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Ms Noelleen Keavey
Office of Climate Licensing and Resources and Research
Environmental Protection Agency
PO Box 3000,
Johnstown Castle Estate
County Wexford.

12th May 2015

Re; Application for Waste Licence (W0140-04) Addendum to EIS

Dear Ms Keavey,

I refer to the Agency's letter dated the 18th December in accordance with Regulation 11(2)(b) of the EPA (Industrial Emissions)(Licensing) Regulations 2013 the Environmental Impact Statement (EIS) does not comply with Article 94 of the Planning and Development Act.



The requested information is set out herein.

1. *The Numbering of the emission points in Table 11.1 of the EIS does not correspond with the points identified in Drawing No. 3 Revision A. Amend Table 11.1 to correlate with Drawing No.3 or vice versa.*

Drawing No 3 Revision B shows the emission points that are referenced in Table 11.1.

2. *Provide a process flow diagram for the RDF manufacturing process.*

A process flow diagram is in Attachment 1.

3. *Identify well locations BH1 and BH2 on Drawing No.3*

The location of the wells are shown on Drawing No.3 Revision B.

*Cont'd*

4. *Section 3.4.1 of the EIS states that a biomass furnace is being used instead of a RTO as it has significantly lower carbon footprint. However, the air and odour dispersion models make reference to RTO exhaust stacks and section 11.5 states that an RTO will be operated at the installation and for what purpose. Provide amended relevant texts of the EIS accordingly.*

An amended Chapter 11 of the EIS is in Attachment 2.

*5. Air Dispersion Modelling*

*a) Section 11.6 states that the gas flare was not included in the air dispersion model; however, the model attached in Appendix 11 includes the predicted emissions from the gas flare.*

While Tables 3.1 and 3.3 in the OMI air dispersion modelling report lists the source characteristics and the emission values respectively for the biogas flare, these were not input to the model. The rationale was that the flare will predominantly be in standby mode and will only run when one of the gas engines shuts down, which will be infrequently.

*b) The modelling did not include the biofilter in Building 4 and the carbon filter in Building 3.*

- *Provide air dispersion modelling which includes all point source emissions to air (excluding the gas flare) at the installation in order to assess the overall impact of the installation's emissions on air quality. Note: ensure the numbering used in the air dispersion correlates with Drawing No.3.*

- *Include modelling for the parameters non-methane volatile organic carbon and hydrogen sulphide from biogas CHP engines.*



A revised air dispersion model prepared by Odour Monitoring Ireland is in Attachment 3 It does not include the emissions from the biofilters in Building 4 and the carbon filter in Building 3 as there were modelled in the Odour Monitoring Ireland Odour Impact Assessment, which is in Appendix 11 of the EIS.

*6 Odour Impact Assessment*

*a) The scope of the Odour Impact Assessment does not seem to include the emission to air at location A-1 (biofilter associated with the Wright Tunnels). Section 4.10 of the EIS states that the Wright Tunnels may be used in the future either in the initial stage of biological treatment, or in the manufacture of RDF/SRF. Provide an odour impact assessment that includes all point and fugitive sources of odour at the installation in order to allow the cumulative effect to be assessed. Note: ensure the numbering used in the odour model correlates with Drawing No.3.*

*Cont'd*

PANDA has decided not to use the Wright Tunnels in the future and therefore it is not necessary to include them in the odour impact assessment.

*7 Noise*

*Table 12.8 lists the predicted noise levels of plant proposed for use at the installation. Confirm how these noise levels were predicted.*

The predicted noise levels are based on information provided by plant suppliers and the results of monitoring similar equipment.

*8 In accordance with Regulations 9(2)(p), describe the measures to be taken for minimizing pollution over long distances.*

The operations carried out at the installation are regulated by the current Waste Licence. The conditions specify the operational controls and emission limit values that must be applied to ensure the facility does not cause pollution or impairment of amenities either inside the site boundaries, or in the surrounding area. The measures also effectively minimise the risk of pollution over long distances.



*9 In accordance with Regulation 9(2)(q), describe the measures to be taken under abnormal operating conditions for current and proposed activates including:*

*a) Start-up and shutdown;*
*b) Leaks;*
*c) Malfunctions, breakdowns and momentary stoppages*

Given the nature of the waste activities, there are no abnormal conditions associated with start-up and shutdown. Abnormalities that may occur include accidents, plant and equipment breakdown and oil/fluids leaks/spill. PANDA has an prepared a Safety Statement, Accident Prevention Policy (APP) and an Emergency Response Procedure (ERP), the objectives of which are to minimise the risk of accidents and ensure that the appropriate actions are taken in the event of an incident. The APP and ERP documents are in Attachment 4.

PANDA has a preventative maintenance programme in place that involves routine inspection and servicing of key plant items. In the event of the breakdown of critical mobile plant, replacements are hired in.

PANDA has documented procedures on the handling and storage of oils/fluids which detail the responses that will be implemented in the event of a spill/release. The response actions are listed in the ERP in Attachment 4.

*10 As required under paragraph 2 (b) of schedule 6 of The Planning and Development Regulations 2001, as amended, provide a descriptions of any aspect of cultural heritage likely to be significantly affected by the activities at the installation.*

*Cont'd*

An amended Chapter 15 of the EIS that describes the cultural heritage in the vicinity of the site and assesses the impacts is in Attachment 5.

*11 Describe fully and in detail the inter-relationship between the following factors: human beings, fauna and flora, soil, water, air, climate, landscape, material assets (Including architectural and archaeologic & cultural heritage).*

An amended Chapter 17 of the EIS that describes the inter-relationship between human beings, fauna and flora, soil, water, air, climate, landscape, material assets (Including architectural and archaeologic & cultural heritage) is in Attachment 6.

## Additional Information

Separately from the above Panda proposes to use recovered C&D waste as fill material to replace quarry won stone in the construction of the new building. Chapter 5 of the EIS has been amended to reflect this and the revised Chapter is in Attachment 7.

PANDA made an End of Waste submission to the Agency on the processed C&D materials in 2012. Although the Agency has not agreed the processed materials can be classified as End of Waste, PANDA considers that the materials can be used for construction purposes within the licensed area. A copy of the 2012 End of Waste submission is in Attachment 8.



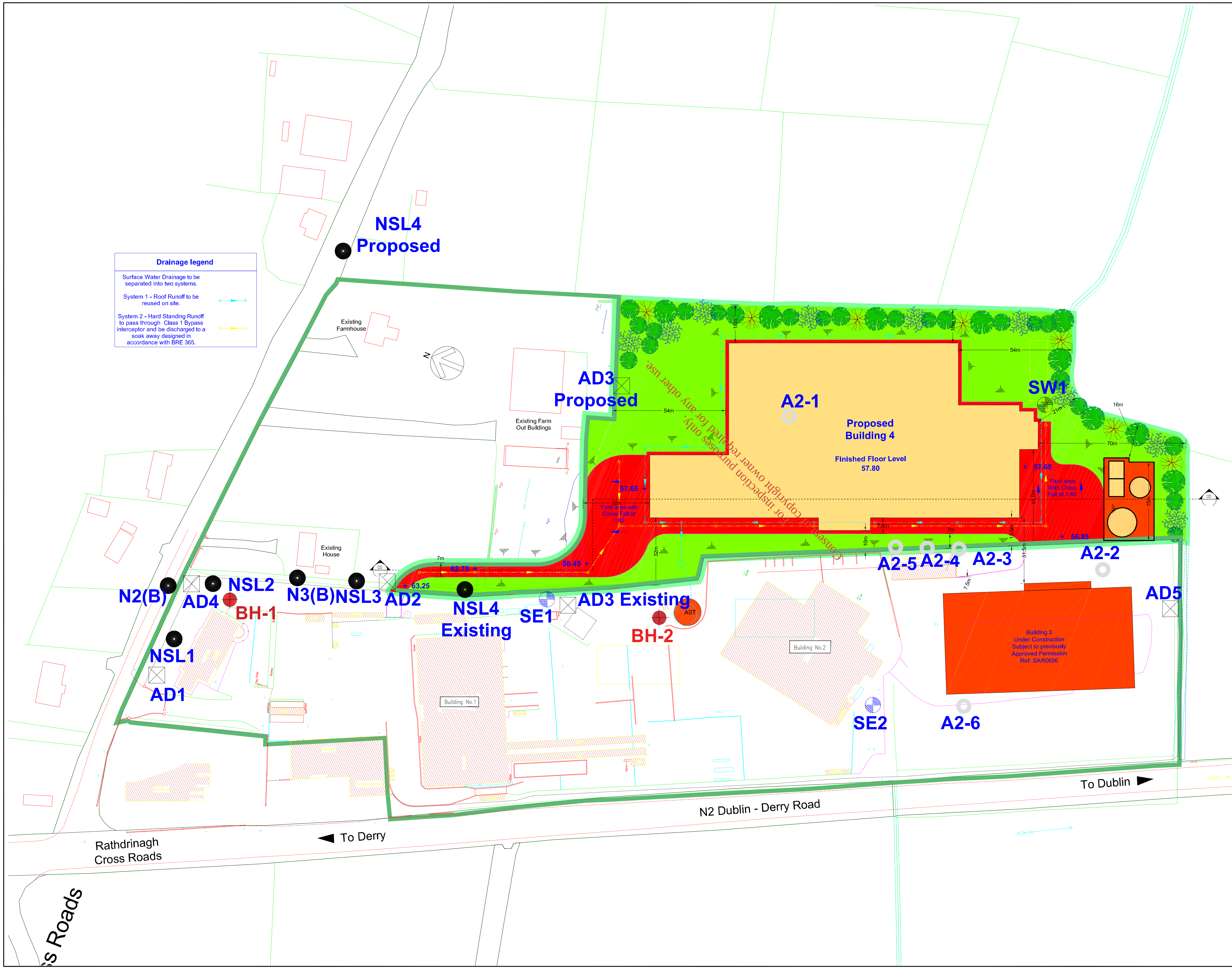
As the materials have the same chemical characteristics as the concrete and bricks that will be used in the construction, it is not necessary to revise the other Chapters of the EIS to assess the impacts of the proposed use.

An updated Non-Technical Summary is in Attachment 9.

Yours Sincerely

Jim O' Callaghan

# Drawing No 3




NOTES

LEGEND:

- Denotes Borehole Location
- Denotes Sewer Monitoring Location
- Denotes Surface Emission/Monitoring Location
- Denotes Noise Monitoring Locations
- Denotes Air Emission/Monitoring Point
- Denotes Dust Monitoring point

| # | I.D. | EASTING | NORTHING |
|---|---|---|---|
| 1 | AD-1 | 297300 | 269480 |
| 2 | AD-2 | 297374 | 269422 |
| 3 | AD-3 | 297481 | 269324 |
| 4 | AD-4 | 297352 | 269483 |
| 5 | AD-5 | 297500 | 269028 |
| 6 | NSL-1 | 297303 | 269484 |
| 7 | NSL-2 | 297357 | 269479 |
| 8 | NSL-3 | 297371 | 269430 |
| 9 | NSL-4 | 297526 | 269481 |
| 10 | N2(B) | 297351 | 269487 |
| 11 | N3(B) | 297372 | 269437 |
| 12 | SE-1 | 297406 | 269316 |
| 13 | SE-2 | 297411 | 269151 |
| 14 | SW-1 | 297585 | 269130 |
| 15 | A2-1 | 297531 | 269239 |
| 16 | A2-2 | 297517 | 269073 |
| 17 | A2-3 | 297501 | 269139 |
| 18 | A2-4 | 297495 | 269151 |
| 19 | A2-5 | 297491 | 269168 |
| 20 | A2-6 | 297432 | 269111 |

| REV | DATE | DESCRIPTION | DRN | CHKD | APP |
|---|---|---|---|---|---|
| A | 04/03/2015 | ISSUE | MW | JOC | ** |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CLIENT

PANDA WASTE SERVICES

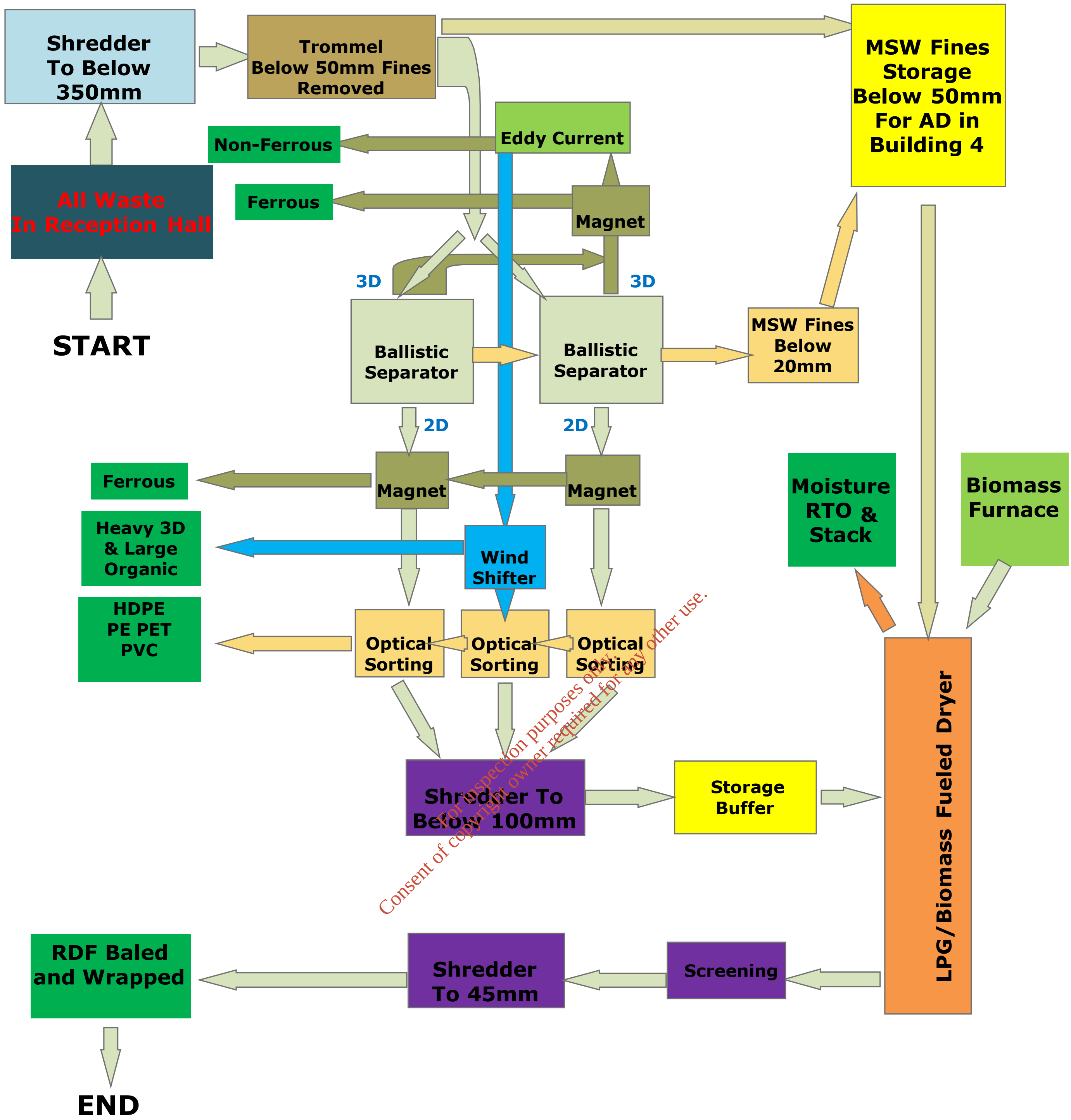
TITLE

PROPOSED MONITORING & EMISSION LOCATIONS

| SCALE | DRAWING No. | REV. |
|---|---|---|
| 1:600 A3 | 3 | B |

DOS Filename : *********

# Attachment 1






# Building 3 Process Flow

**Recovery of Metals, Plastics, Separation of Organic Fines and Production of RDF from MSW**

Panda
An Animal for Recycling

# Attachment 2

# 11 AIR

## 1.1 Introduction

This Chapter describes the ambient air quality and the existing and proposed emissions to air. It presents details of the proposed mitigation measures and assesses the impact, including odours, of the proposed development on air quality.

## 1.2 Methodology

The assessment is based on the EPA's ambient air quality databases, dust monitoring conducted by PANDA, and detailed odour impact assessment and emission dispersion modelling conducted by Odour Monitoring Ireland (OMI) Ltd. The OMI reports, which describe the methodologies applied in the impact assessment and modelling, are included in Appendix 11 and an overview of the findings is presented below.



## 1.3 Existing Conditions

### *1.3.1 Ambient Air Quality*

The EPA implements an air quality monitoring programme at a number of monitoring stations across the country. Although PANDA's facility is in an area categorised as Non Urban (ZONE D), the closest monitoring station that was considered representative of air quality at the site is in Navan (Urban Zone C).

Monitoring for carbon monoxide, sulphur and nitrous oxides, particulates, benzene and lead was conducted between April 2007 and February 2008 and the results indicate that, with the exception of particulates ($PM_{10}$), the air quality was good. A copy of the monitoring report is in Appendix 11.

### *1.3.2 Dust*

Current activities are potential sources of dust emissions. The potential sources of dust emissions are vehicle movements over paved areas during dry periods, processing of C&D wastes.

However, the mitigation measures currently employed, including damping down paved areas, have proven to be effective in controlling emissions from such sources, as is demonstrated by the results of the dust deposition monitoring carried out by PANDA in accordance with the current Licence requirements.

The monitoring is conducted at five monitoring locations within the site boundary, which are shown on Drawing No 3 Rev A. The measurements were carried out using Bergerhoff gauges specified in the German Engineering Institute VDI 2119 document entitled 'Measurement of Dustfall Using the Bergerhoff Instrument' (Standard Method).

The results of the monitoring carried out in 2012 and 2013 are presented in Tables 10.1 and 10.2, which also include the dust deposition limit (350 $mg/m^2/day$) specified in the Licence. In all of the monitoring events, the dust levels recorded were all well below the deposition limit.

**Table 10.1 Dust Monitoring Results 2012**

| Dust Emission ($mg/m^2/day$) Sample Location | May 2012 30 Days | July 2012 30 Days | Sept 2012 30 days | Dec 2012 30 days | Deposition Limit ($mg/m^2/day$) |
|---|---|---|---|---|---|
| **AD-1** | 160 | 240 | 50 | 60 | 350 |
| **AD-2** | 320 | 75 | 60 | 50 | 350 |
| **AD-3** | 220 | 70 | 65 | 50 | 350 |
| **AD-4** | 175 | 70 | 60 | 300 | 350 |
| **AD-5** | 160 | 75 | 175 | 60 | 350 |



**Table 10.2 Dust Monitoring Results 2013**

| Dust Emission ($mg/m^2/day$) Sample Location | Feb/March 2013 30 Days | March/April 2013 30 Days | Aug/Sept 2013 30 days | Nov/Dec 2012 30 days | Deposition Limit ($mg/m^2/day$) |
|---|---|---|---|---|---|
| **AD-1** | 41 | 50 | 104 | 29 | 350 |
| **AD-2** | 52 | 42 | 90 | 90 | 350 |
| **AD-3** | 92 | 82 | 86 | 32 | 350 |
| **AD-4** | 76 | 79 | 77 | 36 | 350 |
| **AD-5** | 156 | 13 | 101 | 199 | 350 |

### *1.3.3 Odours*

The potential sources of odours from the current activities are the processing of mixed MSW and the operation of the Wright Tunnels. The current Waste Licence requires the routine monitoring of the efficiency of the biofilter treating the air extracted from the Wright Tunnels. In 2010 PANDA suspended the use of the tunnels for operational reasons, however the results of the survey carried out in 2011 confirmed that the abatement system had been operating effectively.

Prior to 2010, PANDA had received few complaints from neighbours concerning odours. Any such complaints were recorded and investigated. Where site activities were identified as being a potential cause of the complaint, corrective actions are implemented and the results communicated to the complainant.

In 2011 PANDA received ten complaints from the general public about the facility operation, seven of which related to odours. In 2012, a total of eighteen complaints were received, of which fourteen related to odour. In 2013, a total of 35 complaints about odours were received.

In response to the complaints, the Agency carried out a number of unannounced odour assessments, beginning in 2011 and continuing into 2012 and 2013. A survey completed in November 2011 identified odours at two off-site locations. The EPA instructed PANDA to implement corrective action to ensure that activities were carried out in a manner that odours did not result in a significant interference with the amenities or environment beyond the site boundary.

Three subsequent unannounced odour assessment surveys carried out by the EPA in May, August and December 2012 and a further three assessments on the 13th, 14th and 15th May 2013 did not identify odours that gave rise to significant impairment of amenities or the environment outside the site boundary.

## 1.4 Impacts

### *1.4.1 Fugitive Emissions*



The proposed AD/Composting and manufacture of RDF/SRF are potential sources of dust and odours. Vehicles travelling on the new paved areas are a potential source of dust in dry weather.

### *1.4.2 Point Emissions*

The CHP plant and the biomass furnace will be new sources of air emissions. The CHP plant will comprise two gas engines and a stand-by flare, each forming a separate emission point. The odour abatement systems provide in Building 3 and Building 4 will each have a point emission. The locations of the gas engine stacks, flare, furnace stack and odour abatement plant stacks are shown on Drawing No. 3 Proposed Monitoring & Emissions Locations Rev B**.** Details of the stack heights, maximum flow rates and efflux velocities for each emission point are presented in Table 11.1.

**Table 11.1 Emission Point Details**

| **Emission Point** | **Dry Fermentation A2-1** | **Biomass Furnace A2-2** | **Gas Flare A2-3** | **Gas Engine 1 A2-4** | **Gas Engine 2 A2-5** | **RDF Carbon Filter A2-6** |
|---|---|---|---|---|---|---|
| Stack Height above Ground Level(m) | 16 | 16 | 8 | 17 | 17 | 14 |
| Temperature (K) | 293 | 523 | 1273 | 473 | 473 | 293 |
| Efflux Velocity (m/s) | 18.76 | 20.23 | 12 | 19 | 19 | <15 |
| Max Flow ($Nm^3$/hr) | 96,764 | 21,670 | 3,000 | 5,500 | 3,800 | 35,523 |

## 1.5 Mitigation Measures

The CHP plant and the Biomass Furnace will be designed and operated to achieve the proposed Emission Limit Values (ELVs) presented in Tables 11.2, 11.3 and 11.4. The ELVs are based on BAT and designed to ensure, that the emissions will not result in any environmental impairment outside the facility boundary.

**Table 11.2 Emissions from Biomass Furnace Stack (A2-2)**

| Pollutant | ELV (mg/Nm$^3$11% $O_2$) | Flow (Nm$^3$/hr ref 11% $O_2$) | Mass Emission Rate (g/s) |
|---|---|---|---|
| Carbon Monoxide | 800 | 21,670 | 4.82 |
| Oxides Of Nitrogen | 400 | 21,670 | 1.20 |
| Sulphur dioxide | 150 | 21,670 | 1.20 |
| Total Particulates | 200 | 21,670 | 1.204 |
| Hydrogen Chloride | 10 | 21,670 | 0.060 |
| Hydrogen fluoride | 3 | 21,670 | 0.018 |

**Table 11.3 Emissions from Biogas Flare Stack (A2-3)**

| Pollutant | ELV (mg/Nm$^3$11% $O_2$) | Flow (Nm$^3$/hr ref 11% $O_2$) |
|---|---|---|
| Carbon Monoxide | 50 | 3000 |
| Oxides of Nitrogen | 150 | 3000 |
| Sulphur Dioxide | 250 | 3000 |
| Hydrogen Chloride | 10 | 3000 |
| Hydrogen Flouride | 3 | 3000 |



**Table 11.4 Emissions from Gas Utilisation Engine 1 (A2-4)**

| Pollutant | ELV (mg/Nm$^3$11% $O_2$) | Flow (Nm$^3$/hr ref 11% $O_2$) | Mass Emission Rate (g/s) |
|---|---|---|---|
| Carbon Monoxide | 1,400 | 5,500 | 2.14 |
| Oxides Of Nitrogen | 500 | 5,500 | 0.76 |
| Sulphur dioxide | 250 | 5,500 | 0.38 |
| Total Particulates | 130 | 5,500 | 0.199 |
| Hydrogen Chloride | 10 | 5,500 | 0.015 |
| Hydrogen fluoride | 3 | 5,500 | 0.005 |

**Table 11.4 Emissions from Gas Utilisation Engine 2 (A2-5)**

| Pollutant | ELV (mg/Nm$^3$11% $O_2$) | Flow (Nm$^3$/hr ref 11% $O_2$) | Mass Emission Rate (g/s) |
|---|---|---|---|
| Carbon Monoxide | 1,400 | 3,800 | 1.48 |
| Oxides Of Nitrogen | 500 | 3,800 | 0.53 |
| Sulphur dioxide | 250 | 3,800 | 0.26 |
| Total Particulates | 130 | 3,800 | 0.137 |
| Hydrogen Chloride | 10 | 3,800 | 0.011 |
| Hydrogen fluoride | 3 | 3,800 | 0.0030 |

At present, when the Wright Tunnels are in use, odorous air is extracted and treated in the biolfilter. New odour abatement systems will be provided to treat odorous air within the Building 3 (RDF manufacture) and Building 4 (AD and Composting). A detailed description of the proposed mitigation measures is provided in Section 3.2 of the OMI Odour Impact Assessment Report, including the design and reserve treatment capacities, and an overview is presented below. It should be noted that the RTO referenced in the OMI Report is the Biomass Furnace.

### *1.5.1 Building 4*

In Building 4, the odour abatement system will comprise a staged air extraction, scrubbing and treatment in a roof mounted bio-filter. The building roof plan is shown on Drawing No. 2009-101-203. The system will have a design capacity of 104,000m$^3$/hour. The actual extraction volume from the building will be 96,764m$^3$/hour, giving a reserve treatment capacity of 7,263m$^3$/hour.

The first stage will involve high efficiency acid scrubbing to remove alkaline based odours, particulates, and bioaerosols, which are similar to fine particulates in the particle size range of 1um to 2.5um. This stage will also incorporate a high efficiency vane eliminator capable of removing all mist greater than 1 um to an efficiency of 99.5%.

The second stage will be a biotrickling filter that will remove odours gases and this will be followed by third stage polishing utilising carbon filtration that will also assist in removing particles and odorous gases. The fourth stage involves the injection of plasma after the biotrickling filter and before the air enters a carbon filter.



### *1.5.2 Building 3 RDF/SRF*

In Building 3, the mechanical waste processing area will be segregated from the rest of the building and provided with a negative air pressure system. Odorous air will be extracted from both the mechanical treatment area and the drier and directed to the odour abatement system. The system will have a design capacity of 40,824m$^3$/hour. The actual extraction volume from the building will be 35,253m$^3$/hour, giving a reserve treatment capacity of 5,300m$^3$/hour.

The abatement system will comprise particulate removal (dust cyclone), followed by venturi and alkaline scrubbers that will treat the air before it is fed into the furnace. The temperature in the furnace will be maintained at between 800 and 850$^0$ Centigrade (C). A back up carbon filter will be provided and used to treat the odorous air in the building when the furnace is shut down for routine maintenance.

