available in management system to aid maintenance planning. Pipework plan available in management system to enable maintenance planning. Foam sensors included in head of digesters and anti-foaming agent dosing system available. Reduce risk of gas line being blocked due to foaming incident with subsequent release of gas via pressure relief valves. Staff members are trained to carry out activities and their competency is monitored. SCADA control system to manage plant systems including levels in gas storage through operation of the gas users (upgrading, CHP, flare, biogas boiler). Continuous monitoring of gas pressures, gas production and gas flows. Site operates a system of permits to work and Atex zone entry permits based on DSEAR assessment and zoning report. HAZOP assessment has been applied to site during design and construction phase. Fixed in situ gas detection in CHP, boiler, gas upgrading unit, and grid entry unit containers, and technical building. Lightning risk assessment to be undertaken and suitable measures installed. Daily odour sniff tests will enable operator to detect. presence of biogas and use of gas body worn gas detectors by staff on site will give rises to alarm if gas present on site. Incident reporting procedures in place. Staff on site/call 24/7 who will respond to alarms and attend site for critical alarms. Staff served by a central service team that provide a call out service to enable speedy repair.
Procedures to Respond to Incidents	Cause of gas leak to be identified as soon as possible. Maintenance activity to be undertaken to reduce this immediately if applicable and including appropriate health and safety measures and safe equipment (use of gas monitors, atex rated equipment and breathing apparatus if applicable). Consider the possibility of isolating any part of the site to prevent loss of gas during remediation. Use of emergency flare if applicable to manage gas while repairs undertaken. Addition odour monitoring to be undertaken during known venting to monitor impacts. Consideration to be given to whether feed to facility should be reduced/ceased to reduce gas production while leak is addressed. Safe shut down procedures to be instigated if necessary. Close receptors to be informed of any increased risks if applicable. Emergency response to be instigated if relevant (Section 6 below) Guidelines for relevant scenarios in section 7 below to be

	followed. Incident to be recorded and events evaluated. Any preventative/corrective measures identified as a result of incident review to be entered onto the incident tracking sheet and be subject to review until completion. Schedule 5 notification to be sent to the NRW. NRW to be notified via 24-hour incident reporting hotline if required. Internal reporting procedures to be followed.
Hazard	**Arrangements for the receipt and checking of incoming waste, including rejection and quarantine. Receipt of incompatible material.**
ID	**C**
How likely is the event to occur (source frequency)?	Isolated occurrence possible over a twenty-year operation period from a particular batch of material that is not identified by incoming feedstock procedure. Probability 2.
What substances are released and how much of each (risk evaluation of the event)?	No specific substances are released with the associated event but may increase the likelihood of other events. Severity 1.
Where do the released sources end up (emission prediction – what are the pathways and receptors)?	Material will either be blended or rejected. Any rejected material will be taken offsite for further treatment.
What are the consequences (consequence assessment – what are the effects on the receptors)?	Impact on quality of final digestate which may render it non-compliant with the Quality Protocol for Digestate, or unsuitable for application to land. Impact on process control which may have impact on containment and subsequent impacts in terms of odour.
What are the overall risks (determination of overall risk and its significant to the environment)?	Risk 2.
What can prevent or reduce the risk (risk management – measures to prevent accidents and/or reduce their environmental consequences)?	Procedures for the acceptance, pre-screening and unloading of material. All material delivered to the site is required to undergo a site audit and suit of testing. If the material passes the audit and testing it will be allowed to be brought to site. Each vehicle delivering material to site will undergo screening (odour and contaminants) and testing (pH) before being allowed to enter the facility. Loads can be rejected, suspended and quarantined according to the respective situation. An operator will be present at the reception area during the delivery of all material to monitor quality and suitability. Hauliers are required to adhere to all legal requirements (waste transfer licence, waste transfer notes) and to provide a declaration of vehicle load conformity or up to date clean out certificate. Feedstock suppliers can be suspended from delivering material if they are in breach of regulations or site parameters limits. The NRW will be notified if a load enters site that does not confirm to legal requirements, and it will be added to the site rejected loads register.

Procedures to Respond to Incidents	Any material received on site that is subsequently found to be non-conforming will be isolated/quarantined according to procedures laid out in incoming waste procedure and rejection procedure. Material quarantined in reception tanks to be either a) blended with other wastes to produce an in- spec mix of material that can be fed into the process, or b) removed from site for appropriate disposal. Storage tank to be cleaned if necessary. If material has been passed into the treatment process, depending on the nature of non-conformance, the operator will consider the need for the following: additional monitoring of substrate during processing, additional assessment of final digestate as suitable to spread to land, removal of material from digesters for disposal at a suitable secondary site. If material is a non-conforming ABP material, notification to be made to the APHA and advice to be sought regarding disposal and management of the material. Any secondary disposal site to be authorised to tank the relevant category of ABP. An assessment will be made of the impact of the non-conforming material on the end of waste status of the final digestate at the site. If end of waste status cannot be claimed, any arising digestate will be spread to land as a waste under a waste deployment if suitable or disposed of by an alternative means as outlined in the HACCP for the site. Incident to be recorded and events evaluated. Any preventative/corrective measures identified as a result of incident review to be entered onto the incident tracking system and be subject to review until completion. Schedule 5 notification to be sent to the NRW. NRW to be notified via 24-hour incident reporting hotline if required. Internal reporting procedures to be followed.
Hazard	**Event occurring during the transfer of substances including; chemical, oil, material delivery and removal**
ID	**D**
How likely is the particular event to occur (source frequency)?	Small release – Likely as task is carried out multiple time per day. Probability 3. Large release – Event would be due to equipment failures or human errors. Probability 1.
What substances are released and how much of each (risk evaluation of the event)?	Depending on the event; feedstock, digestate, engine oils, fuel oil or chemicals could be released. Small release - Severity 2. Large release - Severity 4.
Where do the released sources end up (emission prediction – what are the pathways and receptors)?	The pathway of the emission will depend on where the event occurs.
	Roadways - Spills will drain to drainage system via oil interceptor. Material is taken offsite for further treatment or processed. Inside bund – Material is either taken offsite for further

	treatment or released to surface water. Reception Building – Material is released to sealed drainage system with drains to the internal mixing pit. Odours dispersed in the atmosphere. Route will depend on weather conditions on the respective day of release.
What are the consequences (consequence assessment – what are the effects on the receptors)?	Potential release of high COD/BOD or environmentally toxic material, which could be fatal to aquatic life if released to surface water. Contamination of underlying aquifer. Potential release of E Coli/Salmonella, which could contaminate food chain. Potential for odour complaints.
What are the overall risks (determination of overall risk and its significant to the environment)?	Small release – Risk 6. Large release – Risk 4.
What can prevent or reduce the risk (risk management – measures to prevent accidents and/or reduce their environmental consequences)?	Maintenance and inspection system for plant (tanks and pipework) and equipment (pumps, valves, macerators etc) to ensure it is working within design parameters. All main process tanks contained within a sealed concrete bund with enough capacity to contain spills. All chemical storage indoors or in bunded area or container. Ferric chloride storage facility has additional shut off facility for containment of small spills during delivery to prevent these entering the wider bund water collection system. Inspection includes daily checks for fugitive emissions. Testing of the bund pump chamber rainwater before pumping to surface water system. Further visual monitoring of outfalls and inlets. Any identified issues will be repaired as soon as possible. Critical spares kept on site to enable quick repair. P&ID diagrams available in management system to aid maintenance planning. Pipework plan available in management system to enable maintenance planning. Functional Design specification available also. Staff members are trained to carry out activities and their competency is monitored. Procedure for staff detailing how to carry out the delivery/removal of substances outlined in site Standard Operating Procedures. Gas odorant delivered and connected by specialist contractors who supply the chemical. An up-to-date register of chemicals kept onsite, COSHH assessment for substance the respective substance and activity. Facility has a SCADA control system, which automates the pumping cycle of the plant. Tank levels, flows of material and biogas constantly monitored. Tanks fitted with high level alarms and high-high levels switches which prevent the overfilling of tanks. Incident reporting procedures in place. Staff on call 24/7 who will respond to alarms and attend site for critical alarms.

	Staff served by a central service team that provide a call out service to enable speedy repair.
Procedures to Respond to Incidents	Small spills to be cleared up immediately. Tailored spill kits provided for this purpose and contents checked and maintained ready for use. Liquids can be retained in the surface water drainage system via use of a shut off valve at the interceptor outlet and a second valve further up the system which is downstream of the main yard and delivery area and upstream of the bund sump discharge point. If material bypasses the bund or interceptor, then there is a risk that it will leave site. Material that has bypassed the interceptor shut off can be isolated in the drainage system downstream by blocking the outlet to the interceptor itself, or the outlet of the surface water system prior to discharge to the attenuation pond. Any material discharged to the lined attenuation pond will only be discharged to the adjacent brook if the level in the pond reaches the height of the discharge outlet pipe. This can be prevented by dropping the level in the attenuation pond by tanker pump out to prevent it reaching the discharge level, or by blocking the discharge outlet pipe. The is an accessible damming/pump out point on the brook a few meters downstream of the site. This area has tanker access and the brook is small enough to enable damming/over pumping to allow any material released to the brook to be removed and tankered away. All surface water must be pumped from the bund via a rising main, and it is therefore possible to cease operation of this pump to retain material in the bund sump if material is found to contaminated. If contaminated liquid were pumped from the bund to the surface water system, then the liquid could be retained in the interceptor by blocking the outlet. Liquid can then be retrieved from the chamber by tanker for disposal. Emergency response to be instigated if relevant (section 6 below) Guidelines for relevant scenarios in section 7 below to be followed. Emergency procedure and training for management of spillages of gas odorant to be provided by specialist contractor who supply the gas odorant. Incident to be recorded and events evaluated. Any preventative/corrective measures identified as a result of incident review to be entered onto the incident tracking sheet and be subject to review until completion. Schedule 5 notification to be sent to the NRW. NRW to be notified via 24-hour incident reporting hotline if required. Internal reporting procedures to be followed.

Hazard	Over filling of vessels
ID	E
How likely is the event to occur (source frequency)?	The amount released would depend on the event. The event occurring does not specifically mean that there will be an associated release. Small release - isolated occurrence possible across a 20-year operational period. Probability 2. Large release - would be the result of multiple errors occurring simultaneously. Probability 1.
What substances are released and how much of each (risk evaluation of the event)?	Depending on the event; feedstock, digestate, engine oils, chemicals or odours. Small release - Severity 2. Large release - Severity 4.
Where do the released sources end up (emission prediction – what are the pathways and receptors)?	The pathway of the emission depends on where the event occurs. Roadways - Spills will drain to drainage system via oil interceptor. Material is taken offsite for further treatment or processed. Inside bund – Material is either taken offsite for further treatment or released to surface water. Reception Building – Material is released to sealed drainage system with drains to the internal mixing pit. Odours dispersed in the atmosphere. Route will depend on weather conditions on the respective day of release.
What are the consequences (consequence assessment – what are the effects on the receptors)?	Potential release of high COD/BOD or environmentally toxic material, which could be fatal to aquatic life if released to surface water. Contamination of underlying aquifer. Potential release of E Coli/Salmonella, which could contaminate food chain. Potential for odour complaints.
What are the overall risks (determination of overall risk and its significant to the environment)?	Small release – Risk 4. Large release – Risk 4.
What can prevent or reduce the risk (risk management – measures to prevent accidents and/or reduce their environmental consequences)?	Maintenance and inspection system for plant (tanks and pipework) and equipment (pumps, valves, macerators etc) to ensure it is working within design parameters. All main process tanks contained within a sealed concrete bund with enough capacity to contain spills. All chemical storage indoors or in bunded area or container. Inspection includes daily checks for fugitive emissions. Testing of the bund pump chamber rainwater before pumping to surface water system for release. Further visual monitoring of outfall and inlets. Any identified issues will be repaired as soon as possible. Critical spares kept on site to enable quick repair. P&ID diagrams available in management system to aid maintenance planning. Pipework plan available in management system to enable maintenance planning. Functional Design specification available also.

	Staff members are trained to carry out activities and their competency is monitored. Procedure for staff detailing how to carry out the delivery/removal of substances outlined in site Standard Operating Procedures. An up-to-date register of chemicals kept onsite, COSHH assessment for substance the respective substance and activity. Facility has a SCADA control system, which automates the pumping cycle of the facility. Tank levels, flows of material and biogas constantly monitored. Tanks fitted with high level alarms and high-high levels switches which prevent the overfilling of tanks. Incident reporting procedures in place. Staff on call 24/7 who will respond to alarms and attend site for critical alarms. Staff served by a central service team that provide a call out service to enable speedy repair.
Procedures to Respond to Incidents	Small spills to be cleared up immediately. Tailored spill kits provided for this purpose and contents checked and maintained ready for use. If material does overflow tank, spill procedure outlined in section 7 below to be followed. All clean up material to be disposed of appropriately and surface to be sterilised according to APHA requirements if unpasteurised food wastes are released. If material overflows and bypasses the bund or interceptor, then there is a risk that it will leave site. Material that has entered the drainage system may be retained in the interceptor via closing the outlet to the interceptor or it's chambers. Material that has bypassed the interceptor on the drainage system can be retained in the system by blocking the outlet to the attenuation pond, or if released to the attenuation pond, by retaining material in the (lined) pond by dropping the level in the pond to maintain it below the level of the outlet pipe, or blocking the outlet pipe itself. Tanker access and damming points are available on the brook a few metres downstream of the site should material need to be retrieved having entered the brook. All surface water must be pumped from the bund via a rising main, and it is therefore possible to cease operation of this pump to retain material in the bund sump if material is found to contaminated. If contaminated liquid were pumped from the bund to the drainage system, then the liquid could be retained in the final chamber of the interceptor by closing the outlet. Liquid can then be retrieved from the chamber by tanker for disposal. Emergency response to be instigated if relevant (Section 6 below) Guidelines for relevant scenarios in section 7 below to be followed. Incident to be recorded and events evaluated. Any preventative/corrective measures identified as a result of incident review to be entered onto the incident tracking

	sheet and be subject to review until completion. Schedule 5 notification to be sent to the NRW. NRW to be notified via 24-hour incident reporting hotline if required. Internal reporting procedures to be followed.
Hazard	**Emissions from facility or equipment (leakage from joints, over pressurisation of vessels, blocked drains)**
ID	**F**
How likely is the event to occur (source frequency)?	Isolated occurrence possible over a 20-year operation of the facility. Probability 2.
What substances are released and how much of each (risk evaluation of the event)?	Could lead to the release of feedstock material, digestate, biogas, chemicals and engine oil. Amount released likely to be minimal. Severity 2.
Where do the released sources end up (emission prediction – what are the pathways and receptors)?	The pathway of the emission depends on where the event occurs. Roadways - Spills will drain to drainage system via oil interceptor. Material is taken offsite for further treatment or processed. Inside bund – Material is either taken offsite for further treatment or released to surface water. Reception Building – Material is released to sealed drainage system with drains to the internal mixing pit. Odours dispersed in the atmosphere. Route will depend on weather conditions on the respective day of release.
What are the consequences (consequence assessment – what are the effects on the receptors)?	Potential release of high COD/BOD or environmentally toxic material, which could be fatal to aquatic life if released to surface water. Contamination of underlying aquifer. Potential release of E Coli/Salmonella, which could contaminate food chain. Potential for odour complaints
What are the overall risks (determination of overall risk and its significant to the environment)?	Risk 4.
What can prevent or reduce the risk (risk management – measures to prevent accidents and/or reduce their environmental consequences)?	Maintenance and inspection system for plant (tanks and pipework), equipment (pumps, valves, macerators etc) and drainage to ensure it is working within design parameters. All main process tanks contained within a sealed concrete bund with enough capacity to contain spills. All deliveries of raw materials to site via tanker will be undertaken in the reception building on an impermeable surface that drains to a sealed drainage system and supervised. Tanks have high and high-high level alarms. Tanker deliveries have automatic shut off facility when high level reached in tanks delivered to. Inspection includes daily checks for fugitive emissions Critical spares kept on site to enable quick repair. P&ID diagrams available in management system to aid maintenance planning. Pipework plan available in management system to enable maintenance planning. All pipework is above ground. No pipework passes through the bund.

