Addendum I to Environmental Impact Statement

Proposed Composting/Biogas Facility at Durnish, Foynes, County Limerick

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1 INTRODUCTION

Greenport Environmental Ltd. proposes to construct a fully enclosed anaerobic digestion and in-vessel composting facility, capable of receiving up to 50,000 tonnes of organic waste per annum, at Durnish, Foynes, Co. Limerick. McCarthy Keville O'Sullivan Ltd. were appointed as Environmental Consultants on this project in 2008, and commissioned to complete an Environmental Impact Assessment (EIA) and prepare an Environmental Impact Statement (EIS). The planning application and accompanying EIS were submitted to Limerick County Council in 2009. Planning permission was granted by for the facility in late 2009 (Planning Reference No. 09/737). The application is currently at appeal stage and is due to be decided by An Bord Pleanála in April 2010.

A Waste Licence application for the proposed facility was submitted to the Environmental Protection Agency (EPA) by Greenport Environmental Ltd. in August 2009 (Application No. W0271-01). A request for further information was subsequently issued by the EPA, with regards to information required under Article 12 and Article 13 of the Waste Management (Licensing) Regulations. The information required under Article 12 Compliance has been submitted to the EPA by Greenport Environmental. Eleven of the 14 points of information required under Article 13 Compliance are set out in this Addendum to the Environmental Impact Statement. The remaining three points, which relate to the Air Quality, Noise & Climate chapter of the EIS, will be set out in a second Addendum, also to be submitted to the EPA in March 2010.

2 ARTICLE 13 COMPLIANCE REQUIREMENTS

The 14 points of information required by the EPA under Article 13 Compliance for Waste Licence Application W0271-01 are as follows. All points, with the exception of Points No. 9, 12 and 14, are addressed in this Addendum to the EIS. Points No. 9, 12 and 14 will be addressed in Addendum II to the EIS.

1. Quantify the amount of biogas to be stored and used per annum at the facility.
2. Give details of types and quantities of waste and compost product to be produced from the process per annum including hazardous classification.
3. Give details of waste storage facilities (if any) and final disposal/recovery locations for wastes.
4. Give details of the combined heat and power (CHP) plant including thermal input rating, combustion mechanism (i.e. turbine, generator), stack height and emission characteristics.
5. Give details of the flare and standby boiler.
6. Discuss the risks and preventative measures association with gas storage on-site and include the risks of a major accident from nearby Seveso site.
7. Give details of consideration of alternatives (location, process, scale, do nothing).
8. Give details of light lux levels and their significance in relation to ecological disturbance.
9. Give details of impact on air quality from the combustion plant emissions.
10. Give details of foul sewer works to which the sanitary effluent from the proposed facility is to be discharged. Include Section 4 licence and comment on whether the discharge has agreement from the owner of the system and whether the discharge limits from the works will continue to be observed.
11. Give details of the number of air changes proposed for the facility.
12. Give details of the source of information for the 'odour emission levels' and reconcile the comments made with regard to odour emission levels derivation as described on 8-18, Table 8.17 and again on 8-19. Give details of the height at which emissions occur above ground level. Provide the full odour modelling study including model results in graphical format.
13. Provide plan identifying all emission points.
14. Predict the noise impact from operating the facility. Identify the main outdoor stationary noise sources and the measures taken to reduce their impact. Give details in relation to building materials with regard to reducing noise emissions.

The further information request issued by the EPA also states:

> *"Your reply to this notice should include a revised non-technical summary (Application Form and EIS) which reflects the information you supply in compliance with the notice, insofar as that information impinges on the non-technical summary."*

The revised non-technical summary will be submitted as part of Addendum II to the Environmental Impact Statement.

1. Quantify the amount of biogas to be stored and used per annum at the facility.

The total biogas storage volume in each of the two storage tanks will be less than 780 m^3 per tank.

The quantity of biogas to be generated and used per annum will depend on the efficiency and the optimisation of the plant but it is anticipated that the facility will be capable of generating and using 3,500,000 to 5,256,000 m^3 of biogas per annum.

2. Give details of the types and quantities of waste and compost product to be produced from the process per annum including hazardous classification.

There will be three main categories of waste and compost product produced at the facility. The quantities of these three streams will vary depending on the feedstock material. The feedstock will be sourced primarily from source-separated and mechanically separated biodegradable waste. As the implementation of a source separated collection system for biodegradable waste becomes established over time, it is anticipated that the quantities of compost product will increase and the quantities of compost-like stabilised biowaste and oversized residual waste will decrease. Further details regarding the three main waste types are provided below.

I. <u>Compost product from source separated commercial and domestic biodegradable waste(brown bin)</u>

Depending on the success of the implementation of the source-separated organic waste collection system, the quantity of input material from this source will vary. The quality of the material may also vary as the level of contamination with materials other than biodegradable material will vary. The moisture content of the final product may also vary which will impact the tonnage of the final product produced. Therefore, taking these factors into account and assuming the facility accepts up to 50,000 tonnes per annum of source- separated feedstock, with little or no contamination and assuming up to 30% moisture content of the final product, the facility will produce up to 35,000 tonnes per annum. Any off-specification compost product will be returned to the facility for re-processing.

II. <u>Stabilised biowaste from mechanically separated commercial and domestic biodegradable waste</u>

Depending on the success of the implementation of the source-separated organic waste collection system, the quantity of input material from this source will vary. It is anticipated that the quantity of mechanically separated biodegradable waste will reduce as the quantity of source separated waste increases. The quality of the material may also vary depending on the level of non-compostable content. RPS, on behalf of the EPA, recently conducted analysis of the feedstock material, which determined that the material currently contains 77.84% biodegradable waste. The moisture content of the final product may also vary which will impact the tonnage of the final product produced. Therefore, taking these factors into account and assuming the facility accepts up to 50,000 tonnes per annum of mechanically separated feedstock, with 22.16% contamination and assuming up to 30% moisture content of the final product, the facility will produce up to 27,244 tonnes per annum of stabilised material suitable for engineering purposes.

III. Residual oversized waste to be produced from the process:

Oversized residual materials of > 12mm will be separated from the compost products in the screening plant. Following recent characterisation by RPS/EPA of the mechanically separated feedstock material, it was determined that the feedstock material currently contains 22.16% of materials other than biodegradable waste. The quality of the feedstock material may vary and therefore greater quantities of non-compostable material may be produced. Assuming up to 50% of oversized material in the feedstock and assuming the facility processes up to 50,000 tonnes per annum of mechanically separated feedstock, up to 25,000 tonnes per annum of oversized residual waste may be produced.

This waste will be separated into different waste types, including:

- Three-dimensional inert waste suitable for recycling – this will comprise primarily glass and stones.
- Two-dimensional mixed plastics suitable for further recycling.

All materials will be classified as non-hazardous and it is anticipated that the waste streams will be suitable for further recycling/recovery. In the event that the material is deemed unsuitable for recycling or recovery, the material will be sent to landfill/incineration.

Other potential waste streams from the facility will include:

Excess Wastewater

It is anticipated that all wastewater will be reused within the process and an excess of fresh water will be required to supplement the process. In the event that wastewater is generated and cannot be reused in the process, then it will be treated in a pre-approved off-site wastewater treatment plant. The wastewater will be classified as non-hazardous and will have the EWC code 19 06 03 (liquor from anaerobic treatment of municipal waste).

Biofilter Media

Subject to inspection, it is anticipated that the biofilter media will be replaced every three to five years. It is proposed to use woodchip as the medium and it is anticipated that the media can be used as amendment within the composting process, thereby ensuring optimum recycling of this potential waste stream. In the event that the material is not suitable for composting, it may be necessary to send the material off-site for disposal. It is anticipated that less than 1,500 tonnes per annum will be generated every three to five years. The shredded timber will be classified as non-hazardous and will have the EWC code and description 19 06 99 (waste from anaerobic treatment of waste not otherwise specified).

Scrubber Solutions

Dilute aqueous solutions will be generated and will be reused for enriching the compost product or used as a liquid fertiliser. It is anticipated that the site will generate less than 500 tonnes per annum. The solution is classified as non-hazardous. In the unlikely event that the solution cannot be reused, the material will be sent for treatment off-site to an approved facility.

Office/Canteen Waste

A small quantity of dry recyclable and residual waste will be generated from the office and canteen area. This material will be collected and sent to Mr Binman Ltd.'s recycling facilities. Any biodegradable waste suitable for anaerobic/aerobic digestion generated will be processed within the facility. It is anticipated that up to two tonnes per annum of mixed municipal waste and 1.5 tonnes per annum of dry recyclable waste will be generated from the office/canteen area.

Laboratory Waste

It is anticipated that the following waste streams will be generated from the laboratory area:

- Spent agar plates, pipette heads etc. will be placed in autoclave bags and sterilised prior to disposal.
- Waste COD vials and other laboratory smalls will require removal and treatment by hazardous waste contractors.

A summary of the quantities of waste and compost products to be produced at the proposed facility, including hazardous classification, is presented in Table 2.1.

Table 2.1 Summary of Waste Types and Compost Products

Description	EWC Code	EWC Description	Quantity (tonnes/ annum)	Classification
Compost product from source separated feedstock	n/a	n/a	0-35,000	Non-hazardous
Off-specification compost	190503	Off-specification compost	<500	Non-hazardous
Non-composted fraction of animal and vegetable waste from process feedstock	190502	Non-composted fraction of animal and vegetable waste	<500	Non-hazardous
Compost-like stabilised biowaste from mechanically separated feedstock	190599	Waste from aerobic treatment of solid wastes not otherwise specified	0- 27,244	Non-hazardous
Non-compostable residues/oversized waste	190501	Non-composted fraction of municipal and similar wastes from aerobic treatment of solid waste	0-25,000	Non-hazardous
Scrubber Solutions	190599	Waste from aerobic treatment of solid waste not otherwise specified	<500	Non-hazardous
Excess wastewater from anaerobic/aerobic treatment of mechanically separated biodegradable waste	190599 or 190603	Liquor from anaerobic/aerobic treatment of municipal waste	0-2000	Non-hazardous
Excess wastewater from anaerobic/aerobic treatment of source separated biodegradable waste	190606	Liquor from anaerobic treatment of animal and vegetable waste	0-2000	Non-hazardous
Biofilter media	190502	Non-composted fraction of animal and vegetable waste from aerobic treatment of solid wastes	<1500	Non-hazardous
Office/canteen waste	200301	Mixed municipal waste	3.5	Non-hazardous
Laboratory smalls	190599	Waste from aerobic treatment of solid waste not otherwise specified	2.0	Non hazardous
Laboratory smalls (COD vials , etc)	190599	Waste from aerobic treatment of solid waste not otherwise specified	0.05	Hazardous

3. Give details of waste storage facilities (if any) and final disposal/recovery locations for wastes.

There will be no long-term storage of waste on-site. Feedstock material will be unloaded within the enclosed delivery area where the material will be transferred to one of the aerobic/anaerobic digestion tunnels. All material will undergo an extensive screening process in order to separate the composted products from non-compostable residues.

The composted products will comprise of two different grades of material. Compost generated from source separated organic waste will be destined for the compost market and will be suitable primarily for agricultural and horticultural (e.g.gardening) uses as approved by the Department of Agriculture, Fisheries and Food.

Composted material generated from the mechanically separated organic waste will meet the EPA requirements for stability and will be ABP approved. As verified by the EPA, this material will be suitable for engineering use in landfills and potentially for other land remediation. EPA approval for use of all locations will be sought in advance by Greenport Environmental.

Non-compostable residues screened from the compost material will be collected and disposed of at a pre-approved landfill by Greenport Envionrmental's parent company, Mr. Binman Ltd., a permitted waste management company, from which the following landfills are available and approved to accept residual waste:

Table 3.1 Landfills available to be used

Facility Name	Facility Address	Waste Licence No.
Ballaghveny Landfill	Ballymackey, Nenagh, Co. Tipperary	W0078-02
Greenstar Ltd Connaught Regional Residual Landfill	Kilconnell, Ballinasloe, Co. Galway	W0178-01
Limerick Co Co Gortadroma Landfill	Ballyhahill, Co. Limerick	W0017-04
Monaghan County Council	Scotch Corner Landfill, Annyalla, Castleblaney, Co. Monaghan	W0020-01
Clare Co. Council Central Waste Management Facility	Ballyduff Beg, Inagh, Co. Clare	W0109-01
Donohill Landfill	Garryshane, Donohill, Co. Tipperary	W0074-02

All wastewater generated from the process will be reused in the process and additional water is required to optimise the process operation. It is unlikely that excess wastewater will be generated for off-site disposal. However in the event that wastewater is required to be sent for off-site disposal, it will be collected and transported to a pre-approved wastewater treatment facility by Mr. Binman Ltd., a permitted waste management company from which the following treatment plants are available and approved to accept wastewater.

Table 3.2 Wastewater treatment facilities available to be used

Operator	Facility Address
Limerick County Council	Castletroy WWTP, Co. Limerick
Limerick Main Drainage	Bunlicky WWTP, Limerick

4. Give details of the combined heat and power (CHP) plant including thermal input rating, combustion mechanism (i.e. turbine, generator), stack height and emission characteristics.

The facility will be supplied with two Guascor combined heat and power plant (CHP) units. Details of the power rating including thermal efficiencies and emission characteristics are presented in Appendix 1 to this report. Further emission characteristics are provided in the relevant tables of the Article 12 further information submitted by Greenport Environmental in support of the Waste Licence application. The combustion mechanism is provided by high efficiency co-generator units including a calorific energy recovery system, which will provide supplementary heat to the anaerobic digestion/composting process. The stack heights are specified at five metres.

In order to protect the CHP units and minimise maintenance schedules, clean dry biogas is fed into the CHP units following pre-treatment in a scrubbing and a cooling unit.

5. Give details of the flare and standby boiler.

<u>C-Deg HTC Unit</u>

Details of the potential emission point back-up system (enclosed flare) are provided in Appendix 2 to this report. The C-Deg HTC unit ensures a destruction quality of >99.9% by producing greater than or equal to 1,000 degrees Celsius with a 0.3 second retention time. Emission levels for NO_x will be < 150 mg/m^3. The unit will be enclosed.

This potential emission point will only be used in the event that both CHP units fail to function and cannot be restarted, excess storage capacity is consumed and the back up boiler system fails to meet capacity requirements. There is also an option to convert the anaerobic tunnels into aerobic tunnels therefore preventing biogas production. On this basis it is anticipated that the emergency emission point will be used infrequently.

<u>Riello RLS 28 Boiler</u>

The back-up boiler system will be a Riello RLS 28 boiler. Details of the technical data for the boiler including emissions specifications are provided in Appendix 3 to this report. It is anticipated that the boiler will be used during initial start-up to provide supplementary heat for the process until such time as the AD process is producing sufficient quantities of biogas, which will be used to produce electricity and supplementary heat in the CHP units. When the CHP units are fully operational, the boiler will operate only as a back up to the CHP units for consuming biogas and producing supplementary heat. On this basis the emissions from the boiler will be minor.

6. Discuss the risks and preventative measures association with gas storage on-site and include the risks of a major accident from nearby Seveso site.

Detailed consequence modelling of the impact of the Fuel Storage Facility located adjacent to the proposed development site was prepared and submitted with the Planning Application. A second comprehensive consequence modelling report was completed during the planning process and included an assessment of impacts of the Biogas/Composting facility on the adjacent Fuel Storage facility. The second assessment was prepared with reference to the *'Policy & Approach of the Health & Safety Authority to COMAH Risk-based Land-use Planning'*, which was published by the HSA during the planning process on 7th September 2009.

The Health & Safety Authority (HSA) was consulted during the preparation of the reports and the final reports were submitted to the HSA by Limerick County Council. The Planning Report prepared by Limerick County Council indicates that, following consideration of the reports submitted, the HSA had no objection to the proposed development. In a submission to An Bord Pleanala, the County Council Planning Section stated that *'the use is compatible with other type industrial uses in the vicinity'*.

Copies of the consequence modelling reports were also issued to Atlantic Fuel Supply Company, the owners of the nearby Fuel Storage Facility, and they verified that there were no issues associated with the development. The most recent consequence modelling report is provided in Appendix 4 of this report.