### *1.5.3 General Mitigation Measures*

In addition to the new odour abatement systems provided in Buildings 3 and 4, the following mitigation measures will be applied;

- The new building will be provided with a high integrity building fabric;
- The buildings will be fitted with rapid closing doors;

- Separate air extraction systems for the waste reception area, composting tunnels and finished compost areas;

- Routine cleaning of the building interiors;

- The new buildings and odour treatment system will be assessed by an independent experienced contractor to confirm the building integrity (leakage rate, smoke integrity test and absolute pressure test) and odour treatment performance;

- An odour management plan (OMP) will be prepared for the entire facility. The plan will specify the routine inspections and maintenance that must be carried out to ensure the odour control system continues to operate efficiently.

## 1.6 Assessment of Impacts

OMI carried out air dispersion modelling to assess the impacts of the emissions in the context of the relevant air quality standards and guidance, which included:

- Air Quality Standards Regulations (S.I. No 271 of 2002);
- Directive 2008/50 EC on ambient air quality and cleaner air for Europe
- Horizontal Guidance Note, IPPC H4 Parts I and 2 UK Environment Agency
- Air Dispersion Modelling from Industrial Installations Guidance Note AG4 2010 (EPA).



The assumptions, including the performance specification of the new odour abatement system and mitigation measures that will be incorporated into the design and construction of the new building, used in the modelling and the methodologies applied are detailed in the OMI Report. As the gas flare will only run when one of the gas engines is shut down for servicing, and the emissions are less than that from the engine, it was not included in the modelling.

The modelling confirms that all the emissions from the site, including those from the existing and proposed emission points, will comply with the applicable air quality standards (oxides of nitrogen, oxides of sulphur, carbon monoxide, hydrogen chloride, hydrogen fluoride, benzene and particulates). The odour plume will spread in a north-westerly to south easterly direction, between 100 and 200m from the emission points and will not impact sensitive receptors. Therefore the proposed development will have a neutral impact.

# Attachment 3

**ODOUR & ENVIRONMENTAL ENGINEERING CONSULTANTS**

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# 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.**



| | |
|---|---|
| **REPORT PREPARED BY:** | Dr. Brian Sheridan |
| **REPORT VERSION:** | Document Ver.2 |
| **ATTENTION:** | Mr Jim O Callaghan |
| **DATE:** | 20th March 2015 |
| **REPORT NUMBER:** | 2012503(2) |
| **REVIEWERS:** | |

# TABLE OF CONTENTS

# 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.



| **Project Number:** 2012503(2) | | | **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. | | |
|---|---|---|---|---|---|
| 2012503(1) | Document for review | B.A.S. | JMC | B.A.S | 12/12/2012 |
| 2012503(2) | Additions and amendments | B.A.S. | JMC | B.A.S | 20/03/2015 |
| | | | | | |
| | | | | | |
| **Revision** | **Purpose/Description** | **Originated** | **Checked** | **Authorised** | **Date** |

ODOUR monitoring IRELAND

## 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, Beauparc 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, Hydrogen fluoride, Hydrogen sulphide, Total non-methane VOC's 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, Hydrogen fluoride, Hydrogen sulphide, Total non-methane VOC's (as Benzene). 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 $\mu g\ m^{-3}$ for the maximum 8-hour mean concentration at the 100$^{th}$ 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 $NO_2$ from the operation of the facility is 119 $\mu g\ m^{-3}$ for the maximum 1-hour mean concentration at the 99.79$^{th}$ 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$\mu g/m^3$. When compared the annual average $NO_2$ 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 $SO_2$ from the operation of the facility is 120 and 50 µg $m^{-3}$ 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/$m^3$. When compared the annual average $SO_2$ 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/$m^3$. When compared, the annual average Particulate matter air quality impact is 52.50 % of the impact criterion. An annual average was also generated for $PM_{2.5}$ to allow comparison with Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was 16µg/$m^3$. 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 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*.

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 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*.

9. With regards to Hydrogen sulphide emissions at maximum operations equate to ambient Hydrogen sulphide concentrations (including background concentrations) which are 8.85% of the maximum impact criterion for both the 1 hr average period. In addition, the predicted ground level concentration of Hydrogen sulphide 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*.

10. With regards to Total non-methane VOC's (as Benzene) emissions at maximum operations equate to ambient Total non-methane VOC's (as Benzene) concentrations (including background concentrations) which are 27.40% of the maximum impact criterion for both the annual average period. In addition, the predicted ground level concentration of Total non-methane VOC's (as Benzene) 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*.

11. 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.

12. 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 Beauparc 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.



## 1.3 Model assumptions

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 a 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 (z0), 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).

# 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 at 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 H1, 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:

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

### 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 | | | |
|---|---|---|---|---|
| | Concentration[2] | Maximum No. Of exceedences allowed[3] | Exceedence expressed as percentile[3] | Measured as |
| Nitrogen dioxide and oxides of nitrogen | 300 µg $m^{-3}$ $NO_2$<br>200 µg $m^{-3}$ $NO_2$<br>40 µg $m^{-3}$ $NO_2$ | 18 times in a year<br>18 times in a year<br>-- | 99.79$^{th}$ percentile<br>99.79$^{th}$ percentile<br>-- | 1 hour mean<br>1 hour mean<br>Annual mean |
| Particulates ($PM_{10}$) (2008/50/EC) | 50 µg $m^{-3}$<br>40 µg $m^{-3}$<br>20 µg $m^{-3}$ | 35 times in a year<br>None<br>None | 90.40$^{th}$ percentile<br><br>-- | 24 hour mean<br>Annual mean<br>Annual mean |
| Particulates ($PM_{2.5}$) (2008/50/EC) | 25 µg $m^{-3}$ – Stage 1<br>20 µg $m^{-3}$ – Stage 2 | None<br>None | --<br>-- | Annual mean<br>Annual mean |
| Carbon monoxide (CO) | 10 mg $m^{-3}$ | None | 100$^{th}$ percentile | Running 8 hour mean |
| Sulphur dioxide ($SO_2$) | 350 µg $m^{-3}$<br>125 µg $m^{-3}$<br>20 µg $m^{-3}$ | 24 times in a year<br>3 times in a year<br>-- | 99.73th percentile<br>99.18$^{th}$ percentile<br>-- | 1 hour mean<br>24 hour mean<br>Annual mean and winter mean (1$^{st}$ Oct to 31$^{st}$ March |
| Total non-methane VOC's (as benzene | 5 µg $m^{-3}$ | None | - | Annual mean |

*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 | ≤100 µg $m^{-3}$ | 175 times in a year | 98th percentile | 1 hour mean | TaLuft 2002- Hourly limit for protection of human health |
| HCL | ≤750 µg $m^{-3}$ | 0 | 100th percentile | 1 hour mean | H1 Part 2 – Environmental Risk Assessment. |
| HCL | ≤20 µg $m^{-3}$ | - | - | Annual average | H1 Part 2 – Environmental Risk Assessment.. |
| HF | ≤3.0 µg $m^{-3}$ | 175 times in a year | 98th percentile | 1 hour mean | TaLuft 2002- Hourly limit for protection of human health |
| HF | ≤0.30 µg $m^{-3}$ | | - | Annual average | TaLuft 2002- Gaseous fluoride (as HF) as an annual average for protection of vegetation |
| HF | ≤160 µg $m^{-3}$ | 0 | 100th percentile | 1 hour mean | H1 Part 2 – Environmental Risk Assessment. |
| Fluoride | ≤1.0 µg $m^{-3}$ | - | - | Annual average | H1 Part 2 – Environmental Risk Assessment. |
| Hydrogen sulphide | 14 µg $m^{-3}$ (at receptor for Odour) | None | 100th percentile | 1 hr | H1 Part 2 – Environmental Risk Assessment. |
| Hydrogen sulphide | 140 µg $m^{-3}$ (Protection of human health) | 0 | 100th percentile | 1 hr | 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 $PM_{10}$, $SO_2$, $NO_2$, CO and Benzene 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 $PM_{2.5}/PM_{10}$ ratio of 0.53 while monitoring in Heatherton Park in 2008 (EPA, 2008) indicated an average $PM_{2.5}/PM_{10}$ 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 $\mu g/m^3$ (*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.

**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 $m^{-3}$) | Benzene (µg $m^{-3}$) | Details |
|---|---|---|---|---|---|---|
| Shannon town, Clare – Annual average | 1 | 6 | 11 | 0.20 | 0.40 | 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.

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

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

## 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.

# 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**: [1]denotes referencing conditions for emission point A2-2 is 273.15K, 101.3Kpa, dry gas, 11% $O_2$.
[2]denotes referencing conditions for emission point A2-4 to A2-5 are 273.15K, 101.3Kpa, dry gas, 5% $O_2$.
[3]denotes referencing conditions for emission point A2-3 are 273.15K, 101.3Kpa, dry gas, 3% $O_2$.

## 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 (NOx 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 (NOx 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 |
| Hydrogen sulphide | 5 | mg/$Nm^3$ 5% $O_2$ | 5,500 | 0.0076 |
| Total non-methane VOC's | 75 | mg/$Nm^3$ 5% $O_2$ | 5,500 | 0.116 |

**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 |
| Hydrogen sulphide | 5 | mg/Nm3 5% O2 | 3,800 | 0.0053 |
| Total non-methane VOC's | 75 | mg/Nm3 5% O2 | 3,800 | 0.079 |

## 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.

Seventeen 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 100$^{th}$ percentile of 8 hour averages for Dublin meteorological station year 2004 for an Carbon monoxide concentration of less than or equal to 500 μg/m$^3$ (*see Figure 6.2*).

**Ref Scenario 2:** Predicted cumulative ground level concentration of Oxides of nitrogen emission contribution of cumulative emissions for the 99.79$^{th}$ 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/m$^3$ (*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 µg/m$^3$ (*see Figure 6.4*).

**Ref Scenario 4:** Predicted cumulative ground level concentration of Sulphur dioxide emission contribution of cumulative emissions for the 99.73$^{th}$ percentile of 1 hour averages for Dublin meteorological station year 2004 for an Sulphur dioxide concentration of less than or equal to 110 µg/m$^3$ (*see Figure 6.5*).

**Ref Scenario 5:** Predicted cumulative ground level concentration of Sulphur dioxide emission contribution of cumulative emissions for the 99.18$^{th}$ percentile of 24 hour averages for Dublin meteorological station year 2004 for an Sulphur dioxide concentration of less than or equal to 50 µg/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 µg/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 90.40$^{th}$ 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 µg/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 µg/m$^3$ (*see Figure 6.9*).

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**Ref Scenario 9:** Predicted cumulative ground level concentration of Total particulates as $PM_{2.5}$ emission contribution of cumulative emissions for the Annual average for Dublin meteorological station year 2004 for an Total particulates as $PM_{2.5}$ concentration of less than or equal to 6.0 µg/m$^3$ (*see Figure 6.10*).

**Ref Scenario 10:** Predicted cumulative ground level concentration of Hydrogen chloride emission contribution of cumulative emissions for the 100$^{th}$ percentile of 1 hour averages for Dublin meteorological station year 2004 for an Hydrogen chloride concentration of less than or equal to 8 µg/m$^3$ (*see Figure 6.11*).

**Ref Scenario 11:** Predicted cumulative ground level concentration of Hydrogen chloride emission contribution of cumulative emissions for the 98$^{th}$ percentile of 1 hour averages for Dublin meteorological station year 2004 for an Hydrogen chloride concentration of less than or equal to 5 µg/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 µg/m$^3$ (*see Figure 6.13*).

**Ref Scenario 13:** Predicted cumulative ground level concentration of Hydrogen fluoride emission contribution of cumulative emissions for the 100$^{th}$ percentile of 1 hour averages for Dublin meteorological station year 2004 for an Hydrogen fluoride concentration of less than or equal to 2.50 µg/m$^3$ (*see Figure 6.14*).

**Ref Scenario 14:** Predicted cumulative ground level concentration of Hydrogen fluoride emission contribution of cumulative emissions for the 98$^{th}$ percentile of 1 hour averages for Dublin meteorological station year 2004 for an Hydrogen fluoride concentration of less than or equal to 1.50 µg/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 µg/m$^3$ (*see Figure 6.16*).

**Ref Scenario 16:** Predicted cumulative ground level concentration of Hydrogen sulphide emission contribution of cumulative emissions for the 100$^{th}$ percentile of 1 hour averages for Dublin meteorological station year 2004 for an Hydrogen sulphide concentration of less than or equal to 1.24 µg/m$^3$ (*see Figure 6.17*).

**Ref Scenario 17:** Predicted cumulative ground level concentration of Total non-methane VOC's (as Benzene) emission contribution of cumulative emissions for the annual average for Dublin meteorological station year 2004 for an Total non-methane VOC (as Benzene) concentration of less than or equal to 0.97 µg/m$^3$ (*see Figure 6.18*).

# 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 NOx from combustion sources, the source term should be expressed as $NO_2$, e.g., Nox mass (expressed as $NO_2$). Some of the exhaust air is made up of NO while some is made up of $NO_2$. NO will be converted in the atmosphere to $NO_2$ 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 $NO_2$ 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 (µg/m$^3$) | 510 |
| Oxides of nitrogen – 1 hr max 99.79$^{th}$ percentile (µg/m$^3$) | 101 |
| Oxides of nitrogen – Max Annual average (µg/m$^3$) | 13.3 |
| Sulphur dioxide – 1 hr Max 99.73th percentile (µg/m$^3$) | 120 |
| Sulphur dioxide – 24 hr Max 99.18$^{th}$ percentile (µg/m$^3$) | 50 |
| Sulphur dioxide – Max annual average (µg/m$^3$) | 9 |
| Total particulates – 24 hr Max 90.40$^{th}$ percentile (µg/m$^3$) | 17 |
| Total Particulates as $PM_{10}$ - Max annual average (µg/m$^3$) | 7 |
| Total Particulates as $PM_{2.5}$ - Max annual average (µg/m$^3$) | 7 |
| Hydrogen chloride – 1 hr Max 100$^{th}$ percentile (µg/m$^3$) | 9 |
| Hydrogen chloride – 1 hr Max 98$^{th}$ percentile (µg/m$^3$) | 5 |
| Hydrogen chloride – Max annual average (µg/m$^3$) | 0.4 |
| Hydrogen fluoride – 1 hr Max 100$^{th}$ percentile (µg/m$^3$) | 2.5 |
| Hydrogen fluoride – 1 hr Max 98$^{th}$ percentile (µg/m$^3$) | 1.5 |
| Hydrogen fluoride – Max annual average (µg/m$^3$) | 0.13 |
| Hydrogen sulphide – Max 1 hr 100$^{th}$ percentile (µg/m$^3$) | 1.24 |
| Total non-methane VOC's as Benzene Max Annual average (µg/m$^3$) | 0.97 |

*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 - ($\mu g\ m^{-3}$) | Baseline concentration value ($\mu g\ m^{-3}$)[1] | Baseline + Maximum predicted GLC ($\mu g\ m^{-3}$) | Impact criterion ($\mu g\ m^{-3}$)[2] | % of Criterion |
|---|---|---|---|---|---|
| Carbon monoxide - 8 hr maximum GLC ($\mu g/m^3$) | 510 | 300 | 810 | 10,000 | 8.10 |
| Oxides of nitrogen - 1 hr max 99.79th percentile ($\mu g/m^3$) | 101 | 18 (Twice annual mean as per EA) | 119 | 200 | 59.50 |
| Oxides of nitrogen - Max Annual average ($\mu g/m^3$) | 13.3 | 9 | 22.3 | 40 | 55.75 |
| Sulphur dioxide - 1 hr Max 99.73th percentile ($\mu g/m^3$) | 120 | 6 (Twice annual mean as per EA) | 126 | 350 | 36.00 |
| Sulphur dioxide - 24 hr Max 99.18th percentile ($\mu g/m^3$) | 50 | 3.0 | 53 | 125 | 42.40 |
| Sulphur dioxide – Max annual average ($\mu g/m^3$) | 9 | 3.0 | 12 | 20 | 60.00 |
| Total particulates - 24 hr Max 90.40th percentile ($\mu g/m^3$) | 17 | 14 | 31 | 50 | 62.00 |
| Total Particulates as $PM_{10}$ - Max annual average ($\mu g/m^3$) | 7 | 14 | 21 | 40 | 52.50 |
| Total Particulates as $PM_{2.5}$ - Max annual average ($\mu g/m^3$) | 7 | 9.0 | 16 | 25 | 64.00 |
| Hydrogen chloride - 1 hr Max 100th percentile ($\mu g/m^3$) | 9 | 2.70 | 11.7 | 750 | 1.56 |
| Hydrogen chloride - 1 hr Max 98th percentile ($\mu g/m^3$) | 5 | 2.70 | 7.7 | 100 | 7.70 |
| Hydrogen chloride - Max annual average ($\mu g/m^3$) | 0.4 | 2.70 | 3.1 | 20 | 15.50 |
| Hydrogen fluoride - 1 hr Max 100th percentile ($\mu g/m^3$) | 2.5 | 0.050 | 2.55 | 160 | 1.59 |
| Hydrogen fluoride - 1 hr Max 98th percentile ($\mu g/m^3$) | 1.5 | 0.050 | 1.55 | 3.0 | 51.67 |
| Hydrogen fluoride - Max annual average ($\mu g/m^3$) | 0.13 | 0.050 | 0.18 | 0.30 | 60.00 |
| Hydrogen sulphide - 1 hr Max 100th percentile ($\mu g/m^3$) | 1.24 | - | 1.24 | 14 (140) | 8.85 |
| Total non-methane VOC's (as benzene) - Max annual average ($\mu g/m^3$) | 0.97 | 0.4 | 1.37 | 5 | 27.40 |

**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 µg $m^{-3}$ for the maximum 8-hour mean concentration at the $100^{th}$ 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 $NO_2$ 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 $NO_2$ from the operation of the facility is 119 µg $m^{-3}$ for the maximum 1-hour mean concentration at the $99.79^{th}$ 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 22.30µg/$m^3$. When compared the annual average $NO_2$ 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 $SO_2$ 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 $SO_2$ from the operation of the facility is 120 and 50 µg $m^{-3}$ for the maximum 1-hour and 24 hr mean concentration at the $99.73^{th}$ and $99.18^{th}$ 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 12µg/$m^3$. When compared the annual average $SO_2$ 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 10µm from the operation of the facility is 31µg $m^{-3}$ for the maximum 24-hour mean concentration at the $90.40^{th}$ 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/$m^3$. When compared, the annual average Particulate matter air quality impact is 52.50% of the impact criterion.

An annual average was also generated for $PM_{2.5}$ to allow comparison with Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was 16µg/$m^3$. 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*.



#### 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*.

### 4.1.7 Hydrogen sulphide – Ref Scenario 16

The results for the potential air quality impact for dispersion modelling of Hydrogen sulphide based on the emission rates in *Tables 3.4 to 3.5* are presented in *Tables 4.1 and 4.2*. Hydrogen sulphide modelling results indicate that the ambient ground level concentrations are below the relevant air quality guideline for the protection of human health and potential odour nuisance 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 Hydrogen sulphide concentration which are less than 8.85% of the maximum impact criterion for both the 1 hr average period.

In addition, the predicted ground level concentration of Hydrogen sulphide 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*.

### 4.1.8 Total non-methane VOC's (as Benzene) – Ref Scenario 17

The results for the potential air quality impact for dispersion modelling of Total non-methane VOC's (as Benzene) based on the emission rates in *Tables 3.4 to 3.5* are presented in *Tables 4.1 and 4.2*. Total non-methane VOC's (as Benzene) modelling results indicate that the ambient ground level concentrations are below the relevant air quality guideline for the protection of human health for Total non-methane VOC's (as Benzene) 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 Total non-methane VOC's (as Benzene) concentrations (including background concentrations) which are 27.40% of the maximum impact criterion for the annual average period.



In addition, the predicted ground level concentration of Total non-methane VOC's (as Benzene) 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 - (μg/m$^3$) | Scen 2 - (μg/m$^3$) | Scen 3 - (μg/m$^3$) | Scen 4 - (μg/m$^3$) | Scen 5 - (μg/m$^3$) | Scen 6 - (μg/m$^3$) | Scen 7 - (μg/m$^3$) | Scen 8 -(μg/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 17 (*see Section 4 and Figure 6.1*).

| Receptor identity | X coord (m) | Y coord (m) | Scen 9 - (μg/m$^3$) | Scen 10 - (μg/m$^3$) | Scen 11 - (μg/m$^3$) | Scen 12 - (μg/m$^3$) | Scen 13 - (μg/m$^3$) | Scen 14 - (μg/m$^3$) | Scen 15 - (μg/m$^3$) | Scen 16 - (μg/m$^3$) | Scen 17 - (μg/m$^3$) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| R1 | 297498.3 | 269436.6 | 0.73 | 4.09 | 0.61 | 0.04 | 1.24 | 0.18 | 0.01 | 0.62 | 0.08 |
| R2 | 297573.5 | 269493.2 | 0.79 | 3.82 | 0.76 | 0.05 | 1.16 | 0.23 | 0.01 | 0.58 | 0.08 |
| R3 | 297654.7 | 269498.3 | 1.11 | 3.58 | 0.98 | 0.07 | 1.08 | 0.30 | 0.02 | 0.54 | 0.15 |
| R4 | 297395.3 | 269510.8 | 0.61 | 1.54 | 0.54 | 0.04 | 0.47 | 0.16 | 0.01 | 0.23 | 0.08 |
| R5 | 297355.4 | 269515 | 0.65 | 1.28 | 0.54 | 0.04 | 0.39 | 0.16 | 0.01 | 0.19 | 0.08 |
| R7 | 297281.2 | 269519.7 | 0.75 | 2.02 | 0.60 | 0.05 | 0.61 | 0.18 | 0.01 | 0.30 | 0.08 |
| R8 | 297299.3 | 269380.5 | 1.48 | 3.88 | 1.17 | 0.09 | 1.18 | 0.35 | 0.03 | 0.59 | 0.23 |
| R9 | 297744.7 | 269499.2 | 1.33 | 3.35 | 0.97 | 0.08 | 1.02 | 0.29 | 0.02 | 0.51 | 0.15 |
| R10 | 297629.6 | 268891.5 | 0.82 | 1.76 | 0.73 | 0.05 | 0.53 | 0.22 | 0.01 | 0.26 | 0.08 |

# 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:

13. 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.

14. Specific dispersion modelling was performed for Carbon monoxide, Oxides of nitrogen, Sulphur dioxide, Particulate matter, Hydrogen chloride, Hydrogen fluoride, Hydrogen sulphide, Total non-methane VOC's (as Benzene). The combined cumulative impact of odour for the facility has been dealt with in another document which has been submitted to the EPA.

15. With regards to Carbon monoxide, the maximum GLC+Baseline for CO from the operation of the facility is 810 µg $m^{-3}$ for the maximum 8-hour mean concentration at the 100$^{th}$ 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.*

16. With regards to Oxides of nitrogen, the maximum GLC+Baseline for $NO_2$ from the operation of the facility is 119 µg $m^{-3}$ for the maximum 1-hour mean concentration at the 99.79$^{th}$ 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 22.30µg/$m^3$. When compared the annual average $NO_2$ 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*.

17. With regards to Sulphur dioxide, the maximum GLC+Baseline for $SO_2$ from the operation of the facility is 120 and 50 µg $m^{-3}$ for the maximum 1-hour and 24 hr mean concentration at the 99.73$^{th}$ and 99.18$^{th}$ 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/$m^3$. When compared the annual average $SO_2$ 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*.

18. 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 90.40$^{th}$ 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/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 $PM_{2.5}$ to allow comparison with Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was 16µg/m$^3$. 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*.

19. 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 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*.

20. 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 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*.



21. With regards to Hydrogen sulphide emissions at maximum operations equate to ambient Hydrogen sulphide concentrations (including background concentrations) which are 8.85% of the maximum impact criterion for both the 1 hr average period. In addition, the predicted ground level concentration of Hydrogen sulphide 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*.

22. With regards to Total non-methane VOC's (as Benzene) emissions at maximum operations equate to ambient Total non-methane VOC's (as Benzene) concentrations (including background concentrations) which are 27.40% of the maximum impact criterion for both the annual average period. In addition, the predicted ground level concentration of Total non-methane VOC's (as Benzene) 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*.

23. 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.

24. 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

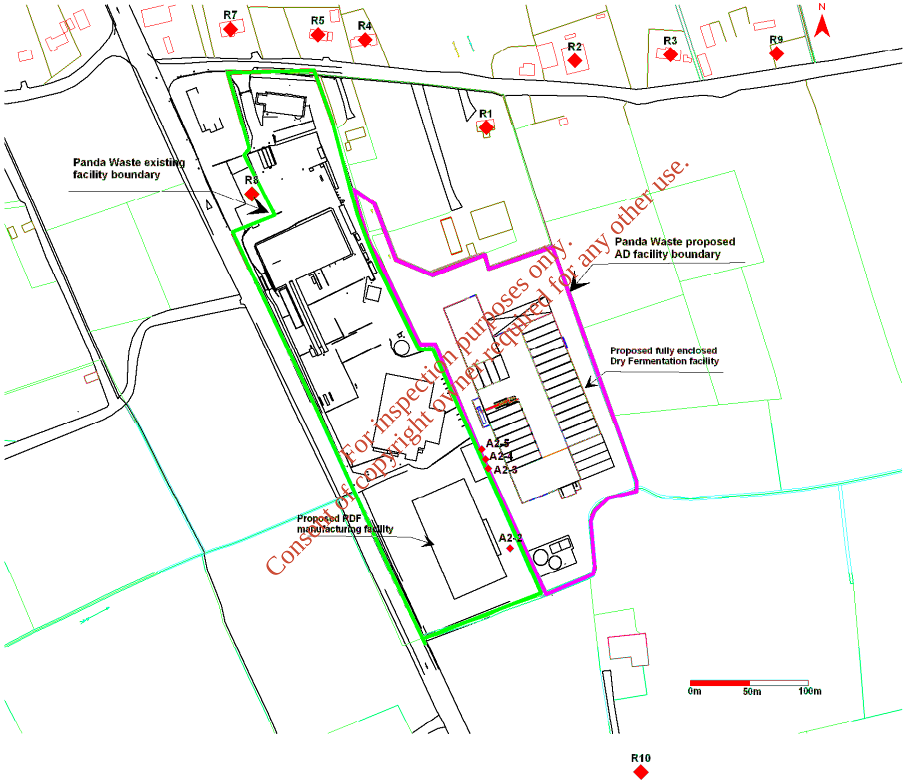





**Figure 6.1.** Plan view facility layout drawings for Panda Waste Ltd facility including specific location of proposed emission points A2-2 to A2-5 and nearest sensitive receptors R1 to R10.