	Staff members are trained to carry out activities and their competency is monitored. Facility has a SCADA control system, which automates the pumping cycle of the plant. Tank levels, flows of material and biogas constantly monitored. Process tanks fitted with high level alarms and high-high levels switches which prevent the overfilling of tanks. Incident reporting procedures in place. Staff on call 24/7 who will respond to alarms and attend site for critical alarms.
Procedures to Respond to Incidents	Small spills to be cleared up immediately. Tailored spill kits provided for this purpose and contents checked and maintained ready for use. If material is lost due to the above, spill procedure outlined in section 7 below to be followed. All clean up material to be disposed of appropriately and surface to be sterilised according to APHA requirements if unpasteurised food wastes are released. If material overflows and bypasses the bund or interceptor, then there is a risk that it will leave site. Material that has entered the drainage system may be retained in the interceptor via closing the outlet to the interceptor or it's chambers. Material that has bypassed the interceptor on the drainage system can be retained in the system by blocking the outlet to the attenuation pond, or if released to the attenuation pond, by retaining material in the (lined) pond by dropping the level in the pond to maintain it below the level of the outlet pipe, or blocking the outlet pipe itself. Tanker access and damming points are available on the brook a few metres downstream of the site should material need to be retrieved having entered the brook. All surface water must be pumped from the bund via a rising main, and it is therefore possible to cease operation of this pump to retain material in the bund sump if material is found to contaminated. If contaminated liquid were pumped from the bund to the drainage system, then the liquid could be retained in the final chamber of the interceptor by closing the outlet. Liquid can then be retrieved from the chamber by tanker for disposal. Emergency response to be instigated if relevant (Section 6 below) Guidelines for relevant scenarios in section 7 below to be followed. Incident to be recorded and events evaluated. Any preventative/corrective measures identified as a result of incident review to be entered onto the incident tracking sheet and be subject to review until completion. Schedule 5 notification to be sent to the NRW. NRW to be notified via 24-hour incident reporting hotline if required. Internal reporting procedures to be followed. If material overflows and bypasses the bund or interceptor, then there is a risk that it will leave site. Material that has entered the drainage system may be

	retained in the interceptor via closing the outlet to the interceptor or it's chambers. Material that has bypassed the interceptor on the drainage system can be retained in the system by blocking the outlet to the attenuation pond, or if released to the attenuation pond, by retaining material in the (lined) pond by dropping the level in the pond to maintain it below the level of the outlet pipe, or blocking the outlet pipe itself. Tanker access and damming points are available on the brook a few metres downstream of the site should material need to be retrieved having entered the brook. All surface water must be pumped from the bund via a rising main, and it is therefore possible to cease operation of this pump to retain material in the bund sump if material is found to contaminated. If contaminated liquid were pumped from the bund to the drainage system, then the liquid could be retained in the final chamber of the interceptor by closing the outlet. Liquid can then be retrieved from the chamber by tanker for disposal. Emergency response to be instigated if relevant (Section 6 below) Guidelines for relevant scenarios in section 7 below to be followed. Incident to be recorded and events evaluated. Any preventative/corrective measures identified as a result of incident review to be entered onto the incident tracking sheet and be subject to review until completion. Schedule 5 notification to be sent to the NRW. NRW to be notified via 24-hour incident reporting hotline if required. Internal reporting procedures to be followed.
Hazard	**Failure of containment (physical failure or overfilling of bunds or drainage sumps)**
ID	**G**
How likely is the event to occur (source frequency)?	Physical failures unlikely to happen. Probability 1. Overfilling of bunds or sumps may happen in an isolated occurrence over a twenty-year operation period. Probability 1.
What substances are released and how much of each (risk evaluation of the event)?	The event could lead to the release of feedstock material, digestate, chemicals, engine oil, fuel oil or odours. The amount released would depend on the event. Physical failure (> 2,000 m^3 of digestate, up to 500 m^3 of feedstock or 1 m^3 of chemicals/oil) Potential for release could lead to environmental damage. Severity 5. Overfilling bund or sump – The event does specifically mean that there will be a release. Any release would likely to be small. Severity 2.
Where do the released sources end up (emission prediction – what are the pathways and receptors)?	The pathway of the emission depends on where the event occurs. Roadways - Spills will drain to drainage system via oil interceptor. Material is taken offsite for further treatment or

	processed. Inside bund – Material is either taken offsite for further treatment or released to drainage system. Reception Building – Material is released to sealed drainage system with drains to the internal mixing pit. Odours dispersed in the atmosphere. Route will depend on weather conditions on the respective day of release.
What are the consequences (consequence assessment – what are the effects on the receptors)?	Potential release of high COD/BOD or environmentally toxic material, which could be fatal to aquatic life if released to surface water or groundwater. Contamination of underlying aquifer. Potential release of E Coli/Salmonella, which could contaminate food chain. Potential for odour complaints
What are the overall risks (determination of overall risk and its significant to the environment)?	Physical failure – Risk 5. Over filling bunds/sumps – Risk 4.
What can prevent or reduce the risk (risk management – measures to prevent accidents and/or reduce their environmental consequences)?	Maintenance and inspection system for plant (tanks and pipework), equipment (pumps, valves, macerators etc) and drainage to ensure it is working within design parameters. All main process tanks contained within a sealed concrete bund with enough capacity to contain spills. All deliveries of raw materials to site via tanker will be undertaken in the reception building on an impermeable surface that drains to a sealed drainage system and supervised. Tanks have high and high-high level alarms. Tanker deliveries have automatic shut off facility when high level reached in tanks delivered to. Inspection includes daily checks for fugitive emissions Critical spares kept on site to enable quick repair. P&ID diagrams available in management system to aid maintenance planning. Pipework plan available in management system to enable maintenance planning. All pipework is above ground. No pipework passes through the bund. Staff members are trained to carry out activities and their competency is monitored. Facility has a SCADA control system, which automates the pumping cycle of the plant. Tank levels, flows of material and biogas constantly monitored. Process tanks fitted with high level alarms and high-high levels switches which prevent the overfilling of tanks. Incident reporting procedures in place. Staff on call 24/7 who will respond to alarms and attend site for critical alarms.
Procedures to Respond to Incidents	Small spills to be cleared up immediately. Tailored spill kits provided for this purpose and contents checked and maintained ready for use. If a breach in the infrastructure of the containment measures is found to have occurred, these will be repaired immediately. If the main bund should give way following a spill, there would be a potentially catastrophic loss of liquid to the

	surrounding area. Should this occur, all means possible will be taken to contain the material in whatever way possible. Safe shut down procedure to be followed. All drainage system pumps to be turned off and all shut off valves to be closed. Any material that has reached the drainage system to be contained within the interceptors or final chamber, or attenuation pond beyond the site boundary. Sumps, interceptors and drainage chambers to be used as low point removal points for tanker removal access. Attenuation pond is also accessible for tanker offtake and damming and access point also available on the brook a few metres downstream of the site. Emergency response to be instigated if relevant (Section 6 below) Guidelines for relevant scenarios in section 7 below to be followed. Additional odour monitoring and assessment to be undertaken for impacts and odour management plan contingencies to be implemented. NRW to be notified via 24-hour incident reporting hotline. Incident to be recorded and events evaluated. Any preventative/corrective measures identified as a result of incident review to be entered onto the incident tracking sheet and be subject to review until completion. Schedule 5 notification to be sent to the NRW. NRW to be notified via 24-hour incident reporting hotline if required. Internal reporting procedures to be followed.
Hazard	**Wrong connections made in drains or other systems.**
ID	**I**
How likely is the event to occur (source frequency)?	Event would be the result of a human error. Probability 1.
What substances are released and how much of each (risk evaluation of the event)?	Release would depend on the event. Could result in the release of feedstock, digestate, chemicals, engine oils, fuel oil and odours. Severity 5.
Where do the released sources end up (emission prediction – what are the pathways and receptors)?	The pathway of the emission depends on where the event occurs. Roadways - Spills will drain to drainage system via oil interceptor. Material is taken offsite for further treatment or processed. Inside bund – Material is either taken offsite for further treatment or released to surface water via the drainage system. Reception Building – Material is released to sealed drainage system with drains to the internal mixing pit. Odours dispersed in the atmosphere. Route will depend on weather conditions on the respective day of release.

What are the consequences (consequence assessment – what are the effects on the receptors)?	Impact on process if material re-circulated inappropriately. Contamination of clean drainage with dirty drainage and subsequent impact on surface water catchment for foul sewage networks and treatment facilities downstream.
What are the overall risks (determination of overall risk and its significant to the environment)?	Risk 5.
What can prevent or reduce the risk (risk management – measures to prevent accidents and/or reduce their environmental consequences)?	All drains are checked by an independent certifier prior to handover as part ot the plant commissioning exercise. Maintenance and inspection system for plant (tanks and pipework) and equipment (pumps, valves, macerators etc) to ensure it is working within design parameters. Drainage maintenance plan in place. Construction completion carried out by independent certifier. Includes certification that drains are connected correctly. Rainwater will only be released from the bund by manual pumping to the surface water system if it passes water quality thresholds set. Any impacts from wrong connections into this system will be detected during this water quality testing process, and material will not be released as a result. Further misconnections will be identified by regular visual and olfactory checks of outfall from surface water system. All effluent collected in the sealed reception shed drainage system will drain to the mixing pit and be passed into the process. This will only be likely to affect the process if large amounts of a non-compatible material are spilled and cannot occur due to wrong connection.
Procedures to Respond to Incidents	Any misconnection likely to be identified as a result of onsite water quality testing prior to release. In the event that water quality tests prior to release show that water quality is not within expected ranges and there are no known on-site events that can account for this, a survey of the site drainage will be undertaken to identify the issue. Once identified the issue will be rectified. In the meantime, any water that does not meet the expected ranges will be removed from site via tanker for disposal at an appropriate site, until quality suitable for discharge to surface water is re-established. Emergency response to be instigated if relevant (Section 6 below) Guidelines for relevant scenarios in section 7 below to be followed. Incident to be recorded and events evaluated. Any preventative/corrective measures identified as a result of incident review to be entered onto the incident tracking sheet and be subject to review until completion. Schedule 5 notification to be sent to the NRW. Report to be made to EA via 24-hour emergency hotline if necessary. Internal reporting procedures to be followed.
Hazard	**Incompatible substances coming into contact with each other. The event can occur in the following areas; gas users, in the lab, reception tanks, digester tanks.**

ID	J
How likely is the event to occur (source frequency)?	Small release: An isolated occurrence possible over a 20-year operational period. Probability 2 Large release: A large release would be the result of multiple errors occurring at the same time. Probability 1.
What substances are released and how much of each (risk evaluation of the event)?	An event occurring does not specifically mean that there will be a release of material. An event could result in the release of feedstock, digestate, oil, chemicals, biogas and odours. Event could lead to; Small release (< 1 m^3 liquid, < 100 m^3 biogas) – Severity 2. Large release (+ 10 m^3 liquid, + 10,000 m^3 biogas) – Severity 4.
Where do the released sources end up (emission prediction – what are the pathways and receptors)?	The pathway of the emission depends on where the event occurs. Roadways - Spills will drain to drainage sysem via oil interceptor. Material is taken offsite for further treatment or processed. Inside bund – Material is either taken offsite for further treatment or released to drainage system. Water is then released to surface water. Reception Building – Material is released to sealed drainage system with drains to the internal mixing pit. Odours dispersed in the atmosphere. Route will depend on weather conditions on the respective day of release.
What are the consequences (consequence assessment – what are the effects on the receptors)?	Potential release of high COD/BOD or environmentally toxic material, which could be fatal to aquatic life if released to surface water. Contamination of underlying aquifer. Potential release of E Coli/Salmonella, which could contaminate food chain. Potential for odour complaints Pollution of the atmosphere by greenhouse gas release and impact on air quality.
What are the overall risks (determination of overall risk and its significant to the environment)?	Small release – Risk 4. Large release – Risk 4.
What can prevent or reduce the risk (risk management – measures to prevent accidents and/or reduce their environmental consequences)?	Maintenance and inspection system for plant (tanks and pipework) and equipment (pumps, valves, macerators etc) to ensure it is working within design parameters. Training of staff to carry out activities and monitoring of competency. Staff also understand the anaerobic digestion process and the potential for adverse reactions. Competency is monitored and trailing updates provided. All dosing to be carried out according to policy and guidelines. An up-to-date register of chemicals kept onsite, COSHH assessment for substance the respective substance and activity. Storage of lab chemicals to be undertaken accordingly. Clean out certificate or load conformity declaration required where necessary. Incoming waste testing regime to be followed and pre-

	screening of wastes prior to acceptance, as outlined in the Waste Acceptance Criteria.
Procedures to Respond to Incidents	Only small volumes of lab chemicals stored on site. Materials to be cleaned up using chemical spill kit and relevant ppe if safe to do so and cited on MSDS. Clean up materials to be disposed of appropriately. If materials cannot be cleaned up safely, isolate inside lab and seek specialist advice. Incompatible material in the reception tanks will be isolated/quarantined according to procedures laid out in incoming feedstock procedure. Material quarantined in reception tanks to be either a) blended with other wastes to produce an in-spec mix of material that can be fed into the process, or b) removed from site for appropriate disposal. Storage tank to be cleaned if necessary. If material has been passed into the treatment process, depending on the nature of non-conformance, the operator will consider the need for the following: additional monitoring of substrate during processing, additional assessment of final digestate as suitable to spread to land, removal of material from digesters for disposal at a suitable secondary site. If material is a non-conforming ABP material, notification to be made to the APHA and advice to be sought regarding disposal and management of the material. Any secondary disposal site to be authorised to take the relevant category of ABP. An assessment will be made of the impact of the non-conforming material on the end of waste status of the final digestate at the site. If end of waste status cannot be claimed, any arising digestate will be spread to land as a waste under a waste deployment if suitable or disposed of by an alternative means as outlined in the HACCP for the site. Incident to be recorded and events evaluated. Any preventative/corrective measures identified as a result of incident review to be entered onto the incident tracking system and be subject to review until completion. Schedule 5 notification to be sent to the NRW. Report incident via NRW 24-hour hotline if necessary. Internal reporting procedures to be followed.
Hazard	**Unexpected reactions or runaway reactions**
ID	**K**
How likely is the event to occur (source frequency)?	Due to the nature of the facility an event is unlikely. Probability 1.
What substances are released and how much of each (risk evaluation of the event)?	An event occurring does not specifically mean that there will be a release of material. An event could result in the release of feedstock, digestate, engine oil, chemicals, biogas and odours. Event could lead to; Small release (< 1 m^3 liquid, < 100 m^3 biogas) – Severity 2. Large release (+ 10 m^3 liquid, + 10,000 m^3 biogas) – Severity 4.
Where do the released sources end up (emission prediction – what are the	The pathway of the emission depends where the event occurs. Roadways - Spills will drain to drainage system via oil

pathways and receptors)?	interceptor. Material is taken offsite for further treatment or processed. Inside bund – Material is either taken offsite for further treatment or released to drainage system. Water is then released to surface water. Reception Building – Material is released to sealed drainage system with drains to the internal mixing pit. Odours dispersed in the atmosphere. Route will depend on weather conditions on the respective day of release.
What are the consequences (consequence assessment – what are the effects on the receptors)?	Potential release of high COD/BOD or environmentally toxic material, which could be fatal to aquatic life. Potential release of E. Coli/Salmonella, which could contaminate food chain. Potential for odour complaints. Pollution of the atmosphere by greenhouse gas release and impact on air quality.
What are the overall risks (determination of overall risk and its significant to the environment)?	Small release – Risk 2. Large release – Risk 4.
What can prevent or reduce the risk (risk management – measures to prevent accidents and/or reduce their environmental consequences)?	Facility process management plan and comprehensive process sampling and monitoring. Training of staff to carry out activities and monitoring of competency. An up-to-date register of chemicals kept onsite, COSHH assessment for substance the respective substance and activity. Procedures for the acceptance, pre-screening and unloading of material. All material delivered to the site is required to undergo a site audit and suit of testing. If the material passes the audit and testing it will be allowed to be brought to site. Each vehicle and consignment of waste delivered to site will undergo screening (odour and contaminants) before being allowed to enter the facility. Loads can be rejected, suspended and quarantined according to the respective situation. Facility has a SCADA control system, which automates the pumping cycle of the plant. Tank levels, flows of material and biogas constantly monitored. Tanks fitted with high level alarms and high-high levels switches which activate respective alarms. Facility has foam sensors fitted in the heads of the digesters, and a dosing system for dosing of anti-foaming agent. Sensors will trigger an alarm to staff in the event of foaming. All dosing will be carried out according to internal guidelines and procedures and with support of in-house biological support. Staff on call 24/7 who will respond to alarms and attend site for critical alarms.
Procedures to Respond to Incidents	If reactions lead to a release of materials, this will be contained within the main process area bund. If in the waste delivery area, the area is on a sealed drainage system and so any spillages will drain to the internal mixing pit. Depending on the nature of reaction, the operator will