7. Give details of the consideration of alternatives (location, process, scale, do nothing).

The Environmental Protection Agency document *'Guidelines on the Information to be contained in Environmental Impact Statements'* (EPA, 2002) states that it is important to acknowledge the existence of difficulties and limitations when considering alternatives. These include hierarchy, non-environmental factors and site-specific issues.

In relation to Hierarchy, the EPA guidelines state that in some instances neither the applicant nor the competent authority can be realistically expected to examine options that have already been previously determined by a higher authority, such as a national plan or regional programme for infrastructure. The issue of hierarchy does not apply in the case of the Greenport application. However, the issues of Non-environmental Factors and Site-specific Issues do apply and are relevant as outlined below.

In relation to Non-environmental Factors, the EPA guidelines state:

> *"EIA is confined to the environmental effects which influence consideration of alternatives. It is important to acknowledge that other non-environmental factors may have equal or overriding importance to the developer of a project, for example project economics, land availability, engineering feasibility, planning considerations."*

The combination of project economics, land availability, engineering feasibility and planning considerations were all critical factors that identified the Durnish, Foynes site as the only viable site available to Greenport Environmental Ltd. for the development of a biogas/composting facility.

As Greenport Environmental Ltd does not own any other sites/lands, the site was the only site/land available to the developer.

Notwithstanding the above, the site was unique for the proposed development as:

- The site was available for development by Greenport Environmental Ltd;
- Engineering reports established that the site was suitable for the proposed development;
- Its location in an existing industrial area with established planning permission for industrial use;
- The site was previously permitted by the Local Authority for handling waste;
- The close proximity to a suitable national electricity grid connection for the electricity produced from the proposed development;
- Excellent access to the national roads network with proximity to sources of feedstock and outlets for products;
- The existing site infrastructure in terms of buildings, hard standing areas, firewater access, etc. ensured minimal further development was required, thereby minimising potential environmental impacts during construction;
- Its distance from occupied dwellings and other sensitive properties was greater than 550metres.

Therefore, with regard to Section 1(d) of Schedule 6 of S.I. 600 (Planning and Development Regulations 2001), no other alternatives were studied for the

development in terms of site availability and hence this was not applicable for inclusion in the EIS.
In relation to Site-specific Issues, the EPA guidelines state:

> *"The consideration of alternatives also needs to be set within the parameters of the availability of the land, i.e. the site may be the only suitable land available to the developer, or the need for the project to accommodate demands or opportunities that are site-specific. Such considerations should be on the basis of alternatives within a site, e.g. design, layout."*

A notification to grant planning permission was given by the Planning Authority to develop a composting facility on this site prior to submission of the current planning application under appeal. Following an appeal of the decision for the composting facility development, this planning permission was subsequently upheld by An Bord Pleanála.

While awaiting a decision on the composting facility planning permission application, the economics of developing a combined biogas/composting facility became viable following amended proposals by the technology providers based on potentially available quantities of feedstock, which required a new planning permission application to be submitted including an EIA. Therefore it is clear that the main alternative technology considered was composting only but this was no longer economically justifiable compared with the biogas/composting alternative.

Information on this alternative was outlined in Section 2.4 of the EIS and the main reasons for choosing the proposed biogas/composting facility over the main alternative was also documented in this section, taking due consideration of the effects on the environment.

In terms of other site-specific considerations, the existing building, hard standings, drainage systems and neighbouring facilities largely dictated the layout of the proposed development, providing few alternatives in terms of the design and layout of the development within the site taking due consideration of the planning and environmental impacts. In order to ensure there would be no emissions of environmental significance, the proposed facility was designed to be fully enclosed and would incorporate best available techniques, where feasible. Therefore the design and technologies were limited and no other main alternatives were studied.

8. Give details of the light lux levels and their significance in relation to ecological disturbance.

Please refer to Section 2.6.2.1 and Appendix 8 of the Environmental Impact Statement for details of the Appropriate Assessment, which includes a lighting plan, associated lux levels and assessment their significance in relation to ecological disturbance. The Lighting Plan and associated lux levels are presented in Figure 2.5 in the Appropriate Assessment. There is no light spill in areas of ecological sensitivity and it will not affect the designated sites.

The Appropriate Assessment was conducted at the request of the Development Applications Unit of the Department of Environment , Heritage and Local Government, which set out the nature conservation recommendations of the National Parks and Wildlife Service. The Heritage Officer of Limerick County Council also requested that the lighting is designed and oriented so as to prevent excessive light spill on to the estuary, in order to minimise any disturbance to any wild fowl that might be using the estuary.

It was concluded in the Appropriate Assessment that the lighting associated with the proposed development will be focused internally onto the site and away from areas of ecological sensitivity. It will not affect the adjacent designated sites.

Refer also to Figure 2.5 within the Appropriate Assessment Report, which demonstrates that the average light spill just outside the perimeter of the site is 0.06 lux units with the maximum reaching 3.0 lux units.

9. Give details of the impact on air quality from the combustion plant emissions.

Addressed in Addendum II to the Environmental Impact Statement.

10. Give details of foul sewer works to which the sanitary effluent from the proposed facility is to be discharged. Include Section 4 licence and comment on whether the discharge has agreement from the owner of the system and whether the discharge limits from the works will continue to be observed.

The foul sewer to which the treated effluent from the facility discharges is currently in the ownership of Atlantic Fuel Supply Company (AFSC). The sewer is a 225 mm diameter sewer and currently takes treated effluent from the treatment plant associated with the AFSC development to its discharge point on the estuary. The existing discharge is subject to a discharge licence, which has issued from Limerick County Council.

Michael Punch and Partners, Consulting Engineers for the proposed development, have confirmed that the sewer, as installed, has adequate capacity to cater for the additional flows to contribute from the Greenport facility. This licence limits the discharge to BOD of 20 mg/l, suspended solids of 30 mg/l and pH of 6-9 and prohibits the discharge of mineral oil, diesel range organics and petrol range organics. The licence also limits the discharge to 5 m^3/day. The maximum flow anticipated from the 12 PE plant at AFSC is 2 m^3/day (based on the licence application).

The proposed treatment plant at Greenport will cater for an initial discharge of 1.2 m^3/day and 0.6 kg/day BOD based on a staff level of 20. (The 25 PE Plant is capable of taking more than this as it was sized to cater for use of the first floor). The proposed treatment plant will be compliant with the terms of the discharge licence.

Please find attached the following:

I. Drainage Layout: Please refer to Drawing No.061-306-012-P5, presented in Appendix 5 of this report.

II. A copy of the Section 4 Licence, presented in Appendix 6 of this report. As required under the conditions of the licence, approval will be sought from the licensing authority in advance of discharge.

III. The connection to the system has the agreement from Atlantic Fuel Supply Company (AFSC), the owner of the existing system. An agreement was reached with Shannon Foynes Port Company (SFPC) for a wayleave to install and to connect to the foul sewer system. Following meetings with SFPC and AFSC, an agreement was reached with AFSC to connect to the existing foul sewer system.

11. Give details of the number of air changes proposed for the facility.

Having considered best practice for waste facilities the number of air changes proposed for the facility will be at least three air changes per hour.

12. Give details of the source of information for the 'odour emission levels' and reconcile the comments made with regard to odour emission levels derivation as described on 8-18, Table 8.17 and again on 8-19. Give details of the height at which emissions occur above ground level. Provide the full odour modelling study including model results in graphical format.

Addressed in Addendum II to the Environmental Impact Statement.

13. Provide a plan identifying all emission points.

The air emission points plan for the facility is provided in Attachment E.1 of the Licence Application – Drawing No. 061-306-042-P1.

The surface water emission point plan is provided in Attachment E.2 of the Licence Application – Drawing No. 061-306-043-P0.

The foul sewer emission point plan is provided in Attachment E.3 of the Licence Application – Drawing No. 061-306-044-P0. Also refer to the information provided under Point 10 of this report.

Drawing No. 061-306-045-P0 provided in Appendix 7 of this report presents the air, surface water and sewer emission points from the proposed facility.

14. Predict the noise impact from operating the facility. Identify the main outdoor stationary noise sources and the measures taken to reduce their impact. Give details in relation to the building materials with regard to reducing noise emissions.

Addressed in Addendum II to the Environmental Impact Statement.

Appendix 1

Combined Heat and Power (CHP) Plant Data Sheet

GROUP	GAS	PRODUCT INFORMATION	INDEX
IC		IC-G-B-36-064	1
POWER RATING		DATE 22-02-07	DEP. 2

GUASCOR

ENGINE:	SFGLD 360	SPEED:	1500
JACKET WATER TEMPERATURE(ºC):	90	FUEL TYPE:	Sewage Gas
INTERCOOLER WATER TEMP(ºC):	55		

APPLICATION:			CONTINUOUS	COMPRESSION RATIO:	11.8:1
COOLING SYSTEM:			TWO STAGE IC	REGULATION:	Electronic
				IGNITION TIMING:	17º
EXHAUST MANIFOLD TYPE:	WATER COOLED			MAX. BACK PRESSURE:	450 mmH2O
EMISSIONS:					
	NOX	mg/Nm3 (8)	500	AMBIENT CONDITIONS ISO 3046/1:	
	CO	mg/Nm3(8)	<800	Atmospheric pressure (kPa)=	100
	NMHC	mg/Nm3	<300	Ambient temperature (ºC)=	25
				Relative humidity (%)=	30

POWER RATING (4)			NOMINAL	PARTIAL LOADS		
LOAD		%	100%	80%	60%	40%
MECHANICAL POWER	(3, 4, 5)	kWb	630	504	378	252
BMEP		bar	14	11,2	8,4	5,6
FUEL CONSUMPTION	(1)	kW	1573	1286	1010	733
THERMAL EFFICIENCY		%	40,1	39,2	37,4	34,4
HEAT IN MAIN WATER CIRCUIT	(1)	kW	441	359	289	221
HEAT IN SECONDARY WATER CIRCUIT	(1)	kW	101	88	76	64
HEAT IN CHARGE COOLER	(1)	kW	30	23	16	8
HEAT IN OIL COOLER	(1)	kW	71	65	59	57
HEAT IN EXHAUST GASES (25 ºC)	(1)	kW	371	307	243	176
HEAT IN EXHAUST GASES (120ºC)	(1)	kW	270	225	179	131
EXHAUST GAS TEMPERATURE	(1)	ºC	372	379	387	395
HEAT TO RADIATION	(1)	kW	30	28	24	20
CARBURETION SETTINGS (2)						
O_2 TO EXHAUST(DRY)(ONLY A REFERENCE)		%	9,0	8,9	8,7	8,2
MASS FLOWS						
INTAKE AIR FLOW	(1)	kg/h	3060	2480	1920	1360
EXHAUST GAS FLOW (WET)	(1)	kg/h	3340	2710	2100	1490

NOTES:

1. 100% LOAD TOLERANCES:

FUEL CONSUMPTION +5%,
COOLING CIRCUIT AND EXHAUST GASES ± 15%, RADIATION ±25
EXHAUST TEMPERATURE ±20ºC, MASS FLOWS ± 10%.

2. THE ENGINE PERFORMANCE DATA, TIMING ADVANCE AND CARBURETION SETTINGS ARE VALID FOR A GAS THAT FULFILS THE REQUIREMENTS DEFINED IN IC-G-D-30-001 AND IC-G-D-30-002
3. NET POWER, MECHANICAL PUMPS NOT INCLUDED.
4. POWERS ARE VALID FOR AMBIENT TEMP.< 25ºC AND AN ALTITUDE OF < 500m. OTHER CONDITIONS IN IC-G-B-00-001
5. OVERLOAD NOT ALLOWED
6. THE SPECIFICATIONS AND MATERIALS ARE SUBJECT TO CHANGE WITHOUT NOTIFICATION
7. A ENGINE WITH INLET OR OUTPUT RESTRICTION OVER PUBLISHED LIMITS, OR WITH INADEQUATE MAINTENANCE OR INSTALLATION CAN MODIFY POWER RATING DATA.
8. EMISSIONS ARE CORRECTED TO 5% OF O2

GROUP	GAS	PRODUCT INFORMATION	INDEX
IC		IC-G-B-24-040	1

GUASCOR

POWER RATING

DATE	
23-12-08	
DEP.	2

ENGINE:	**SFGLD 240**	**SPEED:**	**1500**
JACKET WATER TEMPERATURE(ºC):	**90**	**FUEL TYPE:**	**Sewage Gas**
INTERCOOLER WATER TEMP(ºC):	**55**		

APPLICATION:			**CONTINUOUS**	COMPRESSION RATIO:	**11.8:1**
COOLING SYSTEM:			**TWO CIRCUITS**	REGULATION:	**Electronic**
				IGNITION TIMING:	**17º**
EXHAUST MANIFOLD TYPE:	WATER COOLED			MAX. BACK PRESSURE:	**450 mmH2O**
EMISSIONS:					
NOX	mg/Nm3 (8)		**500**	AMBIENT CONDITIONS ISO 3046/1:	
CO	mg/Nm3(8)		**<800**	Atmospheric pressure (kPa)=	**100**
NMHC	mg/Nm3		**<300**	Ambient temperature (ºC)=	**25**
				Relative humidity (%)=	**30**

POWER RATING (4)			**NOMINAL**	**PARTIAL LOADS**		
LOAD		%	**100%**	80%	60%	40%
MECHANICAL POWER	(3, 4, 5)	kWb	**419**	336	252	168
BMEP		bar	**14**	11,2	8,4	5,6
FUEL CONSUMPTION	(1)	kW	**1056**	868	678	489
THERMAL EFFICIENCY		%	**39,7**	38,7	37,2	34,3
HEAT IN MAIN WATER CIRCUIT	(1)	kW	**257**	220	182	140
HEAT IN SECONDARY WATER CIRCUIT	(1)	kW	**110**	84	60	44
HEAT IN CHARGE COOLER	(1)	kW	**62**	39	18	6
HEAT IN OIL COOLER	(1)	kW	**48**	45	42	38
HEAT IN EXHAUST GASES (25 ºC)	(1)	kW	**247**	208	165	121
HEAT IN EXHAUST GASES (120ºC)	(1)	kW	**180**	154	124	91
EXHAUST GAS TEMPERATURE	(1)	ºC	**377**	391	402	412
HEAT TO RADIATION	(1)	kW	**23**	20	18	16
CARBURETION SETTINGS (2)						
O_2 TO EXHAUST(DRY)(ONLY A REFERENCE)		%	**8,6**	8,5	8,3	8,0
MASS FLOWS						
INTAKE AIR FLOW	(1)	kg/h	**2000**	1620	1250	890
EXHAUST GAS FLOW (WET)	(1)	kg/h	**2190**	1770	1370	980

NOTES:

1. 100% LOAD TOLERANCES:

FUEL CONSUMPTION +5%,
COOLING CIRCUIT AND EXHAUST GASES ± 15%, RADIATION ±25
EXHAUST TEMPERATURE ±20ºC, MASS FLOWS ± 10%.