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

### 6.2.1 Scenario 1 - Carbon monoxide

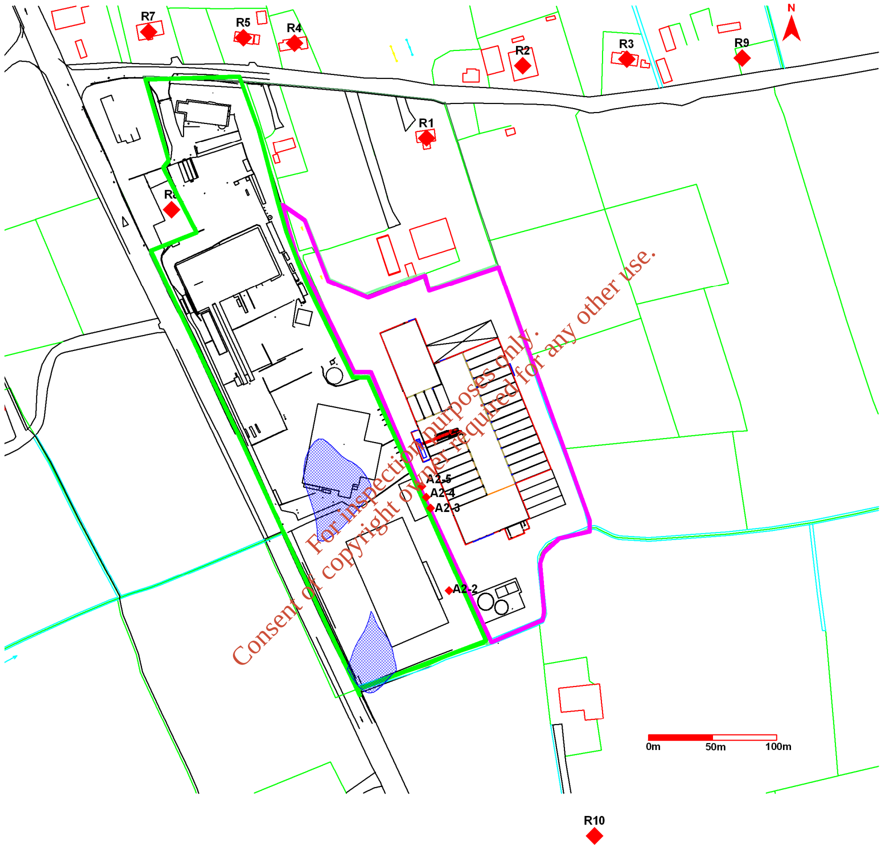





**Figure 6.2.** Predicted 8 hr average CO ground level concentration of 500 µg/m$^3$ (▬) for cumulative emissions from emission points for Scenario 1 for Dublin Airport meteorological station (worst case year 2004).

### 6.2.2 Scenario 2 and 3 - Oxides of nitrogen

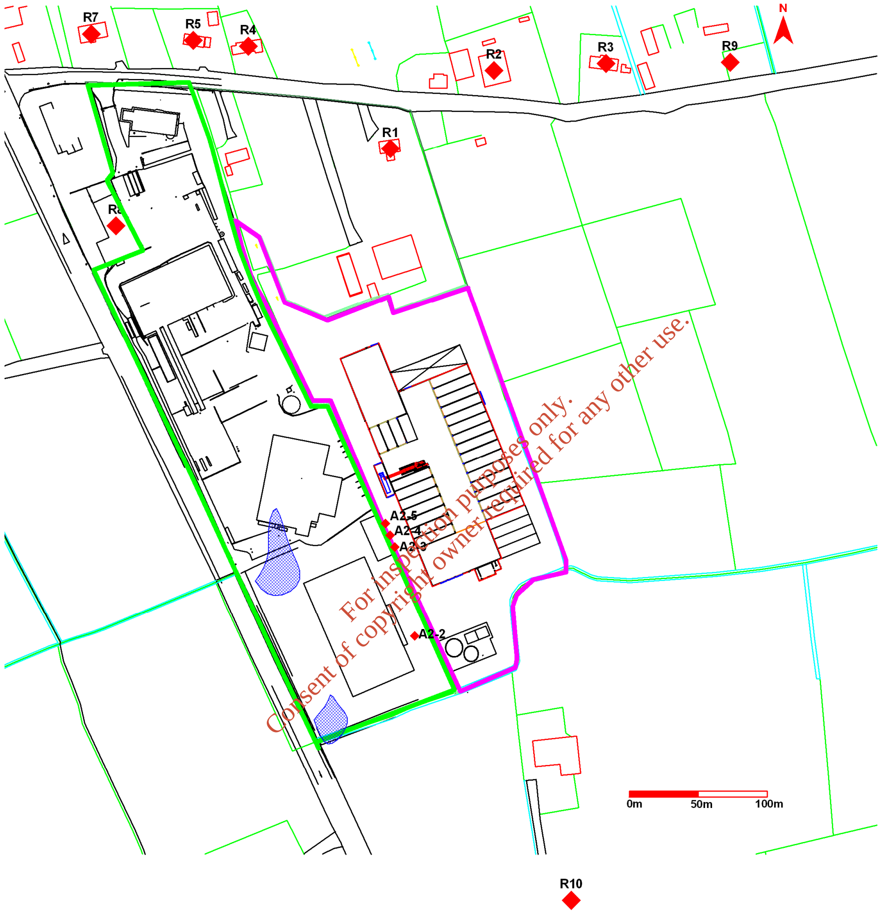





**Figure 6.3.** Predicted 99.79th percentile of 1 hr averages for $NO_2$ ground level concentration of 101 µg/$m^3$ ( ▬ ) for cumulative emission for Scenario 2 for Dublin Airport meteorological station (worst case year 2004).

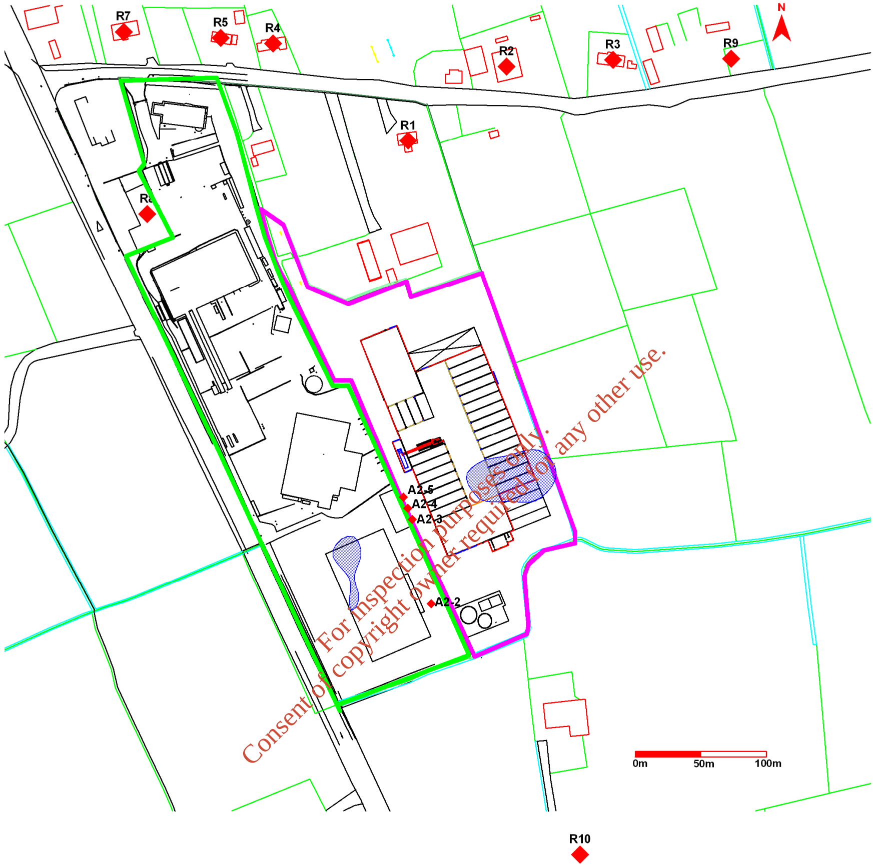





**Figure 6.4** Predicted annual average $NO_2$ ground level concentration of 13.3 $\mu g/m^3$ ( ) for cumulative emissions for Scenario 3 for Dublin Airport meteorological station (worst case year 2004).

### 6.2.3 Scenario 4, 5 and 6 - Sulphur dioxide

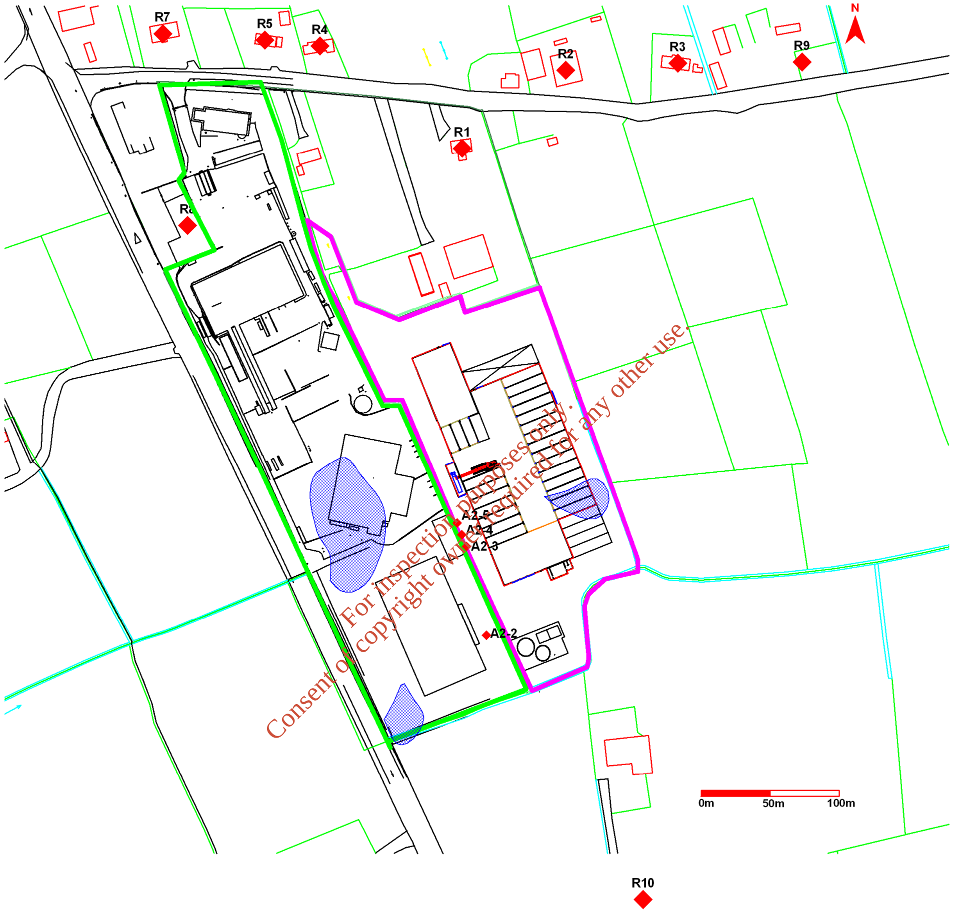





**Figure 6.5.** Predicted 99.73th percentile of 1 hr averages for $SO_2$ ground level concentration of 110 µg/m$^3$ ( ▬▬ ) for cumulative emission for Scenario 4 for Dublin Airport meteorological station (worst case year 2004).

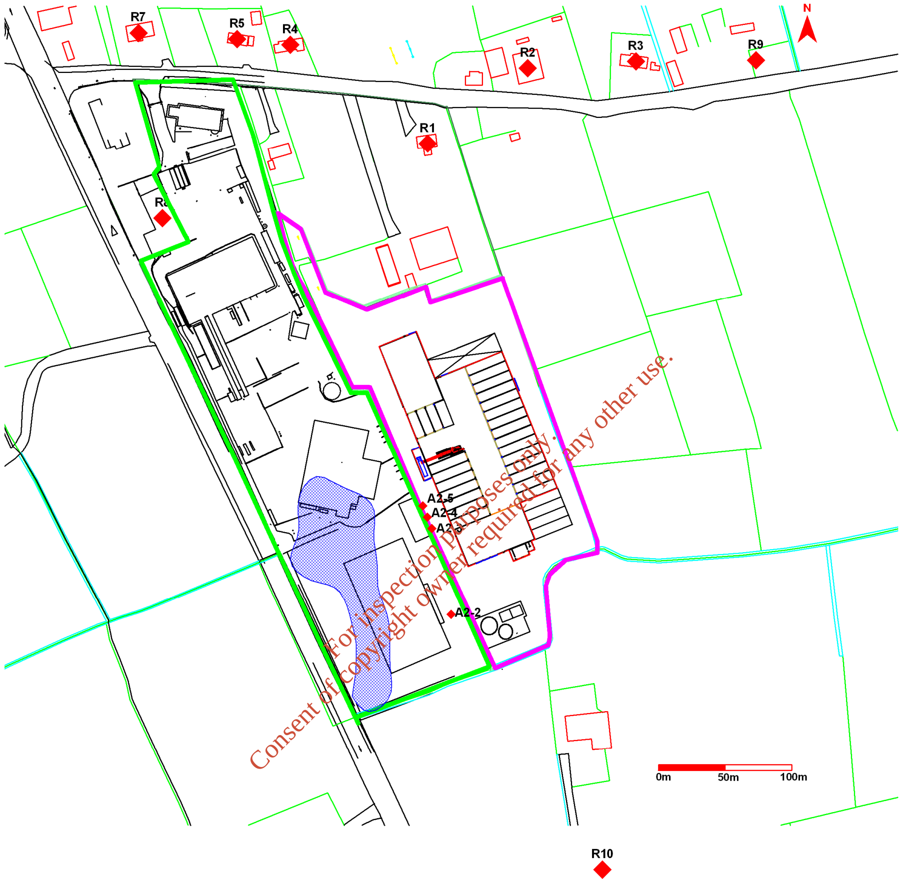




**Figure 6.6.** Predicted 99.18th percentile of 24 hr averages for $SO_2$ ground level concentration of 50 µg/m$^3$ ( ▬▬ ) for cumulative emission for Scenario 5 for Dublin Airport meteorological station (worst case year 2004).

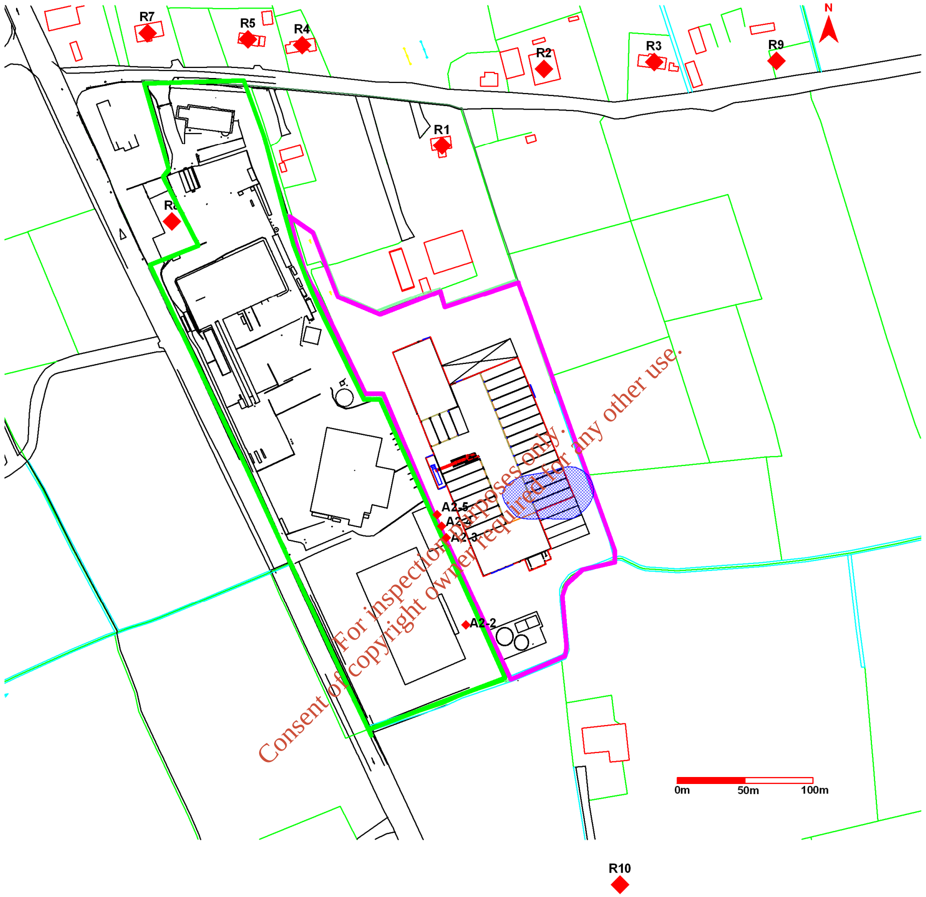





**Figure 6.7.** Predicted annual average $SO_2$ ground level concentration of 9 µg/m$^3$ (▬) for cumulative emissions for Scenario 6 for Dublin Airport meteorological station (worst case year 2004).

### 6.2.4 Scenario 7, 8 and 9 - Total particulates

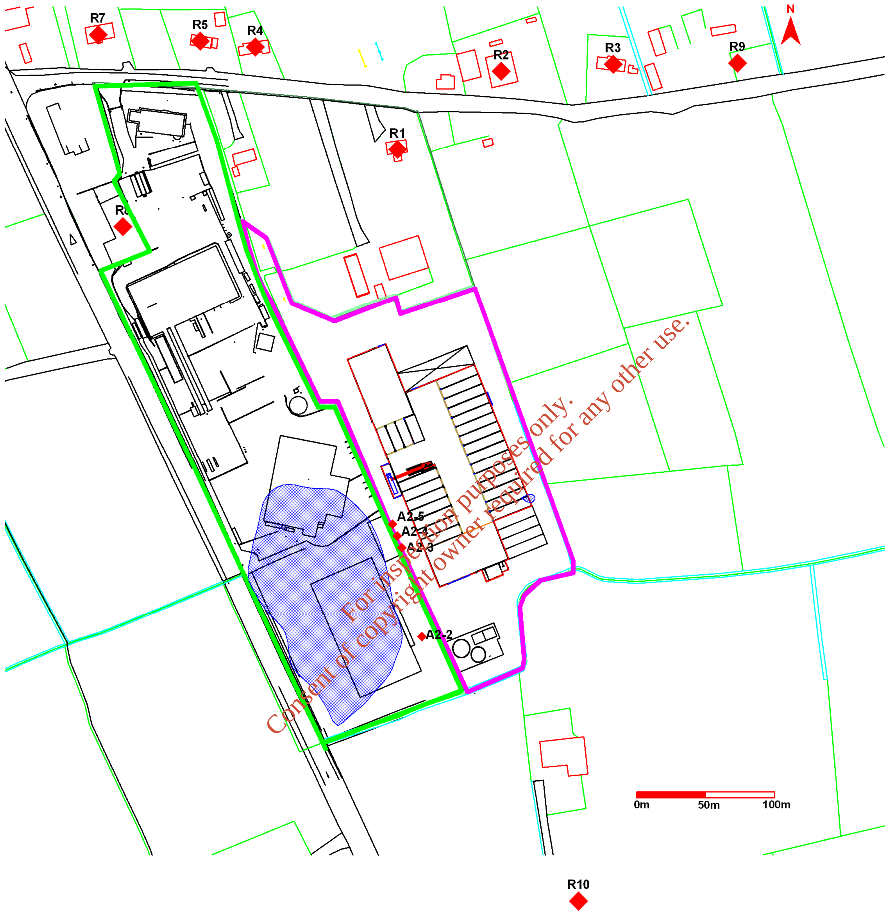





**Figure 6.8.** Predicted 90.40th percentile of 24 hr averages for Total particulates ground level concentration of 17 µg/m$^3$ ( ▬ ) for cumulative emission for Scenario 7 for Dublin Airport meteorological station (worst case year 2004).

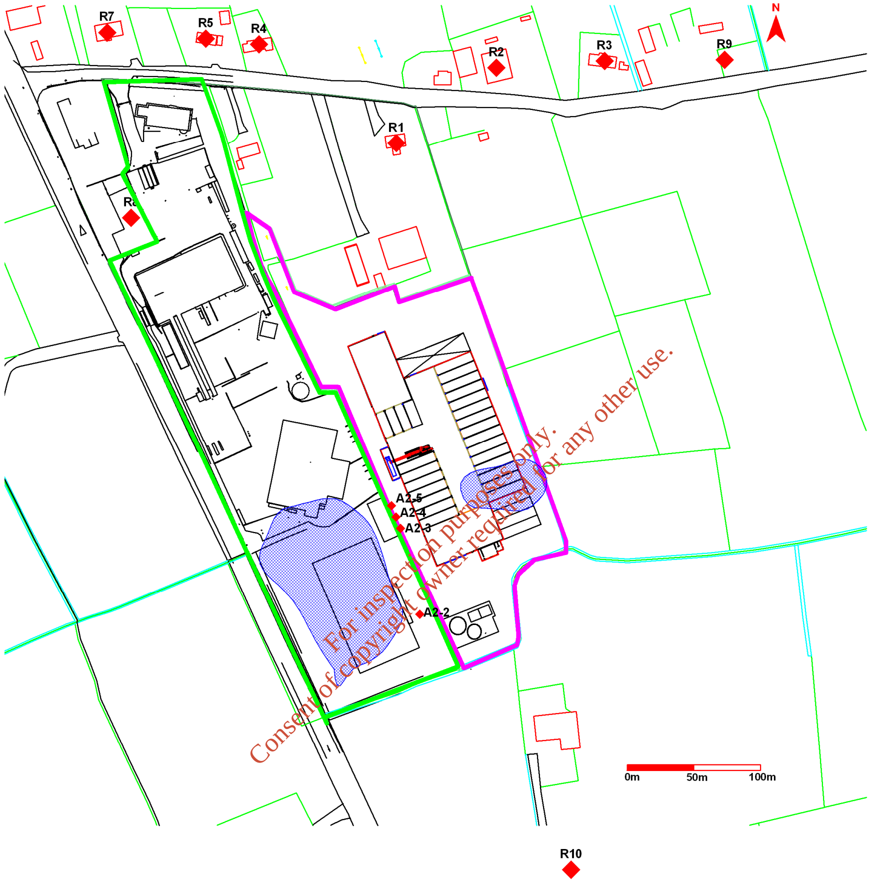





**Figure 6.9.** Predicted annual average Total particulates ground level concentration of 6.0 μg/m$^3$ ( ▬ ) for cumulative emissions for Scenario 8 for Dublin Airport meteorological station (worst case year 2004).

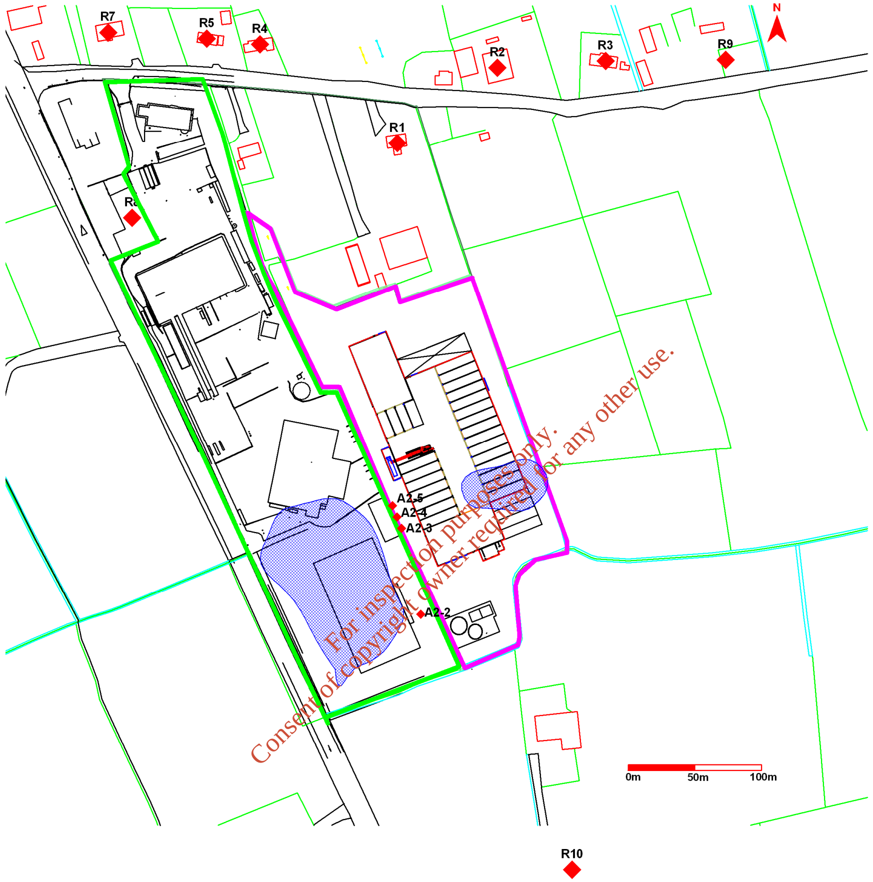





**Figure 6.10.** Predicted annual average Total particulates as $PM_{2.5}$ ground level concentration of 6.0 µg/m$^3$ (▬) for cumulative emissions for Scenario 9 for Dublin Airport meteorological station (worst case year 2004).

### 6.2.5 Scenario 10, 11 and 12 – Hydrogen chloride

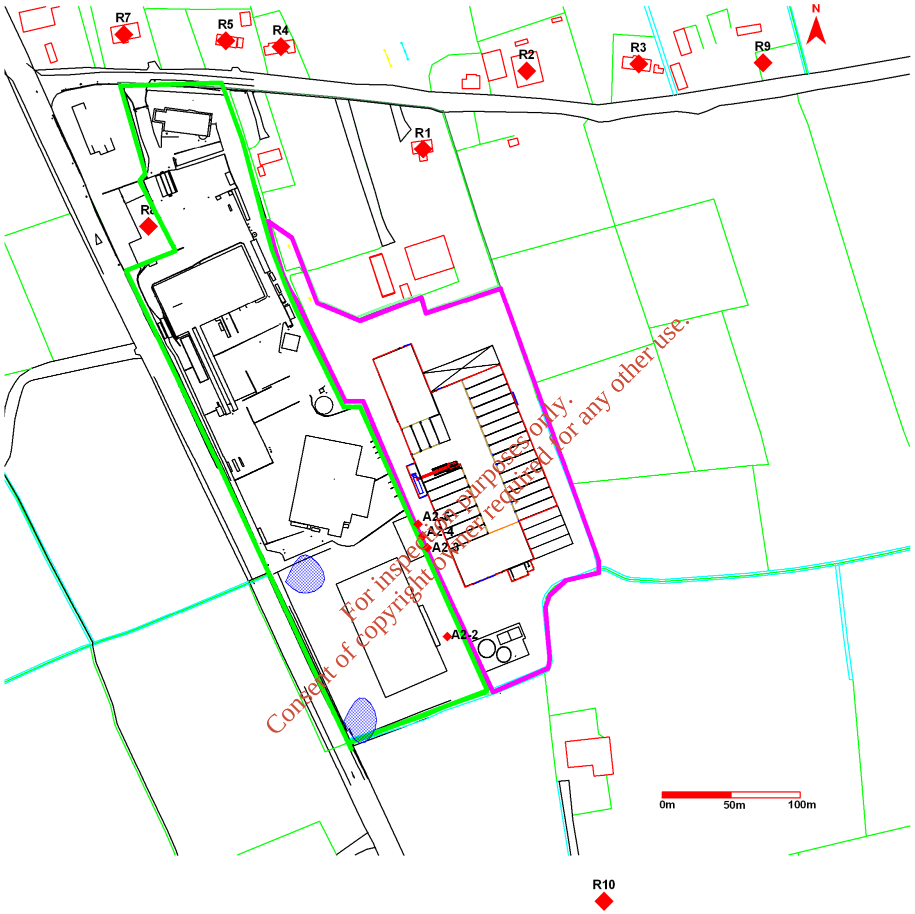



**Figure 6.11.** Predicted 100th percentile of 1 hr averages for Hydrogen chloride ground level concentration of 8 µg/m$^3$ (blue line) for cumulative emission for Scenario 10 for Dublin Airport meteorological station (worst case year 2004).