	consider the need for the following: additional monitoring of substrate during processing, additional assessment of final digestate as suitable to spread to land, removal of material from digesters for disposal at a suitable secondary site. Any material that is spilled within the bund or drainage system will be cleaned up and disposed of appropriately. Any surfaces that have come into contact with unpasteurised ABP spillages will be disinfected as outlined in the HACCP for the site. Incident to be recorded and events evaluated. Any preventative/corrective measures identified as a result of incident review to be entered onto the incident tracking system and be subject to review until completion. Schedule 5 notification to be sent to the NRW. Report to be made by NRW 24-hour hotline if required. Internal reporting procedures to be followed.
Hazard	**Release of an effluent before adequate checking of its composition.**
ID	**L**
How likely is the event to occur (source frequency)?	Event would be the result of human error. Probability 1.
What substances are released and how much of each (risk evaluation of the event)?	Feedstock or digestate could be released. Batch of surface water in bund sump. Severity 3.
Where do the released sources end up (emission prediction – what are the pathways and receptors)?	Material is released to surface water drain, which leads to drainage system and external surface water system (lined attenuation pond with outlet to adjacent brook). Digestate may be released to land or use as a fertilizer. Feedstock released to process tanks.
What are the consequences (consequence assessment – what are the effects on the receptors)?	Potential release of high COD/BOD or environmentally toxic material, which could be fatal to aquatic life. Potential release of E. coli/Salmonella, or other contaminants in digestate which could contaminate food chain. Potential for introduction of undesirable or inhibitory materials into process. Potential for release of highly odorous materials to land if not subject to full digestion process.
What are the overall risks (determination of overall risk and its significant to the environment)?	Risk 3.
What can prevent or reduce the risk (risk management – measures to prevent accidents and/or reduce their environmental consequences)?	Maintenance and inspection system for plant (tanks and pipework) and equipment (pumps, valves, macerators etc) to ensure it is working within design parameters. Training of staff to carry out activities and monitoring of competency. Staff also understand the anaerobic digestion process and the potential for adverse reactions. Competency is monitored recorded and updated. Construction completion carried out by independent certifier. Includes certification that drains are connected correctly. Bund surface water will only be pumped manually to drainage system and discharged to surface water once in situ testing within designated thresholds.

	Process monitoring plan in place that incudes evaluation of substrate in digesters to monitor performance and biological stability. Feed rate controlled by set points on the SCADA system. SCADA control of substrate feed rate and pasteurisation process. Digestate will not be released from the pasteuriser unless a full cycle has been completed. All waste feedstocks subject to pre-assessment before being accepted at the site, and assessment on receipt in accordance with the incoming feedstock procedure and waste acceptance criteria. Ferric chloride, propane, odorant and anti-foaming agent dosing systems controlled by automated dosing systems linked to SCADA control.
Procedures to Respond to Incidents	If materials passed into digesters, the operator will consider the need for the following: additional monitoring of substrate during processing, additional assessment of final digestate as suitable to spread to land, removal of material from digesters for disposal at a suitable secondary site. If material passed into drainage system, outlet to interceptor to be blocked to retain material in the drainage system pending removal by tanker. If unpasteurised or non-conforming digestate removed from site, corrective measures outlined in PAS110 HACCP to be implemented. Incident to be recorded and events evaluated. Any preventative/corrective measures identified as a result of incident review to be entered onto the incident tracking sheet and be subject to review until completion. Schedule 5 notification to be sent to the NRW. Report to be made to NRW 24-hour incident hotline if necessary. Internal reporting procedures to be followed.
Hazard	**Failure of main services**
ID	**M**
How likely is the event to occur (source frequency)?	Failure likely to be isolated occurrence. Probability 2.
What substances are released and how much of each (risk evaluation of the event)?	Biogas via pressure relief valves. Severity 3.
Where do the released sources end up (emission prediction – what are the pathways and receptors)?	Biogas and odours end up dispersed in the atmosphere. Route will depend on weather conditions on the respective day of release.
What are the consequences (consequence assessment – what are the effects on the receptors)?	Potential for odour complaints. Pollution of the atmosphere by greenhouse gas release and impact on air quality.
What are the overall risks (determination of overall risk and its significant to the environment)?	Risk 6.

What can prevent or reduce the risk (risk management – measures to prevent accidents and/or reduce their environmental consequences)?	Temporary generator onsite to supply power to facility critical equipment. Battery back-up to main computerised control system for 30 mins. Should provide enough time for temporary power supply to be deployed and facility to be returned to a safe state. Emergency natural gas boiler (Viessmann Vitoplex 200, 1,100 kW thermal, natural gas only) available on site for heating of process tanks when CHP is unavailable. Emergency flare available for use at the site. Facility has a SCADA control system, which automates the pumping cycle of the plant. Tank levels, flows of material and biogas constantly monitored. Tanks fitted with high level alarms and high-high levels switches which activate respective alarms. Staff on call 24/7 who will respond to alarms and attend site for critical alarms.
Procedures to Respond to Incidents	Emergency shut down procedure to be followed for relevant parts of site. Battery backup for main control system allows 30 mins for emergency generator to be started. Emergency flare available to burn any unused gas in a controlled manner. Feed to facility to be slowed/stopped if downtime is lengthy and gas stores need to be reduced. Emergency response to be instigated if relevant (Section 6 below) Guidelines for relevant scenarios in section 7 below to be followed. Incident to be recorded and events evaluated. Any preventative/corrective measures identified as a result of incident review to be entered onto the incident tracking sheet and be subject to review until completion. Schedule 5 notification to be sent to the NRW. Report to be made to NRW 24-hour hotline if required. Internal reporting procedures to be followed.
Hazard	**Operator error**
ID	**N**
How likely is the event to occur (source frequency)?	Small release – Event is likely to occur at some point over a twenty-year operation period. Probability 4. Catastrophic failure – Event would be the result of multiple failures occurring simultaneously. Probability 1.
What substances are released and how much of each (risk evaluation of the event)?	Potential release of feedstock, digestate, biogas, chemicals and oil. Small release (< 1 m^3 liquid, < 100 m^3 biogas) – Severity 2. Catastrophic failure (+ 1,000 m^3 liquid) – Severity 5.
Where do the released sources end up (emission prediction – what are the pathways and receptors)?	The pathway of the emission depends on where the event occurs. Roadways - Spills will drain to drainage system via oil interceptor. Material is taken offsite for further treatment or processed. Inside bund – Material is either taken offsite for further treatment or released to drainage system. Water is then

	released to surface water. Reception Building – Material is released to sealed drainage system with drains to the internal mixing pit. Odours dispersed in the atmosphere. Route will depend on weather conditions on the respective day of release.
What are the consequences (consequence assessment – what are the effects on the receptors)?	Potential release of high COD/BOD or environmentally toxic material, which could be fatal to aquatic life. Potential release of E. coli/Salmonella, which could contaminate food chain. Potential for odour complaints. Pollution of the atmosphere by greenhouse gas release and impact on air quality.
What are the overall risks (determination of overall risk and its significant to the environment)?	Small release – Risk 8. Large release – Risk 5.
What can prevent or reduce the risk (risk management – measures to prevent accidents and/or reduce their environmental consequences)?	Standard Operating Procedures and risk assessments in place for all work activities. Staff training needs analysis, training records, and training modules/toolbox talks established. Programme of management system audits will include regular review of staff training needs. Permits to work required for all high-risk procedures. Hierarchy of login access levels for SCADA control systems (plant, CHP, pasteuriser etc). Only trained engineers can change critical control points on respective systems.
Procedures to Respond to Incidents	Small spills arising from staff error to be cleaned up straight away as outlined in section 7 below. Depending on type of error and outcome of error, suitable response to be carried out as outlined in this document. Facility design and containment should contain most spills and prevent most occurrences. Any errors should be rectified as soon as noticed. Staff re-training/refreshers to be considered as corrective measures. Warning system and disciplinary/capability procedure in place to address situations of repeated errors and competence issues. Emergency response to be instigated if relevant (Section 6 below).
Hazard	**Vandalism**
ID	**O**
How likely is the event to occur (source frequency)?	Unlikely event. Probability 1.
What substances are released and how much of each (risk evaluation of the event)?	Release will depend on the event. Some events could have no release whereas others could lead to a catastrophic failure. Severity 5. Potential release of feedstock, digestate, biogas, chemicals and oil.
Where do the released sources end up (emission prediction – what are the pathways and receptors)?	The pathway of the emission depends on where the event occurs. Roadways - Spills will drain to drainage system via oil interceptor. Material is taken offsite for further treatment or processed. Inside bund – Material is either taken offsite for further treatment or released to drainage system. Water is then

	released to surface water. Reception Building – Material is released to sealed drainage system with drains to the internal mixing pit. Odours dispersed in the atmosphere. Route will depend on weather conditions on the respective day of release.
What are the consequences (consequence assessment – what are the effects on the receptors)?	Potential release of high COD/BOD or environmentally toxic material, which could be fatal to aquatic life. Potential release of E. coli/Salmonella, which could contaminate food chain. Potential for odour complaints. Pollution of the atmosphere by greenhouse gas release and impact on air quality.
What are the overall risks (determination of overall risk and its significant to the environment)?	Risk 5.
What can prevent or reduce the risk (risk management – measures to prevent accidents and/or reduce their environmental consequences)?	Fencing around the parameter of the site. Site located adjacent steep earth bunds which provide additional barrier to site access. All valves/switches that are not in rooms are locked off. All rooms are locked when staff are not on site. Facility has a SCADA control system, which automates the pumping cycle of the plant. Tank levels, flows of material and biogas constantly monitored. Tanks fitted with high level alarms and high-high levels switches which activate respective alarms. Staff on call 24/7 who will respond to alarms and attend site for critical alarms. Either site staff or security staff on site 24 hours a day. Site Fitted with CCTV.
Procedures to Respond to Incidents	Emergency response to be instigated if relevant (Section 6 below). Police to be contacted to report any unauthorised access or damage caused to the site. Review of access/security measures to be undertaken in the event that vandals access the site and cause damage. Incident to be recorded and events evaluated. Any preventative/corrective measures identified as a result of incident review to be entered onto the incident tracking sheet and be subject to review until completion. Schedule 5 notification to be sent to the NRW. Report to be made to NRW 24-hour hotline if necessary. Internal reporting procedures to be followed.
Hazard	**Air/ventilation management**
ID	**P**
How likely is the event to occur (source frequency)?	Non-catastrophic event – Isolated incidents possible over a twenty-year operation period. Probability 2. Catastrophic event – Event leading to the membrane roof coming off would be the result of multiple events occurring at the same time. Probability 1.
What substances are released and how much of each (risk evaluation of the event)?	Release will depend on the event. Membrane roof failure which could lead to the roof being blown away in severe weather conditions and associated release of biogas. Event could also lead to a catastrophic tank failure and digestate released. Severity 5.

Where do the released sources end up (emission prediction – what are the pathways and receptors)?	The pathway of the emission depends where and when the event occurs. Odours/gas dispersed in the atmosphere. Route will depend on weather conditions on the respective day of release. Roadways - Spills will drain to drainage system via oil interceptor. Material is taken offsite for further treatment or processed. Inside bund – Material is either taken offsite for further treatment or released to drainage system. Water is then released to surface water. Reception Building – Material is released to sealed drainage system with drains to the internal mixing pit.
What are the consequences (consequence assessment – what are the effects on the receptors)?	Potential release of high COD/BOD and toxic material to surface water, which could be fatal to aquatic life. Release of material via surface water or spreading of material could contain E. coli/Salmonella, which could contaminate food chain. Potential for odours at sensitive receptors. Biogas pollution to atmosphere as a greenhouse gas and impact on air quality.
What are the overall risks (determination of overall risk and its significant to the environment)?	No catastrophic event – Risk 2. Catastrophic event – Risk 5.
What can prevent or reduce the risk (risk management – measures to prevent accidents and/or reduce their environmental consequences)?	Sealed external tanks fitted with emergency under/over pressure relief valves to allow for pressure to be equalised within the tank if required. Pressure relief facility also built into the gas upgrading unit. Gas flow and pressure monitored continuously via SCADA system and parameters displayed on the control interface system. Alarm system in place to alert staff to pressure states outside of set points. Maintenance and inspection system for plant (tanks and pipework) and equipment (pumps, valves, macerators etc) to ensure it is working within design parameters. Spare roof fan onsite as part of critical spares. Emergency flare available on site as facility for burning biogas in a controlled manner if required. Staff training and competency recorded in a training record and subject to ongoing review and update. Periodic internal audits of management systems. Staff on call 24/7 who will respond to alarms and attend site for critical alarms.
Procedures to Respond to Incidents	Central services team available with out of hours call out service to repair membrane roof fans and other equipment if required. Maintenance activity to be undertaken immediately if applicable and including appropriate health and safety measures and safe equipment (use of gas monitors, ATEX rated equipment and breathing apparatus if applicable). Consider the possibility of isolating any part of the site to prevent loss of gas during remediation. Use of emergency flare if applicable/possible to manage gas while repairs undertaken. Emergency response to be instigated if relevant (Section 6

	below) Emergency safe shut down procedure to be instigated and feed to plant to be stopped. Report to be made to NRW 24-hour incident hotline. Schedule 5 notification to be sent to the Environment Guidelines for relevant scenarios in section 7 below to be followed. Addition odour monitoring to be undertaken during known venting to monitor impacts. Close receptors to be informed of any increased risks if applicable including nearby residential and workplaces Incident to be recorded and events evaluated. Any preventative/corrective measures identified as a result of incident review to be entered onto the incident tracking sheet and be subject to review until completion. Agency. Internal reporting procedures to be followed.
Hazard	**Failure of Abatement systems**
ID	**Q**
How likely is the event to occur (source frequency)?	An isolated occurrence is possible over a twenty-year operation period. Probability 2.
What substances are released and how much of each (risk evaluation of the event)?	Odours dispersed in atmosphere. The amount depends on the event. Severity 2.
Where do the released sources end up (emission prediction – what are the pathways and receptors)?	Odours end up dispersed in the atmosphere. Route will depend on weather conditions on the respective day of release.
What are the consequences (consequence assessment – what are the effects on the receptors)?	Potential for odours at sensitive receptors.
What are the overall risks (determination of overall risk and its significant to the environment)?	Risk 4.
What can prevent or reduce the risk (risk management – measures to prevent accidents and/or reduce their environmental consequences)?	Maintenance and inspection system for plant and equipment to ensure it is working within design parameters. Odour management plan outlines monitoring systems to be undertaken for odour abatement equipment to establish when maintenance of plant is required. Procedure in place for changing carbon media in abatement system. Staff training and competency monitored and recorded and maintained at updates. Periodic internal audits of management systems. Permits to work required for all high-risk procedures.
Procedures to Respond to Incidents	Majority of site is sealed/in continuity with the gas line. Response to breach in sealed state is outlined earlier in this document. Specific abatement system on site is the reception shed odour abatement system. Daily sniff test to be carried out

	adjacent to this unit to monitor for changes in odour impacts from the unit. If a deterioration is found, then the media will be replaced/maintenance will be undertaken/an investigation into the performance of the unit will be undertaken. Additional monitoring of impacts will be undertaken if problem persists. This is further outlined in the odour management plan for the site.
Hazard	**Storage of waste**
ID	**R**
How likely is the event to occur (source frequency)?	Waste is stored onsite constantly. Probability 5.
What substances are released and how much of each (risk evaluation of the event)?	Storage of waste in pre-storage/buffer tanks and shed does not specifically mean that there will be a release of material. Waste chemicals and engine oils are stored onsite but are taken offsite for further treatment and to be disposed of and only present in small volumes. Waste packaging is stored onsite pending removal. Waste carbon media removed from facility and taken offsite immediately. Severity 1.
Where do the released sources end up (emission prediction – what are the pathways and receptors)?	All material is processed through the facility or taken offsite.
What are the consequences (consequence assessment – what are the effects on the receptors)?	Impact on watercourse, groundwater if spills of waste oils/liquids, or amenity if waste packaging released.
What are the overall risks (determination of overall risk and its significant to the environment)?	Risk 5.
What can prevent or reduce the risk (risk management – measures to prevent accidents and/or reduce their environmental consequences)?	Outdoor pre-storage tanks are part of a gas sealed system. Emissions from indoor tanks are managed via the odour extraction and abatement system. Any gases produced will flow into gas storage and will be consumed by gas users. All chemicals and engine oil waste are stored in suitable containers either indoors or with appropriate bunding. Maintenance and inspection system for plant (tanks and pipework) and equipment (pumps, valves, macerators etc) to ensure it is working within design parameters. Regular environmental checks include checks for litter. Staff training and competency monitored and recorded and maintained at updates. Periodic internal audits of management systems. Facility has a SCADA control system, which automates the pumping cycle of the plant. Tank levels, flows of material and biogas constantly monitored. Tanks fitted with high level alarms and high-high levels switches which activate respective alarms. Staff on call 24/7 who will respond to alarms and attend site for critical alarms. Procedures for the acceptance, pre-screening and unloading of material. All material delivered to the site is required to undergo a site audit and pre-assessment. If the material

	passes the audit and testing it will be allowed to be brought to site. Each vehicle delivering material to site will undergo screening (odour and contaminants) before being allowed to enter the facility. Loads can be rejected, suspended and quarantined according to the respective situation. Firewater lagoon on site to ensure that adequate supply for fire fighting purposes is available at all times.
Procedures to Respond to Incidents	Responses to spillages and releases as a result of over filling, loss of sealed state, and runaway reactions outlined earlier in this document. Emergency response to be instigated if relevant (Section 6 below) Guidelines for relevant scenarios in section 7 below to be followed. Litter picking to be instigated if loss of containment of packaging waste outside the reception building.