2. THE ENGINE PERFORMANCE DATA, TIMING ADVANCE AND CARBURETION SETTINGS ARE VALID FOR A GAS THAT FULFILS THE REQUIREMENTS DEFINED IN IC-G-D-30-001 AND IC-G-D-30-003
3. NET POWER, MECHANICAL PUMPS NOT INCLUDED.
4. POWERS ARE VALID FOR AMBIENT TEMP.< 25ºC AND AN ALTITUDE OF < 500m. OTHER CONDITIONS IN IC-G-B-00-001
5. OVERLOAD NOT ALLOWED
6. THE SPECIFICATIONS AND MATERIALS ARE SUBJECT TO CHANGE WITHOUT NOTIFICATION
7. A ENGINE WITH INLET OR OUTPUT RESTRICTION OVER PUBLISHED LIMITS, OR WITH INADEQUATE MAINTENANCE OR INSTALLATION CAN MODIFY POWER RATING DATA.
8. EMISSIONS ARE CORRECTED TO 5% OF O2

Appendix 2

Enclosed Flare Data Sheet

Technical data sheet of offer

Biogas flare system

Type: HTC 3,3

High Temperature Combustion

Flow rate at a	min.	250	m^3/h	max.	500	m^3/h	
Gas flow pressure of:	min.	5	$mbar_g$	max.	40	$mbar_g$	safety shut down: <5 $mbar_g$
Heating value:	min.	4,8	kWh/m^3	max.	6,5	kWh/m^3	
Firing capacity:	min.	800	kW	max.	3250	kW	

Combustion conditions: ≥1000℃ exhaust gas temperature, concealed combustion inside a thermal insulated combustion chamber with 0.3 sec. retention time and a destruction quality >>99,9%, emissionlevel: NOx <150mg/m^3

Burner type: C-deg-Injection burner with several, back fire protected nozzles

Safety engineering: in dependence of EN, DIN, TR, ATEX, UVV and DVGW regulations

Dimensions:

Number of Burner circles:	1	
Gas connection to gas fitting line:	DN 100	
Total height ex foundation:	~ 9000	mm
Combustion chamber height:	~ 6000	mm
Combustion chamber (outer diameter):	~ 1300	mm
Weight:	~ 4500	kg

Materials (AISI):

Chamber:	[ ] 321	[ ] 304	[X] St. galv.
Insulation:	[ ] bolted	[X] glued	[ ] cliped
Console:	[ ] 316 TI	[ ] 304	[X] St. galv.
Burner:	[X] 316 TI	[ ] 304	[ ] 1.4828
Piping:	[X] 316 TI	[ ] 304	[ ] St. galv.
Gas fittings:	EN, DVGW, IBEXU certified		

Scope of supply:

1 Flare unit consisting of: Burner, heat insulated combustion pipe and console

1 Thermocouple for regulation of combustion air (option: with 4 – 20mA output signal for external registration)

1 Ignition unit consisting of:

- EN-legislated burner control unit
- Ignition transformer (7,5kV, 100% duty ratio) and ignition electrode
- UV-sensor for flame monitoring
- Ignition burner with gas fitting line

1 Gas fitting line incl. internal piping, consisting of:

- Manual butterfly valve, Pressure switches, manometer
- Quick shut valve
- Deflagration flame arrestor with German ATEX certification

Option ○ Heated and insulated weather enclosure — Extra charge:

Option ○ Explosionproof design of gas fittings (Cat3) — Extra charge: on demand

1 Control cabinet, consisting of:

- Switch board, in [ ] painted Steel [X] Plastic [ ] stainless steel
- Start/Stop via remote signal and manual
- Status and fault display, operation status on BCU
- Operation and failure signal via potential free contacts, Reset-Button

1 set of heavy loads anchors

1 set of Documentation in English consisting of:

- Operating and maintenance instructions, Wiring diagram, certificates, EC conformity statement

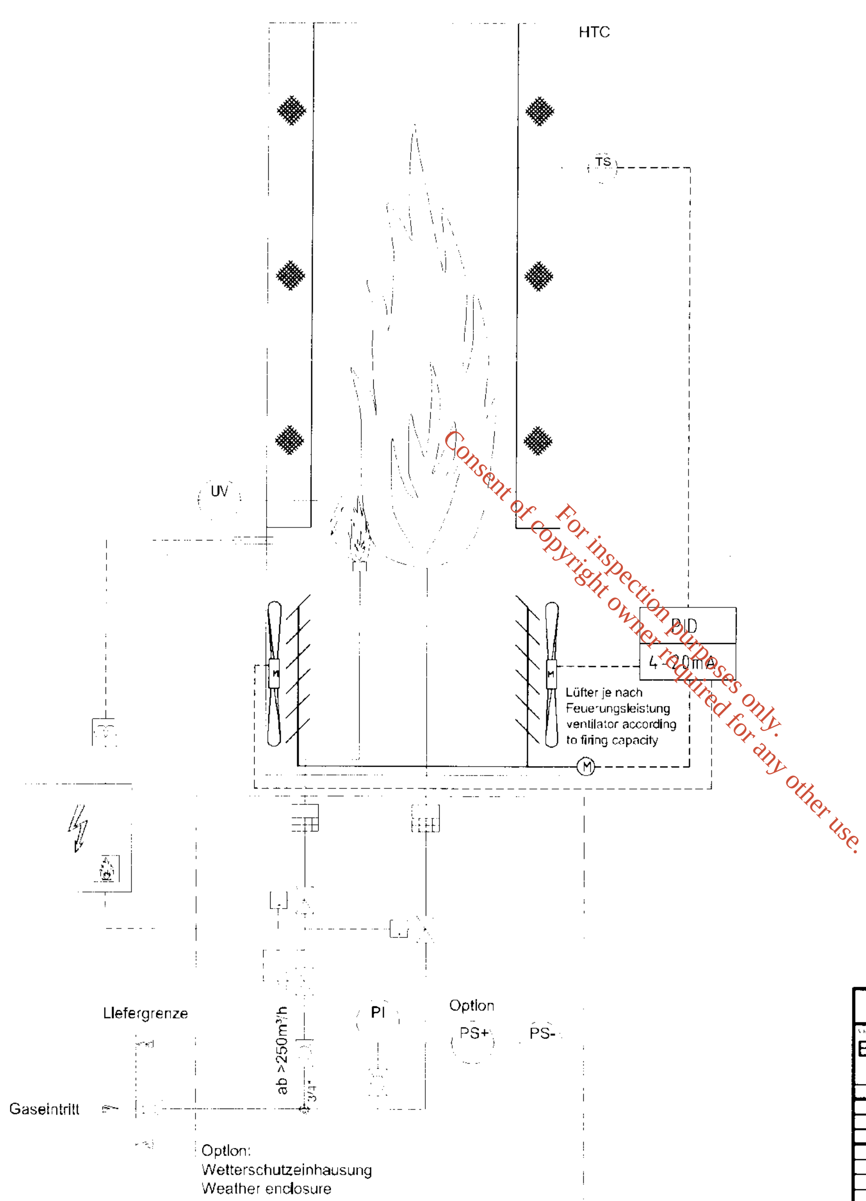
Sum ex works without options (without Tax, customs duties etc.):

Notes: Estimated Transport costs to Limerick: 5.000EUR, Supervisor for installation (1 day on site, tools, crane etc. hotel, transfer from/to airport by client): 2.800EUR, Comissioning (1 day on site, tools, hotel, transfer from/to airport by client: 3.600EUR

Kiel, 10.02.2010

C-deg environmental engineering GmbH

Joachim Hegemann



HANDABSPERRKLAPPE	BUTTERFLY VALVE
VENTIL MIT ANTRIEB	VALVE WITH ACTUATOR
DEFLAGRATIONSSICHERUNG	FLAME ARRESTOR
KUGELHAHN	BALL VALVE
DRUCKREGLER	PRESSURE CONTROLER
ZÜNDELEKTRODE	INITIATING ELECTRODE
ZÜNDTRANSFORMATOR	IGNITION TRANSFORMER
MANOMETER	PRESSURE INDICATOR
DRUCKWÄCHTER	PRESSURE SWITCH REMOTE
THERMOMETER	TEMPERATURE INDICATION REMOTE
UV-SONDE	UV CONTROL REMOTE
TEMPERATURSENSOR	TEMPERATURE SENSOR

C-deg environmental engineering GmbH Grasweg 35, D-24118 Kiel, Tel. +49 / 431 / 220 17 - 0

Bredennord BioEn.
BGP Limerick

2010 10.02. Hegl

Prinzip P&Id

Gasfackel Typ: HTC

C-deg

Appendix 3

Standby Boiler Data Sheet

RIELLO BURNERS

CE

TWO STAGE DUAL FUEL BURNERS

RLS SERIES		
RLS 28	100/163 ÷	325 kW
RLS 38	116/232 ÷	442 kW
RLS 50	145/290 ÷	581 kW
RLS 70	232/465 ÷	814 kW
RLS 100	349/698 ÷	1163 kW
RLS 130	465/930 ÷	1395 kW

The RLS series of burners covers a firing range from 163 to 1395 kW, and it has been designed for use in low or medium temperature hot water boilers, hot air or steam generators, diathermic oil boilers.

Operation is "two stage"; the burners are fitted with an electronic device STATUS PANEL, which supplies complete diagnostic functions: hour meter, ignition meter, identification of trouble shooting.

Optimisation of sound emissions is guaranteed by the use of fans with reverse curve blades and sound deadening material incorporated in the air suction circuit.

The elevated performance of the fans and combustion head guarantee flexibility of use and excellent working at all firing rates.

The exclusive design ensures reduced dimensions, simple use and maintenance. A wide range of accessories guarantees elevated working flexibility.

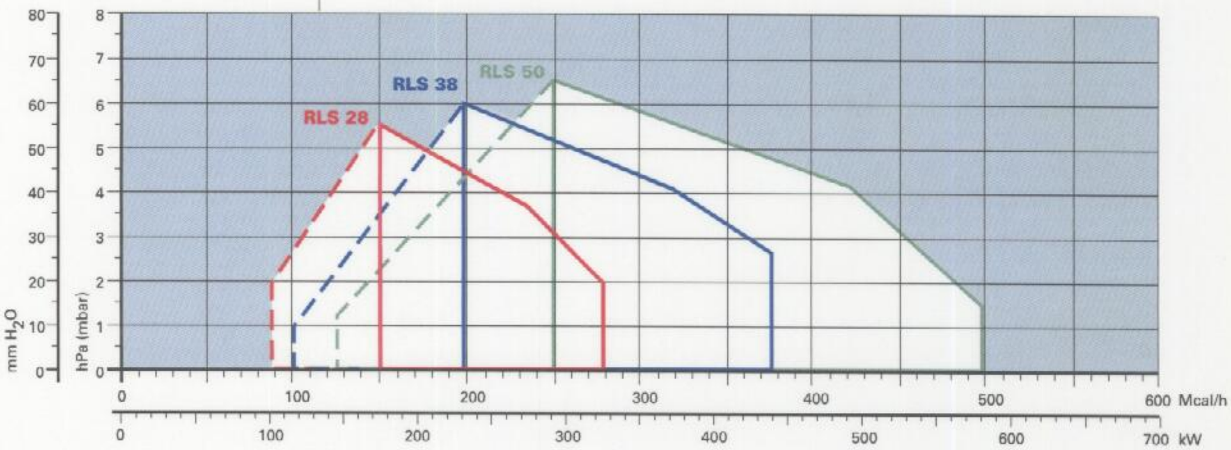
TECHNICAL DATA

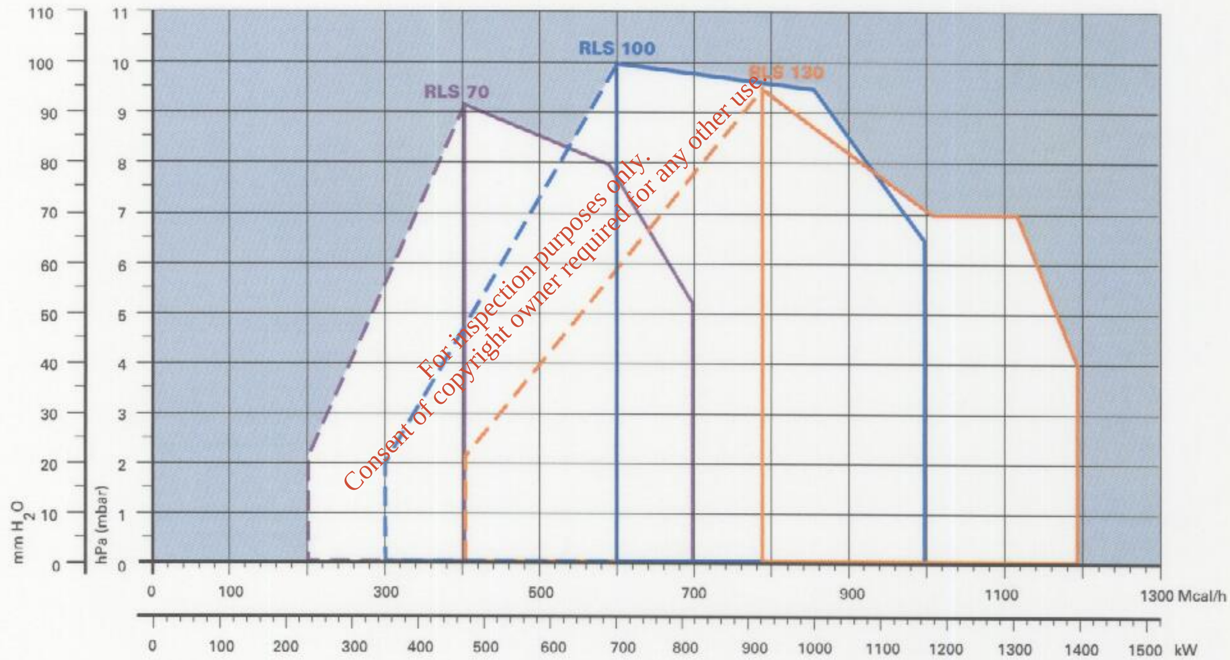
Model				▼ RLS 28	▼ RLS 38	▼ RLS 50	▼ RLS 70	▼ RLS 100	▼ RLS 130
	Operation			Two stage					
	Modulating ratio at max. ouput			2:1					
	Servomotor	type		LKS 210 - 08			LKS 210 -10		
		run time	s	5					
	Heat output		kW	100/163-325	116/232-442	145/290-581	232/465-814	349/698-1163	465/930-1395
			Mcal/h	86/140-303	100/200-380	125/249-500	200/400-700	300/600-1000	400/800-1200
	Working temperature		°C min/max	0/40					
Fuel / air data	Light oil	Net calorific value	kWh/kg	11,8					
		Viscosity at 20°C	mm²/s (cSt)	4-6					
		Delivery	kg/h	8/14-28	10/20-37	12/25-49	20/39-69	30/59-99	39/79-118
		Max temperature	°C	60					
	Pump	type		AL 65B			AJ 6CC		
		delivery	kg/h	63 (at 15 bar)			134 (at 20 bar)		
	Atomised pressure		bar	12					
	G20	Net calorific value	kWh/Nm³	10					
		Density	kg/Nm³	0,71					
		Delivery	Nm³/h	10/16-32,5	12/23-44	14,5/29-58	23/46,5-81	35/70-116	46,5/93-139,5
	G25	Net calorific value	kWh/Nm³	8,6					
		Density	kg/Nm³	0,78					
		Delivery	Nm³/h	12/19-38	13/27-51	17/33-68	27/54-95	41/81-135	54/108-162
	LPG	Net calorific value	kWh/Nm³	25,8					
		Density	kg/Nm³	2,02					
		Delivery	Nm³/h	4/6-13	4/9-17	6/11-23	9/18-32	14/27-45	18/36-54
	Fan		type	Centrifugal - with reverse curve blades					
	Air temperature		max °C	60					
Electrical data	Electrical supply		Ph / Hz / V	1/50/230 (±10%)		3N/50/230-400 (±10%)			
	Auxiliary electrical supply		Ph / Hz / V	1/50/230 (±10%)					
	Control box		type	LFL 1.333					
	Total electrical power		kW	0,53	0,76	0,91	1,8	2,2	3
	Auxiliary electrical power		kW	0,19	0,25	0,17	0,33	0,33	0,43
	Protection level		IP	44					
	Fan electrical motor power		kW	0,25	0,42	0,65	1,1	1,5	2,2
	Rated fan motor current		A	2,1	2,9	3 -1,7	4,8 - 2,8	5,9 - 3,4	8,8 - 5,1
	Fan motor start current		A	4,8	11	13,8-8	22,6 -13,2	29,5 -17	52,8 - 30,6
	Fan motor protection level		IP	44			55	54	
	Pump electric motor power		kW	0,09			0,37		
	Rated pump motor current		A	0,8			2,4		
	Pump motor start current		A	-	-	-	-	-	-
	Pump motor protection level		IP	44					
	Ignition transformer		V1- V2	230 V - 2 x 5 kV					
			I1 - I2	1,9 A - 30 mA					
	Working			Intermittent (at least one stop every 24h)					
Emissions	Sound pressure		dBA	68	70	72	74	77,5	80
	Sound power		W	-	-	-	-	-	-
	Light oil	CO emissions	mg/kWh	< 20					
		Grade of smoke indicator	N° Bacharach	< 1					
		CxHy emissions	mg/kWh	< 10					
		NOx emissions	mg/kWh	< 190					
	G20	CO emissions	mg/kWh	< 15					
		NOx emissions	mg/kWh	< 80					
Approval	Directive			90/396/EC - 89/336 (2004/108) EC - 73/23/EC - 92/42/EC					
	Conforming to			EN 267 - EN 676					
	Certifications			CE 0063 AR 4637			CE 0063 AS 4863 - DIN 5G 835/97 M		

Reference conditions:
Ambient temperature: 20°C
Pressure: 1000 mbar
Altitude: 100 m a.s.l.
Sound pressure level measured in manufacturers combustion laboratory, with burner operating on test boiler and at maximum rated output

Since the Company is constantly engaged in the production improvement, the aesthetic and dimensional features, the technical data, the equipment and the accessories can be changed.

