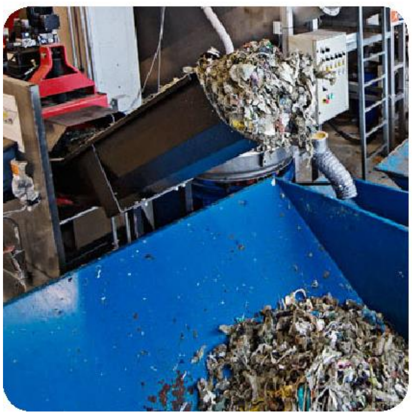
REnescience Northwich

Appendix D: Air Quality





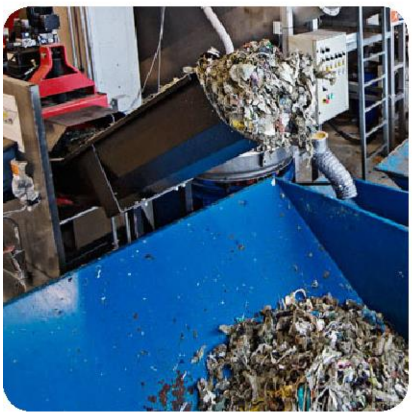


Chapter 10: Air Quality Assessment

REnescience Northwich








Quality Management

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Date of issue:	02 October 2015		**Revision number:**	1
Project number	JAS8407			
Document file path:	O:\Jobs_8001-9000\8407s\Info_share\ES_submission\Final_Word\Vol2_Environmental_Statement\V2C10_Air_Quality.docx			

Revision History				
Rev	**Date**	**Status**	**Reason for revision**	**Additional comments**
0	21/08/15	Draft	-	-
1	02/10/15	Final	Internal review	-

Calculations or models filename, location or link: \\BRIG-LW-02\Projects\Jobs_8001-9000\8407s\AQ\Results				
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DISCLAIMER

Executive Summary

This Air Quality Assessment has been undertaken to support the planning application for the proposed REnescience Northwich development off the A530 Griffiths Road, near Northwich and Lostock Gralam, Cheshire.

The proposed development is located within the administrative area of Cheshire West and Chester Council (CWCC). CWCC has designated two Air Quality Management Areas (AQMAs), due to high levels of nitrogen dioxide (NO_2) attributable to road traffic emissions. Both AQMAs are more than 25 km away from the proposed development. The closest AQMA to the proposed development, declared by Cheshire East, is the Chester Road AQMA, approximately 6.5 km to the north-east.

The assessment has considered effects of nuisance dust during the construction phase of the development; and traffic, point-source and fugitive emissions to air during the operation of the proposed facility.

A draft Dust Management Plan (DMP) has been produced, which is based on the recommended IAQM measures to mitigate air quality impacts during the construction phase. Provided this is implemented, the residual construction-phase effect is expected to be "*not significant*".

In terms of the operation of the proposed facility, the assessment predicts that impacts from stack emissions, development traffic emissions, and fugitive emissions will be within acceptable levels at sensitive receptors and will not give rise to any significant adverse effects based on the criteria in Environment Agency guidance.

No significant cumulative effects are predicted, taking account of other consented but not yet operational schemes, including the Tata SEP and Organic Waste Management Bio-Energy Plant at Lostock Works.

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1 Introduction

1.1 RPS has undertaken an air quality assessment to support the planning application for the proposed REnescience Northwich development off the A530 Griffiths Road, near Northwich and Lostock Gralam, Cheshire. Cheshire West and Chester Council (CWCC) has designated two Air Quality Management Areas (AQMAs), due to high levels of nitrogen dioxide (NO_2) attributable to road traffic emissions. Both AQMAs are more than 25 km away from the proposed development. The closest AQMA to the proposed development is the Chester Road AQMA, declared by Cheshire East, located approximately 6.5 km to the north-east.

Key Emission Sources

1.2 During the construction phase, there would be the potential for dust emissions from construction activities and emissions from construction vehicles.

1.3 During the operational phase of the facility, the principal sources of releases to atmosphere would be point source emissions associated with:

- the exhaust stack for the five reciprocating gas engines which burn biogas generated by the anaerobic digestion (AD) process to produce renewable heat and electricity; and
- the enclosed back-up gas flare which is provided to burn off biogas, avoiding uncontrolled releases, should the gas engines be unavailable (e.g. due to breakdown).

1.4 Other potential operational-stage emission sources are: fugitive emissions of dust, odour and bioaerosols associated with the process; and vehicle exhaust emissions from traffic movements associated with the operation of the facility.

Scope

1.5 This air quality assessment considers the air quality effects of:

- construction traffic and construction dust emissions;
- point and fugitive emissions to air during the operation of the proposed development; and
- exhaust emissions from vehicles movements generated during the operation of the proposed development.

1.6 This chapter describes: a summary of the assessment methodology; the baseline conditions currently existing at the application site and surroundings; the likely significant environmental impacts; the mitigation required to prevent, reduce or offset any significant adverse impacts; and the likely residual effects after these mitigation measures have been employed.

1.7 The policy and legislative context for the assessment is contained within Appendix 10.A and the assessment methodology detail is contained within Appendix 10.B.

2 Summary of Key Pollutants Considered

2.1 For the operational phase of the proposed development, the main pollutants from road traffic with potential local air quality impacts are nitrogen oxides (NO_x) and particulate matter (PM_{10}). Emissions of total NO_x from combustion sources comprise nitric oxide (NO) and NO_2. The NO oxidises in the atmosphere to form NO_2. The assessment of operational impacts due to traffic emissions therefore focuses on changes in NO_2 and PM_{10} concentrations. The impact from fine particulate matter, known as $PM_{2.5}$ (a subset of PM_{10}) concentrations has also been considered.

2.2 Regarding the stack emissions, the main pollutants from the biogas engines and biogas flare with potential for local impacts are $NO_{x,}$ CO, volatile organic compounds (VOCs) and unburned hydrocarbons. Regarding emissions of VOCs, Annex F of the Environment Agency Horizontal Guidance (H1) recommends that where the VOC composition has not been characterised then as a precaution it should be assumed that the VOCs are composed of 100% benzene (a VOC with significant health effects). A similar approach has been adopted for unburned hydrocarbons, whereby it is assumed that they are composed of 100% benzene. This approach is considered to be extremely conservative.

2.3 There is some potential for fugitive dust and odour emissions associated with the AD process. These would be controlled by applying good management practices.

2.4 For the construction phase of the proposed development, the key pollutant is dust, covering both the PM_{10} fraction that is suspended in the air and can be breathed, and the deposited dust that has fallen out of the air onto surfaces and which can potentially cause temporary annoyance effects.

3 Assessment Methodology Summary

3.1 This section provides an overview of the approach to the air quality assessment. The detailed assessment methodology is provided in Appendix 10.B.

3.1 Neither the NPPF nor the nPPG is prescriptive on the methodology for assessing air quality effects or describing significance; practitioners continue to use guidance provided by Defra and non-governmental organisations, including Environmental Protection UK and the Institute of Air Quality Management. However, the nPPG does advise that *“Assessments should be proportionate to the nature and scale of development proposed and the level of concern about air quality, and because of this are likely to be locationally specific. The scope and content of supporting information is therefore best discussed and agreed between the local planning authority and applicant before it is commissioned.”* It lists a number of areas that might be usefully agreed at the outset.

3.2 This air quality assessment covers the elements recommended in the nPPG. The approach has been informed by the following guidance:

- Environmental Protection UK (EPUK)/Institute of Air Quality Management (IAQM) Land-Use Planning & Development Control: Planning For Air Quality [1];
- IAQM Guidance on the assessment of dust from demolition and construction [2]
- Local Air Quality Management - Technical Guidance LAQM.TG(09), Defra, 2009 [3];
- Environment Agency (2011) Environmental Permitting Regulations (EPR) – H1 Environmental Risk Assessment, Annex F;
- Environment Agency (2010) Environmental Permitting Regulations (EPR) – H4 Odour Management; and
- IAQM Guidance on the Assessment of Odour for Planning [4].

3.3 The air quality assessment has addressed the following key elements:

- During site preparation and construction:
  - emissions from construction vehicles; and
  - dust from construction activity.
- During operation:
  - emissions from biogas engines’ stack;
  - emissions from biogas flare stack;
  - fugitive releases of dust, odour and bioaerosols associated with the storage and handling of waste;
  - emissions from operational vehicles; and

- cumulative effects associated with other consented facilities in the vicinity of the proposed development.

3.4 In line with the guidance set out in the nPPG, the Environmental Health Department at CWCC was consulted to agree the scope and methodology for this assessment. Kate Davis, Senior Regulatory Services Officer for Environmental Protection at CWCC, confirmed that the approach to the air quality assessment was appropriate, including the choice of receptor locations [5].

3.5 Air quality guidance advises that the organisation engaged in assessing the overall risks should hold relevant qualifications and/or extensive experience in undertaking air quality assessments. The RPS air quality team members involved at various stages of this assessment have professional affiliations that include Member of the Institute of Air Quality Management, Chartered Chemist, Chartered Scientist, Chartered Environmentalist and Member of the Royal Society of Chemistry and have the required academic qualifications for these professional bodies. In addition, the Director responsible for authorising all deliverables has over 20 years' experience.

4 Baseline Air Quality Conditions

Overview

4.1 Information on background air quality in the UK is usually available from two public sources:

- Each local authority has published results of its Review and Assessment (R&A) of air quality, with reference to local monitoring and modelling studies.
- Defra maps [6], which show estimated pollutant concentrations for each 1 km grid square in the UK.

4.2 This information can be supplemented by the results of any historical monitoring campaigns undertaken in the study area or by any study-specific monitoring campaign that has been undertaken. In the case of this assessment, sufficient data are available from public sources to gain an indication of background air quality.

CWCC Review and Assessment Process

4.3 There are no AQMAs in the vicinity of the proposed development site. CWCC currently has two AQMAs declared due to high levels of NO_2 attributable to road traffic emissions, both of which are located at distances greater than 25 km from the proposed development. The closest AQMA to the proposed development is the Chester Road AQMA, declared by Cheshire East, located approximately 6.5 km to the north-east. Given the distances from the proposed development, it is considered unlikely that there would be any significant impact on air quality in any AQMA.

Background Pollution Concentrations

4.4 The receptors around the proposed development are located mainly in rural or residential suburban areas. Monitors at urban background locations measure concentrations away from the local influence of emission sources and are therefore broadly representative of residential areas within large conurbations. Monitoring at urban background locations is considered an appropriate source of data for the purposes of describing baseline air quality at the sensitive receptors.

4.5 There are no monitoring sites at urban background locations within the vicinity of the proposed development. There are no automatic monitoring sites at any location within 19 km of the proposed development.

4.6 CWCC operates a network of NO_2 diffusion tubes throughout the borough. There are no urban background diffusion tube monitoring sites, although there are several roadside monitoring sites within 5 km of the proposed development site. The most recent available data for these sites are presented in Table 4.1.

Table 4.1 Passively Monitored Roadside Annual-Mean NO_2 Concentrations

Site Code	Site Name	Approx. Distance to Site (Km)	Concentration (µg.m^{-3})		
			2011	2012	2013
CA	Castle St (114)	3	33.7	35.4	35.7
CC	Cottage Close	1	25.8	24.2	22.9
CN	62 Chesterway	2	31.0	30.6	29.4
CP	Castle (Post Office)	3	32.9	37.0	33.5
GR	Griffiths Rd	1	24.5	26.6	26.0
KR	King St. Rudheath	1	34.9	34.5	31.8
LN	London Rd (160)	2	-	30.2	31.0
M15	Manchester Rd (15)	1	-	34.3	30.4
M55	Manchester Rd (55)	1	-	26.9	25.4
MN	Manchester Rd (178)	1	30.4	32.6	33.4
NA	Naylor Ct, London Rd	2	-	37.0	27.3
QS	Queen / Chesterway	2	-	32.5	29.3
SB	Station Birkdale	1	-	36.9	34.1
TG	The Green	5	-	-	27.4

4.7 As shown above, measured NO_2 concentrations at roadside locations within the vicinity of the proposed development site range from 22.9 to 37.0 µg.m^{-3}, all falling below the AQS annual-mean objective of 40 µg.m^{-3}. So as to avoid double-counting the road-traffic contribution to ambient pollution levels, monitored roadside concentrations have not been used to establish baseline conditions for the majority of receptors modelled; the exception being receptors along Manchester Road, where the highest monitored NO_2 concentration of 33.4 µg.m^{-3} from 2013 was used as the ambient NO_2 concentration.

Defra Mapped Concentrations

4.8 The Defra maps provide estimates of pollution concentrations across the UK at a spatial resolution of 1 km^2.

4.9 Total annual-mean NO_2, PM_{10}, $PM_{2.5}$, benzene, and CO concentrations have been collected for the grid square of the proposed development site (367500, 374500). The background Defra mapped NO_2 concentrations are provided in Table 4.2.

Table 4.2: Defra Mapped Annual-Mean Background Concentrations

Pollutant	Annual-Mean Concentration Estimate ($\mu g.m^{-3}$)
NO_2	14.7
PM_{10}	14.8
$PM_{2.5}$	10.3
Benzene	0.5
CO	321

Discussion of Background Concentrations

4.10 The requirement for this assessment is to set the background concentration at a realistic and conservative level.

4.11 In the absence of monitoring at any urban background location within the vicinity of the proposed development site, the background pollutant concentrations have been informed by the Defra mapped concentration estimates.

4.12 To ensure a conservative assessment, no reduction has been applied to pollutant concentrations for future years.

4.13 Table 4.3 summarises the background concentrations for NO_2, PM_{10}, $PM_{2.5,}$ benzene and CO used in this assessment. These have been used for the assessment of effects across the study area, except along Manchester Road, where a more detailed consideration of effects near to the road has been undertaken.

Table 4.3: Summary of Background Long-term and Short-term Concentrations used in the Assessment

Pollutant	Long term Concentration ($\mu g.m^{-3}$)	Short term Concentration ($\mu g.m^{-3}$) (a)
NO_2	14.7	29.4
PM_{10}	14.8	(b)
$PM_{2.5}$	10.3	(b)
CO	-	642
Benzene	0.5	-

(a) Short-term background data approximately equate to the 90th percentile, which is approximately equivalent to 2 x the annual mean.
(b) No short-term background concentration is required for PM_{10} or $PM_{2.5}$ as the shortest averaging period required for consideration is daily average.

5 Assessment of Construction Impacts

5.1 Based on the size of the proposed development, and the duration of construction activities, it has been assumed that the air quality impacts during the construction phase (including potential associated development to widen the access road within Lostock Works) are likely to be in the high risk category as defined in the IAQM dust guidance. The mitigation measures based on this level of risk are described in the IAQM dust guidance and have been listed in this chapter. The guidance states that provided the mitigation measures are successfully implemented, the resultant effects of the dust exposure will normally be "*not significant*".

5.2 One of the listed mitigation measures is to develop and implement a Dust Management Plan (DMP). A DMP for the proposed development has been produced and is provided in Annex 2.C.1.

6 Assessment of Operational Impacts

6.1 Modelling of point source impacts has been undertaken using a grid of 10 km by 10 km with a grid spacing of 50 m.

6.2 In addition, the effects of the proposed development have been assessed at the façades of local existing receptors. Receptors have been selected at representative locations where changes in pollutant concentrations are anticipated to be greatest as a result of the proposed development. All human receptors have been modelled at a height of 1.5 m, representative of typical head height. The receptor locations are listed in Table 6.1 and illustrated in Figure 10.B.

6.3 The proposed development site is located within a predominantly industrial area at the existing 'Lostock Works' site allocated for waste management in the CWCC Local Plan. The closest sensitive residential receptors are located along Manchester Road, approximately 180 m north of the proposed development site boundary and some 240 m from the stack.

Table 6.1: Modelled Sensitive Human Receptors

ID	Description	National Grid Reference	
		X (m)	Y (m)
Roads and Point Source Impacts			
1	1 Griffiths Road	368621	374688
2	1 Cottage Close	368303	373519
3	Cottage Close/Griffiths Road	368292	373468
4	Brittania Drive/King Street	368420	373049
5	School Road North/King Street	368432	372891
6	2 Tudor Close	368468	372739
7	Rudheath Community Primary School	368014	372719
8	Cooke's Lane	369046	373217
9	Village Close	369323	373594
10	High House Farm	368739	372479
Point Source Impacts Only			
11	Proposed Farm Road Residential Development	368138	373690
12	Proposed Griffiths Road Residential Development	368269	373591
13	Proposed Making Space Sheltered Residential Development	367443	373845
14	Proposed Gladedale Residential Development	367553	374712
15	Manchester Road	368149	374574
16	Station Road	369033	374904
17	Lostock Green	369084	374205

Note: Receptors have been modelled at 1.5m above ground level, representative of typical head height
m = metres.

6.4 Receptors 1 to 10 in Table 6.1 have been selected to consider the combined effects of traffic emissions, along roads affected by HGV traffic associated with the proposal. Receptors 11 to 17 have been selected to consider emissions from point source emissions only, primarily the gas engines, in addition to the 10 km by 10 km grid.

6.5 All of the AQS objectives apply at the façades of all residential properties and schools.

6.6 Natural England (NE) and Cheshire West and Chester Council (CWCC) were consulted to agree the scope to assessing air quality impacts at designated habitat sites. NE confirmed that since all European sites and Sites of Special Scientific Interest (SSSIs) lie beyond 500 m of the proposed development, no impacts are expected at the sites and they do not need to be assessed [7]. Laura Hughes, Natural Environment Officer at CWCC, confirmed that a qualitative description of expected air quality impacts on the 'Ashton's and Neumann's Flashes' Local Wildlife Site would be sufficient for assessing air quality impacts at ecological sites [8].

6.7 The following sections present the assessment of air quality impacts associated with the operational-phase of the proposed development.

6.8 Firstly, the maximum predicted concentrations associated with the gas engines and flare stacks, both across the modelled domain and at local receptors around the application site, are presented. The predicted road pollutant concentrations associated with traffic emissions are then presented. Cumulative impacts are subsequently discussed, looking at cumulative industrial emissions taking into account potential impacts from consented but not yet operational schemes, including a closer study into impacts at residential dwellings along Manchester Road. Combined stack and traffic effects are also reported. Fugitive dust, odour and bioaerosol releases are then discussed. Finally, effects on ecology are discussed.

Results of Stack Emissions Modelling

6.9 The maximum predicted ground-level concentration associated with the gas engines and flare stacks in the modelled domain has been derived for each of the five years of meteorological data. Table 6.2 summarises the predicted Process Contributions (PC) for all pollutants while Table 6.3 summarises the resulting Predicted Environmental Concentrations (PEC), which is the PC plus the background. These results have been derived based on the very conservative assumption that the gas engines and flare all operate continuously (in practice this is not possible but it allows an additional margin to be built into the assessment). It has also been assumed that VOCs and unburned hydrocarbons associated with the proposed facility's stack emissions are composed of 100% benzene in line with EA guidance for screening impacts; therefore, the results for benzene presented below are considered to be extremely conservative.

6.10 Figures 10.C and 10.D show the contour plots of NO_2 process contribution, as annual-mean and 99.79^{th} percentile hourly-mean respectively. The plots show the PCs modelled using the 2013 meteorological dataset, which gave the highest results out of the five separate modelled years.

As shown in Figure 10.C, the maximum impacts are predicted to occur approximately 140 m south-east of the stack and flare, within the wider Lostock Works site.

Table 6.2: Predicted Maximum Process Contributions

Long-term or Short-term	Averaging period (Pollutant)	EQS ($\mu g.m^{-3}$)	Max PC ($\mu g.m^{-3}$)	Max PC as % of EQS
Long term	Annual mean (NO_2)	40	5.9	**14.7**
	Annual mean (Benzene)	5	0.8	**16.6**
Short term	8 hour running maximum (CO)	10000	12.7	0.1
	1 hour 99.79th percentile (NO_2)	200	63.7	**31.9**

Note: Values in **bold** are in excess of 1% or 10% (as appropriate) of the relevant EQS.

6.11 The results summarised in Table 6.2 show that the maximum long-term and short-term PCs as a percentage are greater than 1% and 10% of the relevant Environmental Quality Standard (EQS) for NO_2 and benzene. Therefore, a more detailed assessment of NO_2 and benzene is needed that takes into account their background ambient concentrations (AC). The resulting PECs are summarised in Table 6.3.

Table 6.3: Maximum Predicted Environmental Concentrations

Long-term or Short-term	Averaging period (Pollutant)	EQS ($\mu g.m^{-3}$)	AC ($\mu g.m^{-3}$)	Max PEC ($\mu g.m^{-3}$)	Max PEC as % of EQS
Long term	Annual mean (NO_2)	40	14.7	20.6	51.4
	Annual mean (Benzene)	5	0.5	1.4	27.3
Short term	8 hour running maximum (CO)	10000	642.0	654.7	6.5
	1 hour 99.79th percentile (NO_2)	200	29.4	93.1	46.6

Note: AC = ambient concentration, or background

6.12 It can be seen from Table 6.3 that the PECs, which take the background levels into account, are all comfortably below 100% of the EQS. Based on the EA H1 screening methodology, the overall effect is not therefore considered to be significant.

6.13 Dispersion modelling was also undertaken to predict the contributions from the proposed facility at local receptors around the application site as shown on Figure 10.B. The PC and maximum PEC predicted from the proposed gas engines and flare stacks are presented in Table 6.4. These results have been derived based on the very conservative assumption that the gas engines and flare all operate continuously, which cannot happen in practice.

Table 6.4: Predicted Concentrations (µg.m^{-3}) at Sensitive Receptors

	NO_2		CO	Benzene
	1 h	Annual	8 hour	Annual
Receptor ID	99.79%'ile			
11	17.0	0.6	1.9	0.1
12	14.4	0.5	1.8	0.1
13	8.6	0.7	2.2	0.1
14	11.3	1.1	3.2	0.2
15	11.6	2.4	7.1	0.5
16	4.0	0.4	1.4	0.1
17	5.1	0.6	1.9	0.1
EQS	**200**	**40**	**10000**	**5**
Max PC	**17.0**	**2.4**	**7.1**	**0.5**
Max PC as % EQS	**8.5**	**6.0**	**0.1**	**9.3**
AC	**29.4**	**14.7**	**642.0**	**0.5**
Max PEC	**46.4**	**17.1**	**649.1**	**1.0**
Max PEC as % EQS	**23.2**	**42.7**	**6.5**	**20.0**

6.14 It can be seen from Table 6.4 that all predicted concentrations are well below the relevant EQS.

Results of Road Traffic Emissions Modelling

6.15 This section of the chapter summarises the future operational-phase air quality impacts of the key pollutants associated with the development traffic of the proposed scheme.