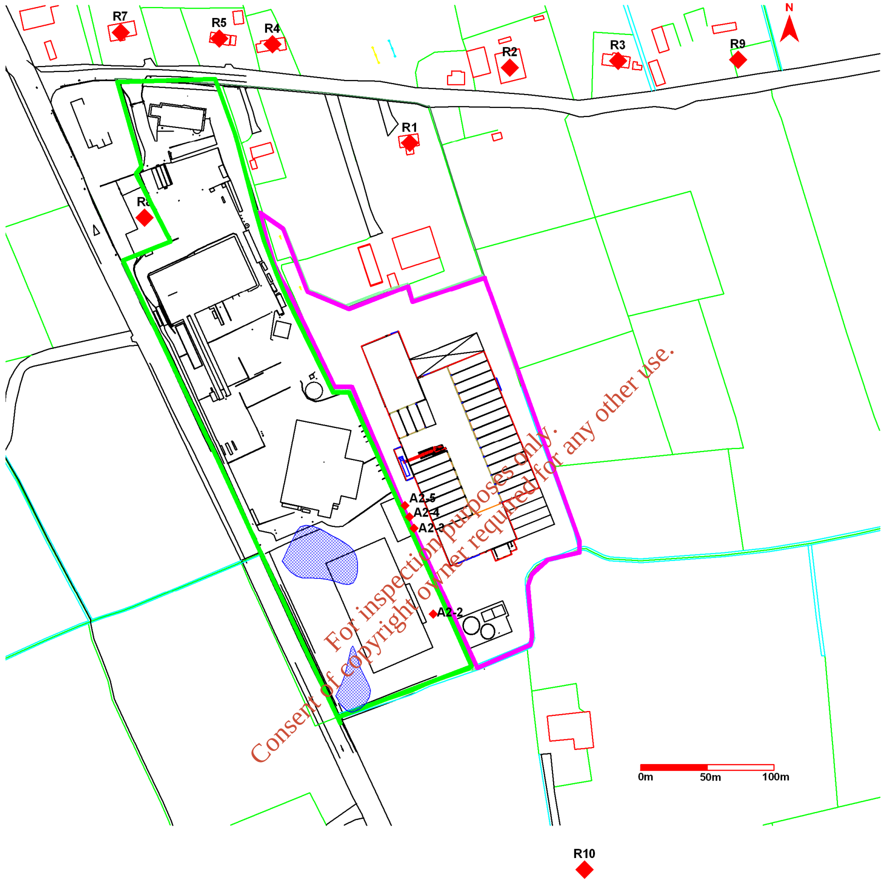





**Figure 6.12.** Predicted 98th percentile of 1 hr averages for Hydrogen chloride ground level concentration of 5 µg/m$^3$ ( ▬ ) for cumulative emission for Scenario 11 for Dublin Airport meteorological station (worst case year 2004).

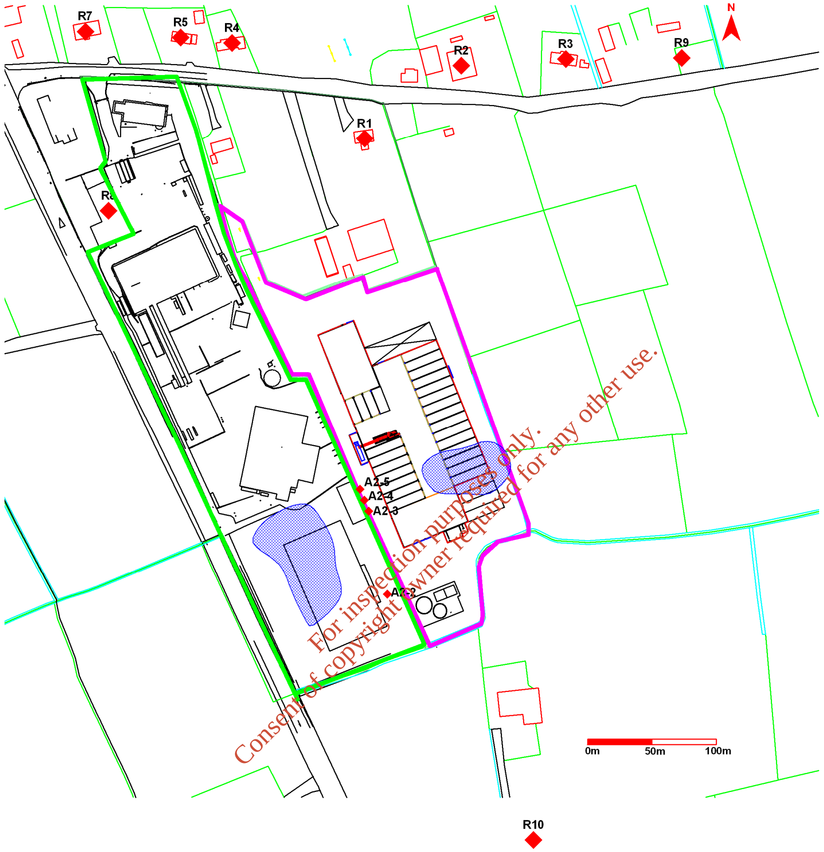





**Figure 6.13.** Predicted annual average Hydrogen chloride ground level concentration of 0.40 µg/m$^3$ (▬▬) for cumulative emissions for Scenario 12 for Dublin Airport meteorological station (worst case year 2004).

### 6.2.6 Scenario 13, 14 and 15 – Hydrogen fluoride

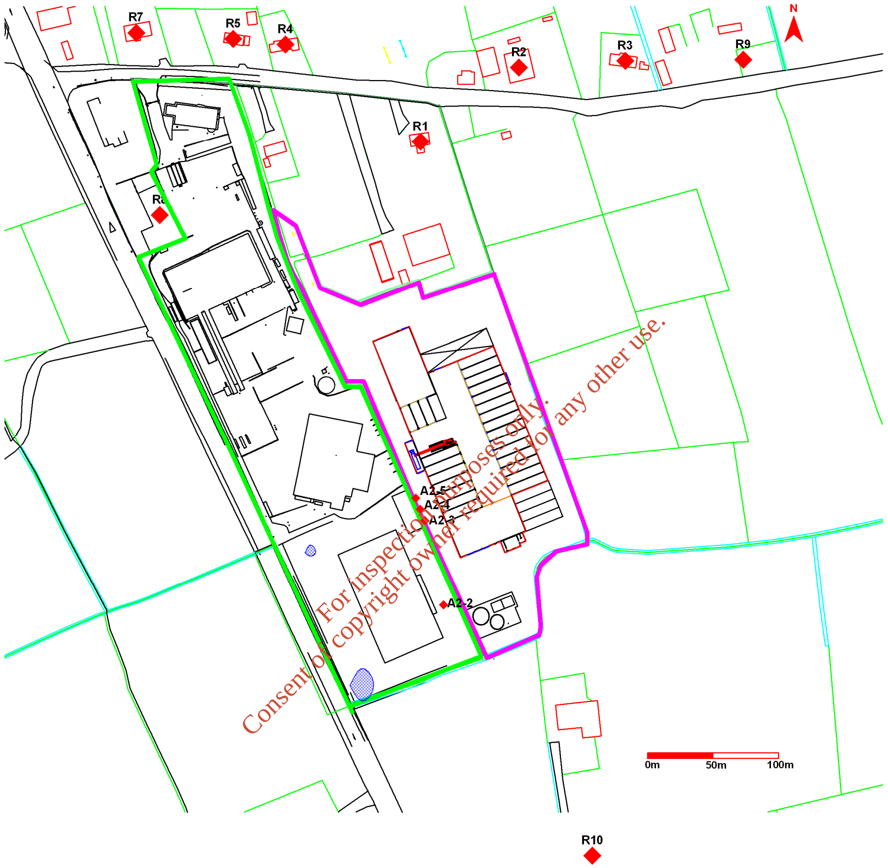





**Figure 6.14** Predicted 100th percentile of 1 hr averages for Hydrogen fluoride ground level concentration of 2.5 µg/m$^3$ (▬▬) for cumulative emission for Scenario 13 for Dublin Airport meteorological station (worst case year 2004).

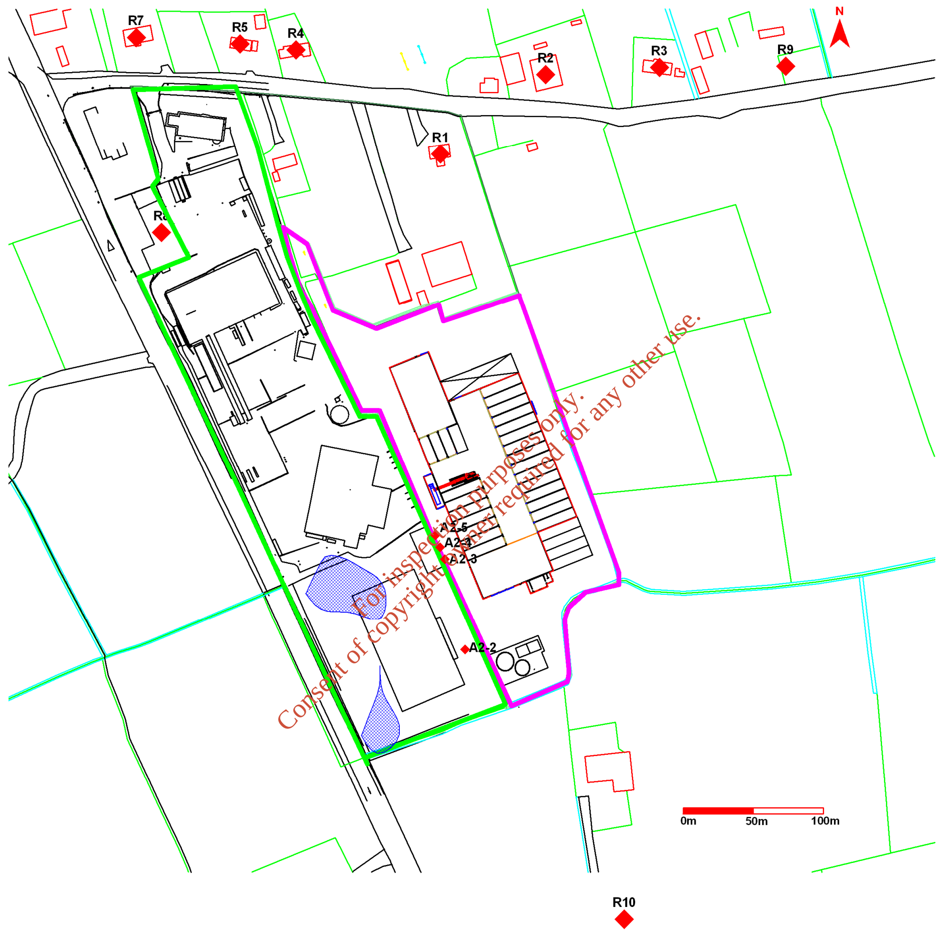





**Figure 6.15.** Predicted 98th percentile of 1 hr averages for Hydrogen fluoride ground level concentration of 1.5 µg/m³ (▬▬) for cumulative emission for Scenario 14 for Dublin Airport meteorological station (worst case year 2004).

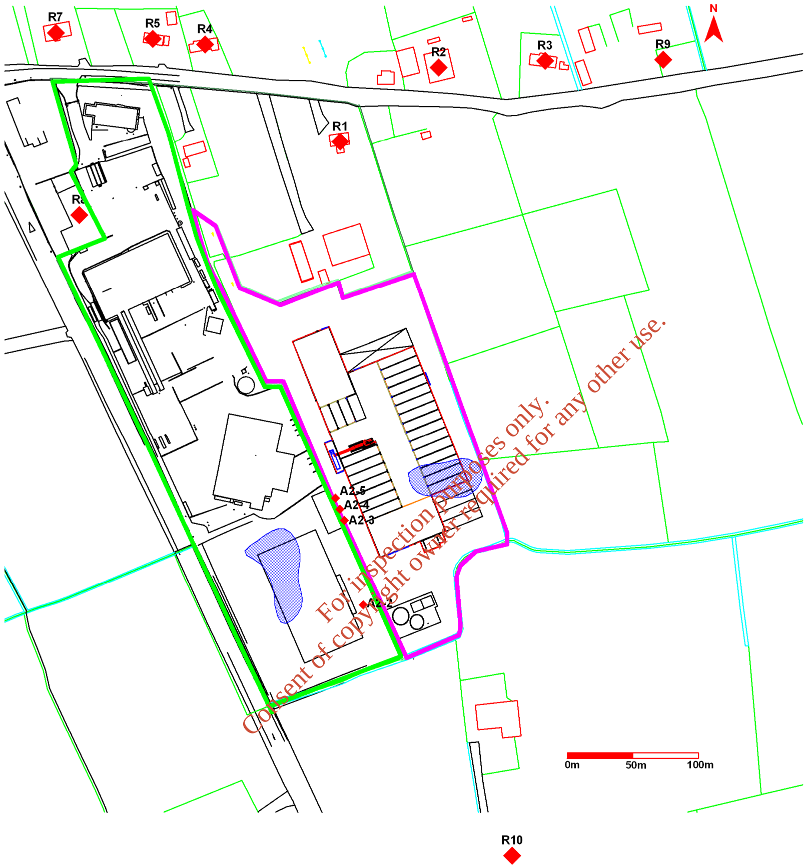




**Figure 6.16.** Predicted annual average Hydrogen fluoride ground level concentration of 0.13 µg/m³ (blue line) for cumulative emissions for Scenario 15 for Dublin Airport meteorological station (worst case year 2004).

### 6.2.7 Scenario 16 – Hydrogen sulphide

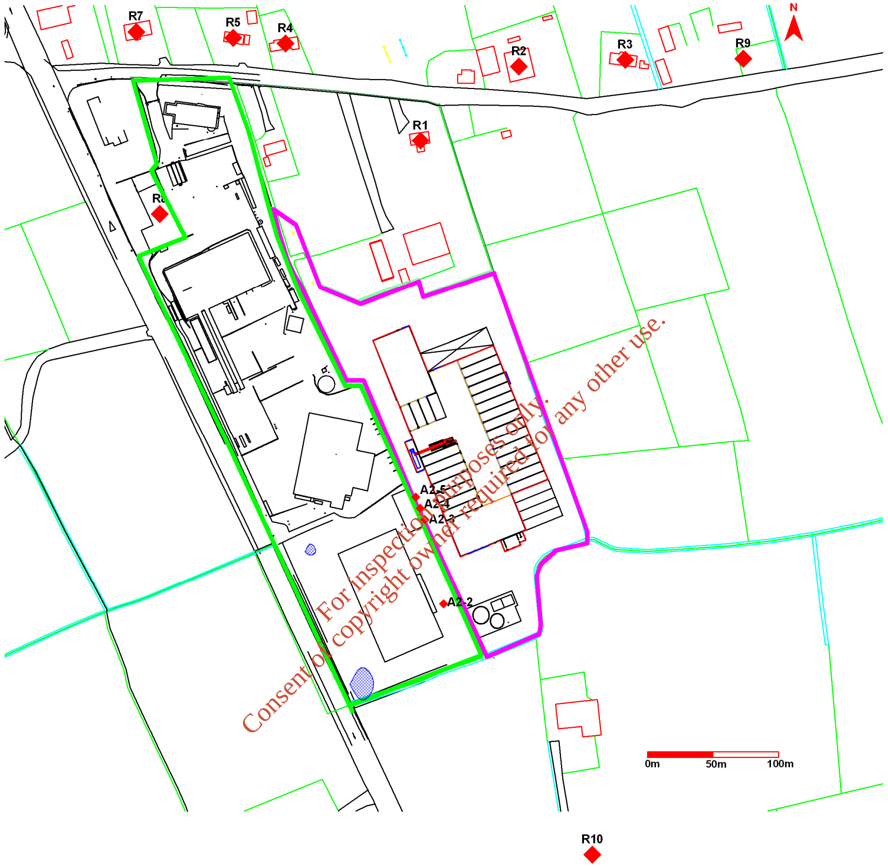





**Figure 6.14** Predicted 100th percentile of 1 hr averages for Hydrogen sulphide ground level concentration of 1.24 µg/m$^3$ ( ▬▬ ) for cumulative emission for Scenario 16 for Dublin Airport meteorological station (worst case year 2004).

### 6.2.8 Scenario 17 – Total non-methane VOC's (as Benzene)

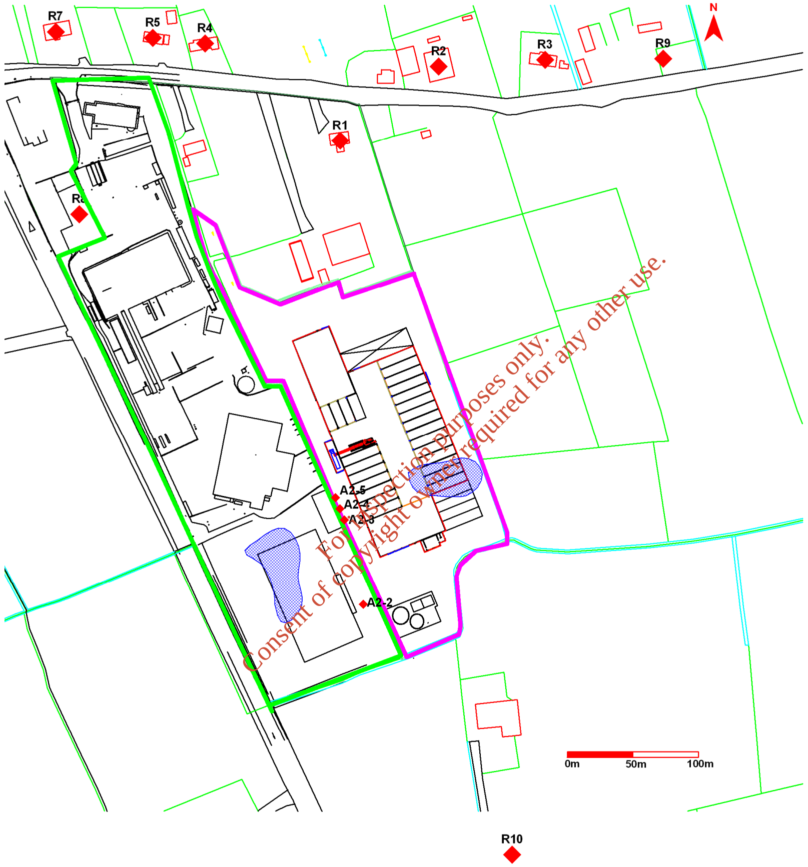





**Figure 6.16.** Predicted annual average Total non-methane VOC's (as Benzene) ground level concentration of 0.97 $\mu g/m^3$ (▬▬) for cumulative emissions for Scenario 17 for Dublin Airport meteorological station (worst case year 2004).

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

**Meteorological file Dublin Airport 2002 to 2006 inclusive**

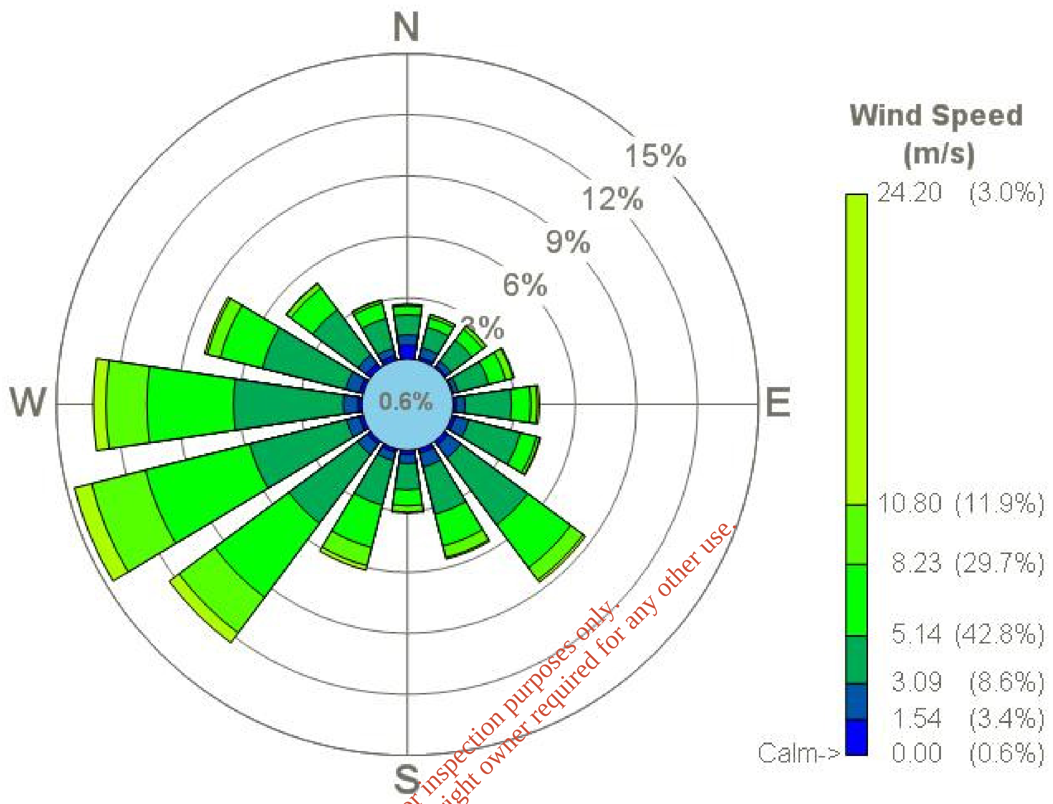





**Figure 7.1.** Schematic illustrating windrose for meteorological data used for atmospheric dispersion modelling, Dublin Airport 2002 to 2006 inclusive.

**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** |

## 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. |

# Attachment 4

| | | | |
|---|---|---|---|
| **Master copy** (in red) | Panda — An Animal for Recycling | SOP No: 7 | |
| | | Revision:<br>No.of pages:<br>Issued:<br>By: | 2<br>6<br>10/09/11<br>D.N. |
| Title: | **Emergency Response Procedure** | | |

Prepared By ____________________________ Date ______________________

Approved By ___________________________ Date ______________________

## 1.0 Purpose:

The purpose of this ERP is to provide an emergency response method for dealing with emergencies in a safe and environmentally friendly manner.

## 2.0 Responsibilities

2.1 Emergency response team

- Brian McCabe — Director
- David Jervis — Operations Manager
- David Naughton — Environmental Manager
- Adam Goff — Health and Safety Officer
- Kieran Connor — Facility Manager
- Noel Hehir — Deputy Facility Manager
- Anthony O'Hare — Supervisor
- Sean Wall — Weighbridge



The director has overall responsibility for this procedure.

The environmental department are responsible for ensuring that all relevant personnel are adequately trained in this procedure.

Employees trained in this procedure are responsible for complying with the requirements of the ERP and are responsible for ensuring that they can adequately respond to any emergency that may arise.

All managers and drivers are responsible for ensuring that vehicles and trailers/skips are maintained in a roadworthy condition at all times.

## 3.0 Definitions

3.1 Emergency: For the purposes of this procedure an emergency shall constitute

- Spillage
- Fire/explosion
- Anything that might result in environmental pollution

ERT Emergency Response Team

## 4.0 Procedure

4.1 Should an emergency situation arise, the facility manager, Environmental Manager and health and safety officer or any other designated person will implement the ERP.

4.2 The environmental officer will review the ERP each year. Additional procedures will be included in the ERP as necessary

4.3 Details if all emergencies will be documented and records maintained on the site for two years. The response to the emergency and the likely impact of the emergency on the environment will also be documented.

4.4 Following a complete investigation into each emergency a corrective and preventative action procedure will be implemented

## 5.0 Possible emergencies that may arise at Panda Waste Services



### *5.1 Definitions*

| | |
|---|---|
| Spill | Any amount of liquid |
| Small spill | less than five litres |
| Medium spill | five litres to two hundred and fifty litres |
| Large spill | greater than two hundred and fifty litres |

Responsibilities
The yard supervisor, as the initial person at the scene, is responsible for dealing with all spills that occur on the site. He is also responsible for informing the environmental manager or other responsible person as soon as possible.

### *5.2 Waste spill*

**Actions to be taken on occurrence of a non-hazardous spill**

- Non-hazardous spills will be cleared immediately into the fowl water storage tank
- The spill will be reported to the environmental manager, who will record all details of the spill

**Actions to be taken on occurrence of a hazardous spill**

- Ensure only competent persons wearing suitable protective clothing handle the hazardous materials
- Ensure appropriate equipment is used for handling the material.
- Evacuate the area, if necessary, and contact the emergency services
- Contain the spill using absorbent materials, which are located around the site, and from the environmental department
- Once a spill has been contained, inform the environmental manager

- The environmental officer will determine the source and nature of the spilled material and obtain a material safety data sheet, where possible.
- In the event that surface water is contaminated, the environmental manager will immediately inform Fingal County Council and the EPA.
- In the event that foulwater is contaminated, the environmental manager will consult Navan Wastewater Treatment Plant and the EPA prior to tankering it off site.
- In the event that the spill is likely to have caused environmental pollution, the spill will be considered as 'an incident' under condition 9.3 of the waste licence and will be treated as outlined in condition 11.1

### *5.3 Equipment Breakdown*

**List of equipment Deemed critical for the normal operation of the plant**

1. Transportation fleet
2. Weigh-bridge
3. Tracking machine, used to sort incoming waste
4. Loading shovels



**Responsibilities**

Transportation fleet: all drivers are responsible for their own lorries.
Weigh-bridge: the facility manager is responsible for the weigh-bridge
All other equipment: the yard manager is responsible for all other equipment

**Actions to be taken in the event of equipment or machinery breakdown**

- There is sufficient fleet to allow the continuation of normal operations in the event of a breakdown of any of the lorries.
- The loading shovels are sufficient to cover the breakdown of the tracking machines and vice versa
- The facility manager will be immediately notified when a problem occurs with any equipment or machinery and will arrange for the equipment to be fixed by the fleet maintenance team.
- In the event that the weighbridge breaks down, the weighbridge in several other waste facilities are available, including Greenstar (Millennium Park), IPR (Walkinstown), Greenstar (Ballymount), Panda (Beauparc).

### 5.4 *Incidents as described in our licence condition 9.3*

- In the event that an incident, as outlined in condition 9.3 occurs, we shall comply with the requirements of the licence

The deputy facility manager will perform the duties of the facility manager in the absence of the facility manager.

