

Administration
Environmental Licensing Programme,
Office of Climate, Licensing & Resource Use,
Environmental Protection Agency,
Headquarters P.O. Box 3000,
Johnstown Castle Estate,
County. Wexford

12th December 2012

RE: Application for the Review of Waste Licence Reg. No. W0140-04
Panda Waste Services Ltd., Rathdrinagh, Navan, Co. Meath

Dear Sir/Madam

On behalf of Panda Waste Services Ltd, I enclose one original and one hard copy of the response to Agency's Notice issued under Article 16(4)(i) of the Waste Management Licensing Regulations for the above referenced facility. I also enclose a CD-ROM disc containing 16 copies of the response in searchable pdf format, the content of which is a true copy of the responses.

Yours sincerely,


Jim O'Callaghan

0913806/JOC/KC

Encs.

c.c. Mr. David Naughton, Panda Waste Services Ltd.

Article 16(1)(a)(i) Further Information

Particulars and Evidence For

Nurendale Ltd

T/A PANDA WASTE SERVICES LTD

Waste Licence Review No. W0140-04

Article 16 Compliance

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Prepared For: -

PANDA Waste Services Ltd.,
Rathdrinagh,
Beauparc,
Navan,
Co. Meath.

Prepared By: -

O' Callaghan Moran & Associates,
Granary House,
Rutland Street,
Cork.

12th December 2012

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1. INTRODUCTION

This is the response by Nurendale Ltd, trading as PANDA Waste Services (PANDA), Rathdrinagh, Beauparc, Navan, County Meath, to the Notice issued under Article 16(1)(a)(i) of the Waste Management Licensing Regulations, dated 18th October 2011, in relation to Application Register No.W0140-04 for the Materials Recovery Facility at Rathdrinagh, Beauparc, Navan, County Meath. Section 2 contains the responses to the Agency's request for further information.

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2. ARTICLE 16 COMPLIANCE REQUIREMENTS

The Article 16 Request relates to the planning status of the site and in particular seeks clarification as to whether the following elements of the licence review application are either exempt from, or have been granted planning.

CHP plants and stack height to 17m

Biogas standby flare and stack height to 17m

Biomass furnace and stack height to 17m

Building 3 dust/carbon filter stack height to 14m

Biofilter (building 4) stack height to 15m

The Agency requested that, in each case, evidence that planning permission has been granted or that the development is exempt from planning permission should be provided in the form of correspondence from the planning authority confirming the exemption

Following receipt of the Article 16 Request, Nurendale Ltd reviewed the Planning and Development Regulations 2001 and 2008 which specify certain works that are classified as exempt development. The review indicated that with the exception of the biomass furnace stack height (17m), all of the other elements could be classified as exempt development. Accordingly, on the 31st October Nurendale Ltd made a submission to Meath County Council, a copy of which is in Attachment A.

Meath County Council responded to the submission on the 3rd December 2012, and a copy of the response is in Attachment B. The Council confirmed that the CHP plant and stack height of 17m, the Building 3 dust/carbon filter stack height to 14m are exempt development. The Council also confirmed that the Biofilter (Building 4) stack height to 15m has planning permission. The Council did not agree that the proposed biogas flare stack height 17m does not constitute exempt development and confirmed that the proposed biomass furnace stack (17m) required planning permission.

Following the receipt of the Council's decision, Nurendale Ltd engaged Odour Monitoring Ireland Ltd (OMI) to assess the gas flare and the biomass furnace stack heights. OMI identified that the proposed 17m height of the gas flare was incorrect, as typically a gas flare would be approximately 8m high. As the emissions from the gas flare had not been included in the previous modelling reports prepared by OMI, this error had not been picked up. Details of the proposed gas flare, which will have a stack height of 7.74m are in Attachment C.

Given that the proposed stack height is less than 15m, Nurendale Ltd considers it to be exempt development under Class 21 (a) (iii) of the Planning and Development Regulations 2001 and has requested Meath County Council to confirm this is the case.

The previous air dispersions modelling carried out by OMI was based on the design heights of the stacks provided by Nurendale Ltd. It was originally intended to provide the heat used to dry the waste during the RDF manufacturing process using a liquid petroleum gas. When it was decided to change from fossil fuel to renewable biomass, Nurendale Ltd assumed that it would be necessary to increase the stack height to 17m, which would be the same as the stack at the CHP plant.

Nurendale Ltd requested OMI to carry out a further air dispersion modelling exercise to determine if the emissions from a 16m stack height would comply with the relevant air quality standards. The modelling has confirmed that the emissions will meet the applicable standards. A copy of the OMI report is in Attachment D.

Nurendale Ltd considers that the revised stack height of 16m is exempt development under Class 56 (i) of the Planning and Development Regulations 2008 and has requested Meath County Council to confirm this is the case.

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3. NON TECHNICAL SUMMARY

Introduction

Nurendale Ltd., trading as Panda Waste Services (PANDA) is applying to the Environmental Protection Agency (Agency) for a review of the current Waste Licence (Reg. No. W0140-03) for its waste processing facility at Beuparc, Navan, County Meath. The objectives of the review are: -

- To extend the licence area to include a new building (Building 4), which will house a biological treatment system. The system, which is a combination of anaerobic digestion and composting, will treat organic waste to produce compost. Gases produced during the digestion stage will be used as a fuel to generate electricity and heat, which will be used at the facility and sold to electricity supply companies;
- To allow the processing of household and commercial waste to recover materials, for example paper and plastic, that can be used as a fuel, for example in cement manufacturing. These materials are called Refuse Derived Fuel (RDF);
- To amend Condition 1.5.3 of the current licence to allow the continuous operation of the biological treatment and RDF manufacturing systems;
- To amend Condition 8.6 to allow the continued operation of the construction and demolition waste processing plant in a dedicated open area.

Nature of the Facility

The facility only accepts non-hazardous wastes, which are processed to recover wastes that are suitable for recycling and to reduce the amount sent to landfill. At present there are two main buildings (Building 1 and Building 2) used for waste processing. A third building, Building 3, will accommodate the RDF system. It is proposed to construct a new building, Building 4, to accommodate the biological treatment system.

Classes of Activity

It is not proposed to change the type of waste activities, as defined in Third and Fourth Schedules of the Waste Management Acts 1996 – 2008, that are carried out. These are:-

Third Schedule – Waste Disposal Activities

Class 12

“Repackaging prior to submission to any activity referred to in the preceding paragraph of this Schedule”.

Class 11

“Blending or mixture prior to submission to any activity referred to in a preceding paragraph of this Schedule”.

Class 13

“Storage prior to submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where the waste concerned is produced”.

Fourth Schedule – Waste Recovery Activities

Class 2

“Recycling or reclamation of organic substances which are not used as solvents, (including composting and other biological processes)”.

Class 3

“Recycling or reclamation of metals and metal compounds”.

Class 4

“Recycling or reclamation of other inorganic materials”. (p)

Class 11

“Use of waste obtained from any activity referred to in a preceding paragraph of this Schedule”.

Class 13

“Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced”.

Quantity and Nature of the Waste to be Recovered or Disposed

There will be no change to the types and quantities of waste that are authorised by the current Licence. These are shown in Table 6.1.

Table 3.1 Waste Types and Quantities

WASTE TYPE	MAXIMUM (TONNES PER ANNUM) ^(Note 1)
Household waste	35,000
Commercial & Industrial	75,000
Construction and Demolition	120,000
Compostable	20,000
TOTAL	250,000

Note 1: The quantities of the different categories referred to in this table may be amended with the agreement of the Agency provided that the total quantity of waste specified is not exceeded.

Raw and Ancillary Materials, Substances, Preparations used on the Site

Diesel, lubricating oil and hydraulic oil are used in the waste processing equipment. Electricity is used to power some of the processing equipment and also in the offices and yard lighting. Drinking water is taken from the County Council mains. Groundwater from an on-site well, which is stored in a tank, is used to damp down the yards during dry weather so as to prevent dust.

Plant, Methods, Processes and Operating Procedures

The biological treatment system includes a series of fully enclosed tanks, called digesters, in which the wastes will be initially treated. At the start of the process, the oxygen in the air in the digesters will be used up by the microbes in the waste to produce anaerobic (no oxygen) conditions.

The microbes will break down the waste and, in the process, produce a biogas, which can be used as a fuel to generate electricity. The biogas will be cleaned (scrubbed) to remove contamination and fed into two gas powered electricity generators. The electricity from the generators will be supplied to the national electricity grid. A stand-by gas flare will be provided and will be used to burn the gas when the generators are being serviced.

The digesters will reduce the amount of organic material in the wastes. The waste will then be moved to the composting area, where the wastes will be composted in fully enclosed containers called tunnels. Air will be supplied to the tunnels to ensure that oxygen levels are kept at the level needed to complete the composting.

When the composting process is complete, the material will be pasteurised at a high temperature to ensure that all the microbes have been killed. This stage is required to meet the conditions set by the Department of Agriculture Fisheries and Marine for the treatment of wastes containing meat and fish.

Unprocessed household and commercial wastes contain water, in some cases up to 40% by weight, which affects the quality of the materials for use as fuel. The most favourable moisture content is around 15%, and therefore it is necessary to dry the wastes. It is proposed to dry the processed wastes in an air dryer in Building 3. The wastes will be placed inside a drying drum and the drum heated using a biomass fired furnace.

Information Related to paragraphs (a) to (g) of Section 40 (4) of the Waste Management Acts 1996 2003.

The actual and potential emissions associated with the new waste activities include noise, dust, odour, trade effluent and rainwater run-off will not breach any applicable legal standard or emission limit. Trade effluent, which includes water from washing down the floors of the buildings, is collected and stored in a tank before being taken to Meath County Council's Navan Sewage Treatment Plant.

The proposed site activities take into consideration the Best Available Technique (BAT) Guidance Note for the Waste Sector: Waste Transfer Activities published by the Agency and when carried out in accordance with the new Licence conditions, will not cause environmental pollution. It is not proposed to amend the current Management Team.

On 15th September 2009 Nurendale Ltd. was convicted at Navan District Court of an offence under the Waste Management Act for a breach of its previous Licence (W0140-02) relating to taking in more waste than approved under the licence. The current Licence (W0140-03), which was granted in March 2009, allows the acceptance of 250,000 tonnes per annum.

Emissions

Surface Water

Rainwater run-off from the existing concrete yards is collected in an underground tank and stored before being sent off-site for treatment. PANDA already has approval to change the drainage system to channel the water to a new reed bed, which will be installed in 2012. Rainwater from the roof of Building 4 will be collected in a tank and used at the site for spraying the yards to keep dust down. This tank is topped up with rainwater run-off collected in an underground storage tank. Rainfall on the new concrete yards will be collected and passed through an oil interceptor and into a soakaway.

Sanitary Wastewater

Sanitary and canteen wastewater is collected and treated in an on-site sewerage treatment plant. The treated wastewater goes to a percolation area. There will be no new sources of sanitary wastewater and the treatment plant has the capacity to cope with the estimated 15 new people that will work in Buildings 3 and 4.

Process Wastewater

Floor washings from Buildings 1 and 2 and water from the truck wash is collected in an underground tank and sent to the Council's Navan treatment plant. Additional wastewater will be produced in the biological treatment process. This will be reused in the process, but any surplus will be sent to the Navan treatment plant.

Groundwater

The only emissions to ground are the treated sanitary wastewater from the on-site treatment plant and rainwater run-off from the new concrete yards. The rainwater will pass through silt traps and an oil interceptor before it enters the soakaway.

Dust

The main source dust emissions with the potential to cause a nuisance are vehicle movements over the concrete yards in dry weather and the Construction and Demolition Waste processing area. The new waste activities are also sources of dust, but these will be carried out inside the buildings, which will effectively prevent dust causing a nuisance.

Odours

A number of the different household and commercial wastes processed at the facility contain materials (for example foodstuff) that are a source of strong odours. The biological treatment and the manufacture of RDF are also sources of malodours. All odorous wastes are handled inside the buildings and are not processed or stored in open areas.

The existing composting tunnels are provided with an odour control system, which draws air from the tunnels into what is called a biofilter, where the substances that form the odours are removed. Building 3 and Building 4 will be provided with separate odour management systems designed to ensure that odours from the buildings will not be a cause of nuisance.

Air

The electricity generators, gas flare, the biomass furnace, carbon filter and biofilter will be new emissions sources. The emissions will consist of combustion gases from the biogas and biomass fuels and air treatment.

Noise

The noise sources include all waste processing, equipment operating inside the buildings and truck and car movements.

Assessment of the Effects of the Emissions

Surface Water

The proposed changes will not result in any new emissions from the site to adjoining or nearby streams. Rainfall on the concrete yards can become contaminated with silt and small quantities of oil that may leak from vehicle oil sumps. The rainwater run-off from the yards will pass through silt traps and interceptors, which will reduce the contamination to acceptable levels, before it enters either the new reed beds, or soakaway.

Sanitary Wastewater

The existing on-site sanitary wastewater treatment plant has the capacity to handle has the capacity to cope with the estimated 15 new people that will work in Buildings 3 and 4.

Process Wastewater

The biological treatment plant will produce a wastewater. This will be reused in the process and any surplus will be collected and sent to the Navan sewage treatment plant.

Groundwater

There are no direct emissions to groundwater. Treated sanitary wastewater goes to a percolation area. The treatment plant is operating satisfactorily and has the capacity to handle the expected additional staff. Rainwater from the concrete yards will pass through silt traps and an oil interceptor before entering the on-site soakaway or reed beds. This will minimise the risk of groundwater contamination.

Dust

There are water mist sprays in Building 1 and 2 which effectively control dust emissions. The odour control systems that will be provided in Buildings 3 and 4 will also effectively control dust. The open yard areas are and will continue to be dampened down during dry weather. The dust monitoring carried out at the site has confirmed that current operations are not a source of dust nuisance.

Odours

The odour control system in Building 3 will involve the collection of air from inside the building and directing it to a carbon filter.

The control system in Building 4 will involve the collection of air inside the building and directing it to the biofilter. A computer model assessment of the odour impacts has confirmed that the emissions from Buildings 3 and 4 will not be a cause of odour nuisance.

Air

The emissions from the generators and the biomass furnace will comply with the conditions set in the Licence. A computer model assessment of the emissions has shown that they will not cause environmental pollution.

Noise

Noise monitoring at the facility has consistently shown noise emissions measured at the nearest noise sensitive locations below the emission limit specified in the existing licence.

Nuisances

Birds can be attracted to sites where there is available foodstuff. The wastes accepted at the site include some foodstuff. All wastes that have the potential to contain food stuff are and will be processed and stored inside the building. This has already been found to eliminate bird attraction.

Monitoring and Sampling Points

The construction on Building 4 means that one of the current noise monitoring and dust monitoring points along the eastern boundary will be lost. It is proposed to replace these with alternative monitoring points, which will be located further to the east.

Prevention and Recovery of Waste

The aim of the Licence Review is to increase PANDA's recycling rates and reduce the amounts of waste sent to landfill.

Off-site Treatment or Disposal of Solid or Liquid Wastes

The new waste activities will not result in any changes to the types or method of off-site disposal of solid and liquid wastes. The Refuse Derived Fuel will be sent to off-site facilities

for use as a fuel and this is classified as a recovery activity. The materials from the composting tunnels in Building 1 may be sent off-site for further treatment

Emergency Procedures to Prevent Unexpected Emissions

PANDA has prepared an Emergency Response Procedure for the facility, which sets out the actions to be taken in an emergency.

Closure, Restoration and Aftercare of the Site

The proposed changes to the current Licence will not affect the measures for the closure, remediation and aftercare of the facility.

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Attachment A

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Ms Wendy Bagnall,
Planning Department
Meath County Council
Navan
County Meath

31st October 2012

Re: EPA Article 16 Request Nurendale Limited, Beauparc

Dear Ms Bagnall,

Nurendale Limited, trading as Panda Waste Services, has received an Article 16 Request from the Environmental Protection Agency dated 18th October 2012 in relation to its application for a review of its current Waste Licence. The review relates to the development of a biological treatment plant, which incorporates a Combined Heat & Power Plant fuelled by biogas and the manufacture of refuse derived fuel, which involves drying the waste.

The Article 16 Request, a copy of which is enclosed, relates to the planning status of the site in particular seeks clarification as to whether the following elements of the licence review application are exempt from or have been granted planning permission:

- *CHP plants and stack height to 17m*
- *Biogas standby flare and stack height to 17m*
- *Biomass furnace and stack height to 17m*
- *Building 3 dust/carbon filter stack height to 14m*
- *Biofilter (building 4) stack height to 15m*

The Agency has requested that, in each case, evidence that planning permission has been granted or that the development is exempt from planning permission should be provided in the form of correspondence from the planning authority confirming the exemption

The locations of each element are shown on Drawing No 3 - Proposed Monitoring and Emission Locations and Nurendal Limited's understanding of the planning status is set out below associated with each element.

CHP Plants and Stack Height to 17m

Nurendale Limited was granted planning for a biological treatment plant to be installed in a new building (Planning Ref: SA/90087). The biogas from this plant will feed a CHP system, as described in the planning application. The CHP enclosure will be located inside the existing Skip Repair Building (Planning Ref: SA/60656 Materials Processing Building (C.4320m²), a Skip Repair Building(C.416m²) a reed-bed surface water treatment area, ancillary site works) The CHP stacks will be located along the east elevation of the building, at location A2-4 and A2- 5 on Drawing No 3.

Cont'd

The CHP enclosure and associated elements will be located within the skip repair building west of the stack locations.

Nurendale Limited considers that these elements are exempt development in accordance with Planning and Development Regulations 2008, S.I. No. 235 of 2008 CLASS 56 (a) Conditions and Limitations, for the following reasons:

1 *The gross floor area of the structure shall not exceed 500m²*

The CHP structure will be 60m²

2 *The structure will not exceed 10m in height or 50 meters in length.*

The structure will be 3m high and 20m long

3 *No such structure shall be within*

a) *10m of any public road.*

The structure is 80m from the nearest public road.

b) *200m of the nearest habitable house or residential building or school, hospital...*

The structure is over 300m away from the nearest house.