Nitrogen Dioxide

6.16 Table 6.5 summarises the annual-mean NO_2 concentrations predicted at the façades of existing receptors in the first year in which the development is expected to be operational, 2017.

Table 6.5 Predicted Annual-Mean NO_2 Impacts at Existing Receptors

Receptor	Concentration ($\mu g.m^{-3}$)		With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	With Development		
1	19.7	19.7	0	Negligible
2	19.7	20.0	1	Negligible
3	19.4	19.6	1	Negligible
4	28.0	28.3	1	Negligible
5	23.1	23.3	0	Negligible
6	23.0	23.0	0	Negligible
7	24.6	24.6	0	Negligible
8	23.5	23.6	0	Negligible
9	22.4	22.4	0	Negligible
10	15.9	16.0	0	Negligible
Maximum	**28.0**	**28.3**	**1**	**-**
Minimum	**15.9**	**16.0**	**0**	**-**

6.17 Predicted annual-mean NO_2 concentrations in the opening year at the façades of the existing receptors are well below the AQS objective for NO_2. When the magnitude of change is considered in the context of the absolute concentrations, the impact descriptor is 'negligible' at all receptors.

6.18 Overall, the impact on the surrounding area from NO_2 is considered to be 'negligible', using the criteria adopted for this assessment and based on professional judgement.

6.19 As all predicted annual-mean NO_2 concentrations are below 60 $\mu g.m^{-3}$, the hourly-mean objective for NO_2 is unlikely to be exceeded and is not considered further within this assessment.

Particulate Matter

6.20 Table 6.6 summarises the annual-mean PM_{10} concentrations predicted at the façades of existing receptors.

Table 6.6 Predicted Annual-Mean PM_{10} Impacts at Existing Receptors

Receptor	Concentration (µg.m^{-3})		With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	With Development		
1	15.9	15.9	0	Negligible
2	15.9	15.9	0	Negligible
3	15.8	15.8	0	Negligible
4	17.6	17.6	0	Negligible
5	16.5	16.5	0	Negligible
6	16.5	16.5	0	Negligible
7	17.0	17.0	0	Negligible
8	16.7	16.8	0	Negligible
9	16.5	16.5	0	Negligible
10	15.1	15.1	0	Negligible
Maximum	**17.6**	**17.6**	**0**	**-**
Minimum	**15.1**	**15.1**	**0**	**-**

6.21 Predicted annual-mean PM_{10} concentrations in the opening year at the façades of the existing receptors are well below the AQS objective for PM_{10}. When the magnitude of change is considered in the context of the absolute concentrations, the impact descriptor at all receptors is ‘negligible’.

6.22 Overall, the impact on the surrounding area from PM_{10} is considered to be ‘negligible’, using the criteria adopted for this assessment and based on professional judgement.

6.23 As all predicted annual mean PM_{10} concentrations are below 31.5 µg.m^{-3}, the daily-mean PM_{10} objective is expected to be met and is not considered further within this assessment.

Fine Particulate Matter

6.24 Table 6.7 summarises the annual-mean $PM_{2.5}$ concentrations predicted at the façades of existing receptors.

Table 6.7 Predicted Annual-Mean $PM_{2.5}$ Impacts at Existing Receptors

Receptor	Concentration (µg.m^{-3})		With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	With Development		
1	10.9	10.9	0	Negligible
2	10.9	10.9	0	Negligible
3	10.8	10.8	0	Negligible
4	11.9	11.9	0	Negligible
5	11.2	11.3	0	Negligible
6	11.2	11.2	0	Negligible
7	11.5	11.5	0	Negligible
8	11.4	11.4	0	Negligible
9	11.2	11.2	0	Negligible
10	10.4	10.4	0	Negligible
Maximum	**11.9**	**11.9**	**0**	-
Minimum	**10.4**	**10.4**	**0**	-

AQS objective = 25 µg.m^{-3}

6.25 Predicted annual-mean $PM_{2.5}$ concentrations in the opening year at the façades of the existing receptors are well below the AQS objective for $PM_{2.5}$ at all receptors. When the magnitude of change is considered in the context of the absolute concentrations, the impact descriptor at all receptors is ‘negligible’.

6.26 Overall, the impact on the surrounding area from $PM_{2.5}$ is considered to be ‘negligible’, using the criteria adopted for this assessment and based on professional judgement.

6.27 As the maximum predicted annual-mean $PM_{2.5}$ concentration is below 25 µg.m^{-3} in the opening year, and concentrations of $PM_{2.5}$ are expected to decrease in future years, the AQS objective for $PM_{2.5}$ is expected to be met by a wide margin by its target date of 2020.

Cumulative Impacts

Cumulative Industrial Emissions

6.28 The following facilities which are consented but are not operational have the potential for cumulative air quality impacts:

- Organic Waste Management Ltd bio-energy plant at Lostock Works; and
- Tata Chemicals Europe and E.ON Energy from Waste Ltd Sustainable Energy Plant (SEP) off Griffiths Road, Lostock (also within Lostock Works).

6.29 Predicted contributions for the key pollutants from the two facilities for which cumulative effects are expected are provided below in Table 6.8. The concentration reported in each case is the maximum that was predicted across their relative modelled domains.

Table 6.8: Cumulative Pollutant Concentrations (µg.m^{-3}) Data used in Assessment

Pollutant	Bio-Energy Plant, Lostock Works [(a)]		SEP, Griffiths Road [(b)]	
	Long-Term	Short-Term	Long-Term	Short-Term
CO	-	21.4	-	9.1
NO_2	3.23 (approx. 1 at receptors along Manchester Road)	19.3	2.6 (approx.1.76 at receptors along Manchester Road)	12.1
PM_{10}	0.8	2.12	0.6	0.2
$PM_{2.5}$ *	0.8	2.12	0.6	0.2
Benzene	0.804	-	-	-

[(a)] Data extracted from Appendix 6 of the Environmental Statement, 2007
[(b)] Data extracted from Chapter 7 of the Environmental Statement, 2010
* to ensure a conservative approach, it is assumed that the predicted $PM_{2.5}$ concentration is equal to the predicted PM_{10} concentration

6.30 The maximum predicted ground-level concentration associated with the gas engines and flare stacks in the modelled domain has been derived for each of the five years of meteorological data. In practice, the maximum PCs for each of the proposals would not occur at the same locations and so the cumulative impacts presented by simply adding these together are highly conservative. Typically, the maximum PC for each facility is higher than the highest combined effect. Notwithstanding this, Table 6.9 summarises the predicted Process Contributions (PC) for all pollutants and the resulting Predicted Environmental Concentrations (PEC), i.e. the PC + background, derived by adding each of the maxima.

Table 6.9: Predicted Maximum Process Contributions and Predicted Environmental Concentrations

Averaging period (Pollutant)	EQS (µg.m^{-3})	AC (µg.m^{-3})	Proposed Development PC (µg.m^{-3})	Total PC (Proposed Development + Bio-Energy Plant + SEP) (µg.m^{-3})	Max PEC (µg.m^{-3})	Max PEC as % of EQS
Annual mean (NO_2)	40	14.7	5.9	11.7	26.4	66.0
Annual mean (Benzene)	5	0.5	0.8	1.6	2.1	42.7
8 hour running maximum (CO)	10000	642.0	12.7	43.2	685.2	6.9
1 hour 99.79th percentile (NO_2)	200	29.4	63.7	95.1	124.5	62.3

6.31 Notwithstanding the conservative assumptions discussed above, Table 6.9 shows that the PECs remain below their relevant EQS.

Cumulative Impacts – Manchester Road

6.32 The closest sensitive residential receptors are located along Manchester Road, approximately 180 m north of the proposed development site. Since these receptors are adjacent to a major road, the urban background NO_2 concentration used as the background ambient concentration (AC) in the results tables above may not be representative at these locations. Instead, the most recent and closest roadside monitored NO_2 concentration of 33.4 $\mu g.m^{-3}$ has been used as the AC at these receptors.

6.33 Figure 10.E shows the contour plot for the total annual-mean NO_2 stack emission Process Contribution, including the estimated contributions from the SEP and Bio-Energy Plant, shown in Table 6.8. The majority of the Manchester Road receptors fall between the 4 and 5 $\mu g.m^{-3}$ contours.

6.34 Table 6.10 summarises the highest predicted cumulative annual-mean NO_2 PC and PEC for the residential receptors along Manchester Road.

Table 6.10: Predicted Maximum Process Contributions and Predicted Environmental NO_2 Concentrations along Manchester Road

Averaging period (Pollutant)	EQS ($\mu g.m^{-3}$)	AC ($\mu g.m^{-3}$)	Proposed Development PC ($\mu g.m^{-3}$)	Total PC (Proposed Development + Bio-Energy Plant + SEP) ($\mu g.m^{-3}$)	Max PEC ($\mu g.m^{-3}$)	Max PEC as % of EQS
Annual mean (NO_2)	40	33.4	2.5	5.3	38.7	96.7

6.35 It can be seen from Table 6.10 that the PEC for annual-mean NO_2 remains below the EQS.

Combined Stack and Traffic Effects

6.36 The combined effects of the stacks associated with the proposed development, the stacks associated with committed developments in the area, and the proposed development traffic for NO_2 in the opening year (2017) are presented in Table 6.11.

Table 6.11 Predicted Annual-Mean NO_2 Concentrations

Receptor	Concentration (μg.m^{-3})						
	Without Development	**Traffic Contribution**	**Biogas Engines Stack Contribution**	**Biogas Flare Contribution**	**Bio-Energy Plant Stack Contribution**	**SEP Stack Contribution**	**PEC**
1	19.7	<0.05	0.8	0.1	3.2	2.6	26.3
2	19.7	0.3	0.4	<0.05	3.2	2.6	26.3
3	19.4	0.2	0.4	<0.05	3.2	2.6	25.8
4	28.0	0.3	0.2	<0.05	3.2	2.6	34.3
5	23.1	0.2	0.2	<0.05	3.2	2.6	29.3
6	22.7	0.1	0.1	<0.05	3.2	2.6	29.0
7	24.3	0.1	0.1	<0.05	3.2	2.6	30.6
8	23.2	0.1	0.3	<0.05	3.2	2.6	29.7
9	22.1	0.1	0.4	<0.05	3.2	2.6	28.7
10	15.9	<0.05	0.1	<0.05	3.2	2.6	21.9
Maximum	**28.0**	**0.3**	**0.8**	**0.1**	**3.2**	**2.6**	**34.3**
Minimum	**15.9**	**<0.05**	**0.1**	**<0.05**	**3.2**	**2.6**	**21.9**

6.37 Table 6.11 shows that the combined annual-mean NO_2 concentrations at sensitive receptors affected by both development traffic and stack emissions are below the AQS objective of 40 μg.m^{-3}.

Significance of Effects of Combined Emissions

6.38 The results above, which take into account both the proposed development's traffic and stack emissions, and cumulative emissions from the committed SEP Plant and Bio-Energy Plant, indicate that with the development, the predicted annual-mean NO_2 concentrations at existing receptors are below the relevant AQS objective.

6.39 Using professional judgement, the resulting air quality effect is considered to be not significant overall.

Assessment of Fugitive Dust and Odour Releases

6.40 The proposed development will treat municipal solid waste (MSW), fines supplied from existing intermediary waste transfer and treatment sites, and similar commercial and industrial wastes.

6.41 The waste will be delivered to site in HGVs with enclosed containers. All doors to the waste reception hall and loading hall will remain closed except when vehicles/people exit/ingress and will be automatically closing. The waste reception hall is located on the southern side of the building structure, which is compartmentalised. Air from the waste reception hall and waste bunker will be kept under slight negative pressure.

6.42 The waste reception building will be fully enclosed and the enzymatic process will take place in fully enclosed vessels (‘bioreactors’). Sorting of recovered materials for recycling will take place within the enclosed loading hall. All recyclable materials will be washed using clean water. Secondary odour control will be provided for these areas.

6.43 AD tanks will be fully enclosed to provide a gas seal with pressure drop and gas flow rate monitoring. Digestate will be pumped for dewatering to produce a compost-like output, with water returned to the process loop in a closed system.

6.44 Overflow materials (e.g. clean recyclables) will be baled and stored in an open area but are not expected to be odorous.

6.45 An external store will contain the compost-like output material of low odour potential, which will be roofed and housed within push walls or in containers.

6.46 Aside from bag-opening and the separation of oversized material, no up-front waste shredding or crushing is required on-site.

6.47 There will be an external washing area for HGVs and loaders. A wheel-washing station will be set up at the site entrance to minimise track-out mud onto the access road and consequent dust generation during construction.

Fugitive Odour

6.48 With reference to Table 4.1 in Appendix 10.B, the compounds involved in the proposed facility’s process are moderately to very odorous, which implies a ‘medium’ or ‘large’ Source Odour Potential. However, mitigation is incorporated into the design of the proposed development as described above and within the Odour Management Plan (OMP) and Appendix 10.E, and few residual emissions are expected. Therefore, the Source Odour Potential from the facility is taken to be ‘medium’.

6.49 There are low sensitivity receptors within 20 m of the site boundary, i.e. neighbouring industrial uses. Using the terminology described in Appendix 10.B, the pathway to these receptors is highly effective. The Risk of Odour Exposure for a medium Source Odour Potential and a highly effective pathway is ‘medium’.

6.50 The likely magnitude of odour effect for a medium Risk of Odour Exposure and low Receptor Sensitivity is ‘negligible’. This is summarised in Table 6.12.

Table 6.12 Likely Odour Effects at the Proposed Development Site

Receptor	Source Odour Potential	Pathway Effectiveness	Risk Odour Exposure	Receptor Sensitivity	Likely Odour Effect
Industrial and business users within 20 m of site boundary	Medium	Highly effective	Medium risk	Low	Negligible

Fugitive Dust

6.51 Dust emissions are best mitigated at source and enclosure is a key means of controlling dust emissions. Compost-like material will have a relatively high moisture content and will be covered and protected from the wind or enclosed. Given the level of mitigation control incorporated into the design of the facility the Dust Emission Magnitude is expected to be ‘small’.

6.52 The receptors surrounding the site are industrial and are considered to be ‘low’ sensitivity. On that basis, the sensitivity of the area is considered to be ‘low’.

6.53 For a small Dust Emission Magnitude and a low Area Sensitivity, the risk of dust impacts is ‘negligible’.

Summary

6.54 Based on the results of the risk assessments undertaken, the residual effects from fugitive emissions of dust and odours from the proposed development are not likely to be significant.

Assessment of Bioaerosol Effects

6.55 The proposed development is not expected to result in releases of bioaerosols, given that there will be no shredding or crushing, activities will take place within enclosed buildings, and the waste received is not likely to be in an advanced state of decomposition.

6.56 For the reasons set out above, the probability of harm from bioaerosols is expected to be negligible, given the absence of a source-generation mechanism or any effective pathway to the receptors. The overall risk of bioaerosol impacts is therefore considered to be negligible and no significant effects should result.

Effects on Ecology

6.57 As discussed in Appendix 10.B, a detailed assessment of air quality impacts on nature conservation sites has not been undertaken. ‘Ashton’s and Neumann’s Flashes’ Local Wildlife Site is the closest Local Wildlife Site to the proposed development site. As shown in the contour plot in Figure 10.C, the maximum annual-mean NO_2 PC at this ecological designation is between 0.3 and 0.4 $\mu g.m^{-3}$. Since it has been assumed that 70% of NO_X is converted to NO_2, this implies a maximum annual-mean NO_X PC of 0.6 $\mu g.m^{-3}$ (0.4/0.7 = 0.6). The most recent 3-year average baseline NO_X concentration at this site is 15.82 $\mu g.m^{-3}$, as obtained from the Air Pollution Information System (APIS) for grid reference 366680,374960 [9]. Based on this, a maximum annual-mean NO_X PEC of 16.22 $\mu g.m^{-3}$ is predicted, which is well below the relevant Environmental Assessment Level of 30 $\mu g.m^{-3}$.

Summary of Effects

6.58 As set out in Appendix 10.B, it is generally considered good practice that, where possible, an assessment should communicate effects both numerically and descriptively. Professional judgement by a competent, suitably qualified professional is required to establish the significance associated with the consequence of the impacts.

6.59 Taking into account the predictions for all pollutants, the effects are generally deemed to be not significant, with no predicted exceedences of any objectives or standards at the point of maximum impact or at modelled discrete receptors, alone or in combination. This is based on a highly conservative (worse case) assessment.

6.60 Fugitive emissions of dust, odours and bioaerosols from the process are not anticipated to be significant, given the level of mitigation and control incorporated within the design.

Sensitivity and Uncertainty

6.61 Appendix 10.B provides an analysis of the sources of uncertainty in the results of the assessment. The conclusion of that analysis is that, overall, the predicted total concentration is likely to be towards the top of the uncertainty range rather than being a central estimate. The flare and gas engines were modelled as continuous sources, which is an extremely conservative assumption.

6.62 The impacts at existing receptors are shown to be not significant even for this extremely conservative scenario. Consequently, further sensitivity analysis has not been undertaken and, in practice, the impacts at sensitive receptors are likely to be lower than those reported in this conservative assessment.

7 Mitigation

Construction Phase

7.1 The IAQM dust guidance lists mitigation measures for low, medium and high dust risks. Without mitigation, the air quality impacts during the construction phase of the proposed development are likely to be in the high risk category. A Dust Management Plan (DMP) has been produced and is provided in Annex 2.C.1. The DMP draws on the mitigation measures described as ‘highly recommended’ for high Dust Impact Risk.

7.2 The IAQM dust guidance states that with the recommended dust mitigation measures in place, the residual effect will normally be “*not significant*”. The DMP will be implemented during the construction phase, which can be secured by a planning condition.

Operational Phase

7.3 Predicted concentrations of pollutants from the operational phase of the proposed facility have been demonstrated by the assessment to meet all relevant air quality standards and objectives. No further mitigation is required in addition to that incorporated into the design of the scheme.

7.4 The level of mitigation already incorporated within the design of the proposed facility should ensure no significant fugitive emissions of dust, odours and bioaerosols.

8 Conclusions

8.1 This Air Quality Assessment has been undertaken to support the planning application for the proposed REnescience Northwich development off the A530 Griffiths Road, near Northwich and Lostock Gralam, Cheshire.

8.2 The assessment has considered effects of nuisance dust during the construction phase of the development; and traffic, point and fugitive emissions to air during the operation of the proposed facility.

8.3 The IAQM dust guidance lists mitigation measures for low, medium and high dust risks. Without any mitigation, the air quality impacts during the construction phase of the proposed development are likely to be in the high risk category. A Dust Management Plan (DMP) has been produced and is provided in Annex 2.C.1. With the recommended dust mitigation measures in place, the residual effect will be "*not significant*".

8.4 The effects of emissions from the facility's biogas engines stack and flare stack have been predicted using best practice approaches. The assessment has been undertaken based on a number of worst-case assumptions, including using the worst-case meteorological conditions and modelling the stacks and the flare as continuous emissions sources, which cannot happen in practice. The results show that the Predicted Environmental Concentrations are below the relevant air quality standards and no significant impact is predicted.

8.5 No significant cumulative effects are predicted, taking account of other consented but not yet operational schemes, including the Tata SEP and Organic Waste Management Bio-Energy Plant at Lostock Works.

8.6 Regarding the operational impact of the development traffic on the surrounding area, detailed atmospheric dispersion modelling has been undertaken for the first year in which the development is expected to be fully operational, 2017. The operational impact of the development on existing receptors in the local area due to road traffic emissions is predicted to be 'negligible', taking into account the changes in pollutant concentrations and absolute levels. Using the significance criteria adopted for this assessment together with professional judgement, the overall impact on the area as a whole is considered to be 'negligible'.

8.7 The level of mitigation already incorporated within the design of the proposed facility should ensure no significant fugitive emissions of dust, odours and bioaerosols. An Odour Management Plan (OMP) has been produced and is provided in Appendix 10.E. This will form one of the management plans for the Environmental Permit.

References

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3 Local Air Quality Management Technical Guidance, 2009 (LAQM.TG(09))

4 IAQM (2014) Guidance on the Assessment of Odour for Planning

5 Email from Kate Davis to Rosemary Challen, dated 31/07/2015

6 Defra Maps (2015) Accessed at http://laqm.defra.gov.uk/maps/maps2010.html#About2010

7 Cheshire West and Chester Council, letter to Tom Dearing dated 13/08/2015 (ref. 15/02915/EIA)

8 Email from Laura Hughes to Rosemary Challen dated 19/08/2015

9 http://www.apis.ac.uk/queryLocationCheckbox-result?gridRef=366680%2C374960&gridType=UkOs&dropDownHabitat=Wood-Pasture+%26+Parkland&pollutants%5B%5D=NO&agreement=agree&submit=See+the+results last accessed 26/08/2015

10 Council Directive 2008/50/EC of 21 May 2008 on ambient air quality and cleaner air for Europe.

11 Defra, 2010, The Air Quality Standards (England) Regulations.

12 OPSI, 2010, The Environmental Permitting (England and Wales) Regulations 2010.

13 Directive 1996/61/EC of 24 September 1996 concerning Integrated Pollution Prevention and Control.

14 Defra, 2007, The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. Volume 2.

15 Environment Agency, 2010, Environmental Permitting Regulations (EPR) – H1 Environmental Risk Assessment, Annex K.

16 Environment Agency, 2011, H4 Odour Management

17 Communities and Local Government, March 2012, National Planning Policy Framework

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Appendix 10.A: Policy and Legislative Context

Ambient Air Quality Legislation and National Policy

The Ambient Air Quality Directive and Air Quality Standards Regulations

The 2008 Ambient Air Quality Directive (2008/50/EC) [10] aims to protect human health and the environment by avoiding, reducing or preventing harmful concentrations of air pollutants; it sets legally binding concentration-based limit values, as well as target values. There are also information and alert thresholds for reporting purposes. These are to be achieved for the main air pollutants: particulate matter (PM_{10} and $PM_{2.5}$), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), ozone (O_3), carbon monoxide (CO), lead (Pb) and benzene. This Directive replaced most of the previous EU air quality legislation and in England was transposed into domestic law by the Air Quality Standards (England) Regulations 2010 [11], which in addition incorporates the 4th Air Quality Daughter Directive (2004/107/EC) that sets targets for ambient air concentrations of certain toxic heavy metals (arsenic, cadmium and nickel) and polycyclic aromatic hydrocarbons (PAHs). Equivalent regulations exist in Scotland, Wales and Northern Ireland. Member states must comply with the limit values (which are legally binding on the Secretary of State) and the Government and devolved administrations operate various national ambient air quality monitoring networks to measure compliance and develop plans to meet the limit values.