### *5.5 Fire Fighting Response*

Fire safety management at the facility is comprised of the following:

- Fire prevention
- Fire containment
- Fire detection
- Fire suppression
- Response in event of fire
- Response in event of an alarm

### *5.6 Fire Prevention*

Fire Prevention is achieved by:

- Safe storage of combustible and flammable materials
- Prevention of mobile sources of ignition in areas with combustible and flammable materials
- Suitable equipment
- Hot work permits will be introduced for proposed welding operations
- Good housekeeping
- Regular maintenance and competent repair of equipment
- Efficient emergency response and communications plan
- Regular safety audits



### *5.7 Storage of Combustible and Flammable Materials*

The following principals are applied to the storage of combustible materials and flammable liquids.

- Good housekeeping and prompt consignment of dry recyclables off the site to prevent the build up of combustible materials
- Regular inspection of plant and equipment for leaks and other miscellaneous problems to prevent spillage of flammable liquids
- Removal of any gas containers or unidentified liquids/chemicals from the off-loading areas to the quarantine area immediately such items are noticed
- Provision of adequate bunds around the diesel and gas oil storage tanks.

### *5.8 Control of Sources of Ignition*

The controls measures applied to minimise ignition sources include:

- No smoking policy within the Licence area
- Hot work permit system
- Only authorised personnel are permitted within the waste handlings areas
- Secure site access and 24 hour site security to prevent unauthorised entry

### *5.9 Fire Detection*

The fire detection system/alarm at the facility consists of the following:

- Site staff or security officer will alert the Emergency Response Team (ERT) in the event of a fire,
- The Facility Manager and Environmental Manager are the designated Site Incident Controllers, with responsibility for assessing the scale of an incident, informing fire service, directing localised rescue and fire abatement services. If an incident occurs outside normal operating hours, the security staff will contact the relevant authorities
- The local fire brigade will be contacted by the ERT or security officer if necessary,



### *5.11 Fire Suppression*

The fire suppression capability is a combination of on site - fire fighting equipment and emergency response plans, and off site – fire service.

### *5.12 On Site Fire Suppression Facilities*

The on site fire abatement equipment includes:

- Fire Extinguishers (7 No)
- Hose reels

### *5.13 Off Site Fire Suppression Facilities*

Fingal County Council Fire Service (Blanchardstown Station) can bring water to site. The volume of water varies depending on number of tenders or tankers. According to the Fingal Fire Service, approximately 2 fire tenders with 1.82m$^3$ capacity each are normally dispatched to an incident.

***5.14 Anything that might result in environmental pollution***

If it is suspected that environmental pollution is being caused as a result of waste transportation

- Stop what is being done immediately and
- Notify the environmental Officer at Panda (Ph. No. 1850 65 65 65).
- The environmental officer will notify the relevant regulatory authorities if necessary.

**6 Useful numbers**

| | |
|---|---|
| Brian M^c^Cabe (Director) | 087 9978422 |
| Peter Waters (Tanker Dept) | 086 8386979 |
| David Naughton (Environmental Manager) | 086 6045905 |
| David Jervis (Operations Manager) | 086 4053925 |
| Adam Goff (Health and Safety Manager) | 087 9534072 |
| Kieran Connor (Facility Manager) | 086 3202015 |
| Noel Hehir (Deputy Facility Manager) | 086 8431140 |
| Sean Wall (Weighbridge) | 087 9861748 |
| Fingal County Council | 01 8905000 |
| EPA Wexford | 053 9160600 |
| EPA Dublin | 01 2680100 |
| H.S.A. | 1890 289 389 |
| Central Fisheries Board | 01-8842600 |
| ***Emergency Services*** | ***999 or 911*** |

| Master copy (in red) | Panda An Animal for Recycling | SOP No: 17 | |
|---|---|---|---|
| | | Revision: | New |
| | | No.of pages: | 2 |
| | | Issued: | 04/09/12 |
| | | By: | D.N. |
| Title: | **Accident Prevention Policy** | | |

Prepared By ____________________________ Date ______________________

Approved By ___________________________ Date ______________________

**1.0 Scope;**

This document presents Pandas, policy on the control and prevention of accidents at the site, including the minimisation of any associated environmental impact of accidents.

.

**2.0 Authority & Responsibility;**

The facility manager is responsible for ensuring that all Panda operatives are trained and carry out the procedure as required. The Facility Manager will implement this policy.

Operatives and sub-contractors working on site are responsible for complying with the procedure as documented



**3.0 Documents Forming Accident Prevention Policy;**

Company Health and Safety Policy

Safety Statement and Site Risk Assessments Document

Site Environmental Management System

Emergency Response Procedures

Accident / Incident Reporting Procedure

Training and Awareness Procedures

**4.0 Health and Safety Policy;**

The Health and Safety Policy describes Panda's commitment to controlling accidents and incidents and ensuring all personnel are protected, including contractors, visitors and the general public. The health and safety policy is communicated to all employees, contractors and visitors and is displayed in main reception area, site canteen and site weighbridge office.

**5.0 Environmental Management System**

The Site Environmental Management System specifies the objectives and targets regarding improvement of the site's environmental performance. It includes Standard Operating Procedures that are designed minimise the risk of accident or incidents occurring during site operations and where these do occur to minimise the associated environmental impacts. These Procedures are as follows.

| S.O.P. Title | SOP No. |
|---|---|
| Document Control | 1 |
| Targets and Objectives | 2 |
| Environmental Complaints | 3 |
| Corrective Action | 4 |
| Daily Site Inspections | 5 |
| Nuisance Management | 6 |
| Emergency Response | 7 |
| Unacceptable Waste | 8 |
| Communication Programme | 9 |
| Training and Awareness | 10 |
| Storage of Fuels and Oils | 11 |
| Designation of waste to suitable outlets | 12 |
| Waste handling and acceptance | 13 |
| Spills on Site | 14 |
| Rejected loads at destination | 15 |
| Metal Recovery from Mattresses | 16 |



**6.0 Emergency Response Procedures**

An Emergency Response Procedure has been prepared that identifies the responsibilities and immediate and subsequent actions to be taken in event of specified emergency or accident. Incidents that will trigger the application of the Emergency Response Procedures include:

- Fire/Explosion
- Spillage/Release of Oils or Hazardous Waste
- Anything that might result in environmental pollution

**7.0 Incident Reporting**

SOP No 4 requires all accidents/incidents to be recorded and reported. Details of incident are recorded and provides to the Site Management. The classification of accident/incident is based on severity and the number of lost man days.

**8.0 Training**

SOP No. 10 Training and Awareness Procedure requires the training programme to be implemented with records maintained in the Training File.

**9.0 Distribution;**

| | |
|---|---|
| **Document Control** | **Master Copy** |
| **Environmental Office** | **Copy** |
| **Operations Office** | **Copy** |
| **Logistical Office** | **Copy** |

# Attachment 5

# 15 ARCHAEOLOGY, ARCHITECTURAL & CULTURAL HERITAGE

## 15.1 Introduction

This Chapter describes the archaeological, architectural and cultural heritage significance of the facility and describes the closest architecturally significant structures in the vicinity of the site. The study was based on information derived from the Records of Monuments and Places published by the Department of Arts, Heritage & Gaeltacht and information contained in the Meath County Development Plan.

## 15.2 Archaeological and Historical Background

The search of the Sites and Monuments Records and the List of Registered Monuments Map in the County Development Plan did not identify any record of any archaeological feature either within the existing site, or in the proposed extension area.



## 15.3 Architectural Heritage – Protected Structures

There is no record of any protected structure (e.g. medieval structure, church) on or adjacent to the site.

## 15.4 Cultural Heritage

There is no record of any ritual and religious associations, riverine and estuarine sites, find spots of archaeological or heritage objects, designed landscapes, natural landscapes with cultural heritage associations, relic landscapes and folklore associations within the existing and proposed development site.

## 15.5 Impact

There is no record of any archaeological, architectural or cultural heritage feature on the site. The proposed development comprises construction in a previously undeveloped area to the east of the existing site boundary and has the potential to impact on unidentified archaeological features.

## 15.6 Mitigation Measures

Any archaeological material must not to be unduly damaged or destroyed and sufficient opportunity be afforded to investigate and record any material of archaeological significance at proposed new developments.

In the unlikely event that archaeological finds are discovered, the construction works programme will be amended to allow a thorough examination by an experienced competent archaeologist.

## 15.7 Assessment of Impact

There is no record of any archaeological features within the proposed extension area. If any such features are identified in the construction stage, they will be examined and recorded. When operational the facility will not impact on archaeological features in the vicinity of the site.

# Attachment 6

# 17 INTERACTION OF THE FOREGOING

## 17.1 Introduction

Earlier Chapters describe the impacts associated with the proposed changes and the mitigation measures. This Chapter discusses the significance of the actual and potential direct, indirect and cumulative effects of the changes due to interaction between relevant receptors, which are Human Beings, Air, Water, Ecology and Landscape. There will be no interaction between Soils and Geology, Material Assets and the Architectural, Archaeological and Cultural Heritage and the other receptors.

The Chapter is based on the combined physical, environmental, visual and socio-economic impact of the development on the receiving environment.

## 17.2 Human Beings / Air

The proposed development has the potential to impact on human beings arising from noise, dust, vehicle exhaust emissions and odour. The location, design and proposed method of operation have taken account of these emissions and effective mitigation measures, which comply with the requirements of the Waste Licence, have been identified and applied. These measures, which are described in detail in Chapter 10, include ensuring the building fabric integrity is appropriate and the installation of a new odour abatement systems. The biomass furnace is the best environmental option in terms of reducing greenhouse gas emissions from the site.



## 17.3 Human Beings/Landscape

The proposed development will result in a slight negative alteration on the existing landscape character and visual amenity.

## 17.4 Surface Water / Ecology

Surface water run-off from the site will discharge to a drain along the southern site boundary following the installation of the constructed wetland. The drain is a tributary of the River Boyne, which it eventually joins 3km from the facility. The Boyne is an SAC and there is the potential for contaminants in the run-off to impact on the river ecosystem.

The proposed design and method of operation, incorporates measures to minimise the risk of contamination of the run-off. These measures, which include the provision of a new oil interceptor up gradient of the constructed wetland and retention capacity in the event of any incidents at the site, will minimise the risk of impact on the Boyne.

## 17.5 Cumulative Effects

The assessment of the impacts of the proposed development took into consideration the impacts of the existing facility. The baseline surveys were conducted during typical operational hours and the predictive assessments included the impacts of both the existing emissions and those associated with the additional waste types that will be accepted at the proposed development.

# Attachment 7

# 5 PROPOSED DEVELOPMENT

## 5.1 Introduction

This Chapter describes the proposed AD/Composting plant and the expansion of the RDF manufacturing process. It provides details of the proposed infrastructure, waste handling and treatment and support activities. It describes the emission control measures incorporated into the design and the method of operation intended to either eliminate or effectively mitigate environmental impacts. A detailed assessment of the impacts is provided in the following Chapters.

## 5.2 Site Development

The proposed site layout is shown on Drawing No 2009-101-103. The majority of the proposed infrastructure will be constructed on an area adjoining the eastern site boundary, which encompasses 3.2ha. The overall development will include:

- Construction of Building 4 (12,183m2) to the east of Buildings 2 and 3;
- Construction of 2 No above ground steel process wastewater storage tanks (154m2 and 78.5m2) and 2 No above ground concrete process wastewater storage tanks (each 61.45m2);
- Provision of an access road from the existing facility and hardstanding areas (3,350m2) for vehicle manoeuvring;
- Installation of a Combined Heat and Power Plant, with associated stacks (2No) and 1 No gas flare;
- Provision of odour control abatement bio-filter on the roof of Building 4 and carbon filter adjacent to Building 3;
- Provision of biomass furnace in Building 3 and rotary drier that will provide heat to dry the RDF and also serve as part of the odour abatement system;
- In addition, the proposed development will include concrete paving surrounding the proposed new structures and an extension to the surface water drainage system and other ancillary works.

The new building will be positioned to the east of the existing Buildings 2 and 3 and elevations are shown on Drawing No 2009-101-201.

## 5.3 Construction Stage

As planning permission has been granted for the development, works have started on the installation of the RDF manufacturing plant at Building 3, including the rotary drum dryer and the provision of the odour abatement plant (carbon filter). However, these will not be commissioned prior to the grant of the Waste Licence.

The main construction stage will involve the following:

- Site clearance and excavation work for the foundations the new building and the extension of the surface water drainage system. The development will require cut and fill to reach formation levels, with the soils excavated in the northern part of the building footprint used to raise the ground level in the southern part. Processed C&D waste which is currently stored on-site will also be used to achieve formation levels. This material has been tested to confirm it is suitable for engineering use and does not present a risk of environmental pollution;

- Construction of new access road to Building 4;

- Construction of Building 4, including the digesters, composting bays and the above ground percolate storage tanks;

- Construction of the new surface water drainage lines and soakaway;

- Installation of new odour abatement system including biofilter ducting and electrical fans in Building 4;

- Installation of the CHP plant and ancillaries including gas engines and backup flare;

- Connection to National Electricity Grid via new 20kv line.



Following the completion of the construction phase the AD/Composting plant, odour abatement system and CHP plant will be commissioned.

The construction and commissioning will be phased over an eight month period and up to 30 people will be employed in the site clearance and civil engineering works; concrete casting and formwork; steel fabrication and erection and electrical fit out, also there will be indirect jobs as all materials and su- contractors will be sourced locally.

The works will typically be carried out between the hours of 07:00 – 19:00 Monday to Friday and 07:00 – 17:00 on Saturdays. Normally, no works will take place on Sundays or Public holidays. The actual construction hours may vary depending on weather conditions and seasonality.

The works will involve the use of standard construction plant, such as:
- Tracked Excavators.
- Dumpers.
- Generators.
- Wheeled Excavators.
- Mobile Crane.

- Teleporter(s).
- Delivery vehicles (for plant and equipment) including articulated and rigid body vehicles

### 5.3.1 Construction Management Plan

A detailed Construction Management Plan (CMP) will be prepared prior to the start of the main construction works. One of the objectives of the CMP is minimise the impacts to the environment during construction. It will define the working hours, construction traffic management and parking arrangements and the environmental protection measures to reduce the environmental impact of the construction activities. The latter will be based on the Conditions in the Waste Licence and will include:

- Measures to prevent surface water and groundwater contamination, including the provision of appropriate storage area and spill containment/clean-up equipment for potentially polluting substances,(fuel and hydraulic oils, cleaning agents etc), suitable on-site welfare facilities and work practices that minimise the risk of blocking of surface drains and watercourses;

- Measures to minimise noise and vibration nuisance, including where necessary the provision of appropriate acoustic barriers and limitations on the use of heavy plant;

- Measures to ensure that all wastes generated by the construction works are properly segregated, stored and either removed from the site or, in the case of clean soils and subsoils and other potentially suitable materials, reused in the development works;

- Measures to ensure that the works do not encroach into or damage terrestrial and aquatic habitats, including the setting of set-back distances;

- Measures to ensure that the public roads in the vicinity of the site are maintained free from all mud and debris trafficked on vehicle wheels, and

- Measures to ensure that on completion of the works, the lands on which the construction compound was located is returned to its original/reasonable condition.



## 5.4 Services

It is not proposed to connect the new building to the mains supply, as canteen and toilets will not be provided. The only additional demand on the mains water supply will be associated with the additional employees that will be recruited. It is expected that 15 new positions will be created.

## 5.5 Surface Water Drainage

The surface water drainage system serving Building 4 is shown on Drawing No. 2009-101-103. Run-off from the extension area will be intermittent and linked to rainfall. The rainwater run-off the paved yards will discharge to a soakaway via an oil interceptor.

Run-off from the roof of Building 4 will be kept separate from yard run-off and will be collected in an existing aboveground water storage tank, which has a capacity of 660m3 and is used to supply a dust suppression system, the road sweeper and the jet vac fleet. At present, the tank is filled with water abstracted from two on-site wells. The rainwater will replace the groundwater, but the wells will be retained as back-up during dry weather.

## 5.6 Wastewater

It is not proposed to install additional welfare and canteen facilities and sanitary wastewater will continue to be treated in the on-site system. The only increased demand on the mains water supply will be the additional 15 employees. The extra water demand, which will result in an increase in sanitary wastewater, is estimated at 3m3/day based on a consumption rate of 200l/employees/day.

The AD/Composting system will generate wastewater. In so far a possible, the wastewater will be reused in the process, but surplus liquid will be sent to the local authority owned municipal wastewater treatment plant where the wastewater currently produced at the facility is treated.

## 5.7 Waste Types and Quantities



The proposed changes will not result in any changes to either the quantities of waste accepted, or the general waste acceptance procedures described in Section 4.10 of this EIS.

## 5.8 Biological Treatment Building 4

Detailed information on the proposed AD/Composting process, including plant capacity, is provided in Appendix 1 and an overview presented below. The type of AD that is proposed is 'Dry Fermentation' and it will be carried out is a series of fourteen (14 No.) fully enclosed fermenters located in the northern part of the building (Drawing No. 2009-101-202). This will produce a bio-gas, which will be scrubbed and used as a fuel in the CHP plant.

After the dry fermentation stage, the residual materials will be composted in a series of fully enclosed forced aeration tunnels, followed by a pasteurisation stage. The finished product will be suitable for horticultural or agricultural use.

All waste handling will be carried out internally, which will prevent the attraction of birds and facilitate the effective control of vermin and pests. An odour management system will be installed to control odours and will comprise air extraction, scrubbing and treatment in a roof mounted bio-filter.

A mass balance of wastewater likely to be produced from the system and the proposed management measures that will be applied are provided in Appendix 1. In so far a possible the wastewater will be reused in the process, but surplus liquid will be sent to an off-site wastewater treatment plant.

### *5.8.1 Animal By-Product Regulations*

The process design and layout will comply with the Department of Agriculture, Food and Marine (DAFMF) requirements regarding Animal By-Products Regulations.

PANDA submitted an application to DAFM for a Stage 1 Approval under the Animal By-Products Regulations EC No 1069/2009 in August 2009. PANDA subsequently met the DAFM on the 16th January 2010, at which clarification on certain aspects of the proposed facility was provided. The DAFM ABP application is being progressed by PANDA.

A copy of the application, which describes the process and the measures that will be implemented to comply with the Regulations, and the DAFM acknowledgement of receipt is in Appendix 2.

Building 4 will located at an adequate distance from any areas where farm animals are kept and there is no access to the building from any place where farm animals or other animals are kept.

Building 4 will be separated from the other waste processing buildings and will be surrounded by stock proof fencing. The access route from the public road to Building 4 is laid out in a manner that ensures the separation between the road used by vehicles delivering the waste to the building and those transporting the finished product from the plant. The routes are shown on Drawing No CCS/JOB/024/004 in Appendix 2.



Building 4 will be segregated into 'Dirty' and 'Clean' Areas, as shown on Drawing No CCS/JOB/24/001 in Appendix 2. There will be a 'one way' materials flow system to avoid interaction between operators and equipment causing cross contamination of the finished product and the non-pasteurised materials. The materials flow, including the access and egress for vehicles, is shown on Drawing No CCS/JOB24/006 in Appendix 2.

The building will be provided with dedicated access/egress routes for operators and vehicles to avoid contaminated materials being inadvertently being brought out of the 'Dirty' Area. The waste reception area will be cleaned at least once daily when in use and disinfected/steam cleaned at least once a week.

The wheels of all vehicles leaving the 'Dirty Area' will be cleaned using a disinfectant in the dedicated 'Wash Down Area'. All personnel access doors to the 'Dirty' Area will be provided with disinfectant boot washes/ foot baths. The locations of the personnel door and 'Wash Down Area' are shown on Drawing No CCS/JOB24/005 in Appendix 2.

When the Wright Tunnels are in operation the treated materials from the tunnels will require further processing in either Building 3 or Building 4. Materials sent to Building 4 will be handled in a similar manner to untreated organic waste to ensure that the finished product is not contaminated.

The access/egress route for Building 4, which is shown on Drawing 2009-101-103, is to the north of and separate from the access to Building 1. This will ensure that the finished product consigned from Building 4 does not come near the processing area in Building 1.

A pest control programme which will include a bait map and bait servicing schedule will be implemented at the plant at the required frequency. The bait points will be visible and clearly numbered. The results of inspections carried out at the bait points, as well as the corrective actions taken, will be recorded.

### *5.8.2 Bio-Gas*

The AD stage will produce a bio-gas that consists largely of methane and carbon dioxide, but also contains a small amount of hydrogen sulphide and ammonia, as well as traces of other gases. The biogas will be treated to reduce the levels of ammonia and hydrogen sulphide.

The treated gas will be used as a fuel in two gas engines in CHP plant. There are a number of utilisation options for the heat and electricity generated in the CHP, which include meeting on-site energy needs and export to the national grid. A gas flare with a capacity of 600m3/hour will be provided as a back–up for when the gas engines are shut down for routine servicing.

### *5.8.3 Odour Management*

An odour management system will be installed to control odours from Buildings 3 and 4 and will comprise air extraction, scrubbing and treatment in a roof mounted bio-filter. The building roof plan is shown on Drawing No. 2009-101-203. More detailed information on the treatment system is provided in Chapter 11.



## 5.9 RDF/SRF Manufacturing Building 3

The types of waste and the processing plant will be the same as that currently deployed (bag shredder, trommel, eddy current separator, magnets and a density separator), but a rotary drum drier will be provided at the end of the separation process, which will be used to reduce the moisture content. The drier will be fuelled by a biomass furnace located inside the building.

### 5.9.1 Odour Management

As the materials that will be processed are odorous an odour abatement system will be provided in Building 3. The mechanical waste processing area will be segregated from the rest of the building and provided with a negative air pressure system. Odorous air will be extracted from both the mechanical treatment area and the drier and directed to the odour abatement system.

The abatement system will comprise particulate removal (dust cyclone), followed by venturi and alkaline scrubbers that will treat the air before it is fed into a furnace. The temperature in the furnace will be maintained at between 800 and 8500 Centigrade (C). A back up carbon filter will be provided and used to treat the odorous air in the building when the furnace is shut down for routine maintenance. More detailed information on the treatment system is provided in Chapter 11.

## 5.10 Safety and Hazard Control

### *5.10.1 Bio-Gas*

The bio-gas generated in the fermenters will occupy the head space above the waste from where it will be drawn directly to the CHP plant and will not be stored in bulk. The total area occupied by the fermenters is 2,992m2. Assuming a head space of 1.5m and that all of the fermenters are operational, the maximum volume of bio-gas in stored at any one time will be 4,488m3. It should be noted that the maximum volume in the headspace in any one of the fermenters will be 321m3 and the pressure will be 25mbar.

The control measures that will be applied in the biological treatment facility and CHP plant to mitigate against fire and explosion risks are described in the report prepared by AWN Consulting, in Appendix 3. As the biological treatment process does not involve the bulk storage of bio-gas, the proposed plant is lower risk than many other anaerobic digestion facilities that do have bulk storage.

Notwithstanding the low risk, the facility will be designed and operated in accordance with the Safety, Health and Welfare at Work (General Application) Regulations 2007; Part 8 Explosive Atmospheres at Places of Works. This will include completion of a Hazard Identification (HAZID) and Hazard and Operability Study (HAZOP) and the preparation of an Explosion Protection Document (EPD) which will be submitted to the Health and Safety Authority (HSA) for approval before operations begin.



### *5.10.2 Pathogens and Micro-Organisms*

There is the potential for a build-up of pathogens and/or other harmful micro-organisms in the in the bio-trickling filter, the carbon filter in the RDF plant and on equipment used prior to the pasteurisation step. A detailed assessment of the control measures that will be applied is presented in the Odour Monitoring Ireland Ltd report in Appendix 4 and an overview is presented below.

As dry fermentation and composting are biological processes that depend on bacteria and other micro-organisms to treat the waste, it is counterproductive to attempt to either kill, or reduce the numbers prior to the pasteurisation stage. However, a strict cleaning and hygiene programme will be implemented at the facility to prevent contamination of the pasteurised materials by the unpasteurised wastes (Ref Appendix 2).

Final stage pasteurisation does not present a risk of the microbiological build-up of pathogens and other harmful bacteria either in the process area, or the air treatment system. The wastes that will be accepted and processed are the same as those already treated at existing composting plants in Ireland, many of which have less sophisticated air handling systems to that proposed for PANDA's facility.

Monitoring at these facilities has demonstrated that bioaerosols, which are the primary vectors by which bacteria can move from the process area to off-site receptors, are not a cause of concern. There is no evidence to indicate that the current controls applied at the facilities are not effective at minimising the risk of build-up of pathogens and other micro-organisms present.

Pre-treatment will be provided on the air ducted to both the biofilter in Building 4 and the back-up carbon filter serving Building 3. In the case of the biofilter, the pre-treatment will comprise a wet scrubber designed to remove particulates and bioaerosols, and a vane eliminator that can remove water droplets >1um. The air leaving the biofilter will then be sterilised using a plasma injector before it enters the carbon filter. This will not only remove odorous compounds, but also sterilise the carbon filter bed and improve operational efficiency.

The odorous air drawn directly to the carbon filter will first pass through a high efficiency dust filter, which is designed to achieve a particulate removal efficiency of 99.5%. This will ensure the molecular voids in the carbon filter are not blocked thereby impeding its proper functioning as an odour control system. The air leaving the dust filter will be injected with plasma that will oxidise any bacteria present and also sterilise the carbon bed.

The wastes treated in the AD/Composting plant will comprise household and commercial wastes that are collected in standard refuse collection vehicles. The vehicles will be subject to routine cleaning and maintenance. The wheels of the vehicles that enter the waste reception area in Building 4 will be cleaned and disinfected and any gross external contamination removed.

## 5.11 Emissions & Mitigation Measures

The actual and potential emissions associated with the construction and operation of the development facility include noise, dust and particulates, exhaust gases from vehicles and mobile plant, exhaust emissions from the CHP stacks, odours, bioaerosols and surface water run-off. These emissions, the proposed mitigation measures and an assessment of the impacts are described in the following Chapters.

# Attachment 8

# End of Waste Status

# Construction & Demolition Materials

# PANDA Waste Services Ltd

# Beauparc

# County Meath

# (W0140-03)



**Prepared For: -**

Panda Waste Services Ltd,
Beauparc,
County Meath

**Prepared By: -**

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

**4th October 2012**

# TABLE OF CONTENTS

# 1. INTRODUCTION

Panda Waste Services (Panda) process construction and demolition (C&D) waste at its Materials Recovery Facility at Beauparc to recover recyclables (metals, wood, aggregates etc), separate out non-recyclables and produce material that that are suitable for use.

Panda considers that one of the products, crushed rubble and also described as 'builders fill' which is produced by processing the inert fraction of the C&D waste can be categorised as recycled aggregate and is suitable for use as general fill and the construction of unbound access/haul roads, for example on farms.

The Environmental Protection Agency (the Agency) has requested Panda to confirm the 'builders fill' meets the 'end of waste status' (EoW) criteria specified in Article 28 (1) (a) of the European Communities (Waste Directive) Regulations 2011 S.I No 126 of 2011 that determine whether a waste that has undergone a recovery operation and meets specified criteria can be deemed not to be a waste. The Regulations transpose the requirements of the Waste Framework Directive 2008/98/EC into Irish law.



Panda commissioned O'Callaghan Moran & Associates (OCM) to determine if the 'crushed rubble' meets the 'EoW' criteria and this report presents the findings of the assessment.