4 *No such structure within 100m of any public road shall exceed 8m in height.*

The structure will be 3m high.

5 *No such structure shall have more than 2 flues, neither of which shall exceed 20 meters in height from ground level.*

The flues/stacks (A2-5 and A2-4) will extend to 17m above ground level.

6 *The diameter of any flue shall not exceed 1 meter.*

The flues/stacks will be 950mm in diameter.

7 *Noise levels must not exceed 43db(A) during normal operation as measured at the nearest party boundary.*

Noise levels will not exceed 43db(A) as the CHP enclosure will be acoustically attenuated.

8 *Not more than one such structure will be erected.*

Only one such structure will be erected.

9 *The structure shall be used for the purposes of housing a Combined Heat and Power Unit only.*

The structure shall be used for the purposes of housing a CHP unit only.

Cont'd

Biogas Standby Flare Standby Flare and Stack Height to 17m.

Biogas Standby Flares operate in conjunction with gas utilisation unit, such as the CHP, as a safety measure to allow the gas, which is generated continuously to be flared safely when the CHP plant is shut down for planned maintenance plant. As the stack is an essential safety measure for the operation of the CHP plant, Nurendale Limited considers it to be exempt development.

Biomass Furnace and Stack to 17m

A Biomass Furnace, which will be used to heat Building 3 and to dry the wastes as part of the manufacture of Refused Derived Fuel, will be installed in Building No 3 (Planning Ref: SA/60656 Materials Processing Building (ca.4,320m²). The associated stack (A3-2) will extend to 17m above ground level. While the unit complies with Conditions and Limitations 1-3 and 5-10 of Planning and Development Regulations 2008, S.I. No. 235 of 2008 CLASS 56 (i), it does not comply with Condition 4, as the height will exceed 16m above ground level and therefore planning permission will be required.

It had originally been intended to use liquid petroleum gas (LPG) as a fuel and the associated stack height was 15m above ground level. However, in the course of the Waste Licence application it was decided, based on environmental concerns i.e. the use of a non-renewable energy source, to change the fuel source to renewable (biomass) fuel. This necessitated an increase in the stack height to 17m above ground level.

Building 3 Dust/Carbon Filter Stack Height to 14m

A dust/carbon filtration unit will be installed at Building No 3 (Planning Ref: SA/60656 Materials Processing Building (ca.4320m²)) to treat the dust and odours in air in the building. The clean air will be discharged to atmosphere via a stack. The proposed location is A2-6 on Drawing 3. Nurendale Limited considers that this element is exempt development as it complies with the Conditions and Limitation of Planning and Development Regulations 2001, S.I. No. 600, CLASS 21 (a) (iii) *the installation or erection by way of addition or replacement of plant or machinery, or structures of the nature of plant or machinery.*

1. *Any such development shall not materially alter the external appearance of the premises of the undertaking.*

The proposed stack will be the same colour as the adjacent Building 3.

2. *The height of any plant or machinery, or any structure in the nature of plant or machinery, shall not exceed 15 metres above ground level or the height of the plant, machinery or structure replaced, whichever is the greater.*

The proposed stack will be 14m high.

Cont'd

Biofilter (Building 4) Stack Height 15m

Approval for this stack was granted under planning reference SA/90087. The stack is shown on the plans and elevations of this planning application. The proposed location is A2-1 on Drawing No 3

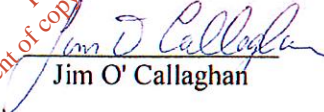
Conclusion

Nurendale Limited considers that, with the exception of the stack at the Biomass Furnace, all of the elements referenced by the EPA are either exempt development or have planning permission. On behalf of Nurendale Ltd, OCM request's Meath County Council to review the information presented herein and provide confirmation of its position on the planning status of the individual elements

If you require any further information, or require clarification on any aspect Nurendale Limited are available to meet at any time that is convenient for you.

Yours sincerely,

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Jim O' Callaghan

0913806/JOC/KC

Encs.

c.c. Mr. David Naughton, Panda Waste Services Ltd.

Attachemnt B

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Comhairle Chontae na Mí

Roinn Pleanáil,
Meallna Mainstreach, Bótharna Mainstreach
An Uaimh, Contae na Mí
Fón: 046 – 9097500/Fax:046 – 9097001
R-phost: info@meathcoco.ie Web: www.meath.ie



Meath County Council

Planning Dept.,
Abbey Mall, Abbey Road,
Navan, Co. Meath.
Tel: 046 – 9097500/Fax: 046 – 9097001
E-mail: info@meathcoco.ie Web: www.meath.ie

RECEIVED 04 DEC 2012

RECEIVED 04 DEC 2012

Mr. Jim O' Callaghan,
O' Callaghan Moran & Associates,
Rutland St,
Cork.

3rd December 2012

Re: EPA Article 16 Request Nurendale Ltd

Dear Mr. O'Callaghan,

I refer to your letter dated 31st October 2012 requesting the comments of the Planning Authority regarding the following information which has been sought by the Environmental Protection Agency: 'Clarification, as to whether or not, the following elements of the license review application require, are exempt from or have been granted planning permission:

- CHP plants and stack height to 17m;
- Biogas standby Flare and stack Height to 17m;
- Biomass furnace and stack height to 17m;
- Building 3 dust/carbon filter stack height to 17m;
- Biofilter (Building 4) Stack height 15m.'

The Planning Authority wish to respond as follows:

- CHP plants and stack height to 17m;

Your letter dated 31st October 2012 sets out your opinion that the above proposal constitutes exempted development in accordance with Article 56a of the Planning and Development Regulations, 2008. The building into which it is intended to insert the CHP plant (as per your letter) received planning permission under planning register reference SA900875. The Planning Authority concur with your opinion that the CHP plant constitutes exempted development. This is subject to strict compliance with all conditions and limitations as set out in Article 56 (a) of the Planning and Development Regulations 2008 including but not limited to the requirement that not more than one such structure shall be erected.

- Biogas standby Flare and stack Height to 17m

Your letter dated 31st October 2012 sets out your opinion that the above proposal constitutes exempted development as it constitutes a safety measure. This proposal does not appear, based on the information provided to the Planning Authority, to constitute exempted development, therefore planning permission is required.

- Biomass furnace and stack height to 17m

Your letter dated 31st October 2012 sets out your opinion that planning permission is required. The Planning Authority concur with this opinion.

Comhairle Chontae na Mí

Roinn Pleanáil,

Meallna Mainstreach, Bótharna Mainstreach
An Uaimh, Contae na Mí

Fón: 046 – 9097500/Fax:046 – 9097001

R-phost: info@meathcoco.ie Web: www.meath.ie



Meath County Council

Planning Dept.,

Abbey Mall, Abbey Road,
Navan, Co. Meath.

Tel: 046 – 9097500/Fax: 046 – 9097001

E-mail: info@meathcoco.ie Web: www.meath.ie

- *Building 3 dust/carbon filter stack height to 14m*

Your letter dated 31st October 2012 sets out your opinion that the above proposal constitutes exempted development as it complies with Class 21 (a) (iii) of the Planning and Development Regulations 2001 which states that 'development carried out by an industrial undertaker on land occupied and used by such undertaker for the carrying on and for the purposes of, any industrial process, or on land used as dock, harbour or quay for the purposes of any industrial undertaking-
(iii) the installation or erection by way of addition or replacement of plant or machinery or structures of the nature of plant or machinery, subject to not materially altering the external appearance of the premises or the undertaking and the height not exceeding 15m.'

The Planning Authority concur with your opinion that the process Building 3 dust/carbon filter stack height to 14m constitutes exempted development. This is subject to strict compliance with all conditions and limitations as set out in Class 21 of the Planning and Development Regulations 2001.

- *Biofilter (Building 4) Stack height 15m.'*

Your letter dated 31st October 2012 sets out your opinion that the above proposal has been granted planning permission Planning Register Reference SA90087. The Planning Authority concur with your opinion that the 15m stack has planning permission, the correct Planning Register Reference is however SA900875 which received planning permission on 22nd October 2009.

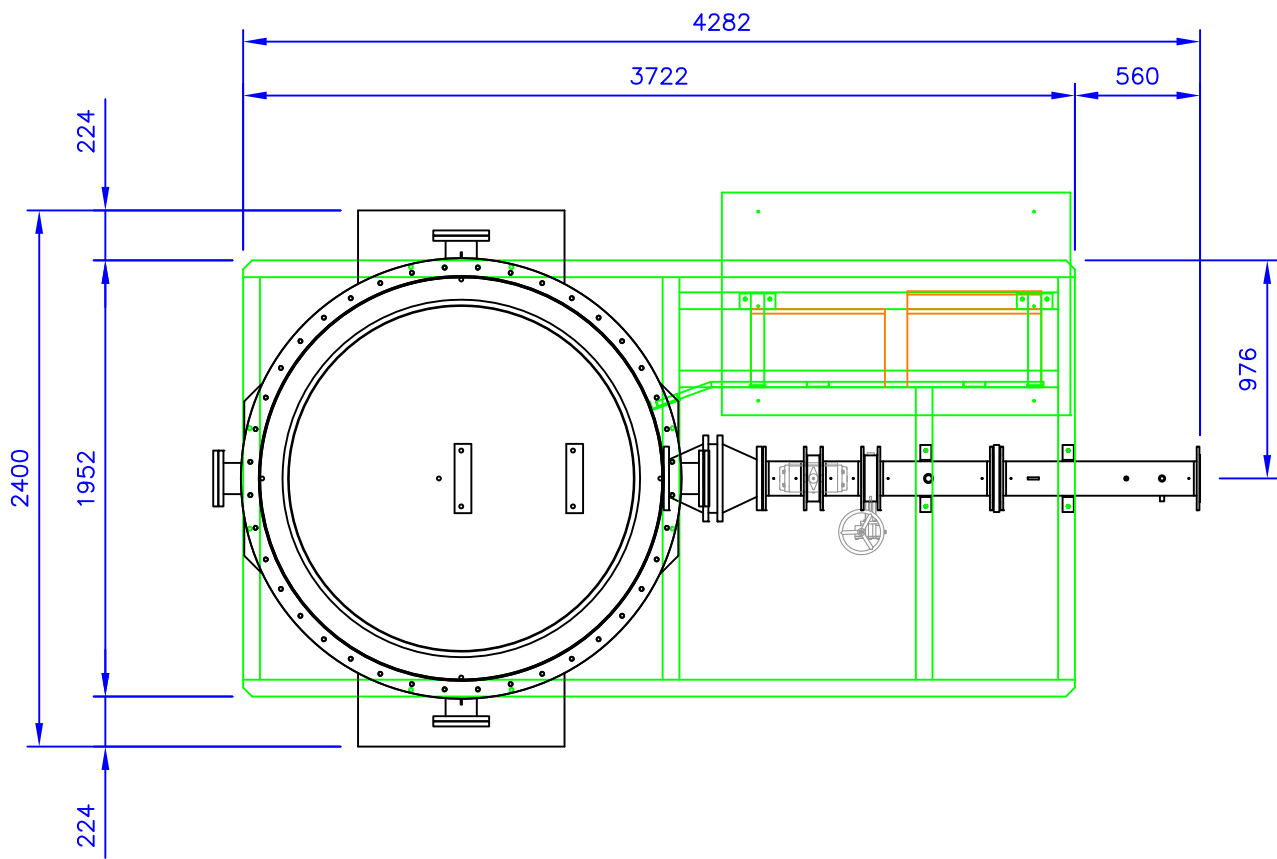
Yours sincerely,

Michael Griffin,
Senior Executive Officer,
Planning and Transportation Department

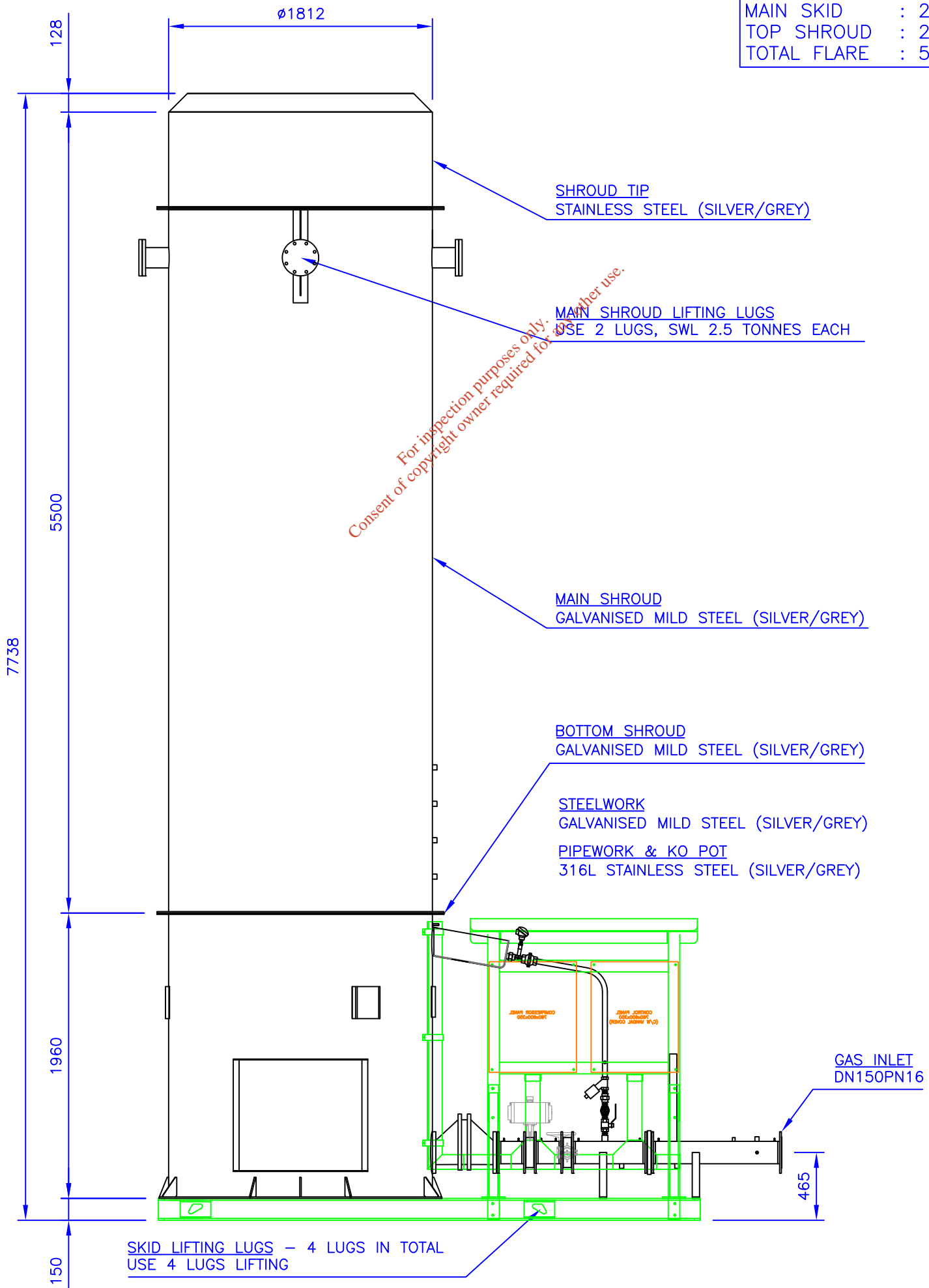
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Attachment C

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FLARE WEIGHTS	
MAIN SKID	: 2.2 TONNES
TOP SHROUD	: 2.9 TONNES
TOTAL FLARE	: 5.1 TONNES



DRAWING ORIGINAL SIZE : A3
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Drawn RPB
Date 06/12/2012

Checked MIJ
Drg.No. UFQ1296-2001

Rev. 0

Attachment D

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ODOUR & ENVIRONMENTAL ENGINEERING CONSULTANTS

Unit 32 De Granville Court, Dublin Rd, Trim, Co. Meath

Tel: +353 46 9437922

Mobile: +353 86 8550401

E-mail: info@odouireland.com

www.odouireland.com

**DISPERSION MODELLING ASSESSMENT OF EMISSIONS FROM PROPOSED EXHAUST
EMISSION POINT OF BIOMASS BOILER AND TWO GAS UTILISATION ENGINES TO BE
LOCATED IN PANDA WASTE, BAUPARC BUSINESS PARK, NAVAN, CO. MEATH.**

PERFORMED BY ODOUR MONITORING IRELAND ON THE BEHALF OF PANDA WASTE LTD.

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REPORT PREPARED BY: Dr. Brian Sheridan
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Document Amendment Record

Client: Panda Waste Ltd

Title: Dispersion modelling assessment of emissions from proposed exhaust emission point of biomass boiler and two gas utilisation engines to be located in Panda Waste, Bauparc Business Park, Navan, Co. Meath.

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Project Number: 2012503(1)			DOCUMENT REFERENCE: Dispersion modelling assessment of emissions from proposed exhaust emission point of biomass boiler and two gas utilisation engines to be located in Panda Waste, Bauparc Business Park, Navan, Co. Meath.		
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EXECUTIVE SUMMARY

Odour Monitoring Ireland was commissioned by Panda Waste to perform a dispersion modelling assessment of exhaust gas emissions from the operation of Biomass boiler and two gas utilisation engines to be located in Panda Waste, Beuparc Business Park, Navan, Co. Meath. Emissions from the biogas flare were not accounted for in the model as this is a standby plant and will only operate when one of the gas utilisation engines is in maintenance. Emissions from the gas utilisation engine would be greater than the biogas flare (see Table 3.3) and therefore worst case is taken into account by assuming the gas utilisation engines operate 24/7/365 days per year. Emission limit values of specific compounds namely Carbon monoxide, Oxides of nitrogen, Sulphur dioxide, Total particulates, Hydrogen chloride and Hydrogen fluoride and source characteristics were inputted into the dispersion modelling to allow for the assessment of air quality in the vicinity of the proposed emissions points when in operation.