INCIDENT RESPONSE

4.3 Incident Response

The site office will contain an incident response file containing documents relating to the following:

- An up to date inventory of all substances used on site, likely volumes stored, and any key MSDS sheets (e.g. Ferric Chloride);
- A list of all tanks and their contents;
- A site layout plan showing site infrastructure, location of tanks and chemical stores etc;
- Safe shut down procedures;
- The contact details for emergency services, regulating authorities and utilities providers, emergency tanker operator, specialist gas odorant suppliers, grid network connection provider, and known receptors, the feedstock supplier, third party service contractors and any other relevant parties.;
- A list of key receptors;
- A site drainage plan and plan showing the location of utilities supply connection points and duct work;
- Plans of tanker access points on the surface water system outside and downstream of the facility;
- A list of spill kits and their contents; and
- A copy of the various emergency response procedures for the site.

In addition to this, the following key measures will be in place:

- The site is secured by means of exterior fencing;
- Operational staff or security staff will be present on site 24 hours a day and operational staff will be on call to alarms 24 hours a day;
- A logbook of all incidents, near misses, abnormal events, changes to procedures, significant findings of maintenance inspections will be held in the site office and be regularly updated in line with site management systems;
- Staff training will be in line with site management systems. Toolbox talks will be used to keep site personnel up to date with procedures to respond to and learn from incidents;
- Briefings will be required between staff at shift change and should be logged in the site diary; and
- A standby generator is available for contingency use in the event of power outage.

5 PROCEDURES TO RESPOND TO SPECIFIC EVENTS

5.1 Fire

In the event of a fire, the person finding the fire should:

- Immediately raise the alarm and contact emergency services – 999;
- If safe to do so and appropriate training received, fight the fire using an extinguisher and/or hose;
- Muster at muster point;
- Note if your direct route to the assembly point is blocked by fire then move away from fire to boundary fence and follow boundary fence to assembly point taking the direction away from any smoke;
- Most senior member of staff present to use visitors' book to account for all personnel on site. If person(s) is missing, staff are to search, provided it is safe to do so; and
- If the fire service is required to attend site present COSHH/MSDS information of the chemicals involved in the fire.

If Facility Site Manager is not on site, they must be contacted on their mobile. If no response a number of other emergency contact numbers can be found in Section 8 of this document. If safe to do so, reduce volume in the gas holder through use of the flare and isolate power to the respective area of the site.

All personnel, associated visitors and/or subcontractors should remain in the muster area until informed by Emergency services or Site Supervisor that it is safe to return to the site. Routine checks and tests will be undertaken and recorded in logbook as per Fire procedures. This to cover: -

- Emergency lighting;
- Fire exits and fire doors;
- Fire extinguishers;
- Air horns; and
- Fire drills.

5.2 Power Failure

There is a temporary generator onsite to sustain key functions during grid blackout scenarios. If staff are not onsite on call staff will be notified and they will attend site to switch on the temporary generator.

A biogas boiler is available on site which can utilise biogas to provide heat to the process tanks.

5.3 Gas System

In the event of a situation that could lead to gas release, further fire or explosion all gas users (CHP, Biogas Boiler and Gas Upgrading Facility) should be turned off and the remaining biogas in the system flared to a minimum level if it is safe to do so.

5.4 Spillage

In the case of any small spills (< 1 m^3) the site employee finding the spill should:

- Ensure that any personnel affected by the spillage are removed to a safe area and receive appropriate medical attention including using the emergency showers and eye wash bottles if necessary.
- Close any valves or taps as the situation dictates if safe to do so in order to stop the spill from occurring.
- Summon medical assistance if necessary (first aider and emergency services 999)
- Consult COSHH, MSDS and spill procedure, immediately contain the spill using spill kits and drain covers if necessary.
- Use spill kit material and drain blockers to contain the spillage on a surface or in a drainage system.
- Arrange for emergency tanker or specialist services to remove spilled material.
- Inform the Site Manager and give full details of the nature of the incident and chemicals involved. If the Site Manager is not on site, they may be contacted on their mobile. If no response from the Site Manager a number of other emergency contact numbers can be found in Section 8 of this document.
- Manage the spill according to COSHH and MSDS guidance.
- Use spill kit material and drain blockers to contain the spillage on a surface or in a drainage system.
- Arrange for emergency tanker or specialist services to remove spilled material.
- Inform Operations Manager of the incident and also fill out incident report form and report.

Do not wash the spill down the drain unless agreed with the Site Manager.

The Site Manager shall initiate a clean-up of spill depending on the nature of the chemical and the extent of the spill. MSDS or COSHH assessments need to be referenced for clean-up procedures. The Site Manager will contact the emergency services or NRW if required.

In the event of any large spill the clean-up should include the following steps:

- Ensure that any personnel affected by the spillage are removed to a safe area and receive appropriate medical attention including using the emergency showers and eye wash bottles if necessary.
- Close any valves or taps as the situation dictates if safe to do so.
- Summon medical assistance if necessary (first aider and emergency services 999)
- Evacuate and isolate the area and post warning notices to prevent unauthorised access.
- All personnel involved in the clean-up must wear suitable PPE worn as identified in the COSHH assessment related to the chemical involved.
- Where possible, the chemical must be prevented from entering any drainage system using appropriate containment equipment in spillage kit including drain covers.
- Any chemical contained should be transferred into spare IBCs of the same chemical and/or to a suitable bund in chemical tank area.
- Contaminated kit must then be transferred into plastic containers, sealed, identified and disposed of in line with Control and Disposal of Waste procedure.
- Any spill kit used must be replaced.
- Once the spill has been completely cleaned up, the Operations Manager should be notified.
- In the event of a major spill, an internal investigation should be carried out in line with the incident reporting procedures.

In the event of a spill of gas odorant used in the upgrading facility, the emergency response

procedure provide by Robinson Brothers is to be followed.

5.5 Injury/Illness on Site

In the case of any employee or any associated visitor and/or subcontractor suffering an injury or becoming ill, the person should:

- Take necessary actions to make the area/site safe.
- If required and appropriate training received, administer immediate first aid.
- Report the incident to the Site Manager. If the Site Manager is not on site, and the injury or illness requires medical attention, then they should either call emergency services, or if injury/illness not serious arrange transport to nearest hospital A&E.
- Complete an injury report in accident book.
- As soon as possible following the incident, either Site Manager and/or Operations Manager shall carry out an internal investigation.

5.6 Extreme Weather

In the event of an extreme weather scenario; lightening, gale force winds, torrential rain or any event deemed unsafe by Site Manager/Supervisor, all staff, visitors and contractors will be required to seek refuge. Loading/unloading will be suspended, and all vehicle engines should be switched off.

5.7 Release to Surface Water Drain

In the event that material which is unsuitable is allowed to enter the surface water drain, the outlet to the surface water drainage system will be blocked using the shut off valves on the drainage system and/or spill kit material and a tanker will be deployed to remove the material from the drainage system.

If material leaves the site that is unsuitable the NRW will be notified accordingly, and the event will be recorded according to internal incident reporting procedures.

5.8 Release of Biogas

Any incidents that involve a release of biogas will be reported to the NRW in accordance with the environmental permit. All maintenance activities will be coordinated to ensure so far as possible that biogas releases to not occur as a direct result.

In the event of a grid failure staff will isolate the site from the grid and start up the onsite generator to power facility essential equipment which will prevent further biogas release. The main control system has a 30-minute battery power backup system to allow time for the emergency generator to be deployed.

6 REPORTING

6.1 AMP Reporting

The site has formal documented incident reporting, recording and tracking procedures outlined within the management system. All incidents will be reported, categorised, and apportioned the appropriate response in line with these procedures.

7 EMERGENCY CONTACT DETAILS

7.1 Emergency Contact Details

The following structure is in place for managing any incidents onsite;

Name (inc. contact number)	Position	Deputy (inc. contact number)	Deputy Position
TBC	Site Manager	TBC	Duty Manager
Darren Smith +44 7860 533833	Snr Manager Operations	Adam Nelson +44 7403 422259	Operational Support
Stefan Weitz +44 7376 256229	Snr Manager Process	Ben Jackson +44 7834 774334	Operational Support

If there is major event the following staff are in place to assess the site and make decisions on appropriate actions to be taken. An escalation process set out in the management system hall ensure senior management are made aware of the incident.

Name	Position	Covering Staff
TBC	Site Manager	TBC
Darren Smith	Snr Manager - Operations	Operational Support
Stefan Weitz	Snr Manager - Process	Operational Support

German Generator GmbH

ALLGEMEINE DATEN - GENERAL DATA

MODELL - MODEL

Baudouin 280 S

Silent

Version - Version	Silent
PRP kVA	250,0
PRP kW	200,0
ESP kVA	275,0
ESP kW	220,0
Leistungsfaktor - Power factor	0,8
Spannung - Voltage (VAC)	400/230
Frequenz - Frequency (Hz)	50
Anzahl der Phasen - Phases	Dreiphasen - Threephases
Neutral - Neutral	Mit neutral - With neutral
Hauben - Canopy	T87
Trakrahmen-Modell - Baseframe Model	-
Kraftstofftank-Liter - Capacity (l)	265

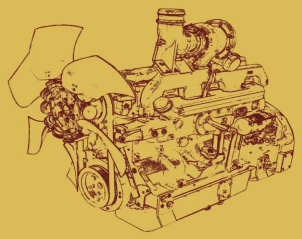
ABMESSUNGEN*-DIMENSIONS*

Laenge - Length (-L- mm)	3.800
Breite - Width (-W- mm)	1.200
Hoehe - Height (-H- mm)	2.000
Gewicht - Weight (kg)	2.700

GERAEUCHTSPEGEL - NOISE

Schalldruck - Sound press. (7mt dBA)	71,0 (+/-3)
Schall-Leistung - Sound power (dBA)	-

MOTOR-DATEN - ENGINE DATA

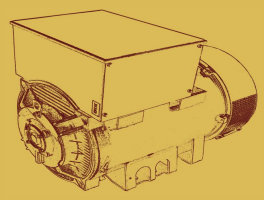


Hersteller - Brand	BAUDOUIN
Modell - Model	6M16G275/5
UpM/min - RPM	1.500
Drehzalregler - Speed regulator	Elektronisch - Electronic
Regulator-Klasse - Regulator class	G3
Elektronische-Regulation - Electronic governor	Standardmaessig - Standard
Kuehlung - Cooling	Wasser - Water
Ansaugung - Air intake	Turbo - Turbocharged
Zylinder - Cylinders	6
Hubraum-Liter - Cubic capacity (l)	9,7
Spannung DC - Voltage (VDC)	24,0
Leistung am Schwungrad PRP-PRP flywheel Power (kWm)	240,0
Leistung am Schwungrad ESP-ESP flywheel Power (kWm)	264,0
BMEP (kPa)	2.171
Gewicht - Weight (kg)	1.095
Kraftstoffverbrauch ESP (lt/std) - Fuel cons. ESP (l/h)	63,2
Kraftstoffverbrauch bei 100% (lt/std) - Fuel cons. 100% (l/h)	56,9
Kraftstoffverbrauch bei 75% (lt/std) - Fuel cons. 75% (l/h)	42,2
Kraftstoffverbrauch bei 50% (lt/std) - Fuel cons. 50% (l/h)	28,4
Kraftstoffverbrauch bei 25% (lt/std) - Fuel cons. 25% (l/h)	15,4
Kuehlfrostschutzmittel (l) - Radiator cooling liquid qty (l)	20,0
Motorfrostschutzmittel(l) - Engine cooling liquid qty (l)	22,0
Oelmenge(liter) - Oil qty (l)	30,0
Kuhlventilator (kw) - Fan loss (kW)	11,0
Irradiationwaerme - Heat to radiation (kW)	TBD
Abgaswaerme - Heat to exhaust (kW)	TBD
Kuehlfluessigkeitswaerme - Heat to coolant (kW)	TBD
Abgastemperatur - Exhaust temperature (°C)	600,0
Kuehlluftmenge - Cooling air flow (m3/min.)	415,0
Verbrennungsluftmenge - Combustion air flow (m3/min.)	18,0
Abgasmenge - Exhaust gas flow (m3/min.)	50,6
Emissionsagluft TA Luft - TA Luft emissions	N.L. - N.A.
Emissionsagluft TA Luft 2000 - TA Luft 2000 emissions	N.L. - N.A.
Emissionsagluft EPA - EPA emissions	N.L. - N.A.
Emissionsagluft EU97/68 - EU97/68 emissions	N.L. - N.A.

** Weitere Informationen auf www.GermanGenerator.com*

German Generator GmbH

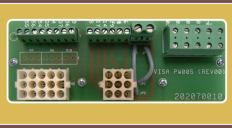
GENERATOR DATEN - ALTERNATOR DATA



Hersteller - Brand	MECC ALTE
Modell - Model	ECO38-2M/4 C
Kontinuierliche Leistung (cl. H kVA)-Cont. Pow. (H cl.kVA)	250,0
Kontinuierliche Leistung (cl. H kW)-Cont. Pow. (H cl.kW)	200,0
Leistung in stand-by - Stand by power (kVA)	275,0
Leistung in stand-by - Stand by power (kW)	220,0
Elektronische Regelung - Electronic regulator	DSR
IP Schutz - IP protection	23
Genauigkeit - Precision (+/- %)	1,0
Wirkungsgrad - Efficiency (%)	93,4
Gewicht - Weight (kg)	653

SCHALTSCHRANDKDATEN - CONTROL PANEL DATA

KLEMMLEISTE - TERMINAL BOX — TB



Schutzschaltertyp - Breaker type	Ohne Hauptschalter - No breaker
Umgebungstemperatur - Ambient Temp (°C)	-
Isolierungsschutz IP - IP Protection	-

STEUERUNG AUTOMATIK – CONTROLLER AUTOMATIC — ComAp IL4 AMF9

Version - Version	Alle - All
Strom - Current (A)	361
Schutzschaltertyp - Breaker type	400 A
Umgebungstemperatur - Ambient Temp (°C)	-
Polenanzahl - Poles nr.	4
Isolierungsschutz IP - IP Protection	-

SCHALTSCHRANK ATS - ATS PANEL — ATS

Strom - Current (A)	361
Umschalter Typ - Transfer switch type	ATS
Umgebungstemperatur - Ambient Temp (°C)	-
Polenanzahl - Poles nr.	4
Isolierungsschutz IP - IP Protection	-

STEUERUNG PARALLEL - PARALLEL CONTROL PANEL — ComAp InteliGen 200

Strom - Current (A)	361
Schutzschaltertyp - Breaker type	400 A
Umgebungstemperatur - Ambient Temp (°C)	-
Polenanzahl - Poles nr.	4
Isolierungsschutz IP - IP Protection	-

ZUBEHORETEILE - ACCESSORIES DATA

Schalldaempfer Typ - Silencer model	-
Durchmesser Schalldaempfer - Silencer diameter (mm)	-
Abgaskompensator-Modell - Bellows	-
Abgaskompensator Durchmesser - Flexible pipe diam. (mm)	-
Batteriegroesse - Battery capacity (Ah)	145
Menge Batterien - Battery qty (nr)	2

CE

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Machinery directive: 2006/42/EC - Low Voltage Directive: 2014/35/UE - CEM Directive: 2014/30/UE - Noise directive:2000/14/EC
Ratings definitions according to ISO8528-1:2005
Reference conditions: Altitude: 100 m / Temperature: 30 °C / Relative humidity: 30%.
Standards Application, ratings and performance of generating set : ISO 8528 – 1 à 10
Application, ratings and performance of generating set : EN 12601

Datas can experience variations up to ±5%

8 NOISE ENVIRONMENT AND VIBRATION

8.1 INTRODUCTION

8.1.1 This Technical Chapter of the ES considers the potential for the construction and operation of the proposed development to impact upon the acoustic environment at the nearby noise-sensitive residential receptors. The chapter describes the scope, relevant legislation, assessment methodology and the baseline conditions existing around the application site.