FIRING RATES





Useful working field for choosing the burner

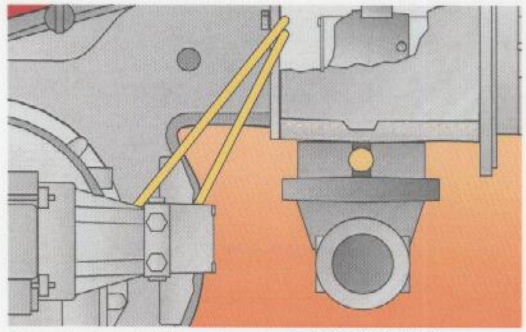
Modulating range

Test conditions conforming to EN 267 - EN 676:
Temperature: 20°C
Pressure: 1013.5 mbar
Altitude: 100 m a.s.l.

FUEL SUPPLY

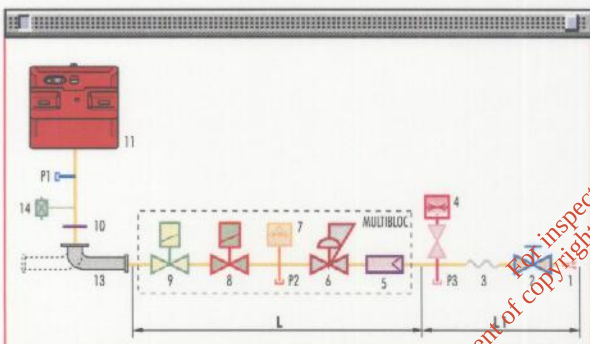
GAS TRAIN

The gas trains are fitted with a regulating valve to adjust fuel delivery in relation to heat required. This valve is controlled by the two-stages device fitted on the burner.
Fuel can be supplied either from the right or left sides, on the basis of the application requirements.
A maximum gas pressure switch stops the burner in case of excess of pressure in the supply line.
The gas train can be selected to best fit system requirements depending on the fuel output and pressure in the supply line.
The gas trains can be "Multibloc" type (containing the main components in a single unit) or "Composed" type (assembly of the single components).

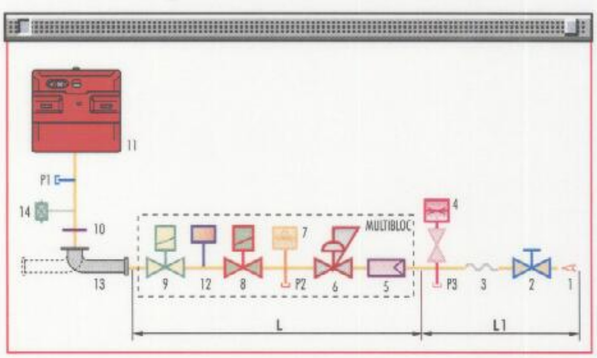


Example of gas inlet pipe burners for RLS 70-100-130

MULTIBLOC gas train without seal control

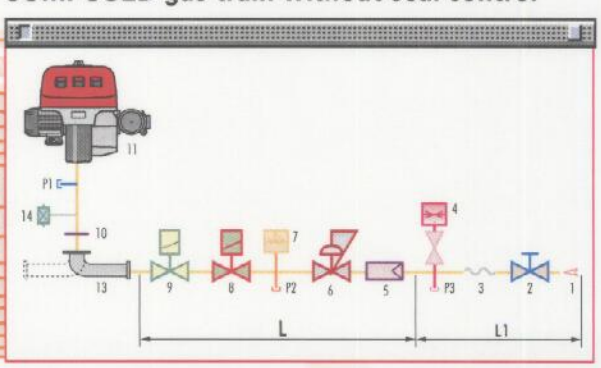


MULTIBLOC gas train with seal control

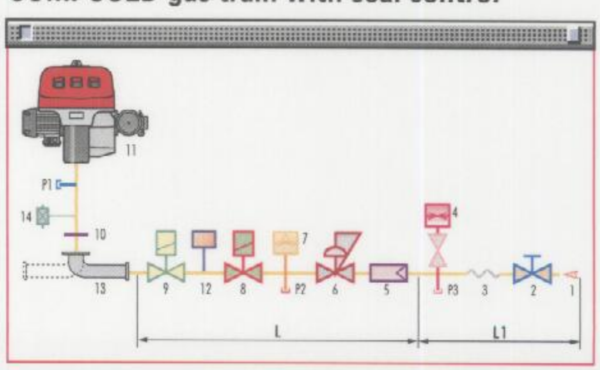


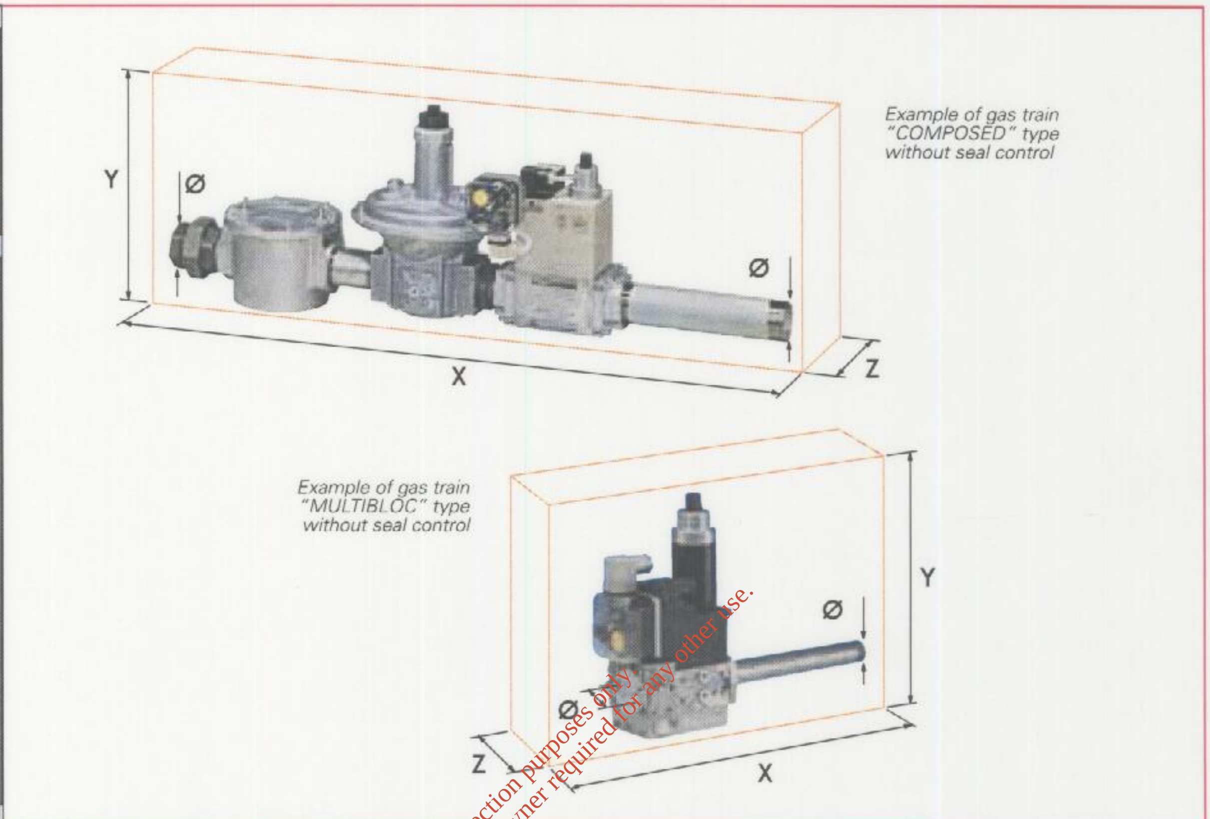
1	Gas input pipework
2	Manual valve
3	Antivibration joint
4	Pressure gauge with pushbutton cock
5	Filter
6	Pressure regulator (vertical)
7	Minimum gas pressure switch
8	VS safety solenoid (vertical)
9	VR regulation solenoid (vertical). Three adjustments: - ignition delivery (rapid opening) - 1st stage delivery (slow opening) - 2nd stage delivery ((slow opening)
10	Gasket and flange supplied with the burner
11	Burner
12	Seal control mechanism for valves 8-9. According to standard EN 676, the seal control is compulsory for burners with maximum output above 1200 kW
13	Gas train-burner adapter.
14	Maximum gas pressure switch
P1	Combustion head pressure
P2	Pressure downstream from the regulator
P3	Pressure upstream from the filter
L	Gas train supplied separately, with the code given in the table
L1	Installer's responsibility

COMPOSED gas train without seal control



COMPOSED gas train with seal control





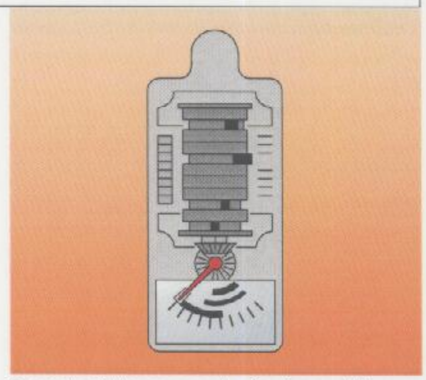
Gas trains are approved by standard EN 676 together with the burner.

The overall dimensions of the gas train depends on how they are constructed. The following table shows the maximum dimensions of the gas trains that can be fitted to RLS burners, intake and outlet diameters and seal control if fitted.
Please note that the seal control can be installed as an accessory, if not already installed on the gas train.
The maximum gas pressure of gas train "Multibloc" type is 300 mbar, and that one of gas train "Composed" type is 500 mbar.

	Name	Code	Ø i	Ø o	X mm	Y mm	Z mm	Seal Control
MULTIBLOC GAS TRAINS	**MBZRDLE 407**	3970046	3/4"	3/4"	195	235	120	-
	MBZRDLE 410	3970079	1"	3/4"	195	235	145	-
	MBZRDLE 412	3970152	1"1/4	1"1/2	433	290	145	-
	MBZRDLE 415	3970183	1"1/2	121/2	523	346	100	-
	MBZRDLE 420	3970184	2"	2"	523	400	100	-
	MBZRDLE 420 CT	3970185	2"	2"	523	400	227	Incorporated
COMPOSED GAS TRAINS	**CB 40/2**	3970153	1"1/2	1"1/2	1013	346	195	-
	CB 50/2	3970154	2"	2"	1150	354	250	-
	CB 50/2 CT	3970166	2"	2"	1150	354	320	Incorporated
	CBF 65/2	3970155	DN 65	DN 65	1166	475	285	-
	CBF 65/2 CT	3970167	DN 65	DN 65	1166	475	285	Incorporated
	CBF 80/2	3970156	DN 80	DN 80	1246	425	285	-
	CBF 80/2 CT	3970168	DN 80	DN 80	1246	425	285	incorporated

VENTILATION

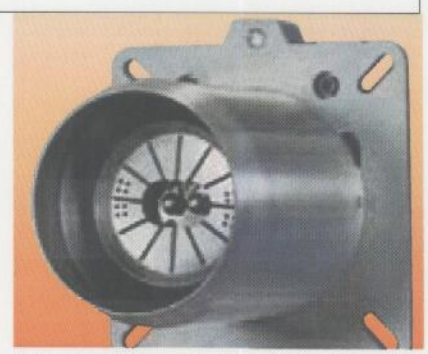
The ventilation circuit guarantees low noise levels with high performances in pressure and air delivery, in spite of compact dimensions.
The use of reverse curve blades and sound proofing material keeps noise level very low.
The result is a powerful yet quiet burner with increased combustion performance.
A servomotor allows to have a right air flow in any operation state and the closure of the air damper when burner is in stand-by.



Example of the servomotor for air regulation on RLS 70-100-130 burners.

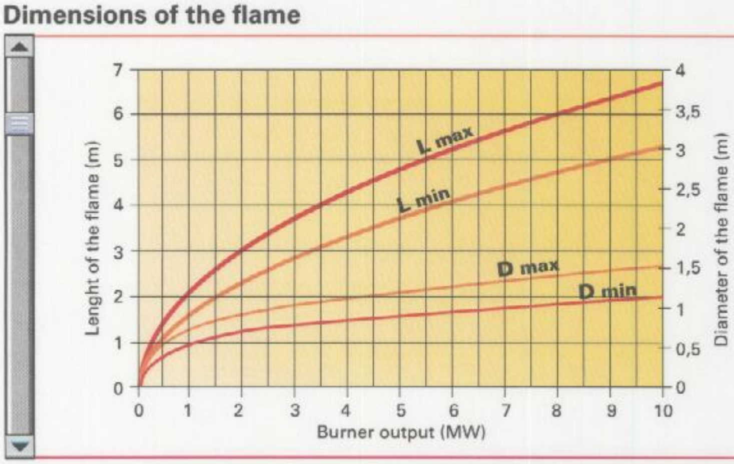
COMBUSTION HEAD

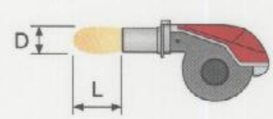
Different lengths of the combustion head can be supplied (with application of a specific "extended head kit") for the RLS series of burners.
The selection depends on the thickness of the front panel and on the type of boiler.
Depending on the type of generator, check that the penetration of the head into the combustion chamber is correct. The internal position of the combustion head can easily be adjusted to the maximum defined output by regulating a screw fixed to the flange.



Example of RLS 130 burners combustion head.

Dimensions of the flame





Example:
Burner thermal output = 3500 kW;
L flame (m) = 3,5 m (medium value);
D flame (m) = 1 m (medium value)

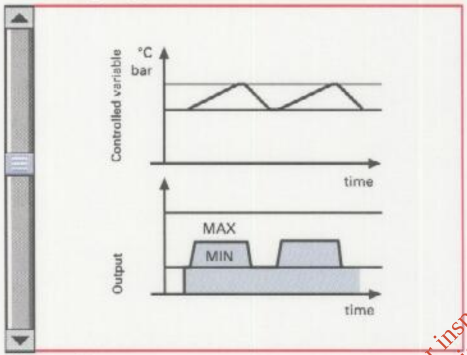
OPERATION

BURNER OPERATION MODE

With two-stage operation, the RLS series of burners can follow the temperature load requested by the system. A modulation ratio of 2:1 is reached thanks to the nozzles when burner is supplied with light oil and to the two-stage gas train when burner is supplied from gas; the air is adapted to the servomotor rotations.

On "two-stage" operation, the burner gradually adjusts output to the requested level, by varying between two pre-set levels (see picture A).