Dispersion modelling assessment was performed utilising AERMOD Prime (12060) dispersion model. Five years of hourly sequential meteorological data from Dublin Airport (2002 to 2006 inclusive) was used within the dispersion model. The dispersion modelling assessment was performed in accordance with requirements contained in AG4 – Irish EPA Guidance for dispersion modelling. The total proposed mass limit emission rate of each pollutant was inputted with the source characteristics into the dispersion model in order to assess the maximum predicted ground level concentrations of each pollutant in the vicinity of the facility. This was then compared with statutory guideline limit values for such pollutants.

The following conclusions are drawn from the study:

1. The assessment was carried out to provide information in line with standard information to be provided to the EPA for license reviews for such projects.
2. Specific dispersion modelling was performed for Carbon monoxide, Oxides of nitrogen, Sulphur dioxide, Particulate matter, Hydrogen chloride and Hydrogen fluoride. The combined cumulative impact of odour for the facility has been dealt with in another document which has been submitted to the EPA.
3. With regards to Carbon monoxide, the maximum GLC+Baseline for CO from the operation of the facility is $810 \mu\text{g m}^{-3}$ for the maximum 8-hour mean concentration at the 100th percentile. When combined predicted and baseline conditions are compared to the Irish guideline/limit values and EU Limit values set out in SI 271 of 2002 and Directive 2008/50/EC, this is 8.10% of the impact criterion. In addition, the predicted ground level concentration of Carbon monoxide at each of the 10 sensitive receptors is presented in *Table 4.3*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Tables 2.1 and 2.2*.
4. With regards to Oxides of nitrogen, the maximum GLC+Baseline for NO₂ from the operation of the facility is $119 \mu\text{g m}^{-3}$ for the maximum 1-hour mean concentration at the 99.79th percentile. When combined predicted and baseline conditions are compared to SI 271 of 2002 and Directive 2008/50/EC, this is 59.50 % of the impact criterion. An annual average was also generated to allow comparison with values contained in SI 271 of 2002 and Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was $22.30 \mu\text{g/m}^3$. When compared the annual average NO₂ air quality impact criterion is 55.75% of the impact criterion. In addition, the predicted ground level concentration of Oxides of nitrogen at each of the 10 sensitive receptors is presented in *Table 4.3*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Tables 2.1 and 2.2*.
5. With regards to Sulphur dioxide, the maximum GLC+Baseline for SO₂ from the operation of the facility is 120 and $50 \mu\text{g m}^{-3}$ for the maximum 1-hour and 24 hr mean

concentration at the 99.73th and 99.18th percentile respectively. When combined predicted and baseline conditions are compared to SI 271 of 2002 and Directive 2008/50/EC, this is 36 and 42.40% of the set target limits established for the 1 hour and 24 hour assessment criteria. An annual average was also generated to allow comparison with SI 271 of 2002 and Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was 12 µg/m³. When compared the annual average SO₂ air quality impact criterion is 60% of the impact criterion. In addition, the predicted ground level concentration of Sulphur dioxide at each of the 10 sensitive receptors is presented in *Table 4.3*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Tables 2.1 and 2.2*.

6. With regards to Particulate matter, the maximum GLC+Baseline for Particulate matter 10µm from the operation of the facility is 31µg m⁻³ for the maximum 24-hour mean concentration at the 90.40th percentile. When combined predicted and baseline conditions are compared to Directive 2008/50/EC, this is 62% of the impact criterion. An annual average was also generated to allow comparison with the SI 271 of 2002 and Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was 21µg/m³. When compared, the annual average Particulate matter air quality impact is 52.50 % of the impact criterion. An annual average was also generated for PM_{2.5} to allow comparison with Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was 16µg/m³. When compared, the annual average PM_{2.5} air quality impact is 64% of the impact criterion. In addition, the predicted ground level concentration of Particulate matter at each of the 10 sensitive receptors is presented in *Table 4.3*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Tables 2.1 and 2.2*.
7. With regards to Hydrogen chloride, emissions at maximum operations equate to ambient HCl concentrations (including background concentrations) which are from 1.56 to 15.5% of the maximum impact criterion for both the 1 hr and annual average period. In addition, the predicted ground level concentration of Particulate matter at each of the 10 sensitive receptors is presented in *Table 4.3*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Tables 2.1 and 2.2*.
8. With regards to Hydrogen fluoride emissions at maximum operations equate to ambient HF concentrations (including background concentrations) which are from 1.59% to 60% of the maximum impact criterion for both the 1 hr and annual average period. In addition, the predicted ground level concentration of Particulate matter at each of the 10 sensitive receptors is presented in *Table 4.3*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Tables 2.1 and 2.2*.
9. Emissions from the biogas flare were not accounted for in the model as this is a standby plant and will only operate when one of the gas utilisation engines is in maintenance. Emissions from the gas utilisation engine would be greater than the biogas flare as per *Table 3.3* and therefore worst case is taken into account by assuming the gas utilisation engines operate 24/7/365 days per year.
10. The overall modelling indicates that the facility will not result in any significant impact on air quality in the surrounding area with all ground level concentrations of pollutants well within their respective ground level concentration limit values.

1. Introduction and scope

1.1 Introduction

Odour Monitoring Ireland was commissioned by Panda Waste Ltd to perform a dispersion modelling assessment of proposed emission limit values for a range of pollutants which could potentially be emitted from the proposed RDF and AD facility to be located in Panda Waste Ltd facility, Bauparc Business Park, Navan, Co. Meath.

The assessment allowed for the examination of proposed short and long term ground level concentrations (GLC's) of compounds as a result of the operation of proposed emission points –biomass boiler (A2-2) and two gas utilisation engines (A2-4 and A2-5). Emissions from the biogas flare (A2-3) were not accounted for in the model as this is a standby plant and will only operate when one of the gas utilisation engines is in maintenance. Emissions from the gas utilisation engine would be greater than the biogas flare (see Table 3.3) and therefore worst case is taken into account by assuming the gas utilisation engines operate 24/7/365 days per year.

Predicted dispersion modelling GLC's were compared to proposed regulatory / guideline ground level limit values for each pollutant.

The materials and methods, results, discussion of results and conclusions are presented within this document.

1.2 Scope of the work

The main aims of the study included:

- Air dispersion modelling assessment in accordance with AG4 guidance of proposed mass emission limits of specified pollutants to atmosphere from the facility to be located in Bauparc business Park, Navan, Co. Meath.
- Assessment whether the predicted ground level concentrations are in compliance with ground level concentration limit values as taken from SI 271 of 2002 – Air Quality Regulations, CAFÉ Directive 2008/50/EC, TaLuft, 2002 and Environment Agency H1 Guidance Environmental Assessment levels.

The approach adopted in this assessment is considered a worst-case investigation in respect of emissions to the atmosphere from proposed emission points A2-2 to A2-5. These predictions are therefore most likely to over estimate the GLC's that may actually occur for each modelled scenario. These assumptions are summarised and include:

- Emissions to the atmosphere from the emission points – A2-4 to A2-5 process operation were assumed to occur 24 hours each day / 7 days per week over a standard year at 100% output. Emissions from A2-2 were assumed to occur 24 hours each day / 6 days per week over a standard year at 100% output. Emissions from emission point A2-3 will only occur on an intermittent basis when either emission point A2-4 and / or A2-5 are out of operation (in maintenance), therefore by assuming emissions occur from either of A2-4 and A2-5 for 100% of the time assumes worst case air quality impact as concentration of pollutants will be greater for these emissions point in comparison to emission point A2-3.
- Five years of hourly sequential meteorological data from Dublin Airport 2002 to 2006 inclusive was screened to assess worst case dispersion year which will provide statistical significant results in terms of the short and long term assessment. This is in keeping with current national and international recommendations. The worst case year Dublin 2004 for used for data presentation.
- Maximum GLC's + Background were compared with relevant air quality objects and limits;
- All emissions were assumed to occur at maximum potential emission concentration and mass emission rates for each scenario.

- AERMOD Prime (12060) dispersion modelling was utilised throughout the assessment in order to provide the most conservative dispersion estimates.
- Five years of hourly sequential meteorological data from Dublin 2002 to 2006 inclusive was used in the modelling screen which will provide statistical significant results in terms of the short and long term assessment. The worst case year for Dublin met station was 2004 and was used for contour plot presentation. This is in keeping with current national and international recommendations (EPA Guidance AG4 and EA Guidance H4). In addition, AERMOD incorporates a meteorological pre-processor AERMET PRO. The AERMET PRO meteorological preprocessor requires the input of surface characteristics, including surface roughness (z_0), Bowen Ratio and Albedo by sector and season, as well as hourly observations of wind speed, wind direction, cloud cover, and temperature. The values of Albedo, Bowen Ratio and surface roughness depend on land-use type (e.g., urban, cultivated land etc) and vary with seasons and wind direction. The assessment of appropriate land-use type was carried out to a distance of 10km from the meteorological station for Bowen Ratio and Albedo and to a distance of 1km for surface roughness in line with USEPA recommendations.
- All building wake effects on all applicable emission points were assessed within the dispersion model using the building prime algorithm (e.g. all buildings / structures / tanks were included).

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2. Materials and methods

This section describes the materials and methods used throughout the dispersion modelling assessment.

2.1 Dispersion modelling assessment

2.1.1 Atmospheric dispersion modelling of air quality: What is dispersion modelling?

Any material discharged into the atmosphere is carried along by the wind and diluted by wind turbulence, which is always present in the atmosphere. This process has the effect of producing a plume of air that is roughly cone shaped with the apex towards the source and can be mathematically described by the Gaussian equation. Atmospheric dispersion modelling has been applied to the assessment and control of emissions for many years, originally using Gaussian form ISCST 3. Once the compound emission rate from the source is known, (g s^{-1}), the impact on the vicinity can be estimated. These models can effectively be used in three different ways:

- Firstly, to assess the dispersion of compounds;
- Secondly, in a “reverse” mode, to estimate the maximum compound emissions which can be permitted from a site in order to prevent air quality impact occurring;
- And thirdly, to determine which process is contributing greatest to the compound impact and estimate the amount of required abatement to reduce this impact within acceptable levels (McIntyre et al. 2000).

In this latter mode, models have been employed for imposing emission limits on industrial processes, control systems and proposed facilities and processes (Sheridan et al., 2002).

Any dispersion modelling approach will exhibit variability between the predicted values and the measured or observed values due to the natural randomness of atmospheric environment. A model prediction can, at best, represent only the most likely outcome given the apparent environmental conditions at the time. Uncertainty depends on the completeness of the information used as input to the model as well as the knowledge of the atmospheric environment and the ability to represent that process mathematically. Good input information (emission rates, source parameters, meteorological data and land use characteristics) entered into a dispersion model that treats the atmospheric environment simplistically will produce equally uncertain results as poor information entered into a dispersion model that seeks to simulate the atmospheric environment in a robust manner. It is assumed in this discussion that pollutant emission rates are representative of maximum emission events, source parameters accurately define the point of release and surrounding structures, meteorological conditions define the local atmospheric environment and land use characteristics describe the surrounding natural environment. These conditions are employed within the dispersion modelling assessment therefore providing good confidence in the generated predicted exposure concentration values.

2.1.2 Atmospheric dispersion modelling of air quality: dispersion model selection

The AERMOD model was developed through a formal collaboration between the American Meteorological Society (AMS) and U.S. Environmental Protection Agency (U.S. EPA). AERMOD is a Gaussian plume model and replaced the ISC3 model in demonstrating compliance with the National Ambient Air Quality Standards (Porter et al., 2003) AERMIC (USEPA and AMS working group) is emphasizing development of a platform that includes air turbulence structure, scaling, and concepts; treatment of both surface and elevated sources; and simple and complex terrain. The modelling platform system has three main components: AERMOD, which is the air dispersion model; AERMET, a meteorological data pre-processor; and AERMAP, a terrain data pre-processor (Cora and Hung, 2003).

AERMOD is a Gaussian steady-state model which was developed with the main intention of superseding ISCST3 (NZME, 2002). The AERMOD modeling system is a significant departure from ISCST3 in that it is based on a theoretical understanding of the atmosphere rather than depend on empirical derived values. The dispersion environment is characterized by turbulence theory that defines convective (daytime) and stable (nocturnal) boundary layers instead of the stability categories in ISCST3. Dispersion coefficients derived from turbulence theories are not based on sampling data or a specific averaging period. AERMOD was especially designed to support the U.S. EPA's regulatory modeling programs (Porter et al., 2003)

Special features of AERMOD include its ability to treat the vertical in-homogeneity of the planetary boundary layer, special treatment of surface releases, irregularly-shaped area sources, a three plume model for the convective boundary layer, limitation of vertical mixing in the stable boundary layer, and fixing the reflecting surface at the stack base (Curran et al., 2006). A treatment of dispersion in the presence of intermediate and complex terrain is used that improves on that currently in use in ISCST3 and other models, yet without the complexity of the Complex Terrain Dispersion Model-Plus (CTDMPLUS) (Diosey et al., 2002).

Input data from stack emissions, and source characteristics will be used to construct the basis of the modelling scenarios.

2.2 Air quality impact assessment criteria

The predicted air quality impact from the operation of proposed emission point – biomass boiler for each scenario is compared to relevant air quality objectives and limits. Air quality standards and guidelines referenced in this report include:

- SI 271 of 2002 – Air Quality Standards Regulations 2002.
- EU limit values laid out in the EU Daughter directives on Air Quality 99/30/EC and 2000/69/EC.
- Ta Luft of 2002 Air Quality Regulations,
- Horizontal guidance Note, IPPC II, Environmental assessment and appraisal of BAT, UK Environment Agency.
- EH40 Notes, Occupational exposure limits (2002).

Air quality is judged relative to the relevant Air Quality Standards, which are concentrations of pollutants in the atmosphere, which achieve a certain standard of environmental quality. Air quality Standards are formulated on the basis of an assessment of the effects of the pollutant on public health and ecosystems.

In general terms, air quality standards have been framed in two categories, limit values and guideline values. Limit values are concentrations that cannot be exceeded and are based on WHO guidelines for the protection of human health. Guideline values have been established for long-term precautionary measures for the protection of human health and the environment. European legislation has also considered standard for the protection of vegetation and ecosystems.

Where ambient air quality criteria do not exist as in the case for some of the speciated substances of interest, it is usual to use:

- 1/100th of the 8-hour time weighted average occupational exposure limit (OEL)-Long term EAL as an annual average.
- 1/500th of the 8 hour MEL time weighted average occupational exposure limit (OEL) - Long term EAL as an annual average.
- 1/10th of the 15-minute time weighted average occupational exposure limit (OEL)-Short term EAL as an hourly average.
- 1/50th of the 15 minute MEL time weighted average occupational exposure limit (OEL) –short term EAL as an hourly average.

Occupational exposure limits are published by the Occupational Safety and Health Authority EH 40 notes and subsequent reviews.

The relevant air quality standards for proposed emission sources A2-2 to A2-5 are presented in *Tables 2.1 and 2.2*.

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2.2.1 Air Quality Guidelines value for air pollutants

Table 2.1 illustrates the guideline and limit values for classical air quality pollutants in Ireland.

Table 2.1. EU and Irish Limit values laid out in the EU Daughter directive on Air Quality 99/30/EC, SI 271 of 2002 and CAFÉ directive 2008/50/EC

POLLUTANT	Objective			Measured as	TO BE ACHIEVED BY ⁴
	Concentration ²	Maximum No. Of exceedences allowed ³	Exceedence expressed as percentile ³		
Nitrogen dioxide and oxides of nitrogen	300 µg m ⁻³ NO ₂	18 times in a year	99.79 th percentile	1 hour mean	19 Jul 1999 ⁴
	200 µg m ⁻³ NO ₂	18 times in a year	99.79 th percentile	1 hour mean	1 Jan 2010
	40 µg m ⁻³ NO ₂	--	--	Annual mean	1 Jan 2010
Particulates (PM ₁₀) (2008/50/EC)	50 µg m ⁻³	35 times in a year	90.40 th percentile	24 hour mean	1 Jan 2010 ⁶
	40 µg m ⁻³	None		Annual mean	1 Jan 2005
	20 µg m ⁻³	None		Annual mean	1 Jan 2010 ⁶
Particulates (PM _{2.5}) (2008/50/EC)	25 µg m ⁻³ – Stage 1	None		Annual mean	1 Jan 2015
	20 µg m ⁻³ – Stage 2	None	--	Annual mean	1 Jan 2020
Carbon monoxide (CO)	10 mg m ⁻³	None	100 th percentile	Running 8 hour mean	31 st Dec 2003
Sulphur dioxide (SO ₂)	350 µg m ⁻³	24 times in a year	99.73 th percentile	1 hour mean	1 st Jan 2005
	125 µg m ⁻³	3 times in a year	99.18 th percentile	24 hour mean	1 st Jan 2005
	20 µg m ⁻³	--	--	Annual mean and winter mean (1 st Oct to 31 st March)	19 th Jul 2001 ⁵

Table 2.2 illustrates the guideline and limit values for specified pollutants as taken from specified reference document including TaLuft 2002 and H1 Part 2 – Environmental Risk Assessment, EPA 2002, etc. These values set out minimum ground level concentration requirements to be attained in the vicinity of the proposed facility for these pollutants.

Table 2.2. Guideline ground concentration limit values pollutant range from Panda Waste Ltd facility proposed emission points A2-2 to A2-5.