## 1.1 Methodology

OCM based the assessment on the information on the development of an 'end of waste' submission provided by the Agency, which refers to the End of Waste Criteria Final Report (EUR 23990EN-2009). In particular the Agency requested detailed criteria/controls on the following:

- Input Material
- Applied Processes & Techniques
- Product Quality:
- Potential Applications
- Quality Control Procedures

The assessment involved a description of the process; geotechnical testing to establish if the materials met the internationally recognised specifications for the end use, and chemical testing to determine that the end use would not give rise to either adverse environmental, or health impacts.

# 2. INPUT MATERIAL

## 2.1 Material Source

There are two sources of the C&D wastes accepted at the Beauparc facility. The first is the development/redevelopment of residential, commercial and industrial lands. The second is once off renovation/extension to existing residential and commercial premises.

The larger scale development/redevelopments are carried out in accordance with a C&D Waste Management Plan that is designed to source separate the different waste types (hazardous, non hazardous and recyclables) and reduce the amount of waste sent for disposal.

The once off renovations/extensions depending on the scale, typically do not require the implementation of a C&D Waste Management Plan, but in the case of demolition works do involve the prior removal of hazardous materials, for example asbestos containing materials, air conditioning and chilling units that contain ozone depleting compounds and electrical equipment that contain hazardous substances.



## 2.2 Material Type

Table 27 of the End of Waste Criteria Final Report (EUR 23990EN-2009) shows the possible potentially hazardous elements in C&D waste that could have an impact on the environment. The document states that, in general, these hazardous substances should be banned as far as possible from materials intended to be used as aggregates.

The incoming wastes typically comprise a mix of concrete, rubble, bricks, tiles, metals, wood, plastic, paper and textile and, in the case of once off renovations, miscellaneous bulky items, for example furniture. They can also contain the occasional bag of mixed municipal waste and potential hazardous waste for example, batteries, gas cylinders, paint tins, light tubes etc that are inadvertently placed in the skip.

Given the sources of the C&D materials, the quantity of hazardous substances are relatively small compared to the total volume, however special management measures must be taken since their presence may contaminate the end product. In addition, the incoming wastes contain non-hazardous materials that are not suitable for the production of recycled aggregates (paper, plastic, wood, textiles and metals).

# 3. APPLIED PROCESSES & TECHNIQUES

## 3.1 Processing

The C&D process has been designed to remove both the small amounts of hazardous waste and separate the unsuitable non-hazardous wastes from the materials that will processed to produce the recycled aggregates. The process flow is shown on Figures 3.1 and 3.2 and described below.

The skips are off loaded inside Building 2 where the contents are inspected. Non conforming materials (bulky items, insulation foam and potential hazardous waste and bags containing mixed municipal waste) are removed and either quarantined pending removal from the site, or sent for processing in Building 2.

The wastes are passed through a shredder, which reduces the size, and are then passed beneath a magnet that removes the ferrous metals and then into a trommel (with a 40mm screen), which separates the materials in to 'oversize' (>40mm) and undersize (<40mm). The oversize is conveyed to a density separator that removes the 'rubble'.



The 'rubble' is the only component of the input material that is subjected to the 'EoW' process. It is moved to a dedicated processing area (Figure 3.2), where it is passed beneath a magnet to remove residual ferrous metals and then conveyed to a 'Picking Station' where wood, non-ferrous metals and 'lights' (paper and plastic) are removed. The 'rubble' is then crushed to produce to final product (crushed rubble) that is the subject of this assessment. Photographs of the process stages and end product are included in Appendix 1.

**Figure 3.1: C&D Processing**

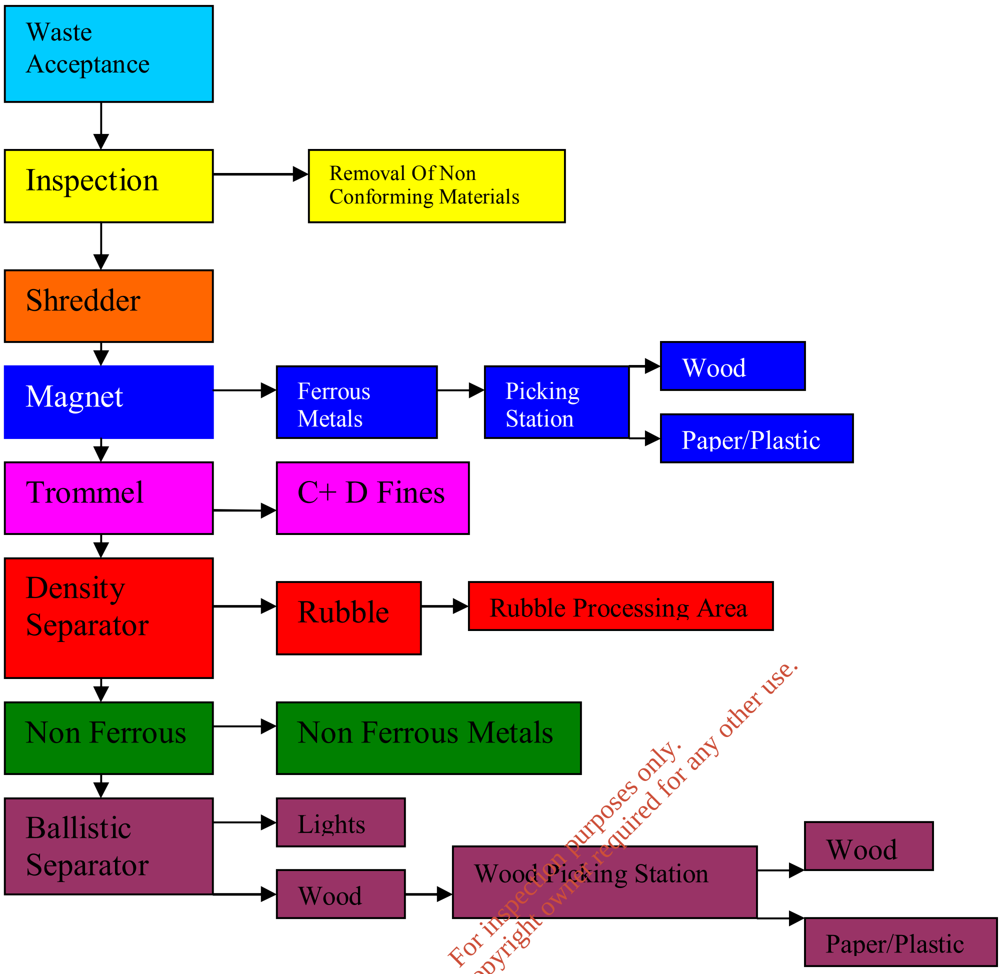
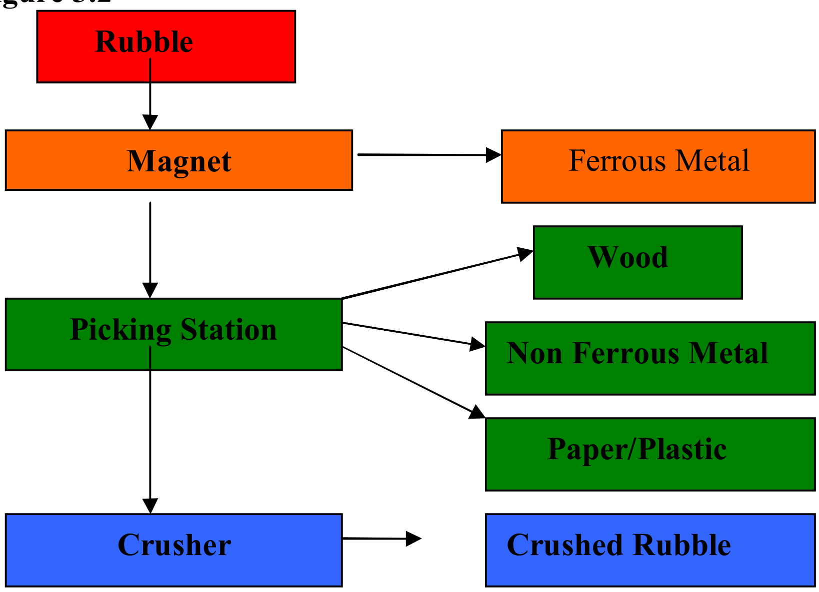





**Figure 3.2**



# 4. PRODUCT QUALITY

## 4.1 Geotechnical Testing

A representative sample (60kg) of the 'crushed rubble' was sent to David Reddy & Associates, which is a specialist geotechnical materials testing company. The samples were graded to assess potential engineering uses, based on both the nature of the materials and their size. The report by David Reddy & Associates, which describes the methodology applied and contains photographs of the materials, is included in Appendix 2.

The results of the grading, with percentages passing the relevant sieves are shown in Table 2.1. The Table also contains the grading classification limits for 50/125mm, Category 80 – 20 of EN 13242:2002 *"Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction"*. The results confirm that the materials meet the grading criteria for 50/125 mm sized aggregate.

**Table 2.1: Grading**

| SIEVE (mm) | Weight. Retained | Weight. Passing | % Passing | Limits |
|---|---|---|---|---|
| **175** | | 83264 | 100 | 98 - 100 % |
| **150** | 0 | 83264 | 100 | |
| **125** | 5556 | 77708 | 93 | 85 - 100 |
| **100** | 30942 | 46766 | 56 | 25 - 70 |
| **75** | 31293 | 15473 | 19 | 20 - 70 |
| **50** | 13690 | 1783 | 2 | 0 - 15 |
| **37.5** | 1257 | 526 | 1 | |
| **28** | 317 | 209 | 0 | 0 - 5 |
| **20** | 0 | 209 | 0 | 0 |
| **BASE** | 209 | | | |



A breakdown of the constituent materials (concrete, aggregate, tiles and brick) is presented in Table 2.2. The table contains the composition requirements derived from Table A.2 EN 13285 : 2003 *"Unbound mixtures – Specification"*. The materials are categorised as Crushed Masonry Aggregates

**Table 2.2 Composition**

| Material | Measured | Requirements |
|---|---|---|
| **Concrete**<br>**Aggregate** | 77%<br>6% | 80% or more when combined |
| **Brick**<br>**Ceramic** | 10%<br>7% | 20% or less when combined |

## 4.2 Pollutant Content and Leachability Testing

A sample of the crushed rubble was sent to Fitz Scientific and was analysed for the parameters set out in the EU Council Decision establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC (Council Decision).

The Council Decision sets threshold values for a range of inorganic and organic parameters, which define whether a waste is inert, non-hazardous or hazardous. The inert limits are used in most Member States as national leaching limit values for recycled and secondary material In Ireland they are commonly applied in Waste Permits issued for land reclamation projects using inert wastes.

This range of testing was considered appropriate as the end use is as unbound materials for general fill (land reclamation) and construction of haul roads, where the materials will be exposed to infiltrating rainfall. It is also consistent with the European Commission's position that pollutant limits and leaching criteria may be necessary in relation to 'EoW' status for C&D materials.

The solid samples were tested for Total Organic Carbon (TOC), BTEX (benzene, toluene, ethylbenzene and xylene) Polychlorinated biphenyls (PCB), phenol, Mineral Oil, and Polycyclic Aromatic Hydrocarbons (PAH). These are considered to be broad indicators of the pollutants likely to be present in the C&D wastes given the source of the materials.



A leachability test was carried out on the solid materials and the leachate were tested for metals (arsenic, barium, cadmium, chromium, copper, mercury, molybdenum, nickel, lead, antimony, selenium and zinc), chloride, fluoride, soluble sulphate, dissolved organic carbon (DOC) and total dissolved solids (TDS). Although non hazardous sulphate, whose primary source is gypsum plasterboard, can cause environmental problems (water pollution and the production of Hydrogen Sulphide gas) if it leaches from waste.

The laboratory methodologies were all ISO approved or equivalent and the method detection limits were all below the relevant Waste Acceptance Criteria (WAC) thresholds in the Council Decision. The complete laboratory test report is in Appendix 3 and the results summarised in Tables 3.1 and Table 3.2.

The Tables also include the WAC for inert waste. The Council Decision does not specify a limit for PAH, as this is left to the individual Member States. In Ireland, Waste Permits for land reclamation projects using inert C&D materials typically set a PAH limit of 2mg/kg and this value has been used as a guideline.

### Table 3.1 Pollutant Content

| Parameter | Unit | Beau-Fill | Inert WAC Thresholds |
|---|---|---|---|
| **Phenols** | **mg/kg** | <0.01 | 1 |
| **Total Organic Carbon** | **mg/kg** | <10,000 | 30,000 |
| **Benzene** | **mg/kg** | <0.05 | 6 |
| **Toluene** | **mg/kg** | <0.05 | 6 |
| **Ethylbenzene** | **mg/kg** | <0.05 | 6 |
| **Total Xylene** | **mg/kg** | <0.05 | 6 |
| **PCB Total of 7** | **mg/kg** | <0.005 | 1 |
| **Total 17 PAH** | **mg/kg** | <0.05 | 100 |
| **Mineral Oil** | **mg/kg** | 60.1 | 500 |

### Table 3.2: Leachability

| Parameter | Unit | Beau-Fill | Inert WAC Thresholds |
|---|---|---|---|
| **Antimony** | **mg/kg** | 0.007 | 0.06 |
| **Arsenic** | **mg/kg** | 0.006 | 0.5 |
| **Cadmium** | **mg/kg** | <0.0009 | 0.04 |
| **Copper** | **mg/kg** | 0.094 | 2 |
| **Chromium** | **mg/kg** | 0.42 | 0.5 |
| **Lead** | **mg/kg** | 0.429 | 0.5 |
| **Nickel** | **mg/kg** | 0.011 | 0.4 |
| **Molybdenum** | **mg/kg** | 0.0091 | 0.5 |
| **Selenium** | **mg/kg** | 0.010 | 0.1 |
| **Zinc** | **mg/kg** | <0.0046 | 4 |
| **Mercury** | **mg/kg** | <0.0002 | 0.01 |
| **Barium** | **mg/kg** | 0.3225 | 20 |
| **Chloride*** | **mg/kg** | 85.80 | 800 |
| **Fluoride** | **mg/kg** | 3.425 | 10 |
| **Sulphate** | **mg/kg** | 427.60 | 1000 |
| **Dissolved Organic Carbon** | **mg/kg** | 39.9 | 500 |
| **Total Dissolved Solids** | **mg/kg** | 3,150 | 4,000 |



The levels of those parameters that were detected were below the relevant WAC Inert threshold value, with the majority being orders of magnitude below the threshold value.

# 5. POTENTIAL APPLICATIONS

The crushed rubble is suitable for use as general fill and the construction and or maintenance of unbound access/haul roads, for example on farms.

As general fill it can be used to raise ground levels and to construct screening berms as part of landscape and site development works. It is not intended for use in areas that will be load bearing, for example beneath buildings, car parks or roadways. A decision on the suitability of the 'crushed rubble' for use in site development works will be made by the relevant Site Engineer.

Farm access roads are intended to allow access for farm machinery across poorly draining lands. They do not have to be constructed or maintained to any particular engineering specification.

# 6. QUALITY CONTROL

Panda has prepared a Standard Operating Procedure (SOP) for the manufacture of the recycled aggregate to facilitate the control of the production process and the quality of the product. The document forms part of the overall environmental management system for the site as required by Condition 2 of the Waste Licence.

A copy of the SOP is included in Appendix 4. It addresses the following:

Responsibility & Authority

Control Measures

Production Management

Inspection & Testing

Records

Storage

# 7. END OF WASTE STATUS

## 7.1 End of Waste Criteria

Article 6 Waste Framework Directive 2008/98/EC states that certain specified waste shall cease to be waste when it has undergone a recovery, including recycling, operation and complies with the specific criteria to be developed for different wastes in accordance with specified conditions:

The Waste Framework Directive was transposed into Irish law by the European Communities (Waste Directive) Regulations 2011, which were made on the 31st March 2011. Article 28 of the Regulations transposes Article 6 of the Directive, and Article 28 (1) transposes the conditions relating to end of waste criteria which are:

*(a) The substance or object is commonly used for specific purposes;*

*(b) A market exists for such a substance or object;*

*(c) The substance or object fulfils the technical requirements for the specific purposes and meets the existing legislation applicable to products, and*

*(d) The use of the substance or object will not lead to overall adverse environmental or health impact.*



The criteria shall include limit values for pollutants where necessary and shall take into account any possible adverse environmental effects of the substance or object.

Criteria have not been yet been defined at Community level for processed C& D wastes. However, there is provision under Article 28 (3) (a) of the Regulations for the Agency to decide, in the absence of criteria set at Community level, whether certain waste has ceased to be waste.

## 7.2 Compliance with End of Waste Criteria

*(a) The substance or object is commonly used for specific purposes*

The use of recycled aggregate produced by processing C&D waste is approved and encouraged under current national standards and guidance for building products and construction works. In 2004, the National Roads Authority issued a Guidance Note relating to the introduction of EN Standards that approved the use of recycled aggregates in road construction. A copy of the guidance is in Appendix 5.

The promotion of the use of recycled aggregates is primarily driven by Kyoto Protocol guidance on reducing carbon dioxide emissions from cement manufacture, and the substitution of natural aggregates materials in construction projects.

*(b) A market exists for such a substance or object*

Panda has established that there is a sustainable market for the 'crushed rubble'. It is particularly suited for the construction and repair of access roads on farm lands and as general fill in the construction of screening berms in landscape and site development projects.

*(c) The substance or object fulfils the technical requirements for the specific purposes and meets the existing legislation applicable to products,*

The 'crushed rubble' meets the grading classification 50/125mm, Category 80 – 20 of EN 13242:2002 *"Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction"*. The composition categorises it as Crushed Masonry Aggregates Table A.2 EN 13285: 2003 *"Unbound mixtures – Specification"*. This means that it is suitable for use as a general backfill in non load bearing areas and the construction of access roads which do not have to meet particular construction specifications.

*(d) The use of the substance or object will not lead to overall adverse environmental or health impact.*

The materials were subject to the testing specified in the EU Council Decision establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC (Council Decision). The Council Decision specifies the analysis for pollutant content and leachate content and sets threshold limits that define whether a waste is inert, non-hazardous or hazardous. The 'inert waste' limits are used in most Member States as national leaching limit values for recycled and secondary material.



The chemical testing has established that the materials are inert and do not present any risk of adverse environmental or health impact arising from the proposed end use.

## 7.3 Conclusion

OCM considers that the 'crushed rubble' satisfies the requirements of the conditions specified in Article 28 (3) of the Regulations and therefore can be classified as achieving end of waste status.

# APPENDIX 1

Photographs

1. Conveyor from Nihot Density Separator (unprocessed rubble)

2. Rubble processing area

3. Bays for Material Segregated from rubble line

4. Metal removed with the Magnet from the rubble line



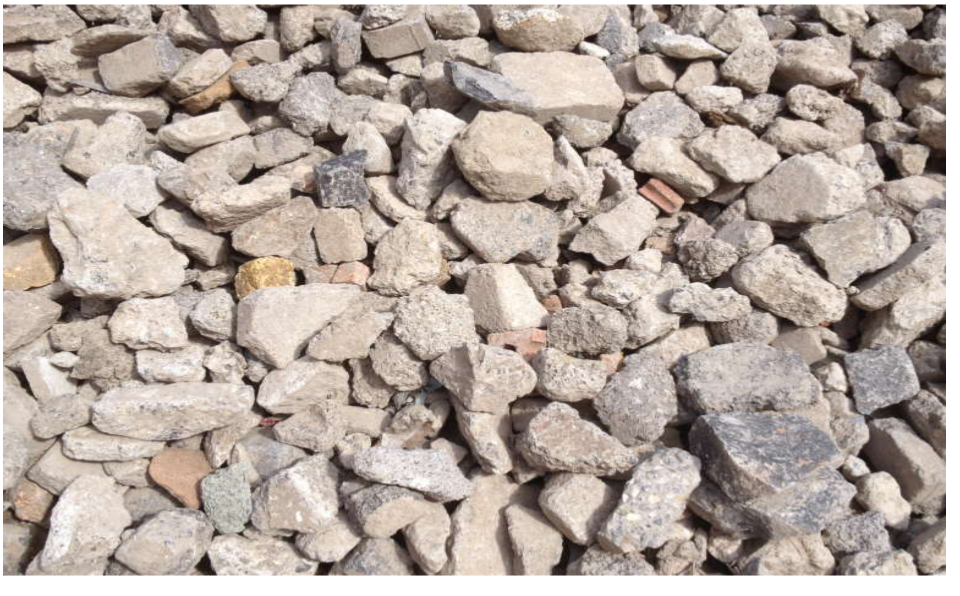
5. Wood removed from the rubble line in the picking station

6. Lights and Non-ferrous removed from the rubble line in the picking station. Non-ferrous is dropped into the skip.

7. Rubble crusher

8. Crushed Recycled Rubble





9. Stockpile of finished rubble.

# APPENDIX 2

David Reddy & Associates

**David Reddy & Associates**

29 Durham Road
Sandymount
Dublin 4.

01-2693436 087-2708854
Email: reddymix@eircom.net

David Naughton,
Panda Waste Services Limited,
Rathdrinagh, Beauparc,
Navan, Co. Meath

**Re: Grading of 125mm crushed recycled materials ref Panda Navan, Co. Meath.**

David,

This to confirm that on August 9th 2012, the writer collected three bags of recycled material from Panda Waste, Ballymount Road, Dublin 12. These bags had been forwarded by yourself from Panda's facility at Navan, Co. Meath.

The material was graded by the writer on August 17th 2012. It was also separated into it's component contents; concrete, brick, ceramic and aggregate. The grading of the sample with percentage passing the relevant sieves are shown in Table A. This table also shows a breakdown of materials present.

Table No.1 of EN 13242:2002 *"Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction"* at first glance does not cover the size of material in question. However Note 1 in this table states that larger sieves sizes can be used for particular applications thus embracing the sample tested. Table No.2 of same standard gives requirements for grading of declared values. These requirements are given in right hand column of Table A.

Annex A of EN 13285 : 2003 *"Unbound mixtures – Specification"* has five distinct compositions for mixtures containing recycled aggregates. This annex gives limits for content of crushed concrete and masonry, aggregates, brick, asphalt etc. This particular material falls into type A.2 and relevant limits are shown on included test results Table A.

The sample tested fits the declared grading classification 50/125mm, Category 80 – 20 of EN 13242:2002 *"Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction"*. The composition of the sample categorises it as Crushed masonry aggregates Table A.2 EN 13285 : 2003 *"Unbound mixtures – Specification"*.

Please contact me if you have any query in regard to this report or if additional work is required.

Yours

**David Reddy** **01 2693436** **087 2708854**

C.C. Jim O'Callaghan, OCM, Granary House, Rutland Street, Cork.

**Photo No.1 shows sample as received.**

**Photo No.2 shows aggregate portion of sample.**


Photo No.3 shows ceramic portion of sample.


Photo No.4 shows brick portion of sample.

**Photo No.5 shows concrete portion of sample.**



**Photo No.6 shows sample separated into aggregate, concrete, ceramic and brick.**

# TABLE A

## AGGREGATE GRADING

**SAMPLE** Panda Navan 50/125 mm recycled

**TEST DATE:** 17/08/2012

| SIEVE | WT. RETAINED | WT. PASSING | % PASSING | LIMITS |
|---|---|---|---|---|
| | | | | |
| 175 mm | | 83264 | 100 | 98 - 100 % |
| 150 mm | 0 | 83264 | 100 | |
| 125 | 5556 | 77708 | 93 | 85 - 100 |
| 100 | 30942 | 46766 | 56 | 25 - 70 |
| 75 | 31293 | 15473 | 19 | 20 - 70 |
| 50 | 13690 | 1783 | 2 | 0 - 15 |
| 37.5 | 1257 | 526 | 1 | |
| 28 | 317 | 209 | 0 | 0 - 5 |
| 20 | 0 | 209 | 0 | 0 |
| BASE | 209 | | | |
| | | | | |

| | Measured | Requirements ** |
|---|---|---|
| Concrete<br>Aggregate | 77%<br>6% | 80% or more when combined |
| Brick<br>Ceramic | 10%<br>7% | 20% or less when combined |

** Table A.2 of EN 13285

TESTED BY: ____________________ DATE: ______________

# APPENDIX 3

Fitz Scientific Test Report

Fitz scientific
Monitoring and Testing Services

Unit 35,
Boyne Business Park,
Drogheda,
Co. Louth
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Tel: +353 41 9845440
Fax: +353 41 9846171
Web: www.fitzsci.ie
email: info@fitzsci.ie

A copy of this certificate is available on www.fitzsci.ie

| | | | |
|---|---|---|---|
| *Customer* | David Naughton<br>Panda Waste<br>Beauparc Business Centre<br>Navan<br>Co Meath<br>Ireland | *Lab Report Ref. No.* | 2190/119/01 |
| | | *Date of Receipt* | 24/08/2012 |
| | | *Sampled On* | 23/08/2012 |
| | | *Date Testing Commenced* | 24/08/2012 |
| | | *Received or Collected* | Delivered by Customer |
| | | *Condition on Receipt* | Acceptable |
| *Customer PO* | T1208307 | *Date of Report* | 13/09/2012 |
| *Customer Ref* | Beau - Fill (23/08/12) | *Sample Type* | Other |
| *Ref 2* | | | |

# CERTIFICATE OF ANALYSIS

| Test Parameter | SOP | Analytical Technique | Result | Units | Acc. |
|---|---|---|---|---|---|
| % Dry Matter | 302 | Drying @ 104 C | 93.63 | % | |
| Acid Neutralisation capacity (pH4) | 128 | Titrimetry | <0.50 | mol/Kg | |
| Acid Neutralisation Capacity (pH7) | 128 | Titrimetry | <0.50 | mol/Kg | |
| Antimony (Leachate) | 128 | ICPMS | 7.749 | ug/Kg | |
| Arsenic (Leachate) | 128 | ICPMS | 6.805 | ug/Kg | |
| Barium (Leachate) | 128 | ICPMS | 322.5 | ug/Kg | |
| Benzene (Solid) | 198 | GC-FID | <0.5 | mg/Kg | |
| BTEX (Solid) | 198 | GC-FID | <0.5 | mg/Kg | |
| Cadmium (Leachate) | 128 | ICPMS | <0.09 | ug/Kg | |
| Chloride (Leachate WAC) | 190 | IC | 85.80 | mg/Kg | |
| Chromium (Leachate) | 128 | ICPMS | 465 | ug/Kg | |
| Copper (Leachate) | 128 | ICPMS | 94 | ug/Kg | |
| Dissolved Organic Carbon (Leachate) | 316 | TOC Analyser | 39.9 | mg/Kg | |
| Ethylbenzene (Solid) | 198 | GC-FID | <0.5 | mg/Kg | |
| Fluoride (Leachate WAC) | 190 | IC | 3.425 | mg/Kg | |
| Lead (Leachate) | 128 | ICPMS | 0.429 | ug/Kg | |
| Loss on Ignition | 310 | Ashing @ 550 C | 4.37 | % | |
| m- & p-Xylene (Solid) | 198 | GC-FID | <1 | mg/Kg | |
| Mercury (Leachate) | 128 | ICPMS | <0.2 | ug/Kg | |
| Mineral oil by Calculation (solid) | 327 | GC-FID | 60.1 | mg/Kg | |
| Molybdenum (Leachate) | 128 | ICPMS | 91.25 | ug/Kg | |
| Nickel (Leachate) | 128 | ICPMS | 11.06 | ug/Kg | |
| o-Xylene (Solid) | 198 | GC-FID | <0.5 | mg/Kg | |
| PAH Solid (Sum of 17) | 200 | GCMS | <0.05 | mg/Kg | |
| PCBs(Solid) | 323 | GCMS | <0.005 | mg/Kg | |



***Signed :*** 

***Philip Jacob - Technical Supervisor***

***Date : 13/09/2012***

Acc. : Accredited Parameters by ISO 17025:2005
PVL - Parametric Value Limit as per EU Drinking water Regulations (SI 278 2007)
All organic results are analysed as received and all results are corrected for dry weight at 104 C
Results shall not be reproduced, except in full, without the approval of Fitz Scientific
Results contained in this report relate only to the samples tested
**The analytical result for this parameter may not be reflective of the concentration present at the time of sampling. The maximum recommended preservation time for this parameter has been exceeded.