Two stage operation



Picture A

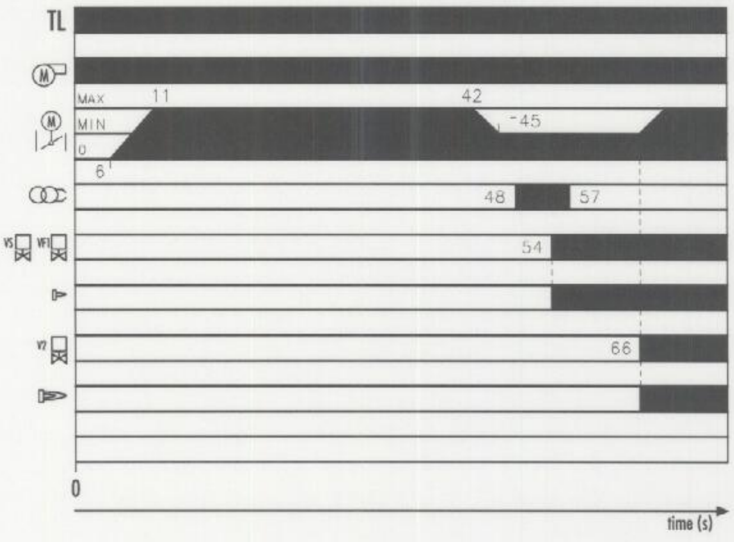
- = Power on
- = Fan motor blocked (red)
- = Burner lock-out (red)
- = 2nd stage operation
- = 1st stage operation
- = Burner operating

Picture B: *Layout of "Led Panel"*

The RLS burners are equipped with an exclusive electronic device "Led panel" that provides the six data items signalled by the leds lighting up of picture B.

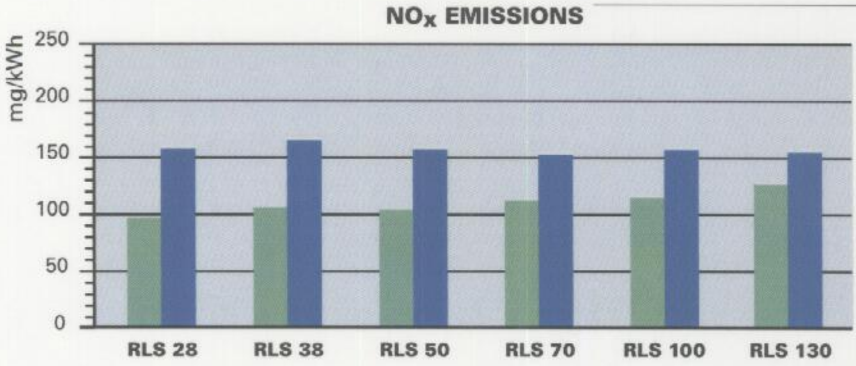
START UP CYCLE

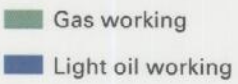
RLS 28 - 38 - 50 - 70 - 100 - 130

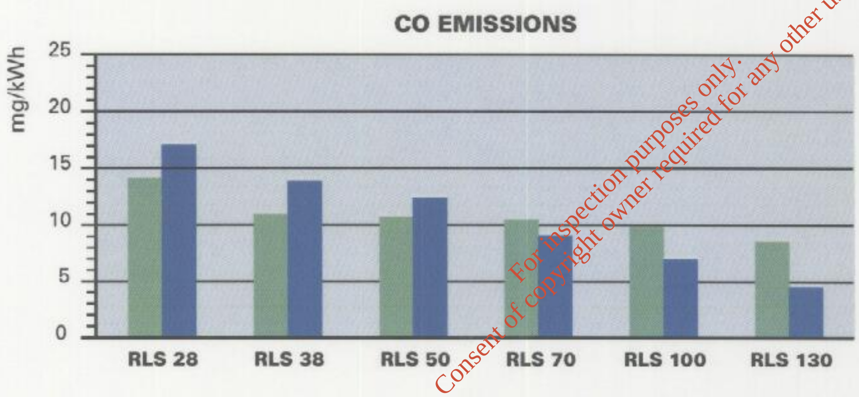


0″	Thermostat closes. The motor starts running.
6″-11″	The servomotor opens the air damper.
11″-42″	Pre-purge with air damper open.
42″-45″	The servomotor takes the air damper to the firing position.
48″	Pre-ignition
54″	Solenoid security valve VS and V1 1st stage valve open; 1st stage flame
57″	After 3″ firing the ignition transformer switches off (if flame is detected, otherwise there is a lock-out)
66″	If heat request is not yet satisfied, 2nd stage solenoid valve V2 opens and at the same time servomotor open completely the air damper. The starting cycle comes to an end. 2nd stage flame.

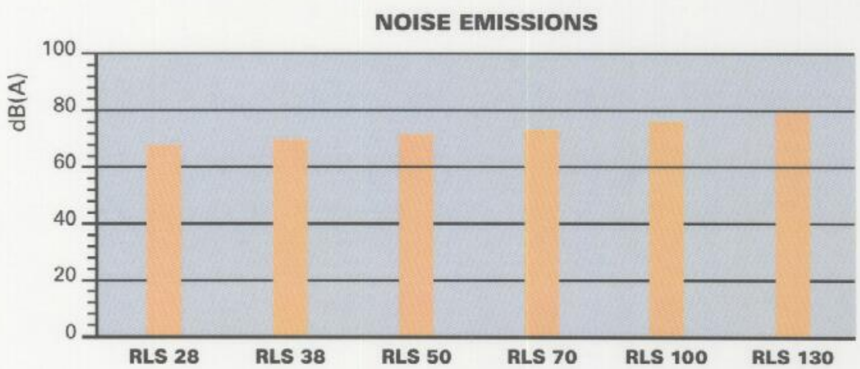
EMISSIONS







The emission data has been measured in the various models at maximum output, according to EN 676 and EN 267 standard.



PRODUCT SPECIFICATION

Burner:
Monobloc forced draught dual fuel burner, two stage operation, made up of:
- Air suction circuit lined with sound-proofing material
- Fan with reverse curve blades
- Fan starting motor
- Air damper for air setting controlled by a servomotor
- Minimum air pressure switch
- Combustion head, that can be set on the basis of required output
- Gears pump for high pressure fuel supply
- Pump starting motor
- Oil safety valves
- Two oil valves (1st and 2nd stage)
- Flame control panel
- Electronic device to check all burners operational modes (Led Panel)
- UV photocell for flame detection
- Burner on/off switch
- Oil/Gas selector
- Manual 1st and 2nd stage switch
- Plugs for electrical connections (RLS 28-38-50)
- Flame inspection window
- Slide bars for easier installation and maintenance
- Protection filter against radio interference
- IP 44 electric protection level.

Conforming to:
- 89/336/EC - 2004/108/EC directive (electromagnetic compatibility)
- 73/23/EC directive (low voltage)
- 92/42/EC directive (performance)
- 98/37/EC directive (machinery)
- EN 267 (liquid fuel burners)
- EN 676 (gas fuel burners).

Standard equipment:
- 1 gas train gasket
- 1 flange gasket
- 4 screws for fixing the flange
- 1 thermal screen
- 4 screws for fixing the burner flange to the boiler
- 2 flexible pipes for connection to the oil supply network
- 2 nipples for connection to the pump with gaskets
- Kit for transformation to LPG
- Fairleads for electrical connections (for RLS 28-38-50 model)
- Instruction handbook for installation, use and maintenance
- Spare parts catalogue.

Available accessories to be ordered separately:
- Nozzles
- Head extension kit
- Degasing unit
- Sound proofing box
- Adapters
- Stabiliser spring
- Seal control kit.

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Appendix 4

Consequence Modelling Report

Client: Michael Punch and Partners/ Greenport Environmental

Land Use Planning Implications for

Biogas/ Composting Facility at Foynes

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1.0 Introduction

At the request of Sinead Kennedy of Michael Punch and Partners (MPP) this report has been prepared by Byrne Ó Cléirigh to assess the potential implications of Greenport Environmental's proposal to establish a Biogas / Composting facility at Foynes, in close proximity to an existing oil storage tank farm operated by the Atlantic Fuel Supply Company (AFSC).

We have examined the worst case major accident scenarios that could occur at each site in order to determine two things:

1. Whether the risks arising from the activities at one site could present an unacceptable risk to people at the adjacent site
2. Whether there is any risk of domino effects between the sites.

2.0 Description of Development

Development of the Biogas / Composting facility will involve an expansion to an existing building at the site. The site was previously operated by ITEC and Albatross Fertilisers and prior to that was operated as a coal processing facility. Greenport Environmental could operate the site with up to 45 personnel present.

A drawing showing the footprint of the existing building and the proposed extension is included as an Annex to this report. The drawing also shows the AFSC oil storage facility.

3.0 Risk Associated with the Oil Storage Installation

3.1 Introduction

We do not have details of the arrangements and procedures in place at the oil storage installation operated by AFSC. As such, we have conducted a high level assessment to determine the potential risks that the bulk storage site could present to the Biogas / Composting facility.

The basic details and dimensions of the AFSC tank farm are shown in Table 1.

Table 1: Details of Petroleum Storage Tank Farm

	Product	Petroleum Class	Diameter (m)	Height (m)	Volume (m^3)
BUND 1					
Tank 1	ATK	II	26	16	8,495
Tank 2	ATK	II	26	16	8,495
Tank 8	ULSD	III	26	16	8,495
Tank 9	ULSD	III	26	16	8,495
Tank 10	ETDN	I	13.5	16	2,290
Tank 3	ATK	II	21	16	5,542
Tank 4	GO	III	21	16	5,542
Tank 5	GO	III	21	16	5,542
Tank 6	ULP	I	13.5	16	2,290
Tank 7	ULP	I	26	16	8,495
BUND 2					
Tank 21	HFO	III	20.5	16	5,281
Tank 22	HFO	III	20.5	16	5,281
Tank 23	HFO	III	20.5	16	5,281
Tank 24	HFO	III	7	16	616
Tank 25	Class III(1)	III	13.5	16	2,290
Tank 26	FAME	III	13.5	16	2,290

ATK	Aviation Grade Kerosene
ULSD	Ultra Low Sulphur Diesel
ETDN	Denatured Ethanol
GO	Gas Oil
ULP	Ultra Low Sulphur Petrol
HFO	Heavy Fuel Oil
FAME	Fatty Acid Methyl Esters

Bund 1 covers a total area of c. 12,500 m^2 and contains a drainage channel running north-south which subdivides the bund into two areas, one of 7,400 m^2 and one of 5,100 m^2. Bund 2 covers a total area of 4,150 m^2.

We have identified two categories of major accident scenario that could arise at the oil storage site and which could potentially have significant impacts at Greenport Environmental, as follows:

- Loss of containment of flammable material (i.e. Class I or Class II) due to failure at tank farm, with ignition of released material, to give rise to a fire
- Overfilling of gasoline storage tank leading to formation of cloud of aerosol / flammable vapour, with ignition, to give rise to vapour cloud explosion

We discuss these scenarios in the following sections.

3.2 Fire Scenarios – Bund Area 1

In the event of a loss of containment of flammable liquid (i.e. Class I or Class II petroleum) from one of the storage tanks, this would result in a pool of flammable liquid on the bund floor. If this spilled material was ignited this would lead to a pool fire.

While there may be a variety of mechanisms by which material can be released from a storage tank, we have conducted a high level assessment of this scenario using guidance published by the UK Health & Safety Executive (HSE) "Failure rates for atmospheric tanks for land use planning". This document breaks down these scenarios into the following categories:

Roof failure:	This scenario involves damage to the storage tank but without a loss of containment. In the event of ignition this would result in a tank fire.
Minor failure:	This scenario involves a release through a small hole in the shell of the tank. In the event of ignition this would result in a pool fire within the bund. For the purposes of this analysis, we have assumed that the dimensions of the fire would be constrained by the drainage channel (i.e. that the pool fire would cover part of the total bund).
Major failure:	This scenario involves a release through a large hole in the shell of the tank. In the event of ignition this would result in a pool fire within the bund. For the purposes of this analysis, we have assumed that this scenario would fill the bund floor.
Catastrophic failure:	This scenario involves the instantaneous release of material due to a catastrophic rupture of the tank. In this case, the momentum of the released material would be such that some of it could overtop the bund wall. The AFSC site is designed with a tertiary containment area intended to prevent any overtopping material from escaping off site.

3.2.1 Roof Failure

In the event of a roof failure, if ignition occurs this would give rise to a tank fire. The potential off site impacts of such a scenario are too low to be significant at the Biogas / Composting facility.

3.2.2 Minor Failure

In the event of a pool fire resulting from a minor failure, we have assumed that the pool of liquid formed would occupy only part of the bund floor, i.e. that the resulting pool would be bounded on three sides by bund wall and on one side by the drainage channel.

On this basis, in the event of a spill from one of the tanks to the east of the drainage channel within the bund, the resulting pool would cover an area of c.7,400 m^2. Similarly, if the spill was from one of the tanks to the west of the drainage channel, the resulting pool would cover an area of c.5,100 m^2.

The resulting heat fluxes arising from these accident scenarios are shown in Table 2.

Table 2: Consequence Modelling Results for a Pool Fire in the event of Minor Tank Failure

Scenario	Material	Area (m^2)	Distance to Thermal Radiation Endpoint		
			4.15 kW/m^2 (500 TDU)	7kW/m^2 (1,000 TDU)	10.85 kW/m^2 (1,800 TDU)
Fire due to spill from Tank 1 or 2	Class II	7,400	83	63	48
Fire due to spill from Tank 10	Class I	7,400	99	75	57
Fire due to spill from Tank 3	Class II	5,100	72	55	42
Fire due to spill from Tank 6 or 7	Class I	5,100	86	66	50

The heat radiation endpoints shown in this table correspond to the endpoints used by the HSA when assessing the impacts of a fire scenario. Exposure to a thermal dose of 1,000 TDU gives rise to a 1% lethality risk to unprotected persons while exposure to 1,800 TDU gives rise to a 50% lethality risk.

The HSE's guidance document states that the average probability of a minor failure occurring is 2.3×10^{-3} per tank per year. In the event of a minor failure resulting in the release of flammable material (Class I or II), the probability of the released material being ignited is 0.05 per event (also from the HSE's guidance document). Therefore, the probability of a minor failure resulting in a pool fire works out as 1.15×10^{-4} per tank per year, for every tank containing flammable materials.

3.2.3 Major Failure

In the event of a pool fire resulting from a major tank failure, we have assumed that the resulting pool would occupy the full bund floor, an area of c.12,500 m^2.

The resulting heat fluxes arising from these accident scenarios are shown in Table 3.

Table 3: Consequence Modelling Results for a Pool Fire in the event of Major Tank Failure

Scenario	Material	Area (m^2)	Distance to Thermal Radiation Endpoint		
			4.15 kW/m^2 (500 TDU)	7kW/m^2 (1,000 TDU)	10.85 kW/m^2 (1,800 TDU)
Fire due to spill from Tank 1, 2 or 3	Class II	12,500	102	77	58
Fire due to spill from Tank 6, 7 or 10	Class I	12,500	121	92	69

The HSE's guidance document states that the average probability of a major failure occurring is 1.1×10^{-4} per tank per year. In the event of a minor failure resulting in the release of flammable material (Class I or II), the probability of the released material being ignited is 0.7 per event (also from the HSE's guidance document). Therefore, the probability of a major failure resulting in a pool fire works out as 7.7×10^{-5} per tank per year, for every tank containing flammable materials.

3.2.4 Catastrophic Failure

In the event of a pool fire resulting from catastrophic tank failure, the momentum of the wave of material would be such that some of the released liquid would overtop the bund wall and reach the tertiary containment area. For the purposes of this analysis we have assumed that the resulting pool would occupy the full bund floor and would also cover much of the tertiary containment area.

In order to calculate the impacts associated with this scenario we have assumed that the pool would extend 8 m in every direction beyond the main bund wall. This results in a total pool area of 16,800 m^2. This scenario would also result in the flame front moving closer to the Biogas / Composting facility, as the pool would be bounded by the tertiary containment wall and not the main bund wall.

The resulting heat fluxes arising from these accident scenarios are shown in Table 4.

Table 4: Consequence Modelling Results for a Pool Fire in the event of Catastrophic Tank Failure

Scenario	Material	Area (m^2)	Distance to Thermal Radiation Endpoint		
			4.15 kW/m^2	7kW/m^2	10.85 kW/m^2
Fire due to spill from Tank 1, 2 or 3	Class II	16,800	114	86	65
Fire due to spill from Tank 6, 7 or 10	Class I	16,800	136	103	76

The HSE's guidance document states that the average probability of a catastrophic tank failure occurring is 4.8×10^{-6} per tank per year. In the event of a catastrophic failure resulting in the release of flammable material (Class I or II), the probability of the released material being ignited is 0.7 per event (also from the HSE's guidance document). Therefore, the probability of a catastrophic failure resulting in a pool fire works out as 1.01×10^{-6} per tank per year, for every tank containing flammable materials.