Pollutant	Objective				Source
	Concentration ²	Maximum No. Of exceedence allowed ³	Exceedence expressed as percentile ³	Measured as	
HCL	$\leq 100 \mu\text{g m}^{-3}$	175 times in a year	98 th percentile	1 hour mean	TaLuft 2002- Hourly limit for protection of human health
HCL	$\leq 750 \mu\text{g m}^{-3}$	0	100 th percentile	1 hour mean	H1 Part 2 – Environmental Risk Assessment.
HCL	$\leq 20 \mu\text{g m}^{-3}$	-	-	Annual average	H1 Part 2 – Environmental Risk Assessment..
HF	$\leq 3.0 \mu\text{g m}^{-3}$	175 times in a year	98 th percentile	1 hour mean	TaLuft 2002- Hourly limit for protection of human health
HF	$\leq 0.30 \mu\text{g m}^{-3}$	-	-	Annual average	TaLuft 2002- Gaseous fluoride (as HF) as an annual average for protection of vegetation
HF	$\leq 160 \mu\text{g m}^{-3}$	0	100 th percentile	1 hour mean	H1 Part 2 – Environmental Risk Assessment.
Fluoride	$\leq 1.0 \mu\text{g m}^{-3}$	-	-	Annual average	H1 Part 2 – Environmental Risk Assessment.

Source: Horizontal guidance Note, IPPC H1 Part 2, Environmental assessment and appraisal of BAT, UK Environment Agency.

EH40 notes, National Authority for Occupational Safety and Health (2002).

Ta Luft 2002 – Technical instructions on air Quality Control.

2.3 Existing Baseline Air Quality

The EPA has been monitoring national Air quality from a number of sites around the country. This information is available from the EPA's website. The values presented for PM₁₀, SO₂, NO₂, and CO give an indication of expected rural imissions of the compounds listed in *Table 2.1 and 2.2*. *Table 2.3* illustrates the baseline data expected to be obtained from rural areas for classical air pollutants. Since the proposed facility is located in a rural area, it would be considered located in a Zone D area according to the EPA's classification of zones for air quality. Traffic and industrial related emissions would be medium.

The results of PM_{2.5} monitoring at Station Road in Cork City in 2007 (EPA, 2007) indicated an average PM_{2.5}/PM₁₀ ratio of 0.53 while monitoring in Heatherton Park in 2008 (EPA, 2008) indicated an average PM_{2.5}/PM₁₀ ratio of 0.60. Based on this information, a conservative ratio of 0.60 was used to generate a background PM_{2.5} concentration in 2008 of 9.0 µg/m³ (see *Table 2.3*)

The monitoring of baseline levels of Hydrogen chloride and Hydrogen fluoride is limited to a number of sites in Ireland including Ringaskiddy, Co. Cork. Since this area is heavily industrialised, it would be reasonable to assume that the levels measured here would be considered worst case in this instance. *Table 2.4* presents the available baseline data for Hydrogen chloride and Hydrogen fluoride as measured over the period November 2006 to February 2007 and April 2008 to July 2008. All monitoring was performed in accordance with European and international standards.

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Table 2.3. Baseline air quality data used to assess air quality impact criterion in a number of Zone D region - Navan.

Reference air quality data – Source identity	Sulphur dioxide-SO ₂ (µg m ⁻³)	Nitrogen dioxide-NO _x as NO ₂ (µg m ⁻³)	Particulate matter-PM ₁₀ (µg m ⁻³)	Carbon monoxide – CO (mg m ⁻³)	Details
Shannon town, Clare – Annual average	1	6	11	0.20	Measured 2011
Glashaboy, Cork – Annual average	-	9	-	0.30 (Old station Rd)	Measured 2011
Castlebar, Mayo – Annual average	-	8	14	-	Measured 2011
Kilkitt, Monaghan – Annual average	3	3	9	-	Measured 2011
Shannon Estuary - Annual average	3		--	-	Measured 2011
Zone B - Heatherton Park – Annual mean PM _{2.5}	-	-	9.0 (PM _{2.5}) (Heatherton Park)	-	Measured 2008 ³

Notes: ¹ denotes taken from Air quality monitoring report 2008 - Navan, www.epa.ie.

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Table 2.4. Baseline air quality data for Hydrogen chloride and Hydrogen fluoride.

Pollutant	Averaging Period	Maximum Measured conc	Notes
HCL ($\mu\text{g m}^{-3}$)	4 week average	2.70	Ref: Porter et al., 2008 – Air quality monitoring report Ringaskiddy Waste to Energy Facility
HF ($\mu\text{g m}^{-3}$)	4 week average	<0.050	Ref: Porter et al., 2008 – Air quality monitoring report Ringaskiddy Waste to Energy Facility

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2.4 Meteorological data

Five years of hourly sequential meteorological data was chosen for the modelling exercise (i.e. Dublin airport 2002 to 2006 inclusive). A schematic wind rose and tabular cumulative wind speed and directions of all seven years are presented in *Section 7*. All five years of met data was screened to provide more statistical significant result output from the dispersion model. This is in keeping with national and international recommendations on quality assurance in operating dispersion models and will provide a worst case assessment of predicted ground level concentrations based on the input emission rate data. Surface roughness, Albedo and Bowen ratio were assessed and characterised around each met station for AERMET Pro processing.

2.5 Terrain data

Topography effects were not accounted for within the dispersion modelling assessment due to the absence of complex terrain in the immediate vicinity of the site and due to the fact that the stack heights are in excess of 16 metres. In order for terrain features to have an influence on the dispersion model output, the topographical feature would need to be in excess of the stack height and be in close proximity to the site in this instance. Individual sensitive receptors were inputted into the model at their specific height in order to take account of any effects of elevation on GLC's at there specific locations. This is in keeping with good practice.

2.6 Building wake effects

Building wake effects are accounted for in modelling scenarios through the use of the Prime algorithm (i.e. all building features located within the facility) as this can have a significant effect on the compound plume dispersion at short distances from the source and can significantly increase GLC's in close proximity to the facility.

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3. Results

This section describes the results obtained for the dispersion modelling exercise. All input data and source characteristics were developed in conjunction with engineering drawings for the development.

3.1. Dispersion model input data – Source characteristics

Table 3.1 illustrates the source characteristics utilised within the dispersion model. Grid reference location, stack height (A.G.L), maximum volume flow and temperature of the emission point are presented within this table for reference purposes.

Table 3.1. Source characteristics for proposed emission points A2-2 to A2-5.

Parameter	Emission point A2-2 – Biomass ¹	Emission point A2-3– Biogas flare 1 ³	Emission point A2-4– gas utilisation engine 1 ²	Emission point A2-5–gas utilisation engine 2 ²
X coordinate	297519.963	297499.9	297497.9	297494.6
Y coordinate	269092.271	269148.4	269155.9	269164.3
Elevation (A.O.D) (m)	56	56	56	56
Stack height (m)	16	8	17	17
Orientation	Vertical	Vertical	Vertical	Vertical
Temperature (K)	523	1273	473	473
Efflux velocity (m/s)	20.32	12	19.0	19.0
Max volume flow (Nm ³ /hr)	21,670	3,000 (ref 3%O ₂)	5,500	3,800
Stack tip diameter (m)	0.85	1.10	0.42	0.35
Max building height (m)	13	--	13	13
Max building ground level (m)	56	56	56	56

Notes: ¹denotes referencing conditions for emission point A2-2 is 273.15K, 101.3KPa, dry gas, 11% O₂.
²denotes referencing conditions for emission point A2-4 to A2-5 are 273.15K, 101.3KPa, dry gas, 5% O₂.
³denotes referencing conditions for emission point A2-3 are 273.15K, 101.3KPa, dry gas, 3% O₂.

3.2 Process emissions - Volume flow rate and flue gas concentrations

The input mass emission rate data used in the dispersion model for each emission point is presented in *Tables 3.2, 3.3, 3.4, and 3.5* for each scenario. All source characteristics and location are reported in *Table 3.1*.

Table 3.2. Emission values from exhaust stack of the emission source A2-2.

Parameters – RTO exhaust stacks (A2-2)	Conc. Limit Values	Units	Volume flow (Nm ³ /hr ref 11% O ₂)	Mass emission rate (g/s)
Carbon monoxide (CO)	800	mg/Nm ³ 11% O ₂	21,670	4.82
Oxides of nitrogen (NO _x as NO ₂)	400	mg/Nm ³ 11% O ₂	21,670	1.20
Sulphur dioxide (SO ₂)	150	mg/Nm ³ 11% O ₂	21,670	1.20
Total particulates	200	mg/Nm ³ 11% O ₂	21,670	1.204
Hydrogen chloride	10	mg/Nm ³ 11% O ₂	21,670	0.060
Hydrogen fluoride	3	mg/Nm ³ 11% O ₂	21,670	0.018

Table 3.3. Emission values from exhaust stack of the emission source A2-3.

Parameters – Biogas flare exhaust stacks (A2-3)	Conc. Limit Values	Units	Volume flow (Nm ³ /hr ref 3% O ₂)
Carbon monoxide (CO)	50	mg/Nm ³ 3% O ₂	3,000
Oxides of nitrogen (NO _x as NO ₂)	150	mg/Nm ³ 3% O ₂	3,000
Sulphur dioxide (SO ₂)	250	mg/Nm ³ 3% O ₂	3,000
Hydrogen chloride	10	mg/Nm ³ 3% O ₂	3,000
Hydrogen fluoride	3	mg/Nm ³ 3% O ₂	3,000

Table 3.4. Emission values from exhaust stack of the emission source A2-4.

Parameters – Gas engine 1 exhaust stacks (A2-4)	Conc. Limit Values	Units	Volume flow (Nm ³ /hr ref 5% O ₂)	Mass emission rate (g/s)
Carbon monoxide (CO)	1,400	mg/Nm ³ 5% O ₂	5,500	2.14
Oxides of nitrogen (NOx as NO ₂)	500	mg/Nm ³ 5% O ₂	5,500	0.76
Sulphur dioxide (SO ₂)	250	mg/Nm ³ 5% O ₂	5,500	0.38
Total particulates	130	mg/Nm ³ 5% O ₂	5,500	0.199
Hydrogen chloride	10	mg/Nm ³ 5% O ₂	5,500	0.015
Hydrogen fluoride	3	mg/Nm ³ 5% O ₂	5,500	0.005

Table 3.5. Emission values from exhaust stack of the emission source A2-5.

Parameters – Gas engine 2 exhaust stacks (A2-5)	Conc. Limit Values	Units	Volume flow (Nm ³ /hr ref 5% O ₂)	Mass emission rate (g/s)
Carbon monoxide (CO)	1,400	mg/Nm ³ 5% O ₂	3,800	1.48
Oxides of nitrogen (NOx as NO ₂)	500	mg/Nm ³ 5% O ₂	3,800	0.53
Sulphur dioxide (SO ₂)	250	mg/Nm ³ 5% O ₂	3,800	0.26
Total particulates	130	mg/Nm ³ 5% O ₂	3,800	0.137
Hydrogen chloride	10	mg/Nm ³ 5% O ₂	3,800	0.011
Hydrogen fluoride	3	mg/Nm ³ 5% O ₂	3,800	0.0030

3.3 Dispersion modelling assessment

AERMOD Prime (12060) was used to determine the overall ground level impact of proposed emission points A2-2, A2-4 and A2-5 to be located in the Panda Waste, Bauparc Business Park, Navan, Co. Meath. Emissions from the biogas flare were not accounted for in the model as this is a standby plant and will only operate when one of the gas utilisation engines is in maintenance. Emissions from the gas utilisation engine would be greater than the biogas flare (see Table 3.3) and therefore worst case is taken into account by assuming the gas utilisation engines operate 24/7/365 days per year. These computations give the relevant GLC's at each 50-meter X Y Cartesian grid receptor location that is predicted to be exceeded for the specific air quality impact criteria. Individual receptor elevations were established at their specific height above ground and also included a 1.80 m normal breathing zone. A total Cartesian + individual receptors of 1,691 points was established giving a total grid coverage area of 4.0 square kilometres around the emission point.

Five years of hourly sequential meteorological data from Dublin Airport (Dublin Airport 2002 to 2006 inclusive) and source characteristics (see Table 3.1), including emission date contained in Tables 3.2 to 3.5 were inputted into the dispersion model.

In order to obtain the predicted environmental concentration (PEC), background data was added to the process emissions. In relation to the annual averages, the ambient background concentration was added directly to the process concentration. However, in relation to the short-term peak concentrations, concentrations due to emissions from elevated sources cannot be combined in the same way. Guidance from the UK Environment Agency advises that an estimate of the maximum combined pollutant concentration can be obtained by adding the maximum short-term concentration due to emissions from the source to twice the annual mean background concentration.

3.4 Dispersion model Scenarios

AERMOD Prime (USEPA ver. 12060) was used to determine the overall air quality impact of the five combined emission points while in operation at 100% capacity for named air pollutants.

Impacts from the five stack emission points were assessed in accordance with the impact criterion contained in Directive 2008/50/EC, SI 271 of 2002, TaLuft 2002 and H1 Guidance.

Nine scenarios were assessed within the dispersion model examination for each of the classical air pollutants.

The dispersion modelling is carried out in line with the requirements of guidance document AG4- Dispersion modelling.

The output data was analysed to calculate the following:

Ref Scenario 1: Predicted cumulative ground level concentration of Carbon monoxide emission contribution of cumulative emissions for the 100th percentile of 8 hour averages for Dublin meteorological station year 2004 for an Carbon monoxide concentration of less than or equal to 500 µg/m³ (see Figure 6.2).

Ref Scenario 2: Predicted cumulative ground level concentration of Oxides of nitrogen emission contribution of cumulative emissions for the 99.79th percentile of 1 hour averages for Dublin meteorological station year 2004 for an Oxides of nitrogen concentration of less than or equal to 101 µg/m³ (see Figure 6.3).

- Ref Scenario 3:** Predicted cumulative ground level concentration of Oxides of nitrogen emission contribution of cumulative emissions for the Annual average for Dublin meteorological station year 2004 for an Oxides of nitrogen concentration of less than or equal to $13.30 \mu\text{g}/\text{m}^3$ (see *Figure 6.4*).
- Ref Scenario 4:** Predicted cumulative ground level concentration of Sulphur dioxide emission contribution of cumulative emissions for the 99.73th percentile of 1 hour averages for Dublin meteorological station year 2004 for an Sulphur dioxide concentration of less than or equal to $110 \mu\text{g}/\text{m}^3$ (see *Figure 6.5*).
- Ref Scenario 5:** Predicted cumulative ground level concentration of Sulphur dioxide emission contribution of cumulative emissions for the 99.18th percentile of 24 hour averages for Dublin meteorological station year 2004 for an Sulphur dioxide concentration of less than or equal to $50 \mu\text{g}/\text{m}^3$ (see *Figure 6.6*).
- Ref Scenario 6:** Predicted cumulative ground level concentration of Sulphur dioxide emission contribution of cumulative emissions for the Annual average for Dublin meteorological station year 2004 for a Sulphur dioxide concentration of less than or equal to $9 \mu\text{g}/\text{m}^3$ (see *Figure 6.7*).
- Ref Scenario 7:** Predicted cumulative ground level concentration of Total particulates as PM_{10} emission contribution of cumulative emissions for the 90.40th percentile of 24 hour averages for Dublin meteorological station year 2004 for an Total particulates as PM_{10} concentration of less than or equal to $17 \mu\text{g}/\text{m}^3$ (see *Figure 6.8*).
- Ref Scenario 8:** Predicted cumulative ground level concentration of Total particulates as PM_{10} emission contribution of cumulative emissions for the Annual average for Dublin meteorological station year 2004 for an Total particulates as PM_{10} concentration of less than or equal to $6.0 \mu\text{g}/\text{m}^3$ (see *Figure 6.9*).
- Ref Scenario 9:** Predicted cumulative ground level concentration of Total particulates as $\text{PM}_{2.5}$ emission contribution of cumulative emissions for the Annual average for Dublin meteorological station year 2004 for an Total particulates as $\text{PM}_{2.5}$ concentration of less than or equal to $6.0 \mu\text{g}/\text{m}^3$ (see *Figure 6.10*).
- Ref Scenario 10:** Predicted cumulative ground level concentration of Hydrogen chloride emission contribution of cumulative emissions for the 100th percentile of 1 hour averages for Dublin meteorological station year 2004 for an Hydrogen chloride concentration of less than or equal to $8 \mu\text{g}/\text{m}^3$ (see *Figure 6.11*).
- Ref Scenario 11:** Predicted cumulative ground level concentration of Hydrogen chloride emission contribution of cumulative emissions for the 98th percentile of 1 hour averages for Dublin meteorological station year 2004 for an Hydrogen chloride concentration of less than or equal to $5 \mu\text{g}/\text{m}^3$ (see *Figure 6.12*).
- Ref Scenario 12:** Predicted cumulative ground level concentration of Hydrogen chloride emission contribution of cumulative emissions for the Annual average for Dublin meteorological station year 2004 for an Hydrogen chloride concentration of less than or equal to $0.40 \mu\text{g}/\text{m}^3$ (see *Figure 6.13*).

- Ref Scenario 13:** Predicted cumulative ground level concentration of Hydrogen fluoride emission contribution of cumulative emissions for the 100th percentile of 1 hour averages for Dublin meteorological station year 2004 for an Hydrogen fluoride concentration of less than or equal to 2.50 $\mu\text{g}/\text{m}^3$ (see *Figure 6.14*).
- Ref Scenario 14:** Predicted cumulative ground level concentration of Hydrogen fluoride emission contribution of cumulative emissions for the 98th percentile of 1 hour averages for Dublin meteorological station year 2004 for an Hydrogen fluoride concentration of less than or equal to 1.50 $\mu\text{g}/\text{m}^3$ (see *Figure 6.15*).
- Ref Scenario 15:** Predicted cumulative ground level concentration of Hydrogen fluoride emission contribution of cumulative emissions for the Annual average for Dublin meteorological station year 2004 for an Hydrogen fluoride concentration of less than or equal to 0.13 $\mu\text{g}/\text{m}^3$ (see *Figure 6.16*).

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4. Discussion of results

This section will present the results of the dispersion modelling.

AERMOD GIS Pro Prime (Ver. 12060) was used to determine the overall named air pollutant air quality impact of the proposed emission points A2-2, A2-4 and A2-5 during operation.