8.1.2 The chapter assesses the potential environmental effects the proposals, which have been described in Chapter 3 and can be summarised as a municipal solid waste (MSW) and commercial and industrial waste (C&I) recycling and recovery plant, would have on the baseline environment. Where necessary, the chapter also considers mitigation measures to prevent, reduce or offset any significant adverse impacts and the likely residual effects after the measures have been employed.

8.1.3 Technical terms and references are used within this Technical Chapter. To aid the reader a Glossary of Acoustic Terminology is included at **Appendix 8.1**.

8.2 ASSESSMENT APPROACH

Methodology

8.2.1 The noise assessment has been undertaken in accordance with national guidance and the relevant standards and considers the likely noise levels that would be generated by the proposed development at the identified nearby sensitive receptors.

8.2.2 The facility would have a core working day of 06:00 to 20:00 hours 5 days per week. However, some elements of the development would be operational 24-hours 7-days per week, i.e. biological processes, biofilter, generator, etc. Heavy good vehicle movements would also take place between 06:00 and 16:00 hours.

8.2.3 It should be noted that the application site is located within an already heavily industrialised area with large industrial (including the Parc Adfer ERF), power and transport infrastructure (road and rail) development closer to the identified receptor than the proposed development.

8.2.4 An assessment has been made of the baseline situation and the potential impacts of the proposed development.

8.2.5 Noise and vibration levels generated during construction have been calculated and assessed in accordance with the guidance contained within BS 5228:2009+A1:2014 (Parts 1 and 2).

8.2.6 Noise levels generated during site operations have been calculated using the calculation methodology outlined in ISO 9613-2 with the resulting predicted sound rating levels assessed in accordance with the methods outlined in BS 4142:2014.

8.2.7 Noise levels generated by HGV movements beyond the site boundary have been calculated using the haul route methodology contained in BS 5228-1:2009+A1:2014 and the potential impact assessed as a change in the prevailing ambient noise levels.

8.2.8 All noise predictions made as part of this assessment have been made using the proprietary noise modelling software SoundPLAN. The noise models have been

constructed utilising Google Earth geo-referenced 1:1 scaled aerial photography and noise source data supplied by the client or, in the case of construction equipment, from manufacturers' datasheets or BS 5228-1:2009+A1:2014.

Assessment of Significance

8.2.9 The following terminology has been used in the assessment to define effects:

- Adverse – detrimental or negative effects to an environmental resource or receptor;
- Negligible – imperceptible effects to an environmental resource or receptor; or
- Beneficial – advantageous or positive effect to an environmental resource or receptor.

8.2.10 Where adverse or beneficial effects have been identified, these have been assessed against the following significance scale:

- Negligible – no discernible change in the baseline environmental conditions, within margins of error of measurement;
- Minor – slight, very short or highly localised effect of no significant consequence;
- Moderate – limited effect (by extent, duration or magnitude), which may be considered significant; or
- Major – considerable effect (by extent, duration or magnitude), or more than local significance or in breach of recognised acceptability, legislation, policy or standards.

8.2.11 In accordance with the principles of environmental impact assessment, the sensitivity of receptors (existing and proposed) to noise or vibration impacts during either construction or operational phases have been defined in **Table 8.1**.

Table 8.1: Sensitivity/Value of Receptor

Sensitivity/Value of a Receptor	Description
High	Residential premises, residential properties, educational buildings, medical facilities, care homes, concert halls/theatres, specialist commercial premises
Medium	Places of worship, community facilities, offices
Low	Other commercial/retail premises

8.2.12 The definition for the magnitude of impact for construction noise, construction vibration and industrial noise are given in Tables 8.3, 8.5 and 8.9 respectively.

8.2.13 The significance of effect resulting from each individual potential impact type above is derived from the magnitude of the impact and the sensitivity or value of the affected receptor using the matrix presented in **Table 8.2**.

Table 8.2: General Approach for Determining Significance

MAGNITUDE	**High**	Moderate	Moderate/Major	Major
	Medium	Minor/Moderate	Moderate	Moderate/Major
	Low	Minor	Minor/Negligible	Moderate
	Very Low	Negligible	Negligible	Negligible
		Low	**Medium**	**High**
		SENSITIVITY		

8.2.14 Based on professional judgement, a 'significant' effect with regard to Environmental Impact Assessment Regulations 2017 (hereinafter referred to as 'the EIA Regulations') is considered to be one of moderate significance or above. Effects classed from negligible to minor adverse are considered insignificant.

Legislative and Policy Framework

Planning Policy Wales (Edition 9, November 2016)

8.2.15 The 9th edition of Planning Policy Wales, published in November 2016, sets out the land use planning and sustainability policies of the Welsh Government and is supplemented by a series of Technical Advice Notes. Technical Advice Note (TAN) 11 relates to noise.

Technical Advice Note (TAN) 11: Noise (1997)

8.2.16 Technical Advice Note (TAN) 11: Noise states that Local Planning Authorities must ensure that noise generating development does not cause an unacceptable degree of disturbance. In the case of industrial development, for example, the character of noise should be taken into account as well as its level. Sudden impulses, irregular noise or noise which contains a distinguishable continuous tone would require special consideration.

8.2.17 TAN11 states that noise from industrial developments can be assessed in accordance with the guidance contained in BS 4142:1990. It should be noted that BS 4142:1990 has been superseded and updated twice since the publication of TAN11, by BS 4142:1997 and more recently by BS 4142:2014. The latter of these standards has been used for this assessment.

Flintshire Unitary Development Plan

8.2.18 The Flintshire County Council website states that:

"The aim of the Flintshire Unitary Development Plan (FUDP) is to provide a framework for making rational and consistent decisions on planning applications and to guide development to appropriate locations".

8.2.19 Chapter 19 of the Interactive Unitary Development Plan for Energy, Waste and Pollution outlines the County Councils' policies.

8.2.20 Paragraph 19.50 states:

"The Welsh Government's objectives (para 13.1.2 Planning Policy Wales) are to:

- Maximise environmental protection for people, natural and cultural resources, property and infrastructure; and

- Prevent or manage pollution and promote good environmental practice.

8.2.21 EWP13 refers to nuisance and states:

"Development which is sensitive to noise, vibration, odour, dust or light pollution and which is proposed near to existing sources of nuisance, such as railways, roads, airfields or industrial activities, will be permitted only if the developer is able to demonstrate that sufficient measures will be taken to mitigate any potential adverse effects.

Proposals which are likely to cause an increase in noise, vibration, odour or light pollution will be permitted only if the developer has demonstrated that there will be no detrimental impact on users outside the boundary of the site, who may be sensitive to such nuisance".

British Standard 5228:2009+A1:2014

8.2.22 British Standard 5228:2009+A1:2014 '*Code of practice for noise and vibration on construction and open sites*' Part 1: Noise outlines methodologies for predicting noise levels arising from a wide variety of construction and related activities.

8.2.23 Noise levels generated by construction operations and experienced at local receptors will depend on a number of variables, the most important of which are:

- The sound power outputs of the processes and/or plant;
- The periods of operation of the processes and/or plant;
- The distance between the source of the noise and the receptor locations;
- The presence of screening by earth mounds, buildings or topographical features;
- The potential reflection of sound; and
- The attenuation provided by soft ground between the source of noise and the receptor locations.

8.2.24 BS 5228-1:2009+A1:2014 gives several examples of acceptable limits for construction noise. The most simplistic being based upon the breach of fixed noise limits. BS 5228-1:2009+A1:2014 states in Paragraph E.2:

"Noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with the windows shut".

8.2.25 The paragraph goes on to state:

"Noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the occupied room closest to the site boundary should not exceed:

- 70 decibels (dBA) in rural, suburban areas away from main road traffic and industrial noise;
- 75 decibels (dBA) in urban areas near main road in heavy industrial areas.

These limits are for daytime working outside living rooms and offices".

8.2.26 The application site is located in an area which is predominantly industrial in nature with receptors located in both rural and urban areas therefore it is considered that the 70dB(A) limit should apply for receptor locations to the north of the application in 'rural' areas and the 75dB(A) limit should apply for receptor location to the south of the application site in 'urban' areas.

8.2.27 The magnitude of the impact of construction noise is classified in accordance with the descriptors in **Table 8.3**.

Table 8.3: Construction Noise Magnitude of Impact

Magnitude of Impact	Daytime $L_{Aeq,T}$, dB	
	Rural	Urban
High	>73	>78
Medium	70 – 73	75 – 78
Low	60 - 70	65 – 75
Very Low	<60	<65

8.2.28 BS 5228:2009+A1:2014 Part 2: Vibration gives recommendations for basic methods of vibration control relating to construction sites where work activities/operations generated significant levels of vibration.

8.2.29 BS 5228:2009-2+A1:2014 indicates that the majority of people are known to be very sensitive to vibration with the threshold of perception being typically in the peak particle velocity (PPV) range 0.14mms^{-1} to 0.30mms^{-1}. Vibration levels above these values can cause disturbance. The guidance on the effects of vibration outlined in BS 5228:2009-2+A1:2014 are shown in **Table 8.4**.

Table 8.4: Guidance on the Effects of Vibration

Vibration Level, mms^{-1}	Effect
0.14	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.30	Vibration might be just perceptible in residential environments.
1.00	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10.00	Vibration is likely to be intolerable for any more than a very brief exposure at this level.

8.2.30 The magnitude of the impact of construction vibration is classified in accordance with the descriptors in **Table 8.5**.

Table 8.5: Construction Vibration Magnitude of Impact

Magnitude of Impact	Level of Vibration
High	>10.00
Medium	0.30 – 1.00
Low	0.14 – 0.30
Very Low	<0.14

British Standard 7385:1993

8.2.31 British Standard 7385:1993 '*Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration*' provides guidance on the transient vibration values for cosmetic damage in buildings and is shown in **Table 8.6**.

Table 8.6: Transient Vibration Guide Values for Cosmetic Damage

Type of Building	**Peak Component Particle Velocity in Frequency Range of Predominant Pulse**	
	4Hz to 15Hz	**15Hz and above**
Un-reinforced or light framed structures, residential or light commercial buildings	15mms^{-1} at 4Hz increasing to 20mms^{-1} at 15Hz	20mms^{-1} at 15Hz increasing to 50mms^{-1} at 40Hz and above

8.2.32 BS 7385-2:1993 states that:

"A building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive".

British Standard 4142:2014

8.2.33 British Standard 4142:2014 '*Methods for rating and assessing industrial and commercial sound*' provides a methodology for the rating and assessing of sound associated with both industrial and commercial premises. The purpose of the Standard is clearly outlined in the opening section where it states that the method is appropriate for the consideration of:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment;
- Sound from loading and unloading of goods and materials at industrial and/or commercial premises; and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

8.2.34 The Standard also states that 'Sound of an industrial and/or commercial nature does not include sound from the passage of vehicles on public roads and railway systems'.

8.2.35 The Standard is based around the premise that the significance of the noise impact of an industrial/commercial facility can be derived from the numerical subtraction of the background noise level (not necessarily the lowest background level measured, but the typical background of the receptor) from the measured/calculated rating level of the specific sound under consideration. This comparison will enable the impact of the specific sound to be concluded based upon the premise that typically "**the greater the difference, the greater the magnitude of impact**". This difference is then considered as follows:

- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context; and

- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact.

8.2.36 BS 4142:2014 further states that "where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact", again depending on the context of the site. The Standard further qualifies the assessment protocol by outlining conditions to the comparative assessment and stating that "not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact", thus implying that all sites should be assessed on their own merits and specifics.

8.2.37 The standard quantifies the typical reference periods to be used in the assessment of noise as shown in **Table 8.7**.

Table 8.7: BS 4142:2014 Typical Reference Periods for Noise Assessments

	Period (hrs)	**Assessment Period**
Typical Daytime	07:00 – 23:00	1-hr assessment period
Typical Night-time	23:00 – 07:00	15-min assessment period

8.2.38 The Standard outlines methods for defining appropriate 'character corrections' within the rating levels to account for tonal qualities, impulsive qualities, other sound characteristics and/or intermittency. These are a) the Subjective Method, b) the Objective Method for Tonality and c) the Reference Method. The Standard notes that, where multiple features are present, the corrections should be added in a linear fashion to the specific sound level.

8.2.39 The Subjective Method is based on the rating correction shown in **Table 8.8**.

Table 8.8: BS 4142:2014 Subjective Method Rating Corrections

Level of Perceptibility	**Corrections**			
	Tonal	**Impulsivity**	**Other sound characteristics**	**Intermittency**
No perceptibility	+0dB	+0dB	Where neither tonal nor impulsive but clearly identifiable +3dB	If intermittency is readily identifiable +3dB
Just perceptible	+2dB	+3dB		
Clearly perceptible	+4dB	+6dB		
Highly perceptible	+6dB	+9dB		

8.2.40 The magnitude of the impact for industrial noise is classified in accordance with the descriptors in **Table 8.9**.

Table 8.9: Magnitude of Impact for Industrial Noise

Magnitude of Impact	BS 4142:2014 Descriptor	Rating Level – Background Level, dB
High	No BS4142:2014 descriptor for this level of magnitude	>15
Medium	Indication of a significant adverse impact depending on the context	+10 approximately
Low	Indication of an adverse impact depending on the context	+5 approximately
Very Low	Indication of a low impact depending on the context	≤0

ISO 9613

8.2.41 The levels of noise generated by the proposed development have been predicted using the calculation methodology set out in ISO 9613 '*Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*'. The methodology considers the distance between the sources and the receptors and applies the amount of attenuation due to atmospheric absorption and other site-specific characteristics.

8.2.42 The methodology assumes downwind propagation, i.e. a wind direction that assists the propagation of noise from the source to all receptors.

Scoping Criteria

8.2.43 Flintshire County Council were consulted regarding the proposed assessment methodology for the proposed development. The Pollution Control Officer agreed the assessment methodology described above and requested that an additional receptor, in addition to those used for the baseline monitoring, be considered namely Dee View Road, Connah's Quay.

8.2.44 Based on the consultation, the following receptor locations have been considered within the assessment. The receptors are shown on **Figure 8.1**:

- Puddington Lane, Puddington;
- Sealand Avenue, Garden City;
- Bridge Street, Shotton;
- Station Road, Burton; and
- Dee View Road, Connah's Quay

8.2.45 No specific criteria with regards to target noise levels were advised.

Extent of Study Area

8.2.46 The study area for the noise and vibration assessment includes land to the north of the A548 Weighbridge Road as far as the village of Burton and includes the village of Puddington to the northeast, as far as Garden City to the southeast, as far as Shotton to the south and as far as Connah's Quay to the southwest.