3.3 Explosion Scenarios – Bund Area 1

In the event of overfilling of a Class I storage tank, there is a risk that the cascade of liquid from the roof of the tank would enhance the formation of aerosol / vapour droplets, potentially leading to a large cloud of flammable vapour. If ignited this could potentially give rise to a Vapour Cloud Explosion (VCE), as happened at the Buncefield oil storage facility in the UK in December 2005.

Following discussions with the HSA, we have modelled the impacts of this scenario on the basis of the methodology set out by Atkins Consultants Ltd in their report to the UK HSE as part of the Buncefield Investigation, "*Review of significance of societal risk for proposed revision to land use planning arrangements for large scale petroleum storage sites*" (RR512). This report sets out what may be viewed as a conservative scenario, due to the fact that it involves a greater release of flammable vapour to atmosphere than occurred during the Buncefield Incident.

The hazard distances associated with such a scenario are as shown in Table 5.

Table 5: Consequence Modelling Results for a 'Buncefield-Type' Explosion

Distance	Overpressure
Near field (up to 50 m)	1,000 mbar
97 m	600 mbar
264 m	140 mbar
447 m	70 mbar
2,000 m	13 mbar

For reference, the distance from the bund to the closest point at the Biogas/Composting facility is c.36 m. The distance from the bund to the office area is c.55 m.

The probability of such a scenario occurring is difficult to estimate and so we have consulted the literature produced following the Buncefield Incident. The final report published by the Major Incident Investigation Board includes an estimate of the risks of such a scenario across the industry as a whole. The report notes that there is little historical data to determine accurate risk estimates for very infrequent incidents such as this. A base case event frequency per site for pre-Buncefield sites was used of 1 in 10,000 years, i.e. 1×10^{-4} per site.

The report also notes that this frequency figure can be reduced for sites that have implemented the recommendations of the Buncefield Investigation. There are three benefit scenarios identified in the report, describing increasing levels of engineering controls and protection at oil storage sites.

Scenario 1: A single off-site automatic shut-off valve on the inlet pipe to the site, preventing the feeding of fuel to all tanks on site.

Scenario 2: An automatic shut-off valve on the inlet pipe to each tank, preventing the feeding of fuel to individual tanks and between tanks, and allowing tanks to be isolated in the event of a fire.

Scenario 3: Dual automatic shut-off valves at each tank, one on the inlet, one on the outlet. This isolates individual tanks and prevents transfer between tanks, even in the event of a valve failing.

We do not have details of the range of measures and arrangements in place at the AFSC site, but we are conscious that the HSA have been bringing the Buncefield recommendations to the attention of operators of oil storage sites in order that they be implemented here.

For benefit scenario 1, the risk of a Buncefield-type VCE occurring is considered to have reduced to 1 in 100,000 years. For benefit scenario 2, the risk is further reduced to 1 in 1,000,000 years. The report does not quantify any further reduction in the probability of such a scenario occurring at a site where the benefit scenario 3 measures have been implemented and so we have assumed that the figure of 1 in 1,000,000 years would also apply here.

As the AFSC site is a new petroleum storage installation, we have assumed that the design of the facility will have taken account of the recommendations arising from the Buncefield Incident. As such we have assumed that the risk of a Buncefield-type VCE occurring can be taken as 1 in 1,000,000 years, or 1×10^{-6} per annum, i.e. that sufficient measures have been put in place to qualify as Benefit Scenario 2 or Benefit Scenario 3.

In order to determine the risk to people in the vicinity of the site, we also need to consider that the location of the blast centre can have a significant role. In accordance with the Atkins methodology, we have chosen nine blast centres, equally distributed about the tank farm area and assumed that each is equally likely to serve as the actual blast centre should this scenario occur.

3.4 Bund Area 2

Bund Area 2 at the AFSC site is used exclusively for Class III storage and so there is no credible fire event at this location except in the event of an external fire which is of sufficient magnitude to elevate the contents of one or more tanks above its flash point. There may also be a risk of a fire following a VCE at Bund Area 1. In either case, the probability of such a scenario occurring is highly unlikely, and it is only the proximity of the flammable storage at Bund Area 1 that makes this a credible scenario.

If such a fire did occur, with loss of containment to the bund and ignition of this material, in the worst case scenario the resulting heat flux at the closest point on the Biogas / Composting facility would be c.1.1 kW/m^2, which would have negligible impact.

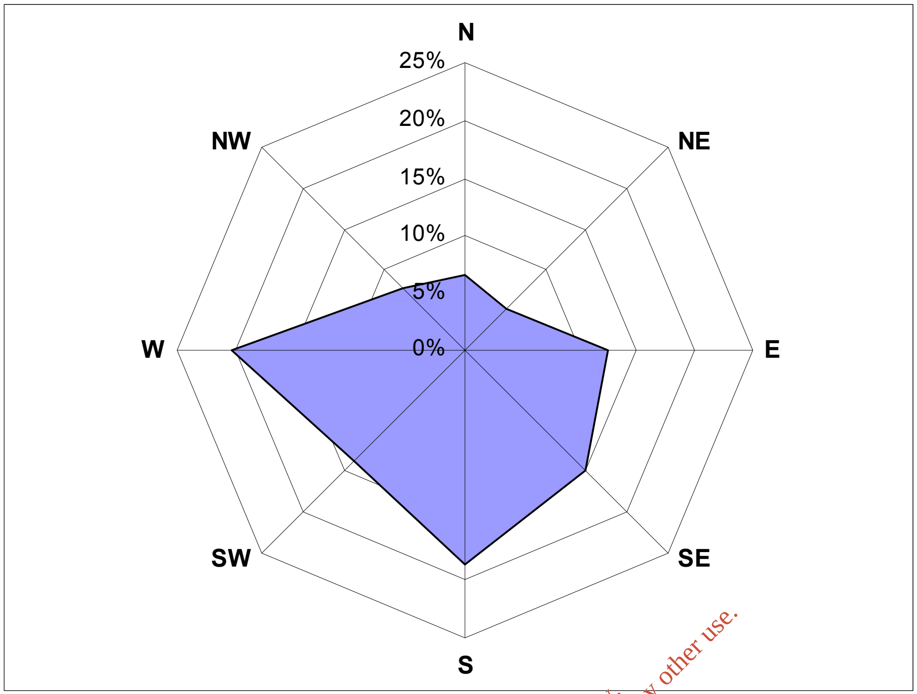
3.5 Aggregating the Risks of all Scenarios

In order to determine the overall risk presented by the petroleum storage site to the Greenport Environmental facility, we have aggregated the various scenarios that we have identified which could give rise to significant impacts. These scenarios are as follows:

- Small bund fire due to minor failure of storage tank of flammable material
- Full bund fire due to major failure of storage tank of flammable material
- Fire in bund and in tertiary containment area due to catastrophic failure of storage tank of flammable material
- Vapour Cloud Explosion due to overfilling of Class I tank

The results in Tables 2, 3 and 4 show the downwind (i.e. maximum) hazard distances. In reality, the flame could potentially be angled in any direction, depending on the wind direction. If there was a northerly or southerly wind at the time, then the flame front would not be angled towards the Biogas / Composting facility and so the resulting heat fluxes experienced there would be less than the figures shown. If the wind was blowing from the east at the time, then the flame would be tilted away from the Biogas / Composting facility and the impacts at this site would be greatly reduced. The wind rose for Shannon Airport is shown in Figure 1.

Figure 1: Wind Rose for Shannon Airport



In contrast, there is no accounting for wind direction in calculating the risk associated with a VCE. The methodology assumes that the blast centre could fall anywhere on the site.

When assessing the impacts of each of these scenarios at the Biogas/Composting facility, it is also important to consider whether people are indoors or outdoors at the time, as this would have a significant bearing on the risk they are exposed to.

We have determined the risk presented to people, both indoors and outdoors, on the following basis, as shown in Table 6:

Table 6: Methods for determining Risk to the Surrounding Population for Fires and Explosions

Scenario	Fire	Explosion
People outdoors	The risk of lethality to a person exposed to heat radiation from a fire is dependent on the total thermal dose received. We have assumed that anyone located outdoors could be exposed to this thermal radiation for up to 75 seconds, in accordance with the HSA's guidance.	The risk of lethality to a person experiencing an overpressure from an explosion is calculated using the Probit function[1] from the Atkins report.
People indoors	For people located indoors when a fire occurs we have assumed that the building structure will provide them with sufficient protection to shield them from the thermal radiation. However, if the heat levels that can be generated at the building are sufficiently high, then there may be a risk of damage and/or the fire spreading to the building.	The risk of lethality is dependant on the degree of overpressure the building experiences and on the nature of the building's construction to determine how well it would resist the overpressure. We have used the response pattern for typical domestic buildings (CIA Category 3 developments), as per the Atkins report.

We have assumed that people will be indoors 90% and outdoors 10% of the time during the day and indoors 99% of the time and outdoors 1% of the time at night, again as per the methodology in the Atkins Report.

The calculations of the overall risk are shown in Table 7. The risks shown apply to any locations to the east of the tank farm, such as the Biogas / Composting facility. The asymmetric nature of both the wind rose and of the tank farm means that the risk profile will be different in other directions.

[1] The probit function is used to calculate the average lethality level across the population as a whole following exposure to a specific overpressure level. As the overpressure decreases with distance from the event, so too does the impacts on people and the surroundings

Table 7: Calculation of Risk Profile to the East of the AFSC Site

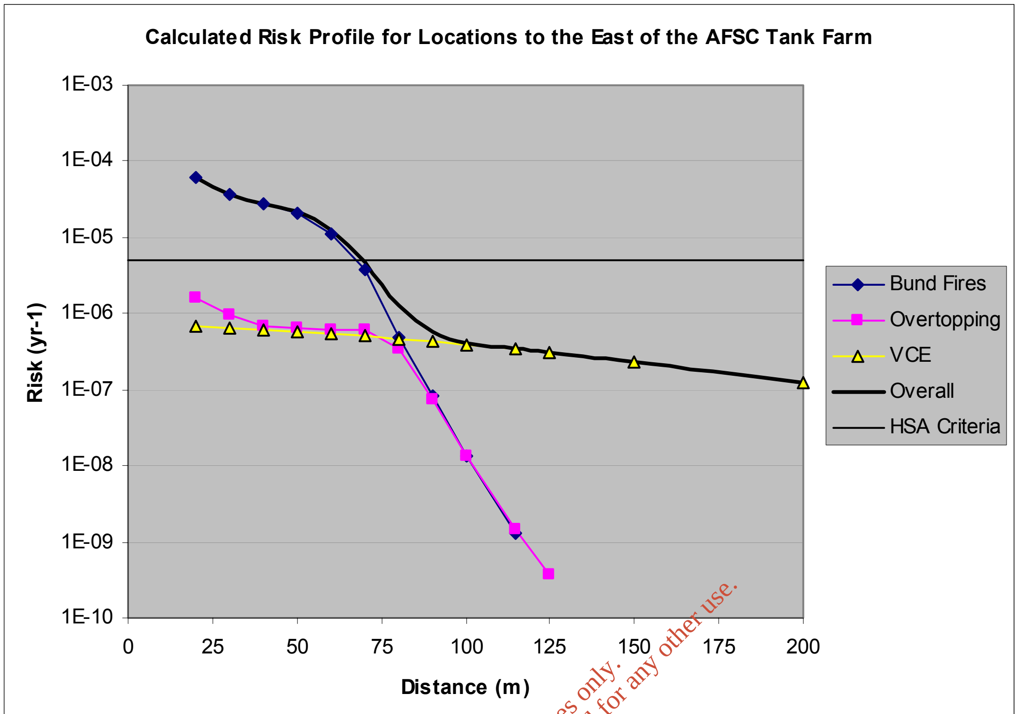
Distance from Main Bund Wall	Lethality Risks			
	Bund Fires	Catastrophic Tank Failure	VCE	Total
10	6.36E-05	2.02E-06	7.09E-07	6.63E-05
20	6.06E-05	1.58E-06	6.77E-07	6.29E-05
30	3.58E-05	9.64E-07	6.49E-07	3.74E-05
40	2.71E-05	6.71E-07	6.22E-07	2.84E-05
50	2.06E-05	6.34E-07	5.89E-07	2.18E-05
60	1.10E-05	6.26E-07	5.46E-07	1.21E-05
70	3.70E-06	6.24E-07	5.03E-07	4.83E-06
80	4.84E-07	3.52E-07	4.66E-07	1.30E-06
90	8.40E-08	7.42E-08	4.28E-07	5.86E-07
100	1.30E-08	1.35E-08	3.91E-07	4.17E-07
125	0.00E+00	3.60E-10	3.10E-07	3.10E-07
150	0.00E+00	0.00E+00	2.31E-07	2.31E-07
200	0.00E+00	0.00E+00	1.25E-07	1.25E-07

The figures for Bund Fires in Table 7 represent the combined risks of bund fires arising from small spills and of bund fires due to large spills.

In each case the distance figure refers to the distance from the main bund wall. As such for some of the accident scenarios that feed into this calculation the flame front would be located further away than this, e.g. in the case of a pool fire from a small spill from one of the tanks to the west of the drainage channel, the flame front would start at the drainage channel and not at the bund wall. Similarly, there are other scenarios for which the flame front may be closer than this, e.g. in the case of a pool fire from bund overtopping the flame front would be at the tertiary containment wall rather than the main bund wall. All of these factors have been included in the calculation. The hazard distances are expressed in terms of the distance from the main bund wall in order to give a common frame of reference.

The values from Table 7 are also represented in Figure 2.

Figure 2: Plot of Risk Profile to the East of the AFSC Site



The plot illustrates how the risk profile in close proximity to the site is dominated by the bund fire scenarios. However as the distance from the site increases, the relative contribution from the vapour cloud explosion risk increases.

This plot shows that workers located to the east of the AFSC tank farm would be exposed to a lethality risk of 5×10^{-6} per annum at a distance of c.70 m from the bund (note, this is the distance from the main bund wall, not the tertiary bund wall). This means that any workers located inside this distance would be exposed to a higher risk than the threshold in the HSA guidance document while any workers who are based more than 70 m away would be exposed to a lower risk than the HSA threshold.

As mentioned previously, we have assumed that in the event of a fire scenario there is no risk of lethality for people at the Biogas / Composting facility provided they are indoors at the time of the accident. However in making this assumption we need to note the maximum fluxes that could arise at the building and assess the risk that a fire at the oil storage site could spread to this building.

Based on our calculations, the maximum fluxes that could arise at the office area at the Biogas / Composting facility, would be as follows:

Full Bund Fire:	20 kW/m^2
Catastrophic Tank Failure:	32 kW/m^2

In order to put these figures into context, we have referred to TNO's "Methods for the determination of possible damage" (the Green Book). Based on the data from the Green Book, both of these heat fluxes are sufficient to cause damage to buildings. The level of damage will depend on the materials of construction used and the Green Book provides some average values for various material types. For wood or for synthetic materials, a flux of 15 kW/m^2 is considered sufficient for ignition to spread. For steel structures, a flux of 25 kW/m^2 is considered sufficient for significant damage to the paint coating or enamel layer on the steel surface, while a flux of 100 kW/m^2 is required for failure or collapse of structural steel elements.

As such, there is a credible risk that a major spill fire at AFSC could result in the fire spreading to the building at the Biogas/Composting facility, but not in sudden failure or collapse of the building structure. Furthermore, for each of these scenarios it would be possible for people inside the office area to escape from the opposite side of the building. Even in the worst case scenario (a fire resulting from catastrophic tank failure with bund overtopping) the maximum heat flux at the far side of the Biogas / Composting facility would be c.3 kW/m^2. This is much less than the threshold figure for emergency exits of 6.3 kW/m^2, which is set out in the Chemical Industries Association (CIA) document "Guidance for the location and design of occupied buildings on chemical manufacturing sites". As such, a safe evacuation could be made from the east side of the building, if it was under fire attack from a major accident at the AFSC site.