Various averaging intervals were chosen to allow direct comparison of predicted GLC's with the relevant the relevant air quality assessment criteria as outline in *Section 2.2.1*. In particular, 1-hour, 24 hour and annual average GLC's of the specified pollutants were calculated at 50 metres distances from the site over a fine and coarse grid extent of 4.0 kilometres squared. Relevant percentiles of these GLC's were also computed for comparison with the relevant pollutant Air Quality Standards to include Directive 2008/50/EC.

In modelling air dispersion of NO_x from combustion sources, the source term should be expressed as NO₂, e.g., NO_x mass (expressed as NO₂). Some of the exhaust air is made up of NO while some is made up of NO₂. NO will be converted in the atmosphere to NO₂ but this will depend on a number of factors to include Ozone and VOC concentrations. In order to take account of this conversion the following screening can is performed.

Use the following phased approach for assessment:

Worse case scenario treatment

35% for short-term and 70% for long-term average concentration should be considered to assess compliance with the relevant air quality objective.

This is in accordance with recommendations from the Environmental Agency UK for the dispersion modelling of NO₂ emissions from combustion processes, www.environmentagency.gov.uk and guidance received from the OEE air unit, Richview, Dublin 14.

Table 4.1 illustrates the tabular results obtained from the assessment for Dublin meteorological station for:

- Worse case scenario and treatment for NO_x only as detailed above.

Maximum predicted GLC's are presented within this table to allow for comparison with Directive 2008/50/EC and SI 271 of 2002. In addition, the predicted ground level concentrations at the selected residential receptors are presented in the Discussion of Results section of the document for all pollutants. A total of 10 individual sensitive receptors were included within the dispersion model and the location of same is presented in *Figure 6.1*. Illustrative contour plots for information purposes only are presented in *Section 6* of this report for each modelled scenario.

Table 4.1. Predicted ground level concentrations for various averaging periods for proposed emission points A2-2, A2-4 and A2-5 for each pollutant at or beyond the boundary of the facility.

Averaging period	Maximum ground level conc (GLC)
Carbon monoxide - 8 hr maximum GLC ($\mu\text{g}/\text{m}^3$)	510
Oxides of nitrogen - 1 hr max 99.79 th percentile ($\mu\text{g}/\text{m}^3$)	101
Oxides of nitrogen - Max Annual average ($\mu\text{g}/\text{m}^3$)	13.3
Sulphur dioxide - 1 hr Max 99.73 th percentile ($\mu\text{g}/\text{m}^3$)	120
Sulphur dioxide - 24 hr Max 99.18 th percentile ($\mu\text{g}/\text{m}^3$)	50
Sulphur dioxide – Max annual average ($\mu\text{g}/\text{m}^3$)	9
Total particulates - 24 hr Max 90.40 th percentile ($\mu\text{g}/\text{m}^3$)	17
Total Particulates as PM ₁₀ - Max annual average ($\mu\text{g}/\text{m}^3$)	7
Total Particulates as PM _{2.5} - Max annual average ($\mu\text{g}/\text{m}^3$)	7
Hydrogen chloride - 1 hr Max 100 th percentile ($\mu\text{g}/\text{m}^3$)	9
Hydrogen chloride - 1 hr Max 98 th percentile ($\mu\text{g}/\text{m}^3$)	5
Hydrogen chloride - Max annual average ($\mu\text{g}/\text{m}^3$)	0.4
Hydrogen fluoride - 1 hr Max 100 th percentile ($\mu\text{g}/\text{m}^3$)	2.5
Hydrogen fluoride - 1 hr Max 98 th percentile ($\mu\text{g}/\text{m}^3$)	1.5
Hydrogen fluoride - Max annual average ($\mu\text{g}/\text{m}^3$)	0.13

Table 4.2 presents the comparison between model predictions for air quality impacts, baseline air quality concentrations for the compounds and the percentage impact of the air quality impact criterion anywhere in the vicinity of the facility.

4.1 Assessment of air quality impacts for pollutants from proposed emission points A2-2, A2-4 and A2-5

Predictive air dispersion modelling was used to ascertain the maximum ground level concentrations at or beyond the boundary of the facility of selected worst case pollutant concentration to allow for comparison with the ground level limit values contained in *Tables 2.1 and 2.2*. *Table 4.2* illustrates the results of the dispersion modelling assessment for each pollutant and comparison with the air quality guideline and limit values contained in *Tables 2.1 and 2.2*.

Table 4.2. Comparison between predicted GLC's + baseline national air quality data and limit values contained in *Tables 2.1 and 2.2*.

Identity	Predicted %ile GLC - ($\mu\text{g m}^{-3}$)	Baseline concentration value ($\mu\text{g m}^{-3}$) ¹	Baseline + Maximum predicted GLC ($\mu\text{g m}^{-3}$)	Impact criterion ($\mu\text{g m}^{-3}$) ²	% of Criterion
Carbon monoxide - 8 hr maximum GLC ($\mu\text{g/m}^3$)	510	300	810	10,000	8.10
Oxides of nitrogen - 1 hr max 99.79 th percentile ($\mu\text{g/m}^3$)	101	18 (Twice annual mean as per EA)	119	200	59.50
Oxides of nitrogen - Max Annual average ($\mu\text{g/m}^3$)	13.3	9	22.3	40	55.75
Sulphur dioxide - 1 hr Max 99.73 th percentile ($\mu\text{g/m}^3$)	120	6 (Twice annual mean as per EA)	126	350	36.00
Sulphur dioxide - 24 hr Max 99.18 th percentile ($\mu\text{g/m}^3$)	50	3.0	53	125	42.40
Sulphur dioxide – Max annual average ($\mu\text{g/m}^3$)	9	3.0	12	20	60.00
Total particulates - 24 hr Max 90.40 th percentile ($\mu\text{g/m}^3$)	17	14	31	50	62.00
Total Particulates as PM ₁₀ - Max annual average ($\mu\text{g/m}^3$)	7	14	21	40	52.50
Total Particulates as PM _{2.5} - Max annual average ($\mu\text{g/m}^3$)	7	9.0	16	25	64.00
Hydrogen chloride - 1 hr Max 100 th percentile ($\mu\text{g/m}^3$)	9	2.70	11.7	750	1.56
Hydrogen chloride - 1 hr Max 98 th percentile ($\mu\text{g/m}^3$)	5	2.70	7.7	100	7.70
Hydrogen chloride - Max annual average ($\mu\text{g/m}^3$)	0.4	2.70	3.1	20	15.50
Hydrogen fluoride - 1 hr Max 100 th percentile ($\mu\text{g/m}^3$)	2.5	0.050	2.55	160	1.59
Hydrogen fluoride - 1 hr Max 98 th percentile ($\mu\text{g/m}^3$)	1.5	0.050	1.55	3.0	51.67
Hydrogen fluoride - Max annual average ($\mu\text{g/m}^3$)	0.13	0.050	0.18	0.30	60.00

Notes: ¹ denotes based on data presented in *Tables 3.1, 3.2, 3.3, 3.4, 3.5 and 4.1*,
² denotes for impact criterion see *Tables 2.1 and 2.2*

As can be observed in *Table 4.2*, the predicted maximum averaging ground level concentration and baseline concentration are presented as a % of the impact criterion contained in *Tables 2.1 and 2.2*.

4.1.1 Carbon monoxide – Ref Scenario 1

The results for the potential air quality impact for dispersion modelling of CO based on the emission rates in *Tables 3.2 to 3.5* are presented in *Tables 4.1 and 4.2*. Results are presented for the maximum predicted percentile emission regime. As can be observed in *Tables 4.1 and 4.2*, the maximum GLC+Baseline for CO from the operation of the facility is $810 \mu\text{g m}^{-3}$ for the maximum 8-hour mean concentration at the 100th percentile. When combined predicted and baseline conditions are compared to the Irish guideline/limit values and EU Limit values set out in SI 271 of 2002 and Directive 2008/50/EC, this is 8.10% of the impact criterion.

In addition, the predicted ground level concentration of Carbon monoxide at each of the 10 sensitive receptors is presented in *Table 4.3*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Tables 2.1 and 2.2*.

4.1.2 Oxides of nitrogen – Ref Scenario 2 and 3

The results for the potential air quality impact for dispersion modelling of NO_x as NO₂ based on the emission rates in *Tables 3.2 to 3.5* are presented in *Tables 4.1 and 4.2*. Results are presented for the maximum predicted percentile emission regime. As can be observed in *Tables 4.1 and 4.2*, the maximum GLC+Baseline for NO₂ from the operation of the facility is $119 \mu\text{g m}^{-3}$ for the maximum 1-hour mean concentration at the 99.79th percentile. When combined predicted and baseline conditions are compared to SI 271 of 2002 and Directive 2008/50/EC, this is 59.50% of the impact criterion.

An annual average was also generated to allow comparison with values contained in SI 271 of 2002 and Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was $22.30 \mu\text{g/m}^3$. When compared the annual average NO₂ air quality impact criterion is 55.75% of the impact criterion.

In addition, the predicted ground level concentration of Oxides of nitrogen at each of the 10 sensitive receptors is presented in *Table 4.3*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Tables 2.1 and 2.2*.

4.1.3 Sulphur dioxide – Ref Scenario 4, 5 and 6

The results for the potential air quality impact for dispersion modelling of SO₂ based on the emission rates in *Tables 3.2 to 3.5* are presented in *Tables 4.1 and 4.2*. Results are presented for the maximum predicted percentile emission regime. As can be observed in *Tables 4.1 and 4.2*, the maximum GLC+Baseline for SO₂ from the operation of the facility is 120 and $50 \mu\text{g m}^{-3}$ for the maximum 1-hour and 24 hr mean concentration at the 99.73th and 99.18th percentile respectively. When combined predicted and baseline conditions are compared to SI 271 of 2002 and Directive 2008/50/EC, this is 36 and 42.40% of the set target limits established for the 1 hour and 24 hour assessment criteria.

An annual average was also generated to allow comparison with SI 271 of 2002 and Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was $12 \mu\text{g/m}^3$. When compared the annual average SO₂ air quality impact criterion is 60% of the impact criterion.

In addition, the predicted ground level concentration of Sulphur dioxide at each of the 10 sensitive receptors is presented in *Table 4.3*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Tables 2.1 and 2.2*.

4.1.4 Particulate matter – Ref Scenario 7, 8 and 9

The results for the potential air quality impact for dispersion modelling of Particulate matter based on the emission rates in *Tables 3.2 to 3.5* are presented in *Tables 4.1 and 4.2*. Results are presented for the maximum predicted percentile emission regime. As can be observed in *Tables 4.1 and 4.2*, the maximum GLC+Baseline for Particulate matter $10\mu\text{m}$ from the operation of the facility is $31\mu\text{g m}^{-3}$ for the maximum 24-hour mean concentration at the 90.40th percentile. When combined predicted and baseline conditions are compared to Directive 2008/50/EC, this is 62% of the impact criterion.

An annual average was also generated to allow comparison with the SI 271 of 2002 and Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was $21\mu\text{g/m}^3$. When compared, the annual average Particulate matter air quality impact is 52.50% of the impact criterion.

An annual average was also generated for $\text{PM}_{2.5}$ to allow comparison with Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was $16\mu\text{g/m}^3$. When compared, the annual average $\text{PM}_{2.5}$ air quality impact is 64% of the impact criterion.

In addition, the predicted ground level concentration of Particulate matter at each of the 10 sensitive receptors is presented in *Table 4.3*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Tables 2.1 and 2.2*.

4.1.5 Hydrogen chloride – Ref Scenario 10, 11 and 12

The results for the potential air quality impact for dispersion modelling of HCL based on the emission rates in *Tables 3.2 to 3.5* are presented in *Tables 4.1 and 4.2*. HCL modelling results indicate that the ambient ground level concentrations are below the relevant air quality guideline for the protection of human health for HCL when the facility is in operation. Thus, no adverse impact on public health or the environment is envisaged to occur under these conditions at or beyond the facility boundary. Emissions at maximum operations equate to ambient HCL concentrations (including background concentrations) which are from 1.56 to 15.50% of the maximum impact criterion for both the 1 hr and annual average period.

In addition, the predicted ground level concentration of Hydrogen chloride at each of the 10 sensitive receptors is presented in *Table 4.3*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Tables 2.1 and 2.2*.

4.1.6 Hydrogen fluoride – Ref Scenario 13, 14 and 15

The results for the potential air quality impact for dispersion modelling of HF based on the emission rates in *Tables 3.2 to 3.5* are presented in *Tables 4.1 and 4.2*. HF modelling results indicate that the ambient ground level concentrations are below the relevant air quality guideline for the protection of human health for HF when the facility is in operation. Thus, no adverse impact on public health or the environment is envisaged to occur under these conditions at or beyond the facility boundary. Emissions at maximum operations equate to ambient HF concentrations (including background concentrations) which are from 1.59% to 60% of the maximum impact criterion for both the 1 hr and annual average period.

In addition, the predicted ground level concentration of Hydrogen fluoride at each of the 10 sensitive receptors is presented in *Table 4.3*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Tables 2.1 and 2.2*.

Table 4.3. Predicted ground level concentration (excluding baseline) of each pollutant at each identified sensitive receptor locations R1 to R10 for Scenarios 1 to 8 (see Section 4 and Figure 6.1).

Receptor identity	X coord (m)	Y coord (m)	Scen 1 - ($\mu\text{g}/\text{m}^3$)	Scen 2 - ($\mu\text{g}/\text{m}^3$)	Scen 3 - ($\mu\text{g}/\text{m}^3$)	Scen 4 - ($\mu\text{g}/\text{m}^3$)	Scen 5 - ($\mu\text{g}/\text{m}^3$)	Scen 6 - ($\mu\text{g}/\text{m}^3$)	Scen 7 - ($\mu\text{g}/\text{m}^3$)	Scen 8 - ($\mu\text{g}/\text{m}^3$)
R1	297498.3	269436.6	113.58	31.38	1.38	37.30	7.04	0.87	2.33	0.73
R2	297573.5	269493.2	130.23	29.56	1.49	34.59	7.94	0.94	2.66	0.79
R3	297654.7	269498.3	143.58	29.84	2.12	33.06	9.84	1.33	4.25	1.11
R4	297395.3	269510.8	90.31	18.91	1.19	23.49	6.09	0.76	1.80	0.61
R5	297355.4	269515	94.35	16.88	1.24	20.74	6.22	0.79	2.06	0.65
R7	297281.2	269519.7	95.97	17.07	1.44	21.25	6.33	0.91	2.79	0.75
R8	297299.3	269380.5	140.08	38.43	2.78	46.37	11.95	1.74	5.54	1.48
R9	297744.7	269499.2	138.65	27.64	2.49	30.97	10.98	1.56	4.38	1.33
R10	297629.6	268891.5	133.41	23.78	1.48	26.96	6.69	0.91	3.14	0.82

Table 4.3 continued. Predicted ground level concentration (excluding baseline) of each pollutant at each identified sensitive receptor locations R1 to R10 for Scenarios 9 to 15 (see Section 4 and Figure 6.1).

Receptor identity	X coord (m)	Y coord (m)	Scen 9 - ($\mu\text{g}/\text{m}^3$)	Scen 10 - ($\mu\text{g}/\text{m}^3$)	Scen 11 - ($\mu\text{g}/\text{m}^3$)	Scen 12 - ($\mu\text{g}/\text{m}^3$)	Scen 13 - ($\mu\text{g}/\text{m}^3$)	Scen 14 - ($\mu\text{g}/\text{m}^3$)	Scen 15 - ($\mu\text{g}/\text{m}^3$)
R1	297498.3	269436.6	0.73	4.09	0.61	0.04	1.24	0.18	0.01
R2	297573.5	269493.2	0.79	3.82	0.76	0.05	1.16	0.23	0.01
R3	297654.7	269498.3	1.11	3.58	0.98	0.07	1.08	0.30	0.02
R4	297395.3	269510.8	0.61	1.54	0.54	0.04	0.47	0.16	0.01
R5	297355.4	269515	0.65	1.28	0.54	0.04	0.39	0.16	0.01
R7	297281.2	269519.7	0.75	2.02	0.60	0.05	0.61	0.18	0.01
R8	297299.3	269380.5	1.48	3.88	1.17	0.09	1.18	0.35	0.03
R9	297744.7	269499.2	1.33	3.35	0.97	0.08	1.02	0.29	0.02
R10	297629.6	268891.5	0.82	1.76	0.73	0.05	0.53	0.22	0.01

5. Conclusions

Odour Monitoring Ireland was commissioned by Panda Waste to perform a dispersion modelling study in order to provide supporting information for a license review of new processes to be located in Bauparc Business Park, Navan, Co. Meath. Following a detailed impact and dispersion modelling assessment, it was demonstrated that no significant environmental impact will exist if the source characteristics and emission limit value in the waste gases are achieved.