Limitations to the Assessment

8.2.47 The assessment does not include the attenuation provided by any intervening buildings between the site and receptor locations and therefore represents a worst-case situation.

8.2.48 The baseline noise monitoring was undertaken prior to the consultation response from Flintshire County Council and therefore baseline noise monitoring at Dee View Road was not undertaken. It is considered that the baseline noise data gathered at Bridge Street would not be dissimilar to that at Dee View Road and is therefore considered suitable for use for the assessment.

8.2.49 The assessment is based on a range of measurements, a system of calculations and noise predictions. As such, this assessment attempts to quantify fluctuations in air pressure and is subject to the effects of meteorology, physical and perceived anomalies, tolerances within the measuring and monitoring equipment and accuracy margins within the noise modelling software. In the interests of repeatability, this assessment must be considered as being affected by common factors involved in the measurement and calculation of noise propagation.

8.2.50 All measured values, outcomes and assumptions are subject to a margin of uncertainty. This has been quantified and assessed as follows:

- Rounding errors – systematic tolerance of +/-1dB;
- Type 1 sound level meter – operational tolerance of +/-1.1dB;
- Meteorology – allowance of +/-1.9dB; and
- Noise modelling software – operational accuracy of +/-2.1dB.

8.2.51 The most influential uncertainty factors for the assessment of noise are considered to be equipment tolerances, meteorology and software accuracy. A root-sum-square statistical average has been used to provide an overall margin of uncertainty of +/-3dB.

8.3 BASELINE CONDITIONS

Site Description and Context

8.3.1 The proposed application site is located off Weighbridge Road, Deeside and is centred at grid reference SJ 31114 71232 approximately. The site is located between the Flintshire Bridge 400kV Converter Station to the south, UPM Shotton Paper Mill to the west, the recently approved Parc Adfer Energy Recovery Facility to the north and a railway line and Deeside Industrial Park to the east. The site location is shown in **Figure 8.2**.

8.3.2 The application site is situation in an already heavily industrialised area with several large works (Paper Mill, Steel Works, Deeside Industrial Park, etc.) in the area which are located closer to the nearby noise-sensitive receptors than the proposed development. There are also major transport routes in the vicinity including the A548 Shotwick Road, A494 and A550 main roads and the railway passing adjacent to the site.

Baseline Survey Information

8.3.3 Environmental noise surveys were undertaken on Thursday 26th and Friday 27th October 2017 to capture the prevailing noise climate at accessible noise-sensitive locations near to the application site.

8.3.4 The baseline noise surveys were carried out in accordance with the requirements of BS 7445:1996 *Description and measurement of environmental noise*', by a suitably qualified acoustic consultant.

8.3.5 The surveys were undertaken to cover both the daytime and night-time periods at the following locations:

- ST01 – Puddington Lane, Puddington, 2,700m NE of the site;
- ST02 – Sealand Avenue, Garden City, 2,300m SE of the site;
- ST03 – Bridge Street, Shotton, 2,150m SW of the site; and
- ST04 – Station Road, Burton, 3,450 N of the site.

8.3.6 The noise monitoring equipment used during the surveys is shown in **Table 8.10**. The meters were set to 'fast' time weighting and to record the following noise level indices:

- $L_{Aeq,T}$ – the A-weighted equivalent continuous noise level over the measurement period;
- L_{A90} – the A-weighted noise level exceeded for 90% of the measurement period and used to describe the background noise level;
- L_{A10} – the A-weighted noise level exceeded for 10% of the measurement period and used to describe road traffic noise; and
- L_{Amax} – the recorded maximum A-weighted noise level over the measurement period.

Table 8.10: Noise Monitoring Equipment

Equipment Description	Serial No.	Calibration Date
01dB Solo Type 1 sound level meter	065445	23/03/2016
01dB Solo Type 1 sound level meter	065446	23/03/2016
Cirrus CR:515 acoustic calibrator	59522	05/01/2016

8.3.7 The sound level meters were field calibrated, using an electronic calibrator, prior to commencement and upon completion of the surveys, no drift in calibration was observed. The external calibration documentation for the equipment used is available upon request.

Weather Conditions

8.3.8 Weather conditions during the daytime were suitable for environmental noise measurement it being dry with dry road surfaces and 100% cloud cover. Wind speeds were measured at 0.2ms^{-1} with no particularly direction discernible. The temperature remained at around 12°C throughout the surveys.

8.3.9 Weather conditions during the night-time were also suitable for environmental noise measurement it being dry with dry road surfaces and 15% cloud cover. Wind speeds were measured at 1.3ms^{-1} from the north. The temperature remained at around 8°C throughout the surveys.

Survey Results

8.3.10 The results of the baseline surveys are summarised in **Table 8.11** and can be found in full in **Appendix 8.11.**

Table 8.11: Summary of Baseline Survey Results, dB

Location	Period	$L_{Aeq,T}$	L_{Amax}	L_{A90}	L_{A10}
ST01	Daytime	50.2	69.9	35.7	52.2
	Night-time	31.7	50.9	26.2	34.0
ST02	Daytime	49.5	72.5	39.1	47.3
	Night-time	42.6	55.0	39.7	44.5
ST03	Daytime	55.9	82.2	38.0	49.8
	Night-time	55.6	83.8	38.7	42.0
ST04	Daytime	52.7	76.8	29.8	46.8
	Night-time	29.9	48.0	21.6	31.9

Subjective Field Monitoring Notes

8.3.11 **ST01 Puddington Lane** – the daytime noise climate at this location consisted of background road traffic, occasional passing traffic on Puddington Lane, aircraft and birdsong. The night-time noise climate comprised background road traffic and rustling of leaves in nearby trees.

8.3.12 **ST02 Sealand Avenue** – the daytime noise climate at this location consisted of background road traffic, aircraft, birdsong and a passing helicopter. Reversing sirens from Garden City Industrial Estate were heard occasionally and a ringing noise from Deeside Industrial Park was also audible. The night-time noise climate was dominated by background traffic noise with a constant ringing noise from Deeside Industrial Park.

8.3.13 **ST03 Bridge Street** - the daytime noise climate at this location consisted of background road traffic, aircraft, passing trains and birdsong. A loud intermittent ringing noise from Deeside Industrial Park was also audible. The night-time noise climate was dominated by background traffic noise, a passing train was noted and a constant low-level hum from Deeside Industrial Park was also audible.

8.3.14 **ST04 Station Road** – the daytime noise climate comprised road traffic passing the measurement position, cyclists, pedestrians, birdsong and aircraft. The night-time noise climate comprised background road traffic and the rustling of leaves in nearby trees.

8.3.15 For the purpose of the assessment it is assumed that all receptors have a high sensitivity in accordance with Table 8.1.

8.4 ASSESSMENT OF LIKELY SIGNIFICANT EFFECTS

Construction

Construction Noise

8.4.1 Noise levels generated by construction works will cause some disturbance to those living nearby. However, disruption due to construction works is a localised phenomenon and is temporary in nature. In general, only people living within 100m to 200m of the site boundary are likely to be adversely affected by construction noise. In the case of the proposed development, the nearest residential receptor is located approximately 2km to the southeast of the site boundary.

8.4.2 It should be noted that the adjacent Parc Adfer ERF to the north of the site is currently under construction and any construction related noise emissions from the proposed development are unlikely to be of a magnitude that would exceed those already being generated in the area.

8.4.3 Although the nearest receptors are more than 2km from the sites boundaries, an estimate of the likely effects of construction from construction activities has been made for those properties described within the 'Baseline Survey Information' paragraphs.

8.4.4 Details of the construction program and activities are unknown at this stage, for the purpose of this assessment construction activities are based on generally established site preparation and building construction procedures. Typical construction plant and equipment likely to used include earthmoving plant, such as excavators, bulldozers and loading shovels, and other equipment such as concrete plant and cranes. **Table 8.12** summaries the typical plant used for this assessment.

Table 8.12: Summary of Construction Equipment and Sound Power Levels

Equipment Description (or similar)	Sound Power Level L_{WA}, dB
Bulldozer (CAT D6N)	110
Concrete Mixer Truck	108
Mobile Crane (Hitachi 400R)	90
Piling Rig	115
Excavator (CAT330F)	105
Dump Truck (Volvo A30G)	111
Grader (CAT16M3)	109
Vibratory Roller (HAMM HD14)	106
Telescopic Handler (10t)	99
Various Hand Tools (total)	98

8.4.5 Construction operations would be undertaken during the daytime only therefore the noise predictions have been made to ground floor level of the residential property façade facing the site. The predictions are based on downwind propagation over 100% hard ground and over a 100% on-time for all plant to provide a worst-case assessment.

8.4.6 Two scenarios have been modelled, considered to be representative of typical phases of construction works:

- Earthworks
  2no. excavators, 1no. bulldozer, 1no. grader, 2no. dumpers, 1no. vibratory roller
- Building Works
  2no. cranes, 2no. concrete trucks, 1no. piling rig, 1no. telescopic handler, hand tools.

8.4.7 Based on experience with similar sites, it is considered that HGV traffic movements associated with construction works would be no greater than those associated with operations, therefore it is assumed that during a worst-case 1-hour period there would be 11no. two-way HGV movements delivering materials to the site. The

assessment is based on average vehicle speeds of 60kph between the A494 and the site entrance.

8.4.8 The predicted noise levels generated by construction works are set out in **Table 8.13**. The predicted noise levels do not include any attenuation provided by intervening buildings, etc., between the sources and the receptors and therefore presents a worst-case situation.

Table 8.13: Predicted Construction Noise Levels

Location	Construction Scenario	Predicted Noise Level, $L_{Aeq,T}$, dB	Overall Noise Level, $L_{Aeq,T}$, dB
Puddington Lane	Earthworks	32.2	34.8
	Building Works	31.8	
Sealand Avenue	Earthworks	32.9	35.6
	Building Works	32.5	
Bridge Street	Earthworks	33.7	36.4
	Building Works	33.2	
Burton Point Farm, Station Road	Earthworks	29.9	32.5
	Building Works	29.5	
Dee View Road	Earthworks	32.8	35.4
	Building Works	32.3	

8.4.9 Table 8.13 shows that worst-case predicted noise levels generated by construction operations would be well within the 70dB $L_{Aeq,T}$ noise limit adopted for rural areas and the 75dB $L_{Aeq,T}$ noise limit adopted for urban areas. This would indicate that construction noise would have a **very low magnitude of impact** and combined with the receptor sensitivity of high, would result in an impact of **negligible significance**, **i.e. an insignificant effect**.

8.4.10 Based on the above, it is considered that mitigation measures to reduce construction noise levels at the nearest residential receptors are un-necessary.

Construction Vibration

8.4.11 It is considered that the potential source of vibration during the construction works would relate to piling operations. It is not known at this stage whether piling would be required, nor which method of piling would be utilised if required.

8.4.12 Predictions have been made assuming that driven sheet piling techniques would be used with ground conditions being stiff clay/dense sand include clay bands. A nominal driving energy of 20kJ per blow and the vibration level calculated at refusal as a worst-case situation. The calculations are based on the methodology outlined in Table E.1 of BS 5228-2:2009+A1:2014 for percussive piling. The results are shown in **Table 8.14**.

Table 8.14: Predicted Construction Vibration Levels

Location	Distance from Piling Location to Receptor	Predicted Vibration Level, mms^{-1}
Puddington Lane	2,525m	0.03
Sealand Avenue	2,325m	0.03
Bridge Street	2,160m	0.03
Burton Point Farm	2,975m	0.02
Dee View Road	2,400m	0.03

8.4.13 The results in Table 8.14 show that predicted vibration levels from construction operations would be well below the level which might be just perceptible in the most sensitive situations. This would indicate that construction vibration would have a **very low magnitude of impact** and combined with the receptor sensitivity of high, would result in an impact of with **negligible significance**, **i.e. an insignificant effect**.

8.4.14 Based on the above, it is considered that mitigation measures to reduce construction noise levels at the nearest residential receptors are un-necessary.

Operation

8.4.15 The operational noise effects associated with the proposed development are anticipated to include the following:

- Fixed plant, i.e. generator, building breakouts, etc.; and
- Site vehicle movements, i.e. HGV and staff vehicle movements.

8.4.16 The development proposals include:

- Main building comprising a waste reception hall, sorting hall, a RDF hall and offices;
- Diesel generator and biofilter;
- Tank Farm comprising digester tanks, acetogenic tanks, balance tank, biogas methanogenic tanks, laboratory and dewatering waste water treatment system;
- Maintenance depot/fuel and gas storage;
- Weighbridge and wheel wash; and
- Internal road network and separate car parking and bin storage areas.

8.4.17 The expected noise emission levels generated by operations at the proposed development are detailed in **Table 8.15**. All noise emission data is either supplied by the client (taken from noise assessments for similar plant), or taken from manufacturers technical data sheets or the tables contained in BS 5228-1:2009+A1:2014.

Table 8.15: Summary of Operational Plant Noise Emission Levels

Equipment Description (or similar)	Sound Power Level, dB L_{WA}	No.
HGV*	105	106 (per day)
Staff vehicles (at start/end of day)*	73	40
RDF Hall (internal reverberant noise level)*	78	1
Main Plant (internal reverberant noise level)*	78	1
Tank Farm Reactor*	85	1
Generator*	98	1

* Noise emission data taken from Heggies report ref:10-6701-R1 Rev 3 (Lucas Heights Alternative Waste Technology Facility Noise Assessment)

8.4.18 Details of the building construction materials are not yet confirmed. However, it has been assumed that any buildings would be constructed as a 1.0mm thick single-skin trapezoidal plastic-coated sheet steel over steel portals fitted with standard roller shutter doors both assumed to give a sound reduction, R_W, of 25dB.

8.4.19 Noise levels generated by the operation of the biomass facility have been predicted for the daytime (07:00 to 23:00 hours) and night-time (23:00 to 07:00 hours) periods. Daytime operations include operations within the main and RDF buildings, generator, other external fixed plant operation and traffic movements within the site boundary. Night-time operations include generator and other external fixed plant operations only.

8.4.20 Predictions have been made to a height of 1.5m during the daytime to represent the normal height of a ground floor receptor and to a height of 4m during the night-time to represent the height of a bedroom window. **Table 8.16** details the predicted specific sound levels at the site facing façade of each receptor identified. The resulting noise contours are shown on **Figure 8.3**.

Table 8.16: Predicted Operational Specific Sound Levels

Location	Period (location)	Specific Sound Level, $L_{Aeq,1hr}$, dB
Puddington Lane	Daytime	25.4
	Night-time	25.2
Sealand Avenue	Daytime	18.2
	Night-time	16.2
Bridge Street	Daytime	14.8
	Night-time	5.7
Burton Point Farm, Station Road	Daytime	12.1
	Night-time	9.6
Dee View Road	Daytime	13.0
	Night-time	2.5

8.4.21 It is expected that any acoustic feature content of the sound sources would not be perceptible at the nearby receptor locations due to the high separation distances

therefore no feature correction penalties have been applied. Therefore, the sound rating level would be equal to the specific sound level in this instance.

8.4.22 A comparative assessment has been undertaken in accordance with the guidance contained in BS 4142:2014 to determine the potential impact of the predicted sound rating levels at the nearby identified receptors upon the prevailing background noise level. It is noted that BS 4142:2014 assessments are undertaken using whole dB values with 0.5dB being rounded up. **Table 8.17** details the results of the assessment.

Table 8.17: BS 4142:2014 Noise Assessment

Location	Period	Sound Rating Level, $L_{Aeq,1hr}$, dB	Background Sound Level $L_{A90,T}$, dB	Level Over Background dB
Puddington Lane	Daytime	25	36	-11
	Night-time	25	26	-1
Sealand Avenue	Daytime	18	39	-21
	Night-time	16	40	-24
Bridge Street	Daytime	15	38	-23
	Night-time	6	39	-33
Burton Point Farm, Station Road	Daytime	12	30	-18
	Night-time	10	22	-12
Dee View Road	Daytime	13	38	-25
	Night-time	3	39	-36

8.4.23 Table 8.17 shows that the predicted sound rating levels would be significantly below the prevailing background noise levels at all locations during both the daytime and overnight. The exception would be at Puddington Lane overnight where the sound rating level would be 1dB below the prevailing background noise level. This would indicate that operational noise would have a **very low magnitude of impact** and combined with the receptor sensitivity of high, would result in an impact of with **negligible significance**, **i.e. an insignificant effect**.