European Legislation

Certain industrial installations and waste management facilities are regulated under the Environmental Permitting Regulations (EPR) 2010 [12], which implement in England and Wales the EU Directive 2008/1/EC concerning Integrated Pollution Prevention and Control ("the IPPC Directive") [13] and the Waste Framework Directive. The EPR define activities that require the operator to obtain an Environmental Permit from the Environment Agency (EA).

On 24 November 2010, Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control) (Recast) ("the IED") was published. The IED repeals the IPPC Directive (2008/1/EC) from 7 January 2014.

UK Air Quality Strategy

The Environment Act 1995 established the requirement for the Government and the devolved administrations to produce a National Air Quality Strategy (AQS) for improving ambient air quality, the first being published in 1997 and having been revised several times since, with the latest published in 2007

[14]. The Strategy sets UK air quality standards♦ and objectives# for the pollutants in the Air Quality Standards Regulations plus 1,3-butadiene and recognises that action at national, regional and local level may be needed, depending on the scale and nature of the air quality problem. There is no legal requirement to meet objectives set within the UK AQS except where equivalent limit values are set within the EU Directives.

The 1995 Environment Act also established the UK system of Local Air Quality Management (LAQM), that requires local authorities to go through a process of review and assessment of air quality in their areas, identifying places where objectives are not likely to be met, then declaring Air Quality Management Areas (AQMAs) and putting in place Air Quality Action Plans to improve air quality. These plans also contribute, at local level, to the achievement of EU limit values. Defra is currently reviewing the LAQM process.

For the purposes of this assessment, the limit values set out in the Air Quality Standards Regulations 2010 and the objective levels specified under the current UK AQS have been used. There is no legal requirement to meet objectives set within the UK AQS except where equivalent limit values are set within the EU Directives.

The limit values and objectives relevant to this assessment are summarised in Table A.1.

Table A.1 Summary of Relevant Air Quality Limit Values and Objectives

Pollutant	Averaging Period	Objectives/ Limit Values	Not to be Exceeded More Than	Target Date
Nitrogen Dioxide (NO_2)	1 hour	200 $\mu g.m^{-3}$	18 times per calendar year (99.79th percentile)	-
	Annual	40 $\mu g.m^{-3}$	-	-
Particulate Matter (PM_{10})	24 Hour	50 $\mu g.m^{-3}$	35 times per calendar year (99.9th percentile)	-
	Annual	40 $\mu g.m^{-3}$	-	-
Particulate Matter ($PM_{2.5}$)	Annual	Target of 15% reduction in concentrations at urban background locations	-	Between 2010 and 2020 (a)
		Variable target of up to 20% reduction in concentrations at urban background		Between 2010 and 2020 (b)

♦ Standards are concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. Standards, as the benchmarks for setting objectives, are set purely with regard to scientific evidence and medical evidence on the effects of the particular pollutant on health, or on the wider environment, as minimum or zero risk levels.

Objectives are policy targets expressed as a concentration that should be achieved, all the time or for a percentage of time, by a certain date.

Pollutant	Averaging Period	Objectives/ Limit Values	Not to be Exceeded More Than	Target Date
		locations (c)		
	Annual	25 µg.m^{-3}	-	01.01.2020 (a)
		25 µg.m^{-3}		01.01.2015 (b)
Carbon monoxide (CO)	Maximum daily running 8 hour mean	10,000 µg.m^{-3}	-	-
Benzene	Annual	5 µg.m^{-3}	-	-

(a) Target date set in UK Air Quality Strategy 2007
(b) Target date set in Air Quality Standards Regulations 2010
(c) Aim to not exceed 18 µg.m^{-3} by 2020
* Applies to vegetation and ecosystems

Environmental Permitting Regulations

EPR is a regulatory system to control the environmental and health impacts across all environmental media (using an integrated approach) of certain listed industrial and waste activities, via a single permitting process. To gain a permit, operators have to demonstrate in their applications, in a systematic way, that the techniques they are using or are proposing to use for their installation are the Best Available Techniques (BAT) to prevent or minimise the effects of the activity on air, land and water taking account of relevant local factors. The permitting process also places a duty on the regulating body to ensure that the requirements of the IPPC Directive are included for permitted sites to which these apply.

The EA also regulates under EPR those facilities where waste is handled, stored, treated or disposed of, such as landfills, waste transfer and treatment facilities. Some of these facilities are issued with a permit and some are exempt from the need for a permit but do have to be registered with the Agency. Prior to EPR, these had been regulated under the Waste Management Licensing (WML) regime, with the Waste Management Licensing Regulations 1994 implementing the Waste Framework Directive (WFD) in the UK. These regulations covered activities where waste is recovered or disposed of and placed a duty on operators to apply best practice *“to ensure that waste is managed properly, recovered or disposed of safely and does not cause harm to human health or pollution of the environment”*. This duty to apply appropriate measures has been transferred into EPR for waste operations.

It is a mandatory requirement of EPR that the EA ensures that no single industrial installation or waste operation regulated is the sole cause of a breach of a UK air quality objective. Additionally, the Agency has committed to guarantee that no installation or waste operation will contribute significantly to a breach of a UK air quality objective.

To do this the Agency will ensure that BAT and other appropriate measures (in the case of waste management sites) are used to deliver the maximum improvements to air quality where UK air quality objectives are in danger of being breached.

The essence of BAT is that the techniques selected to protect the environment should achieve a high degree of protection of people and the environment taken as a whole. Indicative BAT standards are laid out in national guidance and where relevant, should be applied unless a different standard can be justified for a particular installation. The EA may seek to impose lower emissions limits where EU Air Quality Limit Values may be exceeded as a result of the proposals.

The Environment Agency has published guidance on assessment of environmental impacts of regulated processes. Of particular relevance to this application are: Horizontal Guidance Note EPR H1 on Environmental Risk Assessment [15], which provides guidelines for atmospheric dispersion modelling; and Horizontal Guidance H4 [16] on Odour Management, which gives more detailed technical guidance on odour.

National Planning Policy

National Planning Policy Framework

The National Planning Policy Framework (NPPF) [17] is a material consideration for local planning authorities and decision-takers in determining applications. At the heart of the NPPF is a presumption in favour of sustainable development. For determining planning applications, this means approving development proposals if they accord with the local development plan, unless material considerations indicate otherwise. If the development plan is absent, silent or the policies are out of date, then planning permission should be granted unless any adverse impacts would significantly outweigh the benefits, or specific policies in the NPPF indicate development should be restricted.

The NPPF sets out 12 core land-use planning principles. The relevant core-principle in the context of this air quality assessment is that planning should "*contribute to conserving and enhancing the natural environment and reducing pollution*". (Paragraph 17)

As stated in the NPPF, pollution is "*anything that affects the quality of land, air, water or soils, which might lead to an adverse impact on human health, the natural environment or general amenity. Pollution can arise from a range of emissions, including smoke, fumes, gases, dust, steam, odour, noise and light*." The term 'pollution' can therefore be seen to include odour explicitly and also bioaerosols implicitly.

Under the heading 'Conserving and Enhancing the Natural Environment', the NPPF states:

"The planning system should contribute to and enhance the natural and local environment by:

- *…*
- *preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability… "* (Paragraph 109)

National Planning Practice Guidance

The national Planning Practice Guidance (nPPG) was issued on-line on 6th March 2014 and will be updated by government as a live document. The Air Quality section of the nPPG describes the circumstances when air quality, odour and dust can be a planning concern, requiring assessment.

The nPPG advises that whether or not air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to generate air quality impact in an area where air quality is known to be poor. They could also arise where the development is likely to adversely impact upon the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation (including that applicable to wildlife).

The nPPG states that when deciding whether air quality is relevant to a planning application, considerations could include whether the development would:

- *“Significantly affect traffic in the immediate vicinity of the proposed development site or further afield. This could be by generating or increasing traffic congestion; significantly changing traffic volumes, vehicle speed or both; or significantly altering the traffic composition on local roads. Other matters to consider include whether the proposal involves the development of a bus station, coach or lorry park; adds to turnover in a large car park; or result in construction sites that would generate large Heavy Goods Vehicle flows over a period of a year or more.*
- *Introduce new point sources of air pollution. This could include furnaces which require prior notification to local authorities; or extraction systems (including chimneys) which require approval under pollution control legislation or biomass boilers or biomass-fuelled CHP plant; centralised boilers or CHP plant burning other fuels within or close to an air quality management area or introduce relevant combustion within a Smoke Control Area;*
- *Expose people to existing sources of air pollutants. This could be by building new homes, workplaces or other development in places with poor air quality.*
- *Give rise to potentially unacceptable impact (such as dust) during construction for nearby sensitive locations.*
- *Affect biodiversity. In particular, is it likely to result in deposition or concentration of pollutants that significantly affect a European-designated wildlife site, and is not directly connected with or necessary to the management of the site, or does it otherwise affect biodiversity, particularly designated wildlife sites.”*

The nPPG provides advice on how air quality impacts can be mitigated and notes *“Mitigation options where necessary will be locationally specific, will depend on the proposed development and should be proportionate to the likely impact. It is important therefore that local planning authorities work with applicants to consider appropriate mitigation so as to ensure the new development is appropriate for its location and unacceptable risks are prevented. Planning conditions and obligations can be used to secure mitigation where the relevant tests are met.*

Local Planning Policy

The Cheshire West and Chester Local Plan was adopted on 29 January 2015 and forms part of the statutory development plan for the borough, setting out policies to 2030.

The following policies in the Local Plan relate to air quality:

“SOC 5

Health and well-being

…

Development that gives rise to significant adverse impacts on health and quality of life (e.g. soil, noise, water, air or light pollution, and land instability, etc) including residential amenity, will not be allowed.”

Following the adoption of the Local Plan, some policies in the former district and county local plans were retained, including the following policy in the Vale Royal Borough Local Plan:

“***Policy BE1 - Safeguarding and Improving the Quality of the Environment***

Proposals for all new development will be expected to achieve a high standard of design. To safeguard the quality of the existing built environment and, wherever possible improve and enhance the environment all development will be assessed against the following considerations; where they are relevant to the development:

(i) *It should not have a significantly detrimental effect on the amenities of the people living nearby by reason of overshadowing, overlooking, visual impact, noise and disturbance, odour or in any other material way;*

…

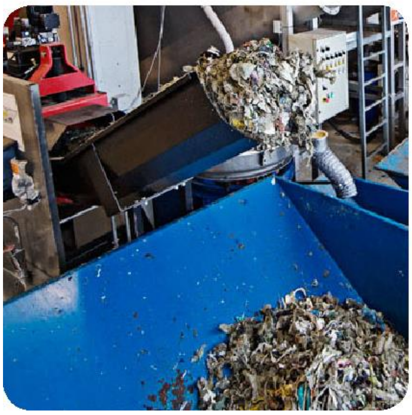
(vii) *It should not increase land, air, noise, light or water pollution to unacceptable levels and where possible should reduce levels. …*”

Appendix 10.B: Detailed Air Quality Assessment Methodology

REnescience Northwich







Quality Management

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Date of issue:	02 October 2015		**Revision number:**	1
Project number:	JAS8407			
Document file path:	O:\Jobs_8001-9000\8407s\Info_share\ES_submission\Final_Word\Vol3_Appendices\V3A10.B_Detailed_Assessment_Methodology.docx			

Revision History				
Rev	**Date**	**Status**	**Reason for revision**	**Additional comments**
0	06/08/15	Draft	-	-
1	02/10/15	Final	Comments	-

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1 Construction Phase – Methodology

Construction Traffic

1.1 Exhaust emissions from construction-related vehicles (contractors' vehicles and Heavy Goods Vehicles (HGVs), diggers, and other diesel-powered vehicles) are unlikely to have a significant impact on local air quality except for large, long-term construction sites: the EPUK/IAQM Land-Use Planning & Development Control: Planning For Air Quality document indicates that air quality assessments should include developments increasing annual average daily Heavy Duty Vehicle (HDV) traffic flows by more than 25 within or adjacent to an AQMA and more than 100 elsewhere. The results of the Highways and Access assessment indicates that the aforementioned EPUK/IAQM thresholds are not expected to be exceeded for any individual road during the construction phase of this project; therefore, construction-vehicle exhaust emissions have not been assessed specifically.

Construction Dust

1.2 Dust is the generic term used to describe particulate matter in the size range 1-75 µm in diameter [1]. Particles greater than 75 µm in diameter are termed grit rather than dust. Dusts can contain a wide range of particles of different sizes. The normal fate of suspended (i.e. airborne) dust is deposition. The rate of deposition depends largely on the size of the particle and its density; together these influence the aerodynamic and gravitational effects that determine the distance it travels and how long it stays suspended in the air before it settles out onto a surface. In addition, some particles may agglomerate to become fewer, larger particles; whilst others react chemically.

1.3 The effects of dust are linked to particle size and two main categories are usually considered:

- PM_{10} particles, those up to 10 µm in diameter, remain suspended in the air for long periods and are small enough to be breathed in and so can potentially impact on health; and
- Dust, generally considered to be particles larger than 10 µm which fall out of the air quite quickly and can soil surfaces (e.g. a car, window sill, laundry). Additionally, dust can potentially have adverse effects on vegetation and fauna at sensitive habitat sites.

1.4 The Institute of Air Quality Management (IAQM) *Guidance on the assessment of dust from demolition and construction* sets out 350 m as the distance from the site boundary and 50 m from the site traffic route(s) up to 500 m of the entrance, within which there could potentially be nuisance dust and PM_{10} effects on human receptors. For sensitive ecological receptors, the corresponding distances are 50 m in both cases. (In this particular application, there are no ecological receptors within the distances and ecological effects have been scoped out). These distances are set to be deliberately conservative.

1.5 Concentration-based limit values and objectives have been set for the PM_{10} suspended particle fraction, but no statutory or official numerical air quality criterion for dust annoyance has been set at a UK, European or World Health Organisation (WHO) level. Construction dust assessments have tended to be risk based, focusing on the appropriate measures to be used to keep dust impacts at an acceptable level.

1.6 The IAQM dust guidance aims to estimate the impacts of both PM_{10} and dust through a risk-based assessment procedure. The IAQM dust guidance document states: *"The impacts depend on the mitigation measures adopted. Therefore the emphasis in this document is on classifying the risk of dust impacts from a site, which will then allow mitigation measures commensurate with that risk to be identified."*

1.7 The IAQM dust guidance provides a methodological framework, but notes that professional judgement is required to assess effects: "*This is necessary, because the diverse range of projects that are likely to be subject to dust impact assessment means that it is not possible to be prescriptive as to how to assess the impacts. Also a wide range of factors affect the amount of dust that may arise, and these are not readily quantified*."

1.8 Air quality impacts of dust from any contaminated land or buildings have not been considered in the air quality assessment. If contaminated land is identified on the Application Site, the impacts will be assessed in other technical discipline reports.

2 Operational Phase – Point Sources and Traffic Impacts Assessment Methodology

Atmospheric Dispersion Modelling of Pollutant Concentrations

2.1 In urban areas, pollutant concentrations are primarily determined by the balance between pollutant emissions that increase concentrations, and the ability of the atmosphere to reduce and remove pollutants by dispersion, advection, reaction and deposition. An atmospheric dispersion model is used as a practical way to simulate these complex processes; such a model requires a range of input data, which can include emissions rates, meteorological data and local topographical information. The model used and the input data relevant to this assessment are described in the following sub-sections.

2.2 The atmospheric pollutant concentrations in an urban area depend not only on local sources at a street scale, but also on the background pollutant level made up of the local urban-wide background, together with regional pollution and pollution from more remote sources brought in on the incoming air mass. This background contribution needs to be added to the fraction from the modelled sources, and is usually obtained from measurements or estimates of urban background concentrations for the area in locations that are not directly affected by local emissions sources. Background pollution levels are described in detail in Section 4 of the Air Quality Assessment Chapter.

Methodology – Operational Effects (Emissions from Industrial Point Sources)

Model Selection

2.3 A number of commercially available dispersion models are able to predict ground level concentrations arising from emissions to atmosphere from elevated point sources. Modelling for this study has been undertaken using ADMS 5, a version of the ADMS (Atmospheric Dispersion Modelling System) developed by Cambridge Environmental Research Consultants (CERC) that models a wide range of buoyant and passive releases to atmosphere either individually or in combination. The model calculates the mean concentration over flat terrain and also allows for the effect of plume rise, complex terrain, buildings and deposition. Dispersion models predict atmospheric concentrations within a set level of confidence and there can be variations in results between models under certain conditions; the ADMS 5 model has been formally validated and is widely used in the UK and internationally for regulatory purposes.

2.4 ADMS comprises a number of individual modules each representing one of the processes contributing to dispersion or an aspect of data input and output. Amongst the features of ADMS are:

- An up-to-date dispersion model in which the boundary layer structure is characterised by the height of the boundary layer and the Monin-Obukhov length, a length scale dependent on the friction velocity and the heat flux at the surface. This approach allows the vertical structure of the boundary layer, and hence concentrations, to be calculated more accurately than does the use of Pasquill-Gifford stability categories, which were used in many previous models (e.g. ISCST3). The restriction implied by the Pasquill-Gifford approach that the dispersion parameters are independent of height is avoided. In ADMS the concentration distribution is Gaussian in stable and neutral conditions, but the vertical distribution is non-Gaussian in convective conditions, to take account of the skewed structure of the vertical component of turbulence;

- A number of complex modules including the effects of plume rise, complex terrain, coastlines, concentration fluctuations and buildings; and
- A facility to calculate long-term averages of hourly mean concentration, dry and wet deposition fluxes and radioactivity, and percentiles of hourly mean concentrations, from either statistical meteorological data or hourly average data.

Approach

2.5 The approach to the assessment of emissions from the exhaust stacks has involved the following key elements:

- Establishing the background Ambient Concentration (AC) from consideration of Air Quality Review & Assessment findings and assessment of existing local air quality through a review of available air quality monitoring and Local Air Quality Management (LAQM) projections in the vicinity of the proposed site.
- Quantitative assessment of the operational effects on local air quality from stack emissions utilising a “new generation” Gaussian dispersion model, ADMS.
- Assessment of Process Contributions (PC) from the facility in isolation, and assessment of resultant Predicted Environmental Concentrations (PEC) taking into account cumulative impacts through incorporation of the AC.
- Comparison of the PEC with the relevant air quality objective.

Stack Height Determination

2.6 Even with all appropriate emission controls in place, there is still the need to discharge the exhaust gases through an elevated stack to allow dispersion and dilution of the residual combustion emissions. The stack needs to be of sufficient height to ensure that combustion emission concentrations are acceptable by the time they reach ground level. The stack also needs to be high enough to ensure that this is not within the aerodynamic influence of nearby buildings, or else wake effects can quickly bring the undiluted plume down to the ground.

2.7 Local pollutant concentrations are primarily determined by the balance between pollutant emissions that increase concentrations, and the ability of the atmosphere to reduce and remove pollutants by dispersion, advection, reaction and deposition. An atmospheric dispersion model is used as a practical way to simulate these complex processes; such a model requires a range of input data, which can include emission rates, meteorological data and local topographical information. A stack height determination ensures that ground level concentrations of the released pollutants remain within acceptable limits.

2.8 A stack height determination has been undertaken for the biogas engines stack to establish the height at which there is minimal additional environmental benefit associated with the cost of further increasing the stack. This is consistent with the approach set out in the EA's Horizontal Guidance Note EPR H1 [2], which requires the identification of "*an option that gives acceptable environmental performance but balances costs and benefits of implementing it*."

2.9 The stack height determination has focussed on identifying the stack height required to overcome the wake effects of nearby buildings. This involved running a series of atmospheric dispersion modelling simulations to predict the ground-level concentrations with the stack at different heights: starting at 15 metres and extending up in 3 metre increments, until a height of 45 metres was reached. The simulations took into account the full range of all likely meteorological conditions by considering five years of hourly sequential meteorological data from a representative measuring station (Manchester Ringway). The model therefore considered dispersion under 43,800 (i.e. 24 x 365 x 5) combinations of hourly-average metrological conditions. Modelling was carried out over a domain of 10 km by 10 km centred on the stack, with a grid spacing of 50 m. Results have been reported for the location where the highest concentration was predicted.

2.10 The detailed methodology for the modelling described in the following sections applies to both the stack height determination and the full assessment.

Meteorological Data

2.11 The most important meteorological parameters governing the atmospheric dispersion of pollutants are wind direction, wind speed and atmospheric stability as described below:

- Wind direction determines the sector of the compass into which the plume is dispersed;
- Wind speed affects the distance that the plume travels over time and can affect plume dispersion by increasing the initial dilution of pollutants and inhibiting plume rise; and
- Atmospheric stability is a measure of the turbulence of the air, and particularly of its vertical motion. It therefore affects the spread of the plume as it travels away from the source. New generation dispersion models, including ADMS, use a parameter known as the Monin-Obukhov length that, together with the wind speed, describes the stability of the atmosphere.

2.12 For meteorological data to be suitable for dispersion modelling purposes, a number of meteorological parameters need to be measured on an hourly basis. These parameters include wind speed, wind direction, cloud cover and temperature. There are only a limited number of sites where the required meteorological measurements are made.

2.13 The year of meteorological data that is used for a modelling assessment can have a significant effect on source contribution concentrations. Dispersion model simulations were performed using five years of data from Manchester Ringway (approximately 16 km north-east of the proposed development) between 2010 and 2014.

2.14 Wind roses have been produced for each of the years of meteorological data used in this assessment and are presented in Figure 10.A.

Emissions Parameters and Rates used in the Model

2.15 The biogas engines are expected to run for up to 8,000 hours per year, allowing for planned maintenance downtime. The flare is expected to run intermittently throughout the year. The start-up boiler is expected to run for no more than four weeks in a year, only to provide start-up heat to the process following shutdown for planned maintenance. As such, the biogas engines and start-up boiler are not expected to run at the same time. Overall, the mass emissions associated with the start-up boiler are significantly less than those associated with the biogas engines (NO_X mass emission rates for the start-up boiler are approximately 2% of those for the biogas engines). Modelling has been undertaken for the biogas engines and the biogas flare on the conservative assumption that they will run all year round for 8,760 hours. No modelling has been undertaken for the start-up boiler specifically; however, it is considered that its effects are included within the modelling of the biogas engines and flare, as the additional 760 hours more than compensates for the likely emissions associated with the start-up boiler.

2.16 Stack emissions characteristics are provided in Table 2.1 and the mass emission rates for the relevant pollutants emitted are summarised in Table 2.2.