The following conclusions are drawn from the study:

1. The assessment was carried out to provide information in line with standard information to be provided to the EPA for license reviews for such projects.
2. Specific dispersion modelling was performed for Carbon monoxide, Oxides of nitrogen, Sulphur dioxide, Particulate matter, Hydrogen chloride and Hydrogen fluoride. The combined cumulative impact of odour for the facility has been dealt with in another document which has been submitted to the EPA.
3. With regards to Carbon monoxide, the maximum GLC+Baseline for CO from the operation of the facility is $810 \mu\text{g m}^{-3}$ for the maximum 8-hour mean concentration at the 100th percentile. When combined predicted and baseline conditions are compared to the Irish guideline/limit values and EU Limit values set out in SI 271 of 2002 and Directive 2008/50/EC, this is 8.10% of the impact criterion. In addition, the predicted ground level concentration of Carbon monoxide at each of the 10 sensitive receptors is presented in *Table 4.3*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Tables 2.1 and 2.2*.
4. With regards to Oxides of nitrogen, the maximum GLC+Baseline for NO₂ from the operation of the facility is $119 \mu\text{g m}^{-3}$ for the maximum 1-hour mean concentration at the 99.79th percentile. When combined predicted and baseline conditions are compared to SI 271 of 2002 and Directive 2008/50/EC, this is 59.50 % of the impact criterion. An annual average was also generated to allow comparison with values contained in SI 271 of 2002 and Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was $22.30 \mu\text{g/m}^3$. When compared the annual average NO₂ air quality impact criterion is 55.75% of the impact criterion. In addition, the predicted ground level concentration of Oxides of nitrogen at each of the 10 sensitive receptors is presented in *Table 4.3*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Tables 2.1 and 2.2*.
5. With regards to Sulphur dioxide, the maximum GLC+Baseline for SO₂ from the operation of the facility is 120 and $50 \mu\text{g m}^{-3}$ for the maximum 1-hour and 24 hr mean concentration at the 99.73th and 99.18th percentile respectively. When combined predicted and baseline conditions are compared to SI 271 of 2002 and Directive 2008/50/EC, this is 36 and 42.40% of the set target limits established for the 1 hour and 24 hour assessment criteria. An annual average was also generated to allow comparison with SI 271 of 2002 and Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was $12 \mu\text{g/m}^3$. When compared the annual average SO₂ air quality impact criterion is 60% of the impact criterion. In addition, the predicted ground level concentration of Sulphur dioxide at each of the 10 sensitive receptors is presented in *Table 4.3*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Tables 2.1 and 2.2*.
6. With regards to Particulate matter, the maximum GLC+Baseline for Particulate matter 10 μm from the operation of the facility is $31 \mu\text{g m}^{-3}$ for the maximum 24-hour mean concentration at the 90.40th percentile. When combined predicted and baseline conditions are compared to Directive 2008/50/EC, this is 62% of the impact criterion.

An annual average was also generated to allow comparison with the SI 271 of 2002 and Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was $21\mu\text{g}/\text{m}^3$. When compared, the annual average Particulate matter air quality impact is 52.50 % of the impact criterion. An annual average was also generated for $\text{PM}_{2.5}$ to allow comparison with Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was $16\mu\text{g}/\text{m}^3$. When compared, the annual average $\text{PM}_{2.5}$ air quality impact is 64% of the impact criterion. In addition, the predicted ground level concentration of Particulate matter at each of the 10 sensitive receptors is presented in *Table 4.3*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Tables 2.1 and 2.2*.

7. With regards to Hydrogen chloride, emissions at maximum operations equate to ambient HCl concentrations (including background concentrations) which are from 1.56 to 15.5% of the maximum impact criterion for both the 1 hr and annual average period. In addition, the predicted ground level concentration of Particulate matter at each of the 10 sensitive receptors is presented in *Table 4.3*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Tables 2.1 and 2.2*.
8. With regards to Hydrogen fluoride emissions at maximum operations equate to ambient HF concentrations (including background concentrations) which are from 1.59% to 60% of the maximum impact criterion for both the 1 hr and annual average period. In addition, the predicted ground level concentration of Particulate matter at each of the 10 sensitive receptors is presented in *Table 4.3*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Tables 2.1 and 2.2*.
9. Emissions from the biogas flare were not accounted for in the model as this is a standby plant and will only operate when one of the gas utilisation engines is in maintenance. Emissions from the gas utilisation engine would be greater than the biogas flare as per *Table 3.3* and therefore worst case is taken into account by assuming the gas utilisation engines operate 24/7/365 days per year.
10. The overall modelling indicates that the facility will not result in any significant impact on air quality in the surrounding area with all ground level concentrations of pollutants well within their respective ground level concentration limit values.

6. Appendix I - Air dispersion modelling contour plots (Process contributions and illustrative purposes only).

These contour maps are for illustrative purposes only.

6.1 Site layout drawing and location of proposed emission points – A2-2 to A2-5

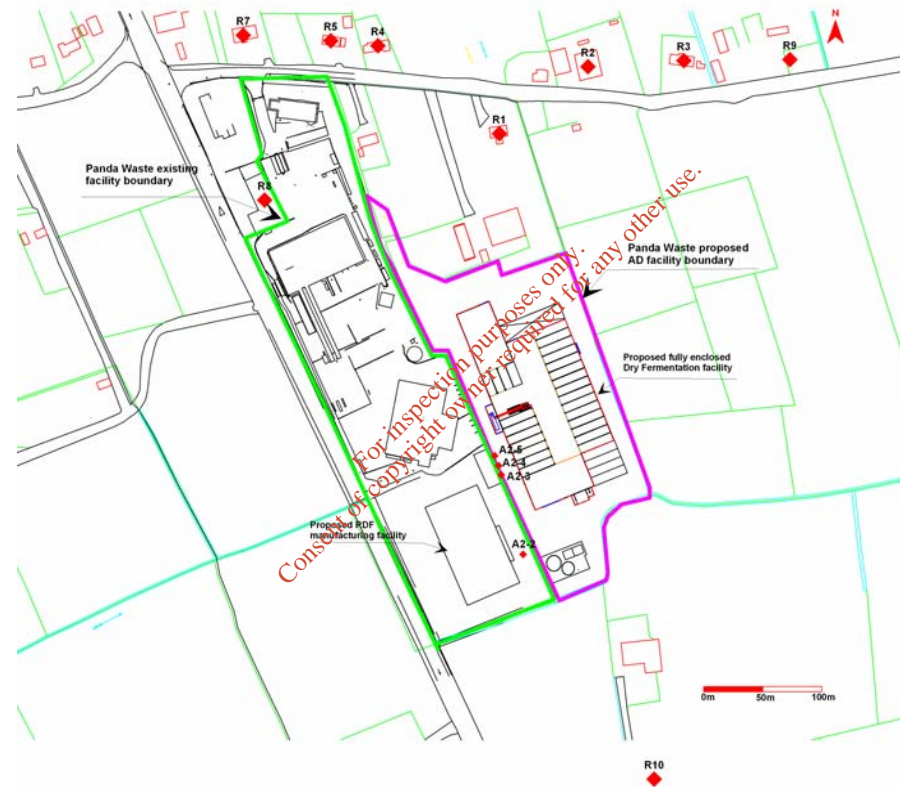


Figure 6.1. Plan view facility layout drawings for Panda Waste Ltd facility including specific location of proposed emission points A2-2 to A2-5 and nearest sensitive receptors R1 to R10.

6.2. Dispersion modelling contour plots for Scenarios 1 to 15 – Worst case meteorological year Dublin 2004

6.2.1 Scenario 1 - Carbon monoxide

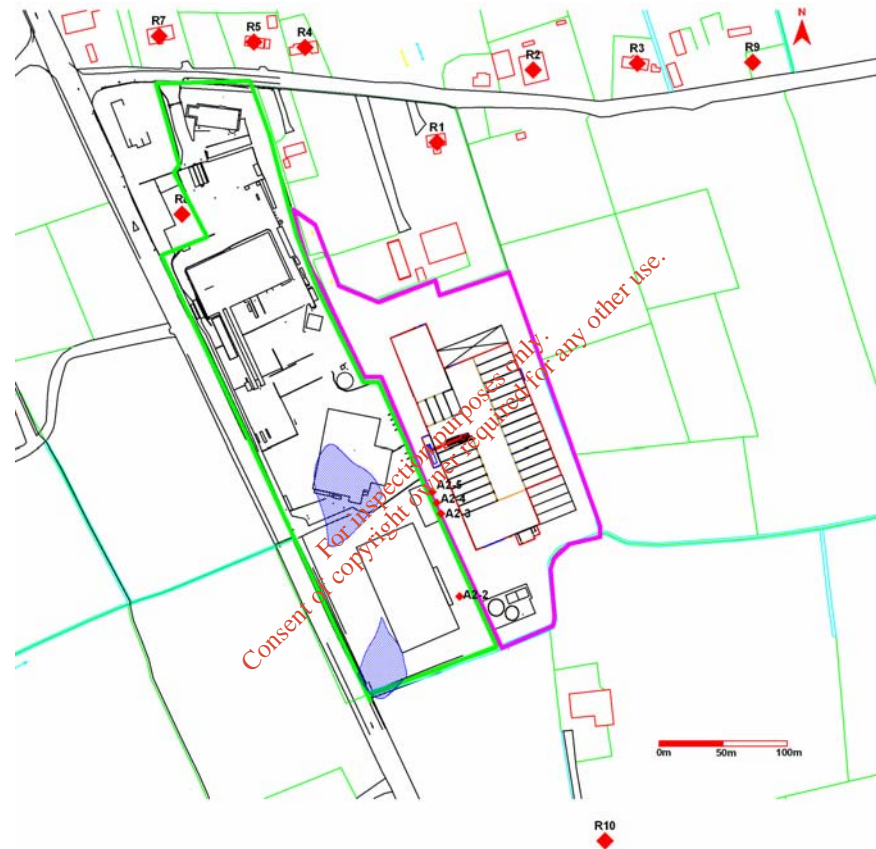


Figure 6.2. Predicted 8 hr average CO ground level concentration of $500 \mu\text{g}/\text{m}^3$ (—) for cumulative emissions from emission points for Scenario 1 for Dublin Airport meteorological station (worst case year 2004).

6.2.2 Scenario 2 and 3 - Oxides of nitrogen

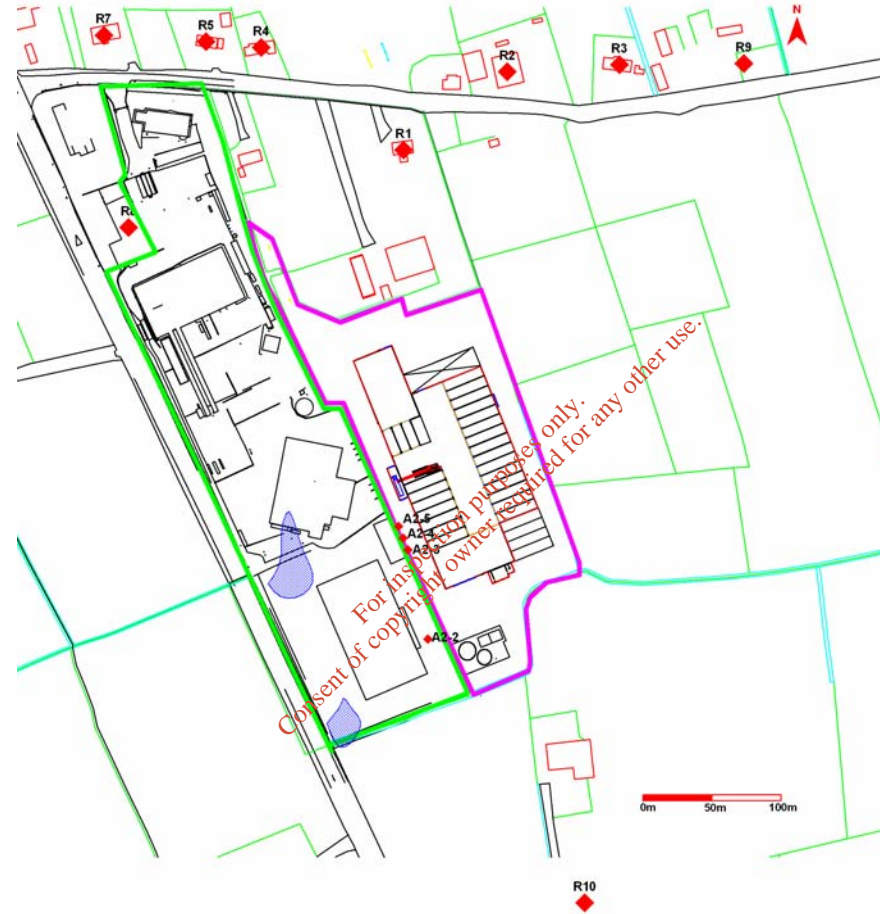


Figure 6.3. Predicted 99.79th percentile of 1 hr averages for NO₂ ground level concentration of 101 µg/m³ (—) for cumulative emission for Scenario 2 for Dublin Airport meteorological station (worst case year 2004).

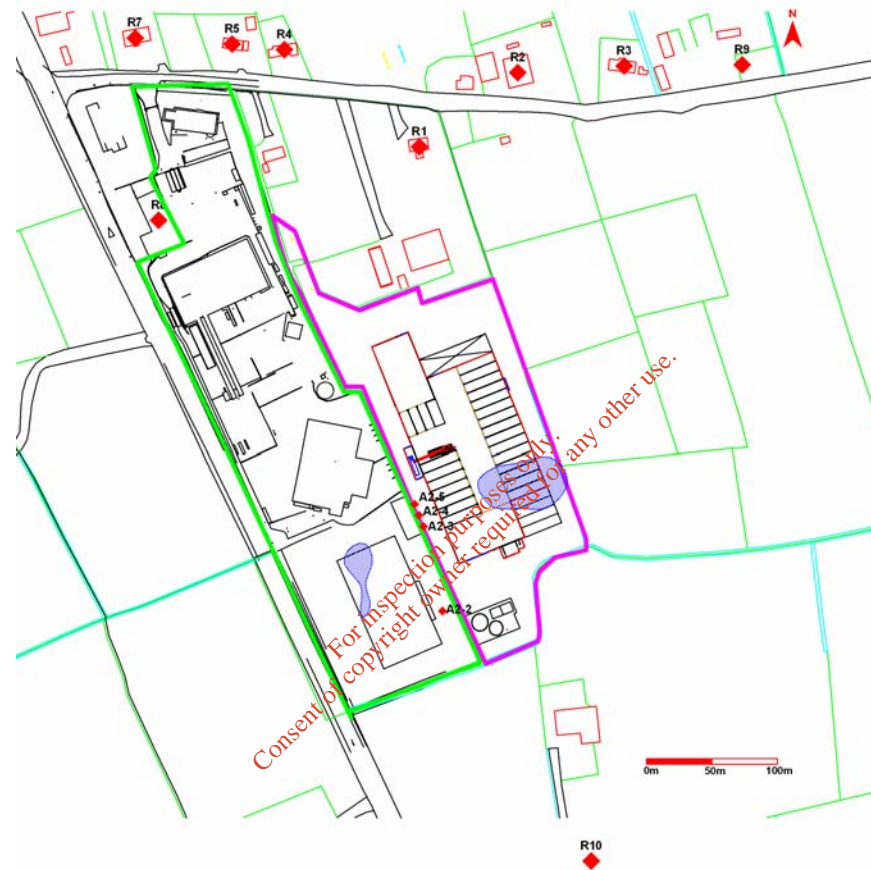


Figure 6.4 Predicted annual average NO₂ ground level concentration of 13.3 µg/m³ (—) for cumulative emissions for Scenario 3 for Dublin Airport meteorological station (worst case year 2004).

6.2.3 Scenario 4, 5 and 6 - Sulphur dioxide

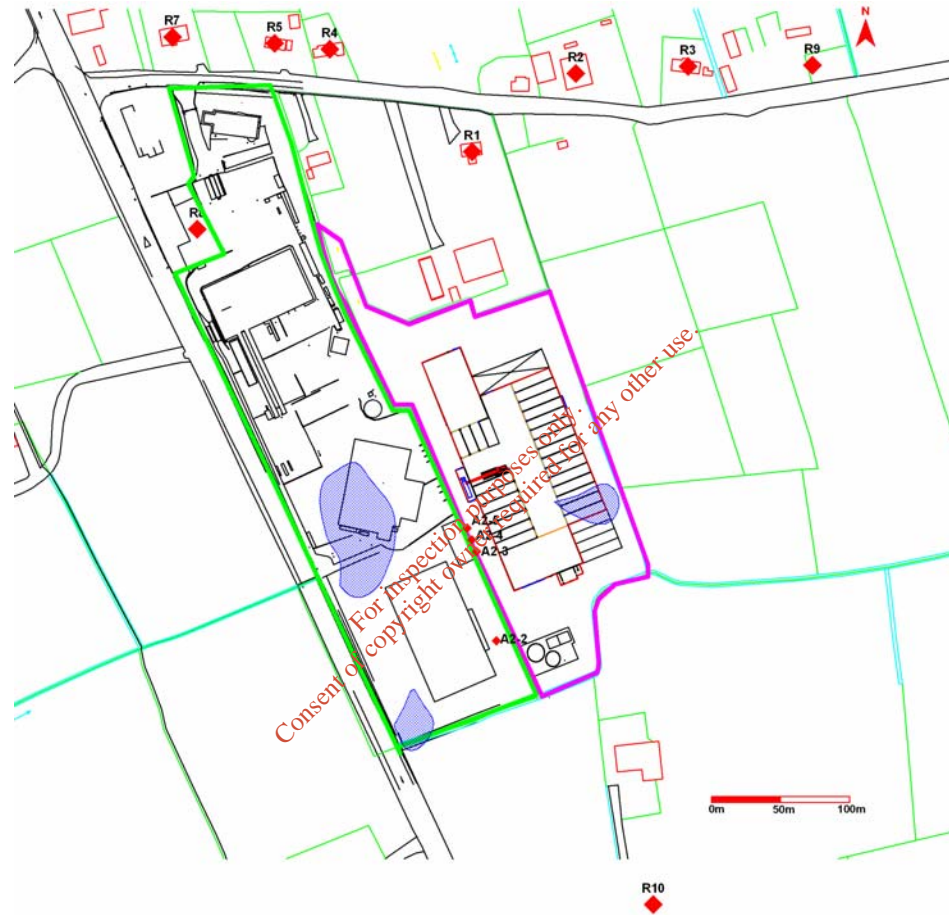


Figure 6.5. Predicted 99.73th percentile of 1 hr averages for SO₂ ground level concentration of 110 µg/m³ (—) for cumulative emission for Scenario 4 for Dublin Airport meteorological station (worst case year 2004).