Site Related Traffic

8.4.24 The former Department of Transport document 'Calculation of Road Traffic Noise' (CRTN, 1988) suggests that calculations of noise for low traffic flows below 50 vehicles per hour or 1000 vehicles per 18-hour day are unreliable and measurement should be taken when evaluating such cases. However, as the proposed development is not operational, the noise levels generated by HGV movements and staff vehicle movements have been predicted using the haul road method outlined in BS 5228-1:2009+A1:2014. The impact of noise from site-related traffic movements has been assessed as a change in ambient noise levels.

8.4.25 The noise levels generated by site related traffic movements have been calculated for a worst-case situation when staff vehicle movements and HGV movements take place during the same 1-hour period at the start of the working day.

8.4.26 Traffic movement information supplied by the Transport Consultant indicated that during a worst-case 1-hour period there would be 11no. two-way HGV movements

and 40no. one-way staff vehicle movements. The assessment is based on average vehicle speeds of 60kph between the site entrance and the A494.

8.4.27 The results of the assessment are shown on **Table 8.18** and **Table 8.19**.

Table 8.18: Predicted Noise Levels from Site-related Traffic Movements

Location	Predicted dB $L_{Aeq,1hr}$
Puddington	24.4
Sealand Avenue	26.1
Bridge Street	22.0
Burton Point Farm	20.4
Dee View Road	20.1

Table 8.19: Predicted Change in Ambient Noise Levels from Site-related Traffic Movements

Location	Ambient Noise Level, dB $L_{Aeq,T}$		Change
	Existing	Predicted Future	
Puddington	50.2	50.2	0
Sealand Avenue	49.5	49.5	0
Bridge Street	55.9	55.9	0
Burton Point Farm	52.7	52.7	0
Dee View Road	55.9	55.9	0

8.4.28 Table 8.19 shows that site related traffic movements would not change the ambient noise levels at the identified sensitive receptors close to the site therefore the significance of the impact is negligible. This would indicate that site related traffic movements would have a **very low magnitude of impact** and combined with the receptor sensitivity of high, would result in an impact of with **negligible significance**, **i.e. an insignificant effect**.

8.5 MITIGATION, ENHANCEMENTS AND RESIDUAL EFFECTS

Mitigation by Design

8.5.1 The proposed biomass facility is located within an area which includes significant industrial development including steelworks, power supply infrastructure, manufacturing plants, waste recovery facilities and transport infrastructure. The proposed facility is also located at significant distance from the nearest sensitive receptors.

8.5.2 The main operational processes have been designed to take place within buildings with external fixed plant located behind buildings and/or tanks which would provide some degree of attenuation.

Additional Mitigation

8.5.3 The assessment has shown that noise levels generated by the proposed development would not lead to adverse impacts at the nearby sensitive receptors with the

significance of impact being negligible in all instances. Therefore, additional mitigation is not considered necessary.

8.5.4 **Table 8.20** details the mitigation strategy for noise.

Table 8.20: Mitigation

Ref	Measure to avoid, reduce or manage any adverse effects and/or to deliver beneficial effects	How measure would be secured		
		By Design	By S.106	By Condition
1	Site location	X		
2	Internalisation of operations	X		
3	Generator housed with an acoustic container/enclosure	X		

Enhancements

8.5.5 The assessment has shown that predicted sound rating levels would remain below the prevailing background noise level at all locations and therefore there is no need to apply any enhancements to the design/layout of the site.

8.5.6 However, should the applicant feel minded to provide enhancements, it is considered that the main contributor to the overall noise emissions from the site is the containerised generator. Upgrading the acoustic container to meet a noise level of 75dB at 1m would reduce noise levels at the nearby receptors.

Residual Effects

8.5.7 By enhancing the acoustic performance of the generator container noise emission levels from the site would be reduced during both the daytime and night-time periods. The results of the enhancements are shown in **Table 8.21**.

Table 8.21: Predicted Enhanced Operational Specific Sound Levels

Location	Period (location)	Specific Sound Level, $L_{Aeq,1hr}$, dB
Puddington Lane	Daytime	15.4
	Night-time	12.2
Sealand Avenue	Daytime	14.3
	Night-time	3.2
Bridge Street	Daytime	14.3
	Night-time	0
Burton Point Farm, Station Road	Daytime	9.8
	Night-time	0
Dee View Road	Daytime	12.6
	Night-time	0

8.5.8 The BS 4142:2014 has been undertaken for the enhancements to the generator container. The results are shown in **Table 8.22**.

Table 8.22: BS 4142:2014 Noise Assessment

Location	Period	Sound Rating Level, $L_{Aeq,1hr}$, dB	Background Sound Level $L_{A90,T}$, dB	Level Over Background dB
Puddington Lane	Daytime	15	36	-21
	Night-time	12	26	-14
Sealand Avenue	Daytime	14	39	-25
	Night-time	3	40	-37
Bridge Street	Daytime	14	38	-24
	Night-time	0	39	-39
Burton Point Farm, Station Road	Daytime	10	30	-20
	Night-time	0	22	-22
Dee View Road	Daytime	13	38	-25
	Night-time	0	39	-39

8.5.9 Table 8.17 shows that the predicted sound rating levels would be significantly below the prevailing background noise levels at all times indicating that the specific sound would have a low impact. This would indicate that residual effects would have a **very low magnitude of impact** and combined with the receptor sensitivity of high, would result in an impact of with **negligible significance**, **i.e. an insignificant effect**.

8.6 CUMULATIVE AND IN-COMBINATION EFFECTS

8.6.1 **Table 8.23** details the cumulative effects of the development proposals and pre-existing third-party developments in the area over the daytime and night-time periods. The cumulative noise levels have been assessed against the existing ambient noise levels.

Table 8.23: Predicted Change in Ambient Noise Levels from Cumulative Noise Levels

Location	Period	Ambient Noise Level, dB $L_{Aeq,T}$		Change
		Existing	Predicted Future	
Puddington	Day	50.2	50.2	0
	Night	31.7	32.5	+0.8
Sealand Avenue	Day	49.5	49.5	0
	Night	42.6	42.6	0
Bridge Street	Day	55.9	55.9	0
	Night	55.6	55.6	0
Burton Point Farm	Day	52.7	52.7	0
	Night	29.9	29.9	0
Dee View Road	Day	55.9	55.9	0
	Night	55.6	55.6	0

8.6.2 It can be seen from the results shown in Table 8.23 that the cumulative effect of the development prior to the enhancement of the generator container would lead to an increase in night-time noise levels at Puddington Lane of 0.8dB.

8.6.3 It is considered that an increase of 0.8dB would not be noticeable over normal fluctuations in noise levels at the receptor and therefore this would indicate that cumulative and in-combination effects would have a **very low magnitude of impact** and combined with the receptor sensitivity of high, would result in an impact of with **negligible significance**, **i.e. an insignificant effect**.

8.7 SUMMARY

Introduction

8.7.1 The assessment considers the potential for noise from construction and operation of the proposed municipal solid waste (MSW) and commercial and industrial waste (C&I) recycling and recovery plant to impact upon nearby sensitive residential receptors.

Baseline Conditions

8.7.2 The application site is situated in an already heavily industrialised area with several large works (Paper Mill, Steel Works, Deeside Industrial Park, etc.) in the area which are located closer to nearby noise-sensitive receptors than the proposed development. The nearest noise-sensitive residential receptors are more than 2km from the site.

8.7.3 The baseline noise climate in the area includes contributions from transport (road, rail and air traffic) and industrial sources. At the rural locations north of the A548 background traffic noise is the main contributor whilst at the locations in Garden City and Shotton industrial noise becomes more prominent adding to traffic noise contributions.

Likely Significant Effects

8.7.4 Due to the nature of the area surrounding the proposed development, i.e. industrial and transport infrastructure developments, and the separation distances between the site and nearby receptor locations it has been shown that the effects of noise during both construction and operation of the facility are negligible (i.e. insignificant effects).

Mitigation and Enhancement

8.7.5 The assessment has shown that the predicted sound rating levels would be below the prevailing background noise levels during both the daytime and overnight and therefore mitigation measures beyond those included within the design of the proposed development are considered un-necessary. The significance of the effect would be negligible.

8.7.6 Enhancements to the attenuation of the generator container would reduce predicted noise levels at the receptor further. However, this would not change the findings of the assessment or change the significance of the effects.

Conclusion

8.7.7 It is concluded that the Proposed Development at the Application Site would have no adverse effects on the nearby sensitive receptors identified. The significance of

effects of both construction, operation and site-related traffic movements on the wider road network would be negligible (i.e. insignificant effects in EIA terms).

8.7.8 **Table 8.24** provides a summary of effects, mitigation and residual effects.

Table 8.21: Summary of Effects, Mitigation and Residual Effects.

Receptor / Receiving Environment	Description of Effect	Nature of Effect	Sensitivity Value	Magnitude of Effect	Geographical Importance	Significance of Effects	Mitigation / Enhancement Measures	Residual Effects
Construction Noise								
Puddington	Very low Direct	Temporary	High	Very Low	United Kingdom	Negligible Adverse	n/a	Negligible Adverse
Sealand Avenue	Very low Direct	Temporary	High	Very Low	United Kingdom	Negligible Adverse	n/a	Negligible Adverse
Bridge Street	Very low Direct	Temporary	High	Very Low	United Kingdom	Negligible Adverse	n/a	Negligible Adverse
Burton Point Farm	Very low Direct	Temporary	High	Very Low	United Kingdom	Negligible Adverse	n/a	Negligible Adverse
Dee View Road	Very low Direct	Temporary	High	Very Low	United Kingdom	Negligible Adverse	n/a	Negligible Adverse
Operation								
Puddington	Very low Direct	Permanent	High	Very Low	United Kingdom	Negligible Adverse	n/a	Negligible Adverse
Sealand Avenue	Very low Direct	Permanent	High	Very Low	United Kingdom	Negligible Adverse	n/a	Negligible Adverse
Bridge Street	Very low Direct	Permanent	High	Very Low	United Kingdom	Negligible Adverse	n/a	Negligible Adverse
Burton Point Farm	Very low Direct	Permanent	High	Very Low	United Kingdom	Negligible Adverse	n/a	Negligible Adverse
Dee View Road	Very low Direct	Permanent	High	Very Low	United Kingdom	Negligible Adverse	n/a	Negligible Adverse

Cumulative and In-combination								
Puddington	Very low Direct	Permanent	High	Very Low	United Kingdom	Negligible Adverse	n/a	Negligible Adverse
Sealand Avenue	Very low Direct	Permanent	High	Very Low	United Kingdom	Negligible Adverse	n/a	Negligible Adverse
Bridge Street	Very low Direct	Permanent	High	Very Low	United Kingdom	Negligible Adverse	n/a	Negligible Adverse
Burton Point Farm	Very low Direct	Permanent	High	Very Low	United Kingdom	Negligible Adverse	n/a	Negligible Adverse
Dee View Road	Very low Direct	Permanent	High	Very Low	United Kingdom	Negligible Adverse	n/a	Negligible Adverse

BioConstruct Arrow Bio

BA4 6NA

DOCUMENT TITLE:	**Floodgate Operational Procedure**
Author:	**BioConstruct New Energy.**
DOCUMENT NUMBER:	**BCNE-PROC-57**
REVISION NUMBER:	**Pre-Operational**
IMPLEMENTED:	**TBA**
NEXT REVIEW DATE:	**TBA**

1.0 Objective

The aim of a flood protection system is to provide containment and reduce the probability of flood occurrence to an area of interest ('receptor'). The flood risk to the area depends on the potential damage or loss within the area (the consequence) and its frequency of flooding (the probability of occurrence).

2.0 Scope

This procedure relates to the operational use of the floodgates and the means to provide site containment in the event of a spillage or catastrophic failure of storage tanks.

3.0 Responsibilities

It is the responsibility of the **Operations Manager** to ensure this procedure is followed at all times. It is the responsibility of all **Operational Staff** and **Contractors** to enact this procedure.
It is the responsibility of the **Operations Manager** to evaluate the performance of this procedure and effectiveness of the equipment. Report any deficiencies so as to mitigate any risk to process.

4.0 Procedure

The lift hinged flood gate is used on a completely flush threshold. A lifting mechanism enables the flood gate to rise up to 0.2m on opening. Installation therefore requires no humps, raised sills or steps thus eliminating all trip hazards.

4.1 The double leaf floodgates are designed as a permanent fixed installation.

4.2 They are designed to provide access and egress whilst being able to withstand any potential high volume release of liquids within the bunded area.

4.3 There will be an operational requirement to open and close these doors daily subject to vehicle movements.

4.4 It is therefore a requirement to ensure these doors are closed immediately after a vehicle has accessed and egressed.

4.5 The floodgates are operated by manual means and require an element of excessive force to initially move the gates and moderate force is required to sustain the gate momentum.

4.6 Gates can be manually closed within 2 minutes.

4.7 It is fair to assume, depending on the direction of the wind and the increase in wind speed, will increase the initial and sustained force required to either open or close a gate. It is therefore a requirement to:

- Avoid the need for hazardous manual handling, so far as is reasonably practicable;
- Assess the risk of injury from any hazardous manual handling that can't be avoided;
- Reduce the risk of injury from hazardous manual handling, so far as is reasonably practicable

4.8 Emergency drill plans are in place to test site responses to safety and environmental emergencies. A risk based approach has been used to determine the aspects selected and the frequency of testing.

4.9 Threshold should be free from debris to ensure water tight seal can be made with the surface. Damage to the seals or gate components would result in some seepage.

4.10 Heavy duty EPDM seals ensure gates remain water tight with no seepage. The EPDM seals are extremely durable, reforming after prolonged periods of compression.

4.11 Gate entrance must be kept clear of obstructions to ensure closure is possible.

4.12 Gates are to be inspected daily to ensure integrity is maintained. In the event of a **structural failure** this must be reported to the **Operations Manager** immediately.

A flood protection system fails when they unable to meet its performance objective. The failure of a component of a protection system does not necessarily imply the failure of the system, even though it could progressively lead to a system failure.

5.0 Reports

All reports and inspections relating to this procedure must be retained for a period of two years.
Periodic inspections are required to be undertaken and reported as part of the site wide maintenance regime.