4.0 Risks Associated with BIOGAS / COMPOSTING Facility

We have examined the following scenarios at the Biogas / Composting facility to determine if there is any risk of a major accident at this site which could in turn lead to domino effects at the oil storage facility.

- Risks associated with a loss of containment of biogas
- Risks associated with the operation of the reserve biogas exhaust system

4.1 Biogas

Biogas is collected in the fermentation tanks. These tanks are both 1,400 m^3 above-ground, vertical cylindrical membrane storage tanks. The biogas is collected in a balloon above the liquid level in the tank. At maximum capacity, these membranes can hold up to 780 m^3 of biogas, at a pressure of up to 8 mbar above atmospheric.

The composition of the biogas is as follows:

- Methane: 52%
- Carbon Dioxide: 47%
- Residual gases: balance

In the event of a loss of containment from the membrane, the outer container (i.e. the cylindrical storage tank) would allow controlled venting of the gas. For the purposes of determining the impacts of this scenario, we have modelled what may be considered a worst case involving the release of 780 m^3 of biogas (or 406 m^3 of Methane) over a 10 minute period. In the event of this release of gas being ignited and giving rise to a VCE, the resulting overpressures are as shown in Table 8.

Table 8: Consequence Modelling for a VCE following a release of Biogas

Distance from Release (m)	Overpressure (mbar)
14.5	600
28.5	140
45	70

The overpressure at the closest tank at the oil storage site would be less than 15 mbar, which would not cause any damage or loss of containment from the tanks. According to the literature, an overpressure of 63 mbar is required to cause roof damage to storage tanks, while overpressures in the range 200 to 280 mbar are required to rupture an oil storage tank. Based on these results there is no risk that a release of biogas could lead to domino effects at the oil storage site.

This scenario was modelled in calm weather conditions as these are the most conducive to the formation of a flammable or explosive cloud. We also modelled the scenario in more typical weather conditions but found that a VCE would not occur in this case.

4.2 Reserve Requirement for Exhausting of Biogas

The biogas stream is mixed with air and fed to generators for the production of power. In the event of generator down time there is capacity to store biogas and allow continued operation while the generators are being prepared. In the event of the storage volume not being sufficient, there is a final option of exhausting the biogas following burn-off of contaminants. The maximum flow rate which would be required in this event is 4,000 m^3/hr. Assuming a stoichiometric mixture is used, the feed to the exhaust system would be composed as follows:

- Oxygen (air): 571 m^3/hr
- Nitrogen (air): 2,857 m^3/hr
- Methane (biogas): 286 m^3/hr
- Carbon Dioxide (biogas): 286 m^3/hr

Such systems are characterised by burning at high temperatures, with high heat fluxes in the immediate vicinity of the flame. However they do not give rise to significant radiant heat to the surroundings.

The main potential concern in relation to having an exhaust system at this site is the risk that a loss of containment at the oil storage facility could result in a flammable atmosphere being formed and extending as far as the exhaust point. If this did occur and the resulting flammable cloud reached the exhaust point while it was ignited, then this could potentially result in a more significant scenario than would otherwise occur, due to the high ignition energy that would be available from the exhaust point.

In order to determine the potential for this scenario to occur, we have looked at the impacts in the event of overfilling of one of the gasoline storage tanks, resulting in enhanced vapour / aerosol formation as the liquid cascades down the side of the tank. It is this scenario that could potentially lead to a Buncefield-type VCE, as described in Section 3.3, only in this case we are examining the dispersion of vapour rather than the impacts of an explosion. The purpose of this assessment is to determine whether there is any risk that the resulting flammable cloud could extend as far as the exhaust point at the Biogas / Composting facility.

We have modelled an overfill scenario at the tank farm on the following basis:

- In the event of overfilling, the high evaporation rate of the cascading material and presence of the drainage channel in the bund will mean that the pool of spilled liquid will only gather over part of the bund floor.
- The evaporation rate for a pool of this size is based on the physical properties of gasoline. The calculated evaporation rate is doubled in order to allow for the enhanced vapour cloud formation that can arise due to tank overfilling.
- The atmospheric dispersion of the resulting vapour cloud is modelled over using a surface roughness length of 0.5 m, which is representative of parkland areas. This is a conservative assumption given the built up nature of the area, but it is necessary in order for the model to generate an explosive atmosphere of vapour following a spill of this type. If the scenario is modelled using a surface roughness of 1 m, which is representative of an area with regular large obstacle coverage then no flammable atmosphere is predicted.

The above assumptions are in accordance with our standard methodology for assessing the risks associated with flammable vapours arising from tank overfilling. They are conservative assumptions which we use in order to replicate the conditions that occurred during the Buncefield incident.

Based on these results we have calculated that in the worst case overfilling scenario, a flammable atmosphere could be generated at a distance of up to 160 m from the pool surface. The gasoline tanks are located at the west side of the drainage channel; the distance from the resulting pool that would be formed in the event of an overspill to the exhaust point stacks is 185 m.

There is a Class I storage tank (Ethanol) to the east of the drainage channel and so if overfilling occurred in this tank, the resulting pool would be closer to the exhaust point. In this case though the lower volatility of Ethanol means that there is much less vapour generated than for a gasoline spill and no impact at the exhaust point.

On the basis of this analysis there is no credible risk of a flammable atmosphere being generated at the exhaust point on the Greenport Environmental site due to a loss of containment at the AFSC site.

5.0 Conclusions

Based on the results of this assessment, there is a portion of the Greenport Environmental Biogas/Composting facility site that is close enough to the AFSC site that the risk presented to people at the Biogas / Composting plant is greater than 5×10^{-6} per year, which is the threshold value used by the HSA when advising local authorities on land use planning for new development sites.

The area at risk primarily includes the existing office element of the structure, as this is the closest part of the facility to the AFSC tank farm. The distance to the HSA's criterion risk level of 5×10^{-6} is 70 m from the main bund wall. The only part of the new facility that does fall within this range is part of the Dispatch Area, and this will not normally be occupied.

The existence and operation of the two storey office building on the site, which was constructed in the early 1990's, is important to consider in the context of any land use planning decisions for this development. It is also of note that the HSA criterion of 5×10^{-6} used in this assessment may be relaxed in respect of neighbours where the new development is the same as or similar to the existing neighbours.

In the event of a VCE at the AFSC site, the resulting overpressures would be significant along the west side of the Biogas / Composting building. However, assuming that the levels of controls at the oil storage facility are sufficiently high to meet the criteria of Benefit Scenario 2 or 3, as described in the Buncefield Investigation report, then the probability of such a scenario can be considered sufficiently low (1×10^{-6} according to the final Buncefield Report) that the risk it presents at the Biogas / Composting site is less than the value used by the HSA for land use planning for new developments.

The main reason that the existing office area falls within the zone where the HSA's criterion is exceeded is due to the risks associated with spill fires and full bund fires, as can be seen in Table 7. In the event of a major fire of this type, the Biogas / Composting building will serve to protect personnel that are indoors at the time. They would also be able to safely evacuate the building from the far side, away from the AFSC site, presuming that an exit point is provided on the east side of the building. However, any personnel at the site that were outdoors at the time of a major bund fire could be exposed to high heat fluxes, and this is the main contributor to the risk calculation.

It should also be noted that in the event of a major spill fire at the AFSC site, it is likely that the fire could spread to the Biogas / Composting building, resulting in a spread of the fire and potentially significant structural damage, although adequate time would be available for personnel evacuation.

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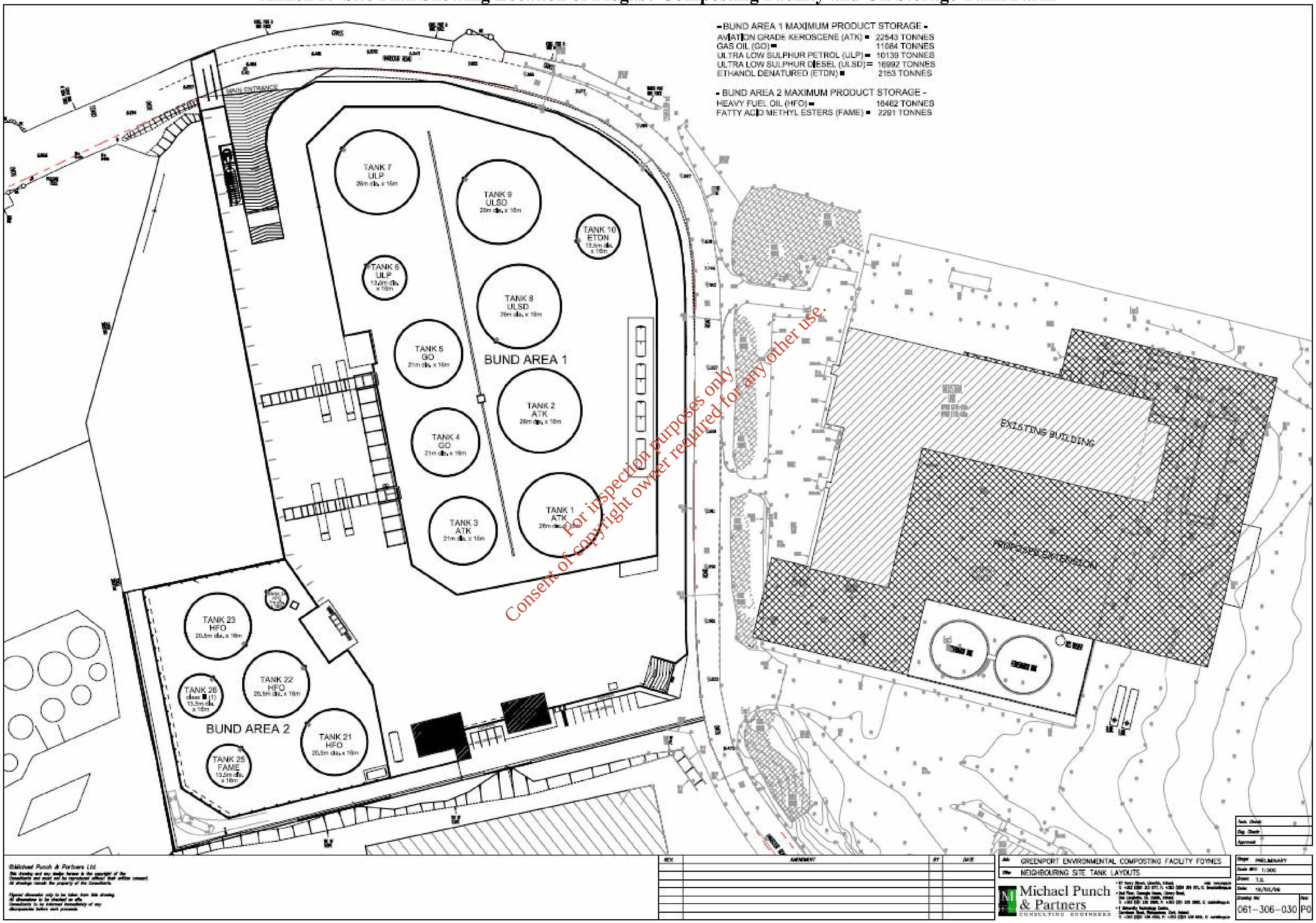
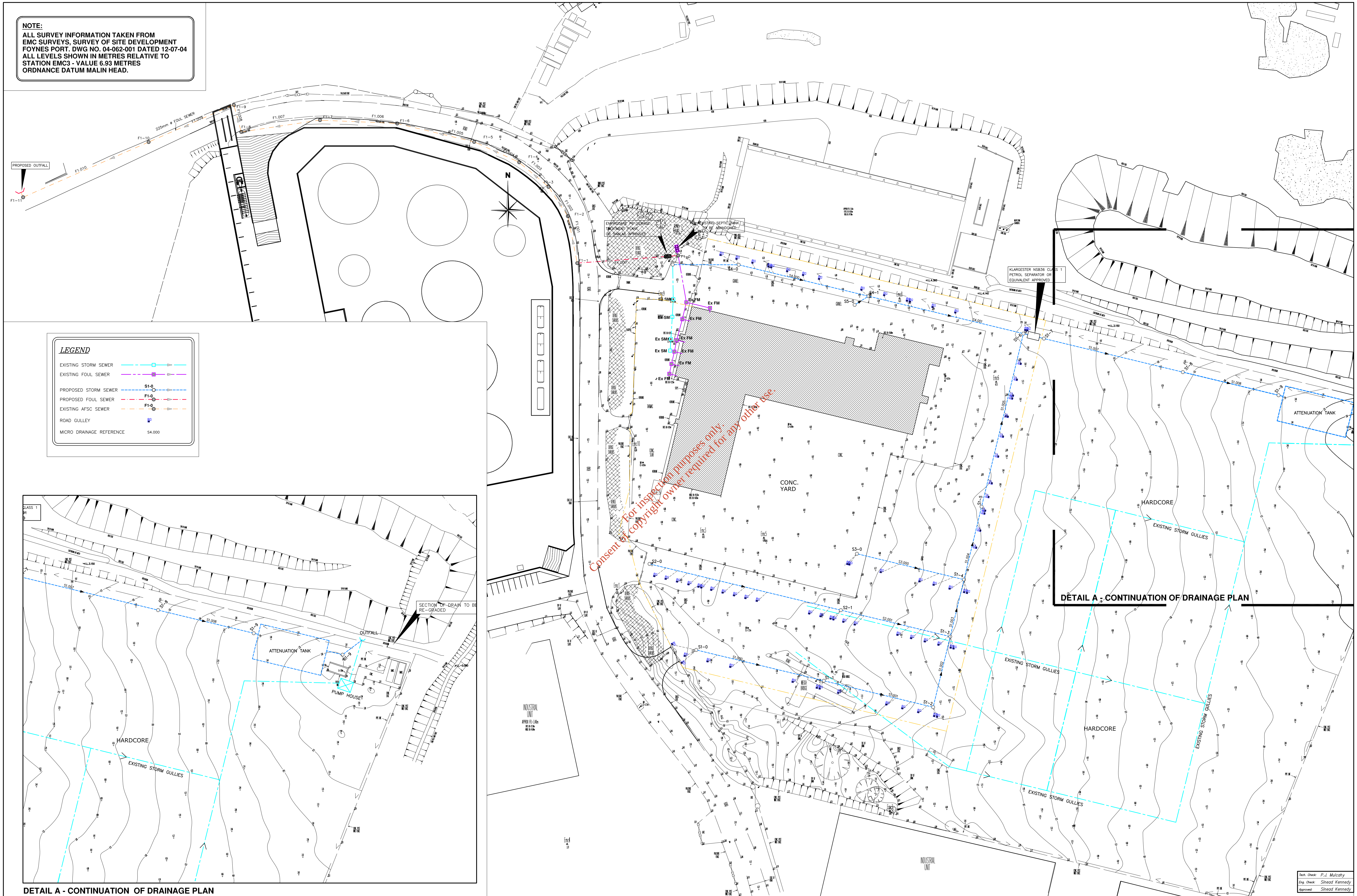
Annex 1: Site Plan Showing Location of Biogas / Composting Facility and Oil Storage Tank Farm



Appendix 5

Foul Sewer Works: Drawing No.061-306-012-P5



Figured dimension only to be taken from this drawing. All dimensions to be checked on site. Consultants to be informed immediately of any discrepancies before work proceeds.

REV.	AMENDMENT	BY	DATE
P1	LEVELS REVISED FROM POOLBEG TO MALIN HEAD & STORM SEWER INFORMATION ADDED	KS	24/09/2008
P2	PLAN LAYOUT REVISED	KS	12/12/2008
P3	PETROL INTERCEPTORS ADDED.	TG	24/02/2009
P4	BUILDING FOOTPRINT REVISED	P.J.M	06/04/2009
P5	AFSC SEWER INCLUDED	KOB	26/02/2010

Job: GREENPORT ENVIRONMENTAL COMPOSTING FACILITY FOYNES

Title: DRAINAGE LAYOUT

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Tech. Check: P.J. Mulcahy
Eng. Check: Sinead Kennedy
Approved: Sinead Kennedy

Stage: PLANNING
Scale @A0: 1:500
Drawn: KS
Date: 16/06/2008
Drawing No: 061-306-012
Rev: P5

Appendix 6

Copy of Discharge Licence

LIMERICK COUNTY COUNCIL

LOCAL GOVERNMENT (WATER POLLUTION) ACTS 1977 & 1990

LICENCE TO DISCHARGE TRADE OR SEWAGE EFFLUENT OR OTHER MATTER TO WATERS

Atlantic Fuel Supply Co. Ltd
River House,
Blackpool Park,
Blackpool,
Co. Cork,
Ireland.