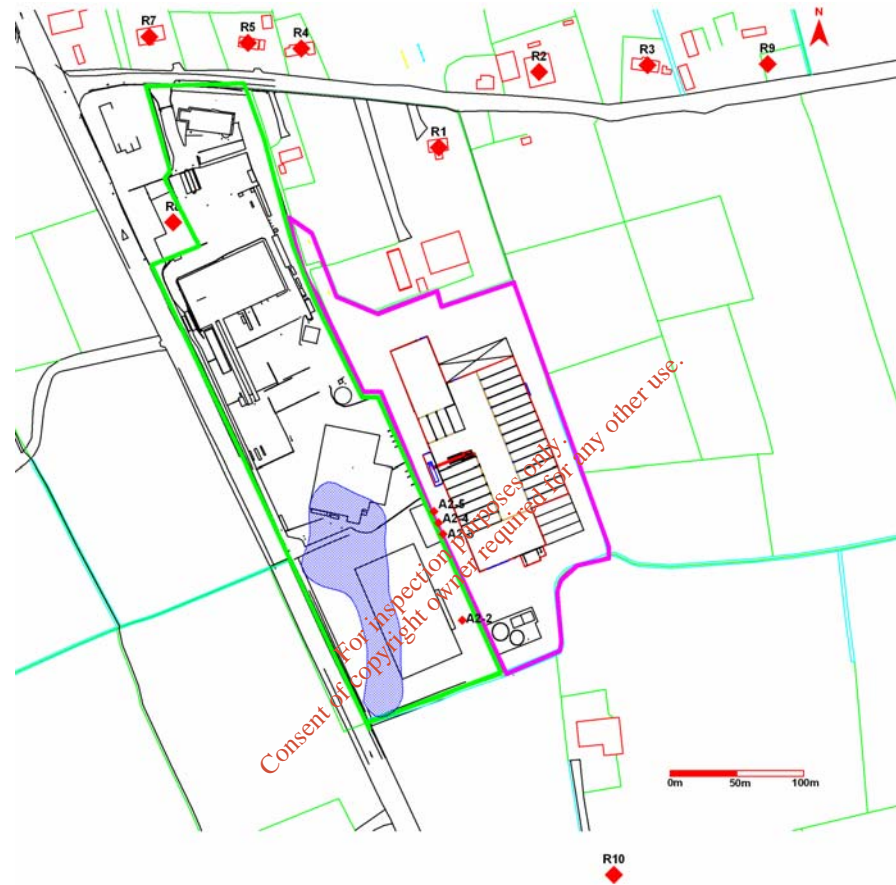


Figure 6.6. Predicted 99.18th percentile of 24 hr averages for SO₂ ground level concentration of 50 µg/m³ (█) for cumulative emission for Scenario 5 for Dublin Airport meteorological station (worst case year 2004).

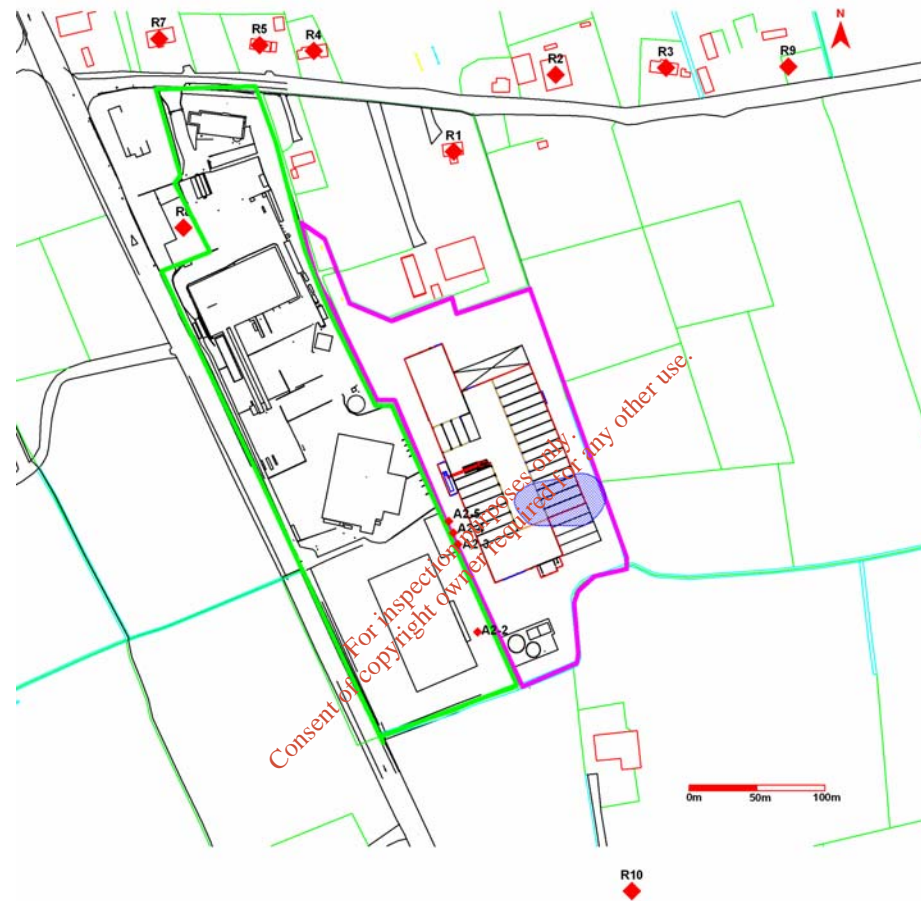


Figure 6.7. Predicted annual average SO₂ ground level concentration of 9 µg/m³ (—) for cumulative emissions for Scenario 6 for Dublin Airport meteorological station (worst case year 2004).

6.2.4 Scenario 7, 8 and 9 - Total particulates

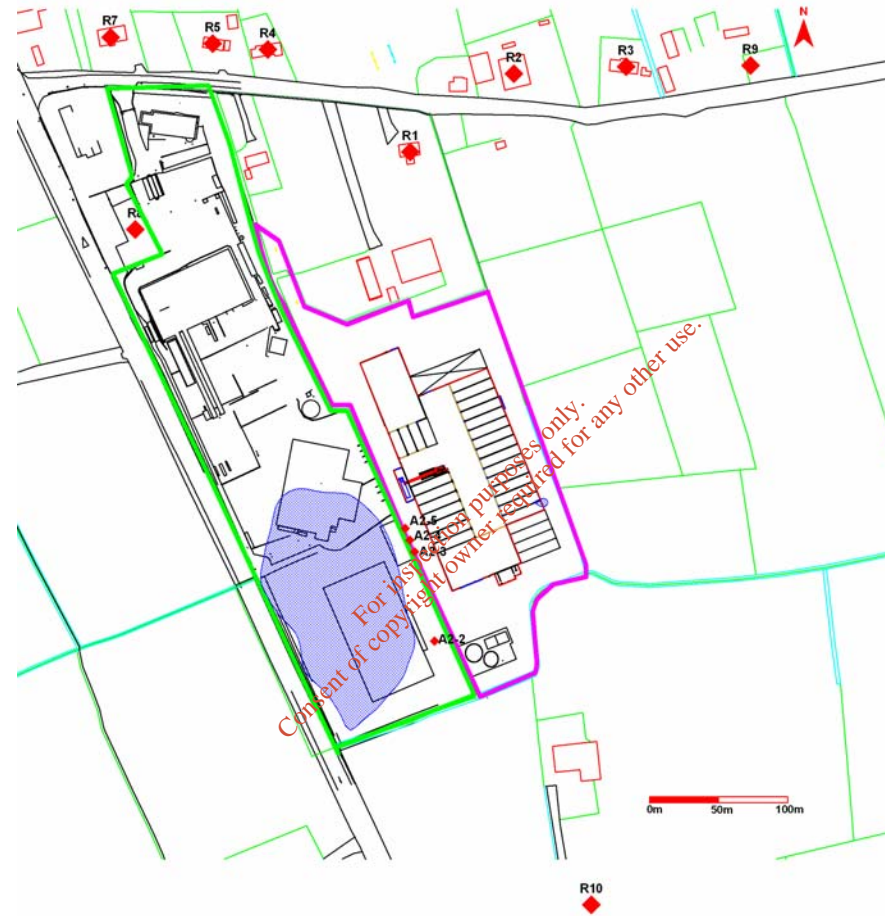


Figure 6.8. Predicted 90.40th percentile of 24 hr averages for Total particulates ground level concentration of 17 µg/m³ (—) for cumulative emission for Scenario 7 for Dublin Airport meteorological station (worst case year 2004).

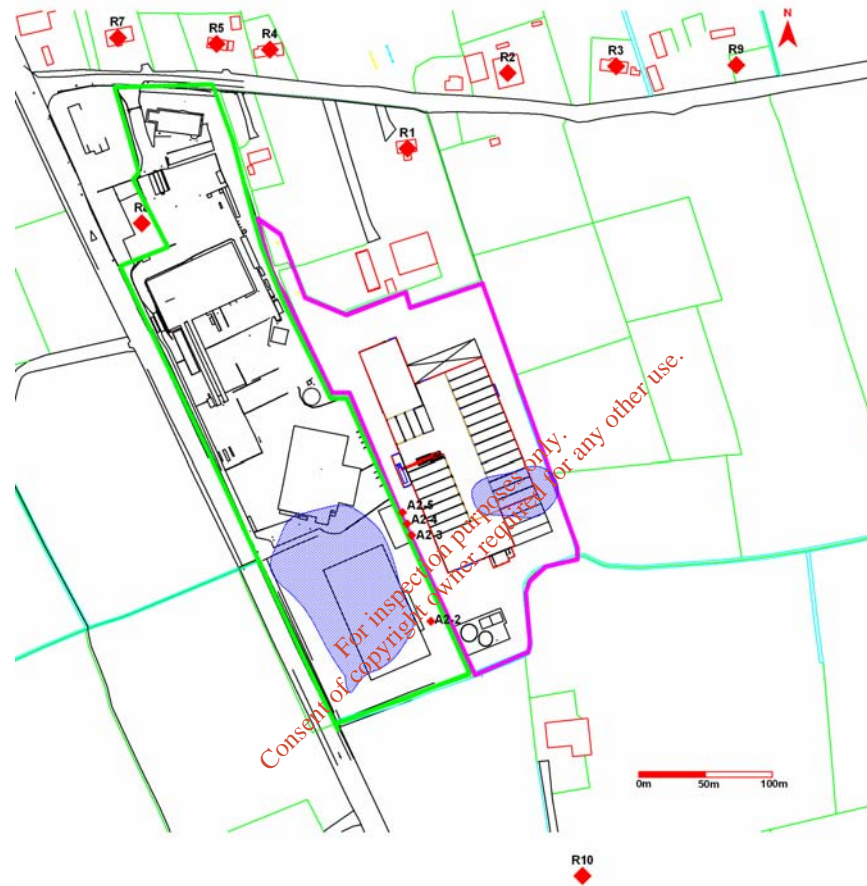


Figure 6.9. Predicted annual average Total particulates ground level concentration of $6.0 \mu\text{g}/\text{m}^3$ (—) for cumulative emissions for Scenario 8 for Dublin Airport meteorological station (worst case year 2004).

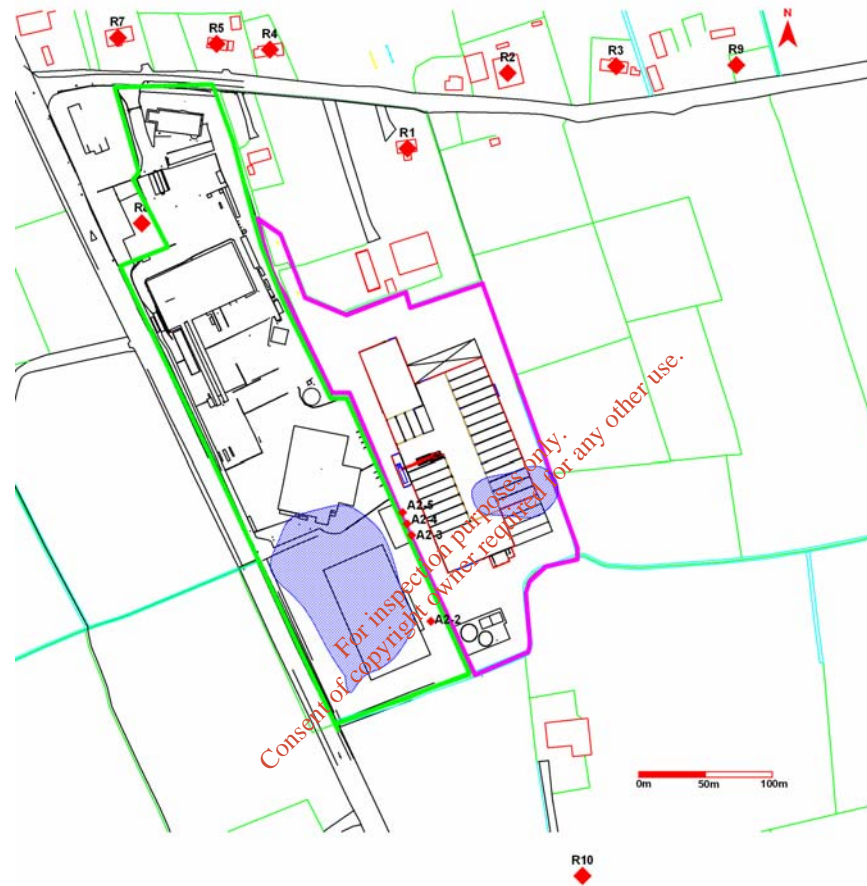


Figure 6.10. Predicted annual average Total particulates as PM_{2.5} ground level concentration of 6.0 µg/m³ (—) for cumulative emissions for Scenario 9 for Dublin Airport meteorological station (worst case year 2004).

6.2.5 Scenario 10, 11 and 12 – Hydrogen chloride

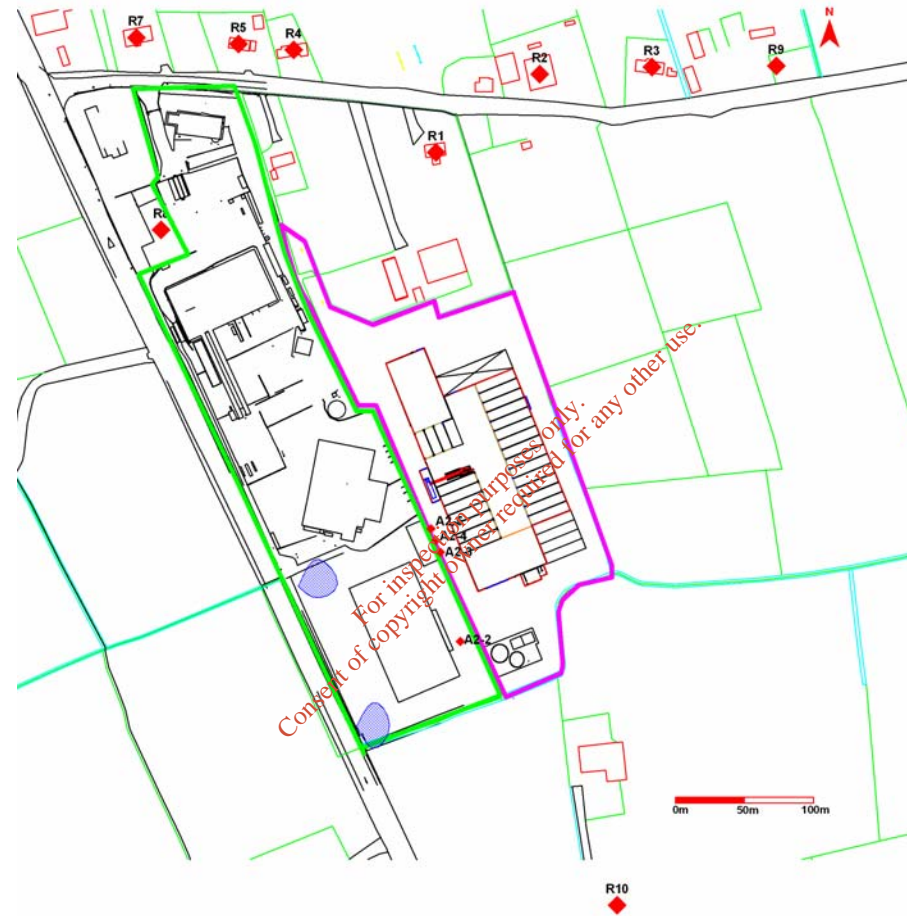


Figure 6.11. Predicted 100th percentile of 1 hr averages for Hydrogen chloride ground level concentration of $8 \mu\text{g}/\text{m}^3$ () for cumulative emission for Scenario 10 for Dublin Airport meteorological station (worst case year 2004).

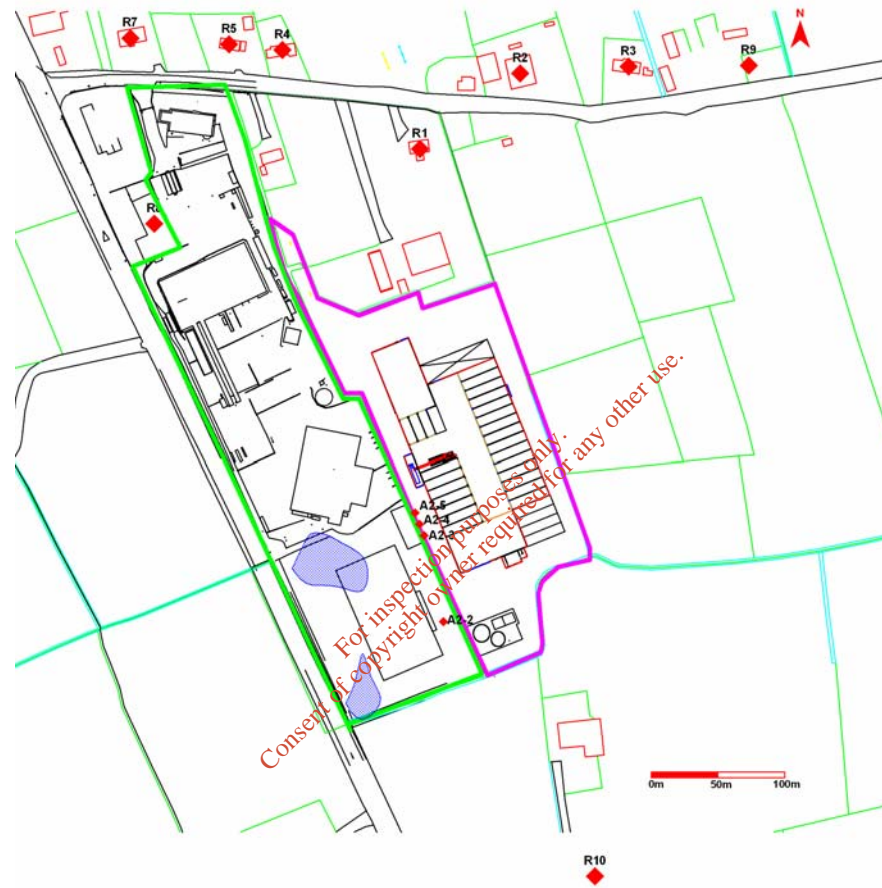


Figure 6.12. Predicted 98th percentile of 1 hr averages for Hydrogen chloride ground level concentration of $5 \mu\text{g}/\text{m}^3$ (█) for cumulative emission for Scenario 11 for Dublin Airport meteorological station (worst case year 2004).