6.0 Additional Documentation

SRA 027 Opening and Closing of Flood Gates
BCNE-PROC-06 Spillage Response Procedure
BCNE-PROC-15 Incident Reporting Procedure

Risk Assessment

Assessment	SRA 027		**Title**	**FLOOD GATES OPERATION**	
Date	Sept 2021	**Revision**			
Review Date	Sept 2022		**Activity**	Opening and Closing of Flood Gates	
Persons at Risk	Operatives & Others		**Application**	Operatives and supervisors, who should be fully conversant with this document	

Client: BioConstruct GmbH	**Project: Site Operations**	**Location: Arrow Bio**

Hazards	**Risk**	**Risk Rating**
1. Pushing and pulling of Flood Gate during opening/closing using manual effort 2. Weight of object/force required to open/close it may increase significantly due to high wind conditions 3. Trapping of fingers/hands within the central latch and Floor sockets 4. Entrapment between gates being opened 5. Contact between gates and plant/vehicles due to gates being blown closed in high winds 6. Slips and trips due to poor housekeeping	• Back injuries, repetitive strain injuries resulting in muscle strains, ligament damage and slipped discs • Cuts to arms and hands causing blood loss and bruising • Tripping or slipping during manual handling resulting in broken bones, cuts and severe bruising	Legend Severity 3: M H H Severity 2: L M H Severity 1: L L M 1 2 3 Likelihood **See key at foot of page** 2 x 2 SCORE 4 **M**

Controls	**Instructions**
1. All site personnel to have received Instruction and Training on good manual handling techniques. 2. Where possible and practical all opening/closing of the Flood Gates must be done using mechanical means 3. Remove all potential trip hazards and obstacles 4. Be aware of poor ground conditions or variations in the floor 5. Additional care to be taken during windy conditions as additional wind loading may increase the weight of the Flood Gates being opened/closed. 6. When plant/vehicles are entering or leaving the bunded area, the gates are to be secured from closing using the securing chains. 7. Always use a firm grip.	1. All site personnel to have read and understood this Risk Assessment prior to Operation of Flood Gates. 2. All site personnel to be familiar with the Operation and maintenance Manual for the Flood Gates. 3. When opening/closing the Flood Gates, operatives are to ensure good manual handling techniques in Pushing and Pulling are to be maintained throughout opening/closing. 4. Extra caution to be taken where the gates have to be opened/closed in windy conditions as the weight may drastically increase requiring extra effort. 5. If during windy conditions the gates are caught by a gust and blown away from the operative, the operative is not to attempt to catch it and let it run its course. Operative may suffer injury as a result of snatching/jerking etc. 6. When opening/closing the gates, operatives are not to stand between the gates as this is a potentially trapping hazard in the event of high winds. 7. Ground around the gates to be kept clear of any trip hazards and other debris which may be caught in the gate seals reducing the seal effect. 8. When opening/closing Latch Boxes or releasing/closing the floor sockets, operative to ensure hands and fingers are clear of any trapping hazard, appropriate safety gloves to be worn. 9. Regular tool box talks must be delivered to be continually focused on safe handling

Typical Operations for Opening/closing Flood Gates	
WHAT	**APPROXIMATE WEIGHT**
Opening/closing gates (normal conditions)	1040kg
Opening/closing gates (windy conditions)	TBD

Typical Operations not Involving Lifting/Carrying
WHAT

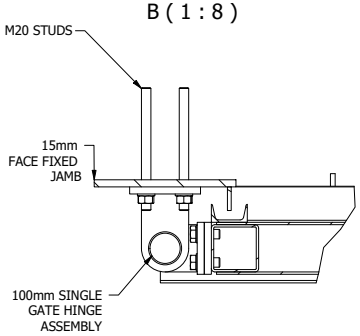
General Cautions & Instructions				**Personal Protective Equipment**			
							
All Personnel must be aware of potential trip hazards	All Accidents Must be Reported to Site	Be Aware Plant Operating on Site	Blank	All Personnel Must Wear Hard Hats	All Personnel Must Wear Appropriate Safety Footwear	All Personnel Must Wear Hi – Visibility Clothing	All Operatives must Wear appropriate Gloves
							
Blank	Blank	Blank	Blank	All Personnel Must Be Aware of Manual Handling Risks	Blank	Blank	Blank

Risk Assessment

Residual Risk Rating when controls are in place and personnel follow safety requirements			
(S) Severity Key	(L) Likelihood Key	Residual Risk Rating (R)	
3 MAJOR – Death/major injury	3 Harm is certain or near certain to occur	2 x 1	
2 SERIOUS - 7 day as RIDDOR	2 Harm will often occur		
1 SLIGHT- All other injuries	1 Harm will seldom occur	SCORE	2
Severity x Likelihood = Residual Risk Rating (S x L = R)		**L**	

RESIDUAL RISK RATING KEY	
H	Cease work/task/operation. Investigation for further controls or elimination of hazard(s) before work can commence.
M	All control measures must be strictly applied by all personnel so that the risk is minimised and controlled. Review controls regularly.
L	Risk of injury or severity of injury considered negligible and controls in place are considered as low as is reasonably practical.

B (1 : 8)



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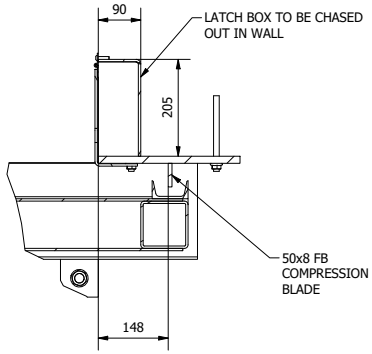
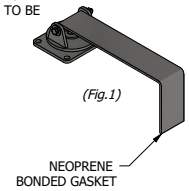
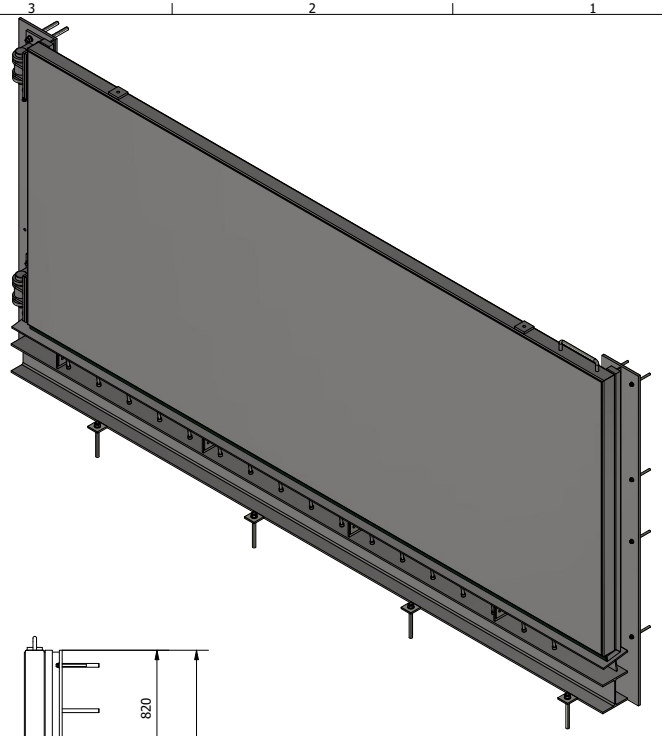


NOTE: Ø22mm ALUMINIUM DOOR STOP & HOLD BACK SWIVEL LATCH (Fig.1) TO BE FITTED ON SITE





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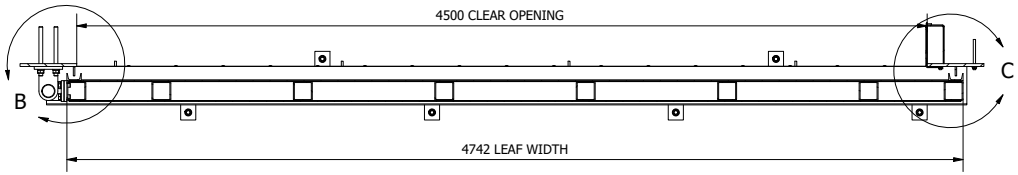

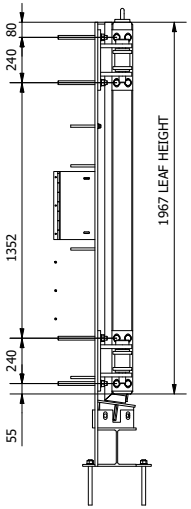

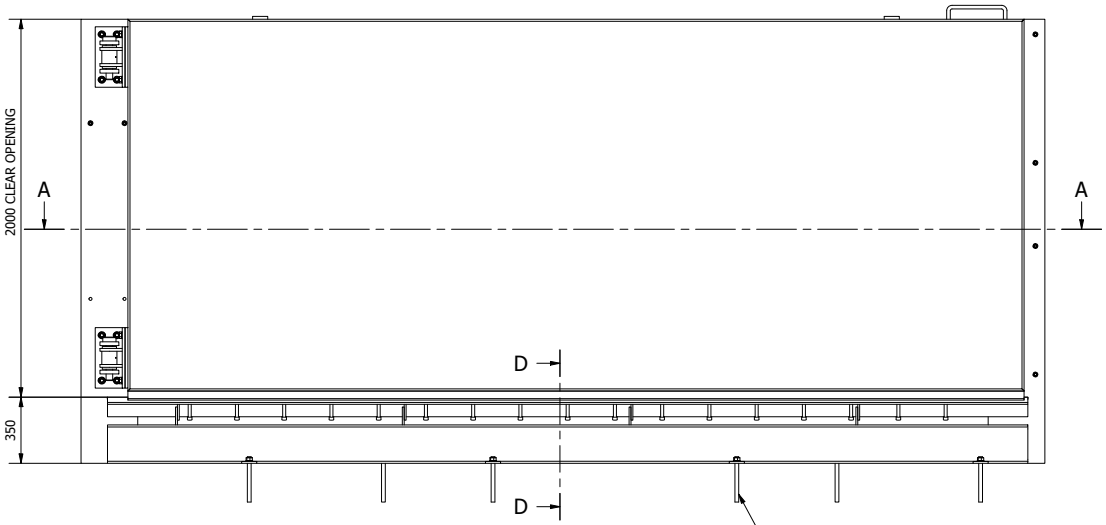

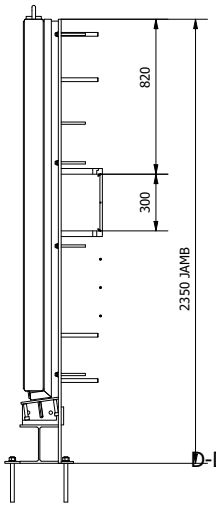

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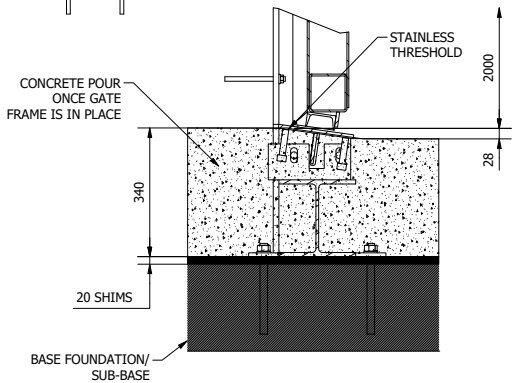

Paint
C4 Sigma Paint System
All materials blast cleaned to SA 2.5
BS 00 A 05 Goosewing Grey

SAFETY, HEALTH & ENVIRONMENTAL INFORMATION

In addition to the hazards risks normally associated with the types of product on this drawing, we note the following risks.

Hazards listed are not exhaustive refer to specific operating manuals, site specific risk assessments and safe systems of work.

Operation
- Opening gates in high winds. The wind speed/loading is to be measured prior to opening and a dynamic risk assessment to be written prior to operation.

Weight
Leaf: 1040kg Frame: 540kg

For information relating to Use, Cleaning and maintenance see the Health and Safety File.

It is assumed that all operating will be carried out by an authorised or competent person.

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Project
Arrow Bio

Drawing Title
100mm Single Gate - Face Fixed Vehicle Access

Drawing Status: Preliminary
MME Project No.: 0309
Scale: A2 - 1 : 6
Revision: A
Drawn By: S. Griffiths
Checked By: J. Morton
Date: 13/08/2021
Drawing No.: 0310-01-SFG G.A
Sheet No.: 1/1

MM Engineered Solutions Ltd - Registered No. 10148554

Approved 13/08/2021

REVISION HISTORY			
REV	DESCRIPTION	DATE	APPROVED
A	Handling Change	13/08/2021	SG

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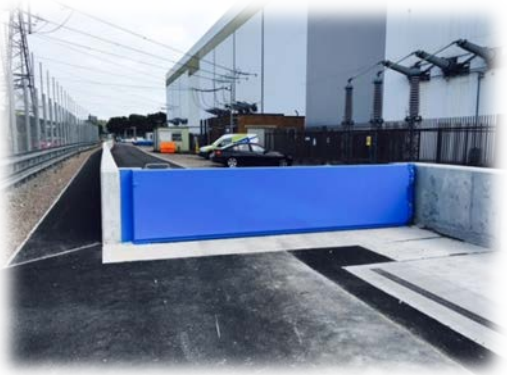
Product Specification – Bund Gates

www.mmengineering.co.uk/bund-gates

Document No: MM/SP/1005



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1. STANDARDS AND LOAD CRITERIA

STANDARDS

MME Bund Gates are designed in accordance with the following codes of practice including relevant national annexes and Eurocodes:

BS EN 1990 – Eurocode 0: Basis of Design

BS EN 1991 – Eurocode 1: Actions on structures

Part 1-1: General actions – Densities, self-weight and imposed loads

BS EN 1993 – Eurocode 3: Design of Steel structures

Part 1-1: General rules and rules for buildings

BS 970 – Wrought steels for mechanical and allied engineering purposes

Part 1: General inspection and testing procedures and specific requirements for carbon manganese, alloy and stainless steels.

BS 5950 – Structural use of steelwork in building

Part 1-2000: Code of practice for design.

LOAD CRITERIA

Design Factors

Eurocode 3 Basic Design Factors:

Variable Loads = 1.5

Imposed Loads = 1.35

BS5950: Part 1: 2000:

Imposed Loads = 1.6

Variable Loads = 1.4

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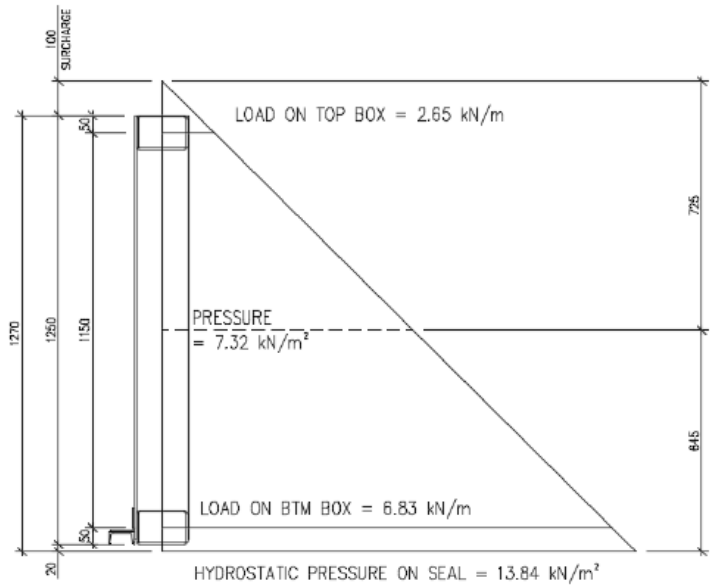
EXAMPLE FOR REFERENCE ONLY

Hydrostatic Loads



HYDROSTATIC PRESSURE
Density of sea water = 1030 kg/m³
Pressure = 1030 x 9.81 x 1.370/1000 = 13.84 kN/m²
IMPOSED LOAD (HYDROSTATIC)
Load = 0.5 x 13.84 x 1.370 = 9.48 kN/m of gate length

2. BUND GATE SPECIFICATIONS

A. Available Sizes

Single Bund Gates	Clear Width	Clear Height
Minimum	500 mm	650 mm
Maximum	6000 mm	4000 mm
Single gates in excess of 2500mm wide and 1000mm high will need frames cast in.		

Double Mitre Gates	Clear Width	Clear Height
Minimum	4500mm	650 mm
Maximum	17000mm	4000 mm
We also do an option for a bi-fold gate arrangement when obstacles are in the way of the gates swept path.		

B. Design Water Head Project specific, up to a maximum of 4000mm / on-seating only. Off seating 1500mm max.

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C. Hinge Sides Left or Right

D. Pivotability 0 to 190 degrees

E. Material Available in Mild-Steel or Stainless steel (316)

F. Guaranteed Leakage Rate In accordance with DIN 19659-4 Table 1, Class 5

Product Tightness acc. to DIN 19569-4 Table 1

Class	Maximum allowed leakage in litres per sec. per metre gasket length (l/s/m)
1	Above 0.3 to 1
2	Above 0.1 to 0.3
3	Above 0.05 to 0.1
4	Above 0.02 to 0.05
5	To 0.02

NOTE: For negative pressure a higher class for leakages must generally be applied.

G. Operation MME latching spindle drive or MME cam latch arrangement. All in 304 grade stainless steel.

H . Mounting Types Gates smaller than 2500mm can be face mounted to existing RC Walls

Cast in frame sub-structure is the standard scope of supply.

I. Frame Width Bespoke to design to accommodate civil wall design.

J. Min. Remaining Sill Height 28mm 200x10 mm S/S threshold at an 8 degree. No trip hazard. Or 120mm stepped threshold

K. Mounting Requirements Project specific, we can accommodate most design requirements.

L. Lockable Lockable via a drop down spindle mechanism or lock back eyes. When in the flood position they are locked by the gates mechanism.

M. Design Life Mild Steel Gates have a 40 year design life, which can be prolonged with the structures maintenance.

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Stainless Steel Gates have a 70 year design life, which can be prolonged with the structures maintenance.

Seals – EPDM foam with neoprene protective skin, these have a 25 year life. Viton and Nitrile seals available subject to containment requirements.

3. EXAMPLE GATE CALCULATIONS

Appendix 1 - Attachment

4. GENERAL DRAWINGS

Appendix 2 – Attachment