Table 2.1: Stack Emission Characteristics

Parameter	Unit	Biogas Engines Stack	Biogas Flare
Stack Height	m	33 [(a)]	10
Location (x, y)	m	(367984.9, 374124.7)	(367981.3, 374122.4)
Effective diameter	m	0.87	1.80
Efflux velocity	$m.s^{-1}$	19.3	10.7
Efflux temperature	^oC	120	1050
Actual volumetric flow	$Am^3.hr^{-1}$	11.40	27.23

Notes: (a) Stack height based on results of stack height determination in Appendix 10.D

Table 2.2: Mass Emissions of Released Pollutants

Pollutants	Mass Emission Rate ($g.s^{-1}$)	
	Biogas Engines Stack	Biogas Flare
CO	10.31	0.06
NO_x	4.30	0.52
VOCs (not including methane)	0.64	-
Unburned hydrocarbons	-	0.01

NO_x to NO_2 Relationship

2.17 The NOx emissions will typically comprise approximately 90-95% nitrogen monoxide (NO) and 5-10% nitrogen dioxide (NO_2) at source. The NO oxidises in the atmosphere in the presence of sunlight, ozone and volatile organic compounds to form NO_2, which is the principal concern in terms of environmental health effects.

2.18 There are various techniques available for estimating the proportion of NOx converted to NO_2. The methods used in this assessment are discussed below.

Assumptions for Annual-Mean Calculations

2.19 Total conversion (i.e. 100%) of NO to NO_2 is sometimes used for the estimation of the absolute upper limit of the annual mean NO_2. This technique is based on the assumption that all NO emitted is converted to NO_2 before it disperses to ground level. However, it should be noted that even at ambient concentrations a proportion of NO_X remains in the form of NO. Total conversion is, therefore, an unrealistic assumption, particularly in the near field.

2.20 The Environment Agency [3] has recommended that for a 'worst case scenario', a 70% conversion of NO to NO_2 should be considered for calculation of annual average concentrations. If a breach of the annual average NO_2 objective/limit value occurs, the Environment Agency requires a more detailed assessment where operators are asked to justify the use of percentages lower than 70%.

2.21 For the purposes of this assessment, a 70% conversion of NO to NO_2 is assumed for annual average NO_2 concentrations in line with the Environment Agency's recommendations.

Assumptions for Hourly-Mean Calculations

2.22 For the calculation of short-term contributions from the stack emissions to ground level concentrations of NO_2, 35% of the modelled NO_x was added to the background concentration of NO_2.

2.23 An assumed conversion of 35% follows the Environment Agency's recommendations for the calculation of 'worst case scenario' short-term NO_2 concentrations [19]. If a breach of the hourly NO_2 objective/limit value is predicted on this basis, the Environment Agency requires a more detailed assessment where operators are asked to justify their use of percentages lower than 35%.

Modelling of Long-term and Short-term Emissions

2.24 Long-term (annual-mean) NO_2 and benzene, and short-term (8-hour) CO have been modelled for comparison with the relevant annual mean objectives.

2.25 For short-term NO_2, the objective is for the hourly-mean concentration not to exceed 200 $\mu g.m^{-3}$ more than 18 times per calendar year. As there are 8,760 hours in a year, the hourly-mean concentration would need to be below 200 $\mu g.m^{-3}$ in 8,742 hours, i.e. 99.79% of the time. Therefore, the 99.79th percentile of hourly NO_2 has been modelled.

Terrain

2.26 The presence of elevated terrain can significantly affect (usually increase) ground level concentrations of pollutants emitted from elevated sources such as stacks, by reducing the distance between the plume centre line and ground level and by increasing turbulence and, hence, plume mixing.

2.27 The terrain in the area of the site for the proposed facility is generally flat but with hills to the north and west of the site. These slopes are considered potentially significant in terms of their effect on the dispersion of pollutants. On this basis, terrain data have been included in the dispersion model.

Surface Roughness

2.28 The roughness of the terrain over which a plume passes can have a significant effect on dispersion by altering the velocity profile with height, and the degree of atmospheric turbulence. This is accounted for by a parameter called the surface roughness length.

2.29 A surface roughness length of 0.5 m has been assigned during the meteorological processing in ADMS 5, to represent the average urban surface characteristics across the study area.

Building Wake Effects

2.30 The movement of air over and around buildings generates areas of flow circulation, which can lead to increased ground level concentrations in the building wakes. Where building heights are greater than about 30 - 40% of the stack height, downwash effects can be significant. The dominant structure (i.e. with the greatest dimensions likely to promote turbulence) included within the model are listed in Table 2.3.

Table 2.3: Dimensions of Buildings Included Within the Dispersion Model

Building	National Grid Reference of Building Centre	Height (m)	Length/Width or Diameter (m)	Angle (^{o}) from North
Bunker Hall	367941, 374191	24	32/29	342
Reception Hall	367967, 374194	11.2	21/21	342
Sorting Hall	367931, 374233	14.5	57/20	342
Digester Tank 1	367859, 374205	20	32	-
Digester Tank 2	367855, 374171	20	32	-
Digester Tank 3	367889, 374161	20	32	-
Digester Tank 4	367863, 374136	20	32	-

Methodology – Operational Traffic Effects

Overview

2.31 The air quality impacts associated with the changes in traffic flow characteristics on the local road network have been assessed using ADMS-Roads, a version of the Atmospheric Dispersion Modelling System (ADMS).

2.32 The following scenarios were modelled:

- Without Development – without the Proposed Development in the first year that the development is expected to be fully operational year, 2017; and
- With Development – with the Proposed Development in the first year that the development is expected to be fully operational year, 2017.

Traffic Data

2.33 Traffic data used in the assessment have been provided by the project's transport consultants. The traffic flow data provided for this assessment are summarised in Table 2.4. The modelled road links are illustrated in Figure 10.B.

Table 2.4 Traffic Data Used Within the Assessment

Road Link ID	Road Link Name	Speed (km.hr^{-1})	Daily Two Way Vehicle Flow					
			Base Flows (2015)		Without Development (2017)		With Development (2017)	
			LDV	HDV	LDV	HDV	LDV	HDV
1	A350 - Griffiths Road (North of Site Access)	63	7236	219	8240	225	8246	225
2	Site access	37	538	108	1368	110	1406	202
3	A350 - Griffiths Road (South of Site)	72	7401	292	5057	622	5088	713
4	A530 - North of A556	51	13802	411	16358	726	16385	817
5	A556 - East	69	27610	1861	29546	2064	29546	2112
6	A530 - South of A556	66	14445	1177	15602	1298	15606	1319
7	A556 - West	68	23990	1609	25393	1715	25423	1739

Notes: (km.hr^{-1}) = kilometres per hour
HDV = Heavy Duty Vehicle - vehicles greater than 3.5 t gross vehicle weight including buses
LDV = Light Duty Vehicle

2.34 The average speed on each road has been reduced by 10 km.hr^{-1} near junctions and at roundabouts to take into account the possibility of slow moving traffic, in accordance with LAQM.TG(09).

Emission Factors

2.35 The modelling has been undertaken using Defra's 2014 emission factor toolkit (version 6.0) which draws on emissions generated by the European Environment Agency (EEA) COPERT 4 (v10) emission calculation tool.

Meteorological Data

2.36 One year of meteorological data for Manchester Ringway (2014) has been used within the ADMS-Roads model.

Long-term Pollutant Predictions

2.37 Annual-mean NO_x and PM_{10} concentrations have been predicted at selected sensitive receptors using ADMS-Roads, then added to relevant background concentrations. Primary NO in the NO_X emissions is converted to NO_2 to a degree determined by the availability of atmospheric oxidants locally and the strength of sunlight. For road traffic sources, annual-mean NO_2 concentrations have been derived from the modelled road-related annual-mean NO_x concentration using the Defra LAQM.TG(09) calculator [4].

Short-term Pollutant Predictions

2.38 In order to predict the likelihood of exceedences of the hourly-mean AQS objectives for NO_2 and the daily-mean AQS objective for PM_{10}, the following relationships between the short-term and the annual-mean values at each receptor have been considered.

2.39 Research undertaken in support of LAQM.TG(09) has indicated that the hourly-mean limit value and objective for NO_2 is unlikely to be exceeded at a roadside location where the annual-mean NO_2 concentration is less than 60 µg.m^{-3}. In May 2008, a re-analysis of the relationship between annual and hourly-mean NO_2 concentrations was undertaken using data collated between 2003 and 2007 [5]. The conclusions and recommendations of that report are:

"Analysis shows that statistically, on the basis of the dataset available here, the chance of measuring an hourly nitrogen dioxide objective exceedence whilst reporting an annual-mean NO_2 of less than 60 µg.m^{-3} is very low….

It is therefore recommended that local authorities continue to use the threshold of 60 µg.m^{-3} NO_2 as the guideline for considering a likely exceedence of the hourly-mean nitrogen dioxide objective."

2.40 The number of exceedences of the daily-mean AQS objective for PM_{10} of 50 µg.m^{-3} may be estimated using the relationship set out in LAQM.TG(09):

*Number of Exceedences of Daily Mean of 50 µg.m^{-3} = -18.5 + 0.00145 * (Predicted Annual-mean $PM_{10})^3$ + 206 / (Predicted Annual-mean PM_{10} Concentration)*

2.41 This relationship suggests that the daily-mean AQS objective for PM_{10} is likely to be met if the predicted annual-mean PM_{10} concentration is 31.8 µg.m^{-3} or less..

2.42 The daily mean objective is not considered further within this assessment if the annual-mean PM_{10} concentration is predicted to be less than 31.5 µg.m^{-3}.

Fugitive PM_{10} Emissions

2.43 Transport PM_{10} emissions arise from both the tailpipe exhausts and from fugitive sources such as brake and tyre wear and re-suspended road dust. Improvements in vehicle technologies are reducing PM_{10} exhaust emissions; therefore, the relative importance of fugitive PM_{10} emissions is increasing. Current emission factors for particulate matter include brake dust and tyre wear (which studies suggest may account for approximately one-third of the total particulate emissions from road transport); however, no allowance is made for re-suspended road dust as this remains unquantified.

Receptors

3.1 The air quality assessment predicts the impacts at locations that could be sensitive to any changes. Such sensitive receptors should be selected where the public is regularly present and likely to be exposed over the averaging period of the objective. LAQM.TG(09) [6] provides examples of exposure locations and these are summarised in Table 2.5.

Table 2.5: Example of Where Air Quality Objectives Apply

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
Annual-mean	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes.	Building façades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the buildings façades), or any other location where public exposure is expected to be short-term.
Daily-mean	All locations where the annual-mean objective would apply, together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expect to be short-term.
Hourly-mean	All locations where the annual and 24 hour mean would apply. Kerbside sites (e.g. pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc which ware not fully enclosed, where member so the public might reasonably be expected to spend one hour or more. Any outdoor locations to which the public might reasonably be expected to spend 1-hour or longer.	Kerbside sites where the public would not be expected to have regular access

3.2 Modelling of point source impacts has been undertaken using a grid of 10 km by 10 km with a grid spacing of 50 m.

3.3 In addition, the effects of the proposed development have been assessed at the façades of local existing receptors. Receptors have been selected at representative locations where changes in pollutant concentrations are anticipated to be greatest as a result of the proposed development. All human receptors have been modelled at a height of 1.5 m, representative of typical head height. The receptor locations are listed in Table 2.6 and illustrated in Figure 10.B.

3.4 The proposed development site is located within a predominantly industrial area at the existing 'Lostock Works' site allocated for waste management in the CWCC Local Plan. The closest known sensitive residential receptors are located along Manchester Road, approximately 180 m north of the proposed development site.

Table 2.6: Modelled Sensitive Receptors

ID	Description	National Grid Reference	
		X(m)	Y(m)
Roads and Point Source Impacts			
1	1 Griffiths Road	368621	374688
2	1 Cottage Close	368303	373519
3	Cottage Close/Griffiths Road	368292	373468
4	Brittania Drive/King Street	368420	373049
5	School Road North/King Street	368432	372891
6	2 Tudor Close	368468	372739
7	Rudheath Community Primary School	368014	372719
8	Cooke's Lane	369046	373217
9	Village Close	369323	373594
10	High House Farm	368739	372479
Point Source Impacts Only			
11	Proposed Farm Road Residential Development	368138	373690
12	Proposed Griffiths Road Residential Development	368269	373591
13	Proposed Making Space Sheltered Residential Development	367443	373845
14	Proposed Gladedale Residential Development	367553	374712
15	Manchester Road	368149	374574
16	Station Road	369033	374904
17	Lostock Green	369084	374205

Note: Receptors have been modelled at 1.5m above ground level, representative of typical head height
m = metres.

3.5 All of the AQS objectives apply at the façades of all residential properties and schools.

3.6 Natural England (NE) and Cheshire West and Chester Council (CWCC) were consulted to agree the scope to assessing air quality impacts at designated habitat sites. NE confirmed that since any European sites and Sites of Special Scientific Interest (SSSIs) lie beyond 500 m of the proposed development, no impacts are expected at the sites and they do not need to be assessed [7]. Laura Hughes, Natural Environment Officer at CWCC, confirmed that a qualitative description of expected air quality impacts on the 'Ashton's and Neumann's Flashes' Local Wildlife Site would be sufficient for assessing air quality impacts at ecological sites [8].

Significance Criteria

Stack Impacts

3.7 In order to ensure that the descriptions of effects used within this report are clear, consistent and in accordance with recent guidance, definitions have been adopted from the EA's H1 Guidance [9].

3.8 Table 3.12 provides a summary of criteria that should be used to:

a) Screen out insignificant emissions,

b) Identify when detailed dispersion modelling is required, and

c) Assess the significance of effects against air quality criteria.

Table 2.7: Summary for the Assessment of Stack Emissions to Air – H1 Methodology

Parameter	**Long-term**	**Short-term**
Criteria for screening out Insignificant Emissions	Emissions can be seen as insignificant where: PC long-term < 1% of long-term EAL / EQS	Emissions can be seen as insignificant where: PC short-term < 10% of short-term EAL / EQS
Criteria for detailed air modelling	Detailed air modelling is required if: PC long-term >70% of long-term EAL / EQS or where there is an AQMA / AQAP for a substance	Detailed air modelling is required if: PC short-term >20% of (short-term EAL / EQS minus the long-term background concentration) or where there is: - local human population - presence of SSSI, SAC etc. within specified distance - groundwater vulnerable zone - other exceptional concerns
Acceptability against local Environmental Quality Requirements	If Long-term background > EU EQS or PEC long-term > long-term EU EQS then consideration of further control measures is required. If long-term background > long-term National EQS or PEC long-term > long-term National EQS then the operator needs to justify that further control measures are not required. Comparison with EALs can be treated as for National EQS	If PEC short-term (PC short-term plus twice the long-term background) > short-term National EQS, then the operator needs to justify that further control measures are not required

Notes: PC = process contribution; PEC = predicted environmental concentration (PC plus background concentration); EAL = Environmental Assessment Level; EQS = Environmental Quality Standard
AQMA = Air Quality Management Area; AQAP = Air Quality Action Plan

Development Traffic Impacts

2.44 The EPUK/IAQM Land-Use Planning & Development Control: Planning For Air Quality document [10] advises that:

"The significance of the effects arising from the impacts on air quality will depend on a number of factors and will need to be considered alongside the benefits of the development in question. Development under current planning policy is required to be sustainable and the definition of this includes social and economic dimensions, as well as environmental. Development brings opportunities for reducing emissions at a wider level through the use of more efficient technologies and better designed buildings, which could well displace emissions elsewhere, even if they increase at the development site. Conversely, development can also have adverse consequences for air quality at a wider level through its effects on trip generation."

2.45 When describing the air quality impact at a sensitive receptor, the change in magnitude of the concentration should be considered in the context of the absolute concentration at the sensitive receptor. Table 2.8 provides the EPUK/IAQM approach for describing the air quality impacts at sensitive receptors.

Table 2.8 Impact Descriptors for Individual Sensitive Receptors

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level			
	1	2-5	6-10	>10
75 % or less of AQAL	Negligible	Negligible	Slight	Moderate
76 -94 % of AQAL	Negligible	Slight	Moderate	Moderate
95 - 102 % of AQAL	Slight	Moderate	Moderate	Substantial
103 – 109 % of AQAL	Moderate	Moderate	Substantial	Substantial
110 % or more than AQAL	Moderate	Substantial	Substantial	Substantial

1. AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency ‘Environmental Assessment Level (EAL)’.
2. The table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e. less than 0.5% will be described as negligible.
3. The table is only designed to be used with annual mean concentrations.
4. Descriptors for individual receptors only; the overall significance is determined using professional judgement. For example, a ‘moderate’ adverse impact at one receptor may not mean that the overall impact has a significant effect. Other factors need to be considered.
5. When defining the concentration as a percentage of the AQAL, use the ‘without scheme’ concentration where there is a decrease in pollutant concentration and the ‘with scheme;’ concentration for an increase.
6. The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure less than 75% of this value, i.e. well below, the degree of harm is likely to be small. As the exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL.
7. It is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the AQAL. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the AQAL, rather than being exactly equal to it.

2.46 The impact descriptors above apply at individual receptors. The EPUK/IAQM guidance states that the impact descriptors *“are not, of themselves, a clear and unambiguous guide to reaching a conclusion on significance. These impact descriptors are intended for application at a series of individual receptors. Whilst it maybe that there are ‘slight’, ‘moderate’ or ‘substantial’ impacts at one or more receptors, the overall effect may not necessarily be judged as being significant in some circumstances.“*

2.47 Professional judgement by a competent, suitably qualified professional is required to establish the significance associated with the consequence of the impacts. This judgement is likely to take into account the extent of the current and future population exposure to the impacts and the influence and/or validity of any assumptions adopted during the assessment process.

3 Operational Phase – Fugitive Odour, Dust and Bioaerosols Assessment Methodology

Fugitive Odour

3.1 The qualitative risk-ranking assessment of the odour impact of emissions from the proposed development on local sensitive receptors was carried out using the method in the IAQM odour guidance for planning Appendix 1, which provides examples of risk factors for odour source potential, pathway effectiveness and receptor sensitivity (set out in Table 3.1).

Table 3.1 IAQM Examples of Risk Factors for Odour Source, Pathway and Receptor

Source Odour Potential	Pathway Effectiveness	Receptor
Factors affecting the source odour potential include: • the magnitude of the odour release (taking into account odour-control measures) • how inherently odorous the compounds are • the unpleasantness of the odour	Factors affecting the odour flux to the receptor are: • distance from source to receptor the frequency (%) of winds from the source to receptor (or, qualitatively, the direction of receptors from source with respect to prevailing wind) • the effectiveness of any mitigation/control in reducing flux to the receptor • the effectiveness of dispersion/ dilution in reducing the odour flux to the receptor • topography and terrain	For the sensitivity of people to odour, the IAQM recommends that the air quality practitioner uses professional judgement to identify where on the spectrum between high and low sensitivity a receptor lies, taking into account the following general principles:
Large Source Odour Potential Magnitude - Larger Permitted processes of odorous nature or large STWs; materials usage hundreds of thousands of tonnes/m^3 per year; area sources of thousands of m^2. The compounds involved are very odorous (e.g. mercaptans), having very low Odour Detection Thresholds (ODTs) where known. Unpleasantness - processes classed as "Most offensive" in H4; or (where known) compounds/odours having unpleasant (-2) to very unpleasant (-4) hedonic score. Mitigation/control - open air operation with no containment, reliance solely on good management techniques and best practice.	**Highly Effective Pathway for Odour Flux to Receptor** Distance - receptor is adjacent to the source/site; distance well below any official set-back distances [a]. Direction - high frequency (%) of winds from source to receptor (or, qualitatively, receptors downwind of source with respect to prevailing wind). Effectiveness of dispersion/dilution - open processes with low-level releases, e.g. lagoons, uncovered effluent treatment plant, landfilling of putrescible wastes.	**High Sensitivity Receptor** - surrounding land where: • users` can reasonably expect enjoyment of a high level of amenity; and • the people would reasonably be expected to be present here continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. Examples may include residential dwellings, hospitals, schools/education and tourist/cultural.
Medium Source Odour Potential Magnitude - smaller Permitted processes	**Moderately Effective Pathway for Odour Flux to Receptor**	**Medium Sensitivity Receptor** - surrounding land where:

Source Odour Potential	Pathway Effectiveness	Receptor
or small Sewage Treatment Works (STWs); materials usage thousands of tonnes/m^3 per year; area sources of hundreds of m^2. The compounds involved are moderately odorous. Unpleasantness ‐ processes classed in H4 as "Moderately offensive"; or (where known) odours having neutral (0) to unpleasant (-2) hedonic score. Mitigation/control ‐ some mitigation measures in place, but significant residual odour remains.	Distance ‐ receptor is local to the source. Where mitigation relies on dispersion/dilution ‐ releases are elevated, but compromised by building effects.	• users' would expect to enjoy a reasonable level of amenity, but wouldn't reasonably expect to enjoy the same level of amenity as in their home; or • people wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. Examples may include places of work, commercial/retail premises and playing/recreation fields.
Small Source Odour Potential Magnitude ‐ falls below Part B threshold; materials usage hundreds of tonnes/m^3 per year; area sources of tens m^2. The compounds involved are only mildly odorous, having relatively high ODTs where known. Unpleasantness ‐ processes classed as "Less offensive" in H4; or (where known) compounds/odours having neutral (0) to very pleasant (+4) hedonic score. Mitigation/control ‐ effective, tangible mitigation measures in place (e.g. BAT, BPM) leading to little or no residual odour.	**Ineffective Pathway for Odour Flux to Receptor** Distance ‐ receptor is remote from the source; distance exceeds any official set-back distances. Direction ‐ low frequency (%) of winds from source to receptor (or, qualitatively, receptors upwind of source with respect to prevailing wind). Where mitigation relies on dispersion/ dilution ‐ releases are from high level (e.g. stacks, or roof vents > 3 m above ridge height) and are not compromised by surrounding buildings	**Low Sensitivity Receptor** ‐ surrounding land where: • the enjoyment of amenity would not reasonably be expected; or • there is transient exposure, where the people would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. Examples may include industrial, farms, footpaths and roads.

Notes: [a] Minimum setback distances may be defined for some odorous activities

3.2 The first step of this qualitative assessment is to estimate the odour-generating potential of the site activities, termed the "Source Odour Potential". This takes into account three factors:

i. The scale (magnitude) of the release from the odour source, taking into account the effectiveness of any odour control or mitigation measures that are already in place. This involves judging the relative size of the release rate after mitigation and taking account of any pattern of release (e.g. intermittency). The assumption has been made, as required by the NPPF, that the pollution-control regimes applying to these sites will operate effectively and that the appropriate BAT standards of odour control will be enforced.

ii. How inherently odorous the emission is. In some cases it may be known whether the release has a low, medium or high odour detection threshold (ODT); this is the concentration at which an odour becomes detectable to the human nose. In most instances the odours released by a source will be a complex mixture of compounds and the detectability will not be known. However, for some industrial processes the odour will be due to one or a small number of known compounds and the detection thresholds will be a good indication of whether the release is highly odorous or mildly odorous.

iii. The relative pleasantness/unpleasantness* of the odour. Lists of relative pleasantness of different substances are given in the Environment Agency guidance H4 Odour Management [11].