Fitz scientific
Monitoring and Testing Services

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A copy of this certificate is available on www.fitzsci.ie

| | | | |
|---|---|---|---|
| *Customer* | David Naughton<br>Panda Waste<br>Beauparc Business Centre<br>Navan<br>Co Meath<br>Ireland | *Lab Report Ref. No.* | 2190/119/01 |
| | | *Date of Receipt* | 24/08/2012 |
| | | *Sampled On* | 23/08/2012 |
| | | *Date Testing Commenced* | 24/08/2012 |
| | | *Received or Collected* | Delivered by Customer |
| | | *Condition on Receipt* | Acceptable |
| *Customer PO* | T1208307 | *Date of Report* | 13/09/2012 |
| *Customer Ref* | Beau - Fill (23/08/12) | *Sample Type* | Other |
| *Ref 2* | | | |

# CERTIFICATE OF ANALYSIS

| Test Parameter | SOP | Analytical Technique | Result | Units | Acc. |
|---|---|---|---|---|---|
| pH (Solid) | 110 | Electrometry | 11.0 | pH Units | |
| Phenol Index (Leachate) | 128 | Colorimetry | <0.01 | mg/Kg | |
| Selenium (Leachate) | 128 | ICPMS | 10.01 | ug/Kg | |
| Sulphate (Leachate WAC) | 190 | IC | 427.60 | mg/Kg | |
| TOC (Solid) | 315 | TOC Analyser | <1.0 | % | |
| Toluene (Solid) | 198 | GC-FID | <0.5 | mg/Kg | |
| Total Dissolved Solids (Leachate) | 128 | Evaporation/ Gravimetry | 3150 | mg/Kg | |
| Xylene Total (Solid) | 198 | GC-FID | <0.5 | mg/Kg | |
| Zinc (Leachate) | 128 | ICPMS | <4.6 | ug/Kg | |



***Signed :*** [signature]

***Date : 13/09/2012***

***Philip Jacob - Technical Supervisor***

Acc. : Accredited Parameters by ISO 17025:2005
PVL - Parametric Value Limit as per EU Drinking water Regulations (SI 278 2007)
All organic results are analysed as received and all results are corrected for dry weight at 104 C
Results shall not be reproduced, except in full, without the approval of Fitz Scientific
Results contained in this report relate only to the samples tested
**The analytical result for this parameter may not be reflective of the concentration present at the time of sampling. The maximum recommended preservation time for this parameter has been exceeded.

Fitz scientific
Monitoring and Testing Services

Client David Naughton
Panda Waste
Beauparc Business Centre
Navan
Co Meath

Eluent Ratio 10:01

Batch Receipt Date 24/08/2012
Received/Collected Delivered by Customer
Condition Acceptable
Report Date 19/09/2012

| ParameterName | Units | Beau - Fill 23/08/12 | Inert Waste | Stable Non-Reactive | Hazardous Waste |
|---|---|---|---|---|---|
| % Dry Matter | % | 93.63 | 0 | 0 | 0 |
| Acid Neutralisation capacity (pH4) | mol/Kg | <0.50 | 0 | 0 | 0 |
| Acid Neutralisation Capacity (pH7) | mol/Kg | <0.50 | 0 | 0 | 0 |
| Antimony (Leachate) | ug/Kg | 7.749 | 60 | 700 | 5000 |
| Arsenic (Leachate) | ug/Kg | 6.805 | 500 | 2000 | 25000 |
| Barium (Leachate) | ug/Kg | 322.5 | 20000 | 100000 | 300000 |
| Benzene (Solid) | mg/Kg | <0.5 | 0 | 0 | 0 |
| BTEX (Solid) | mg/Kg | <0.5 | 6 | 0 | 0 |
| Cadmium (Leachate) | ug/Kg | <0.09 | 40 | 1000 | 5000 |
| Chloride (Leachate WAC) | mg/Kg | 85.8 | 800 | 15000 | 25000 |
| Chromium (Leachate) | ug/Kg | 465 | 500 | 10000 | 70000 |
| Copper (Leachate) | ug/Kg | 94 | 2000 | 50000 | 100000 |
| Dissolved Organic Carbon (Leachate) | mg/Kg | 39.9 | 500 | 800 | 1000 |
| Ethylbenzene (Solid) | mg/Kg | <0.5 | 0 | 0 | 0 |
| Fluoride (Leachate WAC) | mg/Kg | 3.425 | 10 | 150 | 500 |
| Lead (Leachate) | ug/Kg | 0.429 | 500 | 10000 | 50000 |
| Loss on Ignition | % | 4.37 | 0 | 0 | 10 |
| m- & p-Xylene (Solid) | mg/Kg | <1 | 0 | 0 | 10 |
| Mercury (Leachate) | ug/Kg | <0.2 | 10 | 200 | 2000 |
| Mineral oil by Calculation (solid) | mg/Kg | 60.1 | 500 | 0 | 0 |
| Molybdenum (Leachate) | ug/Kg | 91.25 | 500 | 10000 | 30000 |
| Nickel (Leachate) | ug/Kg | 11.06 | 400 | 10000 | 40000 |
| o-Xylene (Solid) | mg/Kg | <0.5 | 0 | 0 | 0 |
| PAH Solid (Sum of 17) | mg/Kg | <0.05 | 100 | 0 | 0 |
| PCBs(Solid) | mg/Kg | <0.005 | 1 | 0 | 0 |
| pH (Solid) | pH Units | 11 | 0 | >6 | 0 |
| Phenol Index (Leachate) | mg/Kg | <0.01 | 1 | 0 | 0 |
| Selenium (Leachate) | ug/Kg | 10.01 | 100 | 500 | 7000 |
| Sulphate (Leachate WAC) | mg/Kg | 427.6 | 1000 | 20000 | 50000 |
| TOC (Solid) | % | <1 | 3 | 5 | 6 |
| Toluene (Solid) | mg/Kg | <0.5 | 0 | 0 | 0 |
| Total Dissolved Solids (Leachate) | mg/Kg | 3150 | 4000 | 60000 | 100000 |
| Xylene Total (Solid) | mg/Kg | <0.5 | 0 | 0 | 0 |
| Zinc (Leachate) | ug/Kg | <4.6 | 4000 | 50000 | 200000 |



**Please refer to the relevant waste licence conditions at the proposed disposal site.**

Note 1: Either TOC or LOI must be used for hazardous wastes

Note 2: UK PAH limit values are being consulted upon (Draft Landfill Amendment Regulations 2005)

Note 3: If inert waste does not meet the SO4 L/S 10 limit, alternative limit values of 1500 mg/L SO4 and Co (initial eluate form the percolation test (prCEN/TS 14405:2003)) and 6000mg/Kg SO4 at L/S10 (either from percolation test or batch test GC EN 12457-3), can be used to demonstrate compliance with the acceptance criteria for inert wastes

Note 4: The values for TDS can be used instead of the values for Cl and SO4

Note 5: DOC at pH 7.5-8.0 and L/S 10 can be determined on the eluate derived from a modified version of the pH dependence test, prCEN/TS 14429:2003, it the limit value at own pH (BS EN 12457 eluate) is not met.

Note 6: In the case of soils, a higher TOC limit value may be permitted by the Environment Agency at an inert waste landfill, provided the DOC value of 500mg/Kg is achieved at L/S 10 l/Kg, either at the soil's own pH or at a pH value between 7.5 and 8.0

Note 7: For determining the total of PAH, the following 17 compounds must be added to a sum:

| | | |
|---|---|---|
| Flouranthene | Naphthalene | Pyrene |
| Benzo(a)pyrene | Acenaphthylene | Chrysene |
| Benzo(b)flouranthene | Acenaphthene | Benzo(a)anthracene |
| Benzo(k)flouranthene | Fluorene (9H-Fluorene) | Dibenzo (a,h) anthracene |
| Benzo(g,h,l)perylene | Phenanthrene | Coronene |
| Indeno(1,2,3,-c,d)pyrene | Anthracene | |

**Signed:** [signature]

**Date:** 19/9/12

# APPENDIX 4

Standard Operating Procedure

| Master copy (in red) | Panda An Animal for Recycling | SOP No: 20 | |
|---|---|---|---|
| | | Revision: | New |
| | | No.of pages: | 3 |
| | | Issued: | 02/10/12 |
| | | By: | D.N. |
| Title: | **Production of Crushed Rubble that meets the End of Waste (EoW) Criteria** | | |

Approved By David Naughton Date 2/10/12

**1.0 Scope;**

The purpose of this SOP is to ensure the quality of the 'crushed rubble' produced from the Construction and Demolition Waste conforms to the (EoW) Criteria.

**2.0 Authority & Responsibility;**

It is the responsibility of the Facility Manager to ensure that all staff involved in the processing the C&D waste are informed of this SOP. It is the responsibility of the Sales Department to fully inform all customers of Panda's requirements regarding the materials that can be placed in the skips and in particular the prohibition on the placement of potentially hazardous waste.

It is the responsibility of the Supervisor to confirm that the wastes are suitable for processing. It is the responsibility of the Environmental Department to ensure that all staff involved in the processing the waste are fully trained and understand this SOP. It is the responsibility for the Environmental Department to ensure that the tests specified in this SOP are carried out at the correct frequencies and that the records of such tests are maintained in accordance this SOP.



**3.0 Procedure;**

*Control Measures*

The skips containing the C&D wastes (Input Material) shall be off loaded inside Building 2 where the contents shall be inspected. Non conforming materials (bulky items, insulation foam and potential hazardous waste and bags containing mixed municipal waste) shall be removed and either quarantined in designated areas inside the building pending removal from the site, or sent for processing in other buildings. Only C&D wastes approved by the Weighbridge Operator and Supervisor shall be processed. .

*Production Management*

The waste process shall be in accordance with the attached Process Flow Diagrams. No variation from this process is permitted. The wastes shall be loaded into the MJ Shredder and then conveyed beneath a magnet that removes the ferrous metals. After the magnet, the wastes will be conveyed into the Powerscreen trommel (with a 40mm screen), which separates the materials in to 'oversize' (>40mm) and undersize (<40mm). The oversize will be conveyed to the Nihot Density Separator that removes the 'rubble'.

The 'rubble' shall be moved to a dedicated processing area, where it will pass beneath a magnet to remove residual ferrous metals. It shall then be conveyed to the 'Picking Station' where wood, non-ferrous metals and 'lights' (paper and plastic) will be removed. The 'rubble' shall then be crushed in the Single Toggle Marsman Jaw Crusher to produce the 'crushed rubble'.

*Product Specification*

The 'crushed rubble' shall comprise a mixture of inert concrete, aggregate, bricks and ceramics with less than 1% other materials.

*Storage*

The 'crushed rubble' shall be moved to the dedicated stockpile area adjacent to the rubble crusher. No other wastes or materials shall be stored in this area.

*Inspection & Testing*

The Supervisor shall visually inspect the stockpile at the end of each production run (working day) and confirm that it meets the production specification. This shall be recorded in a Materials Inspection Sheet. Any material not conforming shall be removed and returned to the input material.



The Environmental Department shall collect or arrange for the collection of representative samples of the processed materials at a frequency of 4000 tonnes produced and send these for grading and pollutant content and leachability testing.

The grading testing shall be conducted by an independent body in accordance with EN 13242:2002. The content shall be classified in accordance with EN 13285 of 2003.

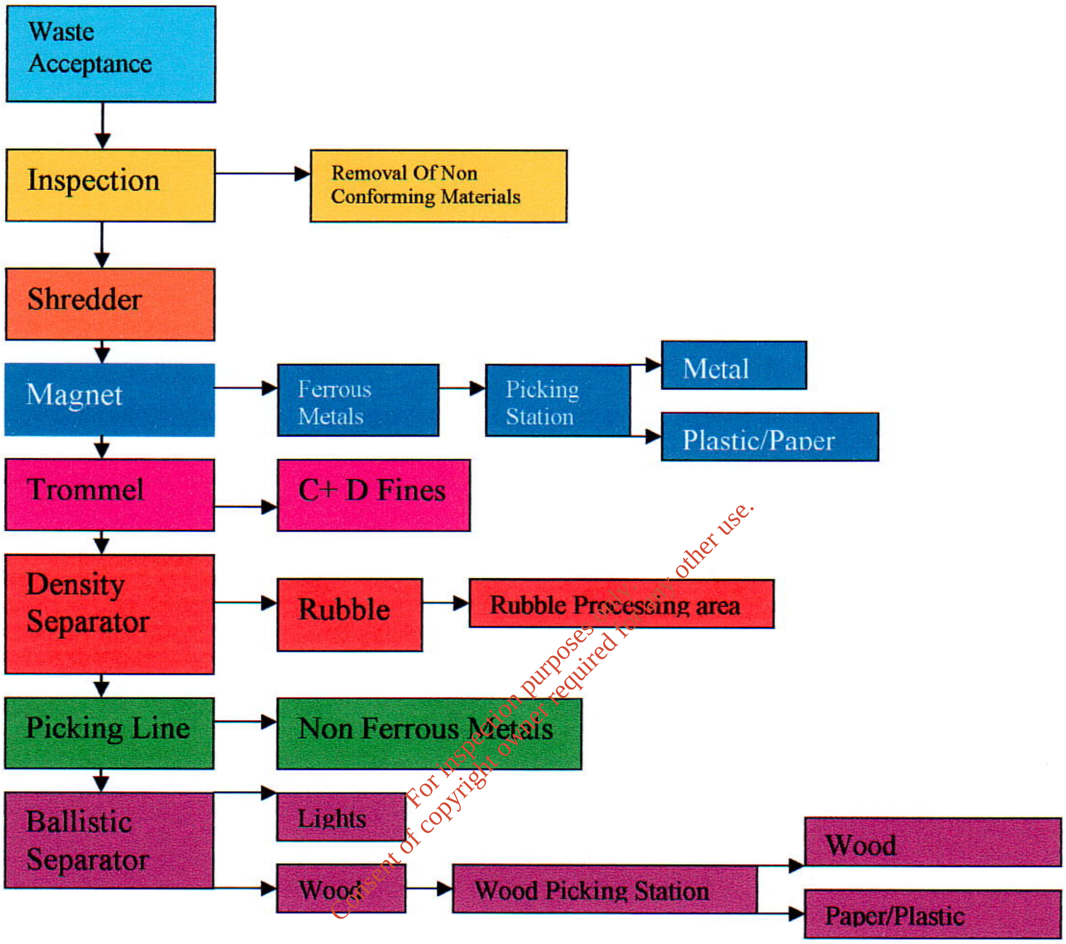
The pollutant content and leachability testing shall be conducted by an independent body and shall include the parameters specified for 'inert wastes' EU Council Decision establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC (Council Decision).

*Records*

The Supervisor shall be responsible for recording the results of the daily inspections and the Environmental Department will be responsible for maintaining the records of the laboratory tests.

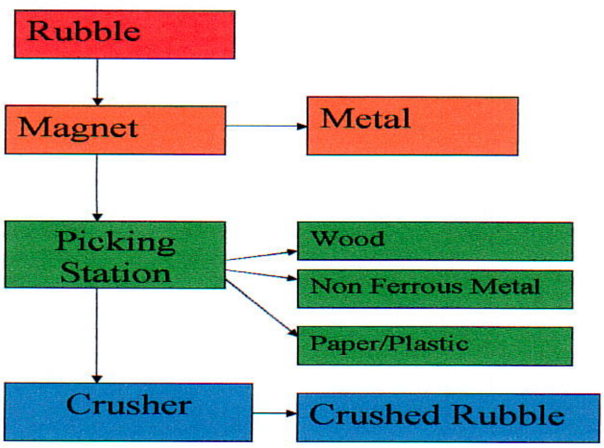
| Master copy (in red) | Panda — An Animal for Recycling | SOP No: 20 | |
|---|---|---|---|
| | | Revision: | New |
| | | No.of pages: | 3 |
| | | Issued: | 02/10/12 |
| | | By: | D.N. |
| Title: | **Production of Crushed Rubble that meets the End of Waste (EoW) Criteria** | | |

**Building 2**






**Rubble Processing Area**



# APPENDIX 5

National Roads Authority Guidance Note

National Roads Authority
An tÚdarás um Bóithre Náisiúnta

## National Roads Authority

# Manual of Contract Documents for Road Works (NRA MCDRW)

## May 2004 Revisions



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# MAY 2004 REVISIONS

The Manual of Contract Documents for Road Works published by the National Roads Authority in March 2000 (NRA MCDRW) and last revised in April 2002 is revised by the following documents.

- Volume 1, Specification for Road Works, Series 800.
- Volume 2, Notes for Guidance on the Specification for Road Works, Series NG 800.
- Volume 2, Notes for Guidance on the Specification for Road Works, Series NG 100.

The revisions are due to the introduction in June 2004 of the following European standards relating to unbound aggregates:

IS EN 13285 – Unbound Mixtures – Specification.

IS EN 13242 – Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction.

Copies of the revised documents, as listed overleaf, are included with the documentation when purchased. These should be inserted in the NRA MCDRW to replace earlier documents.

**NOTE:** In future all series, and revision of series of the Manual of Contract Documents for Road Works will be individually numbered. This revision of the 800 series is individually numbered to reflect this change and thus no page numbers on the contents sheet are assigned.

# CONTENTS

| MCDRW Series | Chapter Reference | Title | Effect of Document |
|---|---|---|---|

**Volume 1, Specification for Road Works, Contents Sheet.**

| | | | |
|---|---|---|---|
| - | - | Specification for Road Works - Contents | Replaces main contents sheet of March 2000 |
| 800 | - | Road Pavements – Unbound Materials | Replaces Series 800 of March 2000 |

**Volume 2, Notes for Guidance on the Specification for Road Works, Series NG 800.**

| | | | |
|---|---|---|---|
| - | - | Notes for Guidance on the Specification for Road Works - Contents | Replaces main contents sheet of March 2000 |
| NG 100 | - | Table NG 1/1: Typical Testing Details | Replaces pages 51 and 52 of March 2000 |
| NG 800 | - | Road Pavements – Unbound Materials | Replaces Series NG 800 of March 2000 |

MANUAL OF CONTRACT DOCUMENTS FOR ROAD WORKS

# SPECIFICATION FOR ROAD WORKS

## Contents

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# ROAD PAVEMENTS – UNBOUND MATERIALS

## Contents

# Road Pavements – Unbound Materials

## 801 Unbound Materials for Sub-bases and Roadbases

1 Unbound sub-bases and roadbases shall be made and constructed using mixtures complying with IS EN 13285 and the following Clauses. Aggregates used in unbound mixtures shall comply with the selected requirements of IS EN 13242 listed in Table 8/2. The permitted alternatives for each part of the Works shall be as described in Appendix 7/1.

2 Materials when placed within 500 mm of cement-bound materials, concrete pavements, concrete structures or concrete products shall have an acid soluble sulphate content not exceeding the Category $AS_{0.2}$ when tested in accordance with IS EN 1744-1: 1998.

3 Except where otherwise stated in Appendix 7/1, unbound material up to 225 mm compacted thickness shall be spread in one layer so that after compaction the total thickness is as specified. Unbound material of compacted thickness greater than 225 mm shall be laid in two or more layers and the minimum compacted thickness of any such layer shall be 110 mm. Where the layers of unbound material are of unequal thickness the lowest layer shall be the thickest layer.



## 802 Compaction

1 Compaction shall be completed as soon as possible after the material has been spread and in accordance with the requirements for the individual materials.

2 Special care shall be taken to obtain full compaction in the vicinity of both longitudinal and transverse joints.

3 Compaction of unbound materials shall be carried out by a method specified in Table 8/1, unless the Contractor demonstrates at site trials that a state of compaction achieved by an alternative method is equivalent to or better than that using the specified method.

4 The surface of any layer of material shall on completion of compaction and immediately before overlaying, be well closed, free from movement under compaction plant and from ridges, cracks, loose material, pot holes, ruts or other defects. All loose, segregated or otherwise defective areas shall be removed to the full thickness of the layer, and new material laid and compacted.

5 For the purposes of Table 8/1 the following shall apply:

(i) The number of passes is the number of times that each point on the surface of the layer being compacted shall be traversed by the item of compaction plant in its operating mode (or struck, in the case of power rammers).

(ii) The compaction plant in Table 8/1 is categorised in terms of static mass. The mass per metre width of roll is the total mass on the roll divided by the total roll width. Where a smooth-wheeled roller has more than one axle, the category of the machine shall be determined on the basis of the axle giving the highest value of mass per metre width.

(iii) For pneumatic-tyred rollers the mass per wheel is the total mass of the roller divided by the number of wheels. In assessing the number of passes of pneumatic-tyred rollers the effective width shall be the sum of the widths of the individual wheel tracks together with the sum of the spacings between the wheel tracks provided that each spacing does not exceed 230 mm. Where the spacings exceed 230 mm the effective width shall be the sum of the widths of the individual wheel tracks only.

(iv) Vibratory rollers are self-propelled or towed smooth-wheeled rollers having means of applying mechanical vibration to one or more rolls:

(a) The requirements for vibratory rollers are based on the use of the lowest gear on a self-propelled machine with mechanical transmission and a speed of 1.5-

2.5 km/h for a towed machine or a self-propelled machine with hydrostatic transmission. If higher gears or speeds are used an increased number of passes shall be provided in proportion to the increase in speed of travel.

(b) Where the mechanical vibration is applied to two rolls in tandem, the minimum number of passes shall be half the number given in Table 8/1 for the appropriate mass per metre width of one vibrating roll but if one roll differs in mass per metre width from the other, the number of passes shall be calculated as for the roll with the smaller value. Alternatively the minimum number of passes may be determined by treating the machine as having a single vibrating roll with a mass per metre width equal to that of the roll with the higher value.

(c) Vibratory rollers operating without vibration shall be classified as smooth-wheeled rollers.

**Table 8/1: Compaction Requirements for Unbound Materials in Road Pavements**

| Type of Compaction Plant | Category | Minimum number of passes for layers not exceeding the following compacted thickness | | |
|---|---|---|---|---|
| | | **110 mm** | **150 mm** | **225 mm** |
| Smooth-wheeled roller (or vibratory roller operating over 5400 kg without vibration) | Mass per metre width of roll:<br>over 2700 kg up to 5400 kg<br>over 5400 kg | <br>16<br>8 | <br>Unsuitable<br>16 | <br>Unsuitable<br>Unsuitable |
| Pneumatic-tyred roller | Mass per wheel:<br>over 4000 kg up to 6000 kg<br>over 6000 kg up to 8000 kg<br>over 8000 kg up to 12000 kg<br>over 12000 kg | <br>12<br>12<br>10<br>8 | <br>Unsuitable<br>Unsuitable<br>16<br>12 | <br>Unsuitable<br>Unsuitable<br>Unsuitable<br>Unsuitable |
| Vibratory Roller | Mass per metre width of vibrating roll:<br>over 700 kg up to 1300 kg<br>over 1300 kg up to 1800 kg<br>over 1800 kg up to 2300 kg<br>over 2300 kg up to 2900 kg<br>over 2900 kg up to 3600 kg<br>over 3600 kg up to 4300 kg<br>over 4300 kg up to 5000 kg<br>over 5000 kg | <br>16<br>6<br>4<br>3<br>3<br>2<br>2<br>2 | <br>Unsuitable<br>16<br>6<br>5<br>5<br>4<br>4<br>3 | <br>Unsuitable<br>Unsuitable<br>10<br>9<br>8<br>7<br>6<br>5 |
| Vibrating Plate Compactor | Mass per square metre of base plate:<br>over 1400 kg/m2 up to 1800 kg/m2<br>over 1800 kg/m2 up to 2100 kg/m2<br>over 2100 kg/m2 | <br>8<br>5<br>3 | <br>Unsuitable<br>8<br>6 | <br>Unsuitable<br>Unsuitable<br>10 |
| Vibro-tamper | Mass:<br>over 50 kg up to 65 kg<br>over 65 kg up to 75 kg<br>over 75 kg | <br>4<br>3<br>2 | <br>8<br>6<br>4 | <br>Unsuitable<br>10<br>8 |
| Power rammer | Mass:<br>100 kg – 500 kg<br>over 500 kg | <br>5<br>5 | <br>8<br>8 | <br>Unsuitable<br>12 |



(d) Vibratory rollers shall be operated with their vibratory mechanism operating at the frequency of vibration recommended by the manufacturer. All such rollers shall be equipped, or provided with devices indicating the frequency at which the mechanism is operating and the speed of travel. Both devices shall be capable of being read by an inspector alongside the machine.

(v) Vibrating-plate compactors are machines having a base-plate to which is attached a source of vibration consisting of one or two eccentrically weighted shafts:

(a) The mass per square metre of baseplate of a vibrating-plate compactor is calculated by dividing the total mass of the machine in its working condition by its area in contact with compacted material.

(b) Vibrating-plate compactors shall be operated at the frequency of vibration recommended by the manufacturer. They shall normally be operated at travelling speeds of less than 1 km/h but if higher speeds are necessary, the number of passes shall be increased in proportion to the increase in speed of travel.

(vi) Vibro-tampers are machines in which an engine driven reciprocating mechanism acts on a spring system, through which oscillations are set up in a base-plate.

(vii) Power rammers are machines which are actuated by explosions in an internal combustion cylinder; each explosion being controlled manually by the operator. One pass of a power rammer shall be considered to have been made when the compacting shoe has made one strike on the area in question.

(viii) Combinations of different types of plant or different categories of the same plant will be permitted; in which case the number of passes for each shall be such proportion of the appropriate number in Table 8/1 as will together produce the same total compactive effort as any one operated singly, in accordance with Table 8/1.

# 803 Granular Material Type A

1 Type A granular material shall be gravel, crushed rock, or recycled crushed mixed concrete aggregates as defined in Annex A of IS EN 13285.

2 The mixture shall comply with IS EN 13285, the requirements of Table 8/2 and with the following sub-clauses. The overall grading requirements for the mixture are summarised in Table 8/3. Where recycled crushed mixed concrete aggregates are used the composition and method of testing of the mixture shall comply with Table A.1 and Annex A of IS EN 13285.

3 The material passing the 425μm BS sieve, when tested in accordance with BS 1377: Part 2, shall have a plasticity index of less than 6.

4 The material passing the 20 mm BS sieve shall have a CBR of 50 per cent or more when tested in accordance with BS 1377: Part 4 at the maximum dry density and optimum moisture content for the material as determined by the vibrating hammer method test in accordance with (IS EN 13286-4).