Reference No. in Register W. 109

Limerick County Council, in exercise of the powers conferred on it by Local Government (Water Pollution) Acts, 1977 & 1990 hereby grants a license to discharge trade effluent:

From: Atlantic Fuel Supply Co. Ltd. Foynes Harbour, Durnish, Co. Limerick
To: Shannon Estuary,
At Foynes Harbour,
Durnish,
Co. Limerick.

Subject to the conditions on the attached Schedule.

Please note that while a licence has been granted, no discharge may occur from the premises until such time as facilities are in place to ensure that the standards specified in the section 2.2 of the licence conditions are not exceeded. It is an offence to permit any discharge from the premises, other than uncontaminated storm water, which does not comply with the conditions of the discharge licence.

Signed on behalf of the said Council: T. Ta[illegible]
APPROVED OFFICER

ORDER NO. 24/2009 **DATE:** 11/2/2009

EXPLANATORY NOTES: *These notes do not form part of the Licence.*

An appeal against the decision of the Sanitary Authority under the provisions of the Local Government (Water Pollution) Acts, 1977 & 1990 may be made to An Bord Pleanala. An appeal shall be made (a) by sending the appeal by prepaid post to the Board or (b) by leaving the appeal with an employee of the Board at the office of the Board during working hours. Appeals should be addressed to An Bord Pleanala, 64 Marlborough Street, Dublin 1 and should be accompanied by this form.

An appeal made to an Bord Pleanala will be invalid unless a fee of €126.00 is received by the Board within the statutory appeal period.

This licence may be reviewed by the Sanitary Authority in accordance with the provisions of Section 7 of the Local Government (Water Pollution) Act, 1977 as amended and inserted by Section 5 of the Local Government (Water Pollution) (Amendment) Act, 1990. The prescribed period of the purpose of an appeal shall be:

(a) In the case of an appeal relating to the grant or refusal of a licence, the period of one month beginning on the date of the grant or refusal of the licence.

(b) In the case of an appeal relating to the decision of a local authority or sanitary authority on a review of a licence, the period of one month beginning on the date of the decision.

Re: Licence under the Local Government (Water Pollution) Acts 1977 & 1990 for the Discharge of Sewage to Waters (Section 4 of the Principal Act).

Applicant: Atlantic Fuel Supply Co. Ltd., The Harbour, Foynes, Co. Limerick.

Licence Register Number: W109

Schedule of Conditions

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1 GENERAL

1.1 This Licence refers to the discharge of the treated sewage effluent from the proposed development at **Atlantic Fuel Supply Company Ltd., Foynes Harbour, Durnish, Co. Limerick** to the Shannon Estuary.

1.2 Effluent discharges shall take place only as specified in the application form received on the 12th December 2008, as modified and/or controlled by this Licence and subject to the requirements of law. **No material change in the quality or quantity of the trade effluent being discharged shall be made without the prior consent of the Licensing Authority**.

1.3 No constituent of the effluent shall be discharged in such quantity as would exceed those concentration limits imposed for the specific substance in national or international legislation.

1.4 The licensee shall notify the Licensing Authority in writing immediately prior to the commencement of the licensed discharge.

2 STORM WATER

2.1 Roof and yard water shall be separately collected and discharged to the surface water drain via oil interceptor.

2.2 A readily and safely accessible monitoring chamber shall be constructed on the storm water pipeline to allow for inspection and sampling of the storm water being discharged. **Within 3 months** of the proposed terminal being in operation a sample shall be taken from surface water manhole S10 as shown on drawing ref. 051-110-059 and analysed for the following parameters:

- B.O.D.
- Suspended Solids
- Mineral Oils
- Diesel Range Organics
- Petrol Range Organics

The results shall be submitted to the Environment Section of Limerick County Council.

2.3 Detail calculations for the design of the oil separator shall be submitted to Limerick County Council for approval prior to installation. The separator shall be a full retention Class 1 with alarm and designed to BS EN 858 Parts 1 & 2.

2.4 Before operations commence detailed proposals for disposal of water from within the bunded areas shall be submitted to the Environment Section of Limerick County Council.

3 EFFLUENT CHARACTERISTICS

3.1 The total volume of trade effluent discharged to the estuary shall not exceed **5m^3/day.**

3.2 From the date of issue of this licence the characteristics of the treated sewage in any sample taken at the monitoring chamber specified in Condition 4.1 below shall not exceed the limits set out in the following table.

Parameter	Concentration (mg/l except for pH)
pH	**6.0 – 9.0**
B.O.D. (5-day with nitrification inhibitor)	**20**
Suspended Solids	**30**

3.3. The following substances shall **not** be discharged to the surface or foul sewer pipeline as shown on drawing 051-110-059 submitted

a) Mineral Oils

b) Diesel Range Organics

c) Petrol Range Organics

4 MONITORING FACILITIES

4.1 A readily and safely accessible monitoring chamber, approved by the Local Authority, shall be provided and maintained by the Licensee on the foul sewer pipeline to allow sampling of the treated effluent.

This chamber shall incorporate:

(a) Automatic flow measurement equipment, which shall continuously indicate, integrate and record the flow in m^3/hour and total daily flow in m^3.

(b) Facilities for taking manual grab samples.

4.2 The equipment and facilities specified at 4.1 shall be operational and in use at all times when effluent is being discharged. Any malfunction of this equipment shall be immediately notified to the Licensing Authority in writing.

4.3 The Licensee shall at all times grant access to the monitoring chambers, to authorised personnel of the Licensing Authority or its authorised agents or any body having statutory responsibility for water pollution control to carry out such inspections, monitoring and investigations as deemed necessary.

4.4 The Licensee shall ensure that authorised personnel of the Licensing Authority or its authorised agents or any body having statutory responsibility for Water Pollution Control can safely access the site and sampling locations.

5 SELF MONITORING

5.1 The Licensee shall carry out monitoring of the effluent as follows:

(a) Total 24 hourly flow (m^3).

(b) From the date of commencement of the discharge of the treated sewage effluent the **parameters listed at 3.2 above** shall be measured on a quarterly basis. The analysis shall be carried out on representative grab samples taken at the monitoring chamber specified in Condition 4.1. The time and date on which the sample was taken shall be recorded.

5.2 The Licensee shall carry out a visual inspection of the effluent discharge point, on a weekly basis. Records of all inspections shall be kept in a logbook. If it appears that there are any abnormalities in effluent quality then the Licensee shall immediately notify the Licensing Authority and initiate an investigation into the possible cause of the abnormalities.

5.3 The Licensee shall carry out a visual inspection of the surface water discharge point(s) on a monthly basis. Records of all inspections shall be kept in a logbook. If it appears that there are any abnormalities the Licensee shall immediately notify the Licensing Authority and initiate an investigation into the possible cause(s) of the abnormalities.

5.4 The licensee shall submit to the licensing authority, within 14 days of the end of each quarter, the results of all monitoring referred to in 5.1 (a) & (b) above and relating to the previous quarter.
The monthly report shall include, as the minimum, the following information:

(a) all monitoring results and flow measurements for the preceding quarter;
(b) details of any non-compliances;
(c) reasons for non-compliance;
(d) proposals for prevention of a re-occurrence of any non-compliances.

5.5 Before February 14th, of each calendar year, the Licensee shall submit a summary report of all monitoring carried out in the previous year. This report shall indicate the percentage compliance with licence values for each parameter achieved in the previous year. The report shall also outline the intentions of the Licensee with regard to modifying their operations should these results not fully comply with the terms of this Licence.

5.6 All monthly and annual reports shall be signed by the Licensee or another senior person designated by him.

5.7 The Licensee shall keep records of all monitoring carried out for a period of five years. These records shall be available for inspection at all reasonable times by authorised personnel of the Licensing Authority or its authorised agents or by any body having statutory responsibility for Water Pollution Control.

6 COLLECTION SUMPS

6.1 The Licensee shall carry out a visual inspection of the collection sumps within the bunded area, on a **once-weekly basis**. Records of all inspections including the depth of solids present and cleaning dates shall be kept in a logbook.

6.2 Prior to disposal off-site the contents of the sumps shall be held within an enclosed and covered skip.

7 MANAGEMENT OF THE EFFLUENT TREATMENT PLANT

7.1 All pumping apparatus shall be alarmed in order to alert the licencee to any pump failure.

7.2 The Licensee shall enter into an annual maintenance contract with the supplier of the treatment system. A copy of these contracts shall be submitted to the licensing authority prior to the commencement of any discharge under this licence and annually thereafter, with the annual report (See Condition 5.5).

7.2..1 Within six weeks of the date of grant of this licence the licensee shall submit to the Licensing Authority, an assessment of the training needs of those engaged in the day to day management of the treatment systems and how these will be met.

8 SLUDGE MANAGMENT

8.1 The solids collected in the yard sumps and sludge arising from the maintenance of the onsite treatment system/petrol interceptors shall only be collected by a waste contractor who holds a current waste collection permit under the *Waste (Collection) Permit Regulations 2001* and disposed of at an appropriate facility.

8.2.1 The Licensee shall maintain a record of following:

- Type of waste
- Date on which the waste was transported off-site;
- Name and address and permit number of the waste contractor;
- Quantity of waste (m^3);
- Disposal location.

8.3 These records will be maintained on-site and shall be available for inspection, by an authorised officer, at all reasonable times. A copy of these records shall be included with the Annual Report.

9 STORAGE FACILITIES

9.1 All over ground storage tank areas and drum storage areas which contain oils, chemicals or other substances which are, or could be, harmful to the aquatic environment shall be rendered impervious to the materials stored therein. Additionally, these areas shall be bunded, either locally or remotely, to a volume of 110% of the largest tank or drum within each individual bunded area, or otherwise designed in order to give protection to sewers, surface waters and groundwaters on spillage or seepage of the stored materials.

9.2 The integrity and water tightness of all bunded structures and underground tanks shall be demonstrated by the Licensee, to the satisfaction of the licensing authority once every five years. An independent chartered engineer shall carry out this assessment.

9.3 With regard to any future storage tank areas or drum storage areas the integrity and water tightness assessments shall be carried our **prior to instalment** and every five years thereafter.

10 SPILLAGES

10.1 The Licensee shall immediately notify the Licensing Authority after the occurrence of any accidental discharge, spillage or deposit of any pollutant or potential pollutant, which enters or is likely to enter waters or cause pollution.

11 RESPONSIBLE PERSONS

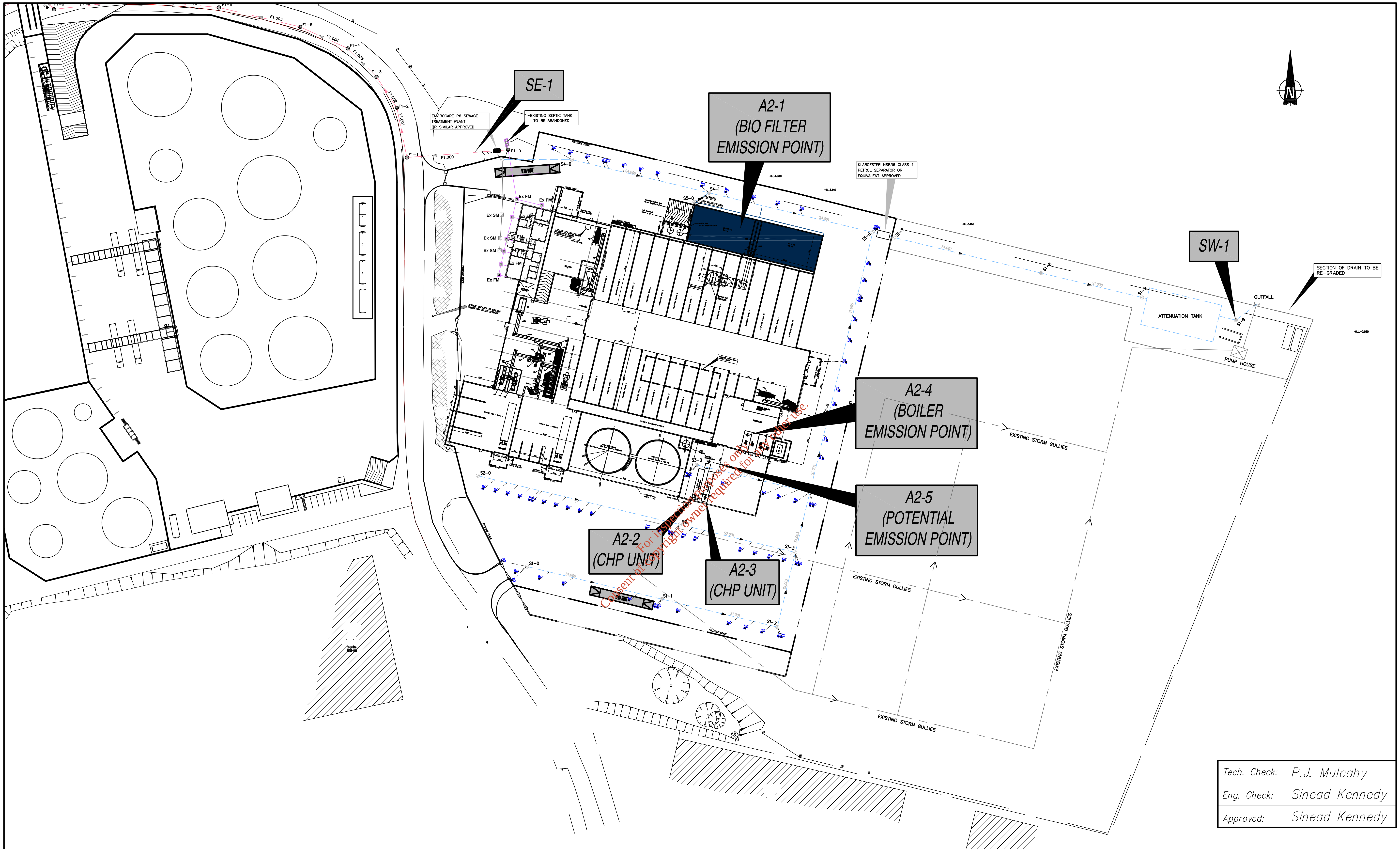
11.1 The Licensee shall nominate suitably qualified persons who shall be responsible for the supervision, control, and monitoring of all discharges arising at the premises as well as giving relevant information, on all such discharges to the Licensing Authority. The names and telephone numbers of these persons shall be submitted in writing to the Licensing Authority, prior to operation of the treatment plant. The Licensee shall ensure that the list of persons and their contact details are kept up-dated at all times.

12 FINANCIAL PROVISIONS

12.1 The Licensee shall pay the Licensing Authority an annual contribution towards the cost of auditing licence compliance. The contribution shall be charged at a rate of €150 per Audit visit and €110.30 per sample taken. The total cost for 2009 shall not exceed €370.60. The first payment shall fall due on 1st January 2010 and annually thereafter, increasing in line with the Consumer Price Index.

Appendix 7

Emission Points: Drawing No.061-306-045-P0



Tech. Check:	P.J. Mulcahy
Eng. Check:	Sinead Kennedy
Approved:	Sinead Kennedy

Figured dimension only to be taken from this drawing.
All dimensions to be checked on site.
Consultants to be informed immediately of any discrepancies before work proceeds.

greenport environmental

Job: GREENPORT ENVIRONMENTAL COMPOSTING FACILITY FOYNES

Title: EMISSION MAP 4 – AIR, SURFACE WATER & SEWER

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Stage:	
Scale @A3:	1:1500
Drawn:	P.J. Mulcahy
Date:	11–03–2010
Drawing No: 061–306–045	Rev: P0