3.3 Using the example risk ranking in Table 3.1, the Source Odour Potential can be categorised as small, medium or large.

Table 3.2 H4 Offensiveness of Odour Emission Sources

Offensiveness	Odour Emission Sources
Most Offensive	Processes involving decaying animal or fish remains Processes involving septic effluent or sludge Biological landfill odours
Moderately Offensive	Intensive livestock rearing Fat frying (food processing) Sugar beet processing Well aerated green waste composting
Less Offensive	Brewery Confectionary Coffee

3.4 Next, the effectiveness of the pollutant pathway as the transport mechanism for odour through the air to the receptor, versus the dilution/dispersion in the atmosphere, needs to be estimated. Anything that increases dilution and dispersion of the odorous pollutant plume as it travels from source (e.g. processes and plant) to receptor will reduce the concentration at the receptor, and hence reduce exposure. Important factors to consider here are:

i. The distance of sensitive receptors from the odour source.

ii. Whether these receptors are downwind (with respect to the predominant prevailing wind direction). Odour episodes often tend to occur during stable atmospheric conditions with low wind speed, which gives poor dispersion and dilution; receptors close to the source in all directions around it can be affected under these conditions. When conditions are not calm, it will be the downwind receptors that are affected. Overall therefore, receptors that are downwind with respect to the prevailing wind direction tend to be at higher risk of odour impact.

* This can be measured in the laboratory as the hedonic tone, and when measured by the standard method and expressed on a standard nine-point scale it is termed the hedonic score.

iii. The effectiveness of the point of release in promoting good dispersion, e.g. releasing the emissions from a high stack will - all other things being equal - increase the pathway, dilution and dispersion.

iv. The topography and terrain between the source and the receptor. The presence of topographical features such as hills and valleys, or urban terrain features such as buildings can affect air flow and therefore increase, or inhibit dispersion and dilution.

3.5 Using the example risk ranking in Table 3.1, the pollutant pathway from source to receptor can be categorised as ineffective, moderately effective, or highly effective.

3.6 In the third step, the estimates of Source Odour Potential and the Pathway Effectiveness are considered together to predict the risk of odour exposure (impact) at the receptor location, as shown by the example matrix in Table 3.3.

Table 3.3 Risk of Odour Exposure (Impact) at the Specific Receptor Location

		Source Odour Potential		
		Small	**Medium**	**Large**
Pathway Effectiveness	**Highly effective**	Low Risk	Medium Risk	High Risk
	Moderately effective	Negligible Risk	Low Risk	Medium Risk
	Ineffective	Negligible Risk	Negligible Risk	Low Risk

3.7 The next step is to estimate the effect of that odour impact on the exposed receptor, taking into account its sensitivity, as shown by the example matrix in Table 3.4. The odour effects may range from negligible, through slight adverse and moderate adverse, up to substantial adverse.

Table 3.4 Likely Magnitude of Odour Effect at the Specific Receptor Location

Risk of Odour Exposure	Receptor Sensitivity		
	Low	**Medium**	**High**
High	Slight Adverse Effect	Moderate Adverse Effect	Substantial Adverse Effect
Medium	Negligible Effect	Slight Adverse Effect	Moderate Adverse Effect
Low	Negligible Effect	Negligible Effect	Slight Adverse Effect
Negligible	Negligible Effect	Negligible Effect	Negligible Effect

3.8 This procedure results in a prediction of the likely odour effect at each sensitive receptor. The next step is to estimate the overall odour effect on the surrounding area, taking into account the different magnitude of effects at different receptors, and the number of receptors that experience these different effects*. This requires the competent and suitably experienced Air Quality Practitioner to apply professional judgement.

Fugitive Dust

3.9 For fugitive dust there is currently no specific technical guidance. A similar approach to the assessment of dust effects during the construction phase has been used to assess the likely risk of effects from dust taking into account the significance of the sources and their likely duration and frequency, the proximity to sensitive receptors and the project design solutions and mitigation incorporated into the scheme.

Bioaerosols

3.10 Bioaerosols are microscopic airborne particles or droplets of biological origin. The individual particles vary in size from fractions of a micron to up to 30 µm or more, but many have a tendency to form larger clumps or agglomerations, or to attach to inert dust particles. Bioaerosols can be subdivided into:

I. Viable components: living organisms/cells; and
II. Non-viable components: non-viable organisms plus chemicals that are parts of the organism (e.g. the cell walls, such as endotoxins).

3.11 In the absence of any specific guidance on assessing bioaerosol emissions from MBT facilities, an approach similar to that commonly used for assessing bioaerosol releases from composting facilities has been employed. This approach is consistent with the Defra document '*Mechanical Biological Treatment of Municipal Solid Waste*' [12].

3.12 Guidance in document '*Guidance on the evaluation of bioaerosol risk assessment for composting facilities*' published by the Environment Agency [13], sets out the following method for assessing the risk of exposure to bioaerosols.

3.13 The probability of harm from bioaerosols can be described as:

- High – exposure is probable, direct exposure likely with no/few barriers between source and receptor;
- Medium – exposure is fairly probable, barriers less controllable;
- Low – exposure unlikely, barriers exist to mitigate; or
- Very low – exposure very unlikely, effective and multiple barriers.

3.14 The consequences of exposure to bioaerosols can be described as:

* Unless there is only a small number of local receptors, then a representative selection of receptors will have been used in the assessment. This final stage of considering the overall effect needs to take into account how many receptors these selected ones represent.

- High – severe consequences, evidence that exposure may result in serious damage
- Medium – significant consequences, evidence that exposure may result in damage that is not severe and is reversible
- Low – minor consequences, damage not apparent, reversible adverse changes possible
- Very low – negligible consequences, no evidence for adverse changes

3.15 By examining the probability and consequences together, the magnitude of the risk can be determined.

4 Uncertainty

4.1 All air quality assessment tools, whether models or monitoring measurements, have a degree of uncertainty associated with the results. The choices that the practitioner makes in setting-up the model, choosing the input data, and selecting the baseline monitoring data will decide whether the final predicted impact should be considered a central estimate, or an estimate tending towards the upper bounds of the uncertainty range (i.e. tending towards worst-case).

4.2 The atmospheric dispersion model itself contributes some of this uncertainty, due to it being a simplified version of the real situation: it uses a sophisticated set of mathematical equations to approximate the complex physical and chemical atmospheric processes taking place as a pollutant is released and as it travels to a receptor. The predictive ability of even the best model is limited by how well the turbulent nature of the atmosphere can be represented.

4.3 Each of the data inputs for the model, listed earlier, will also have some uncertainty associated with them. Where it has been necessary to make assumptions, these have mainly been made towards the upper end of the range informed by an analysis of relevant, available data.

4.4 The atmospheric dispersion model used for this assessment, ADMS Roads, has been validated by its supplier and is widely used by professionals in the UK and overseas. A site-specific verification (calibration) provides additional certainty and is particularly important when air quality levels are close to exceeding the objectives/limit values.

4.5 LAQM.TG(09) requires that local authorities verify the results of any detailed modelling undertaken for the purposes of fulfilling their R&A duties. Model verification refers to *"checks that are carried out on model performance at a local level"*. Modelled concentrations are compared with the results of monitoring. Where there is a disparity between modelled and monitored concentrations, the first step is to review the appropriateness of the data inputs to determine whether the performance of the model can be improved. Once reasonable efforts have been made to reduce the uncertainties in the data inputs, an adjustment may be established and applied to reduce any remaining disparity between modelled and monitored concentrations. No adjustment factor is deemed necessary where the modelled concentrations are within 25% of the monitored concentrations.

4.6 For the verification and adjustment of NO_X/NO_2 concentrations for R&A purposes, LAQM.TG(09) recommends that the comparison involves a combination of automatic and diffusion monitoring, rather than a single automatic monitor. This is to ensure any adjustment factor derived is representative of all locations modelled and not unduly weighted towards the characteristics at a single site. Where only diffusion tubes are used for the model verification, the study should consider a broad spread of monitoring locations across the study area to provide sufficient information relating to the spatial variation in pollutant concentrations.

4.7 Local Authorities generally implement a broad spread of monitoring, particularly in areas that are known to be sensitive to changes in air quality. Consequently, Local Authorities are usually able to verify the models they use for R&A purposes; however for individual developments, there is less likely to be a broad range of monitoring locations within the relevant study area. Within the study area, NO_2 monitoring is undertaken at two passive roadside locations. This would not be considered a broad spread of monitoring locations. While caution should be applied when performing model verification without a broad spread of monitoring locations, the measured concentrations at the two monitoring locations have been compared with the modelled results to assist in determining the performance of the model. Appendix 10.C provides detail on the method and findings of this model performance study.

4.8 The main components of uncertainty in the total predicted concentrations, made up of the background concentration and the modelled fraction, include those summarised in Table 4.1.

Table 4.1 Approaches to Dealing with Uncertainty used Within the Assessment

Concentration	Source of Uncertainty	Approach to Dealing with Uncertainty	Comments
Background Concentration	Characterisation of future baseline air quality (i.e. the air quality conditions in the future assuming that the development does not proceed)	The future background concentration used in the assessment is the same as the current background concentration and no reduction has been assumed. This is a conservative assumption as, in reality, background concentrations are likely to reduce over time as cleaner vehicle technologies form an increasing proportion of the fleet.	The background concentration is the major proportion of the total predicted concentration. The conservative assumptions adopted ensure that the background concentration used within the model is towards the top of the uncertainty range, rather than a central estimate.
Fraction from Modelled Sources	Traffic flow estimates	Traffic flows provided have all been based on traffic counts, rather than flows derived from a traffic model. High growth assumptions have been used to develop the traffic dataset used within the model.	The modelled fraction is a minor proportion of the total predicted concentration. The modelled fraction is likely to be between a central estimate and the top of the uncertainty range.
	Traffic speed estimates	Measured average traffic speeds have been used within the model. The average speed has been reduced in congested areas to take account of slow-moving and queuing traffic.	
	Road-related emission factors – projection to future years	The most recently published emission factors have been used within the modelling and these are based on the current and best understanding of the variation in emission factors in future years.	
	Boiler emissions and stack characteristics	References to the source documents have been provided for each parameter not provided by the project team. Where a range of values are available, the	

Concentration	**Source of Uncertainty**	**Approach to Dealing with Uncertainty**	**Comments**
		parameter likely to give the worst-case prediction has been used. The flare and gas engines have been modelled as continuous sources, which is an extremely conservative assumption.	
	Meteorological Data	Uncertainties arise from any differences between the conditions at the met station and the development site, and between the historical met years and the future years. These have been minimised by using meteorological data collated at a representative measuring site. The model has been run for a full year of meteorological conditions. This means that the conditions in 8,760 hours have been considered in the assessment.	
	Receptors	Receptor locations have been identified where concentrations are highest or where the greatest changes are expected.	
	Dispersion Modelling	The model predictions have been compared with monitored concentrations. The model outputs have been adjusted accordingly.	

4.9 The analysis of the component uncertainties indicates that, overall, the predicted total concentration is likely to be towards the top of the uncertainty range rather than being a central estimate. The actual concentrations that will be found when the development is operational are unlikely to be higher than those presented within this report and are more likely to be lower.

References

1 British Standard Institute (1983) BS 6069:Part 2:1983, ISO 4225-1980 Characterization of air quality. Glossary

2 Environment Agency (2010) Environmental Permitting Regulations (EPR) – H1 Environmental Risk Assessment, Annex K

3 http://www.environment-agency.gov.uk/static/documents/Business/noxno2conv2005_1233043.pdf

4 LAQM.TG(09) Tools http://www.airquality.co.uk/laqm/tools.php

5 AEAT, 2008, Analysis of the relationship between annual-mean nitrogen dioxide concentration and exceedences of the 1-hour mean AQS Objective.

6 Local Air Quality Management Technical Guidance, 2009 (LAQM.TG(09))

7 Cheshire West and Chester Council, letter to Tom Dearing dated 13/08/2015 (ref. 15/02915/EIA)

8 Email from Laura Hughes to Rosemary Challen dated 19/08/2015

9 Environment Agency, 2010, Environmental Permitting Regulations (EPR) – H1 Environmental Risk Assessment, Annex F

10 EPUK/IAQM (May 2015) Land-Use Planning & Development Control: Planning For Air Quality

11 Environment Agency: H4 Odour Management. March 2011

12 Defra, 2014, Mechanical Biological Treatment of Municipal Solid Waste

13 Environment Agency: Guidance on the evaluation of bioaerosol risk assessment for composting facilities’.

Appendix 10.C: Road Traffic Pollution Model Performance Study

The approach to road traffic pollution model verification set out in LAQM.TG(09) requires a comparison of road-related annual-mean NO_X concentrations. For the verification and adjustment of NOx/NO_2 concentrations, the guidance recommends that the comparison involves a combination of automatic and diffusion monitoring. Within the study area, NO_2 concentrations are monitored at only two passive roadside locations using diffusion tubes; therefore, a formal verification

A summary of the monitored data for the two monitoring locations is provided in Table 10.C.1. The monitoring locations are illustrated in Figure 10.F. All data have been obtained from CWCC's 2014 Air Quality Progress Report.

Table 10.C.1 Monitored Annual-Mean NO_2 Concentrations

Site Name	x	y	Concentration (µg.m^{-3})		
			2011	2012	2013
Cottage Close	368307	373523	25.8	24.2	22.9
King St. Rudheath	368432	372988	34.9	34.5	31.8

The existing traffic flow data provided by the transport consultants relates to 2015. The background concentrations have been taken from the Defra maps and the Manchester Ringway meteorological data for 2014 has been used. The predicted concentrations for this scenario are compared with the most recent measured concentrations within the study area, as summarised in Table 10.C.2.

Table 10.C.2 Comparison of Monitored and Modelled Annual-Mean NO_2 Concentrations

Site Name	Modelled NO_2 Concentration (µg.m^{-3})	Monitored NO_2 Concentration (µg.m^{-3})	% Difference [(modelled-monitored)/monitored)* 100]
Cottage Close	17.4	22.9	-23.9
King St. Rudheath	21.4	31.8	-32.8

It is clear from the above that the model is under-predicting at both locations. Therefore, the steps to model verification have been undertaken as detailed below, with the aim of improving the model's accuracy and preventing the under-prediction of concentrations.

The approach to model verification set out in LAQM.TG(09) requires a comparison of the modelled road-related annual-mean NO_X concentrations with the monitored road-related annual-mean NO_X concentrations. This comparison is set out in Table 10.C.3.

Table 10.C.3 Comparison of Road-Related Monitored and Modelled NOx Concentrations

Site Name	Modelled NO_x Road Contribution ($\mu g.m^{-3}$)	Monitored NO_x Road Contribution ($\mu g.m^{-3}$	Ratio: Monitored/Modelled
Cottage Close	5.2	16.1	3.1
King St. Rudheath	13.0	35.3	2.7
Average Ratio			2.9

The average ratio has been applied to the modelled road contribution as a correction factor to determine whether the results of monitoring can be improved. A comparison of the corrected modelled concentrations with the measured concentrations is provided in Table 10.C.4.

Table 10.C.4 Comparison of Road-Related Monitored and Corrected-Modelled NOx Concentrations

Site Name	Corrected Modelled NO_x Road Contribution ($\mu g.m^{-3}$)	Monitored NO_x Road Contribution ($\mu g.m^{-3}$	% Difference [(modelled-monitored)/monitored)* 100]
Cottage Close	15.1	16.1	-2.1
King St. Rudheath	37.7	35.3	3.4
Average % Difference			0.6

The results in Table 10.C.4 show that, with the correction factor applied, the difference in modelled and monitored concentrations is much smaller. While it is not appropriate to undertake a formal verification study for the reasons set out above, these results indicate that the accuracy of the model can be improved through the use of the correction factor. On that basis, and to ensure conservatism of the modelled concentrations, a correction factor of 2.9 has been applied to all predicted road-related concentration contributions in this assessment.

Appendix 10.D: Stack Height Determination

Overview

A stack height determination has been undertaken to establish the height at which ground level concentrations meet Environmental Quality Standards and also the point where there is minimal environmental benefit associated with the cost of further increasing the stack. This is consistent with the approach set out in the Environment Agency's (EA's) Horizontal Guidance Note EPR H1 [15] which requires the identification of "*an option that gives acceptable environmental performance but balances costs and benefits of implementing it*."

The emissions data used in the stack height determination are summarised in the main Air Quality Chapter. Simulations have been run using ADMS 5 to determine what stack height is required to overcome local building wake effects.

The stack height determination considers ground level concentrations over the averaging periods relevant to the air quality assessment for the main pollutant of concern, NO_2, together with the full range of all likely meteorological conditions through the use of five years of hourly sequential meteorological data from a representative measuring station (Manchester Ringway).

The model was run for assuming stack heights of 15 m to 45 m at 3 m incremental spacing. Results were obtained for both long and short-term averaging periods.

The dispersion modelling assumed a domain of 10 km by 10 km centred on the proposed stack location and a grid spacing of 50 m. Results are reported for the location where the highest concentration is predicted. This is considered a robust and conservative approach.

Results

The predicted maximum Process Contribution (PC) at ground level, for short and long-term (annual) averaging periods, were plotted against the varying stack heights as shown in Graph 10.D. 1. The graph suggests that there are no significant environmental benefits with incremental increases in stack heights above 24 m. The predicted maximum PCs are also given in Table 10.D. 1. The PCs have been added to the estimated background concentration to obtain the Predicted Environmental Concentration (PEC). To ensure a worst-case prediction, the background concentration is assumed to be equal to the most recent concentration measured along Manchester Road, 33.4 $\mu g.m^{-1}$.

Graph 10.D. 1 Predicted Process Contribution Against Stack Height

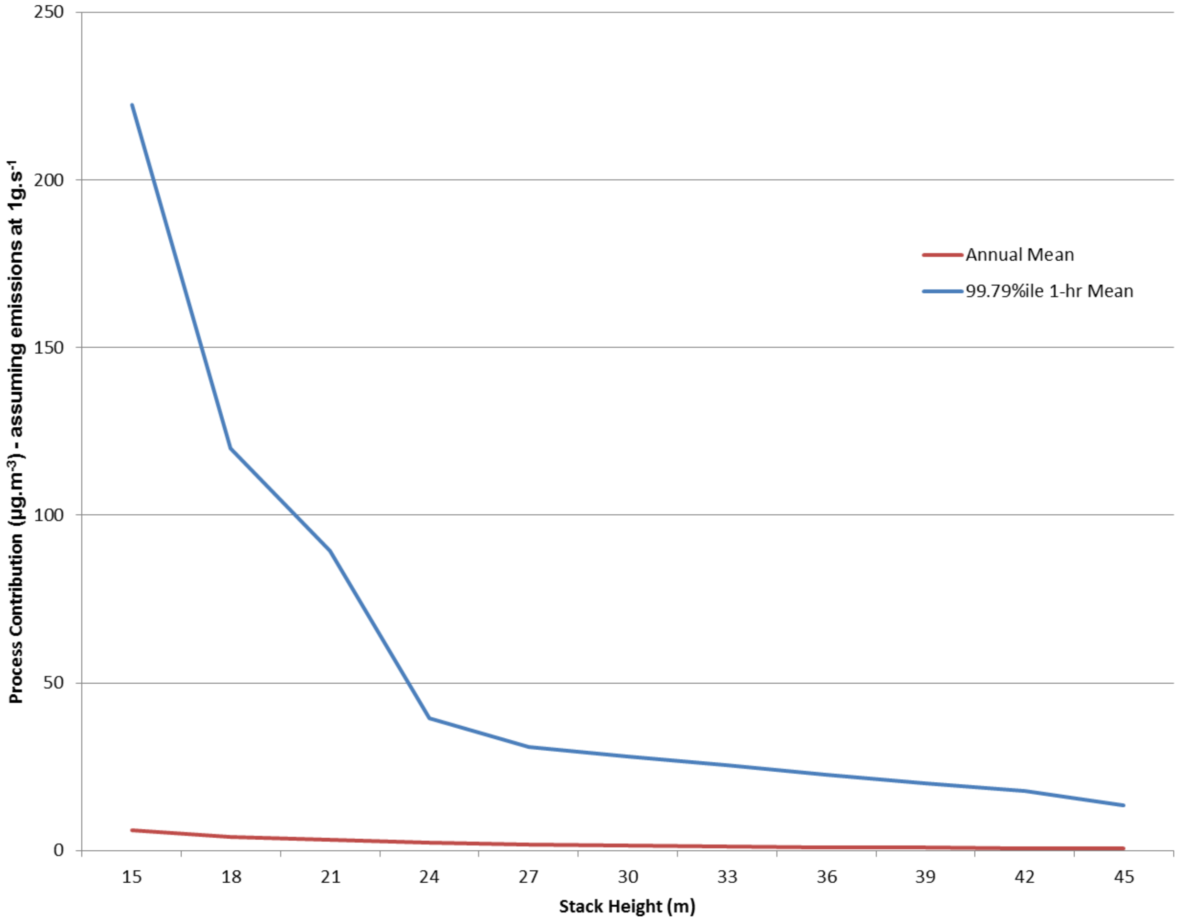

Table 10.D. 1 Predicted NO_2 Concentrations

Stack Height (m)	Process Contribution ($\mu g.m^{-3}$)		Process Contribution as % of the AQS Objective		PEC ($\mu g.m^{-3}$)	
	Annual Mean	99.79th %ile 1-Hour Mean	Annual Mean	99.79th %ile 1-Hour Mean	Annual Mean	99.79th %ile 1-Hour Mean
15	18.3	334.3	45.8	167.1	51.7	401.1
18	12.1	180.3	30.4	90.2	45.5	247.1
21	9.6	134.6	23.9	67.3	43.0	201.4
24	7.5	59.4	18.6	29.7	40.9	126.2
27	5.6	46.5	14.1	23.2	39.0	113.3
30	4.6	42.2	11.4	21.1	38.0	109.0
33	3.7	38.3	9.2	19.1	37.1	105.1
36	3.1	34.2	7.7	17.1	36.5	101.0
39	2.5	30.2	6.3	15.1	35.9	97.0

Stack Height (m)	Process Contribution ($\mu g.m^{-3}$)		Process Contribution as % of the AQS Objective		PEC ($\mu g.m^{-3}$)	
	Annual Mean	99.79th %ile 1-Hour Mean	Annual Mean	99.79th %ile 1-Hour Mean	Annual Mean	99.79th %ile 1-Hour Mean
42	2.1	26.6	5.2	13.3	35.5	93.4
45	1.7	20.2	4.2	10.1	35.1	87.0

As shown in Table 10.D. 1, for a stack height of 33 m, the maximum short and long-term PCs are greater than 1% and 10% of the environmental standards for each averaging period respectively and cannot simply be screened out as being insignificant. The background concentration must therefore also be considered. For a stack height of 33 m, the resulting worst-case long-term and short-term PECs are below the EALs of 40 $\mu g.m^{-3}$ and 200 $\mu g.m^{-3}$ respectively.