5 The material shall be laid and compacted at a moisture content within the range 1 per cent above to 2 per cent below the optimum percentage determined in accordance with the vibrating hammer method test in (IS EN 13286-4), and without drying out or segregation.

6 The material shall be maintained within the moisture content range specified in sub-clause 803-5 whilst awaiting overlaying.

**Table 8/2 - Requirements for Aggregates Used in Unbound Mixtures for Subbase and Roadbase.**

| **Unbound Mixture /Clause No.** | | 803 | 804 | 805 | 806 |
|---|---|---|---|---|---|
| **Standard** | | IS EN 13242 Categories for aggregate properties. | | | |
| **Crushed or broken and totally rounded particles** | | | | | |
| - **Crushed Rock** | | $C_{90/3}$ (See Note 1) | $C_{90/3}$ | Not permitted | $C_{90/3}$ |
| | | | | | |
| - **Gravel** | | $C_{NR}$ | Not permitted | $C_{NR}$ | Not permitted |
| | | | | | |
| - **Crushed Gravel** | | $C_{NR}$ | Not Permitted | $C_{50/10}$ | Not Permitted |
| | | | | | |
| **Shape of coarse aggregate – Flakiness Index** | | $FI_{50}$ | $FI_{35}$ | $FI_{50}$ | $FI_{35}$ |
| **Resistance to fragmentation – Los Angeles test** | | $LA_{30}$ | | | |
| **Fines Quality – Methylene Blue test** | | MB (See Note 2). | | | |
| **Resistance to freezing and thawing** | **Water Absorption** | $WA_{24}2$<br>If water absorption is not greater than 2% then aggregate shall be assumed to be freeze-thaw resistant. | | | |
| | **Magnesium Sulphate Soundness** | $MS_{25}$ | | | |
| **All other IS EN 13242 aggregate requirements** | | Category $_{NR}$ (no requirement) (see note 3). | | | |

**Notes:**

1. IS EN 13242 assumes that crushed rock aggregates comply with category $C_{90/3}$ without further testing.
2. It will be necessary to continue to specify Liquid limits and Plasticity index, where appropriate, until further data on the Methylene Blue test has been collected and reviewed. The contractor/supplier shall furnish current Methylene Blue values on the material as supplied.
3. If required where signs of "Sonnenbrand" of basalt are known, the loss of mass and the resistance to fragmentation shall be determined in accordance with EN 1367-3 and 1097-2 (see clause NG 800 sub-clause 5).

**Table 8/3: Granular Material Type A**

| IS EN 13285 Categories | | |
|---|---|---|
| Mix Designation | 0/31.5 | |
| Oversize Category | OC 80 | |
| Overall Grading | $G_B$ | |
| Sieves for Grading/Fines category | ISO Sieve Size (mm) | Percentage by Mass passing |
| 2D | 63 | 100 |
| D | 31.5 | 80 - 99 |
| A | 16 | 55 - 85 |
| B | 8 | 35 - 68 |
| C | 4 | 22 - 60 |
| E | 2 | 16 - 47 |
| F | 1 | 9 - 40 |
| G | 0.5 | 5 - 35 |
| $UF_7$ | 0.063 | 0 - 7 |
| $LF_N$ | NR | NR |
| The particle size shall be determined by the washing and sieving method of IS EN 933-1. | | |

**Table 8/4: Granular Material Type B**

| IS EN 13285 Categories | | |
|---|---|---|
| Mix Designation | 0/31.5 | |
| Oversize Category | OC 80 | |
| Overall Grading | $G_A$ | |
| Sieves for Grading/Fines category | ISO Sieve Size (mm) | Percentage by Mass passing |
| 2D | 63 | 100 |
| D | 31.5 | 80 - 99 |
| A | 16 | 55 - 85 |
| B | 8 | 35 - 65 |
| C | 4 | 22 - 50 |
| E | 2 | 15 - 40 |
| F | 1 | 10 - 35 |
| G | 0.5 | 0 - 20 |
| $UF_7$ | 0.063 | 0 - 7 |
| $LF_N$ | NR | NR |
| The particle size shall be determined by the washing and sieving method of IS EN 933-1. | | |

## 804 Granular Material Type B

1 Type B granular material shall be crushed rock. The mixture shall comply with IS EN 13285, the requirements of Table 8/2 and with the following sub-clauses. The overall grading requirements for the mixture are summarised in Table 8/4.

2 The material passing the 425 µm BS sieve shall have a liquid limit, determined in accordance with the cone penetrometer method (definitive method) in BS 1377: Part 2, not greater than 20 for limestone and 21 for all other rock types.

3 The material shall be laid and compacted at a moisture content within the range of the optimum to 2 per cent below the optimum percentage determined in accordance with the vibrating hammer method test in (IS EN 13286-4), and without drying out or segregation.

4 The material shall be maintained within the moisture content range specified in sub-clause 804-3 whilst awaiting overlaying.



## 805 Granular Material Type C

1 Type C granular material shall be screened or crushed gravel. The mixture shall comply with IS EN 13285, the requirements of Table 8/2 and with the following sub-clauses. The overall grading requirements for the mixture are summarised in Table 8/5.

2 The material passing the 425 µm sieve shall have a liquid limit, determined in accordance with the cone penetrometer method (definitive method) in BS 1377: Part 2, not greater than 20 for limestone and 21 for all other rock types.

3 The material passing the 20 mm BS sieve shall have a CBR of 150 or more when tested in accordance with BS 1377: Part 4 at the maximum dry density and optimum moisture content for the material as determined by the vibrating hammer method test in accordance with (IS EN 13286-4).

4 The material shall be laid and compacted at a moisture content within the range of the optimum to 2 per cent below the optimum percentage determined in accordance with the vibrating hammer method test in (IS EN 13286-4), and without drying out or segregation.

**5** The material shall be maintained within the moisture content range specified in sub-clause 805-4 whilst awaiting overlaying.

**Table 8/5: Granular Material Type C**

| IS EN 13285 Categories | | |
|---|---|---|
| **Mix Designation** | **0/40** | |
| **Oversize Category** | **OC 80** | |
| **Overall Grading** | **$G_A$** | |
| **Sieves for Grading/Fines category** | **ISO Sieve Size (mm)** | **Percentage by Mass passing** |
| 2D | 80 | 100 |
| D | 40 | 80 - 99 |
| A | 20 | 55 - 85 |
| B | 10 | 35 - 65 |
| C | 4 | 22 - 50 |
| E | 2 | 15 - 40 |
| F | 1 | 10 - 35 |
| G | 0.5 | 0 - 20 |
| $UF_7$ | 0.063 | 0 - 7 |
| $LF_N$ | NR | NR |
| The particle size shall be determined by the washing and sieving method of IS EN 933-1. | | |

## 806 Wet-Mix Macadam

**1** Wet-mix macadam shall be made and constructed in the following manner.

**Aggregate**

**2** The coarse and fine aggregate shall consist of crushed rock and the aggregate shall have the grading shown in Table 8/6. The mixture shall comply with IS EN 13285, the requirements of Table 8/2 and with the following sub-clauses.

**3** The material passing the 425 μm BS sieve shall have a liquid limit, determined in accordance with the cone penetrometer method (definitive method) in BS 1377: Part 2, not greater than 20 for limestone and 21 for all other rock types.

**Moisture Content**

**4** The material shall be transported, laid and compacted at a moisture content within the range 0.5 to 1.5 percent below the optimum percentage determined in accordance with the vibrating hammer method test in (IS EN 13286-4) and without drying out or segregation.

**Table 8/6: Wet Mix Macadam**

| IS EN 13285 Categories | | |
|---|---|---|
| **Mix Designation** | **0/31.5** | |
| **Oversize Category** | **OC 85** | |
| **Overall Grading** | **$G_O$** | |
| **Sieves for Grading/Fines category** | **ISO Sieve Size (mm)** | **Percentage by Mass passing** |
| 1.4D | 45 | 100 |
| D | 31.5 | 85 - 99 |
| A | 16 | 50 - 78 |
| B | 8 | 31 - 60 |
| C | 4 | 18 - 46 |
| E | 2 | 10 - 35 |
| F | 1 | 6 - 26 |
| G | 0.5 | 0 - 20 |
| $UF_7$ | 0.063 | 0 - 7 |
| $LF_N$ | NR | NR |
| The particle size shall be determined by the washing and sieving method of IS EN 933-1. | | |



**Laying and Compaction**

**5** The compacted thickness of each layer shall not be more than 150 mm.

**6** Compaction of wet-mix macadam shall be carried out in accordance with the requirements of Clause 802, using vibrating rollers having a mass per metre width of vibrating roll of at least 1800 kg.

**7** The material shall be protected from weather during transit to the site, whilst awaiting tipping and during laying.

**8** On completion of compaction the surface of the material shall be sealed with cationic bitumen emulsion (70 per cent bitumen) sprayed at a rate between 1.1 and 1.4 litre/m2, covered with 2/6 mm chippings at a rate of spread of 6 to 8 kg/m2, and lightly rolled.

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MANUAL OF CONTRACT DOCUMENTS FOR ROAD WORKS

# NOTES FOR GUIDANCE ON THE SPECIFICATION FOR ROAD WORKS

## Contents

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## Table NG 1/1: Typical Testing Details

| *Clause* | *Work, Goods or Material* | *Test* | *Frequency of Testing* | *Test Certificate* | *Comments* |
|---|---|---|---|---|---|
| | | Series 800 | | | |
| 801 | Unbound sub-base and roadbase material (other than slag) adjacent to cement bound materials, concrete pavements, structures or products | Acid Soluble sulphate content (IL) | 1 per 400 tonnes or per location if less than 400 tonnes* | | |
| 803 | Granular material Type A | Grading/Composition | 1 per 1000 tonnes or minimum of 2 per day* | | Composition testing only required if using recycled aggregates |
| | | Moisture Content | | | |
| | | Methylene Blue (IL) | 1 per week* | | |
| | | Flakiness Index (IL) | | | |
| | | Plasticity index (IL) | | | |
| | | CBR (IL) | | | |
| | | OMC (IL) | 2 per year* | | |
| | | Density (IL) | | | |
| | | Los Angeles Coefficient (IL) | | | |
| | | Magnesium Sulphate Soundness (IL) | 1 per 2 years* | | *[Where required - See NG 803]* |
| | | Water absorption (IL) | *[As required]* | | |
| 804 | Granular material Type B | Grading | 1 per 1000 tonnes or minimum of 2 per day* | | |
| | | Moisture Content | | | |
| | | Methylene Blue (IL) | 1 per week* | | |
| | | Liquid Limit (IL) | | | |
| | | Flakiness Index (IL) | | | |
| | | OMC (IL) | 2 per year* | | |
| | | Los Angeles Coefficient (IL) | | | |
| | | Magnesium Sulphate Soundness (IL) | 1 per 2 years* | | *[Where required - See NG 804]* |
| | | Water absorption (IL) | *[As required]* | | |

**Table NG 1/1: Typical Testing Details**

| *Clause* | *Work, Goods or Material* | *Test* | *Frequency of Testing* | *Test Certificate* | *Comments* |
|---|---|---|---|---|---|
| | | Series 800 (continued) | | | |
| 805 | Granular material Type C | Grading | 1 per 1000 tonnes or minimum of 2 per day* | | |
| | | Moisture Content | | | |
| | | Methylene Blue (IL) | 1 per week* | | |
| | | Liquid Limit | | | |
| | | Flakiness Index (IL) | | | |
| | | CBR (IL) | | | |
| | | OMC (IL) | 2 per year* | | |
| | | Density (IL) | | | |
| | | Los Angeles Coefficient (IL) | | | |
| | | Magnesium Sulphate Soundness (IL) | 1 per 2 years* | | *[Where required - See NG 805]* |
| | | Water absorption (IL) | *[As required]* | | |
| 806 | Wet-mix macadam | Grading | 1 per 1000 tonnes or minimum of 2 per day* | | |
| | | Moisture Content | | | |
| | | Methylene Blue (IL) | 1 per week* | | |
| | | Liquid Limit | | | |
| | | Flakiness Index (IL) | | | |
| | | OMC (IL) | 2 per year* | | |
| | | Los Angeles Coefficient (IL) | | | |
| | | Magnesium Sulphate Soundness (IL) | 1 per 2 years* | | |
| | | Water absorption (IL) | *[As required]* | | |

# ROAD PAVEMENTS – UNBOUND MATERIALS

## Contents

# Road Pavements - Unbound Materials

## NG 800 General

1 Advice on the design and construction of sub-bases is published in the U.K. Highways Agency Design Manual for Roads and Bridges (DMRB) Vol. 7 as amended by the NRA DMRB.

2 IS EN 13285 specifies the requirements for unbound mixtures used for construction and maintenance of roads, airfields and other trafficked areas. Under the construction products directive this standard must be fully implemented. All 800 series unbound mixtures must comply with IS EN 13285. The requirements for aggregates used in mixtures complying with IS EN 13285 are defined with appropriate cross reference to IS EN 13242.

3 Because IS EN 13285 mixtures are not directly equivalent to the established types of granular subbase material specified in previous editions of the Specification for Road Works the gradings and material properties chosen reflect a material of similar quality and product conformity. The grading requirements for the materials specified in accordance with the standards IS EN 13285 and IS EN 13242 refer to gradings carried out with the ISO 565 series of sieves.

4 Presently insufficient data exists on the correlation details of the methylene blue and liquid limit tests and therefore it is not considered satisfactory for the purpose of determining harmful fines content in the fine aggregate.

5 Sonnenbrand of basalt is a type of rock decay that is tested in order to determine the susceptibility of certain types of young basalt aggregates, found in some European countries, to degradation through mineralogical instability. This phenomenon is not experienced and it is not anticipated that this test will be applied in Ireland. It is recommended that category $SB_{NR}$ (No Requirement) is adopted, although further information should be obtained on the susceptibility of imported basalt aggregates.

## NG 802 Compaction

1 Sub-Clause 802.5 (viii) permits combinations of different types of compacting equipment provided each type contributes its correct proportion of the total compactive effort. Thus if a machine when operated singly is required in Table 8/1 to apply a minimum of X passes and that same machine actually applies K passes, then the sum of the values of K/X for each of the types of plant used in combination should equal or exceed unity.

## NG 803, 804 and 805 Granular Material Types A, B and C



1 Clause 803 material allows the use of recycled crushed mixed concrete aggregates as defined in Annex A of IS EN 13285. In accordance with the requirements of IS EN 13285 the composition of mixtures containing recycled crushed mixed concrete aggregates shall comply with Table A.1 of Annex A. The compositions in this table reflect established practice in some countries. Recycled Crushed Mixed Concrete Aggregates in accordance with IS EN 13285 allows for the inclusion of masonry as a component of the mix. Crushed masonry may include crushed concrete brick or block, or cut natural stone or rubble.

2 Clause 804 excludes all gravels from Granular Material Type B. In practice clean boulders and cobbles retained on a 100 mm sieve can be crushed to produce a satisfactory Granular Material Type B.

3 The magnesium sulphate soundness test should initially be used for source approval of aggregates and thereafter only in cases where the Employer's Representative suspects their durability. Where local experience indicates that an aggregate with a higher soundness category than that specified may be acceptable, this value should be inserted

in Appendix 7/1. The water absorption test can be used as a routine check test of such aggregates. Where required, details of the tests should be scheduled in Appendix 1/5.

4 In the past gravel meeting the specification requirements for Granular Material Type C has performed successfully in Irish road pavements. In areas where suitable crushed rock is not available locally, consideration should be given to using gravel complying with Clause 805 on less heavily trafficked roads. Because of the variability in naturally occurring gravels, control of the quality of such materials is important.

5 IS EN 13285 details additional requirements to control individual batches of unbound mixtures with overall grading Categories $G_A$, $G_B$ and $G_O$ within a system of factory production control. The supplier must nominate a supplier declared value for the intermediate sieves in the grading envelope as part of the system of factory production control for the mixture. The nominated value must lie within the supplier declared value grading range applicable to the overall grading category in Table 6 of IS EN 13285. Individual batches are then assessed using the tolerances in Table 7 of IS EN 13285, applied to the supplier declared values. As explained in Annex B (informative) of IS EN 13285, the use of tolerances does not change the overall grading range.

6 IS EN 13285 Table 8 also includes requirements for the calculated difference between the values of percentage by mass passing selected adjacent sieves. These requirements are to ensure a 'well graded' mixture by controlling the continuity of the grading curve.

7 Whilst there is no specified moisture content for laying and compacting unbound mixtures to Clause 802, in order to satisfy the requirements of this clause it will be necessary to carry out these operations at the optimum moisture content or within the range identified in the applicable clauses.

8 It is important to maintain the material within the optimum moisture content range stated in the applicable clause for each mixture. The method of maintaining the mixture within this range may depend on environmental conditions and the time to overlay.

## NG 806 Wet-Mix Macadam

1 Experience has shown that limestone aggregate produces the most satisfactory wet-mix macadam where satisfactory production systems are in place. Satisfactory wet-mix macadam can be produced with aggregates other than limestone, but requires a greater control during production and a higher rate of quality control testing than is necessary with limestone.

2 Past experience indicates that most well graded wet-mix macadams have an optimum moisture content of about 3%-4%, and that high in situ strengths can be mobilised in wet-mix macadam if it is compacted at about 0.5%-1.0% below the optimum moisture content in accordance with the requirements of Table 8/1. However the optimum moisture content for some unbound materials with low fines content may be difficult to determine accurately and, where uncertainty about the optimum moisture content occurs, guidance on the most suitable moisture content range for laying and compaction can be obtained by carrying out CBR tests at a range of moisture content so that the appropriate moisture content range for mobilising maximum strength can be determined. The compaction technique to be used for this purpose should be the vibrating hammer method described in IS EN 13286 - 4. Further information on this topic is given in An Foras Forbartha report RC188 and Environmental Research Unit report RC 358.

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# Attachment 9

## NON-TECHNICAL SUMMARY

### Introduction

This Environmental Impact Statement (EIS) examines the potential impacts and significant effects on the environment associated with the proposal to develop a biological waste treatment plant and to expand the refuse derived fuel manufacturing line at the Nurendale trading as PANDA Waste Services (PANDA), Materials Recovery and Transfer Facility at Beauparc, Slane, County Meath

PANDA has operated its waste recovery plant at Beauparc for over 20 years and currently employs 100 workers at the facility. The site has planning permission from Meath County Council and a Waste Licence granted by the Environmental Protection Agency (EPA). The proposed development requires a revision of the current Waste Licence (W0140-03).

### Description of the Development

*Existing Site*

The current planning permission and Waste Licence allow PANDA to take in and process up to 250,000 tonnes of non-hazardous waste annually. The wastes are collected from households, businesses and construction sites and are processed in three main buildings (Buildings 1, 2 and 3).



The processing includes sorting the wastes to pick out the clean paper, cardboard, plastics, wood, metals, organics, rubble, soil and stones that can either be recycled or used to manufacture refuse derived fuel. The remaining mixed materials, for example dirty paper and organic residues that are not suitable for recycling, can be treated in the compost tunnels before going to landfill.

Government Waste Management Policy

It is government policy to reduce the amount of waste going to landfill and currently there is a levy of €75 on every tonne of waste going into a landfill and it is likely that there will be further increases. The levy is on top of the cost of the landfill operator's cost and will have to be met by the producer of the waste, for example the householder.

*Site Development*

PANDA has looked at ways to reduce the amount of waste going to landfill so as to keep the costs to its customers as low as possible. The two best options are to expand the composting operation (biological treatment) for the food stuff and to improve the quality of the refuse derived fuel. This will not involve changing either the type or the amount of waste taken in, but will require the construction of a new building (Building 4). Recycled construction and demolition rubble will be used to raise the ground level to facilitate the construction of the building.

*Biological Treatment*

The expansion of the composting system will involve the use of what is called a 'dry fermentation anaerobic digestion' plant at the initial stage of the process. This type of system is ideal for the types of waste PANDA accepts and is fully proven and safe.

It will consist of a series of fully enclosed tanks, called digesters, in which the wastes will be placed. 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 number of different gases (biogas). The most common gas will be methane, which is the 'natural gas' supplied by Bord Gais. The biogas will be cleaned (scrubbed) to remove contamination and used as a fuel in new electricity generators, which will connect to the national grid.

While methane gas is explosive and can pose a risk of explosion when present in the air at certain levels, as is the case with natural gas used in homes, the dry fermentation process is designed to minimise the risk of this occurring. The design of the plant will be based on a rigorous hazard assessment including design and operational controls on the gas collection and ventilation systems, explosion protection, fire safety and lightning protection.

The digesters will reduce the amount of organic matter in the wastes and convert it to biogas. The waste will then be moved to the composting area, where they will be composted in fully enclosed containers called tunnels. Unlike anaerobic digestion, the compost process requires oxygen and air will be pumped into the tunnels to ensure that oxygen levels are kept at the level needed to complete the composting.



The existing composting tunnels are provided with an odour control system that draws air from the tunnels into a bio-filter, where the substances that form the odours are removed. This type of system has proven very effective in controlling odours and bio-filters units are in operation at more than 15 other composting plants around the county. A similar system will be provided to treat the air inside the anaerobic digestion and composting building.

When the composting process is complete, the material will be pasteurised by raising and maintaining the temperature to a level that kill the microbes. The compost will be sold to farmers, market gardeners, landscape contractors and the general public.

Pasteurisation is required in the composting process to meet the requirements of the Department of Agriculture Fisheries and Marine for the treatment of wastes containing residues of meat and fish (Animal By-Products) so as to avoid the spread of animal diseases, for example mad cow disease and foot and mouth.

The Department has issued guidelines on how anaerobic digestion and composting plants must be designed and operated. The proposed design fully complies with the Departments guidance. Furthermore, approval must be obtained from the Department before the process can start. Once it is operational vets from the Department will also carry out inspections of the plant to ensure that it is operating properly. These inspections will be entirely separate from those carried out by the EPA.

*Manufacture of Fuel*

The remaining mixed wastes that are not suitable for recycling will be turned into a fuel, called refuse derived fuel RDF or Solid Recovered Fuel (SRF) which can be used in industrial plants in Ireland and abroad, for example cement making plants.

The mixed waste contains a lot of water and needs to be dried to improve its value as a fuel. This will be done using heat from a new furnace. It had been intended to use LPG (liquefied petroleum gas) as a fuel, but this was not the best environmental option because it is a fossil fuel and produces greenhouse gases that contribute to global warming.

A better environmental alternative is to use wood (biomass), as a fuel. Wood is a renewable source of energy and will help PANDA reduce its greenhouse gas emissions from fossil fuels. Waste plastic, paper, cardboard etc. will not be burned in the furnace and the EPA will not approve such use.

The mixed waste will be placed inside a drying drum and the temperature raised using heat from furnace. The air inside the building and the steam from the dryer will contain odours. The air and steam will be sucked into pipes by fans and drawn into the furnace. The temperature of the furnace is designed to ensure that all the odour causing substances are destroyed.

It had been proposed to use a Regenerative Thermal Oxidiser (RTO), operating independently of the furnace to treat the steam from the dryer. However the RTO is fuelled by LPG and if it broke down the production of the RDF would have to stop. The biomass furnace is designed to achieve the same temperatures ($800^0$C to $850^0$C) and same level of treatment performance as the RTO.



As a back-up measure for when the furnace is shut down for maintenance, the odorous air in the building will be treated in carbon filter unit. These units are commonly used in industries that use or manufacture odorous chemicals.

**Existing Environment, Potential Environmental Effects and Mitigation Measures**

*Surface Water*

Rainwater falling on the existing concrete yards is collected in an underground tank and stored before being sent off-site for treatment at a local authority owned sewage treatment plant. Treatment is required because rainfall on concrete yards where vehicles travel and park can become contaminated with silt and small quantities of oil that may leak from vehicle oil sumps.

PANDA has approval to change the drainage system to channel the water from the existing yards to a new reed bed that will be located beside Building 3. The reed bed will remove contaminants that may have been picked up by the rainwater and the treated water will discharge into a drain along the southern site boundary. This drain is a tributary of the River Boyne, which is 3km from the site.

Rainwater from the roof of the new building will be collected in a tank and used for spraying the yards to keep dust down. The rainwater from the new yards will pass through silt traps and interceptors, which will reduce the contamination to acceptable levels, before going to a new soakaway.

*Wastewater*

Water from the canteen and the toilets is collected and initially treated in an on-site wastewater treatment plant before being sent to a local authority owned sewerage treatment plant. The water used clean the floors of the buildings and the water from truck wash is collected in an underground tank and also sent to a local authority owned sewage treatment.

The biological treatment process will produce wastewater and all of this will be collected in drains inside the new building and pumped to new storage tanks. The tanks will be fully enclosed by walls designed to trap any spills or leaks that may happen. The design and construction of the tanks and containing walls will be approved by the EPA.

Much of the wastewater will be reused in the process, but any that cannot, will be sent to the local authority treatment plant.

*Groundwater*

The only emission to ground will be the 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 proposed new waste activities will be carried out inside the new building, which will effectively prevent dust causing a nuisance.



*Odours*

The odour management measures, which have already been described, will ensure that smells from the new activities will not cause a nuisance. Odour surveys carried out by the EPA have confirmed that the site is not a source of obnoxious odours.

*Noise*

The noise sources include the waste processing equipment operating inside the main buildings the C&D processing plant and truck and car movements. The noise monitoring carried out by both PANDA and the EPA has consistently shown noise from the site is not causing a nuisance.

*Vermin and Pests*

Birds, rats and flies can be attracted to sites where there is available food. The waste accepted at the site include waste accepted at the site includes foodstuffs. All such wastes are and will continue to be processed and stored inside the buildings. This has already been effective in preventing bird attraction. A pest and vermin contractor is used to control flies and rodents.

*Traffic*

The proposed development will not result in any increase in the amount of waste that the facility already has approval to accept annually. The local road network has sufficient capacity to handle the traffic to and from the facility, taking account of the cumulative traffic from other activities in the surrounding area. Therefore mitigation measures are not required. However the visibility at the site entrance will be improved by cutting back hedgerows.

*Archaeology, Architectural and Cultural Heritage*

The proposed development will not result in any damage to or interference with recorded monuments or to any known archaeological feature. If any such features are identified in the construction stage, they will be inspected by a qualified archaeologist and the works programme will be amended accordingly.

*Human Beings*

Waste handling and processing has the potential to cause environmental nuisance associated with odour, noise and vermin. At sites where biological treatment of wastes is carried out there is the potential health risks associated with airborne particles. The design and proposed method of operation of the facility will ensure that it will not give rise to nuisance and will not present a health risk. The development will have a positive impact in that it will result in additional jobs and help sustain existing employment levels at the site.



*Material Assets*

The development will not result in the loss of any amenity value either inside or outside the site boundaries. The existing agricultural use of the site will be lost, but the impact will not be noticeable in the context of the agricultural economy in County Meath.

*Interaction of the Foregoing*

The assessment took into consideration the impacts of the existing facility and the proposed changes.

- The aim of the development is to maximise the value of the waste already accepted at the site and there will be no change to the either the type, or amount of waste already approved.

- The proposed biological treatment plant is safe and does not present a threat to our staff or neighbours either through emissions to air, or explosions.

- The proposed biomass furnace is the best environmental option in terms of reducing greenhouse gas emissions from the site.

- The proposed development does not present a risk to the River Boyne.