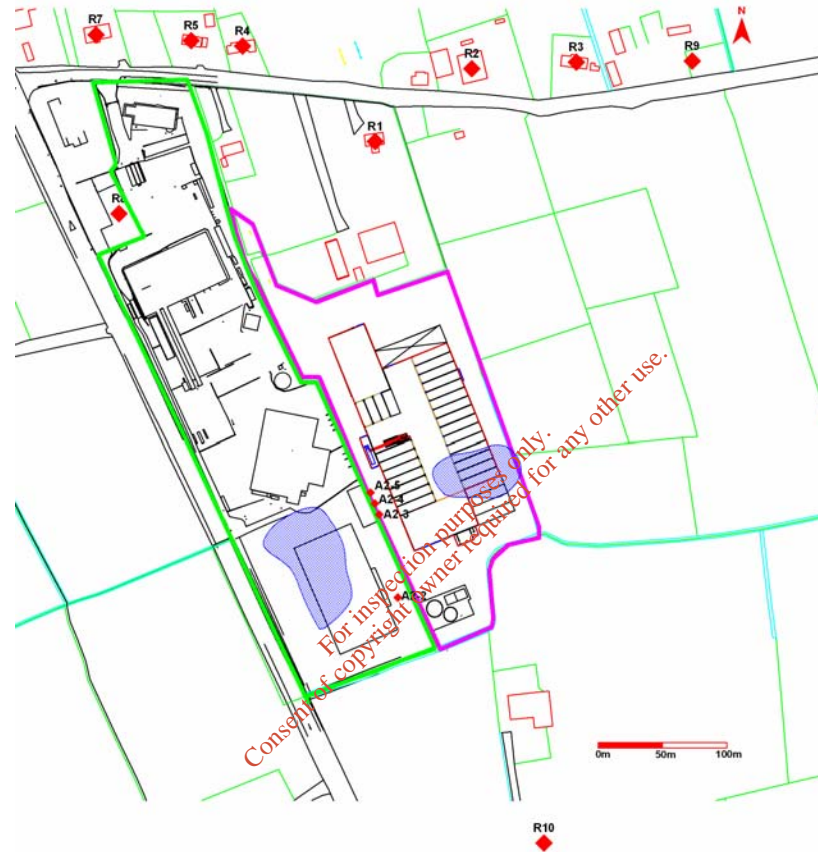


Figure 6.13. Predicted annual average Hydrogen chloride ground level concentration of $0.40 \mu\text{g}/\text{m}^3$ (■) for cumulative emissions for Scenario 12 for Dublin Airport meteorological station (worst case year 2004).

6.2.6 Scenario 13, 14 and 15 – Hydrogen fluoride

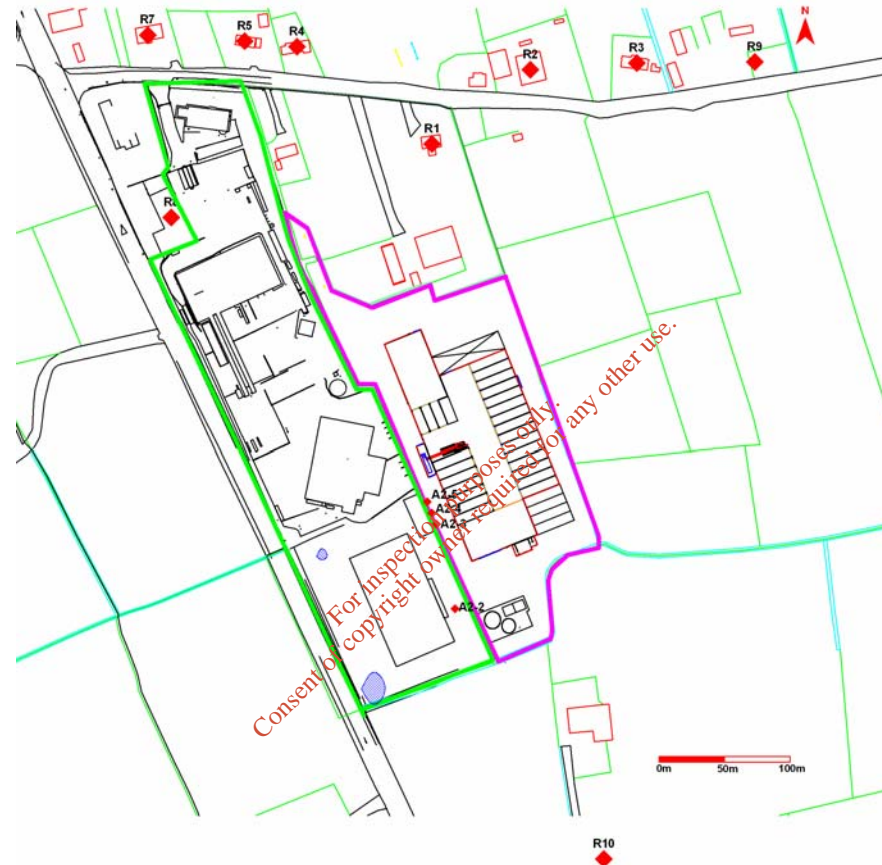


Figure 6.14 Predicted 100th percentile of 1 hr averages for Hydrogen fluoride ground level concentration of $2.5 \mu\text{g}/\text{m}^3$ (—) for cumulative emission for Scenario 13 for Dublin Airport meteorological station (worst case year 2004).

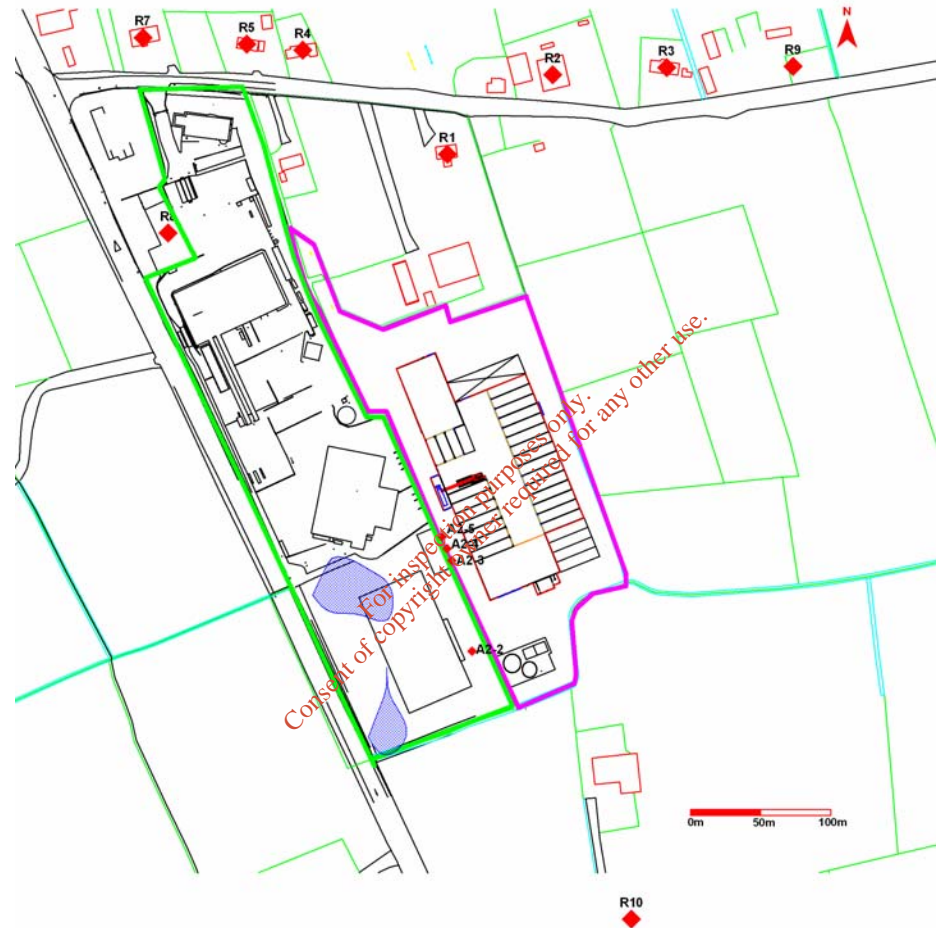


Figure 6.15. Predicted 98th percentile of 1 hr averages for Hydrogen fluoride ground level concentration of $1.5 \mu\text{g}/\text{m}^3$ (■) for cumulative emission for Scenario 14 for Dublin Airport meteorological station (worst case year 2004).

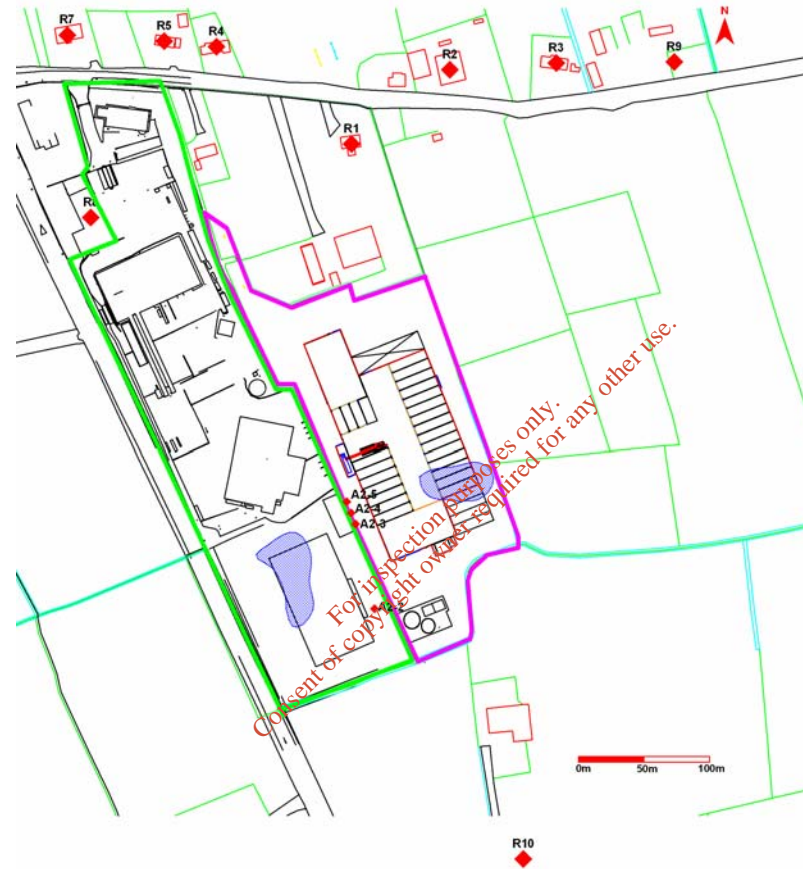


Figure 6.16. Predicted annual average Hydrogen fluoride ground level concentration of $0.13 \mu\text{g}/\text{m}^3$ (—) for cumulative emissions for Scenario 15 for Dublin Airport meteorological station (worst case year 2004).

7. Appendix II - Meteorological data used within the Dispersion modelling study.

Meteorological file Dublin Airport 2002 to 2006 inclusive

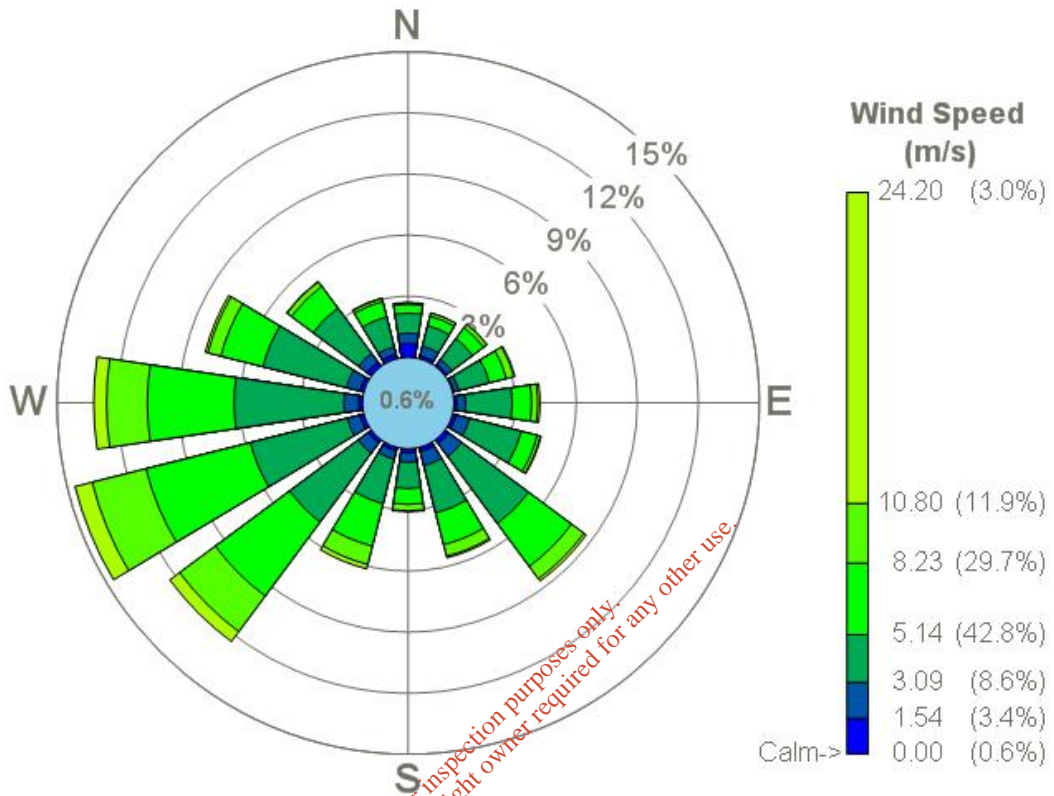


Figure 7.1. Schematic illustrating windrose for meteorological data used for atmospheric dispersion modelling, Dublin Airport 2002 to 2006 inclusive.

Table 7.1. Cumulative wind speed and direction for meteorological data used for atmospheric dispersion modelling Dublin Airport 2002 to 2006 inclusive.

Cumulative Wind Speed Categories							
Relative Direction	> 1.54	>3.09	>5.14	>8.23	> 10.80	< 10.80	Total
0	0.67	0.50	0.99	0.44	0.07	0.02	2.70
22.5	0.15	0.48	1.04	0.48	0.16	0.00	2.31
45	0.11	0.31	1.27	0.67	0.21	0.01	2.57
67.5	0.07	0.24	1.55	0.86	0.38	0.05	3.15
90	0.13	0.44	2.28	0.95	0.31	0.11	4.22
112.5	0.17	0.68	2.62	0.80	0.16	0.04	4.48
135	0.22	0.79	4.10	2.61	0.76	0.14	8.63
157.5	0.22	0.70	2.39	1.61	0.58	0.08	5.58
180	0.20	0.45	1.30	0.77	0.32	0.05	3.09
202.5	0.17	0.42	2.26	2.14	0.93	0.23	6.15
225	0.19	0.62	4.21	4.53	2.18	0.61	12.34
247.5	0.20	0.64	4.91	5.29	2.73	0.87	14.63
270	0.19	0.73	5.39	4.27	2.00	0.63	13.20
292.5	0.19	0.68	4.23	2.13	0.66	0.13	8.03
315	0.26	0.53	2.77	1.33	0.26	0.04	5.20
337.5	0.23	0.37	1.51	0.78	0.15	0.04	3.07
Total	3.39	8.58	42.82	29.66	11.86	3.04	99.36
Calms	--	-	-	-	-	-	0.56
Missing	-	-	-	-	-	-	0.08
Total	-	-	-	-	-	-	100.00

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8. **Appendix III - Checklist for EPA requirements for air dispersion modelling reporting**

Table 8.1. EPA checklist as taken from their air dispersion modelling requirements report.

Item	Yes/No	Reason for omission/Notes
Location map	Section 6	-
Site plan	Section 6	-
List of pollutants modelled and relevant air quality guidelines	Yes	-
Details of modelled scenarios	Yes	-
Model description and justification	Yes	-
Special model treatments used	Yes	-
Table of emission parameters used	Yes	-
Details of modelled domain and receptors	Yes	-
Details of meteorological data used (including origin) and justification	Yes	-
Details of terrain treatment	Yes	-
Details of building treatment	Yes	-
Details of modelled wet/dry deposition	N/A	-
Sensitivity analysis	Yes	Five years of hourly sequential data screened from nearest valid met station-Dublin Airport 2002 to 2006. Due to the fact of simple terrain in the vicinity of the emission point no terrain effect required or accounted for within the model.
Assessment of impacts	Yes	Pollutant emissions assessment from process identified.
Model input files	No	DVD will be sent upon request. Files are a total of 2.2 GB in size.