Appendix 10.E: Draft Odour Management Plan

REnescience Northwich

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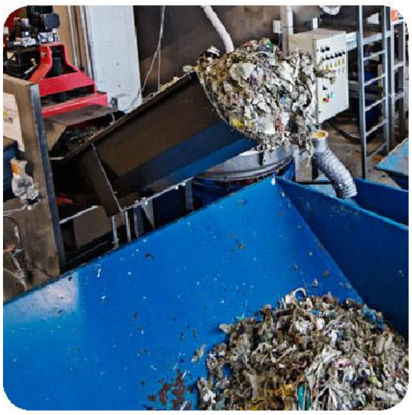

Quality Management

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Date of issue:	24 November 2015		**Revision number:**	2
Project number	JAS8407			
Document file path:	O:\Jobs_8001-9000\8407s\Info_share\ES_submission\Final_Word\Vol3_Appendices\V3A10.E_OMP.docx			

Revision History				
Rev	**Date**	**Status**	**Reason for revision**	**Additional comments**
0	08/15	Draft	-	-
1	02/10/15	Final	Finalise	-
2	24/11/15	Final	Minor updates for Permit Application	-

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Tables and Figures

Figures

1 Introduction

Background

1.1 RPS has prepared an Odour Management Plan (OMP) for the proposed REnescience Northwich development located off the A530 Griffiths Road, near Northwich and Lostock Gralam, Cheshire.

1.2 This draft OMP supports both the environmental assessment and environmental permitting process for the proposed development. The proposed development is located within the administrative area of Cheshire West and Chester Council (CWCC).

1.3 The operation of the facility will be regulated by the Environment Agency (EA) under an Environmental Permit and the OMP will be kept under review by the EA. The Operator Dong Energy REnescience Northwich (DERN) O&M Limited will implement and maintain this OMP within the operational management system.

1.4 The proposed development is a bioresource project, comprising stages of mechanical and biological treatment (MBT) of waste and renewable energy generation. It will have a nominal waste input capacity of up to 18 tonnes per hour, equivalent to 144,000 tonnes per annum (tpa) over the course of 8,000 typical annual operating hours. It will treat municipal solid waste, fines and commercial and industrial waste of a similar composition, that are supplied from existing intermediary waste transfer and treatment sites.

1.5 The air quality effects from the proposed development have been assessed in the Environmental Statement Chapter 10: Air Quality.

Purpose and Scope

1.6 This OMP provides information on the measures to be implemented to control odour emissions from the proposed facility. The OMP addresses the Institute of Air Quality Management (IAQM) good practice requirements, described within *Guidance on the assessment of odour for planning* [1], which is informed by the following guidance:

- The Environment Agency (EA) general requirements for OMPs as part of the permitting process, as described in technical guidance note H4 *Odour Management* (2011) [2];
- The Defra Odour Guidance for Local Authorities (2010) and the Defra Good Practice and Regulatory Guidance on Composting and Odour Control for Local Authorities (2009);
- The Scottish Environment Protection Agency (SEPA) *Odour Guidance* (2010); and

- Odour Monitoring and Control on Landfill Sites (2013)[1].

1.7 In summary, the guidance recommends a simple document along the following lines:

- A process description, particularly describing odorous, or potentially odorous, activities or materials used;
- Identification of all the release points for each of the activities and their locations;
- Identification of the sensitive receptors within the area of influence that could be impacted;
- A description of the baseline mitigation/control measures that would be used day-to-day under normal operating conditions in the absence of any unusual risk factors;
- Identification of possible risk factors (e.g. equipment/control failures, abnormal/unintentional situations, adverse weather conditions, spillages, etc.); and a listing of the consequences for odours of these risk factors;
- A description of the additional measures that will be applied during these periods to deal with these risks;
- A list of the actions in detail and who is responsible for carrying them out;
- A description of what would trigger this further action/additional measures;
- A description of the roles and responsibilities of personnel on site (e.g. organisational chart), and the training and competence of staff in odour-critical roles;
- Details of how the actions contained within the OMP will be carried out, and who has been assigned managerial and operational responsibilities for them.

1.8 To meet these requirements, this OMP is structured as follows:

- Section 2 – a description of the site and process;
- Section 3 – measures that are used to control odour during normal operations;
- Section 4 – routine maintenance and inspection;
- Section 5 – routine monitoring, recording and reporting;
- Section 6 – measures that will be used to control odour during maintenance and any abnormal events; and
- Section 7 – management measures taken to control odours.

[1] *Odour Monitoring and Control on Landfill Sites,* Scotland & Northern Ireland Forum for Environmental Research (Sniffer), March 2013.

2 Description of Site and Process

Section Overview

2.1 This section of the OMP contains:

- Site overview – a description of the site function and layout, neighbouring communities and sensitive receptors;
- Process description – a description of the plant, operations and controls; and
- Odour source inventory – a summary of the main sources of odour, their locations and the materials/activities involved, and the characteristics of the odour sources (e.g. fugitive or controlled, point, area or volume, release height, likely odorous compounds, quantities likely to be released, pattern of release, method of control).

Site Overview

2.2 The proposed REnescience Northwich development is located off the A530 Griffiths Road, near Northwich and Lostock Gralam, Cheshire. The site is within the administrative area of Cheshire West and Chester Council (CWCC).

2.3 The facility will operate 24 hours a day, around 8,000 hours per year.

Process Description

2.4 The facility will use a 'REnescience' enzymatic waste treatment process developed by DONG Energy, which has been proven at a demonstration plant operating in Copenhagen, Denmark for six years that has treated waste from around Europe, including household waste from the UK. The REnescience process uses enzymes to break down and remove organic matter from mixed wastes, in order that recyclable materials can be efficiently recovered and renewable energy can be generated. The REnescience process separates waste into four constituent fractions, all of which are expected to be capable of further use or recovery.

2.5 By using enzymes to target organic materials entrained in the waste and concentrate these organics into a single output, the process removes contamination from the remaining fractions, thus generating cleaner recyclable materials and enabling a higher degree of recycling to be achieved (the principal benefit of the DONG REnescience process). The process is designed to treat unsorted, non-hazardous residual ('black bag') waste, and commercial and industrial waste of a similar nature: REnescience Northwich will not accept source-segregated recyclables and will complement existing municipal and commercial recycling, helping to raise the overall recycling rate.

2.6 In the proposed development, the separated organic fraction (in the form of bioliquid) will be further treated using an anaerobic digestion (AD) process to generate biogas, which will then be used to generate renewable electricity in on-site reciprocating gas engines. Waste renewable heat from the gas engines will also be utilised in the REnescience process on site. Separating and concentrating organic material into bioliquid before AD treatment maximises the biogas production for renewable electricity and heat generation, and minimises the residual digestate after de-watering.

2.7 The four separated waste fractions and their recycling/recovery/disposal routes are as follows.

- Bioliquid, containing concentrated organic material in a liquid suspension. This is further treated on-site using AD to yield:
  - biogas, used to generate renewable heat and electricity in reciprocating gas engines; and
  - digestate, de-watered to leave compost-like output (CLO) that will be suitable for use in land restoration.
- Recovered recyclable materials: ferrous and non-ferrous metal and solid plastics (e.g. plastic bottles).
- Other recovered materials such as film plastics, textiles and remaining cardboard, which together form a refuse-derived fuel (RDF) or solid recovered fuel (SRF) that can be used for energy generation in facilities elsewhere.
- Recovered inert materials such as gravel and glass cullet/sand that can be re-used as aggregates.

2.8 In separating out these waste fractions, the process tends to reduce the odour potential, such that the recovered materials are all of low odour potential.

Neighbouring Communities, other Odour Sources and Sensitive Receptors

2.9 The proposed development site is set in a predominantly industrial area of existing and former chemical industry works. The site is located approximately 0.6 km from the residential outskirts of Northwich and Rudheath to the west and south (or around 2 km from Northwich town centre), and 1.2 km from the village of Lostock Gralam to the east. The closest residential dwellings are located along Manchester Road, approximately 180 m north of the proposed development site.

2.10 There are no universal guidelines setting out distances within which potential odours give cause for concern; however, the Environment Agency has recently issued guidance for industrial installations that need both a permit and planning permission. For AD plant, the guidelines state developments within 400 m of sensitive receptors are likely to require additional risk assessment and odour control measures. There are several sensitive receptors within 400 m of the site, as shown in Figure 10.G.

Odour Sources

Generation of Odours at the Facility

2.11 There is the potential for odours to arise from some aspects of the waste treatment process. Table 2.1 on the following pages contains the Odour Source Inventory for the facility. It provides a summary of the main sources of odour, their locations and the materials/activities involved, and the characteristics of the odour sources (e.g. fugitive or controlled, point, area or volume, release height, likely odorous compounds, quantities likely to be released, pattern of release and method of control).

Table 2.1: REnescience Facility Odour Source Emissions Inventory

Source	Location	Activity and materials involved	Type of emissions	Likely odorous compounds	Means of control	Description of Release	Characteristics of Release
Waste delivery and reception	Site access road	Incoming loads of waste	Fugitive to outside air	Fresh odours	Measures to control at source listed in Section 3	Vehicle paths along the access road (fugitive line source)	Close to ground level, intermittent release, at ambient temperature
	Waste Reception Building	Opening and closing of vehicle access doors	Fugitive to outside air	Fresh odours	Measures to control at source listed in Section 3	Escapes periodically from open doors (fugitive area sources)	Close to ground level, intermittent release, at ambient temperature
Enzymatic waste treatment process	"Bioreactors" (enclosed vessels)	Enzymatic waste treatment to target organic materials and concentrate into bioliquid	Fugitive to outside air, e.g. during inspection or maintenance	Biogas smell, e.g. terpenes	Measures to control at source listed in Section 3	Escapes periodically	Close to ground level, intermittent release, at ambient temperature
	2D/3D material sorting areas	Sorting of 2D and 3D material	Point source	Fresh odours	Measures to control at source listed in Section 3	From carbon filters	Continuous release, at an elevation of approximately 3-4 m
Anaerobic digestion process	Bioliquid reception/retention/ digester tanks	Anaerobic digestion of bioliquid	Point source	Biogas smell with the potential for hydrogen sulphide	Measures to control at source listed in Section 3	Loss of containment due to failure	Intermittent, elevated release
Biogas Engines	Biogas engines stack	Combustion of biogas	No significant odour potential	Combusted biogas has no residual odour	Measures to control at source listed in Section 3	From stack	Continuous release at an elevation
Flare	Flare	Emergency flaring of biogas	No significant odour potential	Combusted biogas has no residual odour	Measures to control at source listed in Section 3	From flare	Continuous release at an elevation
Digestate storage and removal	Digestate store	Digestate storage	Material has low odour potential as most volatiles and odorous compounds are in biogas	Minor residual odour	Measures to control at source listed in Section 3	Escapes periodically	Ground level, intermittent release, at ambient temperature

3 Odour Control During Normal Operation

Section Overview

3.1 This section of the OMP describes the means by which REnescience Northwich will control odour impacts from normal operations. A great deal can be done to minimise the quantities of odours at site or to minimise their release by good working practices and process control. Therefore, the proposed facility works in accordance with the accepted hierarchy of preferred controls, that is:

- prevent formation/release of odour in the first place;
- where this is not practicable, minimise the release of odour;
- abate excessive emissions; finally
- dilute any residual odour by effective dispersion in the atmosphere.

Containment of Residual Odour Releases

3.2 The waste reception building is fully enclosed. The enzymatic process takes place in fully enclosed vessels ('bioreactors'). Sorting of 2D and 3D material takes place within the enclosed loading hall.

3.3 Secondary odour control will be provided in each of these areas using a combination of external carbon filters (waste reception building) or effective dispersion (sorting hall). AD tanks will be fully enclosed, continuously monitored and subject to routine regular inspection. Offgas will be combusted in a high temperature flare with pilot light or automatic ignition.

3.4 Recovered materials (e.g. clean 3D recyclables) may be baled and stored in an covered area but are not expected to be odorous. A digestate store will contain compost-like output material.

3.5 All waste will be delivered in HGVs within enclosed containers.

3.6 All doors to the odorous buildings (reception hall and sorting hall) will remain closed except when vehicles/people exit/ingress.

3.7 All doors to the odorous building will be automatic. These may be opened manually by the driver for safety reasons but will close automatically.

3.8 The air from the waste reception hall and waste bunker will be extracted by a ventilation hood and passed through a carbon filter or alternative equivalent means of control to control and minimise odour. Reject loads will remain enclosed and will be rejected normally within two hours. Particularly odorous incoming loads may be preferentially rapidly processed, or mixed and covered with waste in the bunker to aerate and dilute the material. Quarantine material will be stored in the quarantine area pending its treatment or rejection.

3.9 The bioliquid reception tanks will be enclosed. Bioliquid and AD tanks will have pressure monitoring and gas production rates will be monitored. Any loss of pressure or unexpected change in gas production will be investigated using safe monitoring techniques.

Good Working Practices/Housekeeping Measures to Minimise Odour Releases

3.10 The following ‘good housekeeping’ site practices will be used:

- Keeping the area clean and tidy;
- Removing and bagging any spilled materials;
- Designing floors for easy clean-up, including a concrete surface with a positive slope to drainage systems;
- Eliminating crevices, corners and flat surfaces, which are hard to keep clean and where waste residues can accumulate;
- Drainage systems will be treated periodically with odour neutralising and bacteria-inhibiting solutions as required and using reactive monitoring/inspection and feed forward to a preventative maintenance programme;
- Building catch basins, floor drains and drainage systems will be kept clean to ensure that odour-causing residues will not build up; and
- External washing area for HGVs and loaders.

4 Routine Maintenance and Inspection

Section Overview

4.1 This section of the OMP describes how DERN O&M Limited will address plant performance and planned inspection and maintenance to help maintain the effectiveness of odour controls.

General

4.2 Planned maintenance and inspection is crucial to maintaining the effectiveness of odour control measures. DERN O&M Limited will ensure the good performance of all plant, both the main processes and odour control equipment. An effective, planned inspection and preventative maintenance programme will be employed on all odour-critical plant and equipment, as specified below. This includes a written maintenance programme and a record of maintenance.

4.3 A list of spares required and the procedure for re-ordering will be developed as part of DERN O&M Limited DERN O&M Limited Environmental Management System (EMS) and will be based on the manufacturers' recommendations of spares required, together with standby equipment for odour-critical items (e.g. fans, pumps) or covered by call-out contracts with contractors. Odour-critical plant and equipment will be covered by an out-of-hours breakdown contract by the supplier/contractor.

4.4 The sections below detail how often different pieces of plant are maintained.

Building Containment

4.5 In order to achieve overall odour containment and thus minimise unplanned releases of odour to atmosphere, the integrity of the building fabric will be maintained continuously, particularly in the waste reception hall and doorways. It is an essential requirement that all doors in buildings remain closed when vehicles are not entering or exiting the work areas. The effective operation of closing of doors will be checked routinely.

Enzymatic Waste Treatment Process

4.6 The bioreactors will be enclosed vessels. The sorting of 2D and 3D materials will take place within the enclosed loading hall. Although the odour potential here is fairly low, secondary odour control will be provided in the sorting hall using a carbon filter, or alternative, to provide fluctuating control of odours.

4.7 The process will be subject to a regular inspection and preventative maintenance programme as part of the Environmental Management System (EMS).

AD Process

4.8 Bioliquid tanks will be fully enclosed and regularly inspected.

4.9 The process will be subject to a regular inspection and preventative maintenance programme as part of the EMS.

Biogas Engines and Flare

4.10 The biogas engines and flare will be subject to a regular inspection and preventative maintenance programme as part of the EMS.

5 Routine Monitoring, Recording and Reporting

Section Overview

5.1 Monitoring has an important role to play in assessing the effectiveness of operational practices to prevent and contain odours; and in assessing the nature and extent of an odour problem should it arise.

5.2 This section of the OMP describes how the effectiveness of operational practices and controls will be checked by:

- monitoring of changes on site; and
- monitoring of effects off site (at the site boundary and beyond).

Monitoring of Odour Emissions at Source

5.3 The term 'monitoring' includes both emissions monitoring of odour (or a surrogate parameter) and inspections of the process, buildings and equipment to check that emissions are being contained and controlled to meet the accepted standards of good practice in relevant guidance.

5.4 DERN O&M Limited will incorporate periodic (annual for the first five years of operation) odour emissions monitoring of the carbon filters to check the continuing effectiveness of odour abatement control.

Monitoring of Odour at the Site Boundary and Sensitive Receptors

General Approach to Off-site Monitoring

5.5 DERN O&M Limited will monitor the emissions at the site boundary to ensure releases do not result in odour nuisance at sensitive receptors. The routine monitoring techniques at the REnescience Northwich facility – sniff tests and complaints monitoring – are recognised as appropriate tools in current best-practice for odour assessments in the IAQM's *Guidance on the assessment of odour for planning.* The techniques are well suited for checking how well the odour controls are performing and ensuring residual odour releases do not result in odour nuisance at sensitive receptors.

5.6 It is not appropriate to set "boundary limit" values for sniff tests and complaints monitoring. These routine monitoring techniques do not generate absolute, quantitative results that can be compared to a limit value, but are subjective and subject to validation by checking activities on site and complaints. The monitoring is designed to act as a trigger for management actions and investigations if they indicate a problem.

5.7 Details of how the results will be recorded and submitted, and action plans for investigation, remedial measures and procedural changes in the event of detected abnormal emissions are given in paragraphs 5.16 to 5.19.

Sensory Field Odour Assessment by the 'Sniff Test'

5.8 Monitoring of odour exposure by sensory field odour assessment ("sniff testing") uses trained odour assessors to record the attributes of the odour. The assessment is "sensory" in that the human nose is used as the detector – a sound approach considering that no analytical instrument can give a unified measure of a complex mixture of compounds that quantifies it as a unified whole in the same way that a human experiences odour. This technique is recommended in Defra's Draft Local Authority Guide on Odour, the Environment Agency's H4 Odour Management Guidance and the IAQM *Guidance on the assessment of odour for planning* as being suitable for daily monitoring of odours at the boundary of the site.

5.9 DERN O&M Limited will carry out walkover surveys incorporating daily or twice-daily sniff testing at the site boundary. If necessary (e.g. in the event of any complaints being received), investigations will be also be carried out at the locations of sensitive receptors. DERN O&M Limited will normally meet with respondents as soon as practicable after receiving a complaint, except where vexatious. The OMP will provide details of the method used and the information recorded during each sniff test.

Table 5.1: Summary of field odour (sniff test) monitoring at the site boundary

Parameter	Measure
Sampling Time	Approximately 5 minutes at each location
Sampling locations	At regular intervals along the site boundary
Sampling and analysis method	Based on the Environment Agency Sniff Test protocol in H4
Odour Categories	None, faint, moderate and strong
Person carrying out the assessment	Site Chargehand, Site Manager or Site Supervisor
Monitoring frequency	Daily or twice-daily
Weather Information to be noted	Temperature, wind speed, wind direction, wind speed gust and summary

5.10 The sensory field odour ("sniff test") assessment is based on the Environment Agency Sniff Test protocol in H4. The detailed description of that methodology has not been repeated in this OMP.

5.11 Details of how the results are recorded and submitted are given in Section 5. Sniff testing is designed to detect any abnormal plant odour emissions. In the event that abnormal odour is detected the source of the odour would be investigated and remedial action taken as necessary, as described in Section 5.

Complaints Monitoring

5.12 Separate from the procedural response to a received complaint is the monitoring of complaints levels. This technique – complaints monitoring – is an important tool for assessing the level of odour impact. The Environment Agency recognises in its former Internal Guidance on Odour from Waste Management Facilities that reliable complaints, in themselves, should be considered a form of monitoring and complaints should be treated as if they were monitoring data.

5.13 DERN O&M Limited will implement a system of complaints monitoring and analysis. Complaints are collected, registered and validated as described in Section 7 of this OMP. The record of complaints received at the end of each calendar quarter will be reviewed with a view to identifying:

- trends, in terms of the subject, cause or origin of complaints; and
- aspects experienced at one location that could apply to other locations.

5.14 Any action deemed necessary as a result of the analysis shall be identified and discussed in order to programme a course of corrective actions.

5.15 Complaints are a very important indicator of community dissatisfaction (although not the only one) and the technique of complaints monitoring is a powerful tool. However, it is important to bear in mind that complaints are only a symptom of annoyance or nuisance; there are various reasons why complaint level is not an exact indicator of odour annoyance or nuisance itself. Nevertheless, the collection, maintenance and analysis of complaints records is an important method of indicating the effectiveness or otherwise of measures implemented to reduce nuisance due to odour. Whilst complaints are not a perfect indicator of nuisance, a change in the number of complaints is a reasonable indicator of improving or worsening impact due to odour. It is certainly true that the level of annoyance due to odour is extremely difficult to distinguish from factors such as traffic, noise, dust or just a perception of general unpleasantness on a personal level. It is also quite common for a large proportion of complaints to be received from a very limited number of people in the community. Therefore, odour complaints are most useful when used as a prompt for further investigations.

Recording of Results, Reporting and Actions

Recording of Results

5.16 The results of the sniff-tests will be recorded on the daily inspection sheet. DERN O&M Limited will maintain records of all monitoring carried out under this OMP, including records of the taking and analysis of samples when necessary, any instrumental measurements (periodic and continual), calibrations, examinations, tests and surveys and any assessment or evaluation made on the basis of such data. The records will be retained, unless otherwise agreed by the Environment Agency, for at least 6 years from the date when the records were made.

Reporting

5.17 Any records required to be submitted by the Environmental Permit will be supplied to the Environment Agency within 14 days where the records have been requested in writing by the Agency.

5.18 The Agency will be notified without unnecessary delay (with written confirmation submitted within 24 hours) following the detection of any malfunction, breakdown or failure of equipment or techniques, accident or fugitive emission which has caused, is causing or may cause significant odour annoyance; or the breach of any odour limit specified in the Environmental Permit.

5.19 In addition, individual reports of complaints will be submitted immediately after receipt.

Actions in the Event of Abnormal Emissions

5.20 In the event of abnormal emissions (e.g. visual inspections, alarms triggered in the site control room, or monitoring beyond the site boundary), the Site Manager or Site Supervisor would take the following actions:

- check all relevant items of the odour control plant in order to identify possible cause of excursion (for example, neutraliser fan failure, chemical flow failure, etc);
- contact relevant maintenance contractor - to give telephone support/advice or attend site;
- record response to alarm and remedial action taken in the site diary; and
- contact DERN O&M Limited to advise of a potential problem leading to possible customer complaints.

6 Odour Control during Maintenance and Abnormal Events

Section Overview

6.1 This section of the OMP deals with the management and control of odours during maintenance and emergency periods and is crucial to the Odour Management Plan. This section describes how DERN O&M Limited will operate an action plan for abnormal event scenarios (including emergencies, maintenance, breakdowns, weather anomalies, etc). This is a summary of the foreseeable situations that may compromise the operator’s ability to prevent and/or minimise odorous releases from the process and the actions to be taken to minimise the impact. Such actions may be as simple as temporarily preventing the input of feedstock to the more drastic shutting down of the plant. The action plan is intended to be used by operational staff on a day-to-day basis.

Risk Assessment

6.2 In the following pages, a tabular risk assessment has been compiled. This table:

- identifies the conditions under which abnormal operational conditions or failures might arise;
- describes what these are;
- summarises the potential impacts from the identified abnormal/failure situations and assesses the degree of those impacts; and
- describes how these conditions could be prevented and/or mitigated and controlled.

6.3 The highest risk of odour problems at the proposed development can be expected to be from the receipt of the waste. The majority of the odour can be controlled in some way by effective management, good housekeeping and the handling inside enclosed buildings and processes.

6.4 Where routine, planned and emergency maintenance of the facility has to be carried out and there is a likelihood of odour being released to atmosphere in quantities sufficient to result in detection off-site, a detailed risk assessment of the activity is conducted. As part of this, issues of odour generation, release and control are considered.

6.5 With regards to essential items of equipment a list of spares required will be developed as part of EMS and will be based on the manufacturers` recommendations of spares required, together with standby equipment for some critical items (e.g. biogas engines).

6.6 In the event of a serious breakdown, such that material cannot be transferred, deliveries to the site will be stopped to ensure compliance with licence conditions. Alternatively, replacement equipment will be brought onto site.

Identify possible abnormal operation or failure that would lead to an odour event	Measures in place to prevent or reduce abnormal operation or failure	Actions/ Responsibilities
Spillages	DERN O&M Limited will implement a cleaning procedure and schedule all site areas.	Competent Person to carry out regular inspections of all areas to detect spills. If spills detected required, spilt materials and debris will be hosed down.
Extreme weather conditions (e.g. prolonged heat wave)	Use odour neutralising sprays, where appropriate.	The site manager will be capable of performing these measures.
Doors/openings – failure of automatic closing mechanism	Doors will be able to be operated by remote control or manually. A routine maintenance plan and schedule will be incorporated into any existing maintenance programme.	Nearest person to immediately close the doors either remotely or manually and inform Competent Person. Competent Person to ensure doors are repaired as quickly as possible. Until repairs are completed, Competent Person to ensure doors remain open for the shortest time possible. Reason for failure will be investigated (in association with supplier/contractor if required) and maintenance plan revised if required.
Breakdown/malfunction of odour-critical plant (e.g. fans, scrubbers, filters)	On-site M&E staff to repair, using spares held, as required. Call-out made to equipment supplier/manufacturer, as required or repaired on site. Use odour neutralising sprays, where appropriate.	M&E staff to ensure plant repaired as quickly as possible. Reason for breakdown/malfunction will be investigated (in associated with supplier/contractor if required) and maintenance plan revised if required.
Replacement of the filter bed (needed every 12-24 months typically)	Run down operation and reduce waste storage/plan for seasonal changes e.g. low temperature.	M&E staff to ensure filter bed replaced quickly, normally within one working day.

7 Management Issues

Section Overview

7.1 This section of the OMP provides information on:

- staffing responsibilities;
- staff training;
- complaint management, investigation and resolution procedures;
- provision of a complaints telephone line; and
- communications with external stakeholders.

Roles and Responsibilities

7.2 DERN O&M Limited is committed to managing effectively the impacts of odour from the proposed development. This section describes the responsibility for the management and operation of the proposed development.

7.3 In order to effectively implement the control measures discussed within this document the site has a management structure in place designed to deal with any potential odour emission.

7.4 Where a site operative becomes aware of a potential odour release from the site it must be reported to the Site Manager as soon as practical. It is the responsibility of the Site Manager to resolve any potential odour issues.

7.5 Any complaints or issues relating to the surrounding land use will be directed to the Site Manager for dialogue and a suitable conclusion.

7.6 All site staff are subject to EMS awareness training that includes their individual requirements to conduct continual daily odour assessments and their responsibility to record any non-conformances.

7.7 The Site Manager will review all control measures in place in the event that an odorous emission is substantiated off site. Any control measures seen to be failing following a review, will have new controls agreed and implemented.

Training and Competence

General Procedures for Training and Competency of Staff

7.8 Training and competency of staff is controlled by the EMS that covers training, awareness and competence. The company identifies training requirements of its employees and provides suitable resources to ensure they have the required knowledge, skills and expertise to carry out their duties. This includes their roles and responsibilities in complying with the policy statements, the EMS and all relevant legislation. This is achieved through induction training for new employees, awareness training for all and specific training as required. Contractors and all persons performing tasks on behalf of the Company will be made aware of the policy and relevant EMS requirements and will be competent in the roles undertaken.

7.9 All new starters to the REnescience Northwich Facility will be trained on this complaints policy and procedure as part of standard induction procedures. All REnescience Northwich facility personnel receive ongoing training based upon identified needs; any staff deficient in knowledge and understanding of this procedure will be nominated for additional training.

Training and Competency of Operational Staff at the REnescience Northwich facility

7.10 All staff at the REnescience Northwich facility are made fully aware of the need to be vigilant with regard to site odour control and management procedures.

7.11 Staff responsible for the operation, maintenance or repair of odour-critical plant are trained and competent. Records will be maintained (documented training records) demonstrating compliance with this. In order to minimise risk of emissions, particular emphasis will be given during training to:

- awareness of their responsibilities for avoiding odour nuisance;
- minimising emissions on start-up and shut-down; and
- actions to minimise emissions during abnormal conditions.

7.12 DERN O&M Limited will maintain a statement of training requirements for each operational post and keep a record of the training received by each person whose actions may have an impact on the environment.

7.13 The Environment Agency will be notified of any changes in technically competent management and the name of the incoming person together with evidence that that person has the required technical competence.

7.14 Regulation 4 of The Waste Management Licensing Regulations 1994 [3] provides that a person is technically competent for the purposes of section 74(3)(b) of the 1990 Act if he is the holder of the relevant Certificate of Technical Competence (COTC) awarded by the Waste Management Industry Training and Advisory Board (WAMITAB). Relevant operational staff at the facility will have a Certificate of Technical Competence, having successfully completed the WAMITAB qualification Level 4 in Mechanical Biological Treatment (4MBTFAD6).

Complaints Handling and Communications

7.15 DERN O&M Limited will have in place a comprehensive system of monitoring and inspection to check odour control measures are functioning effectively at the REnescience Northwich facility.

However, in the event that an odour complaint is received, it is important that complaints are properly and systematically dealt with, and acted upon.

7.16 This section of the OMP describes:

- How DERN O&M Limited will respond to any odour complaint;
- How DERN O&M Limited will investigate any odour complaints, take the appropriate steps and actions, and keep stakeholders informed; and
- How DERN O&M Limited will communicate to appropriate bodies routinely and in response to any incidents or planned maintenance.

Complaints Management and Registration

7.17 The following procedure for dealing with odour complaints describes who is responsible for dealing with the different aspects of the complaint.

Publicising Contact Details for Odour Complaints

7.18 DERN O&M Limited will provide contact details to allow odour complaints to be made by telephone, email or via a website. These details will be publicised and communicated to members of the general public and displayed on signs at the site gate and on the company website.

Complaint Registration

7.19 In the event that DERN O&M Limited receives a complaint alleging potential odour nuisance from the REnescience Northwich facility:

- the complaint will be registered; and
- complaints data will be recorded in a systematic way, enabling comparison with standard odour descriptors, with wind direction and with site work activities.

Roles and responsibilities for complaints management

7.20 The following team members will deal with specific aspects of the complaint.

Table 7.1: Odour Complaints Contact List

Recipient	Position	Contact Details
The person within DERN O&M Limited to whom complaints are to be directed to as a point of central contact and to record the complaint on the registration system	Environmental Manager	Site address
The person within DERN O&M Limited to who has management responsibility for ensuring complaints are assessed and dealt with	Site Manager	Site address
The person within DERN O&M Limited who has technical responsibility for dealing with the resolution of any complaints where assessed as significant	Environmental Manager	Site address
The person within DERN O&M Limited responsible for liaison with the Environment Agency on progress (from acknowledgement of complaint to resolution where assessed as significant)	Environmental Manager	Site address
The person within DERN O&M Limited responsible for liaison with the local stakeholders on progress (from acknowledgement of complaint to resolution where assessed as significant)	Environmental Manager	Site address

Collecting the relevant complaint details

7.21 The recommended minimum information that needs to be collected for each complaint is:

- the time and date when the offensive odour was observed;
- the location (within approx. 100 m) where the offensive odour was observed, e.g. postal address, grid reference) and its sensitivity;
- the Complainant`s description of odour. This should include a subjective description of all the factors necessary to make an assessment of the impact of the odour, including intensity, character (preferably on the basis of a choice from standardised descriptors given in Environment Agency Technical Guidance Note H4), relative unpleasantness (either pleasant, unpleasant or neutral), frequency and duration;
- the identity of the complainant, if possible, to assess the repeated nature of complaints;
- the residential address of the complainant; and
- any other information the complainant can offer on activities at the alleged odour source.

7.22 It is also necessary to collect (by observation or further investigation) the following additional information to allow subsequent analysis and collation of complaints:

- wind direction and speed, and atmospheric stability class at the time of complaint; and
- any process incidents at the time of complaint.

7.23 A standardised form (based on that used by the Environment Agency in its H4 Odour Management guidance) is used for recording this information and entering it on the registration system is used, shown in Table 7.2.

Table 7.2: Form for the recording of an odour-related complaint

Odour Complaint Report Form			Sheet No
Date:	Installation to which complaint relates		Grid Reference:
Name and address of complainant:			
Tel no. of complainant:			
Time and date of complaint:			
Date, time and duration of offending odour:			
Location of odour, if not at above address:			
Weather conditions (ie, dry, rain, fog, snow):			
Cloud cover (0-8):			
Cloud height (low, high, very high):			
Wind strength - (light, steady, strong, gusting) or use Beaufort scale:			
Wind direction:			
Complainant's description of odour (i.e. comparison with other odours, strong/weak, continuous, fluctuating):			
Has complainant any other comments about the odour?			
Are there any other complaints relating to the installation, or to that location? (either previously or relating to the same exposure)			
Any other relevant information:			
On-site activities at time the odour occurred:			
Operating condition at time offensive odour occurred (e.g. flow rate, pressure at inlet and pressure at outlet)			
Actions taken:			
Form completed by		Signed	

Investigation of Odour Complaints

7.24 This escalating response procedure shows what investigative actions will be taken in response to a complaint. The aim of the investigative actions will be to establish:

- the source of the odour complaint; and
- the impact of the odour.

7.25 A series of investigative tools, of increasing sophistication, will be used until these two questions can be satisfactorily answered. This then enables the appropriate odour controls to be applied if the impact is significant and the source is confirmed as the REnescience Northwich facility.

Complaint screening

7.26 Investigation will start with an initial screening of the complaint. If the screening process “fails to confirm” the odour incident the odour investigation will stop at that point. If the screening process confirms the odour incident, then a more detailed investigation is carried out.

7.27 The object of the initial screening is to quickly identify those odour complaints that are unlikely to be due to the REnescience Northwich facility, perhaps because they result from some other activities in the area.

7.28 Initial screening should consider the following:

- knowledge of potential sources on the REnescience Northwich facility (tie-up with work activities in progress, any plant problems, etc);
- knowledge of potential sources in the locality other than the REnescience Northwich facility;
- wind direction at the time of the alleged odour episode of the locations of the REnescience Northwich facility and the complainant;
- distance of the complainant from site; and
- concurrent odour monitoring data (e.g. daily perimeter sniff tests).

7.29 If a trained odour assessor is able to attend rapidly after a complaint it may be possible to carry out effective appraisal of the complaints independently by a sniff test.

7.30 DERN O&M Limited will liaise with local stakeholders (including the complainant) and inform them on the outcome of the screening assessment of the complaint and whether or not any action is to be taken.

Further investigation of the complaint

7.31 If the initial screening is unable to discount the REnescience Facility as the source of the odour complaint, then further investigation will be carried out, which will either 'confirm' and 'further characterise' the odour incident as due to the Renescience Facility, or it will 'fail to confirm' the incident.

7.32 Further investigation will be by means of a graded response, designed to answer the questions:

- Is the episode due to the facility? (i.e. source verification); and
- How bad is episode? (i.e. assessment of impact).

7.33 DERN O&M Limited may use odour monitoring (including, but not necessarily restricted to sniff testing) to provide data to answer these questions, or provide additional confirmation. The monitoring effort is increased in a graduated way until the data generated is sufficient to answer the relevant questions being asked. If the level of monitoring being carried out at a particular stage in the graded response cannot answer the question (either at all, or with sufficient confidence to satisfy stakeholders) then monitoring should move to the next level.

7.34 As well as monitoring, DERN O&M Limited may be able to obtain more detailed information from operator records about process conditions, observations or inspections at the time of complaint – this would allow odour trends to be identified and possibly reconciled with particular process operations or maintenance.

Communications with External Stakeholders

Communicating with the Environment Agency

7.35 In the event that any complaint is made by a member of the public about any matter associated with the REnescience Facility, DERN O&M Limited will give notice in writing to the Environment Agency no later than the next working day after the complaint is received. This written notification will normally be in the form of an email. The notification will include a description of the complaint, the name and address of the person making the complaint and the action proposed as a result, unless agreed by the Environment Agency. Depending on the nature of the complaint, it will not always be possible to resolve the matter within this short timescale. In such cases an indication will be given that further investigations are necessary.

Communicating with Complainants

7.36 In the case of answer phone messages and complaints submitted by email or by letter, an acknowledgement and initial response will be given by telephone or by email within 48 hours, provided that telephone or email contact details have been given by the complainant. Where complaints cannot be resolved on initial contact and further investigations are required, a written response will be made within 10 working days of submission of the complaint.

7.37 The primary reasons for further investigation of complaints are to assess potential nuisance and identify the likely cause and source of the odour so that nuisance can be reduced or stopped. In the case of further investigations, DERN O&M Limited will communicate to the complainant the course of actions likely to be taken.

7.38 The level of annoyance associated with odours can often be reduced if affected individuals are provided with credible information about what they are smelling, the process that generates the odours, any factors affecting dispersion, what health impacts might be associated with the odour, what efforts are being undertaken to control odours and what is being done in response to their complaint. Liaison with the local community, offering credible reassurance and taking complaints seriously are often effective means of mitigating odour nuisance. To put this into practice, DERN O&M Limited will aim to communicate the following message:

- The reason for the odour;
- The likely duration of the odour;
- What plan is in place to end the odour episode;
- What preventative plan will be implemented to prevent a re-occurrence;
- What grievance procedure the aggrieved party can take; and
- Who is the responsible person on site to contact.

OMP Updating and Review

7.39 DERN O&M Limited is committed to an internal auditing process and to developing documented auditing procedures (forms) to record the process. The updating and review of controlled documents will be controlled by the EMS.

7.40 The Environment Agency will be provided reasonable access to audit the implementation of the OMP, the sniff test results, complaints records and records of DERN O&M Limiteds compliance with the OMP.

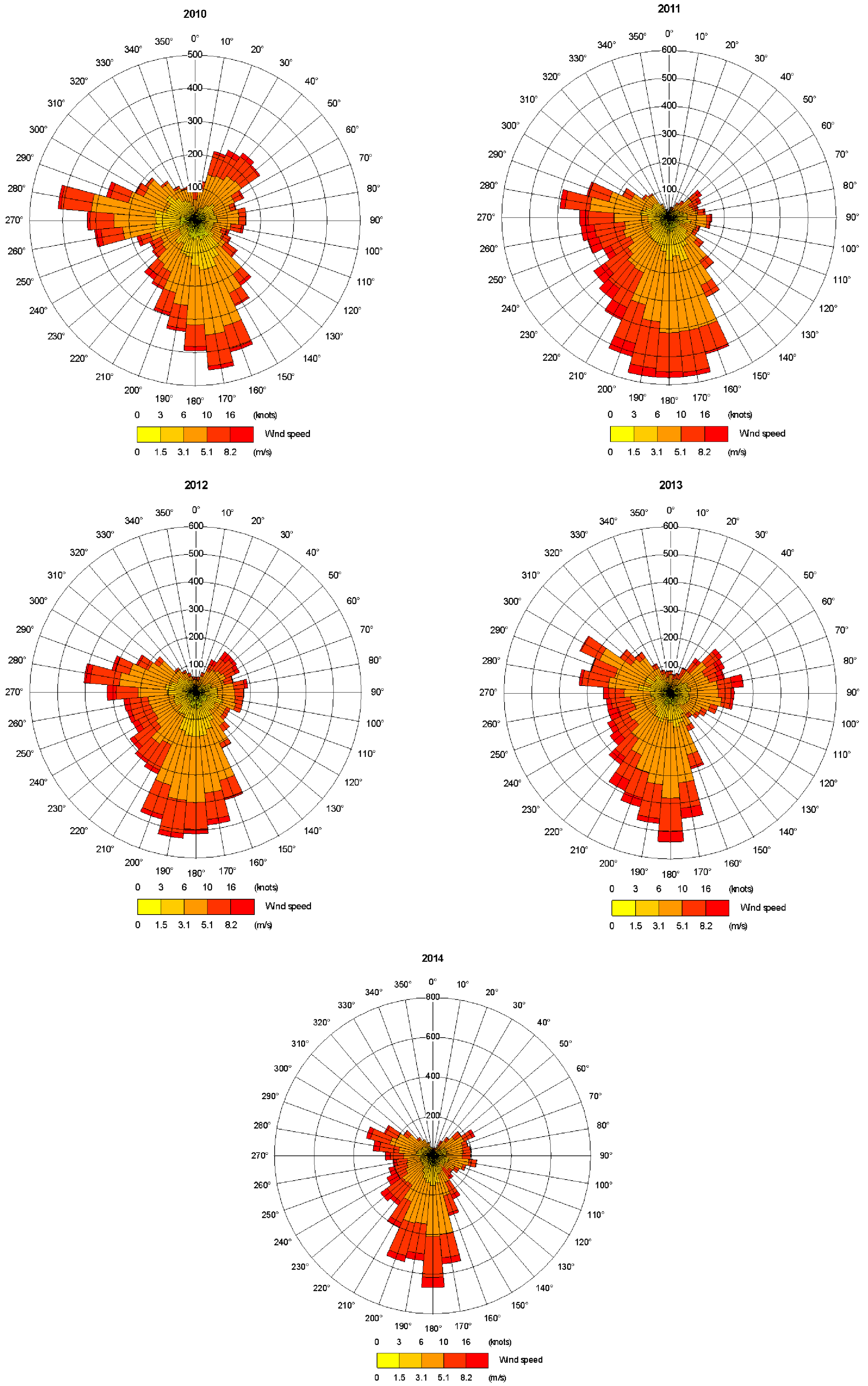
7.41 It is DERN O&M Limiteds intent that the change mechanism should provide for improvements in management practice and organisation, to allow the OMP to be a living document, whereby changes to plant, equipment and practices that improve the operation of the facility and do not detract from overall environmental performance, are not unduly delayed or hindered. It is envisaged that the OMP will be reviewed and updated on an annual or biannual basis.

References

1 Bull et al (2014). *IAQM Guidance on the assessment of odour for planning,* Institute of Air Quality Management, London.

2 Environment Agency (March 2011). H4 Odour Management.

3 ODPM (1994) Environmental Protection. The Waste Management Licensing Regulations 1994



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Project: REnescience Northwich

Title: Windroses, Manchester Ringway 2010 - 2014

Date: 25/08/15 Scale: Not to scale

Drawn: RC Checked: DS Job Ref: JAS8407

Figure Number: 10.A Rev: 0

Approx. Source of Emissions

Roads and Point Source Receptors

Point Source Receptors

Modelled Roads

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Project: REnescience Northwich

Title: Modelled Roads and Receptors

Date: 26/08/15 Scale: Not to scale

Drawn: RC Checked: DS Job Ref: JAS8407

Figure Number: 10.B Rev: 0

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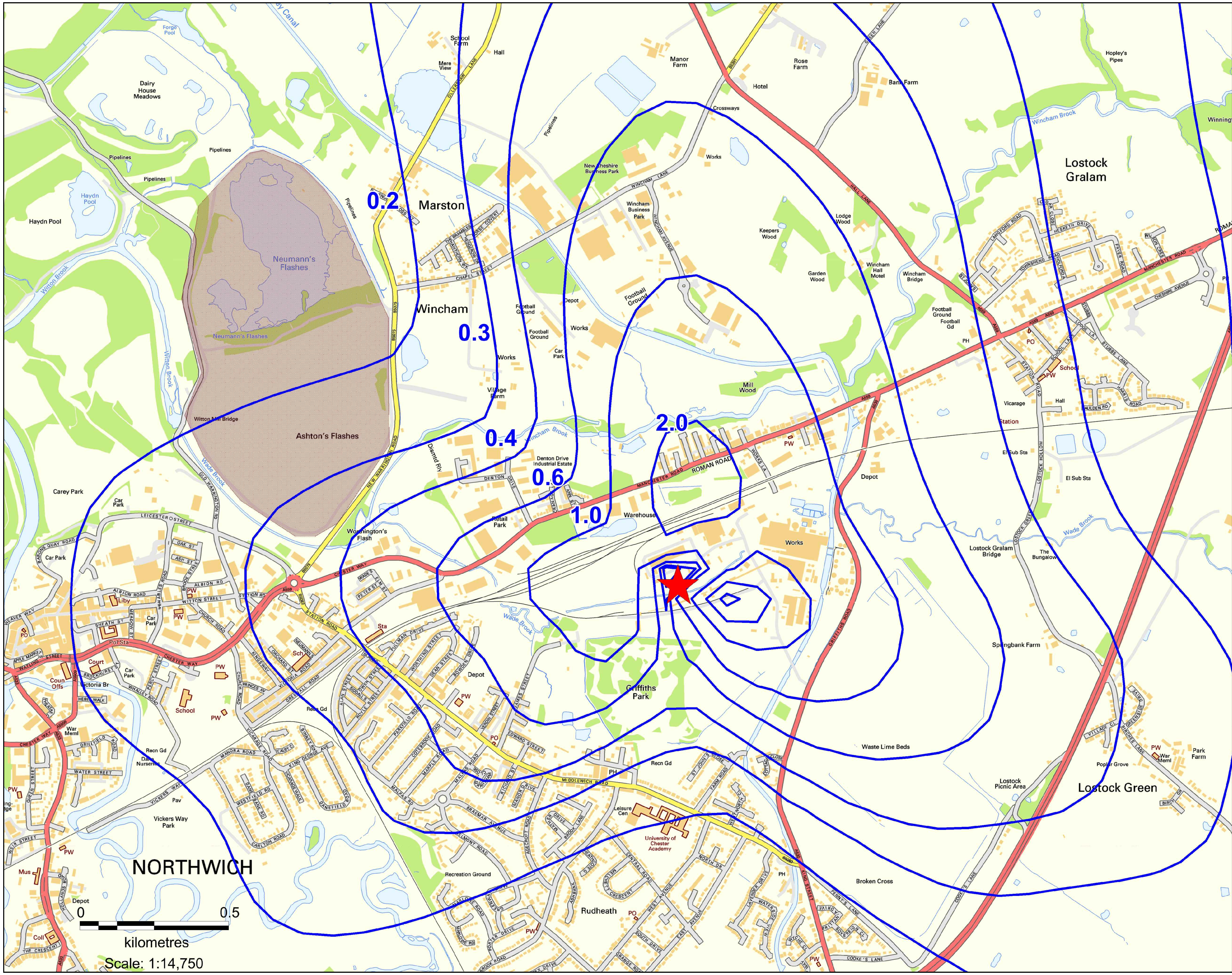

Ashton's and Neumann's Flashes

Approx. Source of Emissions

PC

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Client: DONG Energy Limited

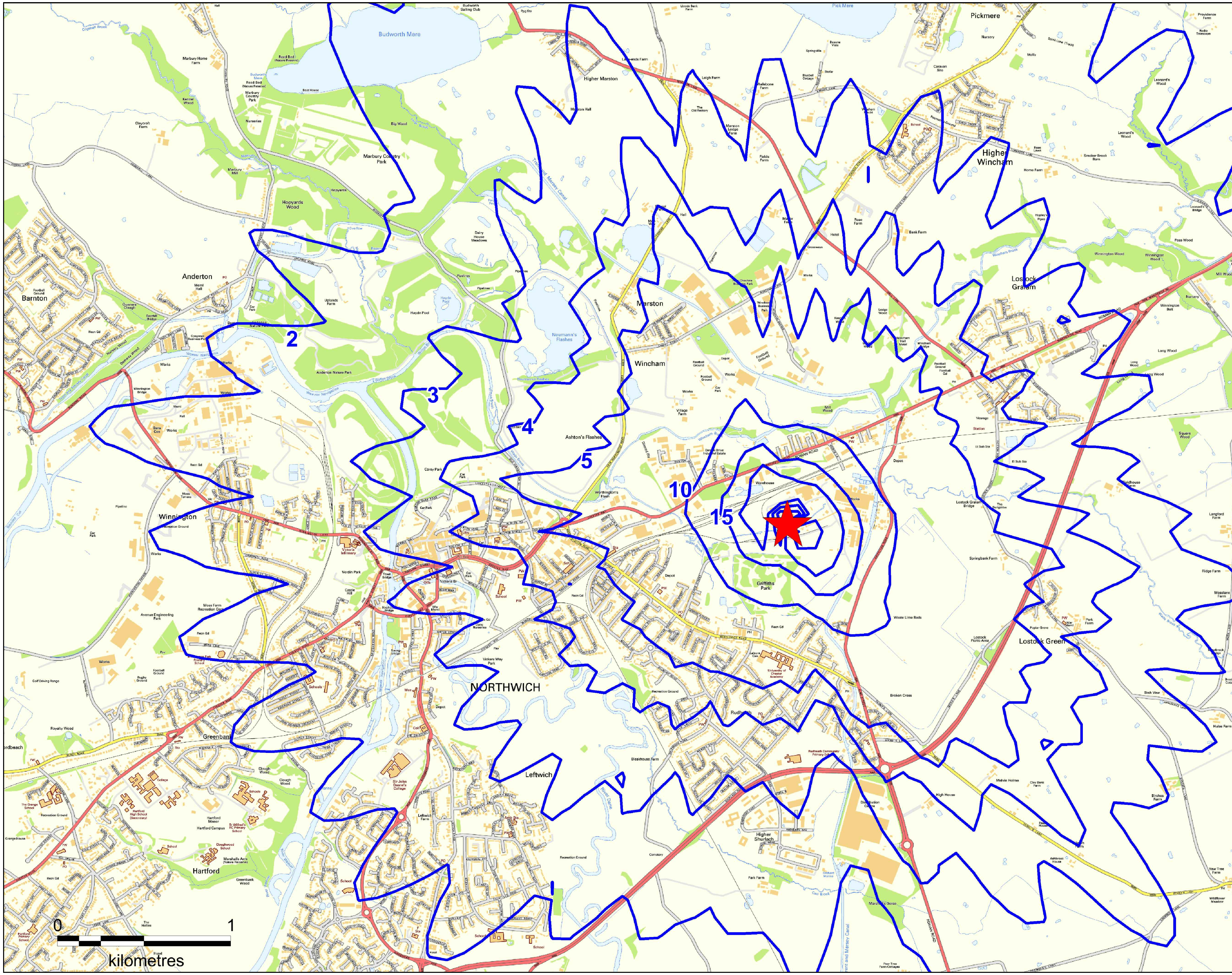
Project: REnescience Northwich

Title: Annual-Mean NO_2 Process Contribution ($\mu g.m^{-3}$)

Date: 26/08/15 Scale: Not to scale

Drawn: RC Checked: DS Job Ref: JAS8407

Figure Number: 10.C Rev: 0



Approx. Source of Emissions

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Client: DONG Energy Limited

Project: REnescience Northwich

Title: 99.79th Percentile Hourly-Mean NO_2 Process Contribution ($\mu g.m^{-3}$)

Date: 26/08/15 Scale: Not to scale

Drawn: RC Checked: DS Job Ref: JAS8407

Figure Number: 10.D Rev: 0

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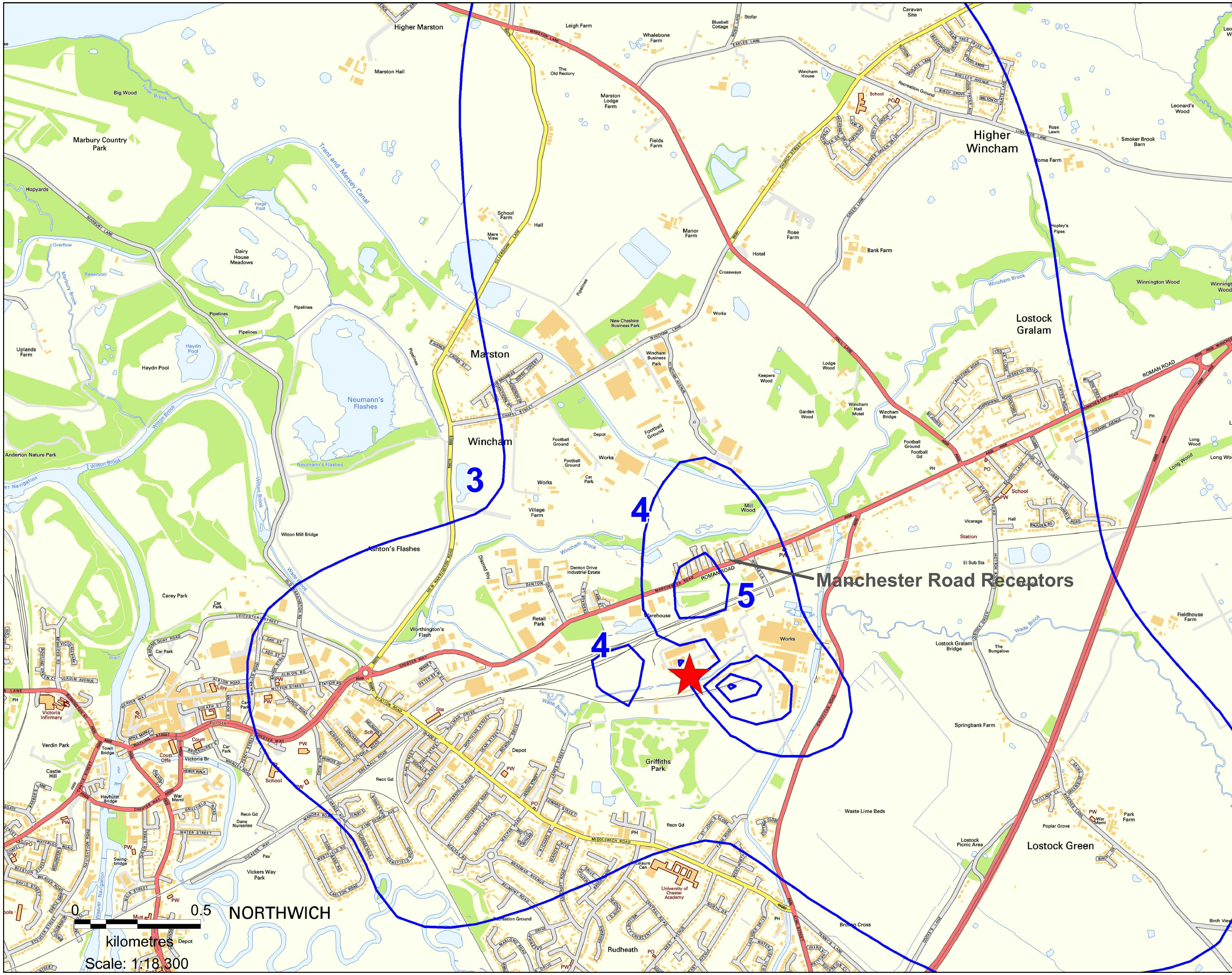

Approx. Source of Emissions

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Client: DONG Energy Limited

Project: REnescience Northwich

Title: Annual-Mean Cumulative NO_2 Process Contribution ($\mu g.m^{-3}$)

Date: 26/08/15 Scale: Not to scale

Drawn: RC Checked: DS Job Ref: JAS8407

Figure Number: 10.E Rev: 0

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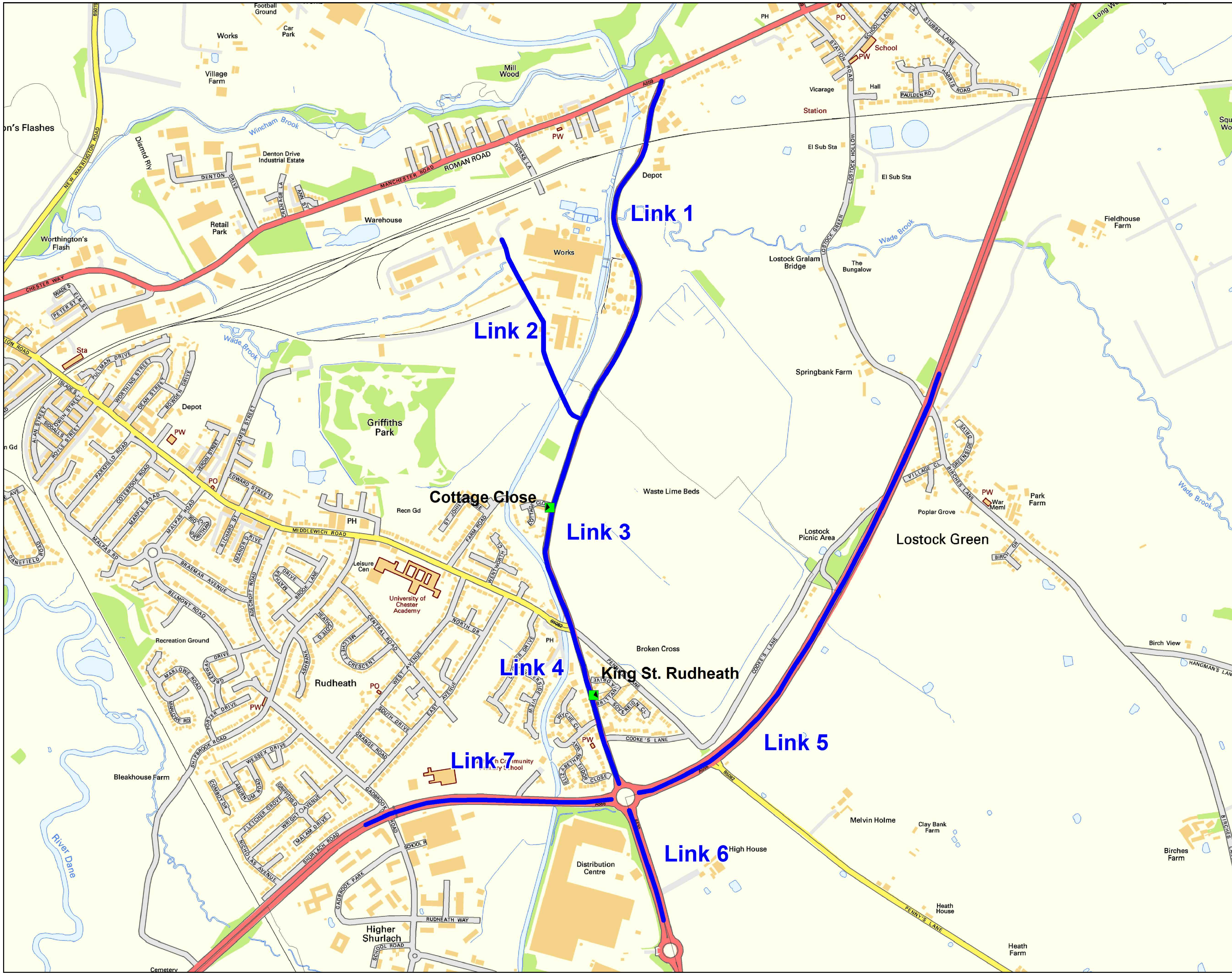

Diffusion Tube Location

Modelled Road

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Client: DONG Energy Limited

Project: REnescience Northwich

Title: Model Performance Study

Date: 26/08/15 Scale: Not to scale

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Figure Number: 10.F Rev: 0

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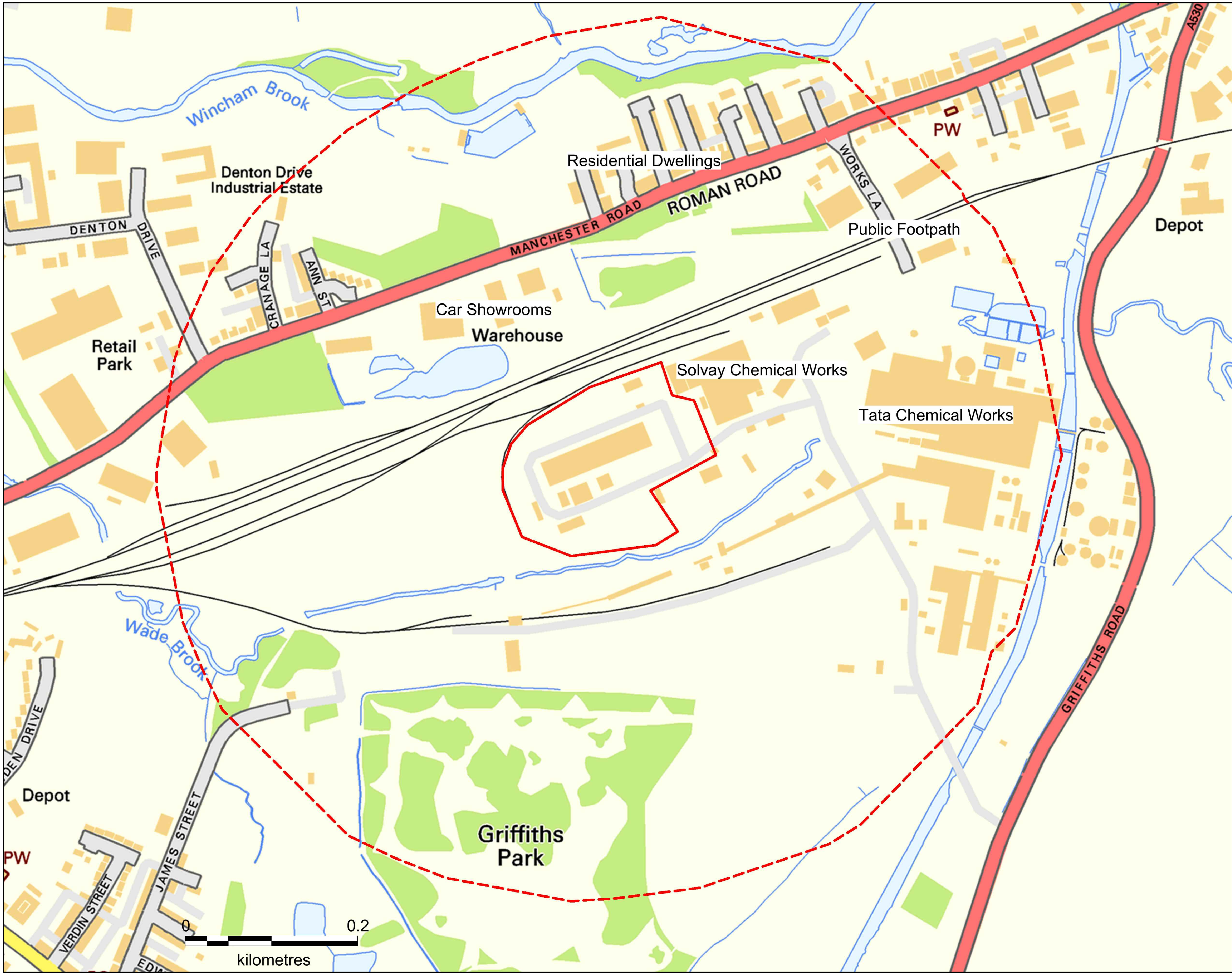

Approximate Site Boundary

400 m Buffer

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Client: DONG Energy Limited

Project: REnescience Northwich

Title: Sensitive Receptors to Odour

Date: 22/09/15 Scale: Not to scale

Drawn: RC Checked: DS Job Ref: JAS8407

Figure Number: 10.G Rev: 0

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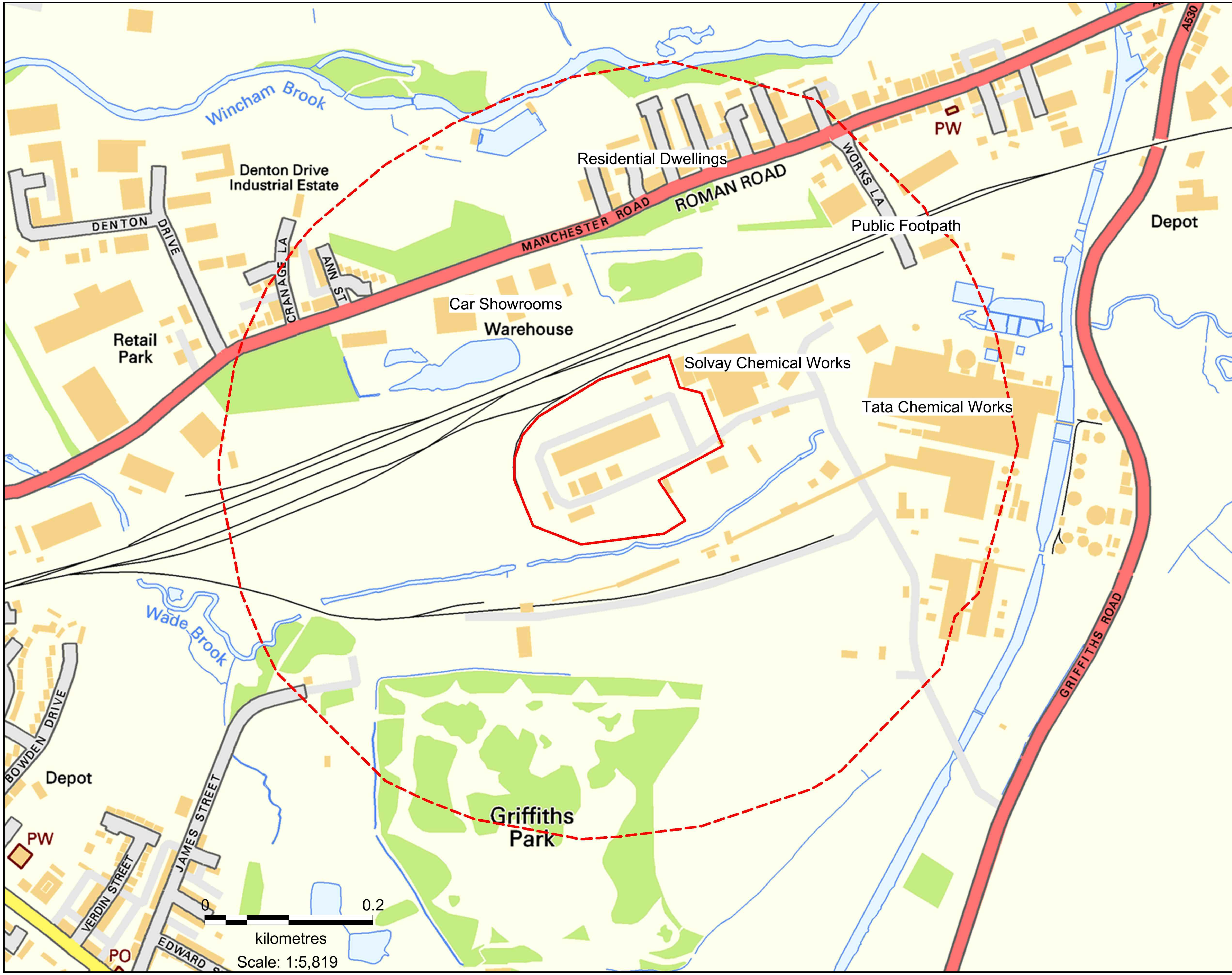

350 m Buffer

Approximate Site Boundary

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Client: DONG Energy Limited

Project: REnescience Northwich

Title: Sensitive Receptors to Dust

Date: 22/09/15 Scale: Not to scale

Drawn: RC Checked: DS Job Ref: JAS8407

Figure Number: 10.H Rev: 0

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